NSW GOVERNMENT | sydney METRO

West

Westmead to The Bays and Sydney CBD

Environmental Impact Statement

Concept and Stage 1

Technical Paper 1
Transport and traffic

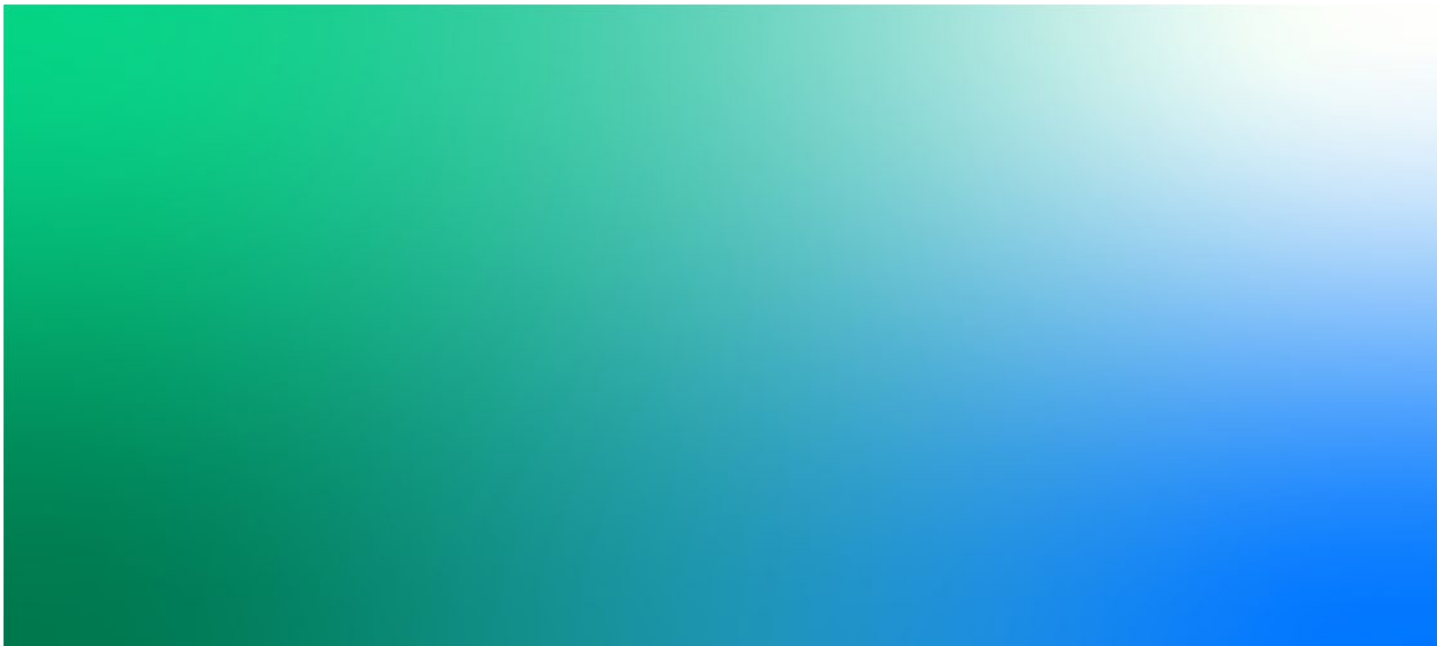
Sydney Metro West – Stage 1

Technical Paper 1: Transport and traffic

Final

April 2020

Sydney Metro



Sydney Metro West – Stage 1

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Glossary of terms and acronyms

Term	Meaning
Average delay	Duration, in seconds, of the average vehicle waiting time at an intersection
Bus lane	A traffic lane dedicated to buses, but which can also be used by taxi, hire cars, bicycles and motorcycles
Capacity	The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a given time period under prevailing roadway conditions
CBD	Central Business District
Corridor	A substantial segment of the transport network, in which parallel, possibly competing, transport routes (and modes, where appropriate) operate between two locations
CTMF	Construction Traffic Management Framework
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessment on its own
DDA	Disability Discrimination Act
Detour	An alternative route, using existing roads, made available to traffic
Footpath	A paved area in a footway
Footprint	The extent of the
Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two-axle truck) or larger, in accordance with the Austroads Vehicle Classification System
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
Local road	A road or street used primarily for access to abutting properties
Median	The central reservation which divides a carriageway for traffic travelling in opposite directions
Midblock	A general location on a road between two intersections
Motorway	Fast, high capacity, access-controlled roads that primarily link regional hubs and cities usually with grade separated interchanges and without traffic signals. May be tolled or untolled
NML	Noise Management Level
NSW	New South Wales
Off ramp	A ramp by which one exits a limited access highway/tunnel
On ramp	A ramp by which one enters a limited access highway/tunnel
Public transport	Includes, metro, train, bus, ferry and light rail
SPECTS	Safety, Productivity and Environment Construction Transport Scheme
Transitway	A route designed for use by public transport. In Sydney, this is a rapid bus network.

Term	Meaning
Transport for NSW	Transport for New South Wales
Truck and dog	A construction vehicle with 20 cubic metre capacity and a maximum length of 19 metres

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Executive summary

Stage 1 overview

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

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

- Approval for the whole Sydney Metro West (at concept level) concurrent with Stage 1. Stage 1 involves the major civil construction works between Westmead and The Bays Precinct (and is the subject of this technical paper)
- Future stage(s) would include the remaining major civil construction works 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)).

Sydney Metro is seeking a specific declaration for Sydney Metro West to be declared as 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.

Sydney Metro West would mainly be underground in twin tunnels. Stage 1 extends from Westmead to The Bays Precinct. The Stage 1 would involve the major civil construction work for Sydney Metro West (Westmead to The Bays Precinct), including:

- Enabling works
- Tunnel excavation including tunnel support activities
- Station excavation for 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, Silverwater and between Five Dock Station and The Bays Station
- Civil works 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.

The location of the services facility between Five Dock Station and The Bays Station is currently being investigated, and is not assessed within this technical paper.

Approach to transport and traffic assessment

To assess the impact of Stage 1 on the transport and traffic network, the following methodology has been used to identify and, where possible, quantify the following:

- Impacts on road network performance – assessed through the use of traffic modelling to determine the performance of the road network with and without Stage 1 construction vehicles, including consideration of overlapping construction vehicle routes
- Impacts on parking – assessed through a qualitative analysis of removed parking spaces and availability of parking in nearby locations to determine the impacts of parking overflow

- Impacts on property access – assessed through an analysis of existing access provisions and a comparison with access provisions during construction
- Impacts on public transport – assessed through an analysis of proposed changes to public transport operations including routes and stop infrastructure to determine impacts on public transport customers
- Impacts on pedestrians and cyclists – assessed through an analysis of proposed changes to shared user paths, cycleways, footpaths and pedestrian crossings to determine impacts on access to and availability of pedestrian and cycle infrastructure
- Cumulative impacts – assessed through the use of traffic modelling to determine the performance of the road network with construction vehicle movements associated with other major projects expected to be occurring at the same time as Stage 1 based on current publicly available information.

Overview of potential impacts

The potential impacts of Stage 1 have been identified as the following:

- Temporary or permanent loss of parking spaces, especially in Westmead, Parramatta, Clyde, Silverwater, North Strathfield, Burwood North and Five Dock
- Temporary closure of pedestrian and cyclist facilities in Westmead, Parramatta, Clyde, Sydney Olympic Park and North Strathfield
- Detour routes due to road closures in Westmead, Parramatta and Sydney Olympic Park, impacting general traffic, buses, cyclists and/or emergency vehicles
- Temporary relocation of bus stops in Westmead, North Strathfield and Burwood North
- Potential deterioration of intersection performance around construction sites, particularly in Westmead, Five Dock and The Bays
- Temporary relocation of a taxi zone in Sydney Olympic Park
- Temporary relocation of a kiss and ride zone in North Strathfield
- Potential minor increase in delays to bus services on routes around construction sites
- Potential safety implications for pedestrians, cyclists and motorists, especially around construction access and egress points and during special events.

Summary of mitigation measures

The planning for Stage 1 and the arrangements of the construction sites have been developed to avoid and minimise transport and traffic related impacts where possible. This has included the following:

- Haulage routes have been developed in consultation with Transport for NSW including Transport Coordination and have aimed to minimise the use of local roads and use the most efficient route to the arterial road network
- Selection of truck sizes at each construction site has considered a balance between reducing overall truck movements and manoeuvrability to, from and within the construction sites.

Mitigation and management measures relevant to transport and traffic impacts of Stage 1 have been identified and broadly include:

- Ongoing consultation (as relevant) with Transport for NSW including Transport Coordination, Sydney Trains, NSW TrainLink, local councils, emergency services and bus operators for the duration of the construction period
- Using directional signage and line marking to direct and guide drivers and pedestrians past construction sites and on the surrounding road network.

- Coordinating with Transport Coordination's Operations Manager in the event of an unplanned transport or traffic related incident
- Notifying the community in advance of proposed road, public transport and pedestrian network changes through appropriate forms of community liaison
- Managing vehicle access to and from construction sites
- Enhancing pedestrian, cyclist and motorist safety near construction sites
- Maintaining access to existing properties and buildings in consultation with property owners
- Ensuring all trucks enter and exit construction sites in a forward direction, where feasible and reasonable
- Managing construction site traffic to minimise movements during peak periods
- Managing construction site traffic immediately around construction sites to minimise movements through school zones during pick up and drop off times
- Consulting relevant local councils to investigate opportunities to provide alternative parking facilities where existing parking is removed to facilitate construction activities
- Managing construction sites to minimise the number of constructions workers parking on surrounding streets
- Providing access at all times to properties for emergency vehicles.

Construction site specific mitigation and management measures have also been identified and are documented in Chapter 5 of this report.

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1. Introduction

1.1 Sydney Metro West

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

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

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

Sydney Metro is seeking a specific declaration for Sydney Metro West to be declared as 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.

1.1.1 Location

Sydney Metro West would mainly be underground in twin tunnels. Stage 1, which is the subject of this assessment, extends from Westmead to The Bays (Figure 1-1).

1.1.2 Overview of Stage 1

The Stage 1 would involve the major civil construction work for Sydney Metro West (Westmead to The Bays), including:

- Enabling works, such as demolition, utility supply to construction sites, utility adjustments and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for 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 Station and The Bays Station
- 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.

The Stage 1 is further described in Chapter 9 (Stage 1 description) of the Environmental Impact Statement.

The location of the services facility between Five Dock Station and The Bays Station is currently being investigated, and is not assessed within this technical paper. Further detail on the locational and design criteria that would be used as part of determining the preferred location is detailed in Chapter 9 (Stage 1 description) of the Environmental Impact Statement.

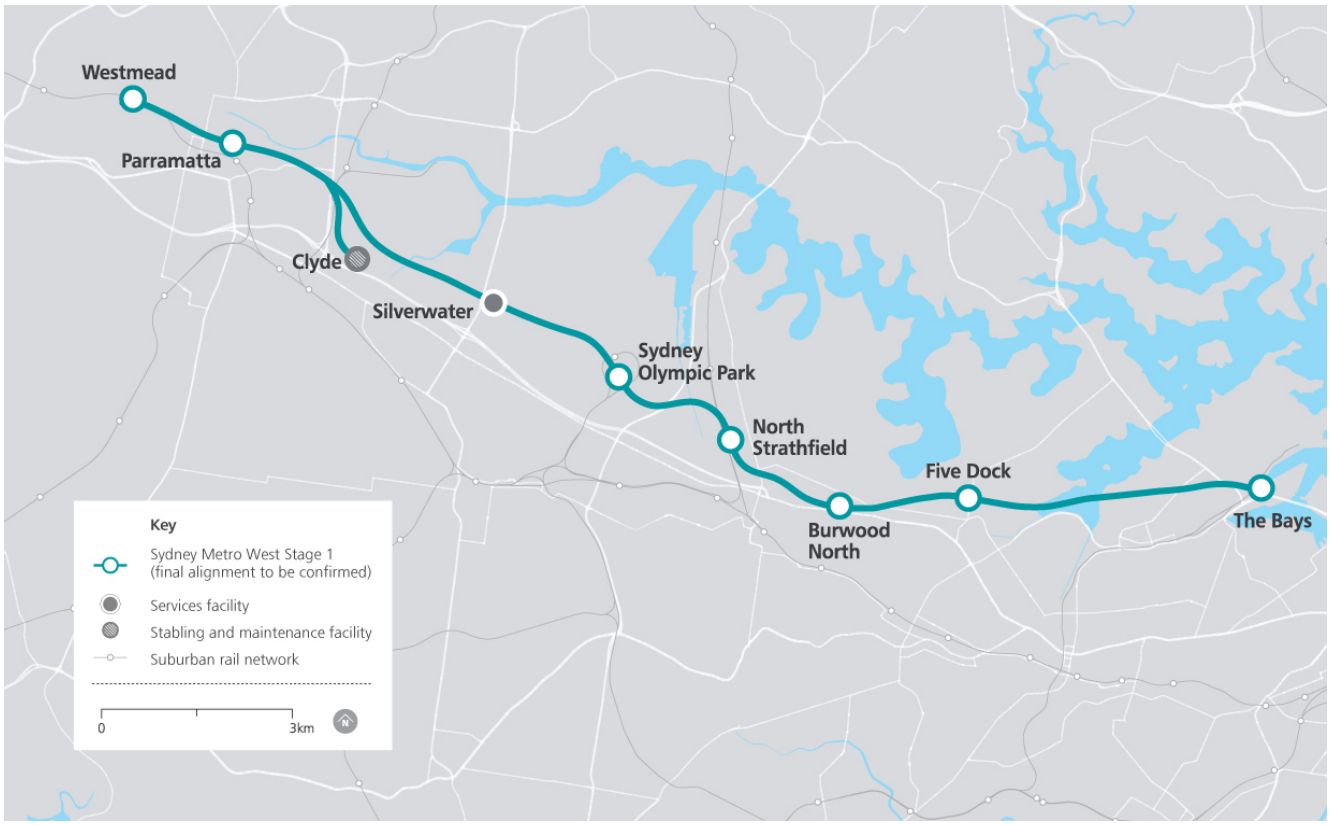

Figure 1-1: Sydney Metro West - Stage 1 overview

1.2 Purpose and scope of this report

This technical paper, Technical Paper 1: Transport and Traffic is one of a number of technical papers that form part of the Environmental Impact Statement. The purpose of this technical paper is to identify and assess the potential impacts of Stage 1, in relation to transport and traffic. It responds directly to the Secretary's Environmental Assessment Requirements outlined in Section 1.2.1.

This report includes the following:

- A review of the existing transport network, including a description of transport infrastructure in the study area, public transport service provision, pedestrian and cycle networks, and traffic volumes and patterns
- Assessment of the potential transport and traffic impacts of Stage 1, including consideration of cumulative impacts and special events
- A suite of measures to mitigate and manage the identified transport and traffic impacts during construction of Stage 1.

1.2.1 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements were issued for Stage 1 on 11 December 2019. The requirements specific to transport and traffic, and where these requirements are assessed in this technical paper, are outlined in Table 1-1. The Secretary's Environmental Assessment Requirements also makes reference to the *Sydney Metro West Scoping Report – Westmead to The Bays and Sydney* CBD (Sydney Metro, 2019), which

identified a number of investigations and further assessments. How this technical paper addresses these matters is outlined in Table 1-2.

Table 1-1: Secretary's Environmental Assessment Requirements – Transport and traffic

Secretary's environmental assessment requirements	Where addressed
1 Commitments made in Section 9.1.2 of the Scoping Report	Refer to Table 1-2
2 Transport and traffic (vehicle, pedestrian and cyclists) impacts of construction, including, but not necessarily limited to:	
a) A considered approach to route identification and scheduling of construction vehicle movements;	Section 4.1 to 4.2 and 4.7 to 4.16
b) The indicative daily number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements) across the construction schedule;	Section 4.1 and 4.7 to 4.16
c) The nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements);	Section 3.2 to 3.10
d) Construction worker parking;	Section 4.1
e) Access constraints and impacts on public transport (infrastructure and services), pedestrians and cyclists and property; and	Section 4.3 to 4.5 and 4.7 to 4.15
f) The need to close, divert or otherwise reconfigure elements of the road, pedestrian and cycle network associated with construction of the project and the duration of these changes; and	Section 4.7 to 4.16
g) Impacts to on-street parking, loading, servicing and pick-up, including to residents and businesses.	Section 4.7 to 4.15

Table 1-2: Scoping Report investigations and further assessments – Transport and traffic (Sydney Metro, 2019)

Investigations and further assessments	Where addressed
Identification of haulage routes, site access and egress points	Section 4
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.	Section 5

1.3 Structure of this report

The remainder of this report is structured as follows:

- Chapter 2 documents the assessment methodology including the traffic modelling approach adopted to assess the potential transport and traffic impacts of Stage 1 during construction
- Chapter 3 details the existing transport and traffic environment.
- Chapter 4 provides an assessment of the potential transport and traffic impacts of Stage 1 during construction, including cumulative impacts
- Chapter 5 identifies mitigation and management measures.

2. Assessment methodology

2.1 Overall assessment approach

To assess the impact of Stage 1 on the transport and traffic network, the following methodology has been used to identify and, where possible, quantify the following:

- Impacts on road network performance – assessed through the use of traffic modelling to determine the performance of the road network with and without Stage 1 construction vehicles
- Impacts on parking – assessed through a qualitative analysis of removed parking spaces and availability of parking in nearby locations to determine the impacts of parking overflow
- Impacts on property access – assessed through an analysis of existing access provisions and a comparison with access provisions during construction
- Impacts on public transport – assessed through an analysis of proposed changes to public transport operations including routes and stop infrastructure to determine impacts on public transport customers
- Impacts on pedestrians and cyclists – assessed through an analysis of proposed changes to shared user paths, cycleways, footpaths and pedestrian crossings to determine impacts on access to and availability of pedestrian and cycle infrastructure
- Cumulative impacts – assessed through a qualitative analysis or use of traffic modelling to determine the performance of the road network with construction vehicle movements associated with other major projects expected to be occurring at the same time as Stage 1 based on current publicly available information.

2.2 Traffic modelling approach

To assess the impacts of Stage 1 on road network performance, traffic modelling has been undertaken of proposed primary construction vehicle routes between each construction site and the nearest arterial road inclusive of the arterial road interface.

The approach to traffic modelling undertaken for this assessment aligns with the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013) and includes the following broad steps:

- Development of calibrated and validated base models to align with existing operational conditions along each construction vehicle route
- Development of future year base models to align with anticipated operational conditions in the year of peak construction activity (2023), including road network changes as a result of Parramatta Light Rail (Stage 1) and the operation of WestConnex (M4 East)
- Application of anticipated construction traffic demands to the future year base models to allow the identification of potential impacts to road network performance.

Due to the geographical scope of Stage 1, modelling was undertaken in geographical sub-areas corresponding to each construction site as follows:

- 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
- The Bays Station.

Models were developed using Aimsun (except for The Bays Station construction site) and Vissim (Version 11.0) (for The Bays Station construction site) traffic modelling software packages. Vissim was used for The Bays Station construction site to provide consistency with existing modelling undertaken by Transport for NSW for the Rozelle area.

Aimsun and Vissim are microsimulation traffic modelling software packages that use dynamic, stochastic, discrete time modelling techniques to simulate the movement of individual vehicles based on car-following, lane-changing and gap acceptance algorithms that are updated several times every second. These vehicle-to-vehicle interactions provide the basis for calculating delays. Their flexibility allows the modelling of complex traffic operations. The advantage of this type of modelling is that the build-up and dissipation of queues and their effect on surrounding congestion and travel times is sensitively modelled. This type of modelling can provide a better representation of queuing, congestion and delays in at-capacity urban networks compared to static traffic modelling software packages.

The traffic modelling was undertaken for the morning (7 am to 9 am) and evening peak (4 pm to 6 pm) periods only, which is consistent with the standard approach for this type of assessment. The peak traffic periods represent a worst-case scenario as during these periods the road network experiences the maximum background traffic demand and the available spare capacity of the road network is at its most limited. Construction vehicle volumes are anticipated to be higher outside the morning and evening weekday peak periods; however, the number of movements would remain relatively low and be within the range of daily variations in traffic volumes on the road network when compared to background traffic. The number of construction vehicles modelled for the construction assessment corresponds to the construction phase that generates the highest number of construction vehicle movements (when converted to passenger car units) over the two-hour modelled peak period. However, the traffic modelling results presented for the construction assessment corresponds to the network peak hour which represents a worst-case scenario.

In addition, a review of Saturday traffic volumes compared to weekday traffic volumes generally indicates that weekday peak hour traffic volumes are higher than Saturday peak hour traffic volumes. Hence, a quantitative assessment on Saturdays has not been undertaken. Although construction vehicles would be generated on Saturdays, the addition of construction vehicles on the road would be below the peak hour volumes on a weekday, and therefore would not represent a worst-case scenario.

2.3 Performance indicators

The performance of a road network is largely dependent on the operating performance of intersections, which form critical capacity control points. The performance indicators that are reported for this assessment include:

- Intersection Level of Service – based on criteria outlined in Table 2-1 and defined in the *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002). The average delay assessed for signalised intersections is for all movements. The average delay assessed for priority (sign-controlled) intersections is for the worst movement and is expressed in seconds per vehicle
- Maximum queue length on each approach (in metres) over the peak hour.

Table 2-1: Intersection LoS criteria

Level of Service	Average delay per vehicle (seconds/vehicle)	Traffic signals and roundabouts
A	Less than 15	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity; at signals, incidents will cause delays Roundabouts require other control mode
F	Over 70	Extra capacity required

Source: Guide to Traffic Generating Developments (Roads and Traffic Authority, 2002)

It is generally accepted that when intersection performance falls to Level of Service D, investigations should be initiated to determine if suitable remediation can be provided. However, limited road capacity and high demand mean that Level of Service E and Level of Service F are regularly experienced by motorists, particularly during peak periods.

3. Existing transport and traffic environment

3.1 Study area

The Stage 1 study area for the transport and traffic assessment is informed by the construction vehicle routes at each of the following locations:

- Westmead metro station construction site
- Parramatta metro station construction site
- Clyde stabling and maintenance facility construction site
- Silverwater services facility construction site
- Sydney Olympic Park metro station construction site
- North Strathfield metro station construction site
- Burwood North Station construction site
- Five Dock Station construction site
- The Bays Station construction site.

Figure 3-1 provides an overview of the construction site locations for Stage 1.

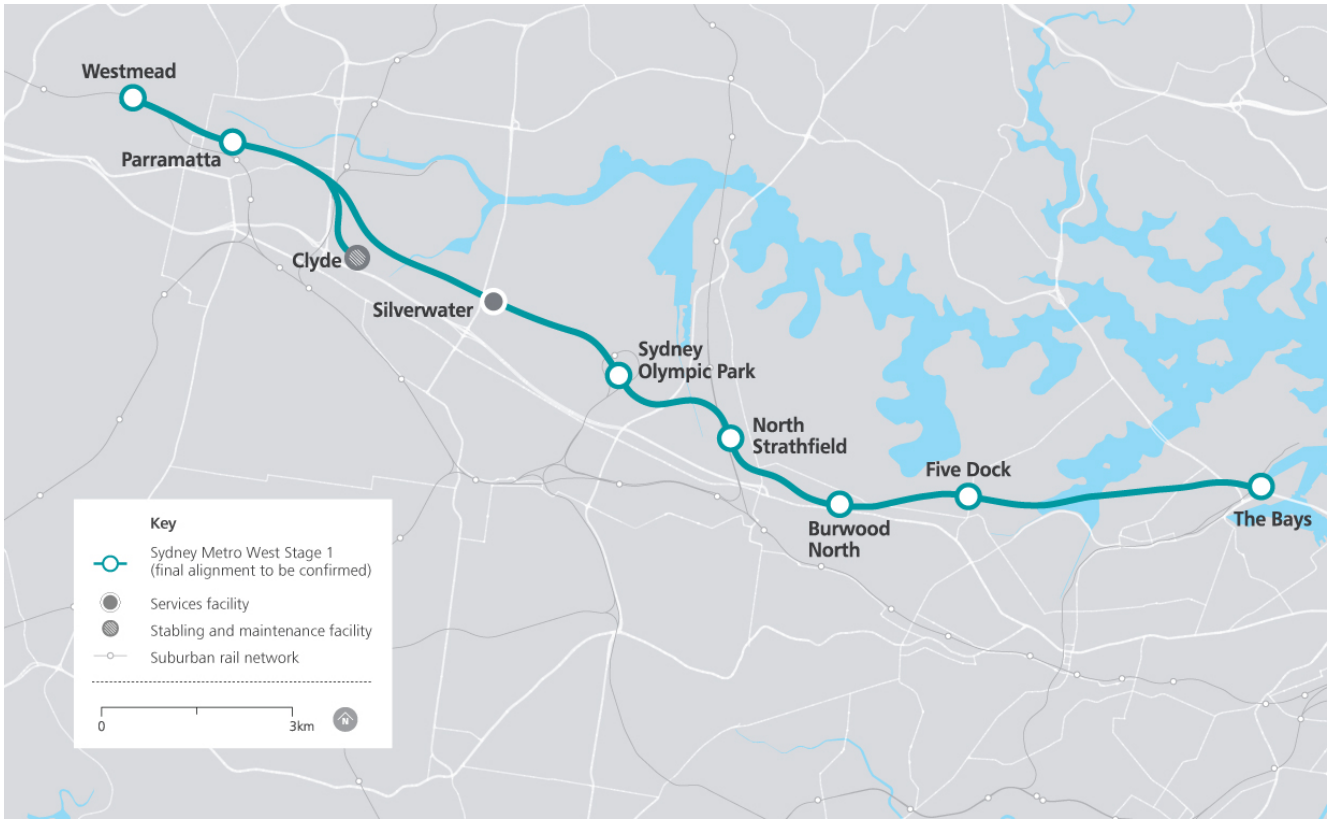

Figure 3-1: Sydney Metro West study area

3.2 Westmead metro station construction site

3.2.1 Active transport network

Footpaths are provided along the majority of roads in the vicinity of the station construction site location. Controlled crossings are provided at two of the three approaches of the Alexandra Avenue / Hassall Street intersection, at three of the four approaches of the Hawkesbury Road / Alexandra Avenue intersection, and across all approaches of the Hawkesbury Road / Priddle Street, Hawkesbury Road / Railway Parade and Hawkesbury Road / Darcy Road intersections. A staged pedestrian crossing is provided on the western approach of the Hawkesbury Road / Darcy Road intersection to accommodate North-West Transitway buses which travel in dedicated bus lanes in the middle of the road and pick-up and drop-off passengers at bus stops located near the intersection. Further north, there is a zebra crossing across Queens Road and on Hawkesbury Road between Queens Road and the entrance to the Westmead Hospital car park and emergency area. Closer to the construction site, a zebra crossing is provided on Railway Parade, facilitating movements to and from the northern side of the existing Westmead Station, and a raised zebra crossing is provided on Grand Avenue, accommodating movements to and from Westmead Public School.

High levels of pedestrian activity occur around the existing Westmead Station and the health and education precinct located north of the rail line, with key pedestrian desire lines along Hawkesbury Road and Darcy Road. Darcy Road is a signposted High Pedestrian Activity Area between east of Bridge Road and Hawkesbury Road. Land use south of the rail line is predominately residential, with lower pedestrian volumes. Pedestrian refuge islands and zebra crossings along with traffic calming devices such as speed humps feature throughout to accommodate these local trips.

The cycle network surrounding the Westmead metro station construction site is shown in Figure 3-2 and consists of a low difficulty on-road route along Queens Road and within Parramatta Park, and off-road shared paths on Mons Road, Darcy Road and Hawkesbury Road. There is also a separated on-road bicycle lane on the north side of Queens Road. The off-road shared paths and bicycle lanes provide east-west connectivity between Parramatta Park, the Westmead health and education precinct, and towards the north-western suburbs. Cyclists can cross Hawkesbury Road using a marked cycle path on the zebra crossing located north of Queens Road.

Bicycle racks are located at the existing Westmead Station north and south entrances on Railway Parade and Alexandra Avenue, respectively. Bicycle lockers are also provided about 100 metres east of the station on Railway Parade and Alexandra Avenue.

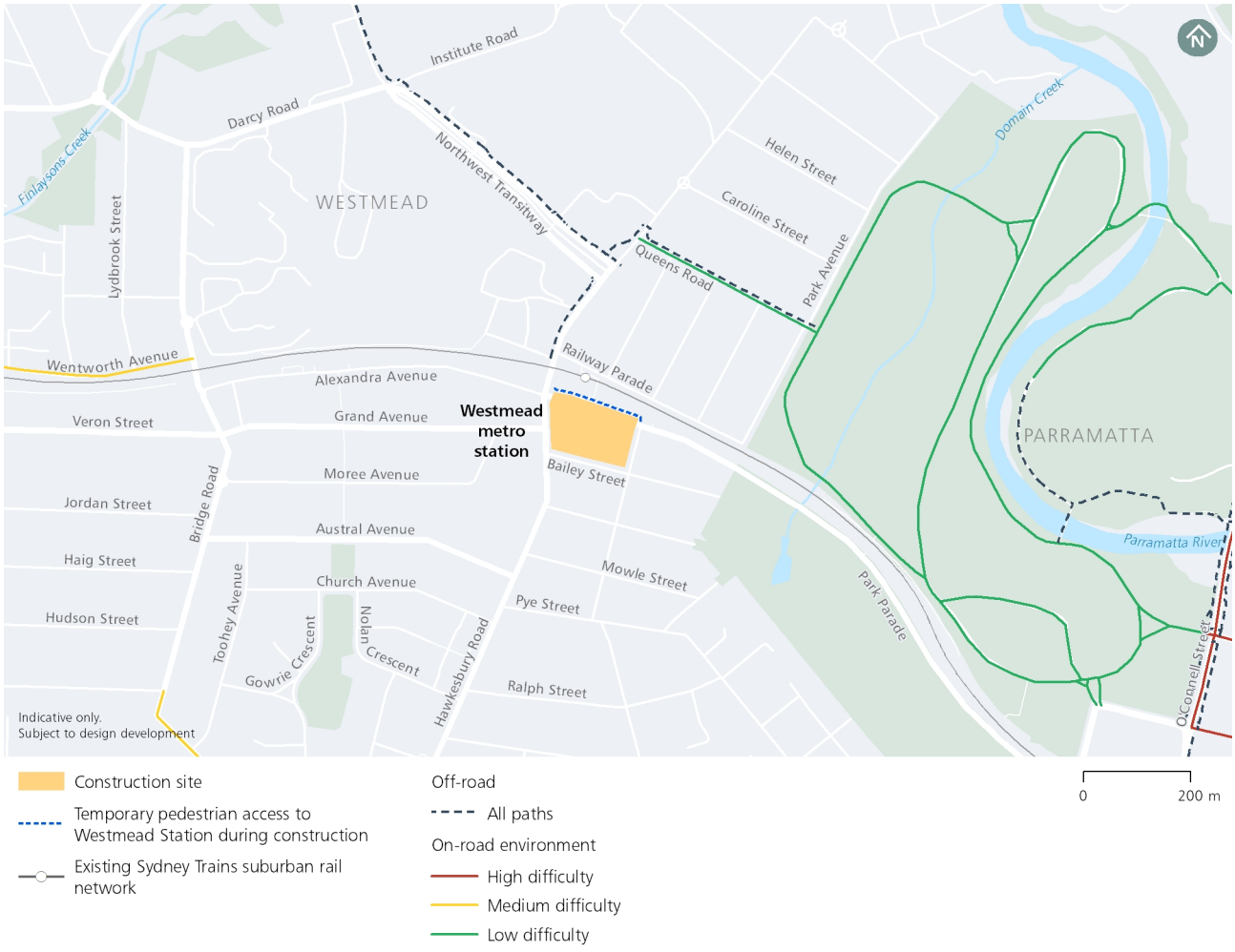

Figure 3-2: Cycle network surrounding the Westmead metro station construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.2.2 Public transport network

The existing Westmead Station is served by the T1 Western Line and the T5 Cumberland Line on the Sydney Trains network. These rail lines provide direct connections to Penrith, Richmond, Blacktown, Parramatta, Liverpool, Leppington, Strathfield, Sydney CBD, Chatswood and Hornsby. Westmead Station is also on the NSW TrainLink network as part of the Blue Mountains Line, providing connections to Bathurst, the Blue Mountains, Strathfield and Central.

Westmead is served by 14 bus routes operated by Transit Systems and Hillsbus, including two NightRide bus routes. Major bus stops are located in close proximity to the existing Westmead Station and Westmead health and education precinct along Darcy Road, Hawkesbury Road, Alexandra Avenue and Park Parade. These roads form part of the North-West Transitway, which is a bus rapid transit route between Parramatta and Rouse Hill consisting of bus-only lanes and dedicated bus roadways. Local buses also operate on the North-West Transitway and the local road network, providing connections to Wentworthville, Seven Hills, Blacktown and Merrylands. Within the immediate surrounds of the site, bus stops on local roads are provided on Church Avenue, Pye Street and Good Street. The area is also served by 17 school bus routes.

Ferry services do not operate in close proximity to the construction site.

In the future, light rail services will operate in Westmead as part of Parramatta Light Rail (Stage 1). The light rail will run along Hawkesbury Road with the terminus located on the corner of Hawkesbury Road and Railway Parade.

The public transport network surrounding the Westmead metro station construction site is shown in Figure 3-3.

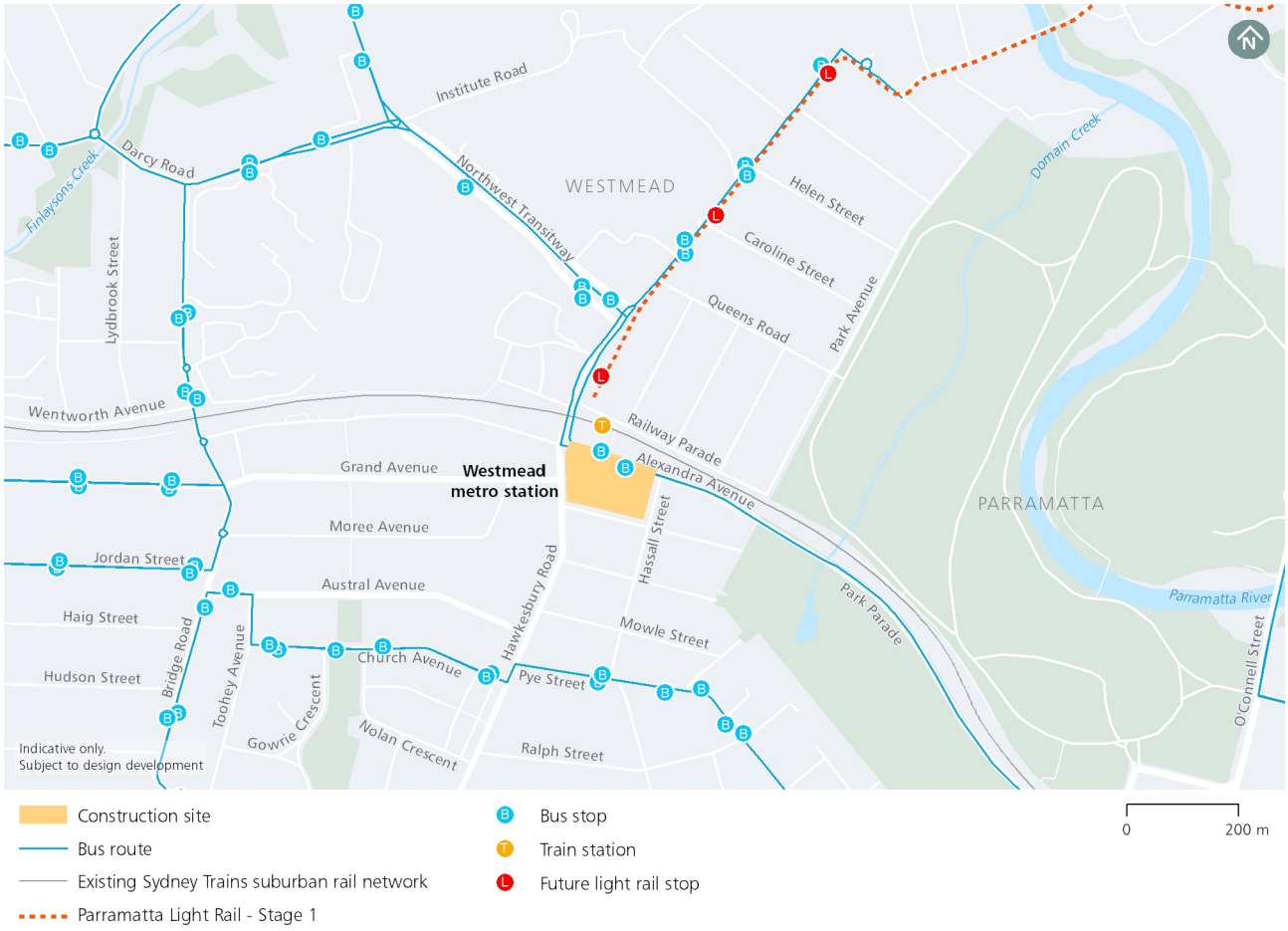

Figure 3-3: Public transport network surrounding the Westmead metro station construction site

3.2.3 On-street parking, loading, servicing and pick-up arrangements

On-street parking is provided on both sides of most local roads and is generally time-restricted to two hours on weekdays and Saturdays. Near the construction site, on-street parking is provided on the eastern side of Hawkesbury Road south of Alexandra Avenue. On-street parking is not provided on Alexandra Avenue between Hawkesbury Road and Hassall Street and Hawkesbury Road between Alexandra Avenue and Queens Road. East of Hassall Street, on-street parking is provided along the southern side of the road. North of the rail line, unrestricted 90-degree parking is provided along the southern side of Railway Parade, primarily serving commuters using Westmead Station.

A taxi zone is located on the northern side of Railway Parade between Hawkesbury Road and Ashley Lane and a mail zone is located on the northern side of Alexandra Avenue near the existing Westmead Station entrance. There are no kiss and ride or loading zones on the roads immediately surrounding the construction site.

3.2.4 Traffic volumes and patterns

Great Western Highway is a major arterial road that carries a high volume of traffic. During the morning peak hour, the peak direction is eastbound with volumes of about 1,770 vehicles. During the evening peak hour, the peak direction is westbound with a considerably higher volume of about 2,570 vehicles.

Hawkesbury Road is a collector road that exhibits a northbound morning peak direction and a southbound evening peak direction. Near its intersection with Alexandra Avenue, peak hour volumes on Hawkesbury Road are up to 760 vehicles. Alexandra Avenue runs east-west and forms part of the North-West Transitway. Alexandra Avenue carries volumes ranging from 410 to 830 vehicles per hour in each direction and exhibits an eastbound morning peak direction and a westbound evening peak direction.

Bridge Road is a collector road that carries traffic volumes ranging between 480 and 670 vehicles per hour in each direction during peak periods. It exhibits a northbound morning peak direction and a southbound evening peak direction.

Hassall Street is a local road that has a northbound morning peak and southbound evening peak direction. Traffic volumes in the peak direction are between 450 and 520 vehicles per hour, more than triple the volume experienced in the counter-peak direction. Grand Avenue and Bailey Street are also local roads that carry between 10 and 210 vehicles per hour in each direction.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-1.

The future road network within the vicinity of the existing Westmead Station will be modified to accommodate Parramatta Light Rail (Stage 1). These changes, which will be implemented by 2023, and which have been incorporated into the construction traffic modelling assessment, are discussed in Section 4.7.4.

Table 3-1: Existing peak hour traffic volumes by direction (2019) – Westmead

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Alexandra Avenue east of Hawkesbury Road	Eastbound	520	490
	Westbound	410	830
Great Western Highway west of Hawkesbury Road	Eastbound	1,770	1,100
	Westbound	1,100	2,570
Grand Avenue west of Hawkesbury Road	Eastbound	130	10
	Westbound	60	90
Bailey Street east of Hawkesbury Road	Eastbound	40	40
	Westbound	60	210
Hawkesbury Road south of Alexandra Avenue	Northbound	760	440
	Southbound	390	760
Hassall Street south of Alexandra Avenue	Northbound	520	130
	Southbound	160	450
Bridge Road north of Grand Avenue	Northbound	670	480
	Southbound	490	600

3.2.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the Westmead metro station construction site is shown in Table 3-2.

Modelled intersection performance indicates that the following intersections perform poorly at Level of Service E or F:

- Hawkesbury Road / Grand Avenue during the morning peak hour
- Hawkesbury Road / Bailey Street during the evening peak hour
- Hawkesbury Road / Great Western Highway / Coleman Street during the morning and evening peak hour.

Key points include:

- The poor performance of Hawkesbury Road / Grand Avenue and Hawkesbury Road / Bailey Street is due to these intersections being unsignalised where the worst movement is reported, which for both intersections corresponds to vehicles turning out of Grand Avenue or Bailey Street onto Hawkesbury Road. Grand Avenue and Bailey Street are minor roads and therefore vehicles must give way to vehicles travelling on Hawkesbury Road. In addition, northbound queues at these intersections are the result of downstream queues from the Hawkesbury Road / Alexandra Avenue intersection
- High traffic volumes on the majority of approaches at the Hawkesbury Road / Great Western Highway / Coleman Street intersection contributes to its poor performance during both peak hours.
- At the Bailey Street / Hassall Street intersection, queuing along Hassall Street is the result of downstream queues from the Alexandra Avenue / Hassall Street intersection (northbound) and the Hawkesbury Road / Bailey Street intersection (westbound), due to vehicles avoiding the Hawkesbury Road / Alexandra Avenue intersection.

Table 3-2: Modelled peak hour existing intersection performance (2019) – Westmead

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Alexandra Avenue					
Morning	2,310	36	C	NB	190
				EB	115
				SB	150
				WB	185
Evening	2,259	45	D	NB	150
				EB	60
				SB	235
				WB	175

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Grand Avenue					
Morning	1,264	79	F	NB	135
				EB	95
				SB	<5
				WB	-
Evening	1,349	47	D	NB	95
				EB	15
				SB	<5
				WB	-
Hawkesbury Road / Bailey Street					
Morning	1,246	25	B	NB	95
				EB	-
				SB	<5
				WB	35
Evening	1,420	80	F	NB	50
				EB	-
				SB	<5
				WB	185
Hawkesbury Road / Priddle Street					
Morning	1,245	10	A	NB	105
				EB	-
				SB	30
				WB	50
Evening	1,269	7	A	NB	30
				EB	-
				SB	50
				WB	25

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Amos Street					
Morning	1,386	10	A	NB	65
				EB	-
				SB	65
				WB	30
Evening	1,388	45	D	NB	60
				EB	-
				SB	150
				WB	30
Hawkesbury Road / Great Western Highway / Coleman Street					
Morning	3,605	66	E	NB	175
				EB	115
				SB	150
				WB	100
Evening	3,825	>100	F	NB	75
				EB	105
				SB	400
				WB	400
Bailey Street / Hassall Street					
Morning	708	16	B	NB	100
				EB	25
				SB	25
				WB	25
Evening	646	5	A	NB	60
				EB	25
				SB	95
				WB	15

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Alexandra Avenue / Hassall Street					
Morning	1,426	22	B	NB	200
				EB	95
				SB	-
				WB	95
Evening	1,405	13	A	NB	130
				EB	50
				SB	-
				WB	330
Alexandra Avenue / Bridge Road					
Morning	1,549	23	B	NB	30
				EB	-
				SB	60
				WB	65
Evening	1,422	10	A	NB	35
				EB	-
				SB	50
				WB	70
Bridge Road / Grand Avenue					
Morning	1,626	21	B	NB	35
				EB	65
				SB	85
				WB	30
Evening	1,408	46	D	NB	45
				EB	35
				SB	85
				WB	45

3.3 Parramatta metro station construction site

3.3.1 Active transport network

The pedestrian network surrounding the Parramatta metro station construction site is well developed. Footpaths are provided along both sides of all roads and controlled crossings are provided at all signalised intersections. Signalised pedestrian crossings are provided on all approaches of the Church Street / George Street intersection,

while scramble crossings are in operation at the George Street / Smith Street, Macquarie Street / Smith Street and Church Street / Macquarie Street intersections. A signalised midblock crossing is provided on Macquarie Street between Church Street and United Lane, and zebra crossings are located across Horwood Place and the access road on the southern side of Macquarie Street between Horwood Place and Smith Street.

Pedestrian volumes are typically high throughout the day, with increased pedestrian activity towards the existing Parramatta Station, bus interchange and Westfield Parramatta shopping centre. Church Street is the main north-south pedestrian route and includes a pedestrian only zone between Macquarie Street and Darcy Street. In the east-west direction, pedestrian levels are high on Phillip Street, George Street, Macquarie Street, Darcy Street, Hassall Street and Argyle Street, providing connectivity between Parramatta Park, Parramatta CBD and Harris Park.

Signposted High Pedestrian Activity Areas include:

- Church Street between Palmer Street and Macquarie Street
- Phillip Street between Marsden Street and Charles Street
- Charles Street between Phillip Street and George Street.

The cycle network surrounding the Parramatta metro station construction site is shown in Figure 3-4 and consists of on-road and off-road cycle routes. On-road east-west cycle routes are provided on Phillip Street, George Street and Macquarie Street, connecting to shared paths along O'Connell Street, Elizabeth Street and Macarthur Street that provide connectivity to the Parramatta River and Parramatta Park. These shared paths also provide regional connections to the north-western suburbs towards the west and to locations along the Parramatta River towards the east. On-road north-south cycle routes are located along O'Connell Street, Horwood Place, Elizabeth Street, Smith Street and Church Street. These provide local connectivity to North Parramatta and Harris Park. Cyclists have the opportunity to cross Parramatta River at Noller Bridge, O'Connell Street, Elizabeth Street, Charles Street Weir and Macarthur Street.

Bicycle lockers are located near the existing Parramatta Station on Wentworth Street and at the corner of Darcy Street and Station Street East. In addition, a bicycle shed is located at the corner of Hassall Street and Station Street East.

In the future, the active transport network will be modified in Parramatta CBD as part of Parramatta Light Rail (Stage 1). These changes include new pedestrian zones on Church Street and Macquarie Street, modification of scramble and midblock pedestrian crossings surrounding the construction site on Church Street, Macquarie Street, George Street and Smith Street, and adjustments to cycle routes on Macquarie Street.

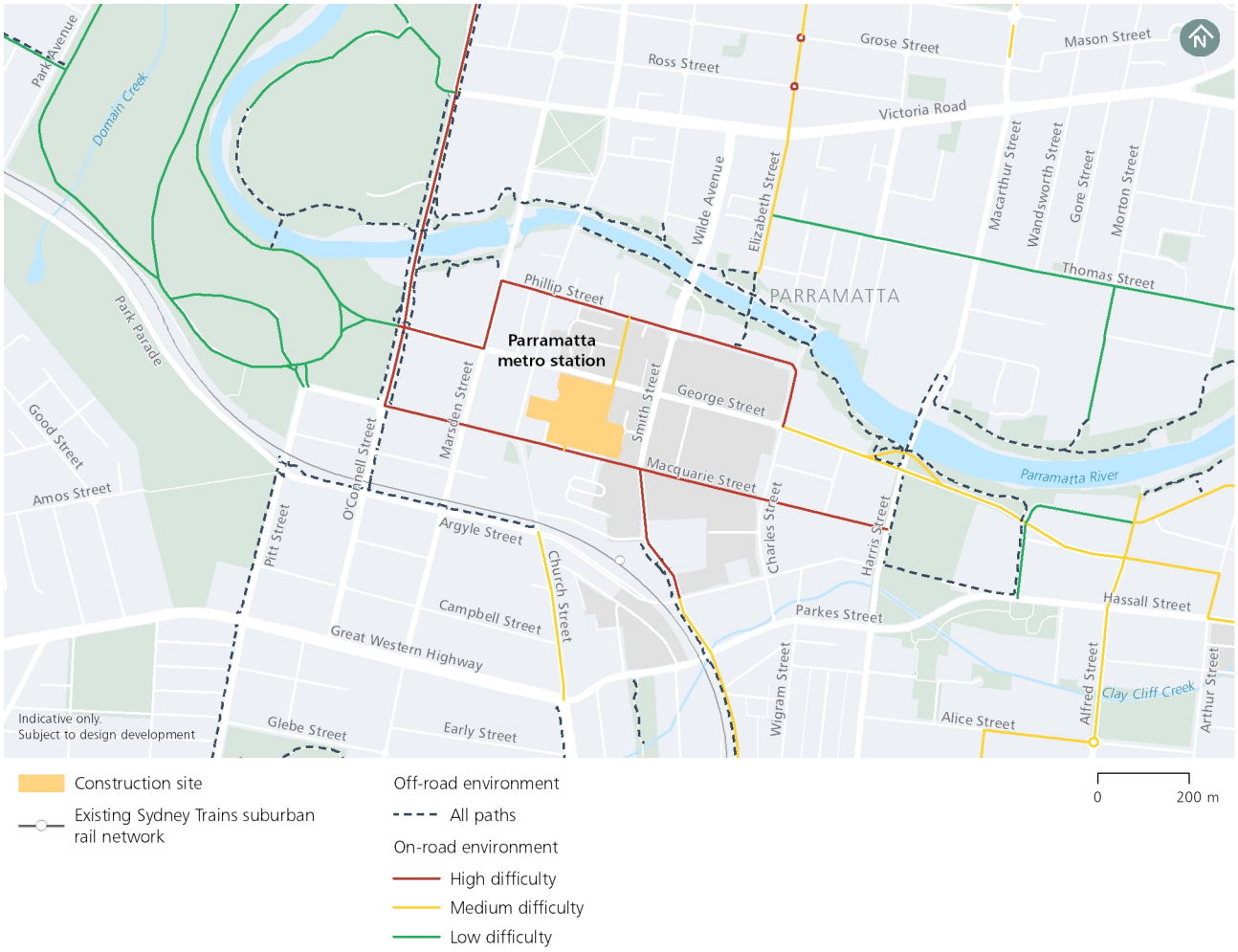

Figure 3-4: Cycle network surrounding the Parramatta metro station construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.3.2 Public transport network

Parramatta CBD is well served by public transport services. The existing Parramatta Station is served by three lines on the Sydney Trains network: the T1 Western Line, the T2 Inner West and Leppington Line and the T5 Cumberland Line. These rail lines provide direct connections to Penrith, Richmond, Blacktown, Liverpool, Leppington, Strathfield, Sydney CBD, Chatswood and Hornsby. The existing Parramatta Station is also on the NSW TrainLink network as part of the Blue Mountains and Western NSW Lines, providing connections to Broken Hill, Dubbo, Bathurst, the Blue Mountains, Strathfield and Central.

A substantial number of buses serve the Parramatta CBD, originating and terminating at the Parramatta Interchange on Argyle Street. The Parramatta Interchange is a major transport hub allowing customers to easily transfer between the suburban rail network, intercity rail network, regional rail network, bus network, and the future Parramatta Light Rail line. Buses are operated by Sydney Buses, Hillsbus, Transdev and Transit Systems, with 48 routes accessible at the Parramatta Interchange including four NightRide routes, five Metrobus routes and eight transitway routes. These buses serve Greater Sydney via local roads or major bus corridors. The busiest roads for buses include Smith Street, Wilde Avenue, Victoria Road, Argyle Street and Church Street.

Two transitways converge at the Parramatta Interchange, the North-West Transitway (as discussed in Section 3.2.2) and the Liverpool to Parramatta Transitway, which is a bus rapid transit route consisting of bus-only lanes

and dedicated bus roadways between Liverpool and Parramatta. In the Parramatta CBD, the Liverpool to Parramatta Transitway runs along Argyle Street, Pitt Street and Great Western Highway. Bus lanes also exist on both sides of the road on Smith Street and Station Street East in the Parramatta CBD. The area is also served by 41 school bus routes.

A free shuttle bus service operates in the Parramatta CBD as a one-way loop via George Street, O'Connell Street, Grose Street, Villiers Street, Marist Place, Marsden Street, Phillip Street and Charles Street. This service is operated by Transdev NSW and takes about 22 minutes to complete one circuit.

Western Sydney University also operates a shuttle bus service, transporting staff and students between its Parramatta campuses. The service is accessible near the Western Sydney University Parramatta City campus on Smith Street.

Parramatta Leagues Club privately operates a courtesy shuttle bus service for members and guests living locally in the area. The service does not travel on a fixed route, instead picking up and dropping of passengers at their place of residence.

Ferry services are accessible at the Parramatta Wharf located about 600 metres north-east of the construction site via the active transport or road networks. The F3 Parramatta River Line operates to and from this wharf, providing connections between Parramatta and Circular Quay.

In the future, light rail services will operate in Parramatta CBD as part of Parramatta Light Rail (Stage 1). The light rail will run along Church Street and Macquarie Street.

The public transport network surrounding the Parramatta metro station construction site is shown in Figure 3-6.

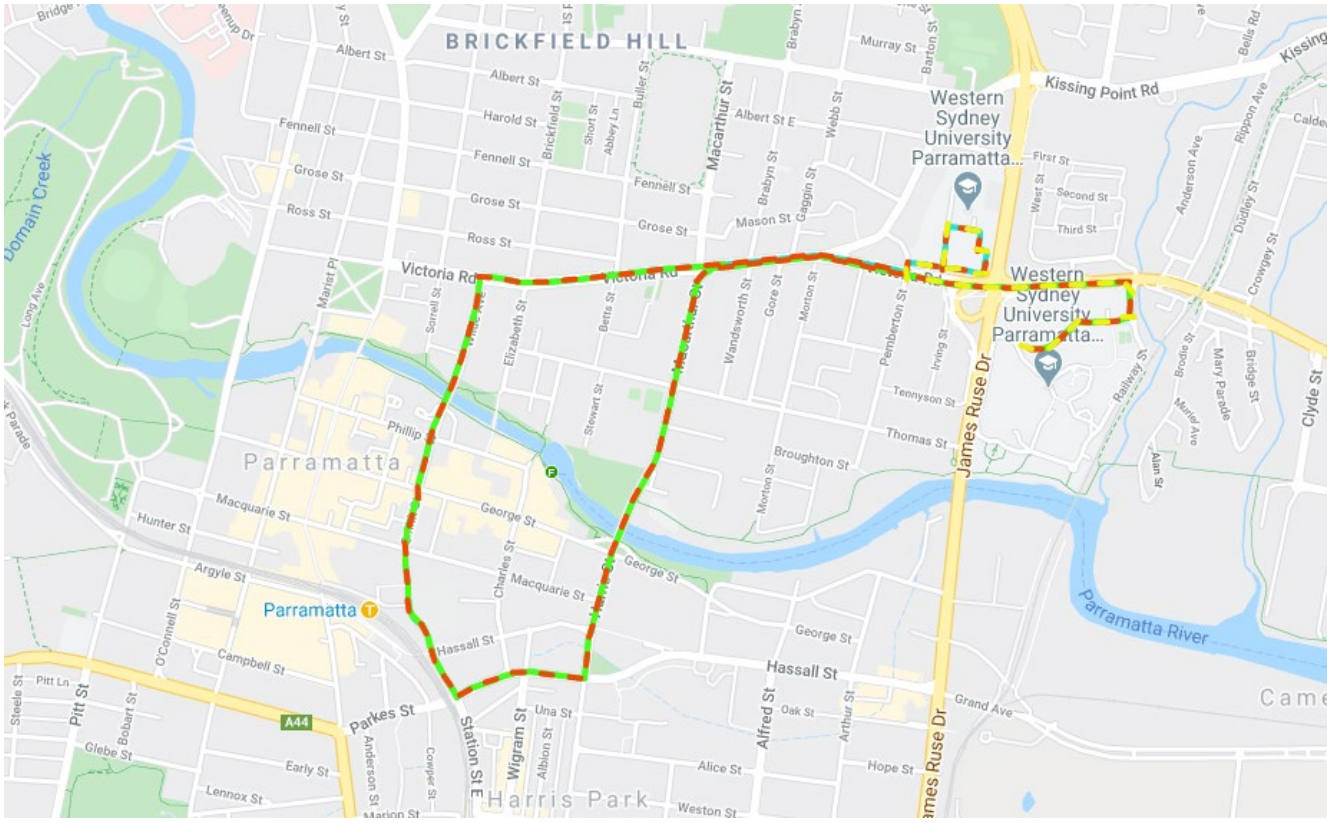

Figure 3-5: Western Sydney University Parramatta shuttle bus service route

Source: Shuttle Tracker (Western Sydney University, 2020)

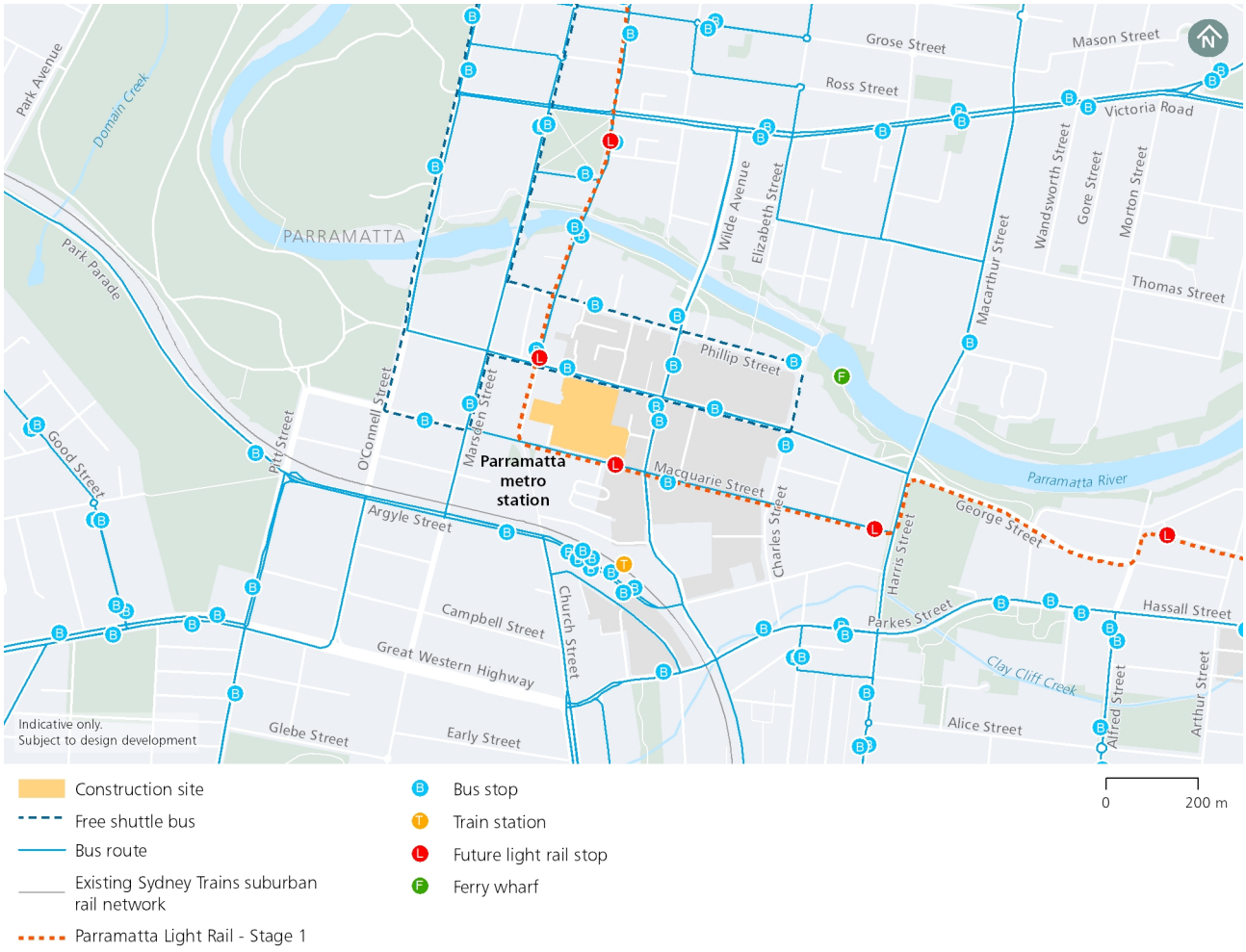

Figure 3-6: Public transport network surrounding the Parramatta metro station construction site

3.3.3 On-street parking, loading, servicing and pick-up arrangements

On-street parking in Parramatta consists of free and paid parking. Immediately surrounding and within the construction site, there are some paid on-street parking spaces along Horwood Place, Macquarie Street and Church Street. On-street paid parking is also provided on a number of sections of George Street, particularly near Horwood Place and east of Smith Street. In contrast, there are no on-street parking spaces provided on Smith Street.

Kiss and ride and loading zones are located throughout the Parramatta CBD. Taxi zones are located close to Parramatta Station on Fitzwilliam Street and Valentine Avenue. Figure 3-7 provides a summary of the on-street parking arrangements in the Parramatta CBD.

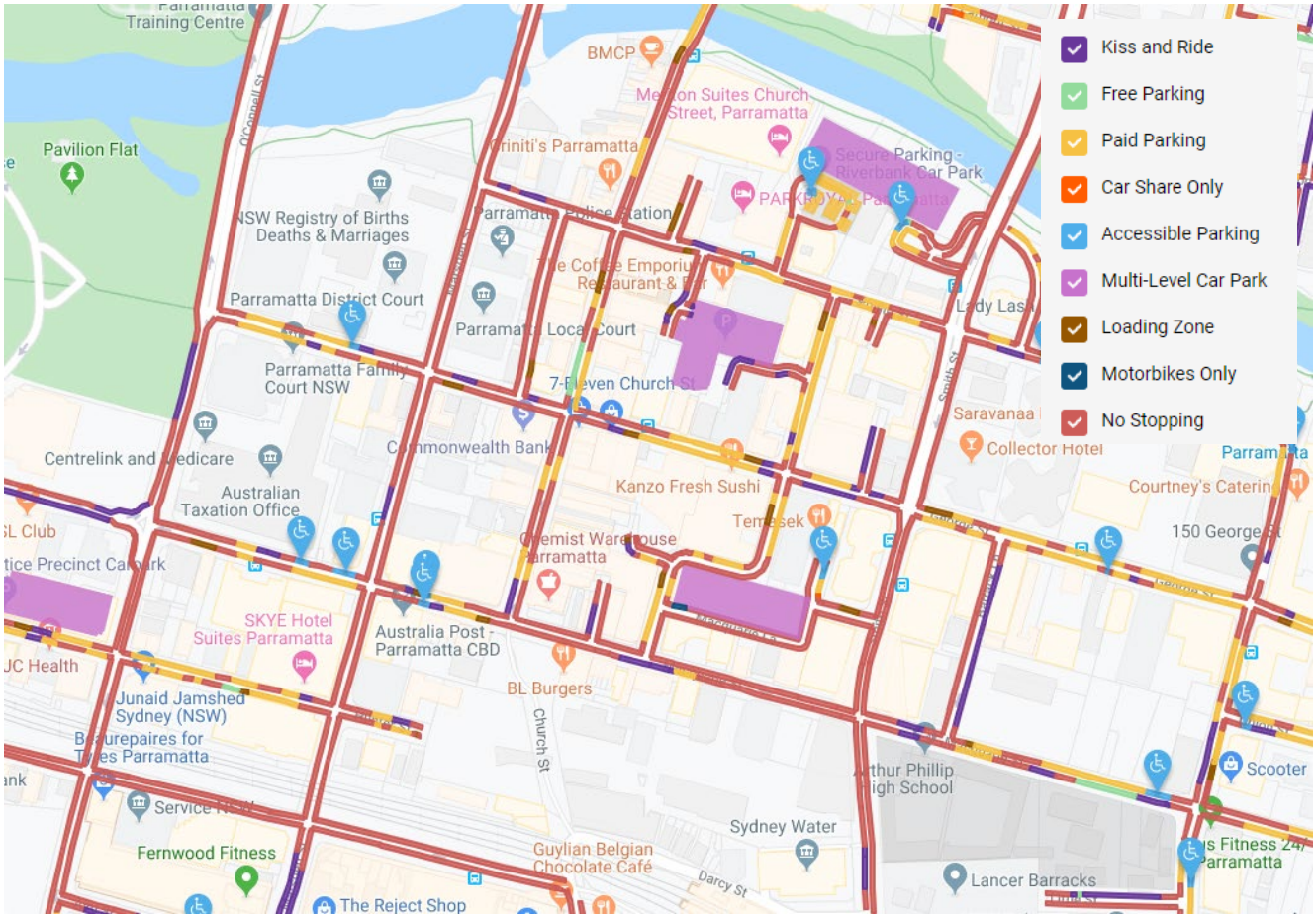

Figure 3-7: On-street parking arrangements in Parramatta

Source: City of Parramatta – Parking Finder (City of Parramatta, 2019)

3.3.4 Traffic volumes and patterns

Great Western Highway is a major arterial road. Near Pitt Street it experiences a distinct eastbound morning peak and westbound evening peak direction, with traffic volumes of about 1,780 vehicles, almost double the volumes experienced in the counter-peak direction. O'Connell Street, a sub-arterial road, operates in both directions north of Macquarie Street, and south of Macquarie Street it operates in the southbound direction only. Traffic volumes are greater than 1,000 vehicles in each direction throughout its length and reaches as high as 2,140 vehicles during the morning peak hour in the northbound direction.

Macquarie Street is a collector road that also carries a high volume of traffic and operates one-way in the eastbound direction with 2,440 vehicles during the morning peak hour and 1,480 vehicles during the evening peak hour. General traffic may travel on Pitt Street in the northbound direction while only buses are permitted to travel in the southbound direction. Pitt Street is a sub-arterial road that carries between 810 and 1,330 vehicles in the northbound direction during both peak hours, and up to 30 buses in the southbound direction during both peak hours.

George Street is a collector road that, prior to November 2019, operated as one-way in the eastbound direction, carrying between 510 and 780 vehicles per hour during the morning and evening peak period. George Street converted to two-way operation between O'Connell Street and Harris Street in November 2019 as part of road network modifications to accommodate Parramatta Light Rail (Stage 1). This and other changes, which will be

implemented by 2023, and which have been incorporated into the construction traffic modelling assessment, are discussed in Section 4.8.4.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-3.

Table 3-3: Existing peak hour traffic volumes by direction (2019) – Parramatta

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Great Western Highway west of Pitt Street	Eastbound	1,780	940
	Westbound	990	1,770
Macquarie Street west of O'Connell Street	Eastbound	2,440	1,430
	Westbound	-	-
George Street east of Church Street (prior to two-way operation)	Eastbound	780	510
	Westbound	-	-
Pitt Street north of Great Western Highway	Northbound	1,330	810
	Southbound	20	30
O'Connell Street south of George Street	Northbound	2,140	1,260
	Southbound	1,420	1,140
O'Connell Street north of Great Western Highway	Northbound	-	-
	Southbound	1,020	1,460

3.3.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the Parramatta metro station construction site is shown in Table 3-4.

Modelled intersection performance indicates that all intersections perform at Level of Service D or better during the morning and evening peak hour. Some intersections along Great Western Highway, O'Connell Street and Pitt Street are approaching capacity and experience queues that extend past adjacent intersections.

Table 3-4: Modelled peak hour existing intersection performance (2019) – Parramatta

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Great Western Highway / Pitt Street					
Morning	3,954	44	D	NB	170
				EB	260
				SB	30
				WB	260
Evening	3,410	32	C	NB	105
				EB	85
				SB	25
				WB	280
Great Western Highway / O'Connell Street					
Morning	2,894	29	C	NB	-
				EB	30
				SB	210
				WB	60
Evening	2,990	48	D	NB	-
				EB	105
				SB	235
				WB	70
Pitt Street / Argyle Street / Park Parade					
Morning	2,618	53	D	NB	345
				EB	25
				SB	-
				WB	105
Evening	2,040	28	B	NB	140
				EB	15
				SB	-
				WB	150

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
O'Connell Street / Aird Street					
Morning	1,438	6	A	NB	-
				EB	-
				SB	65
				WB	25
Evening	1,429	53	D	NB	-
				EB	-
				SB	45
				WB	45
O'Connell Street / Argyle Street					
Morning	1,881	15	B	NB	-
				EB	25
				SB	115
				WB	35
Evening	2,360	32	C	NB	-
				EB	10
				SB	190
				WB	60
O'Connell Street / Hunter Street					
Morning	1,608	<5	A	NB	-
				EB	-
				SB	35
				WB	35
Evening	1,872	24	B	NB	-
				EB	-
				SB	95
				WB	105

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
O'Connell Street / Macquarie Street					
Morning	3,291	13	A	NB	-
				EB	235
				SB	30
				WB	65
Evening	2,620	44	D	NB	-
				EB	165
				SB	190
				WB	50
O'Connell Street / George Street					
Morning	3,640	36	C	NB	120
				EB	-
				SB	430
				WB	-
Evening	2,671	22	B	NB	65
				EB	-
				SB	360
				WB	-
George Street / Marsden Street					
Morning	1,761	21	B	NB	60
				EB	70
				SB	80
				WB	-
Evening	1,713	20	B	NB	100
				EB	45
				SB	115
				WB	-

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
George Street / Church Street					
Morning	772	23	B	NB	15
				EB	80
				SB	45
				WB	-
Evening	587	27	B	NB	25
				EB	60
				SB	140
				WB	-
George Street / Horwood Place					
Morning	939	14	A	NB	30
				EB	35
				SB	35
				WB	-
Evening	808	17	B	NB	45
				EB	25
				SB	30
				WB	

3.4 Clyde stabling and maintenance facility construction site

3.4.1 Active transport network

The pedestrian network around the Clyde stabling and maintenance facility construction site is limited given the industrial land uses to the east of Rosehill Gardens Racecourse and north of Duck River. Footpaths are located on Unwin Street (running parallel to the rail line), Kay Street, Wentworth Street south of Kay Street, James Ruse Drive and Parramatta Road. There are no footpaths along Colquhoun Street, Tennyson Street, Deniehy Street, Wentworth Street north of Kay Street, and the section of Unwin Street that runs perpendicular to the rail line). The closest formal pedestrian crossing facilities are located at the Parramatta Road / Wentworth Street intersection via signalised pedestrian crossings, some 550 metres away from the site access. In addition, James Ruse Drive forms a barrier to east-west movements. These movements are limited to at-grade crossings at the Parramatta Road / James Ruse Drive intersection or via a pedestrian bridge connecting Oak Street to the car park that served the now closed Rosehill Station, both a considerable distance from the construction site. Given the limited pedestrian infrastructure, typical pedestrian volumes within the immediate vicinity of the construction site are low. Exceptions would be during events held at Rosehill Gardens racecourse or the Sydney Speedway, where pedestrian volumes are higher near the now closed Rosehill Station and Clyde Station, respectively, and the surrounding local road network. Rosehill Station was closed as part of Parramatta Light Rail (Stage 1) from January 2020.

The cycle network surrounding the Clyde stabling and maintenance facility construction site is shown in Figure 3-8 with limited facilities throughout the area. Near the southern boundary of the construction site there is the M4 cycleway, which is a 15 kilometre shared path between South Wentworthville and Sydney Olympic Park, generally following the M4 Western Motorway alignment. A shared path that runs along the northern side of Parramatta Road connects to the M4 cycleway via Kendall Street and Martha Street, which are designated moderate difficulty on-road cycle routes. There is also a short section of Alfred Street between Prospect Street and Virginia Street that is also designated as a moderate difficulty on-road cycle route.

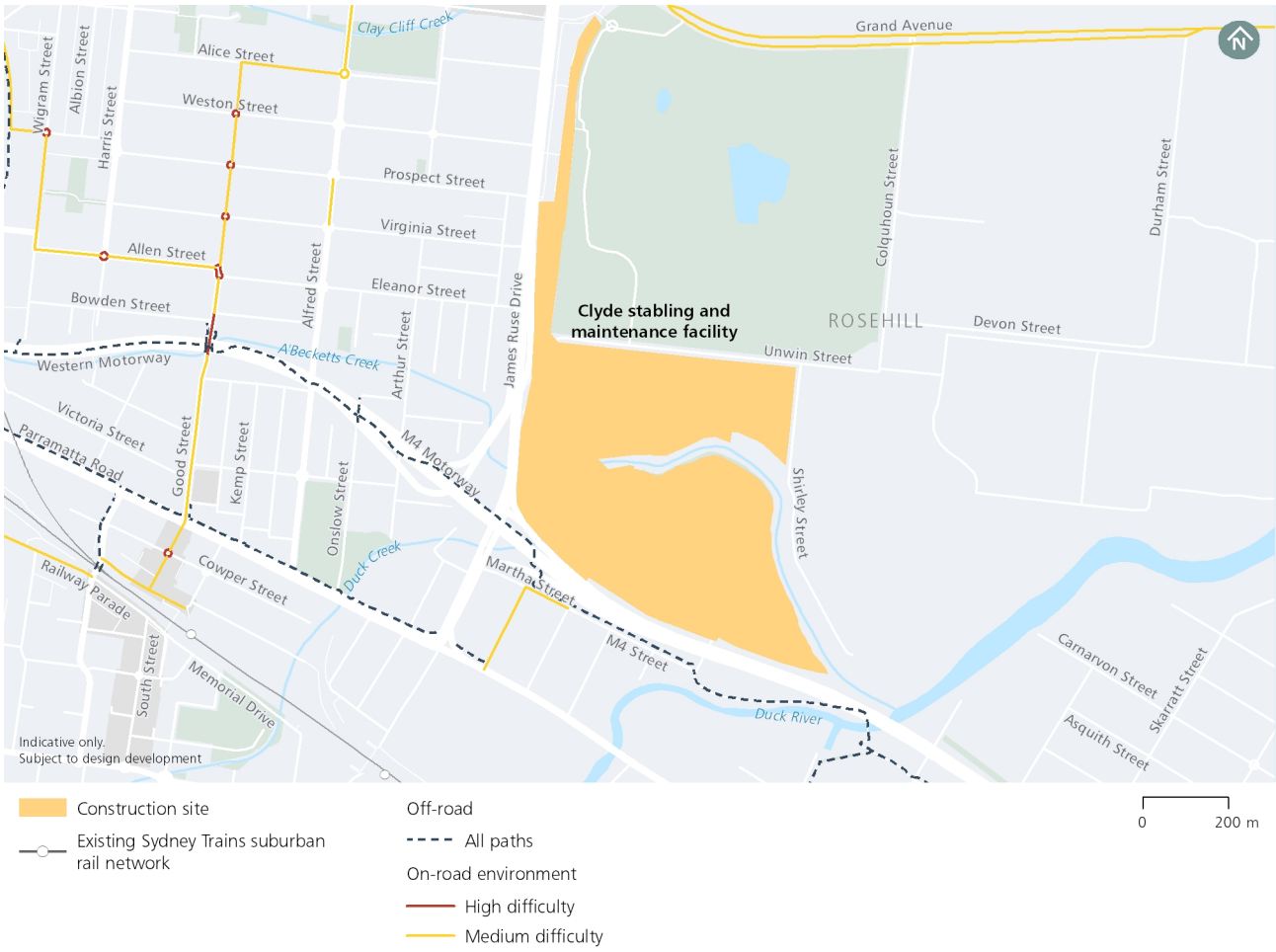

Figure 3-8: Cycle network surrounding the Clyde stabling and maintenance facility construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.4.2 Public transport network

There are no train stations located within the immediate surrounds of the Clyde stabling and maintenance facility construction site. The nearest rail services are accessible from Clyde Station on the Sydney Trains network, located about one kilometre from the site access point. Clyde Station is served by the T1 Western Line and T2 Inner West and Leppington Line.

The T6 Carlingford Line closed in January 2020 as part of Parramatta Light Rail (Stage 1).

A few bus routes operate near the Clyde stabling and maintenance facility construction site and are accessible at bus stops located at least 500 metres from the site on Parramatta Road, James Ruse Drive and Alfred Street. Two bus routes which are operated by Transdev NSW travel on James Ruse Drive or Alfred Street, before

continuing on Parramatta Road. These services provide connections to Bankstown, Parramatta and Sutherland. Two NightRide bus services operated by Hillsbus are accessible from Parramatta Road or James Ruse Drive and provide connectivity between Sydney CBD and Fairfield or Carlingford. The area is also served by six school bus routes.

Ferry services do not operate in close proximity to the proposed stabling and maintenance facility construction site.

The public transport network surrounding the Clyde stabling and maintenance facility construction site is shown in Figure 3-9.

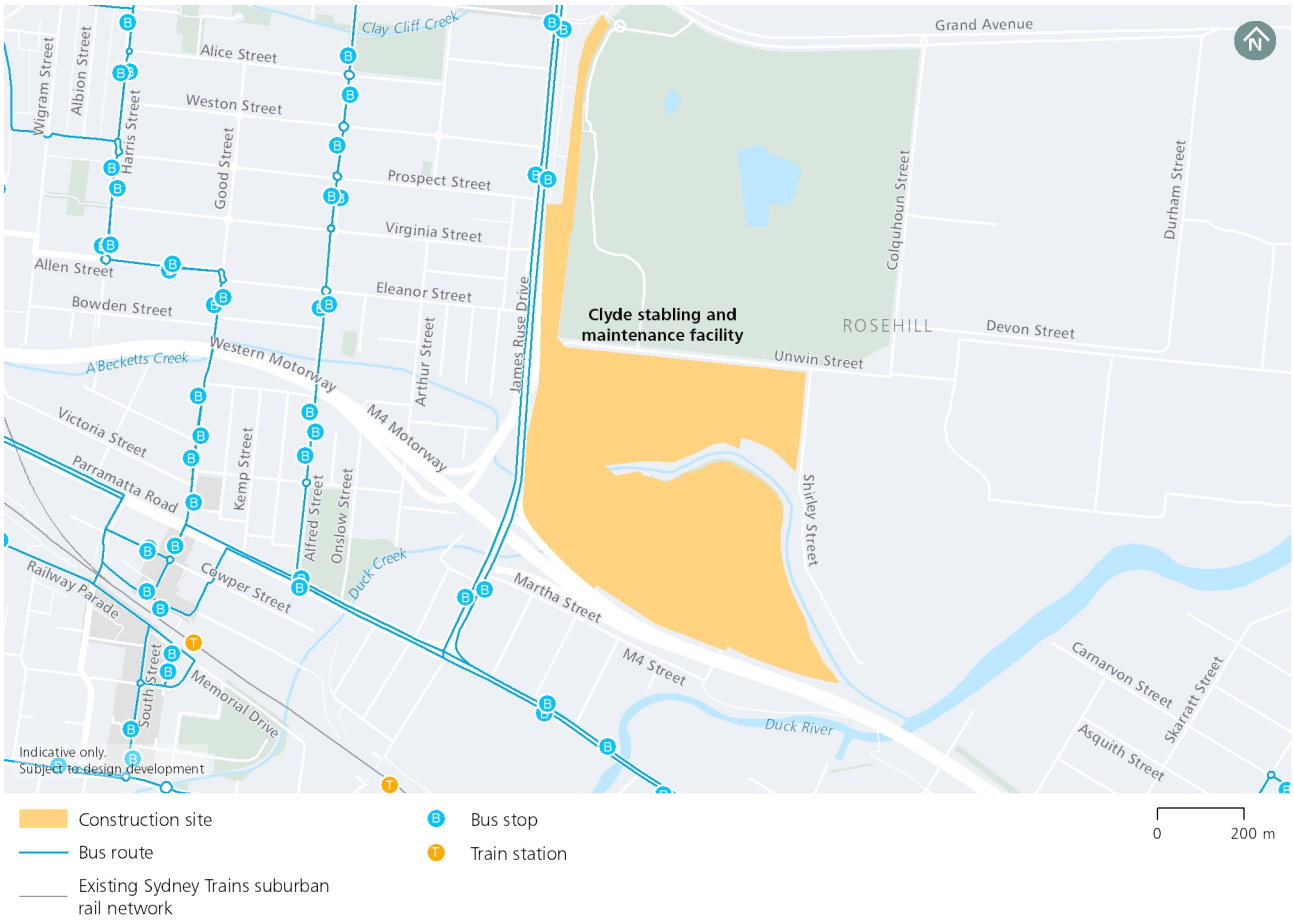

Figure 3-9: Public transport network surrounding the Clyde stabling and maintenance facility construction

3.4.3 On-street parking, loading, servicing and pick-up arrangements

Unrestricted on-street parking is provided on Kay Street, Unwin Street and Wentworth Street. Parking is prohibited on Parramatta Road and James Ruse Drive, with clearways in operation seven days a week during daylight hours (6 am to 7 pm Monday to Friday, 8 am to 8 pm Saturday and Sunday).

There are no kiss and ride, loading zone or taxi zones on roads immediately surrounding the construction site.

3.4.4 Traffic volumes and patterns

Parramatta Road is a major arterial road that carries high traffic volumes of at least 1,600 vehicles during the peak hour in each direction. West of Wentworth Street, westbound volumes are higher than eastbound volumes, and slightly higher volumes are experienced in both directions during the morning peak hour compared to the evening peak hour.

Traffic volumes on James Ruse Drive, which is a major arterial road, north of Parramatta Road are also high, ranging between 1,110 and 1,500 vehicles in each direction during the peak hour. This section of James Ruse Drive exhibits a southbound morning peak direction and a northbound evening peak direction.

Given the industrial land uses surrounding the local road network east of James Ruse Drive, low traffic volumes are experienced on Unwin Street, Kay Street and Wentworth Street, with fewer than 280 vehicles per hour observed in each direction during both peak periods.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-5.

Table 3-5: Existing peak hour traffic volumes by direction (2019) – Clyde

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Unwin Street west of Colquhoun Street	Eastbound	220	190
	Westbound	280	130
Parramatta Road west of Wentworth Street	Eastbound	1,730	1,600
	Westbound	2,110	1,950
Kay Street west of Wentworth Street	Eastbound	150	170
	Westbound	270	90
James Ruse Drive north of Parramatta Road	Northbound	1,300	1,280
	Southbound	1,500	1,110
Wentworth Street north of Parramatta Road	Northbound	260	120
	Southbound	150	180

3.4.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the Clyde stabling and maintenance facility construction site is shown in Table 3-6.

Modelled intersection performance indicates that all intersections perform at Level of Service D or better during the morning and evening peak hour.

Table 3-6: Modelled peak hour existing intersection performance (2019) – Clyde

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Parramatta Road / James Ruse Drive					
Morning	5,078	42	C	NB	-
				EB	175
				SB	165
				WB	170
Evening	4,764	53	D	NB	-
				EB	175
				SB	190
				WB	260
Parramatta Road / Marsh Street					
Morning	3,214	52	D	NB	35
				EB	260
				SB	-
				WB	170
Evening	3,430	40	C	NB	200
				EB	105
				SB	-
				WB	175
Parramatta Road / Wentworth Street					
Morning	4,044	15	A	NB	-
				EB	190
				SB	50
				WB	115
Evening	3,670	19	B	NB	-
				EB	200
				SB	60
				WB	200

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Wentworth Street / Kay Street					
Morning	413	<5	A	NB	25
				EB	<5
				SB	10
				WB	-
Evening	258	<5	A	NB	<5
				EB	<5
				SB	10
				WB	-

3.5 Silverwater services facility construction site

3.5.1 Active transport network

Footpaths are available on both sides of Silverwater Road, Wetherill Street North and Carnarvon Street while Derby Street west of Wetherill Street North consists of a footpath along its northern side and a grassed area along its southern side. The majority of pedestrian traffic in the vicinity of the services facility would primarily be employees of the commercial and industrial businesses operating in the area.

Provision of pedestrian crossing facilities is minimal in the area. Signalised pedestrian crossings are provided at the Silverwater / Carnarvon Street intersection, about 250 metres south of the site, and at the Silverwater Road / Fariola Street intersection, about 500 metres north of the site.

The cycle network surrounding the Silverwater services facility construction site is shown in Figure 3-10 and includes the M4 cycleway (discussed in Section 3.4.1), shared paths through Deakin Park and between Beaconsfield Street and the Louise Sauvage Pathway, both connecting to the M4 cycleway, and moderate difficulty on-road cycle routes south of the M4 Western Motorway which connect to Auburn Station and its surrounding suburbs via the local road network. East of the site, Newington Boulevard and John Ian Wing Parade are designated on-road cycle environments of low difficulty, providing connectivity between Newington and Sydney Olympic Park.

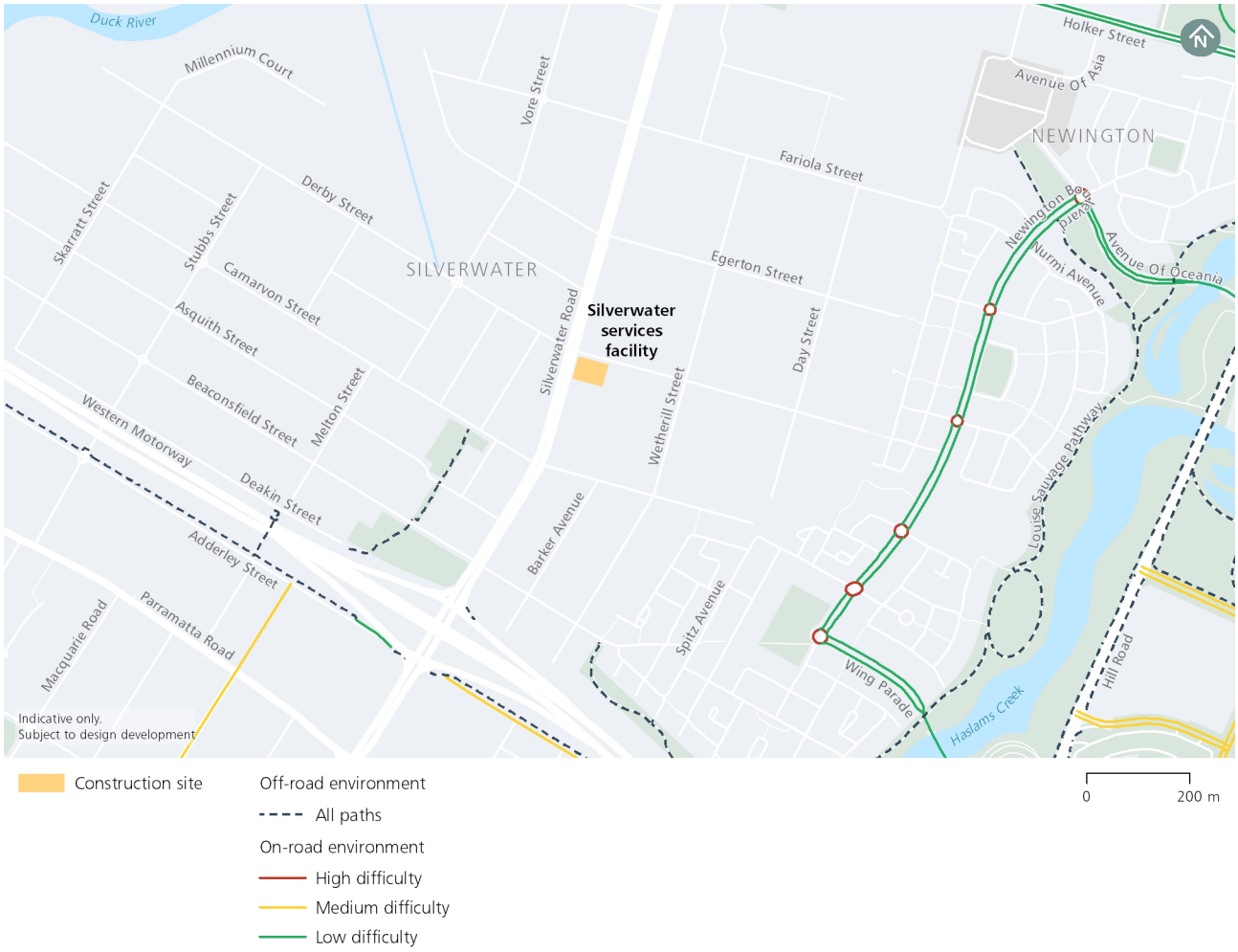

Figure 3-10: Cycle network surrounding the Silverwater services facility construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.5.2 Public transport network

The rail network is not located in close proximity to the Silverwater services facility construction site. The nearest rail service is accessible from Auburn Station which serves the T1 Western Line and T2 Inner West and Leppington Line on the Sydney Trains network. The station is located about two kilometres away from the site access point.

Two bus routes operated by Sydney Buses travel on the local road network in close proximity to the construction site, with stops provided on Stubbs Street, Carnarvon Street, Vore Street and Wetherill Street North. These services provide connections to Auburn, Newington, Eastwood and Macquarie Park. Another two bus routes operated by Transdev are accessible on Parramatta Road, about one kilometre from the site access point. These provide connections to Bankstown, Parramatta and Sutherland. An additional three bus routes serve the neighbouring suburb of Newington to the east and are operated by Sydney Buses, Transit Systems and Hillsbus (NightRide service).

Transit Systems also operates On Demand bus services in Newington. These services are accessible about one kilometre from the site access point, either via Fariola Street to the north or Beaconsfield Street to the south.

The Newington area is also served by two school bus routes.

Ferry services do not operate in close proximity to the Silverwater services facility construction site.

The public transport network surrounding the Silverwater services facility construction site is shown in Figure 3-11.

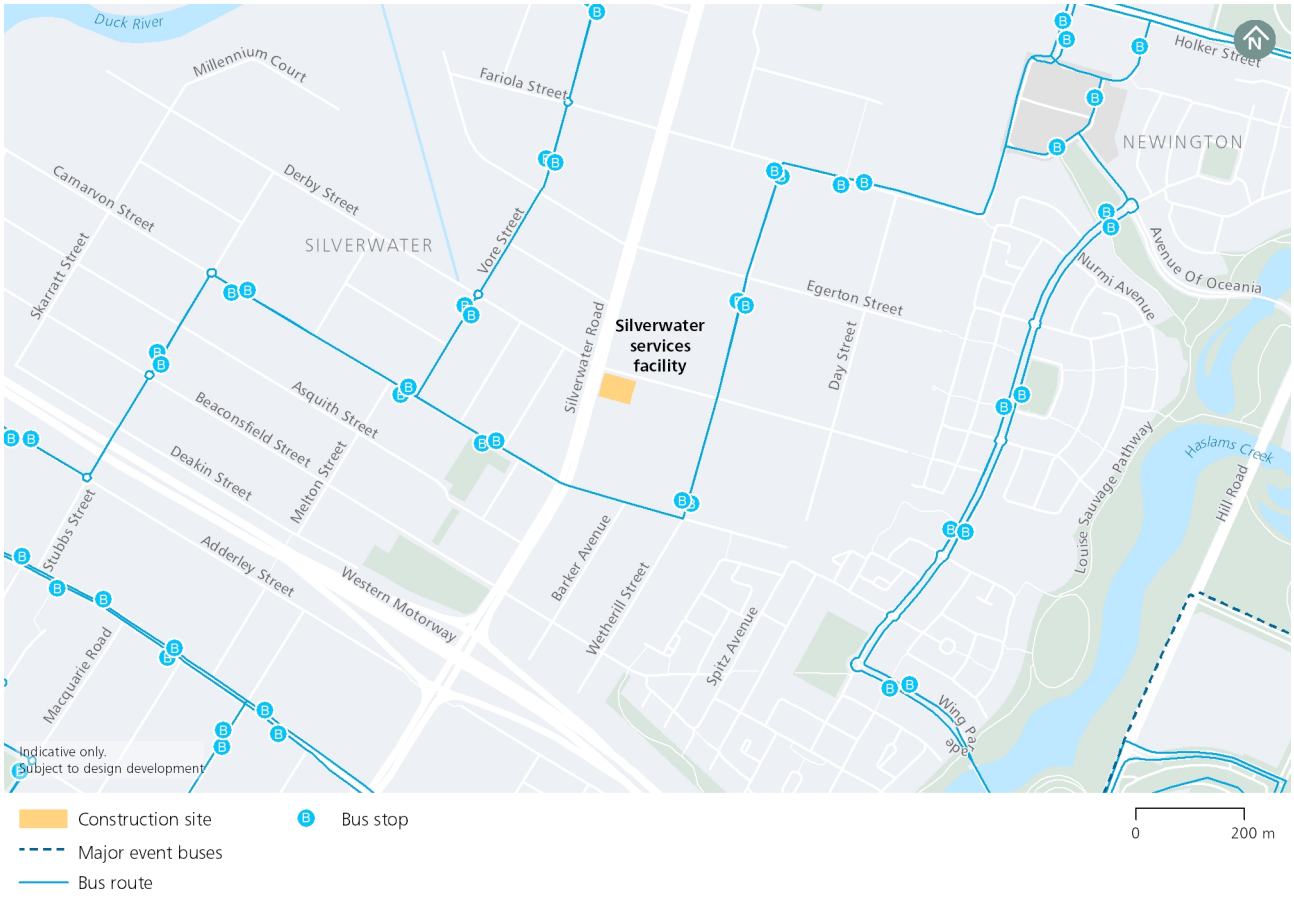

Figure 3-11: Public transport network surrounding the Silverwater services facility construction site

3.5.3 On-street parking, loading, servicing and pick-up arrangements

Unrestricted on-street parking is provided on both sides of the majority of local roads including Derby Street, Wetherill Street North and Carnarvon Street. However, during special events on-street parking on these roads is time restricted to two hours. Parking is prohibited on Silverwater Road, with clearways in operation seven days a week during daylight hours (6 am to 7 pm Monday to Friday, 9 am to 6 pm Saturday and Sunday).

There are no kiss and ride, loading zone or taxi zones on roads immediately surrounding the construction site.

3.5.4 Traffic volumes and patterns

Silverwater Road, which is a major arterial road, experiences a southbound peak direction during both peak hours with traffic volumes exceeding 1,890 vehicles per hour, whereas in the northbound direction traffic volumes do not exceed 1,710 vehicles per hour. Carnarvon Street, Wetherill Street North and Derby Street are local roads that carry substantially lower peak traffic volumes, ranging from 20 to 280 vehicles per hour in each direction. Carnarvon Street exhibits an eastbound morning peak direction and a westbound evening peak direction, while

Wetherill Street North exhibits a northbound morning peak direction and a southbound evening peak direction. A westbound peak direction is evident on Derby Street during the morning and evening peak hours.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-7.

Table 3-7: Existing peak hour traffic volumes by direction (2019) – Silverwater

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Derby Street east of Silverwater Road	Eastbound	30	20
	Westbound	110	40
Carnarvon Street east of Silverwater Road	Eastbound	280	130
	Westbound	160	350
Silverwater Road south of Derby Street	Northbound	1,600	1,710
	Southbound	2,110	1,890
Wetherill Street North south of Derby Street	Northbound	270	110
	Southbound	90	260

3.5.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the Silverwater services facility construction site is shown in Table 3-8.

Modelled intersection performance indicates that the Silverwater Road / Derby Street intersection performs poorly at Level of Service F during the evening peak hour. This is due to the intersection being unsignalised where the worst movement is reported, which is vehicles turning left from Derby Street onto Silverwater Road during the evening peak hour. Given that the intersection is restricted to left-in and left-out movements, its poor performance during the evening peak hour does not impact vehicles travelling on Silverwater Road. Southbound queues on Silverwater Road from the Carnarvon Street intersection extend past Derby Street, resulting in an increase to average delays at the Silverwater Road / Derby Street intersection.

Table 3-8: Modelled peak hour existing intersection performance (2019) – Silverwater

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Silverwater Road / Carnarvon Street					
Morning	4,283	29	B	NB	150
				EB	70
				SB	150
				WB	65
Evening	4,229	54	D	NB	130
				EB	95
				SB	380
				WB	65
Silverwater Road / Derby Street					
Morning	3,796	18	B	NB	45
				EB	30
				SB	25
				WB	15
Evening	3,684	77	F	NB	60
				EB	60
				SB	115
				WB	85
Carnarvon Street / Wetherill Street North					
Morning	474	<5	A	NB	<5
				EB	45
				SB	25
				WB	<5
Evening	494	5	A	NB	<5
				EB	50
				SB	60
				WB	<5

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Derby Street / Wetherill Street North					
Morning	408	9	A	NB	35
				EB	15
				SB	10
				WB	15
Evening	355	15	A	NB	15
				EB	10
				SB	15
				WB	30

3.6 Sydney Olympic Park metro station construction site

3.6.1 Active transport network

The pedestrian network around the Sydney Olympic Park metro station construction site is well established, with wide footpaths and large, paved pedestrian areas to accommodate large crowds in the precinct during major special events. There are few signalised intersections in the precinct and no formal pedestrian crossing facilities immediately surrounding the construction site. However, given that local roads such as Herb Elliott Avenue, Showground Road and Figtree Drive carry low vehicle volumes and have a 40 kilometres per hour signposted speed limit, pedestrians would generally be able to cross the road safely. A wide median exists on Olympic Boulevard, allowing pedestrians to undertake a staged crossing if required. Pedestrians can also cross Sarah Durack Avenue and Australia Avenue, which both have a 60 kilometres per hour signposted speed limit, at signalised pedestrian crossings at the Sarah Durack Avenue / Olympic Boulevard, Sarah Durack Avenue / Australia Avenue and Australia Avenue / Herb Elliott Avenue intersections. South of the construction site, pedestrian activated signals are located on the Homebush Bay Drive ramps at the Homebush Bay Drive / Australia Avenue / Underwood Road roundabout.

Major pedestrian desire lines in the Sydney Olympic Park precinct are generally between the existing Olympic Park Station and the various stadiums and arenas located throughout, particularly during special events such as a concert or sporting events. There is also an east-west pedestrian desire line along Dawn Fraser Avenue where numerous businesses operate along the southern frontage.

The cycle network surrounding the Sydney Olympic Park metro station construction site is shown in Figure 3-12 and is well developed, consisting of on-road and off-road cycle routes. Marked cycle lanes of moderate difficulty are provided in the shoulder of both sides of the following roads:

- Australia Avenue
- Sarah Durack Avenue
- Edwin Flack Avenue
- Dawn Fraser Avenue
- Bennelong Parkway.

On-road cycle routes of low difficulty are located along Shirley Strickland Avenue and Rod Laver Drive. Off-road shared paths also feature throughout the precinct, particularly west of Olympic Boulevard around the Aquatic and Athletic Centres and the Warm Up Arena, and east of Australia Avenue around Bicentennial Park. The shared paths generally serve recreational users and provide access to on-road cycle routes that serve local trips as well as linking to the regional cycle network including as the M4 cycleway and the Cooks River cycleway, which is a 30 kilometre shared path that generally follows the Cooks River between Ryde and Kyeemagh. Three defined bicycle circuits exist within the Sydney Olympic Park precinct including the Olympic Circuit, River Heritage Circuit and Parklands Circuit. These circuits comprise both on-road and off-road cycle paths already discussed, as well as other cycle paths located north of Bicentennial Park and Dawn Fraser Avenue.

Bicycle racks are provided throughout the Sydney Olympic Park precinct. Within the immediate vicinity of the construction site, these are located on Herb Elliott Avenue, Olympic Boulevard and Dawn Fraser Avenue.

Figure 3-12: Cycle network surrounding the Sydney Olympic Park metro station construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.6.2 Public transport network

The existing Olympic Park Station is served by the T7 Olympic Park Line on the Sydney Trains network, which operates as a shuttle between Olympic Park and Lidcombe. During major special events held at the Sydney Olympic Park precinct, direct trains run between Olympic Park and Central. In addition, some westbound services may extend past Lidcombe to Blacktown, Leppington and Campbelltown.

Bus stops are located on Edwin Flack Avenue, Dawn Fraser Avenue, Park Street and Australia Avenue, serving two bus routes operated by Sydney Buses, one bus route operated by Transit Systems, and a NightRide bus route operated by Hillsbus. These buses provide connections to Parramatta, Burwood, Chatswood, Macquarie Park and Sydney CBD. Bus customers are able to transfer to the Sydney Trains network at the existing Olympic Park Station, with bus stops located on Dawn Fraser Avenue providing access to the station at its western end, and bus stops on Park Avenue providing access to the station at its eastern end. Another bus route operated by Transit Systems serves the Lidcombe local area, with the closest bus stops located on Carter Street about 800 metres away from the site access point.

On Demand bus services operated by Transit Systems are directly accessible from the site, connecting Sydney Olympic Park to adjacent suburbs including Concord, Cabarita, Mortlake, Homebush and North Strathfield. The areas serviced are shown in Figure 3-13.

Figure 3-13: On Demand bus services for Mortlake, Cabarita, Concord, North Strathfield and Sydney Olympic Park

Source: To and from Sydney Olympic Park (BRIDJ, 2019)

During major events held at Sydney Olympic Park, nine additional bus routes operate. Four routes arrive and depart from bus stands at the Aquatic Terminal, located on Olympic Drive between Figtree Drive and Herb Elliott Avenue. The other five bus routes arrive and depart from bus stands at the Plaza Terminal, located on Olympic Drive between Barrier Street and Kevin Coombs Avenue.

School buses also service the area, with two school bus routes.

Ferry services do not operate in close proximity to the construction site, with the Olympic Park Wharf located about 3.6 kilometres away.

Light rail is proposed to serve the Sydney Olympic Park precinct as part of Parramatta Light Rail (Stage 2). This project is currently in its planning stages and if approved, would connect with Stage 1 and provide 10 to 12 light rail stops over 10 kilometres.

The public transport network surrounding the Sydney Olympic Park metro station construction site is shown in Figure 3-14.

Figure 3-14: Public transport network surrounding the Sydney Olympic Park metro station construction site

3.6.3 On-street parking, loading, servicing and pick-up arrangements

Free, time-limited on street parking spaces are available along Olympic Boulevard, Murray Rose Avenue, Dawn Fraser Avenue, Figtree Drive, Herb Elliot Avenue, Showground Road, Grand Parade and Parkview Drive. There are also paid on-street parking spaces available along Herb Elliot Avenue, Dawn Fraser Avenue and Showground Road. During major special events, on-street parking may not be available due to road closures in place around the Sydney Olympic Park precinct.

A number of other on-street parking arrangements exist on Herb Elliott Avenue and include parking for motorbikes, a loading zone on the northern side about 90 metres east of Showground Road, a kiss and ride zone near Olympic Boulevard and a taxi zone on the southern side near Showground Road. In addition, there is a mail zone on the western side of Showground Road. A loading zone is also located on the southern side of Dawn Fraser Avenue between Showground Road and Park Street.

3.6.4 Traffic volumes and patterns

Traffic volumes on major roads surrounding the Sydney Olympic Park precinct such as Parramatta Road and Australia Avenue north of Homebush Bay Drive carry high traffic volumes in the peak direction, generally between 1,760 and 2,300 vehicles during the peak hour. Traffic volumes on the Homebush Bay Drive on and off ramps west of Australia Avenue, Sarah Durack Avenue, Australia Avenue north of Figtree Drive, Edwin Flack Avenue and Birnie Avenue are lower, however still carry a considerable volume of traffic in the peak direction, with these roads experiencing a maximum peak direction volume between 760 and 980 vehicles per hour.

Olympic Boulevard, Herb Elliott Avenue and Figtree Drive are local roads that are signposted with a 40 kilometres per hour speed limit and carry low volumes of traffic of up to 370 vehicles per hour in each direction. On Herb Elliot Avenue and Figtree Drive, also local roads, a westbound morning peak direction represents trips to the precinct while an eastbound evening peak direction represents trips to away from the precinct.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-9.

Table 3-9: Existing peak hour traffic volumes by direction (2019) – Sydney Olympic Park

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Parramatta Road west of Birnie Avenue	Eastbound	1,840	1,510
	Westbound	2,070	1,760
Homebush Bay Drive ramps west of Australia Avenue	Eastbound	850	670
	Westbound	360	480
Herb Elliott Avenue west of Australia Avenue	Eastbound	160	330
	Westbound	370	90
Sarah Durack Avenue west of Olympic Boulevard	Eastbound	370	570
	Westbound	450	810
Figtree Drive west of Australia Avenue	Eastbound	40	150
	Westbound	230	20
Australia Avenue north of Homebush Bay Drive	Northbound	1,810	1,750
	Southbound	1,300	1,800
Australia Avenue north of Figtree Drive	Northbound	760	400
	Southbound	420	630
Olympic Boulevard north of Sarah Durack Avenue	Northbound	160	240
	Southbound	140	290
Edwin Flack Avenue north of Sarah Durack Avenue	Northbound	460	830
	Southbound	480	430
Birnie Avenue north of Parramatta Road	Northbound	650	600
	Southbound	500	980

3.6.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the Sydney Olympic Park metro station construction site is shown in Table 3-10.

Modelled intersection performance indicates that the following intersections perform poorly at Level of Service E or F:

- Australia Avenue / Sarah Durack Avenue / Bennelong Parkway during the evening peak hour
- Australia Avenue / Underwood Road / Homebush Bay Drive during the morning and evening peak hour
- Birnie Avenue / Parramatta Road during the morning and evening peak hour
- Edwin Flack Avenue / Shane Gould Avenue / Birnie Avenue during the evening peak hour.

Key points include:

- Traffic congestion along Parramatta Road adjacent to Sydney Olympic Park is high during both peak hours, which is reflected in the poor performance of the Birnie Avenue / Parramatta Road intersection. Queuing on Parramatta Road impacts the ability of vehicles to turn out of Birnie Avenue. Southbound queues from the intersection reduces the capacity and impacts on the performance of the Edwin Flack Avenue / Shane Gould Avenue / Birnie Avenue intersection upstream, particularly during the evening peak hour
- The roundabout at Australia Avenue / Underwood Road / Homebush Bay Drive also performs poorly during the morning and evening peak hour, with long queues on the Homebush Bay Drive westbound off ramp. This is due to vehicles approach from the off ramp having to yield to vehicles from Australia Avenue. The poor performance of the roundabout is further compounded as vehicles from the Underwood Road northbound approach yield to right turning vehicles from Australia Avenue and the Homebush Bay Drive westbound off ramp
- The poor performance of the Australia Avenue / Sarah Durack Avenue / Bennelong Parkway intersection in the evening peak hour can be attributed to the high number of vehicles travelling northbound into the Sydney Olympic Park precinct.

Table 3-10: Modelled peak hour existing intersection performance (2019) – Sydney Olympic Park

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Australia Avenue / Sarah Durack Avenue / Bennelong Parkway					
Morning	3,418	24	B	NB	130
				EB	70
				SB	65
				WB	130
Evening	3,176	57	E	NB	310
				EB	105
				SB	95
				WB	120

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Australia Avenue / Underwood Road / Homebush Bay Drive					
Morning	3,973	64	E	NB	95
				EB	45
				SB	50
				WB	140
Evening	3,931	>100	F	NB	225
				EB	30
				SB	45
				WB	>500
Birnie Avenue / Parramatta Road					
Morning	4,617	>100	F	NB	290
				EB	455
				SB	275
				WB	350
Evening	4,535	79	F	NB	275
				EB	275
				SB	280
				WB	245
Edwin Flack Avenue / Shane Gould Avenue / Birnie Avenue					
Morning	1,406	30	C	NB	65
				EB	120
				SB	60
				WB	30
Evening	1,857	58	E	NB	155
				EB	140
				SB	100
				WB	30

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Herb Elliott Avenue / Parkview Drive / Australia Avenue					
Morning	1,263	43	D	NB	85
				EB	35
				SB	130
				WB	30
Evening	887	56	D	NB	80
				EB	80
				SB	130
				WB	65
Olympic Boulevard / Herb Elliott Avenue					
Morning	618	<5	A	NB	25
				EB	-
				SB	25
				WB	15
Evening	528	<5	A	NB	15
				EB	-
				SB	<5
				WB	30
Olympic Boulevard / Sarah Durack Avenue					
Morning	1,166	17	B	NB	15
				EB	45
				SB	30
				WB	50
Evening	1,671	22	B	NB	30
				EB	65
				SB	60
				WB	85

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Sarah Durack Avenue / Edwin Flack Avenue					
Morning	968	17	B	NB	<5
				EB	30
				SB	70
				WB	<5
Evening	1,315	6	A	NB	10
				EB	<5
				SB	85
				WB	<5
Olympic Boulevard / Figtree Drive					
Morning	884	<5	A	NB	<5
				EB	-
				SB	<5
				WB	10
Evening	926	<5	A	NB	<5
				EB	-
				SB	<5
				WB	15

3.7 North Strathfield metro station construction site

3.7.1 Active transport network

Footpaths exist on both sides of most streets in the vicinity of the North Strathfield metro station construction site, except on Queen Street south of Shipley Avenue which does not have a footpath on the western side adjacent to the rail line. Immediately surrounding the site, there are no signalised pedestrian crossings. Signalised pedestrian crossings are provided along Concord Road and at the Pomeroy Street / George Street intersection. A raised zebra crossing exists at the Queen Street / Wellbank Street intersection, serving a key pedestrian desire line between the existing North Strathfield Station, the shops fronting Queen Street and the residential properties located east of the rail line. In the north-south direction, pedestrian movements are higher along Concord Road, particularly around the businesses operating between Correys Avenue and Homedale Avenue.

The rail line also presents a barrier to east-west movements. Opportunities to cross the rail line are provided via the pedestrian bridge accessible from Queen Street at its eastern end and via Hamilton Street East or Pomeroy Street at its western end. Footpaths are also provided on both sides of the Pomeroy Street overpass.

The cycle network surrounding the North Strathfield metro station construction site is shown in Figure 3-15. There are no designated cycle paths in the immediate vicinity of the construction site. West of the rail line, there

are moderate difficulty on-road cycle routes along Underwood Road, Bridge Road, Pomeroy Street and The Crescent. Shared paths near Powells Creek form part of the Cooks River cycleway, providing connectivity to Ryde, the Sydney Olympic Park precinct, Strathfield and suburbs along the Cooks River towards Botany Bay. East of the rail line, there is a mix of on-road and off-road cycle routes south of the construction site along Concord Road, Patterson Street and Gipps Street, which provide east-west connections from Homebush and Strathfield to the Inner West.

Bicycle racks are located on both sides of the existing North Strathfield Station. In addition, bicycle lockers are located on Queen Street.

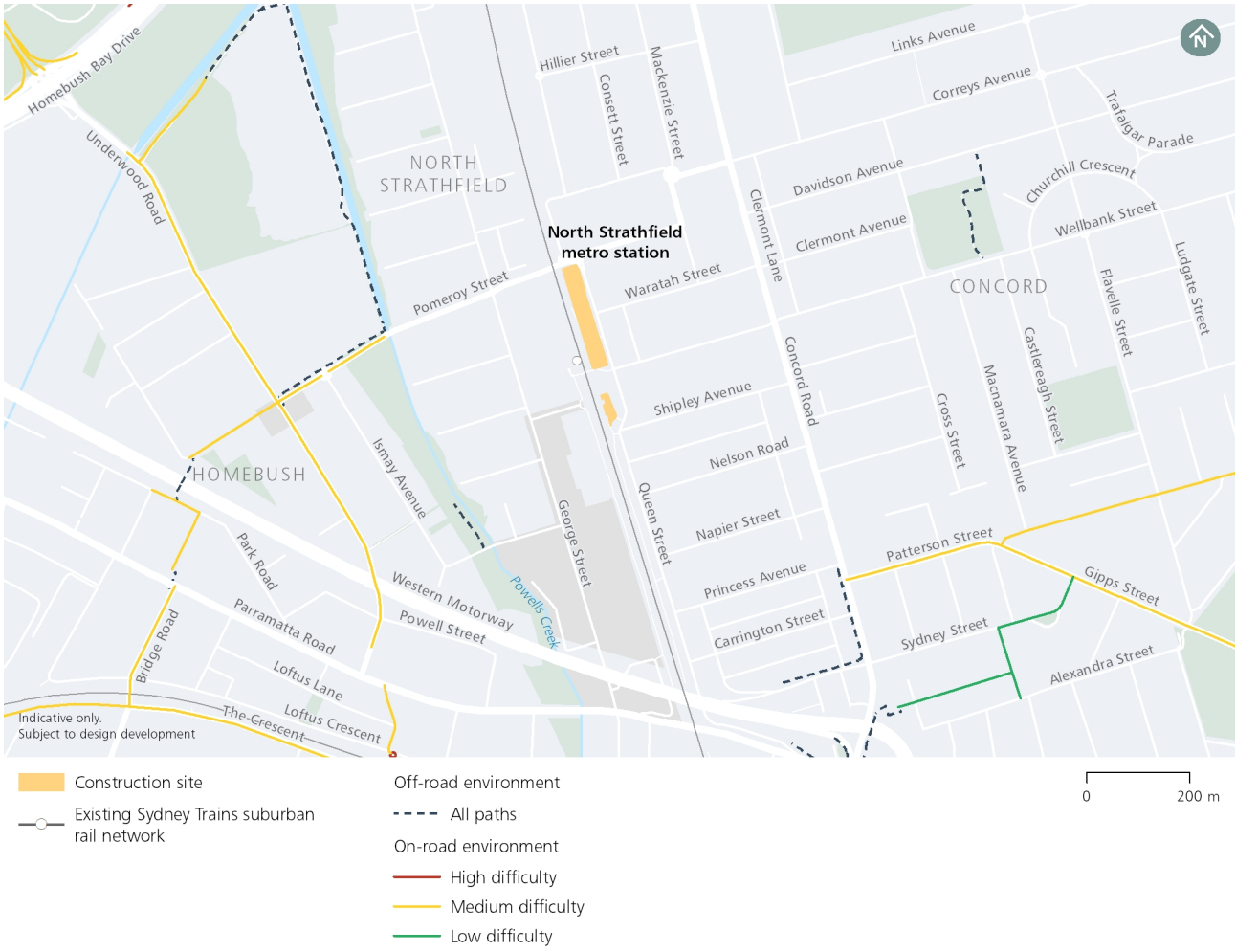

Figure 3-15: Cycle network surrounding the North Strathfield metro station construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.7.2 Public transport network

The existing North Strathfield Station is served by the T9 Northern Line on the Sydney Trains network, providing direct connections to Epping, Strathfield, Sydney CBD, Chatswood and Hornsby.

There are no scheduled routes that currently service the existing North Strathfield, apart from Nightride services. On the western side of the rail line, two bus routes travel on Underwood Road, about 600 metres west of the construction site. These bus routes are operated by Sydney Buses and Transit Systems and provide connections to Burwood, Macquarie Park and Parramatta. On the eastern side of the rail line, four bus routes travel on

Concord Road and Wellbank Street, about 500 metres east of the construction site. These comprise of a service operated by Sydney Buses between Burwood and Ryde, a service operated by Transit Systems between Macquarie Park and Hurstville, and two NightRide bus routes operated by Hillsbus between Sydney CBD, Parramatta and Hornsby.

On Demand bus services operated by Transit Systems are directly accessible from the site, connecting North Strathfield to adjacent suburbs including Sydney Olympic Park, Concord, Cabarita, Mortlake and Homebush. The areas serviced are shown in Figure 3-13.

School buses also service the area, with 22 school bus routes.

Ferry services do not operate in close proximity to the construction site.

The public transport network surrounding the North Strathfield metro station construction site is shown in Figure 3-16.

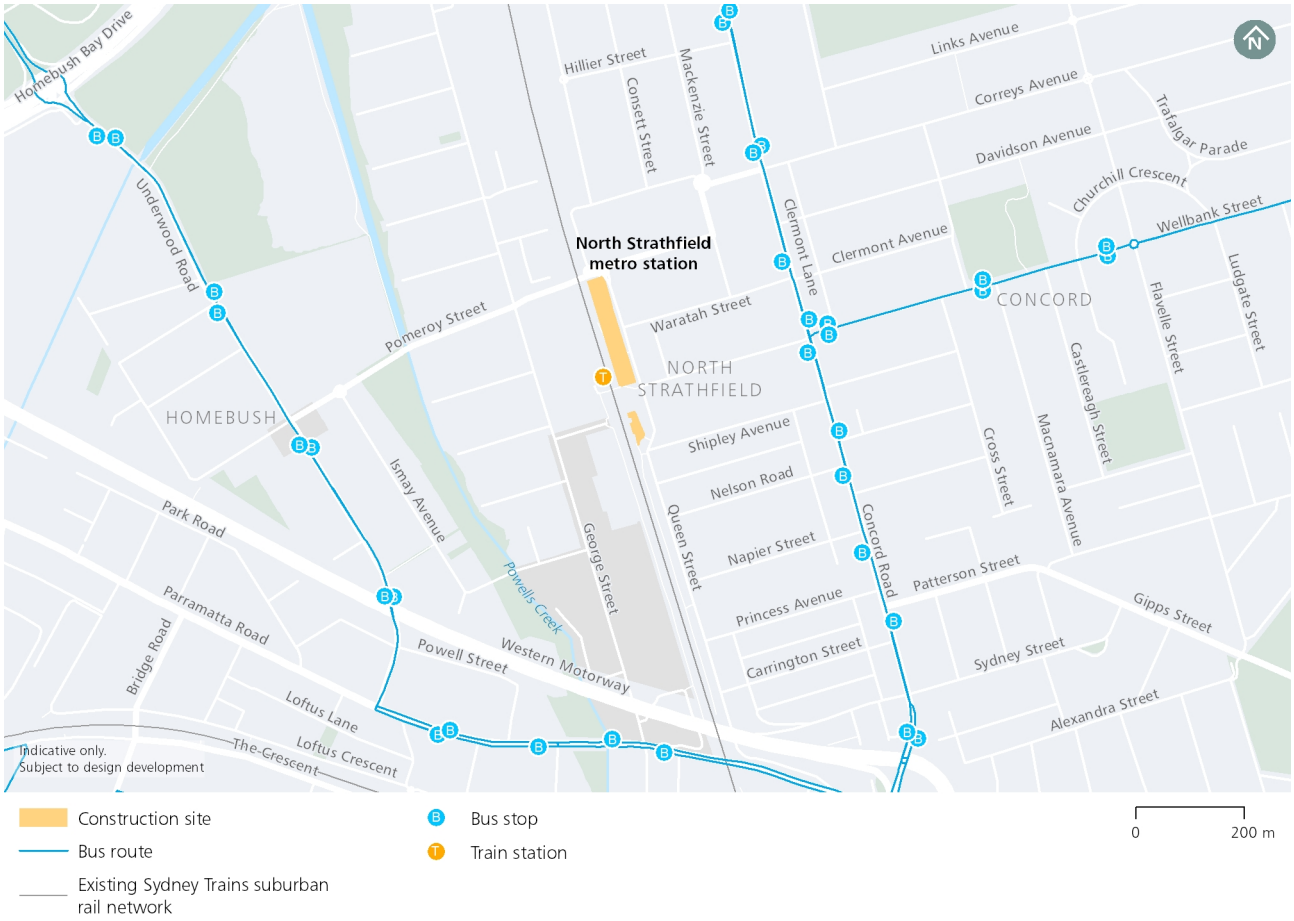

Figure 3-16: Public transport network surrounding the North Strathfield metro station construction site

3.7.3 On-street parking, loading, servicing and pick-up arrangements

A mix of time-restricted and unrestricted on-street parking is provided on roads near the construction site including Queen Street, Beronga Street, Waratah Street, Wellbank Street and Shipley Avenue. On-street parking spaces close to North Strathfield Station are generally time-restricted. Weekday peak period clearways operate on Concord Road, with on-street parking available on the western side only, outside of these periods.

A kiss and ride zone is located on the western side of Queen Street near Wellbank Street and a mail zone is located on the eastern side of Queen Street near Wellbank Street. There are no loading zones on roads immediately surrounding the construction site.

3.7.4 Traffic volumes and patterns

The M4 Western Motorway near Parramatta Road carries high traffic volumes of about 2,000 vehicles or more per hour in each direction during peak periods. A westbound peak direction occurs during the morning peak hour and an eastbound peak direction occurs during the evening peak hour. Parramatta Road west of Concord Road carries about half the number of vehicles compared to the M4 Western Motorway.

Concord Road is also an arterial road that carries a high volume of traffic, with a northbound morning peak direction and a southbound evening peak direction. Adjacent to the rail line, Queen Street and Wellbank Street are collector roads that carries peak hour traffic volumes between 340 and 490 vehicles in each direction.

The M4 East, which is part of the WestConnex program of works, opened to traffic in July 2019. Traffic volumes on Parramatta Road have been forecast to decrease following its opening. Changes to the road network associated with the M4 East project in North Strathfield, which have been incorporated into the construction traffic modelling assessment, are discussed in Section 4.12.4.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-11.

Table 3-11: Existing peak hour traffic volumes by direction (2019) – North Strathfield

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Parramatta Road west of Concord Road	Eastbound	800	950
	Westbound	960	1,040
M4 Western Motorway north of Parramatta Road	Eastbound	2,060	2,140
	Westbound	2,500	1,990
Wellbank Street east of Queen Street	Eastbound	340	380
	Westbound	410	410
Concord Road north of Parramatta Road	Northbound	1,320	910
	Southbound	1,060	1,290
Concord Road south of Wellbank Street	Northbound	1,170	770
	Southbound	520	870
Queen Street north of Wellbank Street	Northbound	400	490
	Southbound	430	440

3.7.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the North Strathfield metro station construction site is shown in Table 3-12.

Modelled intersection performance indicates that the following intersections perform poorly at Level of Service E or F:

- Concord Road / Parramatta Road / Leicester Avenue during the morning peak hour
- Wellbank Street / Queen Street during the evening peak hour.

Key points include:

- High traffic volumes on all approaches to the Concord Road / Parramatta Road / Leicester Avenue intersection results in its poor performance during the morning peak hour
- Queuing on Queen Street in the northbound direction during the evening peak hour emanates from the Queen Street / Beronga Street intersection and extends past the Queen Street / Wellbank Street intersection, reducing its capacity and resulting in a deterioration in performance. This is an unsignalised intersection, where the intersection performance reported is for the worst movement (in this case, the Queen Street northbound right-turn).

The intersection modelling results presented in Table 3-12 is reflective of the road network prior to the opening of the M4 East.

Table 3-12: Modelled peak hour existing intersection performance (2019) – North Strathfield

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Concord Road / Parramatta Road / Leicester Avenue					
Morning	3,530	65	E	NB	450
				EB	210
				SB	240
				WB	185
Evening	3,756	45	D	NB	135
				EB	100
				SB	150
				WB	200

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Concord Road / Patterson Street					
Morning	2,755	25	B	NB	175
				EB	-
				SB	100
				WB	115
Evening	2,834	23	B	NB	185
				EB	-
				SB	155
				WB	80
Concord Road / Wellbank Street					
Morning	2,626	24	B	NB	100
				EB	50
				SB	60
				WB	130
Evening	2,583	24	B	NB	85
				EB	60
				SB	95
				WB	100
Queen Street / Parramatta Road					
Morning	1,748	7	A	NB	-
				EB	115
				SB	10
				WB	<5
Evening	2,010	5	A	NB	-
				EB	<5
				SB	10
				WB	<5

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Wellbank Street / Queen Street					
Morning	740	41	C	NB	50
				EB	-
				SB	30
				WB	175
Evening	893	91	F	NB	60
				EB	-
				SB	50
				WB	95
M4 Western Motorway / Concord Road					
Morning	2,645	54	D	NB	255
				EB	50
				SB	100
				WB	-
Evening	2,804	33	C	NB	245
				EB	65
				SB	70
				WB	-

3.8 Burwood North Station construction site

3.8.1 Active transport network

The construction site is located along Parramatta Road, which is a developed corridor with businesses fronting both sides and high pedestrian activity in the vicinity of these businesses. Pedestrian activity is also high on Burwood Road between Parramatta Road, Burwood Park and the Burwood commercial area. Immediately surrounding the site, footpaths are also located on both sides of Burwood Road, Loftus Street and Esher Street. Given that Parramatta Road is a major corridor carrying high volumes of traffic throughout the day, north-south pedestrian crossing opportunities are generally limited to signalised intersections.

Signalised pedestrian crossings are provided on all approaches of the Parramatta Road / Burwood Road intersection, on two of the three approaches of the Parramatta Road / Shaftesbury Road intersection and on the north approach of the Parramatta Road / Broughton Street intersection. Pedestrians may also cross Parramatta Road near Broughton Street and Britannia Avenue via a pedestrian bridge. This bridge improves pedestrian safety at the intersection as it caters to vulnerable pedestrian user groups such as school children at St Mary's Catholic Primary School and Parish, and the elderly at St Mary's Villa Residential Aged Care facility. At the Parramatta Road / Loftus Street intersection, a raised median provided on Loftus Street allows pedestrians to complete a staged crossing if required. There are no pedestrian facilities along Neichs Lane and Esher Lane.

The cycle network surrounding the Burwood North Station construction site is shown in Figure 3-17 and consists of on-road and off-road cycle routes. The Broughton Street bridge discussed above may also be used by cyclists. This bridge and the shared path along the southern side of Parramatta Road between the bridge and Grantham Street provide north-south connectivity to the regional cycle network via moderate and high difficulty on-road cycle routes in Burwood and Enfield towards the Cooks River cycleway. East-west connectivity is provided along Gipps Street, Stanley Street and shared paths located within recreational areas, linking Burwood and Concord to the Inner West.

Figure 3-17: Cycle network surrounding the Burwood North Station construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.8.2 Public transport network

There are no train stations located in the immediate surrounds of the Burwood North Station construction site. The nearest rail service is accessible from Burwood Station, located about 900 metres south of the site. Burwood Station is served by the T1 Western Line, T2 Inner West and Leppington Line and T9 Northern Line on the Sydney Trains network. These lines provide directions connections to Penrith, Richmond, Blacktown, Parramatta, Liverpool, Leppington, Strathfield, Epping, Sydney CBD, Chatswood and Hornsby.

Burwood and Concord are well served by buses, with 27 bus routes operated by Transdev NSW, Transit Systems, Sydney Buses and Hillsbus. The majority of these buses pass through or terminate near Burwood Station, allowing bus customers to transfer to suburban rail services. Bus stops near Burwood Station are about 600

metres south of the construction site. Bus stops located closer to the site include those near the Parramatta Road / Burwood Road intersection, and those along Gipps Street. A bus route is also accessible on Crane Street, about 600 metres north of the construction site. The busiest roads for buses include Parramatta Road, Burwood Road, Railway Parade and local roads surrounding the Westfield Burwood shopping centre including Victoria Street, Wilga Street and Shaftesbury Road. Buses from Burwood and Concord provide connections to Liverpool, Parramatta, Strathfield, Macquarie Park, Ryde, Chatswood, Sydney CBD, Hurstville, Rockdale and Sydney Airport.

On Demand bus services operated by Transit Systems are directly accessible from the site, connecting Burwood to adjacent suburbs including Mortlake, Cabarita and Strathfield. The areas serviced are shown in Figure 3-18.

School buses also service the area, with 46 school bus routes.

Ferry services do not operate in close proximity to the construction site.

The public transport network surrounding the Burwood North Station construction site is shown in Figure 3-19.

3.8.3 On-street parking, loading, servicing and pick-up arrangements

On-street parking is provided on both sides of most local and collector roads including Loftus Street, Burton Street, Broughton Street and Gipps Street east of Burwood Road. The majority of these on-street parking spaces do not have any time restrictions. West of Burwood Road, on-street parking is prohibited on both sides of Gipps Street during weekday peak periods to allow for two trafficable lanes in each direction. On-street parking spaces provided on Burwood Road close to Gipps Street are not time-restricted. Near Parramatta Road, parking is prohibited on both sides of Burwood Road during weekday peak periods, with time-restricted parking available outside of these hours.

On-street parking along Parramatta Road is generally not provided with clearways in operation seven days a week during daylight hours (6 am to 7 pm Monday to Friday, 8 am to 8 pm Saturday and Sunday), and no parking or no stopping signs along most sections of the corridor.

There are no kiss and ride, loading zone or taxi zones on roads immediately surrounding the construction site.

Figure 3-18: On Demand bus services for Mortlake, Cabarita, Canada Bay, Burwood, Strathfield and Concord

Source: Strathfield and Burwood Stations (BRIDJ, 2019)

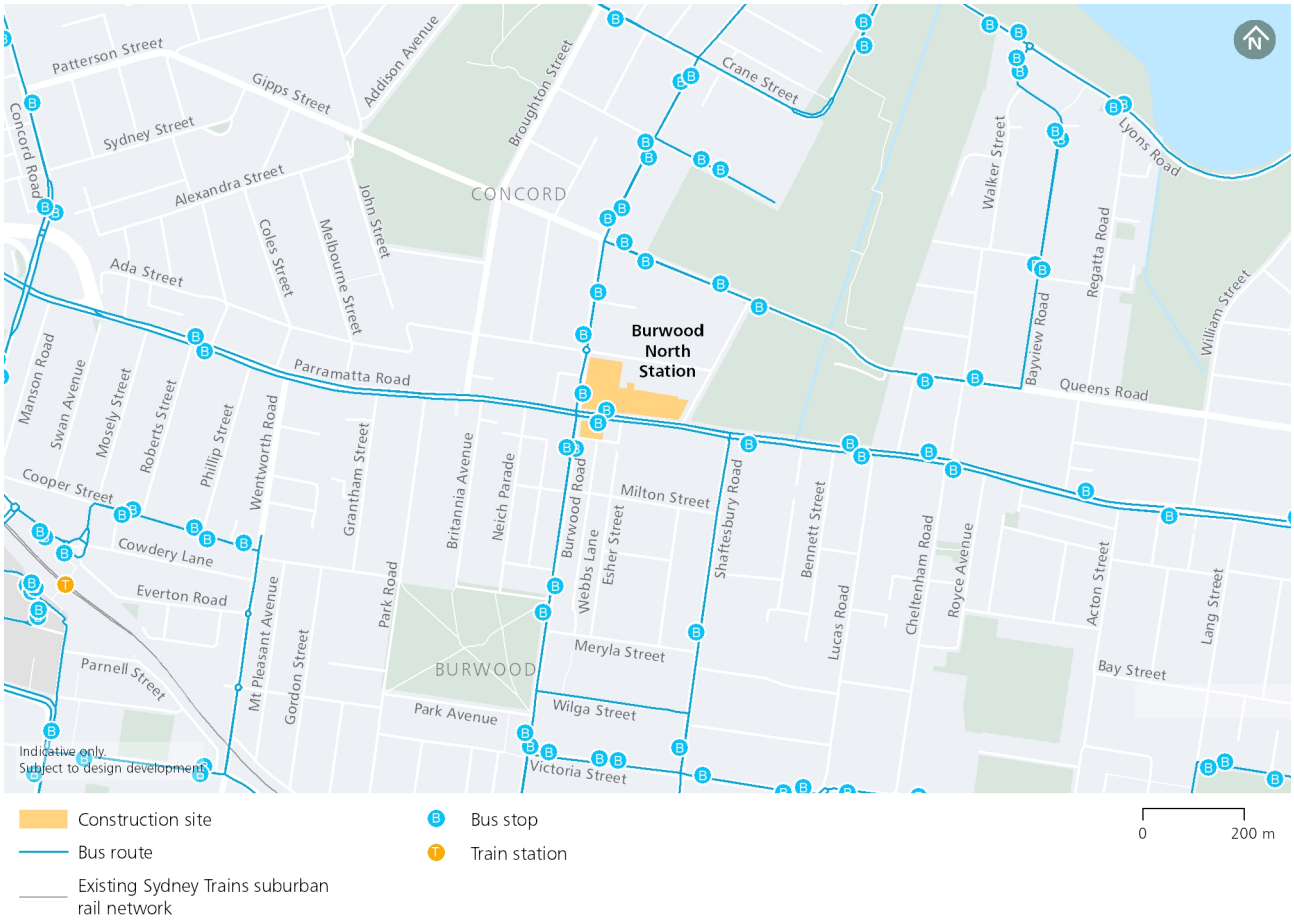

Figure 3-19: Public transport network surrounding the Burwood North Station construction site

3.8.4 Traffic volumes and patterns

Parramatta Road is a major arterial road that carries a high volume of traffic throughout the day, typically greater than 2,000 vehicles per hour in each direction during the morning and evening peak period. An eastbound peak direction is evident during both peak periods. Gipps Street is a collector road that experiences peak hour traffic volumes of about 1,000 vehicles in each direction.

A southbound peak direction exists during the morning and evening peak hour along Broughton Street, which is a collector road, with traffic volumes between 370 and 410 vehicles per hour, up to 140 vehicles higher than the northbound direction. On Burwood Road, which is a sub-arterial road, a southbound peak direction is experienced during the morning peak hour, while volumes are of a similar magnitude in both directions during the evening peak hour.

Low volumes of about 30 vehicles or less travel on Loftus Street, which is a local road, in the northbound direction during both peak hours, substantially lower than the 180 and 140 vehicles recorded in the southbound direction during the morning and evening peak hours, respectively.

The M4 East, which is part of the WestConnex program of works, opened to traffic in July 2019. Traffic volumes on Parramatta Road have been forecast to decrease following its opening.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-13.

Table 3-13: Existing peak hour traffic volumes by direction (2019) – Burwood North

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Parramatta Road west of Broughton Street	Eastbound	2,520	2,920
	Westbound	2,260	2,280
Parramatta Road west of Loftus Street	Eastbound	2,300	2,650
	Westbound	1,840	2,010
Gipps Street west of Loftus Street	Eastbound	1,120	1,030
	Westbound	820	1,030
Broughton Street north of Parramatta Road	Northbound	250	270
	Southbound	370	410
Burwood Road south of Parramatta Road	Northbound	440	450
	Southbound	520	430
Loftus Street north of Parramatta Road	Northbound	<10	30
	Southbound	180	140

3.8.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the Burwood North Station construction site is shown in Table 3-14.

Modelled intersection performance indicates that the following intersections perform poorly at Level of Service E or F:

- Burton Street / Broughton Street during the morning peak hour
- Parramatta Road / Loftus Street during the morning peak hour.

Key points include:

- The poor performance of the Burton Street / Broughton Street intersection during the morning peak hour is due to downstream queuing from the Parramatta Road / Broughton Street intersection
- Traffic congestion along Parramatta Road prevents vehicles from Loftus Street turning into Parramatta Road, and is reflected in the poor performance of the Parramatta Road / Loftus Street intersection. This is an unsignalised intersection, where the intersection performance reported is for the worst movement (in this case, the Loftus Street southbound left-turn).

The intersection modelling results presented in Table 3-14 is reflective of the road network prior to the opening of the M4 East.

Table 3-14: Modelled peak hour existing intersection performance (2019) – Burwood North

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Broughton Street / Gipps Street					
Morning	2,457	33	C	NB	60
				EB	-
				SB	245
				WB	95
Evening	2,698	21	B	NB	100
				EB	-
				SB	50
				WB	105
Burton Street / Broughton Street					
Morning	735	>100	F	NB	85
				EB	80
				SB	165
				WB	120
Evening	932	20	B	NB	25
				EB	60
				SB	45
				WB	25
Gipps Street / Burwood Road					
Morning	2,516	25	B	NB	70
				EB	80
				SB	85
				WB	105
Evening	2,820	22	B	NB	140
				EB	100
				SB	60
				WB	165

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Gipps Street / Loftus Street					
Morning	1,868	29	B	NB	15
				EB	245
				SB	-
				WB	<5
Evening	2,216	36	C	NB	25
				EB	255
				SB	-
				WB	15
Loftus Street / Burton Street					
Morning	263	6	A	NB	<5
				EB	45
				SB	75
				WB	-
Evening	252	<5	A	NB	<5
				EB	10
				SB	<5
				WB	-

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Parramatta Road / Broughton Street					
Morning	5,114	35	C	NB	-
				EB	130
				SB	130
				WB	140
Evening	5,155	27	B	NB	-
				EB	170
				SB	130
				WB	80
Parramatta Road / Burwood Road					
Morning	5,420	17	B	NB	70
				EB	80
				SB	120
				WB	120
Evening	5,506	22	B	NB	170
				EB	60
				SB	85
				WB	120
Parramatta Road / Loftus Street					
Morning	4,745	>100	F	NB	-
				EB	95
				SB	115
				WB	<5
Evening	4,780	37	C	NB	-
				EB	135
				SB	50
				WB	<5

3.9 Five Dock Station construction site

3.9.1 Active transport network

Footpaths are provided on both sides of all roads in the vicinity of the Five Dock Station construction site. Five Dock is a well-established local centre with numerous businesses fronting Great North Road, which is also a major north-south pedestrian desire line. Signalised pedestrian crossings are provided on all approaches of the Great North Road / Ramsay Road / First Avenue, Great North Road / Garfield Street and Great North Road / Lyons Road intersections, and on three of the four approaches of the Great North Road / Queens Road / Fairlight Street intersection. Towards the town centre and near the proposed station location, east-west movements across Great North Road are also facilitated via a signalised mid-block crossing in front of Fred Kelly Place, and a raised zebra crossing near Henry Street.

East of Great North Road and immediately surrounding the construction site, there are no controlled pedestrian crossings on Second Avenue and Waterview Street. Similarly, west of Great North Road, there are no controlled pedestrian crossings on East Street and West Street. There is a cul de sac at the southern end of East Street which is also contiguous with the pedestrian only area around Fred Kelly Place and Five Dock Library. Barnstaple Road, Second Avenue and First Avenue provide east-west connections between the town centre and Five Dock Park.

The cycle network surrounding the Five Dock Station construction site is shown in Figure 3-20 and consists primarily of moderate difficulty on-road cycle routes. These roads include Lyons Road West, Henry Street, Barnstaple Road, First Avenue and Queens Road, serving local cycle trips and providing connectivity to the wider cycle network towards Concord and Strathfield in the west, and the Inner West towards the east. Provision of off-road cycle paths is minimal and limited to short cycle paths near two roundabouts on Lyons Road West, and a shared path along the southern side of Iron Cove Creek between Dobroyd Parade and Wolseley Street.

3.9.2 Public transport network

The rail and light rail networks are not located in close proximity to the Five Dock Station construction site. The nearest train stations are located more than two kilometres away at either Croydon or Ashfield. The nearest light rail stops – Marion and Hawthorne – are also located more than two kilometres away in Leichhardt.

Bus stops in Five Dock are located on Great North Road, Lyons Road, Lyons Road West, Garfield Street, Harris Road, First Avenue, Ingham Avenue, Ramsay Road and Parramatta Road. There are 16 bus routes serving the area including four NightRide bus routes accessible on Parramatta Road. All bus routes are operated by Transit Systems, except for NightRide bus routes which are operated by Hillsbus. The bus routes provide connections to Abbotsford, Drummoyne, Sydney CBD, Hurlstone Park, Hurstville, Burwood and Mortlake.

On Demand bus services operated by Transit Systems are directly accessible from the site, connecting Five Dock to adjacent suburbs including Rhodes, Mortlake, Cabarita and Concord. The service only operates during off-peak periods on weekdays. The areas serviced are shown in Figure 3-21.

School buses also service the area, with 56 school bus routes.

Ferry services do not operate in close proximity to the construction site.

The public transport network surrounding the Five Dock Station construction site is shown in Figure 3-22.

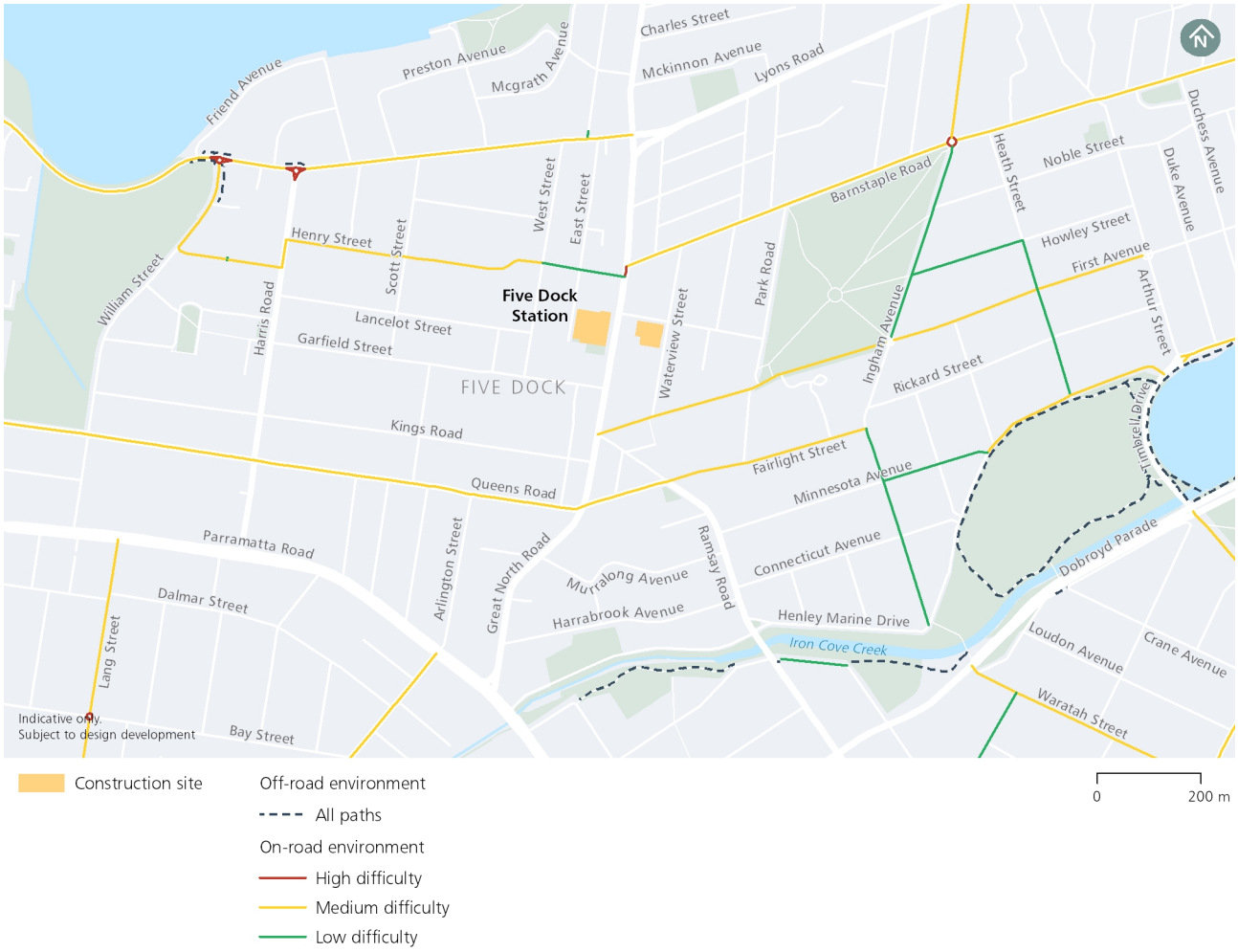

Figure 3-20: Cycle network surrounding the Five Dock Station construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

Figure 3-21: On Demand bus services for Rhodes, Concord, Mortlake, Cabarita, Canada Bay and Five Dock

Source: To and from Five Dock (BRIDJ, 2019)

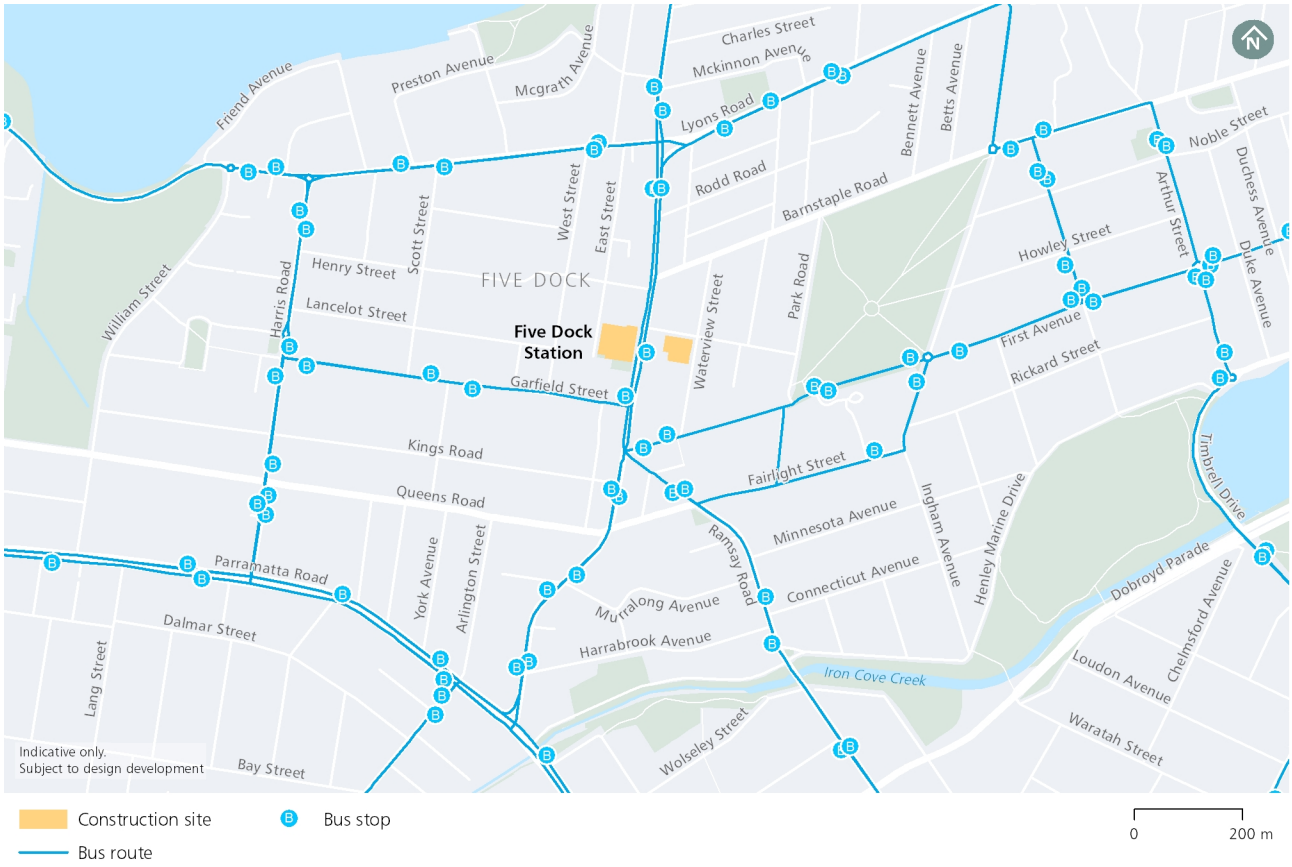

Figure 3-22: Public transport network surrounding the Five Dock Station construction site

3.9.3 On-street parking, loading, servicing and pick-up arrangements

On-street parking is provided on both sides of Great North Road. Near the Five Dock town centre, parking spaces on the western side of Great North Road are time-restricted while parking spaces on the eastern side of Great North Road are not time-restricted. On-street parking is also available on both sides of local roads such as First Avenue, Waterview Street and Second Avenue, consisting of time-restricted and unrestricted spaces.

A loading zone is located on the northern side of Henry Street near Great North Road and a mail zone is located on the northern side of Garfield Street near Great North Road. There are no kiss and ride zones on roads immediately surrounding the construction site.

3.9.4 Traffic volumes and patterns

Parramatta Road is a major arterial road that carries a high volume of traffic, greater than 2,150 vehicles per hour in each direction during the morning and evening peak period. Near Great North Road, eastbound volumes are 200 to 400 vehicles higher than westbound volumes during both peak hours. Lyons Road is an arterial road that exhibits an eastbound morning peak hour and a westbound evening peak hour, with peak direction volumes of up to 1,080 vehicles per hour, some 300 to 400 vehicles higher than the counter-peak direction.

Lower traffic volumes are experienced on Great North Road given that traffic is often constrained to one lane in each direction. During peak periods, Great North Road carries traffic volumes between 450 and 600 vehicles per hour. First Avenue, which is accessible from Great North Road, is a collector road that carries higher traffic volumes in the eastbound direction during the morning and evening peak hour of up to 290 vehicles.

Local roads such as Second Avenue and Waterview Street carry low traffic volumes of about 110 vehicles or less. Both roads experience higher traffic volumes during the evening peak hour in both directions compared to the morning peak hour.

The M4 East, which is part of the WestConnex program of works, opened to traffic in July 2019. Traffic volumes on Parramatta Road have been forecast to decrease following its opening.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-15.

Table 3-15: Existing peak hour traffic volumes by direction (2019) – Five Dock

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
Lyons Road east of Great North Road	Eastbound	1,050	770
	Westbound	620	1,080
Parramatta Road west of Great North Road	Eastbound	2,540	2,620
	Westbound	2,150	2,270
Parramatta Road east of Great North Road	Eastbound	2,540	2,620
	Westbound	2,310	2,400
First Avenue east of Great North Road	Eastbound	290	270
	Westbound	100	160
Second Avenue east of Great North Road	Eastbound	70	90
	Westbound	30	80
Great North Road south of Lyons Road	Northbound	450	590
	Southbound	500	500
Great North Road north of Garfield Street	Northbound	490	570
	Southbound	540	600
Waterview Street north of First Avenue	Northbound	20	80
	Southbound	20	110

3.9.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of the Five Dock Station construction site is shown in Table 3-16.

Modelled intersection performance indicates that the following intersections perform poorly at Level of Service E or F:

- Great North Road / Lyons Road during the evening peak hour
- Parramatta Road / Great North Road during the evening peak hour.

The poor performance of some intersections on Great North Road in the evening peak hour is due to the conflict between local traffic with their end destinations in Five Dock and regional traffic travelling between Lyons Road and Parramatta Road via Great North Road.

The intersection modelling results presented in Table 3-16 is reflective of the road network prior to the opening of the M4 East.

Table 3-16: Modelled peak hour existing intersection performance (2019) – Five Dock

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Great North Road / Garfield Street					
Morning	1,308	21	B	NB	65
				EB	65
				SB	150
				WB	-
Evening	1,422	32	C	NB	65
				EB	60
				SB	150
				WB	-
Great North Road / Lyons Road					
Morning	2,748	47	D	NB	310
				EB	100
				SB	140
				WB	85
Evening	3,124	66	E	NB	130
				EB	>500
				SB	70
				WB	375
Great North Road / Queens Road / Fairlight Street					
Morning	2,507	27	B	NB	120
				EB	155
				SB	95
				WB	175
Evening	2,520	30	C	NB	135
				EB	150
				SB	95
				WB	175

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Great North Road / Ramsay Road / First Avenue					
Morning	1,418	16	B	NB	70
				EB	35
				SB	65
				WB	45
Evening	1,484	28	B	NB	100
				EB	65
				SB	65
				WB	165
Parramatta Road / Great North Road					
Morning	5,335	34	C	NB	-
				EB	130
				SB	150
				WB	290
Evening	5,193	62	E	NB	-
				EB	135
				SB	105
				WB	350
Great North Road / Second Avenue					
Morning	1,018	9	A	NB	45
				EB	-
				SB	35
				WB	15
Evening	1,121	15	A	NB	80
				EB	-
				SB	80
				WB	35

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
First Avenue / Waterview Street					
Morning	387	<5	A	NB	-
				EB	10
				SB	10
				WB	<5
Evening	437	<5	A	NB	-
				EB	10
				SB	10
				WB	10
Second Avenue / Waterview Street					
Morning	98	7	A	NB	15
				EB	<5
				SB	10
				WB	<5
Evening	195	8	A	NB	15
				EB	<5
				SB	15
				WB	<5

3.10 The Bays Station construction site

3.10.1 Active transport network

Footpaths are provided on both sides of Victoria Road, James Craig Road and Robert Street. Solomons Way and sections of Sommerville Road are not open to the general public, however there are some formal footpaths on sections of one side of both roads. Surrounding the site, signalised pedestrian crossings are provided at the east approach of the Victoria Road / Robert Street intersection, the west approach of the Victoria Road / The Crescent intersection and the east approach of the James Craig Road / The Crescent intersection. Medians are provided at the roundabout on James Craig Road east of The Crescent, allowing pedestrians to undertake a staged movement if required.

Pedestrian activity within the immediate vicinity of the construction site is low given the marine and industrial land uses present. However, the predominately residential areas in surrounding suburbs such as Rozelle, Balmain, Glebe and Annandale have a well-developed pedestrian network.

The cycle network surrounding The Bays Station construction site is shown in Figure 3-23 and is well established with provision of a number of off-road shared paths and on-road cycle routes. Off-road shared paths are provided at the following locations:

- Eastern side of Victoria Road
- Western side of Victoria Road north of Wellington Street
- Northern side of the ANZAC Bridge
- Northern side of James Craig Road
- Southern and eastern side of The Crescent
- Robert Street east of Buchanan Street
- Railway Parade near Rozelle Bay light rail stop
- Throughout Jubilee Park
- Western side of Whites Creek.

On-road cycle routes are generally on local and collector roads including Balmain Road, Darling Street, Lilyfield Road and Robert Street serving east-west trips. Local north-south cycle connections to these roads include Crescent Street, Gordon Street, Denison Street and Cecily Street. The area is well serviced by the regional cycle network, either in the east-west direction via ANZAC Bridge, Lilyfield Road or Balmain Road, or in the north-south direction via Victoria Road, The Crescent and Young Street.

The future active transport network within the vicinity of The Bay Station construction site will be modified to accommodate M4-M5 Link, which is part of the WestConnex program of works. These changes, which will be implemented by the time construction of Stage 1 commences, are discussed in Section 4.15.7.

Figure 3-23: Cycle network surrounding The Bays Station construction site

Source: Cycleway Finder (Roads and Maritime Services, 2019)

3.10.2 Public transport network

There are no train stations located in close proximity to The Bays Station construction site. The light rail network is accessible at the Rozelle Bay light rail stop, located about 500 metres south of the site. The Rozelle Bay light rail stop is part of the L1 Dulwich Hill Line.

Victoria Road is a major bus corridor adjacent to the construction site. Short bus only lanes are provided at the Victoria Road / The Crescent intersection on the westbound approach and the northbound kerbside departure lane between The Crescent and Lilyfield Road. A morning peak period bus lane operates on Victoria Road in the southbound direction.

Two bus operators, Transit Systems and Sydney Buses, provide services via 23 bus routes that travel on Victoria Road and provide connections between Sydney CBD, the Inner West, northern suburbs and western suburbs. Nearly all buses travel on the Western Distributor to and from Sydney CBD, with one bus route operating on collector and arterial roads through Glebe and via the Parramatta Road bus corridor to access Sydney CBD. Transit Systems also operates two additional bus routes accessible from Darling Street, located about 900 metres north of the site, and another bus route is accessible from Glebe Point Road near the southern side of Rozelle Bay, about 1.2 kilometres south of the site.

School buses also service the area, with 20 school bus routes.

The White Bay Cruise Terminal is located about one kilometre from the construction site and serves cruise ships when the Overseas Passenger Terminal at Circular Quay is occupied. Captain Cook Cruises operates a ferry service between the White Bay Cruise Terminal and Barangaroo on days when cruise ships are docked at the White Bay Cruise Terminal. On cruise ship days, access to the White Bay Cruise Terminal is provided via James Craig Road only, with no access permitted from Robert Street.

The public transport network surrounding The Bays Station construction site is shown in Figure 3-24.

Figure 3-24: Public transport network surrounding The Bays Station construction site

3.10.3 On-street parking, loading, servicing and pick-up arrangements

Parking is prohibited in both directions along City West Link and The Crescent east of City West Link with clearways in operation at all times. Also, on-street parking is not available along James Craig Road and The Crescent south of City West Link.

There are no kiss and ride, loading zone or taxi zones on roads immediately surrounding the construction site.

3.10.4 Traffic volumes and patterns

Traffic volumes are high on City West Link, The Crescent and Victoria Road in both directions. These are major arterial roads that carry volumes between 1,500 and 3,940 vehicles per hour in each direction. Eastbound

volumes on City West Link and The Crescent are generally higher than the traffic volumes in the opposite direction during the morning peak hour. Traffic volumes are about the same in both directions on these roads during the evening peak hour. On Victoria Road, a distinct southbound peak direction is evident during the morning peak hour while a northbound peak direction is evident during the evening peak hour.

Substantially lower volumes of up to 330 vehicles per hour are experienced on James Craig Road, which is a local road.

The future road network within the vicinity of The Bays Station construction site will be modified to accommodate WestConnex M4-M5 Link. Additional road network changes are proposed as part of Western Harbour Tunnel and Beaches Link. This project is currently in its planning stages and if approved, would connect to M4-M5 Link and the surface road network in Rozelle. Furthermore, Port Access Road is proposed to be relocated prior to commencement of site establishment for Stage 1. This project is subject to a separate planning pathway.

Approximate peak hour midblock volumes on key access roads are shown in Table 3-17.

Table 3-17: Existing peak hour traffic volumes by direction (2016) – The Bays

Road	Direction	Morning peak hour volume (vehicles/hr)	Evening peak hour volume (vehicles/hr)
The Crescent west of James Craig Road	Eastbound	2,630	2,990
	Westbound	2,240	2,990
City West Link west of The Crescent	Eastbound	1,830	2,260
	Westbound	1,500	2,250
James Craig Road east of The Crescent	Eastbound	330	130
	Westbound	160	210
Victoria Road north of The Crescent	Northbound	1,920	3,690
	Southbound	3,940	2,930

3.10.5 Existing intersection performance

Modelled intersection performance during the morning and evening peak hours for key intersections in the vicinity of The Bays Station construction site is shown in Table 3-18.

Modelled intersection performance indicates that the following intersections perform poorly at Level of Service E or F:

- City West Link / The Crescent during the morning peak hour
- City West Link / Catherine Street during the morning peak hour.

Poor performance of these intersections is a result of high volumes of through traffic conflicting with right turning and cross-street traffic, in conjunction with substantial queuing along City West Link in the eastbound direction.

Table 3-18: Modelled peak hour existing intersection performance (2016) – The Bays

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
Victoria Road / Robert Street					
Morning	5,876	48	D	NB	-
				EB	250
				SB	240
				WB	160
Evening	6,721	39	C	NB	-
				EB	205
				SB	125
				WB	160
Victoria Road / The Crescent					
Morning	9,741	32	C	NB	-
				EB	155
				SB	270
				WB	260
Evening	11,551	36	C	NB	-
				EB	150
				SB	250
				WB	>500
The Crescent / James Craig Road					
Morning	5,190	29	C	NB	45
				EB	215
				SB	-
				WB	180
Evening	6,521	9	A	NB	40
				EB	165
				SB	-
				WB	175

Intersection and peak hour	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of Service	Maximum queue length by directional approach (metres)	
City West Link / The Crescent					
Morning	5,076	>100	F	NB	265
				EB	>500
				SB	-
				WB	155
Evening	6,699	32	C	NB	205
				EB	255
				SB	-
				WB	200
City West Link / Catherine Street					
Morning	3,926	73	F	NB	65
				EB	390
				SB	105
				WB	255
Evening	5,174	32	C	NB	70
				EB	40
				SB	95
				WB	425

4. Stage 1 assessment

4.1 Key assumptions

Key assumptions included for the analysis of construction impacts are outlined below.

4.1.1 Construction vehicle types

The anticipated construction vehicle numbers are based on factors such as site accessibility (factoring any constraints on the local road network), materials required to be delivered to the site, spoil volumes and construction activities. The heavy vehicle types and sizes selected and shown in Table 4-1 are based on the maximum sized vehicles anticipated to be able to service the construction site. Larger vehicles may also be required for oversize deliveries or those under the Safety, Productivity and Environment Construction Transport Scheme (SPECTS). SPECTS allows participating heavy vehicles greater road network access and the ability to carry more construction materials in return for meeting higher environmental, safety and compliance standards.

Table 4-1: Construction vehicle type

Heavy vehicle type	Capacity (m^3)	Maximum length (m)	Construction site
Rigid truck and dog trailer	20	19	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 northern Five Dock Station The Bays Station
Rigid truck (medium)	6	8.8	Burwood North Station southern

Under the Heavy Vehicle National Law (NSW), a heavy vehicle is defined as having a gross vehicle mass of more than 4.5 tonnes. Within this report, a light vehicle is classified as any vehicle equal to or less than 4.5 tonnes.

4.1.2 Construction hours

Proposed construction hours for each construction activity are shown in Table 4-2. These hours have been developed based on a balanced consideration of the construction program and the need to minimise noise and traffic-related impacts.

Most aboveground construction activities would be carried out during the following hours:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- No works on Sundays or public holidays.

Table 4-2: Proposed construction hours

Activity	Construction hours	Comments or exceptions
Underground construction activities		
Tunnelling	24 hours per day, seven days per week	Construction works that support tunnelling may need to occur 24 hours per day, up to seven days per week.
Underground excavation at station construction sites and the Clyde stabling and maintenance facility construction site	24 hours per day, seven days per week	Construction works requiring rail possessions may need to be carried out outside standard construction hours up to 24 hours per day, seven days per week. Construction works requiring the temporary possession of roads or to accommodate road network requirements may need to be carried out outside standard daytime construction hours during periods of low demand to minimise safety impacts and inconvenience to commuters.
Aboveground construction activities		
Demolition Station and services facility construction (aboveground)	• 7 am to 6 pm Monday to Friday • 8 am to 1 pm Saturdays • No works on Sundays and Public Holidays.	Aboveground work supporting underground construction works (e.g. concrete pumping, truck loading) are expected to be required 24 hours per day, up to seven days per week where noise mitigation is in place. Aboveground work at Parramatta metro station and North Strathfield metro station construction sites would generally be restricted to standard construction hours. Saturday works at Parramatta metro station and The Bays Station construction sites may be carried out between 8 am to 6 pm. Construction works requiring rail possessions may need to be carried out outside the standard construction hours up to 24 hours per day, seven days per week. Construction works requiring the temporary possession of roads or to accommodate road network requirements may need to be carried out outside the standard daytime construction hours during periods of low demand to minimise safety impacts and inconvenience to commuters.
Construction traffic for material supply to, and spoil removal from, tunnelling and underground excavation (station and services facility sites)	24 hours per day, seven days per week	Restrictions would be in place during peak hours (7 am to 10 am and 4 pm to 6 pm) and special events. At locations where night-time sensitive noise receivers are close to construction sites, substantial construction vehicle movements are likely to be restricted during evening and night-time periods.

However, other activities (as identified in Table 4-2) would need to be carried out outside these hours. As the tunnel boring machines would operate continuously, the tunnelling and associated support activities would need to be carried out up to 24 hours per day and seven days per week.

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

- Work determined to comply with the relevant noise management level (NML) at the nearest sensitive receiver.
- Work required to be carried out during rail possessions.
- Delivery of materials outside approved hours as required by the NSW Police or other authorities (including Transport for NSW) 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.

Oversize deliveries are anticipated to be required to support the following activities:

- Tunnel boring machine delivery and removal
- Gantry cranes and other cranes for construction site lifting operations
- Temporary and permanent props
- Large pre-cast elements
- Mechanical and electrical plant.

All deliveries of this type would be undertaken during non-standard construction hours with specific traffic management arrangements.

4.1.3 Construction haulage routes and volumes

The construction haulage routes assessed for each construction site is provided in Section 4.7 to Section 4.15. Construction traffic generated by each construction site would vary according to stage of construction activity (as described in Section 4.7 to Section 4.15). For each construction site, the assessment has considered the construction stage that would generate the greatest number of movements in the AM and PM peak.

4.1.4 Construction assessment year

The peak construction year that has been assessed is 2023. This coincides with peak tunnelling for Stage 1, when the haulage of spoil (which constitutes the majority of construction vehicle movements) would be at its maximum.

An assessment of cumulative construction impacts has been undertaken, which considers projects that fall within the construction footprint of Stage 1, as well as projects with construction vehicle routes that use roads near the Stage 1 construction sites. Further details are provided in Section 4.16.

4.1.5 Construction worker parking

Car parking for construction workers would not be provided at all sites due to the constrained nature of the construction sites. The majority of construction sites are located in close proximity to public transport services and construction workers would be encouraged to use these services. At The Bays Station construction site, the feasibility of providing shuttle bus services to transfer construction workers to and from major transport interchange(s) would be considered by Sydney Metro. The final arrangements for this service would be confirmed during detailed construction planning of Stage 1 and may be coordinated with other concurrent transport project in consultation with Transport Coordination.

With the exception of the Clyde stabling and maintenance facility construction site, each construction site would typically provide parking spaces intended to be used by trade vehicles or other light vehicles that are required to travel between construction sites.

4.2 Spoil transport options and spoil reuse

4.2.1 Spoil transport options

For the purposes of this assessment, it has been assumed that all spoil transport would be undertaken by road and therefore represents a worst-case scenario in terms of the assessment of impacts on the transport and traffic network. However, there are alternative spoil transport options that could be considered to reduce impacts on the road network including rail and barge. These options are discussed in Chapter 3 (Sydney Metro West development and alternatives) of the Environmental Impact Statement.

4.2.2 Spoil reuse

Spoil would be classified in accordance with NSW guidelines. Spoil that is not classified as hazardous or special waste would be reused following a hierarchy of options. The spoil management hierarchy for Stage 1 is shown in Table 4-3.

Table 4-3: Spoil management hierarchy

Priority	Reuse options	Possible reuse options
1	Within the Stage 1 footprint	• Reuse spoil for landscaping, structural fill, general fill, fill embankments and mounds within a short haulage distance of the source • Reuse spoil to restore any pre-existing contaminated sites within the Stage 1 construction footprint • Reuse spoil as a feed product in construction materials.
2	Environmental projects (outside of the Stage 1 footprint)	• Reuse spoil for coastal protection, such as beach nourishment and land raising • Reuse spoil in flood mitigation projects.
3	Other development projects (including other Sydney Metro projects)	• Reuse spoil for landscaping, structural fill, general fill, fill embankments and mounds on projects within a financially feasible transport distance of the site • Reuse spoil for land reclamation or remediation projects • Reuse sand for manufacturing concrete and shale for manufacturing bricks and tiles.
4	Land restoration	• Reuse spoil to fill disused facilities (for example mines and quarries) to enable either future development or site rehabilitation.

Priority	Reuse options	Possible reuse options
5	Landfill management	• Reuse spoil to cap completed landfill cells • Reuse spoil in daily covering of landfill waste.

Sydney Metro would target beneficial reuse of 100 per cent of the usable spoil generated during construction. The geology of the spoil material as well as its consistency and quality would determine the reuse options. It is envisaged the spoil produced by Stage 1 would have the characteristics and potential reuse opportunities suitable for priority 1, 2 and 3 spoil management options outlined in Chapter 24 (Spoil, waste management and resource use) of the Environmental Impact Statement.

The Stage 1 civil works for the Clyde stabling and maintenance facility would present a key opportunity for spoil reuse. About one million cubic metres of fill would be required to protect the facility from flooding impacts. The suitability of the spoil generated by Stage 1 for this use would be assessed during construction. It is expected there may be limited opportunities for additional spoil reuse at other Stage 1 construction sites. The quantities and locations of any additional reuse opportunities would be determined during further design of Stage 1. The reuse of spoil for Stage 1 construction works would be maximised to the extent possible before alternative off-site opportunities for spoil reuse are pursued.

Where spoil cannot be reused for Stage 1, opportunities to reuse this material in future stages or on other projects (preferably within the Sydney region to reduce transport distances) would be identified.

Spoil could be used for filling former quarries in the Sydney region and beyond. Former quarries and other sites that are potentially available for large-scale reuse of virgin excavated natural material, excavated natural material and material subject to resource recover orders/exemptions are listed in Chapter 24 (Spoil, waste management and resource use) of the Environmental Impact Statement. Spoil could also be used to cap completed landfill cells and to cover waste at active landfill sites. Potential opportunities for spoil reuse in land restoration and landfill management applications would be determined during further construction planning for Stage 1.

4.3 Pedestrian, cyclist and road user safety

The introduction of additional heavy vehicles on the road network has the potential to result in safety impacts to pedestrians, cyclists and other motorists, especially where there is an increased likelihood for interaction with pedestrians and cyclists.

Key locations where pedestrian and cyclist safety issues may arise include:

- Construction site access and egress points where construction vehicles would interface with pedestrians using surrounding footpaths. This would be especially important in Westmead, Parramatta, Sydney Olympic Park, North Strathfield and Five Dock where high volumes of pedestrians are expected
- Construction sites where access and egress points, or construction vehicle routes would interface with marked cycle routes. This would occur at the Parramatta metro station, Sydney Olympic Park metro station, Burwood North Station northern and Five Dock Station eastern construction sites
- Locations where footpath widths are reduced around construction sites.

Access and egress arrangements at construction sites have been developed with consideration for pedestrian, cyclist and motorist safety. For example, the need for construction vehicles to perform a right turn to or from an arterial road to access a construction site has been avoided where possible.

Appropriate controls would be established where vehicles are required to cross footpaths to access construction sites. This may include manual supervision, physical barriers or temporary traffic signals as required. Road safety audits would be carried out as part of construction traffic management planning for each of the construction site.

In addition, Sydney Metro is currently investigating options to further enhance pedestrian, cyclist and motorist safety in the vicinity of construction sites. This would include measures such as:

- Assessing the suitability of construction haulage routes through sensitive land use areas with respect to road safety
- Deployment of speed awareness signs in conjunction with variable message signs near construction sites to provide alerts to drivers
- Providing community education and awareness about sharing the road safely with heavy vehicles
- Specific construction driver training to understand route constraints, safety and environmental considerations such as sharing the road safely with other road users and limiting the use of compression braking
- Requiring technology and equipment to eliminate heavy vehicle blind spots, monitor vehicle location and driver behaviour, and improve vehicle safety standards.

4.4 Special events

A large number of special events occur within the Parramatta CBD area and Sydney Olympic Park precinct. In addition, special events are held at the Rosehill Gardens racecourse and sporting events are held at Leichhardt Oval.

The Roads and Maritime Services special events management guidelines identify the following classes of special events:

- Class 1: an event that impacts major transport and traffic systems and there is significant disruption to the non-event community. For example, an event that affects a principal transport route in Sydney, or one that reduces the capacity of the main highway through a country town
- Class 2: is an event that impacts local transport and traffic systems and there is low scale disruption to the non-event community. For example, an event that blocks off the main street of a town or shopping centre but does not impact a principal transport route or highway
- Class 3: is an event with minimal impact on local roads and negligible impact on the non-event community. For example, an on-street neighbourhood Christmas party
- Class 4: is an event that is conducted entirely under Police control (but is not a protest or demonstration). For example, a small march conducted with a Police escort.

Liaison would occur with event organisers of Class 1 and 2 events, and (as relevant) Transport for NSW including Transport Coordination to provide appropriate management of construction vehicle movements to manage potential impacts to event patrons, the general public and the construction works. This may involve measures such as temporary adjustment to construction vehicle routes, construction working hours or potentially stopping works for the duration of the event.

Lane and road closures would be avoided during special events. Special events and the impact to transport and traffic is particularly important around the Parramatta metro station construction site and the Sydney Olympic Park metro station construction site. These impacts are discussed further in Section 4.8.8 and Section 4.11.8 respectively.

4.5 Emergency vehicles

The introduction of construction traffic is anticipated to result in minor impacts to the surrounding intersection performance at most construction (discussed below). As such, there is not anticipated to be any substantial change to emergency vehicle access, except at the Westmead metro station construction site. Furthermore, construction sites would be arranged so that emergency vehicle access to nearby buildings and the surrounding area is maintained, or alternative arrangements are in place as determined in consultation with relevant emergency services. Construction sites may also be made available for emergency vehicle passage if required. Ongoing consultation would be carried out with emergency providers in relation to changed traffic conditions. This is particularly important in Westmead due to the close proximity of the Westmead metro station construction site to the Westmead health precinct. Emergency vehicle access for this site is discussed further in Section 4.7.5.

4.6 Road condition

The increase in construction traffic, in particular heavy vehicles, on the road network has the potential to impact the condition of roads along construction vehicle routes. A pre-construction condition survey would be undertaken to document the existing condition of all roads along construction vehicles routes. Upon completion, a post-construction condition survey would be undertaken to determine whether construction activities and/or construction vehicles have caused sections of road to deteriorate.

A report would be prepared by the construction contractor in consultation with Transport for NSW and relevant councils, detailing the findings of the pre-construction and post-construction condition surveys and any remediation works required. Damage attributed to construction works would be rectified by the construction contractor, in line with any relevant Transport for NSW and council requirements.

4.7 Westmead metro station construction site

4.7.1 Worksite location and access

The Westmead metro station construction site is bound by Hawkesbury Road, Bailey Street, Hassall Street and the rail line. Roads forming part of the construction vehicle route include the Great Western Highway, Hawkesbury Road and Bailey Street as shown in Figure 4-1. Site access would be left-in via Bailey Street and left-out via Hawkesbury Road.

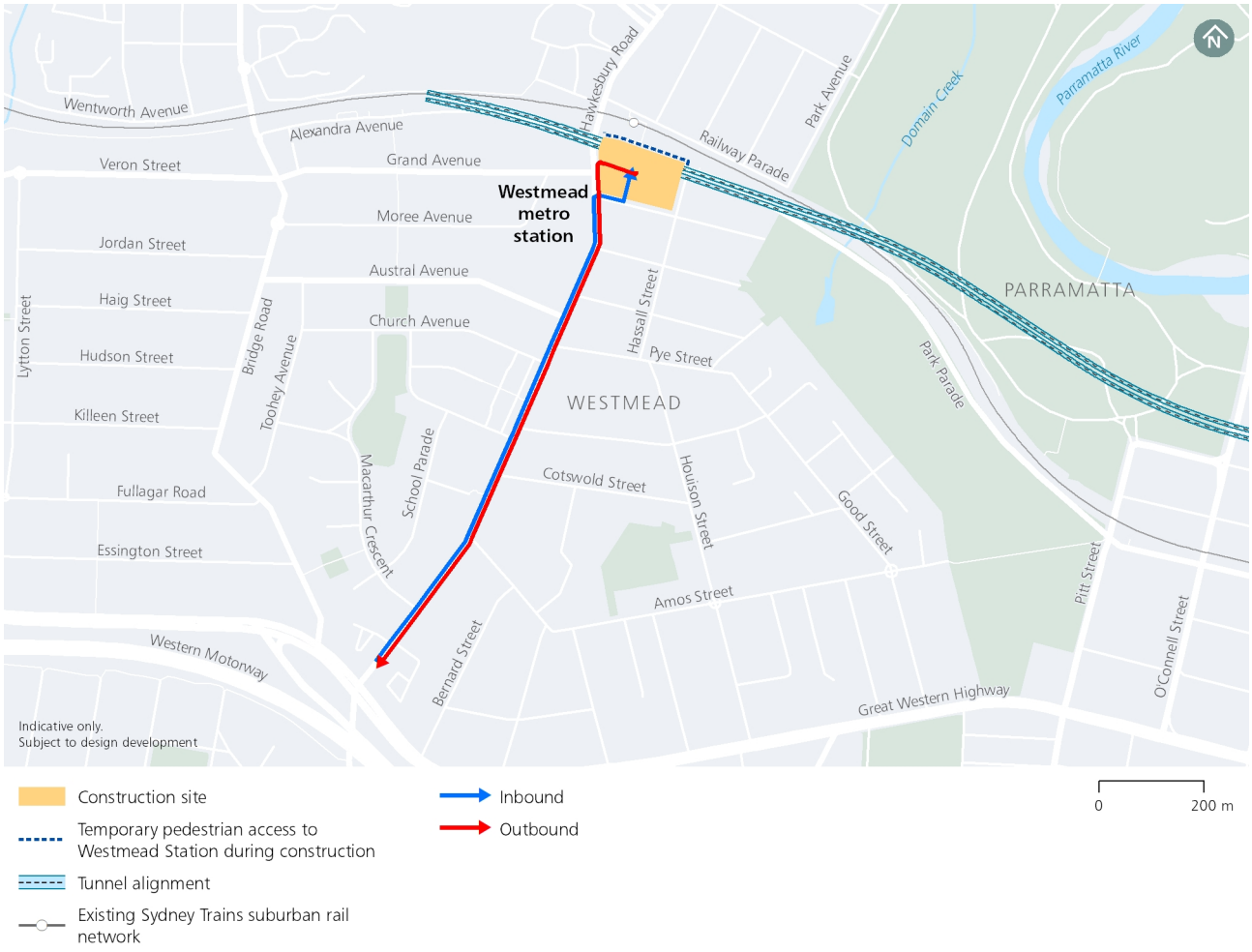

Figure 4-1: Westmead metro station construction site indicative construction vehicle routes

Road network changes as a result of Parramatta Light Rail (Stage 1)

For the purposes of this assessment, it has been assumed road network changes associated with Parramatta Light Rail (Stage 1) will be in operation by the time peak tunnelling and station excavation activity for Stage 1 occurs in 2023. Road network changes in Westmead, and the associated redistribution of traffic resulting from the road network changes, have been incorporated into the '2023 without Stage 1' and '2023 with Stage 1' traffic models. These changes include:

- A centre-running light rail alignment along Hawkesbury Road from Darcy Road to Hainsworth Street
- The removal of right turn movements from the following intersections:
  - Hawkesbury Road / Queens Road
  - Hawkesbury Road / Jessie Street
  - Hainsworth Street / The Children's Hospital at Westmead visitor car park access
- New traffic signals at the following intersections:
  - Hawkesbury Road / Caroline Street
  - Hainsworth Street / Bridge Road.

Road network changes as a result of Stage 1 (temporary)

In addition to the road network changes outlined above as part of Parramatta Light Rail (Stage 1), other temporary road network changes are required to facilitate construction works. These changes include:

- Closure of Alexandra Avenue between Hawkesbury Road and Hassall Street
- Signalisation of the Hawkesbury Avenue / Bailey Street intersection
- Signalisation of the Hassall Street / Bailey Street intersection
- Modified traffic signals at the Hawkesbury Road / Alexandra Avenue intersection
- Modified traffic signals at the Alexandra Avenue / Hassall Street intersection.

Road network changes as a result of Stage 1 (permanent)

At the completion of Stage 1, Alexandra Avenue would be realigned between Hassall Street and Hawkesbury Road. The permanent road network changes are shown in Figure 4-2 and include:

- Realignment of Alexandra Avenue to connect between Hassall Street and Grand Avenue
- Removal of traffic signals at the existing Hawkesbury Road / Alexandra Avenue intersection
- Conversion of Alexandra Avenue west of Hawkesbury Road to be left-in, left-out
- Signalisation of the Hawkesbury Road / Grand Avenue / Alexandra Avenue east intersection, with provision for all movements at each approach
- Modified traffic signals at the Alexandra Avenue / Hassall Street intersection
- Removal of temporary traffic signals at the Hawkesbury Road / Bailey Street intersection
- Removal of temporary traffic signals at the Hassall Street / Bailey Street intersection.

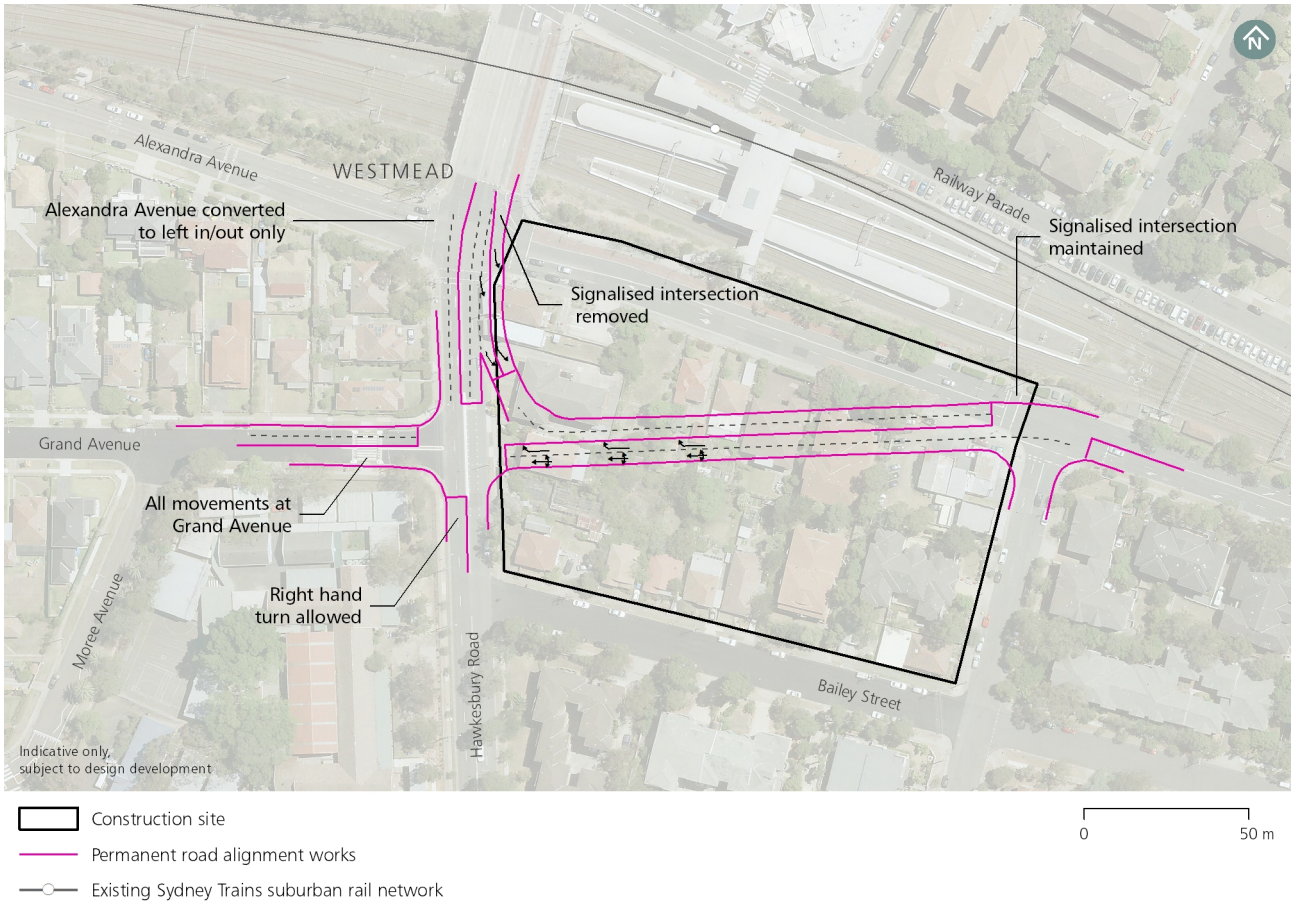

Figure 4-2: Permanent changes to the road network around Westmead metro station construction site (indicative only)

4.7.2 Construction activities

Major construction activities anticipated at the Westmead metro station construction site include:

- Demolition and site establishment, including temporary adjustments to the road network
- Piling
- Excavation
- Tunnel boring machine launch and support (including spoil removal)
- Permanent adjustments to the local road network.

4.7.3 Construction vehicle movements

Construction vehicles would access and egress the Westmead metro station site 24 hours a day during excavation (once acoustic sheds have been erected) and tunnel boring machine launch, with construction vehicles generated for all other activities to access and egress the construction site during standard hours.

The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods, as well as keeping night time heavy vehicle movements to a low level.

The anticipated number of construction vehicle movements to and from the site per hour during the various phases of construction are shown in Figure 4-3 and Figure 4-4. Heavy vehicles have been assumed to travel to and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-4.

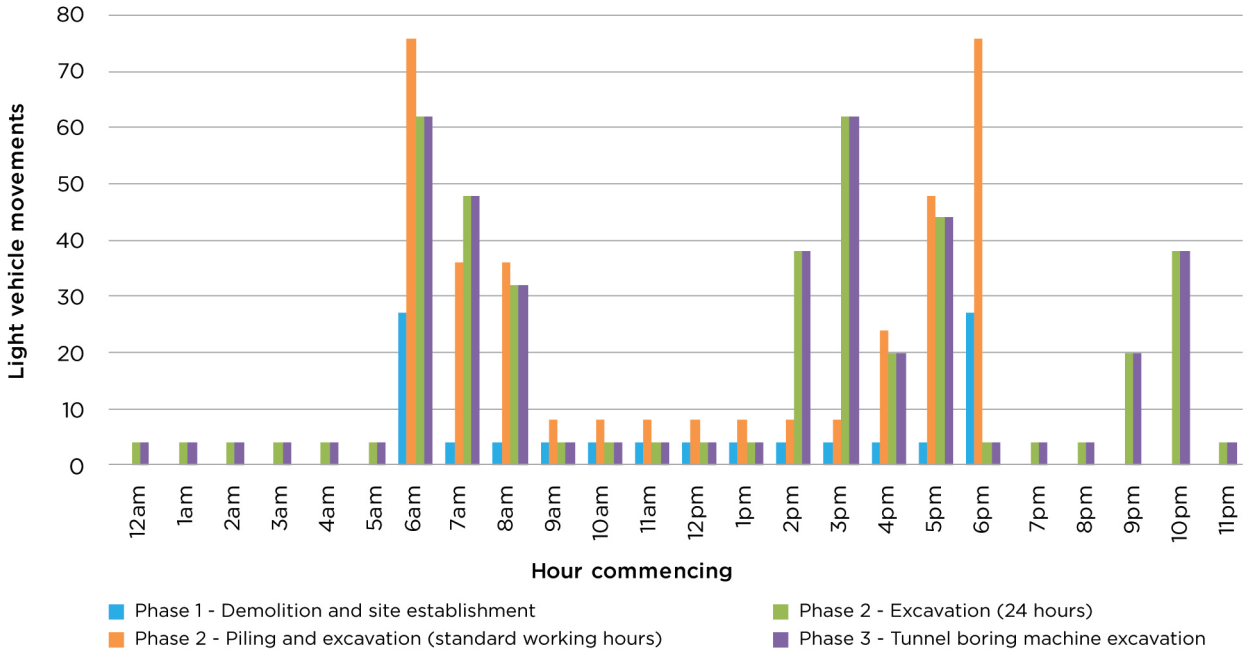

Figure 4-3: Hourly light vehicle movements (arrival and departure) at the Westmead metro station construction site

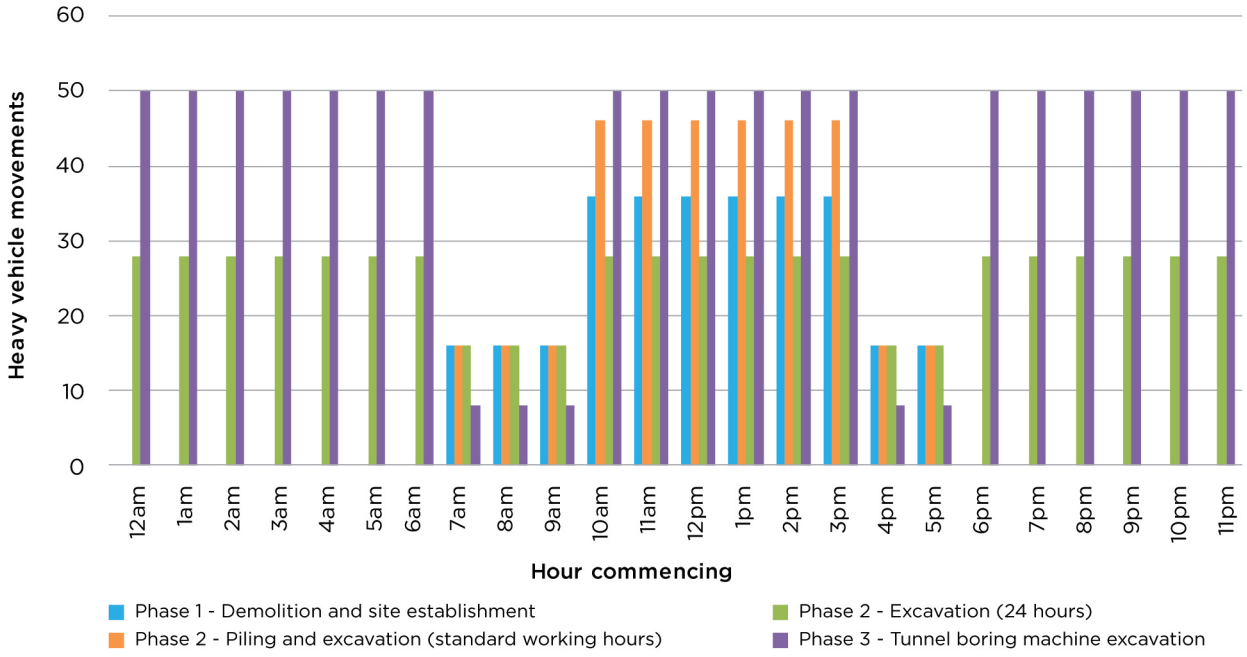

Figure 4-4: Hourly heavy vehicle movements (arrival and departure) at the Westmead metro station construction site

Table 4-4: Daily construction movements per day by phase – Westmead metro station construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment	98	296	394
Phase 2 – Piling and excavation (standard working hours)	352	356	708
Phase 2 – Excavation (24 hours)	424	612	1,036
Phase 3 – Tunnel boring machine excavation	424	990	1,414

4.7.4 Impacts on road network performance

Impacts associated with the temporary road network changes

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-5 for the morning and evening peak hours. The '2023 with Stage 1' scenario includes the temporary signalisation of Hawkesbury Road / Bailey Street and Hassall Street / Bailey Street.

During the morning peak hour presented in this assessment (8 am to 9 am), it is anticipated that the construction site would generate 32 light vehicle movements (32 light vehicles travelling to the construction site) and 16 heavy vehicle movements (eight heavy vehicles travelling to and from the construction site). During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the construction site would generate 48 light vehicle movements (48 light vehicles travelling from the construction site) and 16 heavy vehicle movements (6 heavy vehicles travelling to and from the construction site). As discussed in Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Hawkesbury Road / Priddle Street during the morning and evening peak hour – from Level of Service A to B and Level of Service A to D, respectively. This is due to the closure of Alexandra Avenue, resulting in vehicles performing a detour. The majority of detoured vehicles would travel on Bailey Street, however some would instead travel on Priddle Street. This intersection would still operate with spare capacity with the addition of construction traffic
- Hawkesbury Road / Amos Street during the morning and evening peak hour – from Level of Service A to B and Level of Service A to F, respectively. This intersection would still operate with spare capacity with the addition of construction traffic during the morning peak hour. During the evening peak hour, the deterioration in performance is due to downstream congestion emanating from the Hawkesbury Road / Great Western Highway / Coleman Street intersection.
- Bailey Street / Hassall Street during the morning peak hour – from Level of Service A to D. As discussed above, this is due to the majority of detoured vehicles traveling on Bailey Street while Alexandra Avenue is closed. This intersection would still operate with spare capacity with the addition of construction traffic.

Analysis of modelled intersection performance results shows that at some locations, changes to the road network to accommodate construction activities and the addition of construction traffic would result in an improvement in intersection performance. This is forecast to occur at the following intersections:

- Hawkesbury Road / Alexandra Avenue during the evening peak hour – from Level of Service F to E
- Hawkesbury Road / Grand Avenue during the morning and evening peak hour – from Level of Service F to D and Level of Service F to B, respectively
- Hawkesbury Road / Bailey Street during the morning and evening peak hour – from Level of Service E to C and Level of Service F to D, respectively
- Alexandra Avenue / Hassall Street during the morning and evening peak hour – from Level of Service F to C
- Alexandra Avenue / Bridge Road during the evening peak hour – from Level of Service E to C.

Modification of the Hawkesbury Road / Alexandra Avenue intersection would improve its efficiency and overall intersection performance, and would lead to lower delays at the Hawkesbury Road / Grand Avenue and Hawkesbury Road / Bailey Street intersections. Similarly, modification of the Alexandra Avenue / Hassall Street intersection would result in lower delays to vehicles as the only conflicting movement is when a pedestrian phase is called during a signal cycle.

The improved performance of the Alexandra Avenue / Bridge Road intersection is due to Alexandra Avenue carrying a lower number of vehicles during construction, as (depending on destination) some detoured vehicles would preference Grand Avenue when travelling west of Hawkesbury Road.

In addition, analysis of modelled intersection performance results shows that at some locations, the addition of construction traffic would result in a small reduction in demand flow due to the following factors:

- Additional 'latent' or 'unreleased' demand, which is traffic that is not able to be assigned in the model during the morning and/or evening peak period. These trips are assumed to still exist, however, these trips would be delayed and not completed until after the peak period, effectively increasing the duration of the peak period
- Fewer vehicles passing through an intersection due to the addition of construction-related heavy vehicles, which have a slower acceleration profile compared to light vehicles. This would likely result in an increase to average delay.

In reality, from an operational perspective, the performance of an intersection where the modelling results show a small reduction in demand flow and / or average delay would remain very similar with and without construction traffic.

Table 4-5: Modelled intersection performance (2023) – Westmead metro station construction site (temporary)

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Alexandra Avenue										
Morning	2,702	38	C	NB	155	2,665	31	C	NB	200
				EB	150				EB	340
				SB	140				SB	150
				WB	190				WB	-
Evening	2,585	75	F	NB	165	2,429	61	E	NB	150
				EB	375				EB	155
				SB	235				SB	235
				WB	190				WB	-
Hawkesbury Road / Grand Avenue										
Morning	1,404	>100	F	NB	100	2,519	52	D	NB	140
				EB	100				EB	115
				SB	<5				SB	30
				WB	-				WB	-
Evening	1,189	>100	F	NB	105	2,534	20	B	NB	95
				EB	25				EB	15
				SB	<5				SB	30
				WB	-				WB	-

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Bailey Street										
Morning	1,389	60	E	NB	60	2,477	32	C	NB	100
				EB	-				EB	-
				SB	<5				SB	70
				WB	85				WB	85
Evening	1,198	77	F	NB	65	2,521	45	D	NB	50
				EB	-				EB	-
				SB	10				SB	70
				WB	95				WB	85
Hawkesbury Road / Priddle Street										
Morning	1,346	10	A	NB	100	1,528	22	B	NB	135
				EB	-				EB	-
				SB	15				SB	65
				WB	50				WB	80
Evening	1,267	9	A	NB	45	1,373	51	D	NB	35
				EB	-				EB	-
				SB	65				SB	100
				WB	45				WB	15
Hawkesbury Road / Amos Street										
Morning	1,468	11	A	NB	65	1,507	16	B	NB	60
				EB	-				EB	-
				SB	50				SB	305
				WB	60				WB	60
Evening	1,472	14	A	NB	65	1,529	95	F	NB	65
				EB	-				EB	-
				SB	135				SB	315
				WB	30				WB	35

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Great Western Highway / Coleman Street										
Morning	4,077	88	F	NB	185	4,038	>100	F	NB	185
				EB	115				EB	115
				SB	330				SB	410
				WB	115				WB	115
Evening	4,240	>100	F	NB	175	4,258	>100	F	NB	175
				EB	115				EB	115
				SB	220				SB	420
				WB	415				WB	415
Bailey Street / Hassall Street										
Morning	692	11	A	NB	35	1,539	44	D	NB	105
				EB	30				EB	45
				SB	70				SB	100
				WB	10				WB	10
Evening	563	<5	A	NB	80	1,437	14	A	NB	70
				EB	15				EB	50
				SB	100				SB	80
				WB	10				WB	15
Alexandra Avenue / Hassall Street										
Morning	1,555	>100	F	NB	130	962	36	C	NB	150
				EB	85				EB	-
				SB	-				SB	-
				WB	500				WB	210
Evening	1,687	>100	F	NB	170	898	31	C	NB	120
				EB	190				EB	-
				SB	-				SB	-
				WB	465				WB	50

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Alexandra Avenue / Bridge Road										
Morning	1,932	27	B	NB	70	1,877	22	B	NB	60
				EB	-				EB	-
				SB	60				SB	60
				WB	130				WB	70
Evening	1,780	64	E	NB	60	1,654	41	C	NB	60
				EB	-				EB	-
				SB	60				SB	60
				WB	115				WB	95
Bridge Road / Grand Avenue										
Morning	1,865	29	B	NB	35	1,938	26	B	NB	35
				EB	70				EB	70
				SB	85				SB	85
				WB	35				WB	30
Evening	1,630	43	D	NB	80	1,661	43	D	NB	80
				EB	35				EB	35
				SB	85				SB	85
				WB	80				WB	65

Impacts associated with the permanent road network changes

To assess the impacts associated with realignment of Alexandra Avenue and associated network changes in the vicinity of the Westmead metro station construction site, the performance of the intersections prior and following the changes in 2023 has been compared without the influence of Stage 1 construction traffic. Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with permanent road realignment' (without construction vehicles) scenarios are summarised in Table 4-6 for the morning and evening peak hours. The Hawkesbury Road / Bailey Street and Hassall Street / Bailey Street intersections are unsignalised in both scenarios.

Modelled intersection performance with construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Hawkesbury Road / Priddle Street during the morning and evening peak hour – from Level of Service A to B and Level of Service A to C, respectively

- Alexandra Avenue / Bridge Road during the morning and evening peak hour – from Level of Service B to C and Level of Service E to F, respectively
- Bridge Road / Grand Avenue during the morning peak hour – from Level of Service B to C.

The majority of these intersection would still operate with spare capacity with the exception of Alexandra Avenue / Bridge Road during the evening peak hour. This is due to additional vehicles travelling along Grand Avenue, and the Grand Avenue / Bridge Road intersection accommodating a higher number of vehicles with increased queue lengths on most approaches. This would result in congestion on the westbound approach of the adjacent Alexandra Avenue / Bridge Road intersection. Potential opportunities to mitigate the impacts at this intersection would be investigated in consultation with Transport for NSW and Cumberland City Council and may include local area traffic management changes, intersection turning bans and the like.

Analysis of modelled intersection performance results shows that at some locations, the permanent realignment of Alexandra Avenue would result in an improvement in intersection performance. This is forecast to occur at the following intersections:

- Hawkesbury Road / Alexandra Avenue during the evening peak hour – from Level of Service F to A
- Hawkesbury Road / Grand Avenue during the morning and evening peak hour – from Level of Service F to C
- Hawkesbury Road / Bailey Street during the morning and evening peak hour – from Level of Service E to C and Level of Service F to E, respectively
- Alexandra Avenue / Hassall Street during the morning and evening peak hour – from Level of Service F to B
- Bridge Road / Grand Avenue during the evening peak hour – from Level of Service D to C.

The permanent realignment of Alexandra Avenue would lead to a reduction in traffic on Hassall Street, Bailey Street and Alexandra Avenue west of Hawkesbury Road, reducing overall delays experienced at intersections along Hawkesbury Road at Alexandra Avenue, Grand Avenue and Bailey Street, and at the Alexandra Avenue / Hassall Street intersection.

Table 4-6: Modelled intersection performance (2023) – Westmead metro station construction site (permanent)

Intersection and peak hour	2023 without Stage 1					2023 with permanent road realignment				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Alexandra Avenue										
Morning	2,702	38	C	NB	155	2,417	34	C	NB	175
				EB	150				EB	115
				SB	140				SB	65
				WB	190				WB	-
Evening	2,585	75	F	NB	165	2,432	8	A	NB	105
				EB	375				EB	25
				SB	235				SB	210
				WB	-				WB	-

Intersection and peak hour	2023 without Stage 1					2023 with permanent road realignment				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Grand Avenue										
Morning	1,404	>100	F	NB	100	2,507	32	C	NB	120
				EB	100				EB	165
				SB	<5				SB	30
				WB	-				WB	105
Evening	1,189	>100	F	NB	105	2,839	34	C	NB	85
				EB	25				EB	85
				SB	<5				SB	30
				WB	-				WB	135
Hawkesbury Road / Bailey Street										
Morning	1,389	60	E	NB	60	1,280	41	C	NB	80
				EB	-				EB	-
				SB	<5				SB	35
				WB	85				WB	70
Evening	1,198	77	F	NB	65	1,350	59	E	NB	45
				EB	-				EB	-
				SB	10				SB	35
				WB	95				WB	50
Hawkesbury Road / Priddle Street										
Morning	1,346	10	A	NB	100	1,248	26	B	NB	80
				EB	-				EB	-
				SB	15				SB	85
				WB	50				WB	45
Evening	1,267	9	A	NB	45	1,285	33	C	NB	35
				EB	-				EB	-
				SB	65				SB	60
				WB	45				WB	10

Intersection and peak hour	2023 without Stage 1					2023 with permanent road realignment				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Hawkesbury Road / Amos Street										
Morning	1,468	11	A	NB	65	1,479	12	A	NB	60
				EB	-				EB	-
				SB	50				SB	95
				WB	60				WB	60
Evening	1,472	14	A	NB	65	1,557	15	A	NB	65
				EB	-				EB	-
				SB	135				SB	120
				WB	30				WB	30
Hawkesbury Road / Great Western Highway / Coleman Street										
Morning	4,077	88	F	NB	185	4,051	86	F	NB	185
				EB	115				EB	115
				SB	330				SB	350
				WB	115				WB	115
Evening	4,240	>100	F	NB	175	4,291	>100	F	NB	175
				EB	115				EB	120
				SB	220				SB	365
				WB	415				WB	420
Bailey Street / Hassall Street										
Morning	692	11	A	NB	35	695	7	A	NB	45
				EB	30				EB	15
				SB	70				SB	50
				WB	10				WB	10
Evening	563	<5	A	NB	80	306	<5	A	NB	<5
				EB	15				EB	10
				SB	100				SB	30
				WB	10				WB	10

Intersection and peak hour	2023 without Stage 1					2023 with permanent road realignment				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Alexandra Avenue / Hassall Street										
Morning	1,555	>100	F	NB	130	1,592	22	B	NB	135
				EB	85				EB	140
				SB	-				SB	-
				WB	500				WB	85
Evening	1,687	>100	F	NB	170	1,533	16	B	NB	50
				EB	190				EB	120
				SB	-				SB	-
				WB	465				WB	130
Alexandra Avenue / Bridge Road										
Morning	1,932	27	B	NB	70	1,785	30	C	NB	80
				EB	-				EB	-
				SB	60				SB	60
				WB	130				WB	60
Evening	1,780	64	E	NB	60	1,438	>100	F	NB	80
				EB	-				EB	-
				SB	60				SB	60
				WB	115				WB	235
Bridge Road / Grand Avenue										
Morning	1,865	29	B	NB	35	2,039	33	C	NB	35
				EB	70				EB	165
				SB	85				SB	85
				WB	35				WB	60
Evening	1,630	43	D	NB	80	1,806	37	C	NB	95
				EB	35				EB	30
				SB	85				SB	95
				WB	80				WB	100

4.7.5 Impacts on parking and property access

On-street parking spaces may be temporarily removed along Hassall Street and Bailey Street adjacent to the construction site (about 10 parking spaces on each road). In addition, some parking spaces may be permanently removed at the Hawkesbury Road / Bailey Street (about four parking spaces) and Hassall Street / Bailey Street (about 10 parking spaces) intersections to accommodate the temporary signalisation of these intersections. The combined loss of on-street parking spaces would have minor impacts to the road network given the availability of parking on other local roads nearby, and the permanent demolition of properties that currently generate parking demand. Opportunities to mitigate impacts to on-street car parking would be explored in consultation with Cumberland City Council during construction planning (refer to Section 5).

The permanent closure of Alexandra Avenue between Hawkesbury Road and Hassall Street would require a temporary detour to be implemented. Vehicles would instead travel via Hassall Street, Bailey Street and Hawkesbury Road, resulting in an additional travel distance of about 150 metres. This is considered a minor impact due to the small increase in travel distance and resultant small increase in travel time.

There would be no impacts to private property access.

4.7.6 Impacts on the public transport network

A number of buses travel along Alexandra Avenue east of Hawkesbury Road. As a result of the permanent closure of Alexandra Avenue between Hawkesbury Road and Hassall Street, these buses would be required to travel on the temporary detour route along Hassall Street, Bailey Street and Hawkesbury Road. As discussed in Section 4.7.5, this would result in an additional travel distance of 150 metres and is a minor impact. The bus stops on Alexandra Avenue between Hawkesbury Road and Hassall Street would be temporarily relocated to east of Hassall Street or onto Hassall Street. These bus stops are not Disability Discrimination Act (DDA) compliant and serve 12 bus routes, including North-West Transitway and NightRide bus services. The relocated bus stops may result in bus customers walking up to an additional 200 metres and is considered a minor impact. The location of the relocated bus stops would be determined in consultation with Transport for NSW, Cumberland City Council, and relevant bus operators. As part of a future construction stage of Sydney Metro West, new DDA compliant bus stops would be provided on the realigned Alexandra Avenue within close proximity to the Westmead metro station entrance.

In the interim, potential opportunities to temporarily improve bus priority would be investigated during detailed design to minimise impacts on the bus lane along Alexandra Avenue.

Three light rail stops would be provided along Hawkesbury Road as part of Parramatta Light Rail (Stage 1) and serve the existing Westmead Station, Westmead Hospital and the Children's Hospital at Westmead. Construction vehicles are not proposed to (but on occasion may be required to) travel on Hawkesbury Road north of Alexandra Avenue and therefore no impacts to the light rail network are anticipated.

Rail services at the existing Westmead Station would not be impacted by the construction works. If works are required within the rail corridor, these would likely be carried out during scheduled Sydney Trains rail track possessions. Alternative bus services, as provided in standard rail track possessions, would be provided.

4.7.7 Impacts on the active transport network

Footpaths on both sides of Alexandra Avenue between Hawkesbury Road and Hassall Street would be closed during construction. East-west connectivity would be maintained via a temporary pedestrian footpath along the northern boundary of the construction site, which would also provide maintenance of access to Westmead Station. Existing signalised pedestrian crossings at intersections would be maintained and modified where necessary including Hawkesbury Road / Alexandra Avenue and Alexandra Avenue / Hassall Street. The introduction of traffic signals and signalised pedestrian crossings at the Hawkesbury Road / Bailey Street

intersection would improve conditions for pedestrians. Therefore, impacts to the pedestrian network would be minimal.

The bicycle racks and lockers located on the northern side of Alexandra Avenue near the existing Westmead Station may be temporarily relocated. If required, these facilities would be relocated to a distance close to their current location and therefore the potential impact to cyclists is expected to be minor.

4.7.8 Emergency vehicles

Emergency response services, particularly those travelling to and from the Westmead health precinct may also be impacted by the closure of Alexandra Avenue. Emergency response vehicles that would have previously used Alexandra Avenue to travel between the Westmead health precinct and Parramatta CBD would be diverted onto Bailey Street and Hassall Street. Ambulance Service of NSW would be consulted about the proposed road network changes during construction, and mitigation strategies would be detailed in the Construction Traffic Management Plan for the site (refer to Section 5). The potential for ambulance services to travel through the site in specific circumstances would be further investigated as Stage 1 progresses.

4.7.9 Construction impacts summary

Figure 4-5 and Figure 4-6 provide a summary of construction impacts on road network performance with the temporary and permanent road network arrangement, respectively. Figure 4-7 provides a summary of construction impacts on parking, access, public transport and active transport.

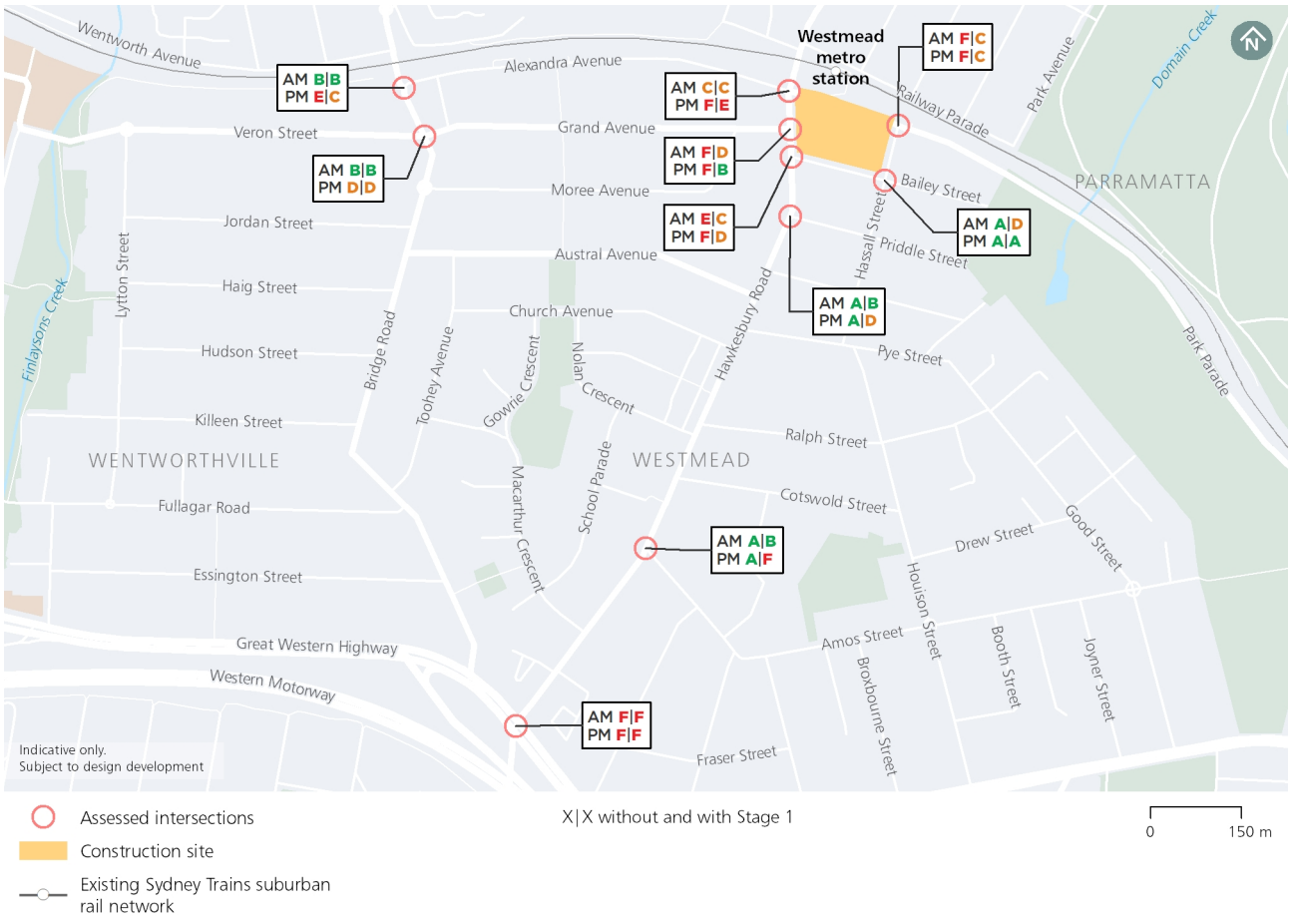

Figure 4-5: Road network performance summary – Westmead metro station construction site (temporary)

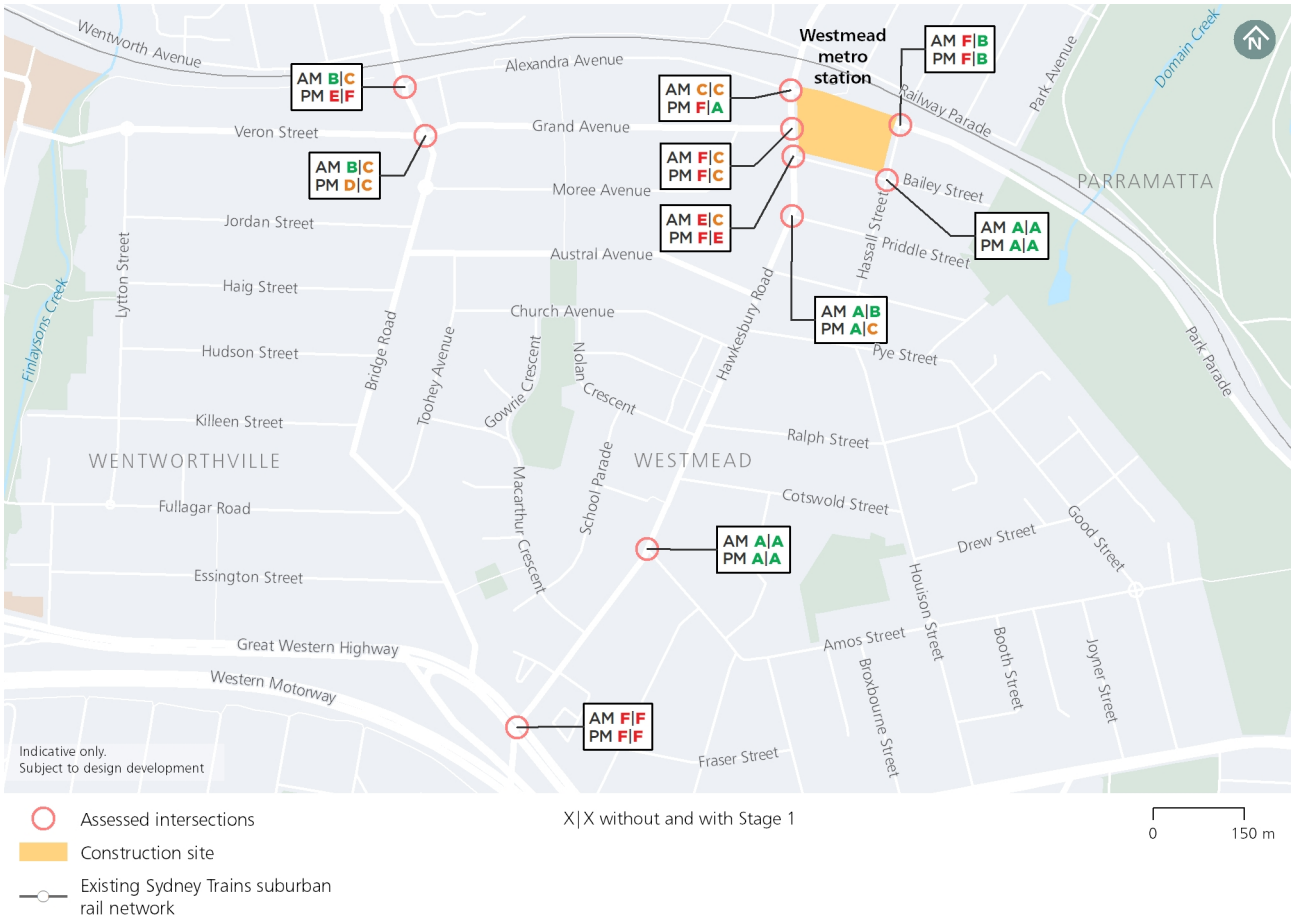

Figure 4-6: Road network performance construction impact summary – Westmead metro station construction site (permanent)

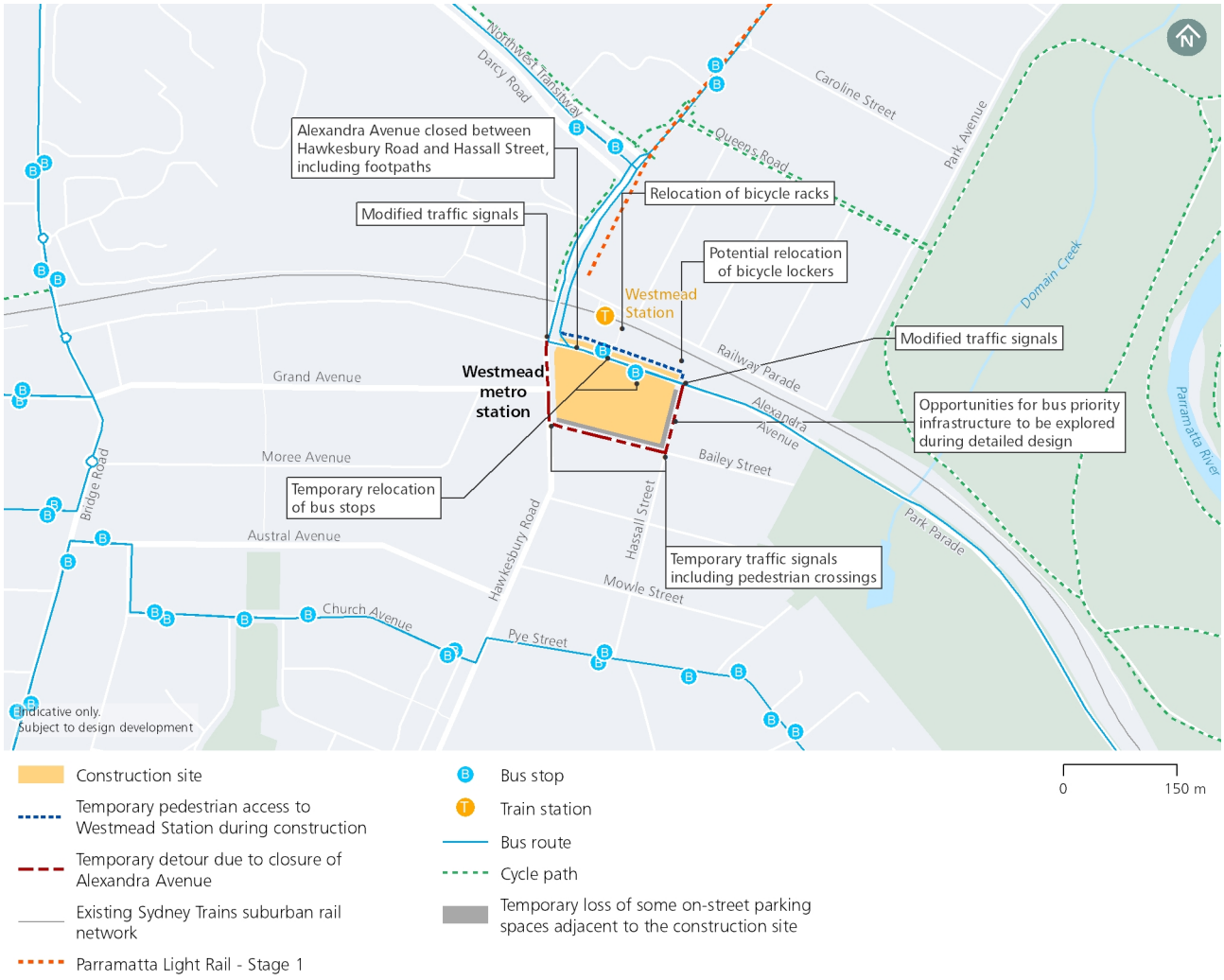

Figure 4-7: Parking, access, public transport and active transport construction impact summary – Westmead metro station construction site

4.8 Parramatta metro station construction site

4.8.1 Worksite location and access

The Parramatta metro station construction site within the block bound by George Street, Church Street, Macquarie Street and Smith Street. Roads forming part of the construction vehicle route include Great Western Highway, Pitt Street, Macquarie Street, O'Connell Street and George Street as shown in Figure 4-8. Site access would be right-in, left-out, to and from George Street, following modification of George Street to allow for two-way traffic as part of Parramatta Light Rail (Stage 1).

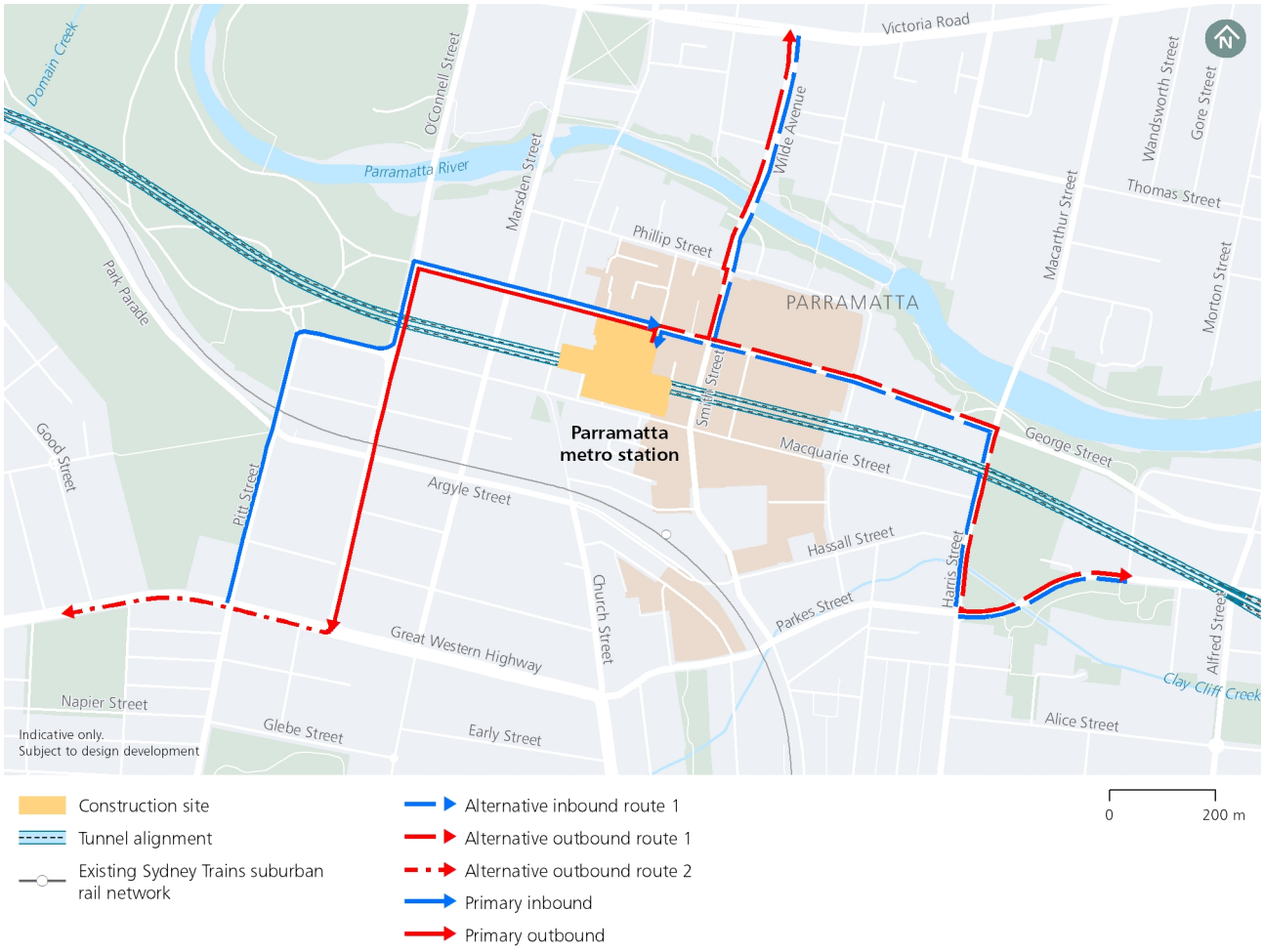

Figure 4-8: Parramatta metro station construction site indicative construction vehicle routes

Road network changes as a result of Parramatta Light Rail (Stage 1)

For the purposes of this assessment, it has been assumed road network changes associated with Parramatta Light Rail (Stage 1) will be in operation by the time peak tunnelling and station excavation activity for Stage 1 occurs in 2023. Road network changes in Parramatta CBD, and the associated redistribution of traffic resulting from the road network changes, have been incorporated into the '2023 without Stage 1' and '2023 with Stage 1' traffic models. Changes in the vicinity of the construction site include:

- Closure of Church Street to vehicular traffic between Market Street and Macquarie Street
- Closure of Macquarie Street to vehicular traffic between Horwood Place and Smith Street
- Conversion of Macquarie Street to one-way eastbound between Marsden Street and Horwood Place, and between Smith Street and Harris Street
- Conversion of George Street to two-way operation

- Changes to allowed movements at the following intersections:
  - Church Street / Phillip Street
  - Church Street / George Street
  - Church Street / Macquarie Street
  - Macquarie Street / Horwood Place
  - Macquarie Street / Smith Street.

4.8.2 Construction activities

Major construction activities anticipated at the Parramatta metro station construction site include:

- Demolition and site establishment
- Piling
- Excavation.

4.8.3 Construction vehicle movements

Construction vehicles would access and egress the Parramatta metro station construction site during standard hours only, with the exception of spoil haulage at night and extended day-time hours on Saturdays. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods, as well as keeping night time heavy vehicle movements to a low level.

The anticipated number of construction vehicle movements to and from the site per hour during the various phases of construction is shown in Figure 4-9 and Figure 4-10. Heavy vehicles have been assumed to travel to and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-7.

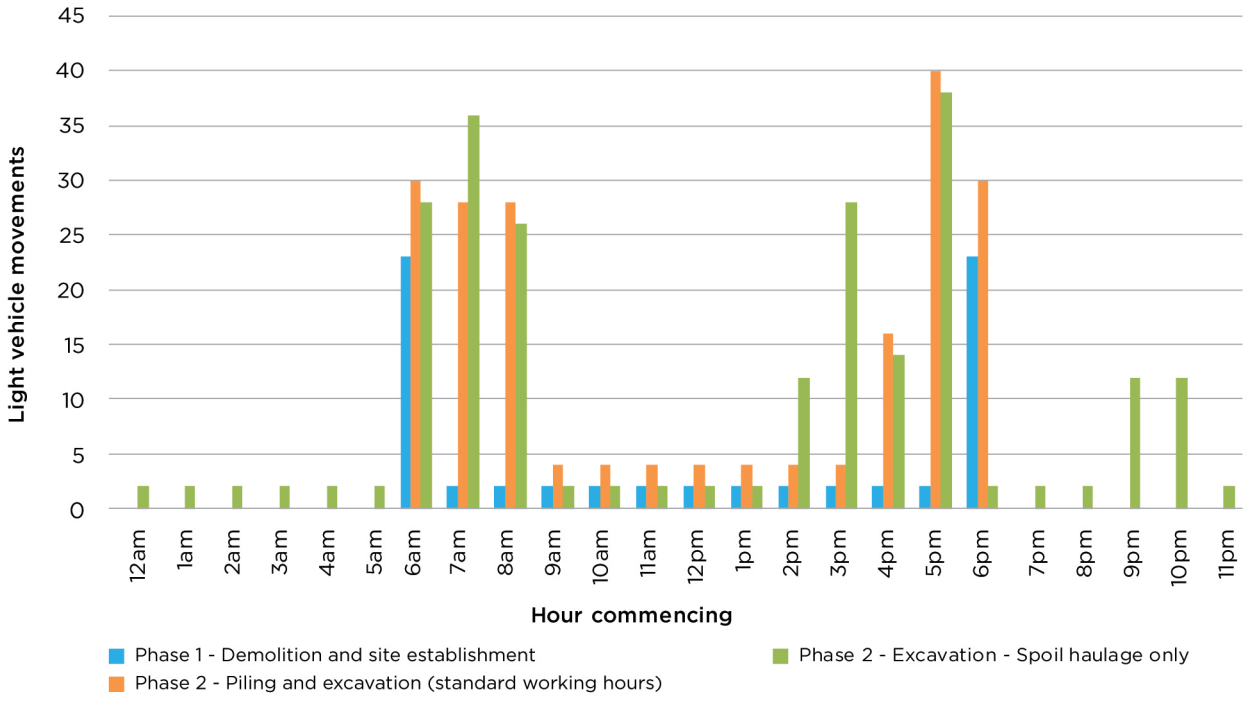

Figure 4-9: Hourly light vehicle movements (arrival and departure) at the Parramatta metro station construction site

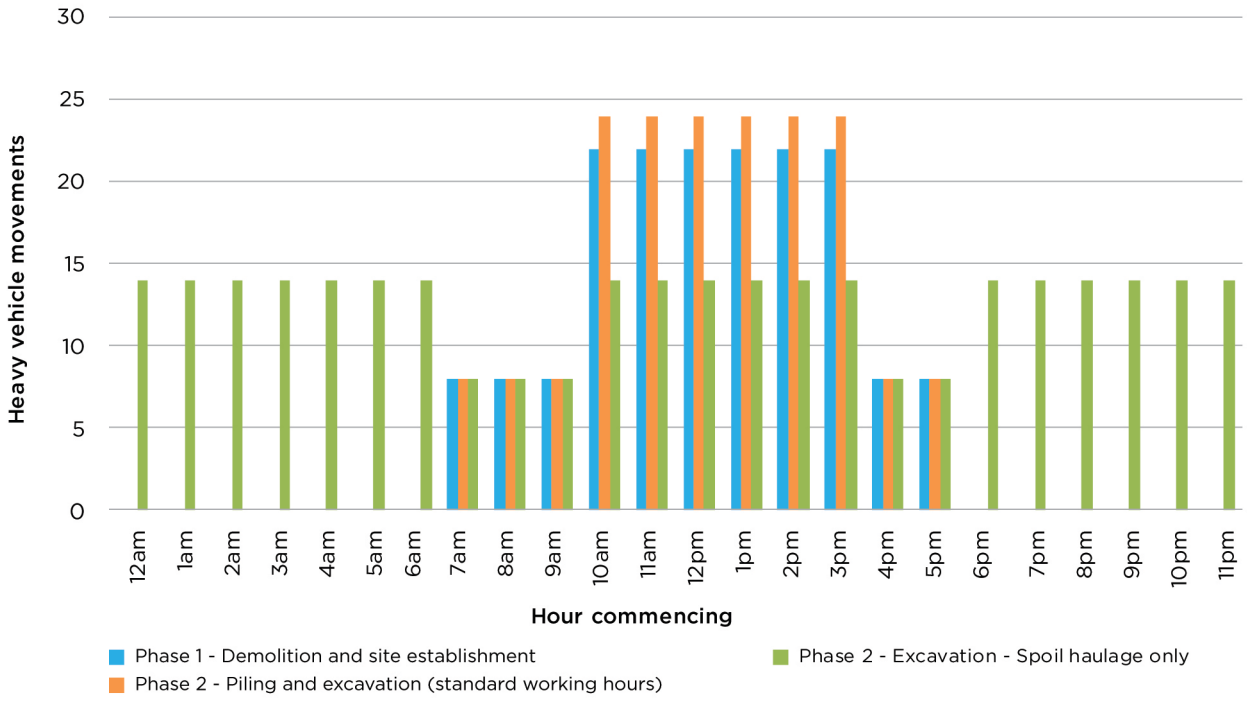

Figure 4-10: Hourly heavy vehicle movements (arrival and departure) at the Parramatta metro station construction site

Table 4-7: Daily construction movements per day by phase – Parramatta metro station construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment	68	172	240
Phase 2 – Piling and excavation (standard working hours)	200	184	384
Phase 2 – Excavation (Spoil haulage only)	236	306	542

4.8.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-8 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (8 am to 9 am), it is anticipated that the construction site would generate 26 light vehicle movements (26 light vehicles travelling to the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the construction site would generate 40 light vehicle movements (40 light vehicles travelling from the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). As discussed in Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that the O'Connell Street / Argyle Street intersection would experience a deterioration in performance during the evening peak from Level of Service D to F. This is due to the additional construction vehicles travelling on O'Connell Street in the southbound direction. Furthermore, O'Connell Street between Macquarie Street and Argyle Street is a major weaving segment, and the additional construction vehicles increases the difficulty for vehicles to change lanes, resulting in increased congestion.

Analysis of modelled intersection performance results shows that the Pitt Street / Argyle Street / Park Parade intersection improves with Stage 1. This is due downstream changes at the Hawkesbury Road / Alexandra Avenue and Alexandra Avenue / Hassall Street intersections in Westmead, which would be modified during construction. The modification of these intersections would result in a substantial reduction in westbound queues along Alexandra Avenue and Park Parade, improving the overall operational performance of the Pitt Street / Argyle Street / Park Parade intersection.

In addition, analysis of modelled intersection performance results shows that at some locations, the addition of construction traffic would result in a small reduction in demand flow due to the following factors:

- Additional 'latent' or 'unreleased' demand, which is traffic that is not able to be assigned in the model during the morning and/or evening peak period. These trips are assumed to still exist, however, these trips would be delayed and not completed until after the peak period, effectively increasing the duration of the peak period
- Fewer vehicles passing through an intersection due to the addition of construction-related heavy vehicles, which have a slower acceleration profile compared to light vehicles. This would likely result in an increase to average delay.

In reality, from an operational perspective, the performance of an intersection where the modelling results show a small reduction in demand flow and / or average delay would remain very similar with and without construction traffic.

Traffic control measures would be required for the construction site access to and from George Street, and may include traffic signals. The final measures would be determined in consultation with Transport for NSW.

Table 4-8: Modelled intersection performance (2023) – Parramatta metro station construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Great Western Highway / Pitt Street										
Morning	5,357	62	E	NB	375	5,334	66	E	NB	375
				EB	295				EB	295
				SB	30				SB	30
				WB	315				WB	325
Evening	4,181	99	F	NB	295	4,443	86	F	NB	295
				EB	205				EB	220
				SB	30				SB	25
				WB	415				WB	410
Great Western Highway / O'Connell Street										
Morning	3,985	35	C	NB	-	3,973	35	C	NB	-
				EB	95				EB	95
				SB	245				SB	255
				WB	115				WB	120
Evening	3,629	65	E	NB	-	3,736	60	E	NB	-
				EB	105				EB	105
				SB	245				SB	255
				WB	205				WB	205

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Pitt Street / Argyle Street / Park Parade										
Morning	3,064	36	C	NB	270	3,026	33	C	NB	235
				EB	140				EB	120
				SB	-				SB	-
				WB	135				WB	85
Evening	2,446	86	F	NB	330	2,468	34	C	NB	165
				EB	30				EB	65
				SB	-				SB	-
				WB	205				WB	185
O'Connell Street / Aird Street										
Morning	2,154	9	A	NB	-	2,169	10	A	NB	-
				EB	-				EB	-
				SB	95				SB	100
				WB	85				WB	85
Evening	1,500	50	D	NB	-	1,568	49	D	NB	-
				EB	-				EB	-
				SB	100				SB	105
				WB	105				WB	105
O'Connell Street / Argyle Street										
Morning	2,698	20	B	NB	-	2,707	22	B	NB	-
				EB	30				EB	30
				SB	185				SB	200
				WB	50				WB	50
Evening	2,371	48	D	NB	-	2,303	72	F	NB	-
				EB	10				EB	15
				SB	205				SB	200
				WB	200				WB	205

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
O'Connell Street / Hunter Street										
Morning	2,161	13	A	NB	-	2,195	14	A	NB	-
				EB	-				EB	-
				SB	95				SB	100
				WB	84				WB	85
Evening	1,677	83	F	NB	-	1,593	85	F	NB	-
				EB	-				EB	-
				SB	105				SB	105
				WB	205				WB	190
O'Connell Street / Macquarie Street										
Morning	3,760	30	C	NB	-	3,767	28	B	NB	-
				EB	290				EB	225
				SB	150				SB	155
				WB	120				WB	85
Evening	2,770	>100	F	NB	-	2,776	>100	F	NB	-
				EB	295				EB	290
				SB	205				SB	200
				WB	165				WB	115
O'Connell Street / George Street										
Morning	4,175	55	D	NB	120	4,190	54	D	NB	120
				EB	-				EB	-
				SB	>500				SB	>500
				WB	35				WB	35
Evening	3,090	>100	F	NB	120	3,115	>100	F	NB	120
				EB	-				EB	-
				SB	>500				SB	>500
				WB	200				WB	190

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
George Street / Marsden Street										
Morning	1,757	>100	F	NB	190	1,740	>100	F	NB	190
				EB	200				EB	190
				SB	165				SB	165
				WB	25				WB	25
Evening	1,909	>100	F	NB	190	1,738	>100	F	NB	190
				EB	190				EB	185
				SB	155				SB	155
				WB	30				WB	35
George Street / Church Street										
Morning	678	<5	A	NB	-	689	<5	A	NB	-
				EB	95				EB	80
				SB	-				SB	-
				WB	15				WB	15
Evening	555	<5	A	NB	-	623	<5	A	NB	-
				EB	<5				EB	<5
				SB	-				SB	-
				WB	<5				WB	<5
George Street / Horwood Place										
Morning	989	17	B	NB	25	1,002	16	B	NB	25
				EB	35				EB	30
				SB	35				SB	35
				WB	10				WB	10
Evening	886	17	B	NB	50	960	19	B	NB	50
				EB	25				EB	30
				SB	35				SB	35
				WB	15				WB	15

4.8.5 Impacts on parking and property access

Horwood Place would be temporarily closed for the duration of Stage 1. Existing rear access provided from Horwood Place for properties fronting Church Street would be maintained via a temporary alternative access lane to be constructed at the start of the construction phase. This access lane would be accessible to and from George Street. Impacts to vehicles accessing these properties are anticipated to be minor given the potential increase in travel distance of up to 360 metres and potential increase in travel time of up to two minutes. Access from Macquarie Lane to properties fronting Smith Street that would remain during construction would be maintained via the existing laneway.

Vehicular access to the back of house service building and fire hydrant on the eastern side of Horwood Place for the property located on 69 George Street would be restricted during construction. Sydney Metro would consult affected property owners about these restrictions and any proposed alternative access arrangements. There would be no other impacts to private property access.

A number of on-street and off-street parking spaces would be permanently removed during construction. These include:

- About 30 metered on-street parking spaces in Horwood Place
- 20 off-street parking spaces accessible from Horwood Place and located to the rear of properties fronting the south-eastern corner of the Church Street / George Street intersection
- The City Centre (Horwood Place) multi-level car park with about 780 off-street parking spaces, which would be demolished.

Permanent closure of the City Centre (Horwood Place) car park is consistent with the City of Parramatta's approach of closing some council-owned parking facilities to allow redevelopment within Parramatta CBD, as stated in the *Draft Parramatta CBD Public Car Parking Strategy* (City of Parramatta 2017). The strategy states the impacts arising from the closure of the City Centre (Horwood Place) car park, closure of other public car parks and the removal of on-street parking spaces as a result of Parramatta Light Rail (Stage 1) would be offset and therefore minimised through:

- Increased utilisation of other parking facilities by converting long-stay parking to short-stay parking
- Additional capacity to be provided with the opening of a multi-level public car park on Macquarie Street
- Potential increase in capacity due to the provision of parking at Parramatta Square.

The City of Parramatta also envisaged the removal of this car park as part of the Civic Link, which will be a green, pedestrianised public space between Parramatta Square and Parramatta River, as documented in the *Civic Link Framework Plan* (City of Parramatta 2017) and the *Draft Civic Link Development Control Plan* (City of Parramatta, 2019). Therefore, removal of the City Centre (Horwood Place) car park during construction would complement the City of Parramatta's objectives and intentions to redevelop the area.

4.8.6 Impacts on the public transport network

Roads forming part of the Parramatta metro station construction vehicle route that are also used by buses include Great Western Highway, Pitt Street, O'Connell Street and George Street. Impacts to buses would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network. No impacts are anticipated on the operation of bus stops.

Light rail stops would be provided along Church Street and Macquarie Street as part of Parramatta Light Rail (Stage 1). Construction vehicles would interface with the light rail network at the George Street / Church Street intersection. At this intersection, inbound and outbound construction vehicles along George Street would be required to cross the light rail line. Impacts to the light rail network would be minor and limited to a potential increase in travel time due to additional construction vehicles on the road network.

No impacts to the rail and ferry networks are anticipated during construction.

4.8.7 Impacts on the active transport network

Existing pedestrian connectivity surrounding the Parramatta metro station construction site is expected to be maintained throughout construction. Temporary closure of Horwood Place would require pedestrians to travel via Church Street or Smith Street as an alternative north-south pedestrian route.

Batman Walk, which is a short pedestrian-only lane, would be closed during construction. This lane connects Macquarie Street and Macquarie Lane and primarily functions as an access route to the City Centre (Horwood Place) car park. Given that this car park would be demolished during construction, the impact to pedestrians is anticipated to be negligible.

Horwood Place is also a designated on-road cycle route of moderate difficulty. As this would be closed during construction, cyclists would be required to travel via alternative roads. These could include Smith Street or Church Street. However, these roads are not designated cycle routes. Designated roads for cyclists are located further away, either along O'Connell Street or Charles Street, up to 450 metres from Horwood Place. The overall impact to cyclists is anticipated to be minor given that the closure of Horwood Place would be temporary and short in duration.

4.8.8 Special events

Major special events in the vicinity of the Parramatta metro station construction site are shown in Table 4-9.

Table 4-9: Special events in the Parramatta CBD

Indicative month	Event	Location
December / January	New Year's Eve	Centenary Square
January	Australia Day	Parramatta Park
February	Lunar New Year	Centenary Square
February	Tropfest	Parramatta Park
March	Parramasala	Prince Alfred Square
July	Winterlight Festival	Prince Alfred Square
July	Burramatta NAIDOC	Parramatta River Foreshore
October	Parramatta Lanes Festival	Throughout Parramatta CBD
November	Loy Krathong: Thai Water Festival	Parramatta River Foreshore
November	Christmas in Parramatta	Centenary Square
Year-round	Various sporting events	Western Sydney Stadium

Although Centenary Square is located adjacent to the south-western corner of the Parramatta metro station construction site, construction activities are not anticipated to directly impact the operation of special events scheduled there. Pedestrian access along major pedestrian desire lines to and from Centenary Square, the other venues identified above, and Parramatta interchange such as Church Street, Phillip Street, George Street, Macquarie Street and Argyle Street would be maintained during construction.

In recent years, the Parramatta Lanes Festival has used Centenary Square and locations nearby including the block bound by Church Street, George Street, Smith Street and Macquarie Street. This block is the location of the construction site, which also includes Horwood Place and Batman Walk. Event organisers would be consulted

about proposed construction works in order to allow sufficient time for event organisers to consider the event's interaction with Stage 1.

Section 5 outlines mitigation measures that would be implemented to minimise impacts during special events, which would be detailed in future Construction Traffic Management Plans.

4.8.9 Construction impacts summary

Figure 4-11 provides a summary of construction impacts on road network performance. Figure 4-12 provides a summary of construction impacts on parking, access, public transport and active transport.

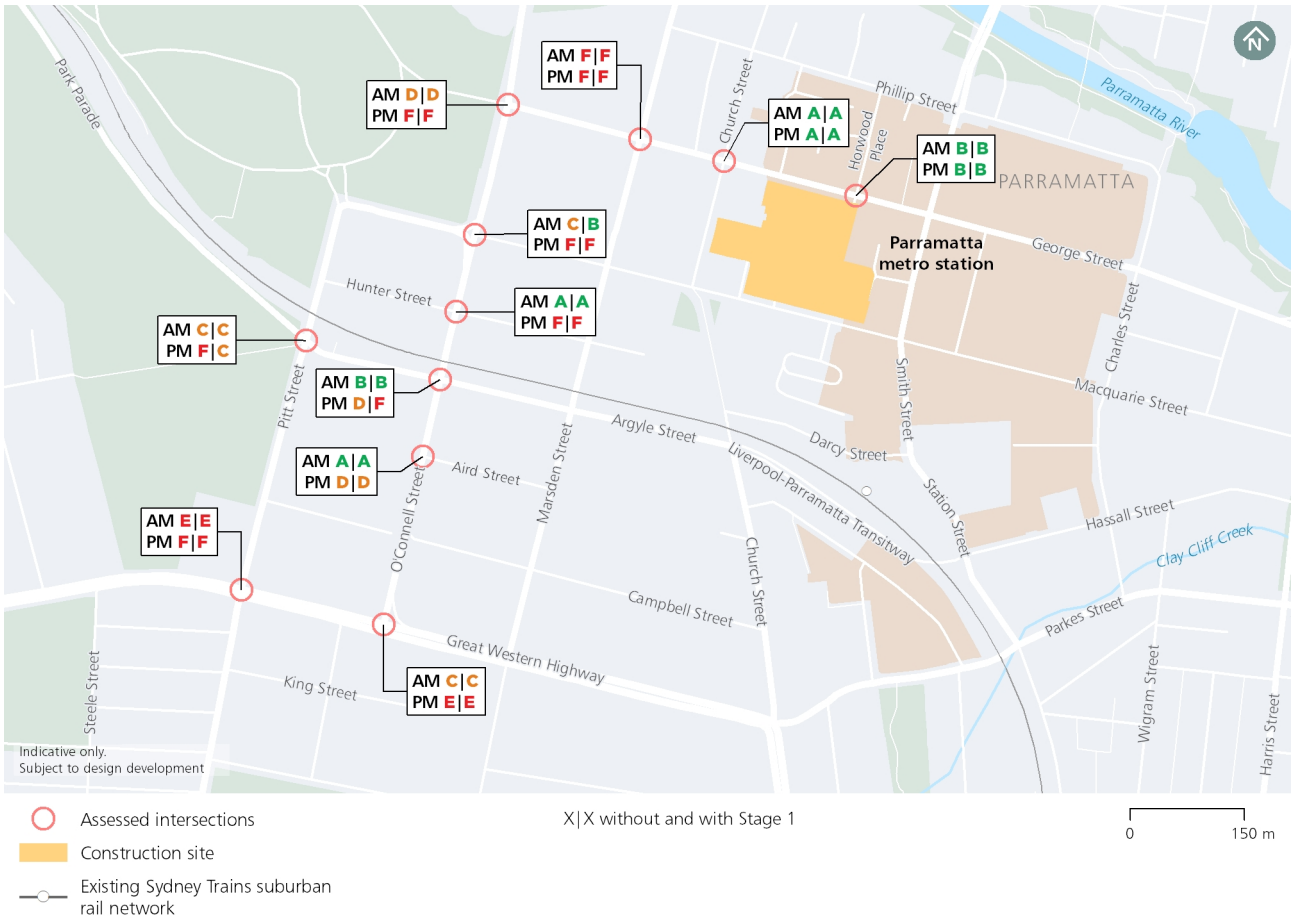

Figure 4-11: Road network performance summary – Parramatta metro station construction site

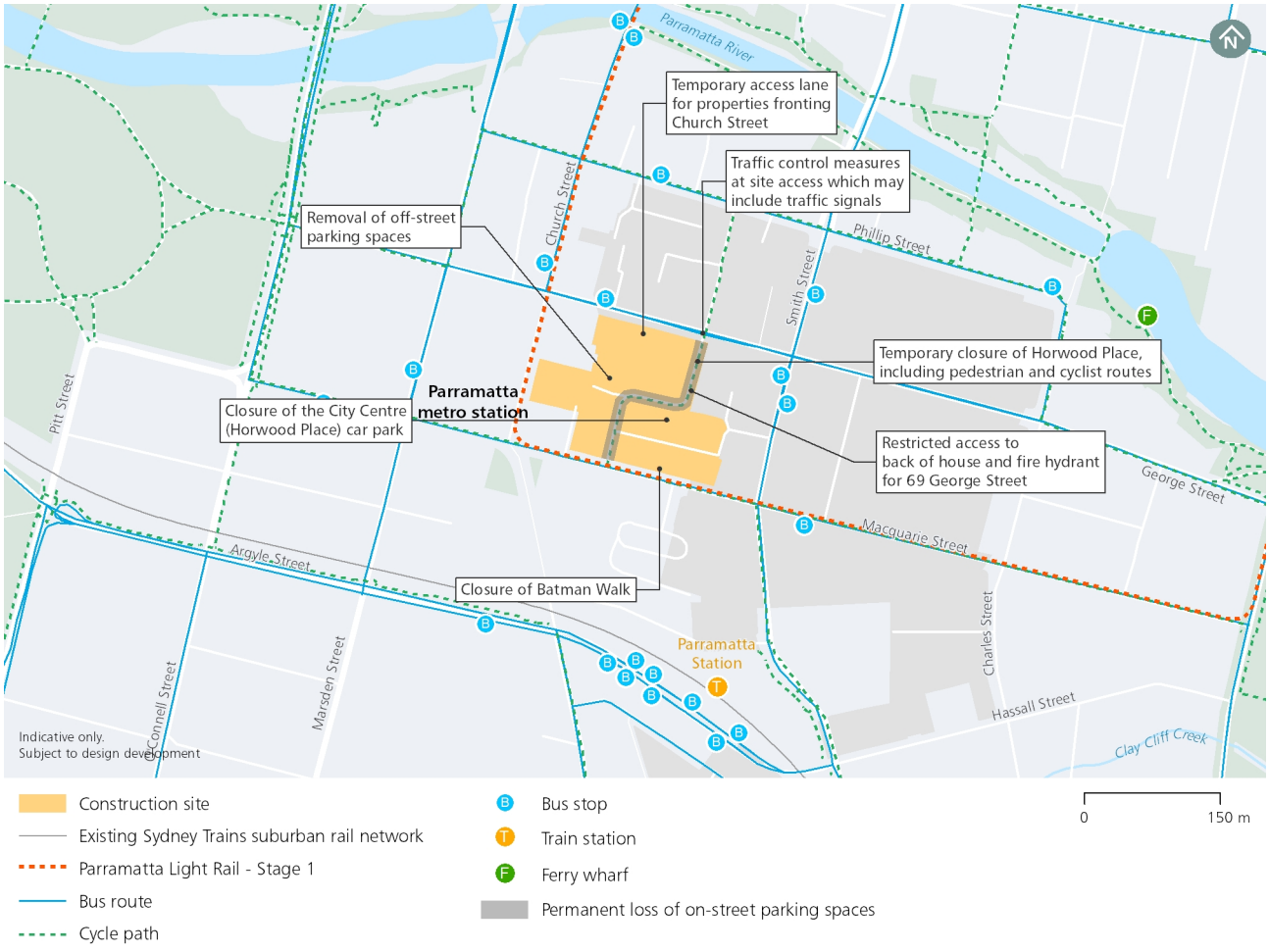

Figure 4-12: Parking, access, public transport and active transport construction impact summary – Parramatta metro station construction site

4.9 Clyde stabling and maintenance facility construction site

4.9.1 Worksite location and access

The Clyde stabling and maintenance facility construction site is bound by Shirley Street, Unwin Street, James Ruse Drive and the M4 Western Motorway. Roads forming part of the construction vehicle route include Parramatta Road and Wentworth Street as shown in Figure 4-13. Site access would be to and from Wentworth Street.

Figure 4-13: Clyde stabling and maintenance facility construction site indicative construction vehicle routes

Road network changes as a result of Stage 1

Road network changes are required to facilitate construction works. These road network changes (shown in Figure 4-14) would be permanent and, at this stage, are anticipated to include:

- Realignment of Unwin Street and Kay Street to travel around and above the construction site. This would include the following:
  - A bridge over the future metro rail line
  - A bridge over A'Becketts Creek
  - A bridge over Duck Creek
- Installation of a turning head at the western end of Unwin Street, adjacent to the rail line.

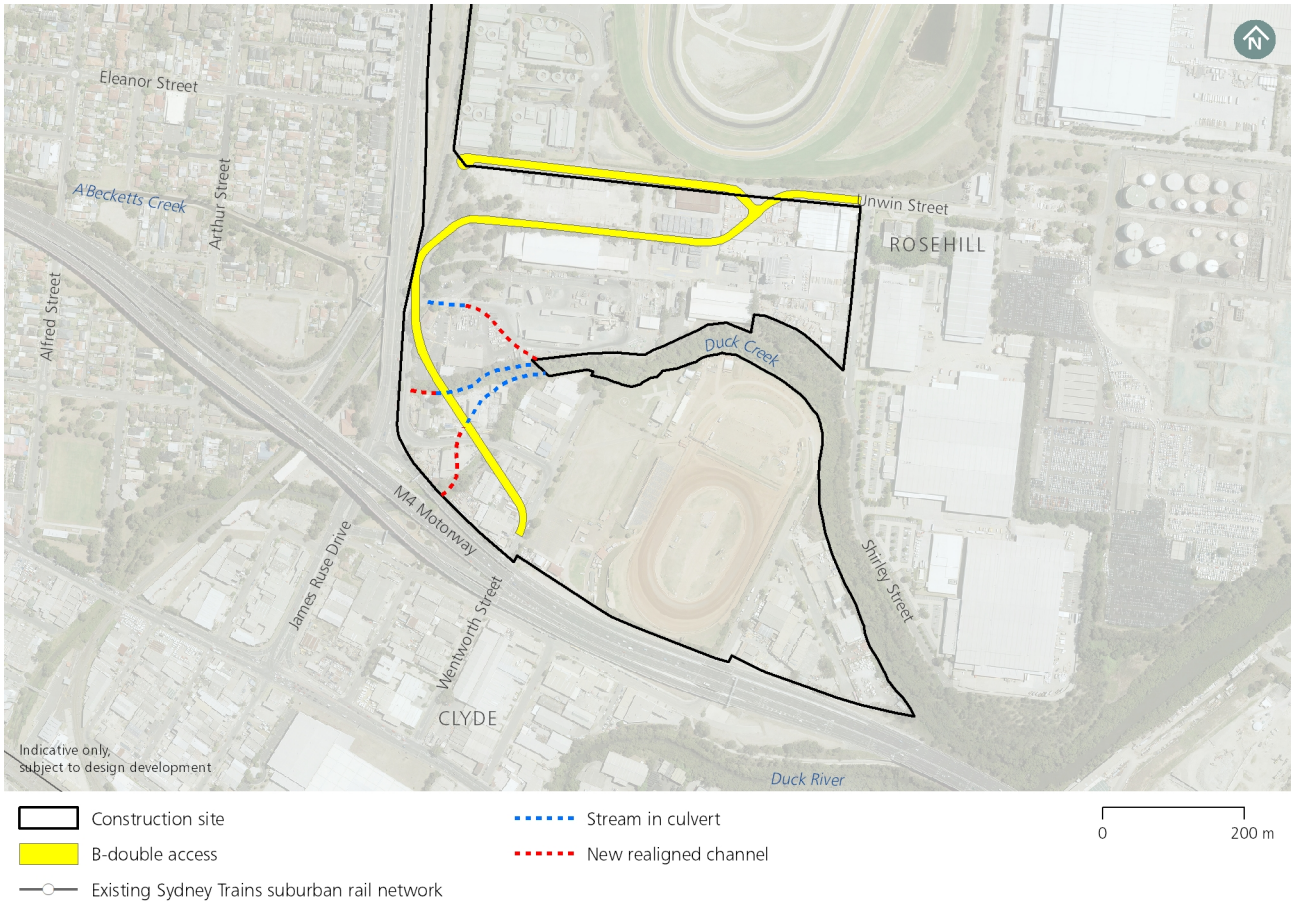

Figure 4-14: Permanent changes to road network (in blue) around Clyde stabling and maintenance facility construction site

4.9.2 Construction activities

Major construction activities anticipated at the Clyde stabling and maintenance facility construction site include:

- Demolition and site establishment
- Piling
- Excavation, including the dive structure at Rosehill
- Concrete segment production facility
- Surface construction, including civil construction works for the stabling and maintenance facility and spoil receival.

4.9.3 Construction vehicle movements

Construction vehicles would access and egress the Clyde stabling and maintenance facility construction site 24 hours a day at the precast facility, during piling and excavation, and during surface construction, with construction vehicles generated for all other activities to access and egress the construction site during standard hours. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods.

The anticipated number of construction vehicle movements to and from the site per hour during the various phases of construction are shown in Figure 4-15 and Figure 4-16. Heavy vehicles have been assumed to travel to

and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-10.

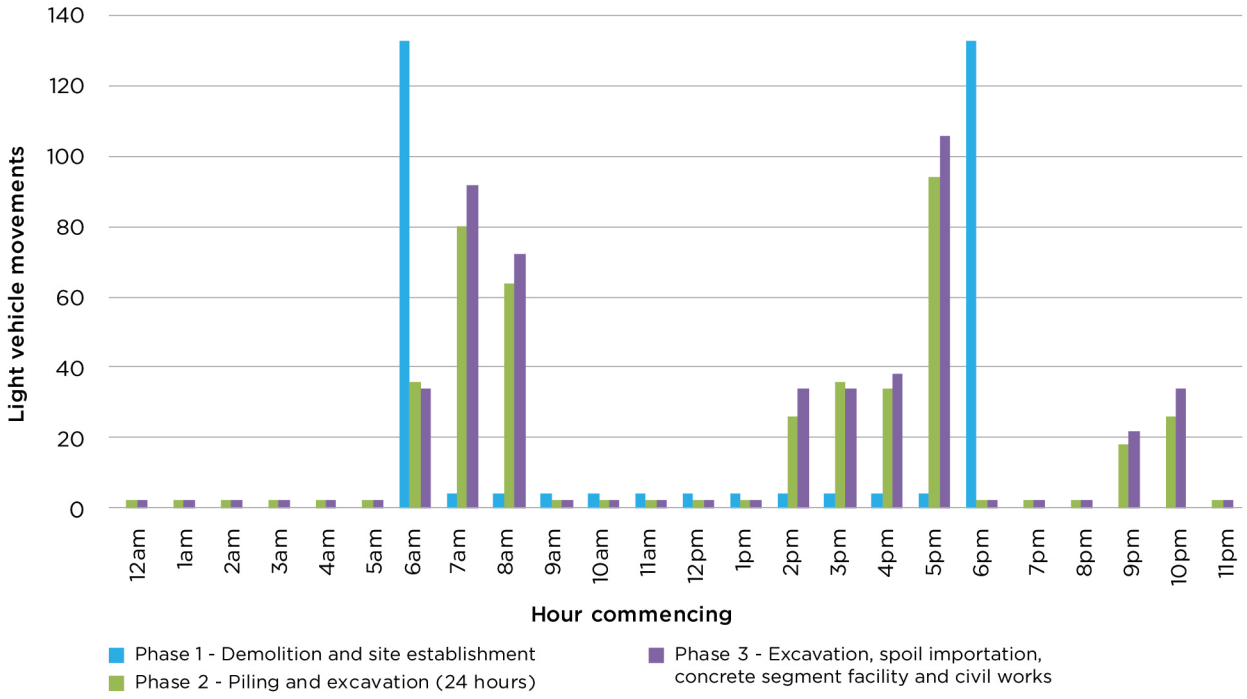

Figure 4-15: Hourly light vehicle movements (arrival and departure) at the Clyde stabling and maintenance facility construction site

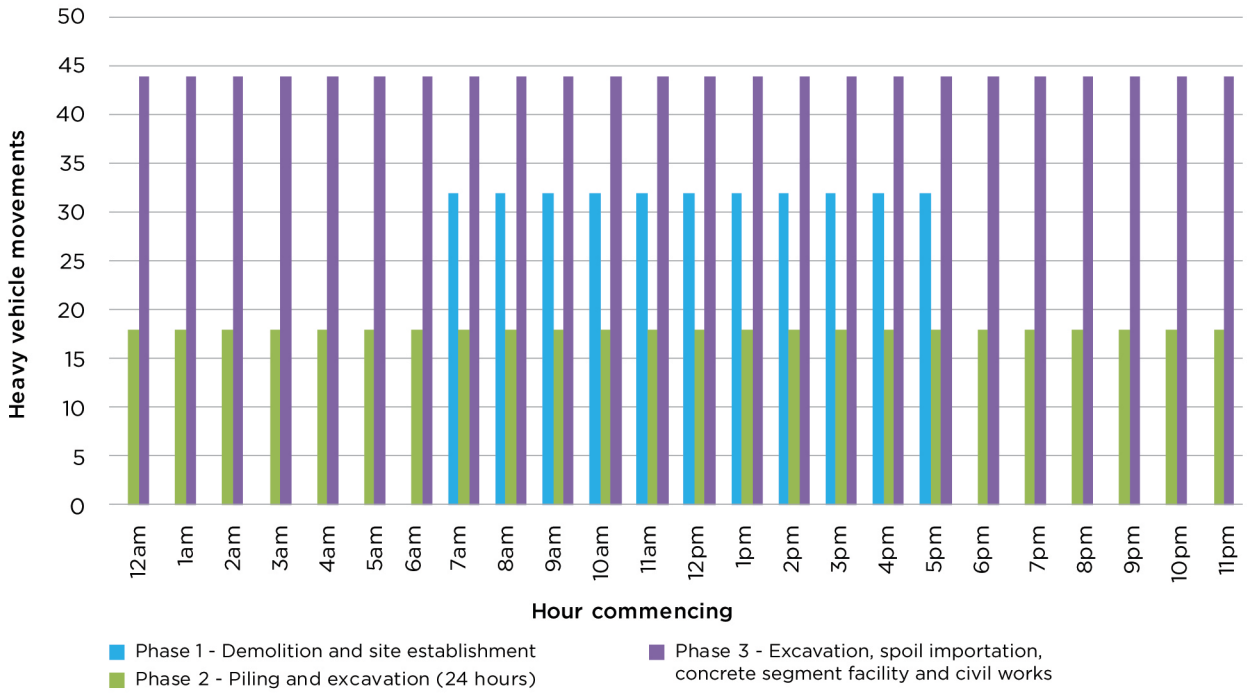

Figure 4-16: Hourly heavy vehicle movements (arrival and departure) at the Clyde stabling and maintenance facility construction site

Table 4-10: Daily construction movements per day by phase – Clyde stabling and maintenance facility construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment	310	352	662
Phase 2 – Piling and excavation (24 hours)	444	432	876
Phase 3 – Excavation, spoil importation, concrete segment facility and civil works	496	1,056	1,552

4.9.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-11 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (7 am to 8 am), it is anticipated that the construction site would generate 92 light vehicle movements (92 light vehicles travelling to the construction site) and 44 heavy vehicle movements (22 heavy vehicles travelling to and from the construction site). During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the construction site would generate 106 light vehicle movements (106 light vehicles travelling from the construction site) and 44

heavy vehicle movements (22 heavy vehicles travelling to and from the construction site). As discussed in Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that all intersections forming part of the construction vehicle route would perform at the same Level of Service compared to the scenario without construction traffic.

Analysis of modelled intersection performance results shows that at some locations, the addition of construction traffic would result in a small reduction in demand flow due to the following factors:

- Additional 'latent' or 'unreleased' demand, which is traffic that is not able to be assigned in the model during the morning and/or evening peak period. These trips are assumed to still exist, however, these trips would be delayed and not completed until after the peak period, effectively increasing the duration of the peak period
- Fewer vehicles passing through an intersection due to the addition of construction-related heavy vehicles, which have a slower acceleration profile compared to light vehicles. This would likely result in an increase to average delay.

In reality, from an operational perspective, the performance of an intersection where the modelling results show a small reduction in demand flow and / or average delay would remain very similar with and without construction traffic.

Table 4-11: Modelled intersection performance (2023) – Clyde stabling and maintenance facility construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Parramatta Road / James Ruse Drive										
Morning	5,741	76	F	NB	-	5,672	78	F	NB	-
				EB	175				EB	170
				SB	240				SB	240
				WB	255				WB	255
Evening	4,638	84	F	NB	-	4,459	94	F	NB	-
				EB	175				EB	175
				SB	170				SB	200
				WB	260				WB	260

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Parramatta Road / Marsh Street										
Morning	3,707	52	D	NB	25	3,647	53	D	NB	25
				EB	255				EB	255
				SB	-				SB	-
				WB	175				WB	170
Evening	3,272	>100	F	NB	315	3,214	87	F	NB	315
				EB	255				EB	255
				SB	-				SB	-
				WB	175				WB	175
Parramatta Road / Wentworth Street										
Morning	4,960	45	D	NB	-	4,893	47	D	NB	-
				EB	210				EB	225
				SB	140				SB	190
				WB	360				WB	360
Evening	3,588	81	F	NB	-	3,415	>100	F	NB	-
				EB	205				EB	205
				SB	80				SB	220
				WB	360				WB	350

4.9.5 Impacts on parking and property access

On-street parking spaces along Kay Street would be permanently removed. These parking spaces serve the businesses fronting both sides of the road. During construction, these business premises would be demolished and therefore the impact of the lost parking spaces would be minimal.

Up to 10 parking spaces may be removed on Unwin Street and Wentworth Street where the realigned Unwin Street ties in with the existing road network. The impact of these lost parking spaces would be minimal due to the low net decrease in parking spaces, the demolition of buildings which would likely generate parking demand for these spaces, and the availability of alternative parking nearby. Opportunities to mitigate impacts to on-street car parking would be explored in consultation with Parramatta City Council during construction planning (refer to Section 5).

There would be no impacts to private property access.

4.9.6 Impacts on the public transport network

Bus services operate on Parramatta Road, which also forms part of the Clyde stabling and maintenance facility construction vehicle route. Minimal impacts to buses are expected and would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network. No impacts are anticipated on the operation of bus stops.

The construction of Parramatta Light Rail (Stage 1) has resulted in the cessation of T6 Carlingford Line services and closure of the existing Rosehill and Camellia Stations as the line is being converted to allow for light rail operation. Replacement bus services will be in place until the light rail is operational. No impacts to the rail network, replacement bus services or light rail network are anticipated during construction.

4.9.7 Impacts on the active transport network

Footpaths located on Unwin Street and Kay Street would be removed to accommodate the construction site. These footpaths serve properties that would be demolished during construction and therefore the impact to the pedestrian network is expected to be minimal. Pedestrian access through this area and on the realigned road would be managed to ensure safe pedestrian environments.

No impacts to cyclists are anticipated during construction.

4.9.8 Construction impacts summary

Figure 4-17 provides a summary of construction impacts on road network performance. Figure 4-18 provides a summary of construction impacts on parking, access, public transport and active transport.

Figure 4-17: Road network performance summary – Clyde stabling and maintenance facility construction site

Figure 4-18: Parking, access, public transport and active transport construction impact summary – Clyde stabling and maintenance facility construction site

4.10 Silverwater services facility construction site

4.10.1 Worksite location and access

The Silverwater services facility construction site is on the south-eastern corner of Silverwater Road and Derby Street. Roads forming part of the construction vehicle route include the M4 Western Motorway, Silverwater Road, Carnarvon Street, Wetherill Street North and Derby Street as shown in Figure 4-19. Site access would be left-in, left-out, to and from Derby Street.

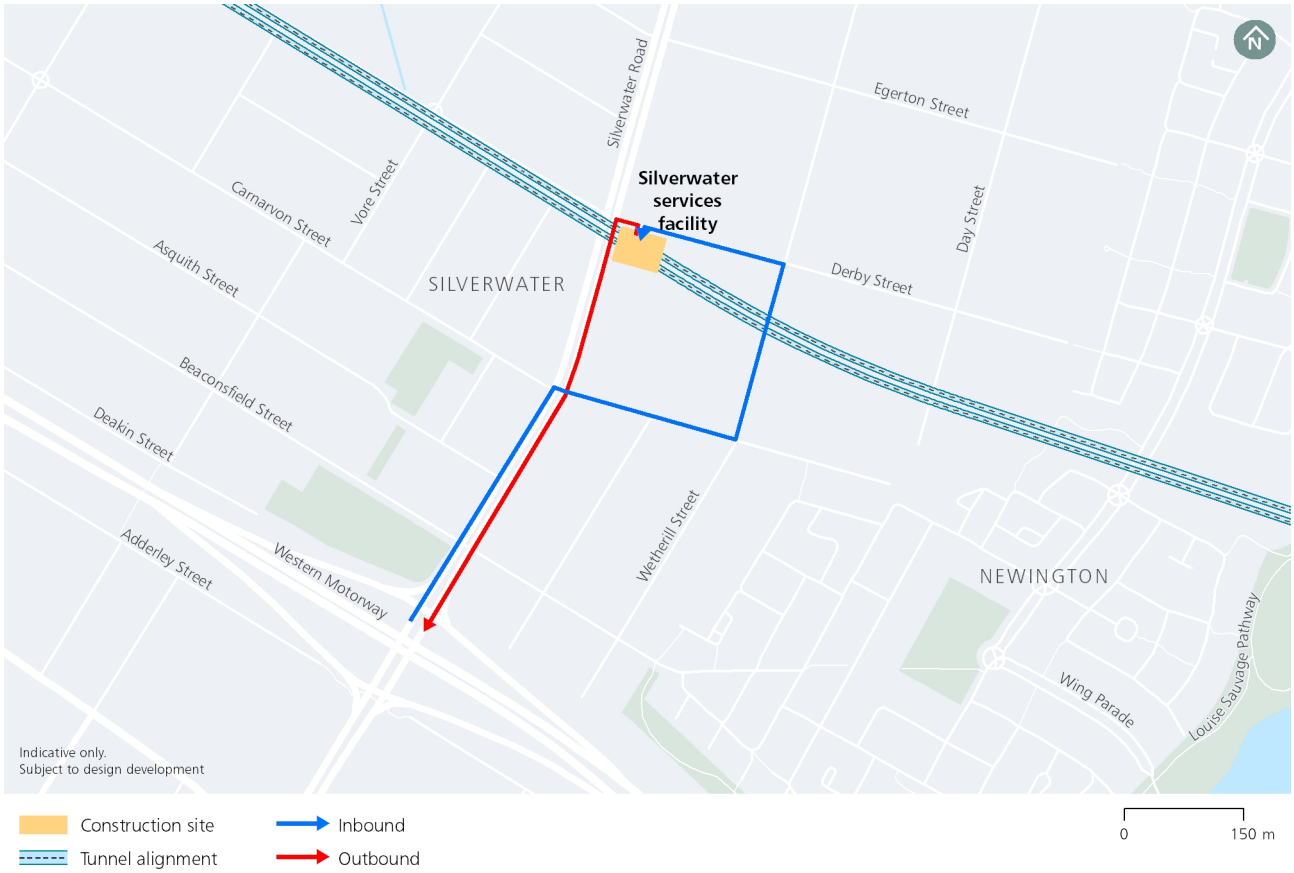

Figure 4-19: Silverwater services facility construction site indicative construction vehicle routes

4.10.2 Construction activities

Major construction activities anticipated at the Silverwater services facility construction site include:

- Demolition and site establishment
- Piling
- Excavation.

4.10.3 Construction vehicle movements

Construction vehicles would access and egress the Silverwater services facility construction site during standard hours, and extended hours on Saturdays only. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods.

The anticipated number of construction vehicle movements to and from the site per hour during the various phases of construction is shown in Figure 4-20 and Figure 4-21. Heavy vehicles have been assumed to travel to and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-12.

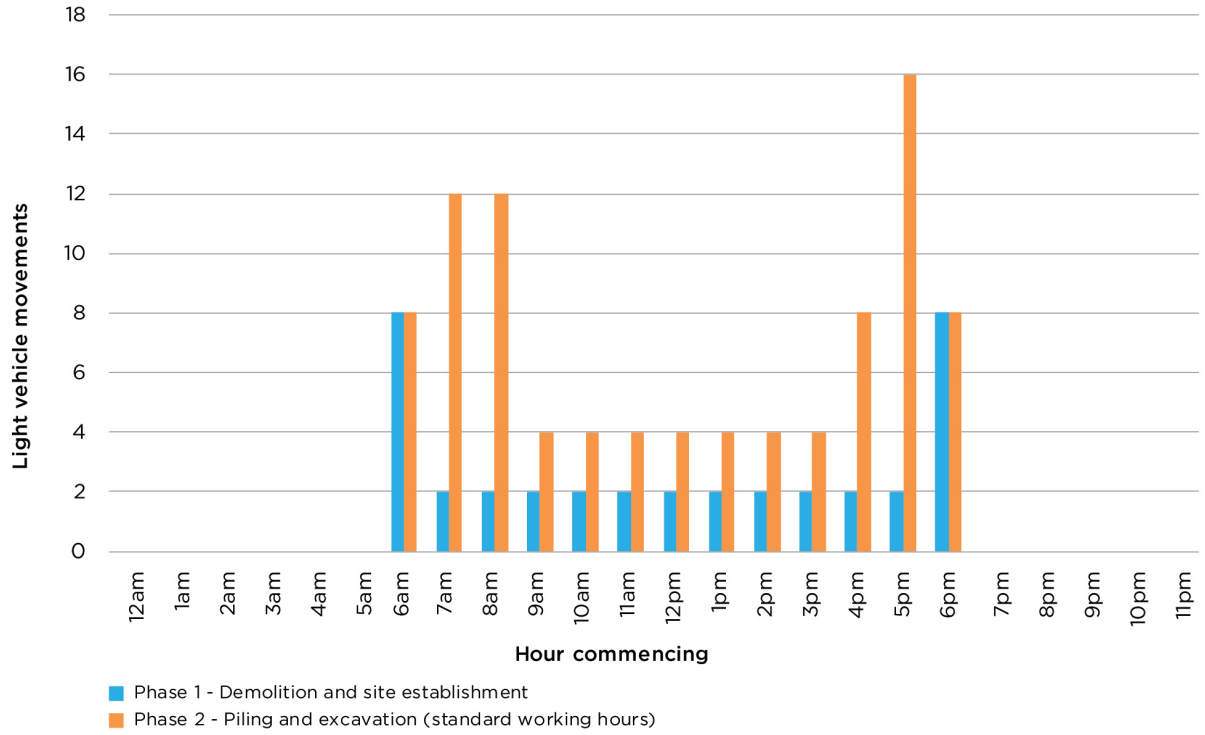

Figure 4-20: Hourly light vehicle movements (arrival and departure) at the Silverwater services facility construction site

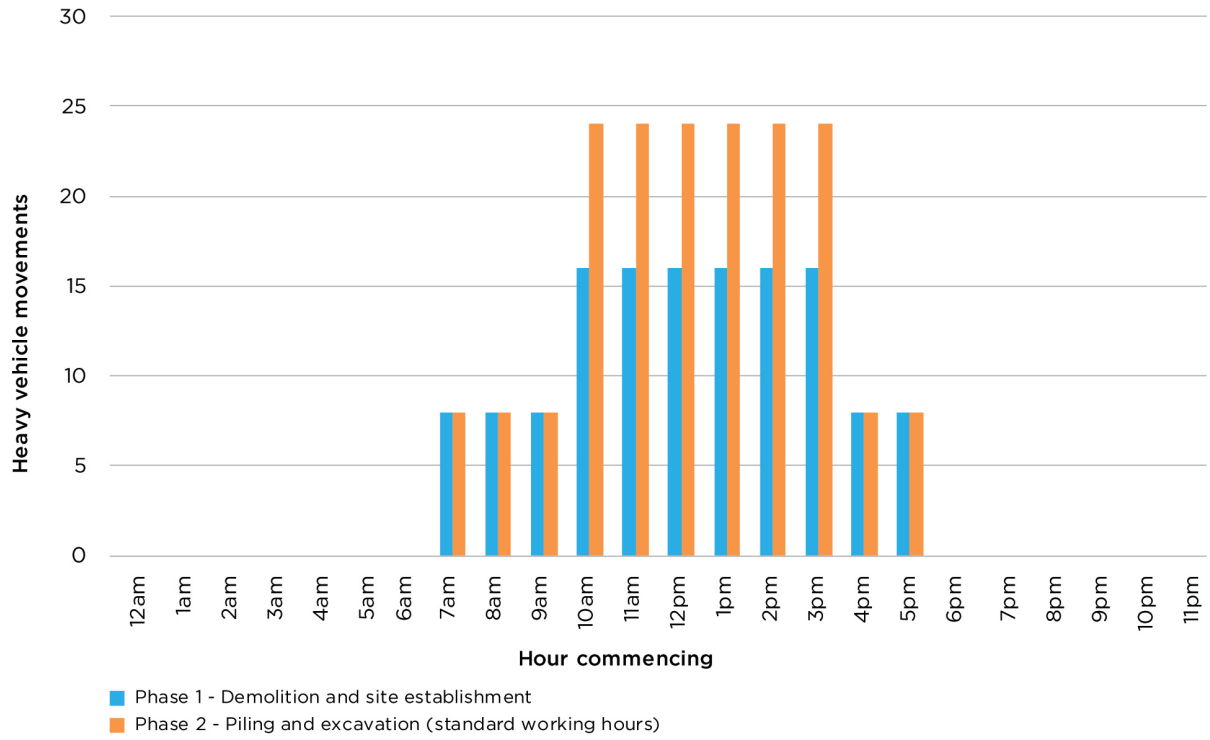

Figure 4-21: Hourly heavy vehicle movements (arrival and departure) at the Silverwater services facility construction site

Table 4-12: Daily construction movements per day by phase – Silverwater services facility construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment	38	136	174
Phase 2 – Piling and excavation	92	184	276

4.10.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-13 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (7 am to 8 am), it is anticipated that the construction site would generate 12 light vehicle movements (12 light vehicles travelling to the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the construction site would generate 16 light vehicle movements (16 light vehicles travelling from the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). As discussed in Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Silverwater Road / Carnarvon Street during the morning peak hour – from Level of Service B to C. This intersection would still operate with spare capacity with the addition of construction traffic.
- Silverwater Road / Derby Street during the evening peak hour – from Level of Service D to F. This is due to an increase in traffic volumes at the intersection, with outbound construction vehicles turning left from the westbound approach. Southbound queues on Silverwater Road from the Carnarvon Street intersection during the evening peak hour extend past Derby Street, resulting in an increase to average delays experienced by vehicles turning left from Derby Street into Silverwater Road.

All other intersections forming part of the construction vehicle route would perform at the same Level of Service compared to the scenario without construction traffic. The deterioration of one intersection during the evening peak hour is not considered major, given that Silverwater Road / Derby Street is an unsignalised intersection and therefore the worst performing movement is reported as the overall performance of the intersection. In addition, it is likely that queued vehicles on Silverwater Road in the southbound direction immediately upstream of Derby Street would give way to some vehicles turning out of Derby Street.

Table 4-13: Modelled intersection performance (2023) – Silverwater services facility construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Silverwater Road / Carnarvon Street										
Morning	4,250	29	B	NB	140	4,263	33	C	NB	165
				EB	65				EB	65
				SB	155				SB	155
				WB	50				WB	50
Evening	3,933	51	D	NB	135	3,963	57	D	NB	130
				EB	135				EB	220
				SB	340				SB	295
				WB	65				WB	65
Silverwater Road / Derby Street										
Morning	3,757	21	B	NB	60	3,758	22	B	NB	65
				EB	50				EB	60
				SB	10				SB	10
				WB	10				WB	15
Evening	3,425	52	D	NB	25	3,428	95	F	NB	10
				EB	45				EB	60
				SB	85				SB	65
				WB	70				WB	70
Carnarvon Street / Wetherill Street North										
Morning	525	<5	A	NB	<5	534	<5	A	NB	<5
				EB	35				EB	30
				SB	25				SB	25
				WB	<5				WB	<5
Evening	471	<5	A	NB	<5	474	<5	A	NB	<5
				EB	25				EB	25
				SB	30				SB	30
				WB	<5				WB	<5

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Derby Street / Wetherill Street North										
Morning	437	8	A	NB	35	446	8	A	NB	35
				EB	15				EB	15
				SB	15				SB	15
				WB	15				WB	15
Evening	356	9	A	NB	45	359	10	A	NB	45
				EB	10				EB	10
				SB	25				SB	25
				WB	25				WB	25

4.10.5 Impacts on parking and property access

Up to six on-street parking spaces may be temporarily removed near the site access on Derby Street to accommodate construction vehicle movements. Impacts are anticipated to be minor given the low number of potential lost parking spaces and the availability of alternative on-street parking on roads nearby. Opportunities to mitigate impacts to on-street car parking would be explored in consultation with Parramatta City Council during construction planning (refer to Section 5).

There would be no impacts to private property access.

4.10.6 Impacts on the public transport network

Carnarvon Street and Wetherill Street North are used by route 544 buses and forms part of the construction vehicle route for the Silverwater services facility construction site. Route 544 operates every 30 minutes during the weekday morning and evening peak periods. The impact to this service due to additional construction vehicles on the road network would be negligible due to the limited frequency of the service. No impacts are anticipated on the operation of bus stops.

4.10.7 Impacts on the active transport network

No impacts to pedestrians and cyclists are anticipated during construction.

4.10.8 Construction impacts summary

Figure 4-22 provides a summary of construction impacts on road network performance. Figure 4-23 provides a summary of construction impacts on parking, access, public transport and active transport.

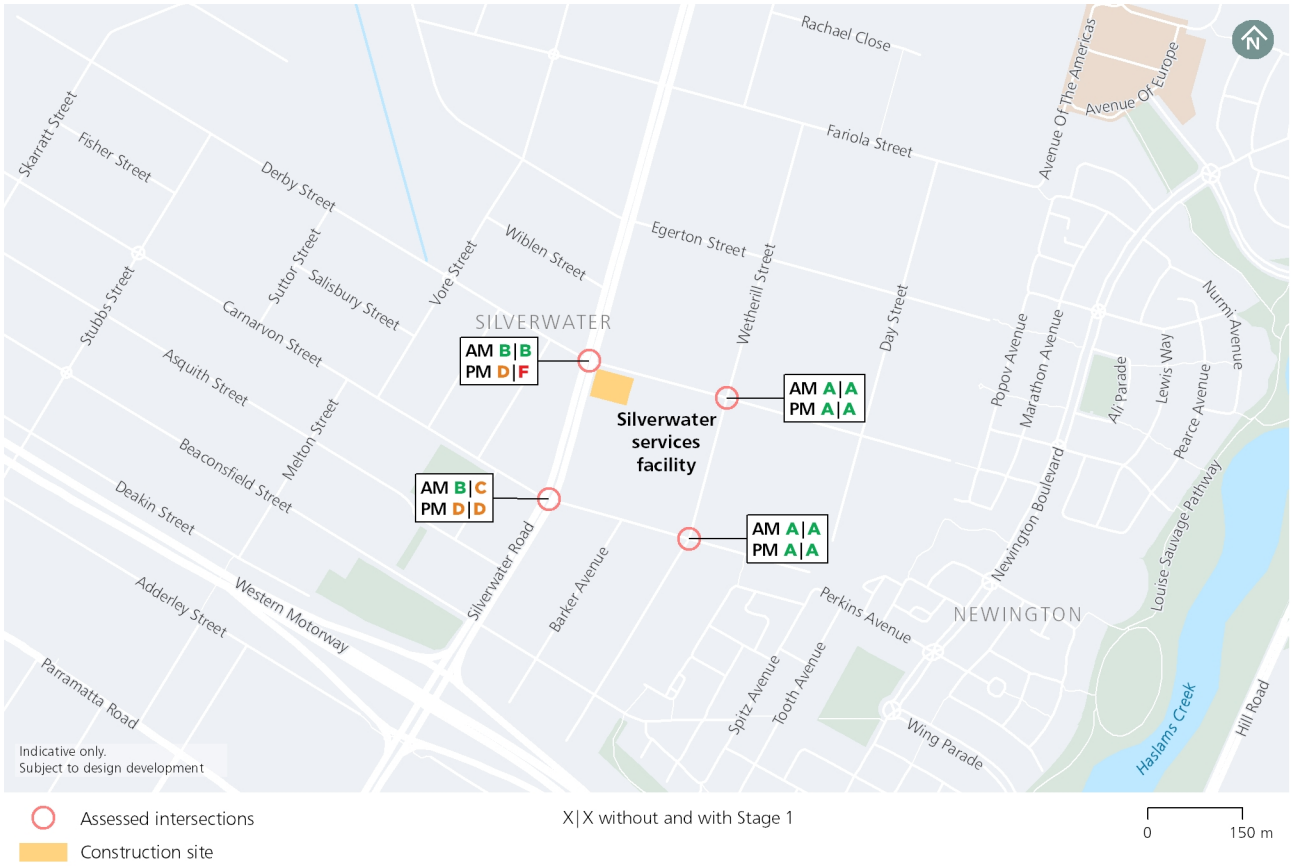

Figure 4-22: Road network performance summary – Silverwater services facility construction site

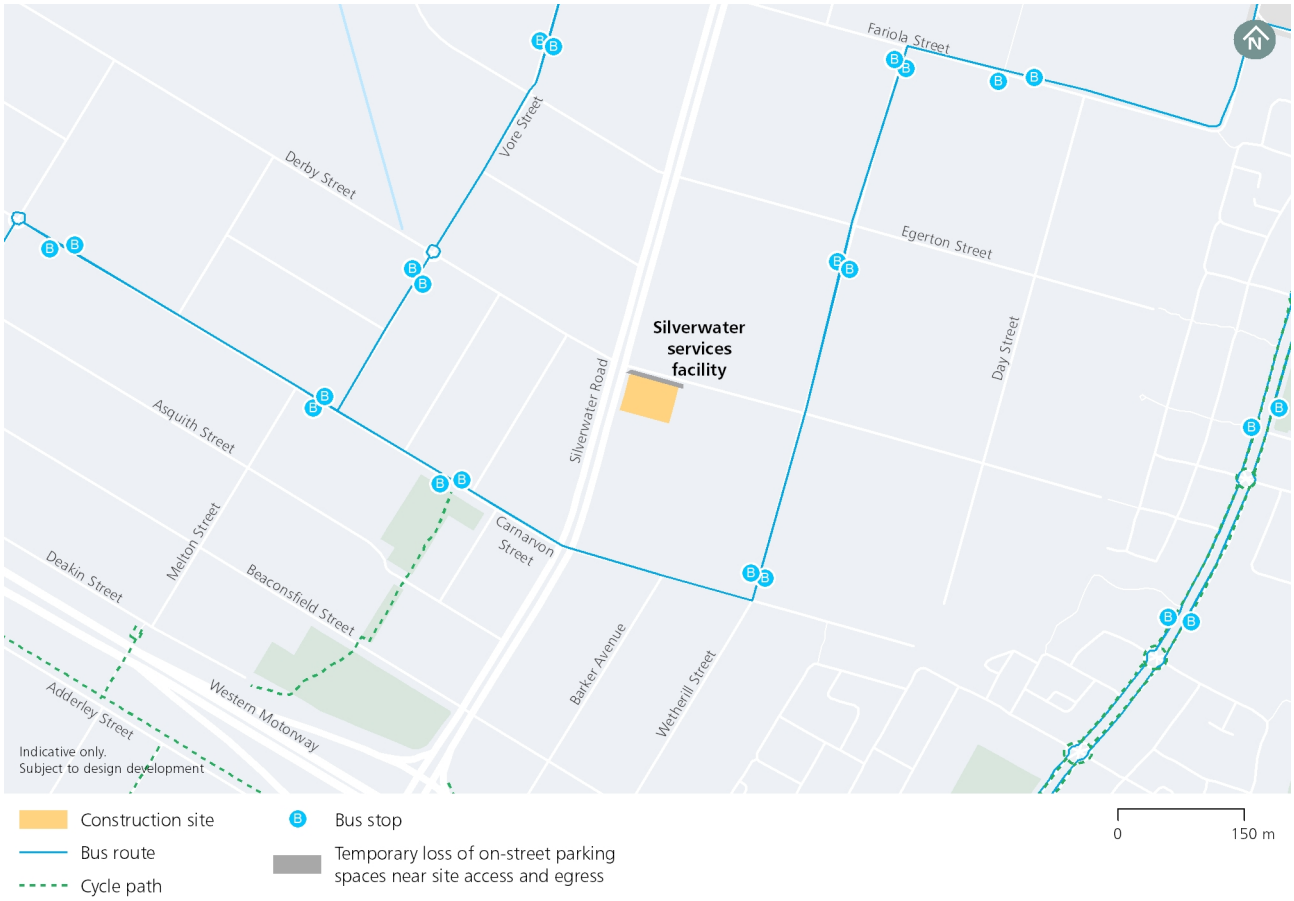

Figure 4-23: Parking, access, public transport and active transport construction impact summary – Silverwater services facility construction site

4.11 Sydney Olympic Park metro station construction site

4.11.1 Worksite location and access

The Sydney Olympic Park metro station construction site generally runs between Herb Elliott Avenue and Figtree Drive, with a portion that extends north to Dawn Fraser Avenue. Roads forming part of the construction vehicle route include the M4 Western Motorway, Homebush Bay Drive, Australia Avenue and Herb Elliott Avenue as shown in Figure 4-24. Egressing vehicles may also travel on Olympic Boulevard, Sarah Durack Avenue, Edwin Flack Avenue, Birnie Avenue and Parramatta Road. Site access would be left-in, left or right-out, to and from Herb Elliott Avenue.

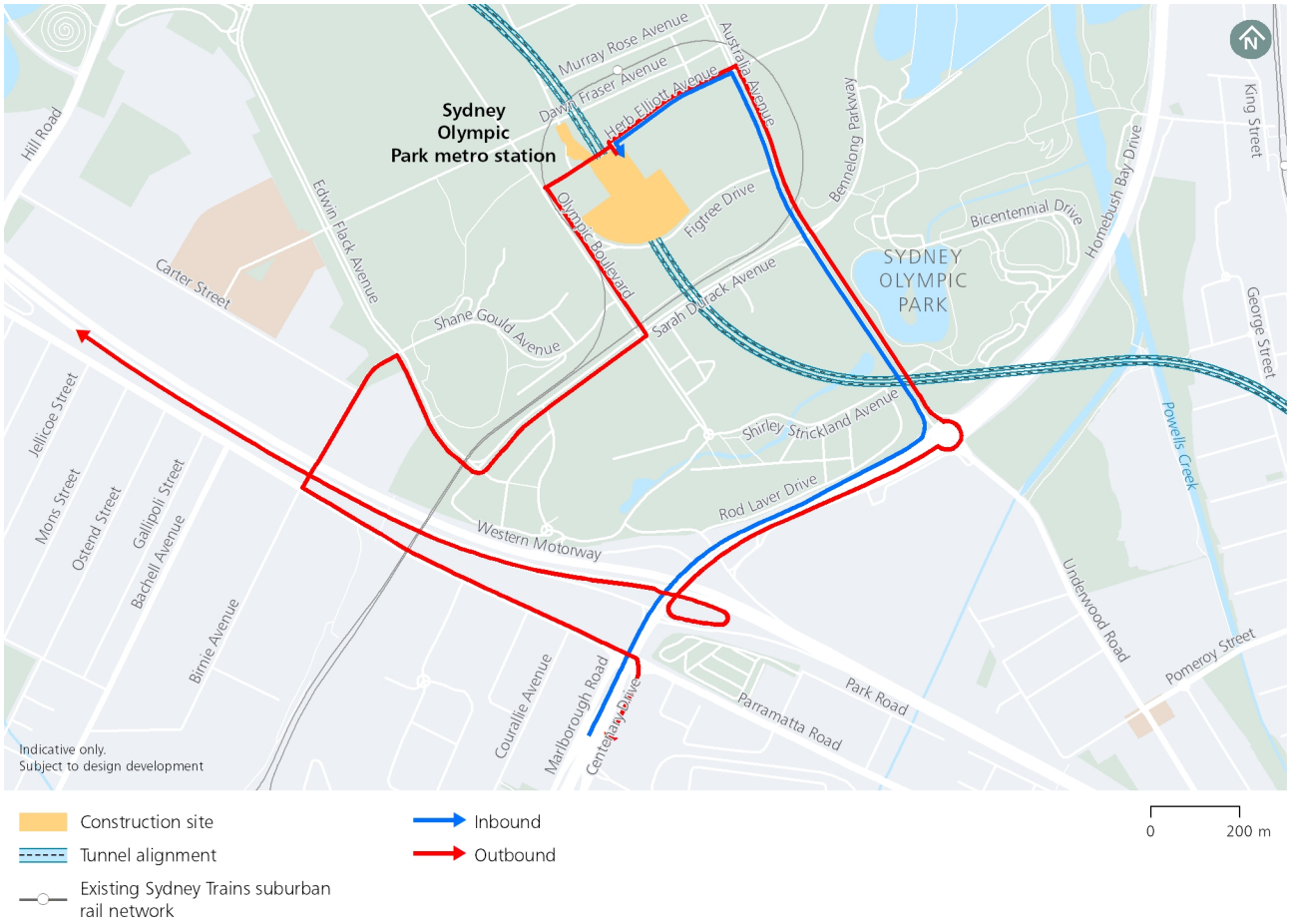

Figure 4-24: Sydney Olympic Park metro station construction site indicative construction vehicle routes

4.11.2 Construction activities

Major construction activities anticipated at the Sydney Olympic Park metro station construction site include:

- Demolition and site establishment
- Piling
- Excavation
- Tunnel boring machine retrieval.

4.11.3 Construction vehicle movements

Construction vehicles would access and egress the Sydney Olympic Park metro station construction site 24 hours a day during excavation (once acoustic sheds have been erected) and tunnel boring machine retrieval, with construction vehicles generated for all other activities to access and egress the construction site during standard hours. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods, as well as keeping night time heavy vehicle movements to a low level. Movements to and from the construction site may be restricted during special events that involve the closure of the western end of Herb Elliot Avenue.

The anticipated number of construction vehicle movements to and from the site per hour during the various phases of construction is shown in Figure 4-25 and Figure 4-26. Heavy vehicles have been assumed to travel to

and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-14.

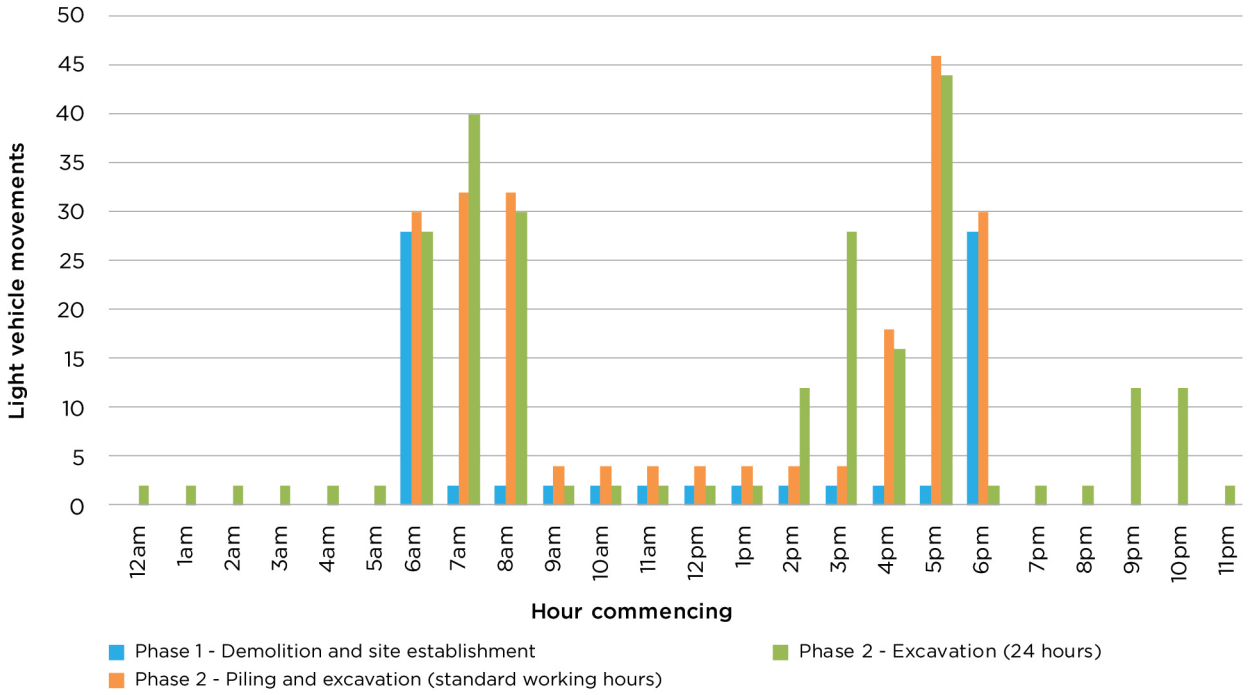

Figure 4-25: Hourly light vehicle movements (arrival and departure) at the Sydney Olympic Park metro station construction site

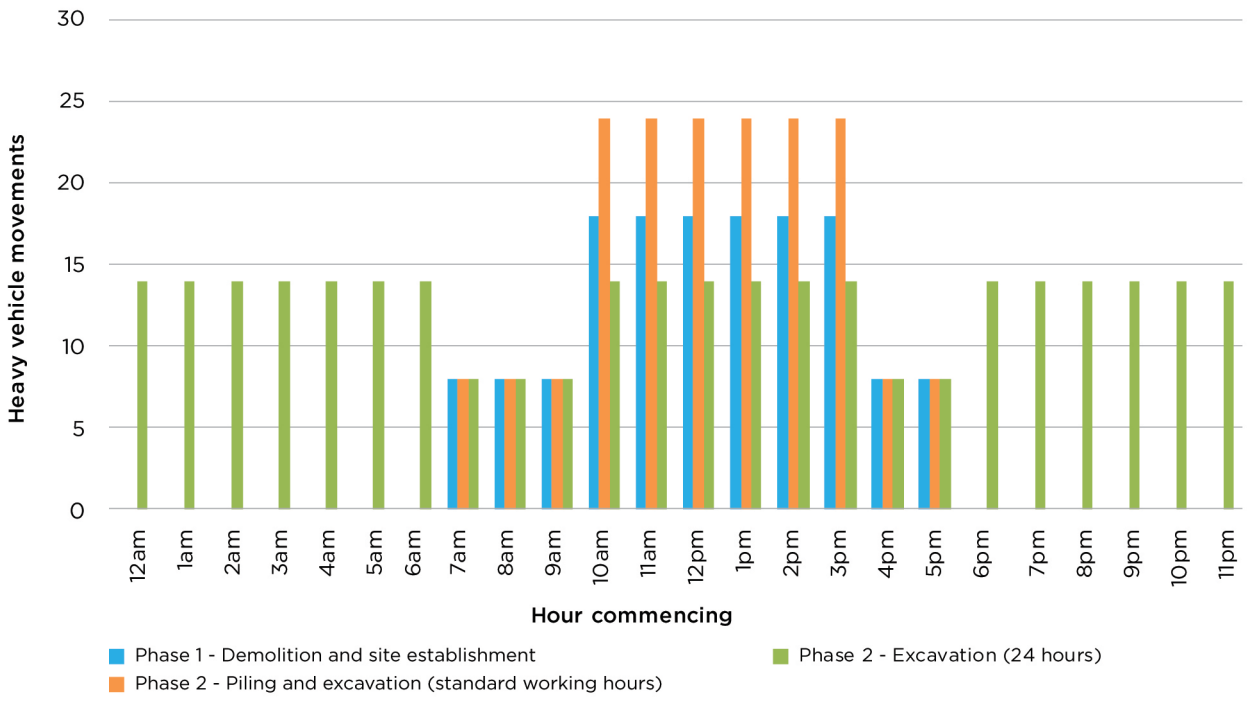

Figure 4-26: Hourly heavy vehicle movements (arrival and departure) at the Sydney Olympic Park metro station construction site

Table 4-14: Daily construction movements per day by phase – Sydney Olympic Park metro station construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment	78	148	226
Phase 2 – Piling and excavation (standard working hours)	216	184	400
Phase 2 – Excavation (24 hours)	252	306	558

4.11.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-15 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (7 am to 8 am), it is anticipated that the construction site would generate 40 light vehicle movements (40 light vehicles travelling to the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the construction site would generate 46 light vehicle movements (46 light vehicles travelling from the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). As discussed in

Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Herb Elliott Avenue / Parkview Drive / Australia Avenue during the evening peak hour – from Level of Service D to F. This is due to an increase in traffic volumes at the intersection, with inbound construction vehicles turning left from the northbound approach and outbound construction vehicles turning right from the eastbound approach
- Sarah Durack Avenue / Edwin Flack Avenue during the evening peak hour – from Level of Service A to B. This intersection would still operate with spare capacity with the addition of construction traffic.

All other intersections forming part of the construction vehicle route would perform at the same Level of Service compared to the scenario without construction traffic. The deterioration of one intersection during the evening peak hour can be managed, given that Herb Elliott Avenue / Parkview Drive / Australia Avenue intersection does not interface with the arterial road network. Only localised impacts are anticipated and would not require mitigation measures to be implemented.

Table 4-15: Modelled intersection performance (2023) – Sydney Olympic Park metro station construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Australia Avenue / Sarah Durack Avenue / Bennelong Parkway										
Morning	3,291	22	B	NB	100	3,375	22	B	NB	105
				EB	80				EB	80
				SB	85				SB	95
				WB	130				WB	130
Evening	3,852	79	F	NB	280	3,872	92	F	NB	210
				EB	225				EB	220
				SB	185				SB	175
				WB	105				WB	115

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Australia Avenue / Underwood Road / Homebush Bay Drive										
Morning	3,764	50	D	NB	95	3,861	44	D	NB	80
				EB	25				EB	30
				SB	25				SB	35
				WB	120				WB	210
Evening	4,505	>100	F	NB	85	4,547	>100	F	NB	155
				EB	45				EB	60
				SB	130				SB	140
				WB	>500				WB	>500
Birnie Avenue / Parramatta Road										
Morning	4,974	>100	F	NB	295	4,967	>100	F	NB	295
				EB	>500				EB	>500
				SB	280				SB	280
				WB	375				WB	375
Evening	5,091	>100	F	NB	290	5,131	>100	F	NB	290
				EB	>500				EB	>500
				SB	280				SB	290
				WB	410				WB	365
Edwin Flack Avenue / Shane Gould Avenue / Birnie Avenue										
Morning	1,415	>100	F	NB	165	1,420	>100	F	NB	170
				EB	85				EB	85
				SB	295				SB	280
				WB	30				WB	25
Evening	2,065	>100	F	NB	225	2,079	>100	F	NB	240
				EB	140				EB	135
				SB	295				SB	280
				WB	130				WB	45

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Herb Elliott Avenue / Parkview Drive / Australia Avenue										
Morning	1,047	33	C	NB	95	1,123	32	C	NB	95
				EB	60				EB	60
				SB	85				SB	70
				WB	30				WB	30
Evening	1,213	56	D	NB	100	1,231	82	F	NB	140
				EB	165				EB	170
				SB	120				SB	130
				WB	70				WB	95
Olympic Boulevard / Herb Elliott Avenue										
Morning	444	<5	A	NB	30	450	<5	A	NB	30
				EB	-				EB	-
				SB	<5				SB	<5
				WB	15				WB	10
Evening	885	<5	A	NB	30	950	5	A	NB	25
				EB	-				EB	-
				SB	<5				SB	<5
				WB	45				WB	65

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Olympic Boulevard / Sarah Durack Avenue										
Morning	1,098	12	A	NB	15	1,108	12	A	NB	15
				EB	30				EB	35
				SB	30				SB	30
				WB	50				WB	60
Evening	2,111	23	B	NB	45	2,163	24	B	NB	35
				EB	65				EB	70
				SB	85				SB	105
				WB	100				WB	115
Sarah Durack Avenue / Edwin Flack Avenue										
Morning	888	40	C	NB	60	898	38	C	NB	60
				EB	60				EB	45
				SB	85				SB	85
				WB	<5				WB	<5
Evening	1,446	10	A	NB	35	1,503	19	B	NB	35
				EB	<5				EB	10
				SB	65				SB	80
				WB	<5				WB	<5
Olympic Boulevard / Figtree Drive										
Morning	320	<5	A	NB	<5	326	<5	A	NB	<5
				EB	-				EB	-
				SB	<5				SB	<5
				WB	15				WB	15
Evening	822	<5	A	NB	<5	887	6	A	NB	<5
				EB	-				EB	-
				SB	10				SB	<5
				WB	30				WB	30

4.11.5 Impacts on parking and property access

Cut and cover works across Herb Elliott Avenue would require temporary closures of Herb Elliot Avenue. Options for this work are currently under investigation and may include:

- Full closure for an extended period: In this case, access to adjacent properties would be maintained from either end of Herb Elliott Avenue
- Stage partial closures: In this case, through traffic would be maintained under traffic control, although this would be likely to extend the total duration of works.

Sydney Metro is also investigating the feasibility of design solutions that would avoid the need for cut-and-cover works across Herb Elliott Avenue.

Showground Road at its intersection with Dawn Fraser Avenue would be pedestrianised as part of Stage 1 to accommodate the proposed northern station entry. This would remove access to the Ibis, Pullman and Novotel Hotels' underground car park and driveway access (for authorised vehicles only) to the Abattoir Heritage Precinct from the Dawn Fraser Avenue / Showground Road intersection. Vehicles on Dawn Fraser Avenue would be required to access these properties via Olympic Boulevard and Herb Elliott Avenue instead, resulting in additional travel distance of up to 220 metres. This would be considered a minor impact due to the small increase in travel distance and resultant small increase in travel time. There would be no other impacts to parking or private property access.

The taxi rank on the southern side of Herb Elliott Avenue adjacent to the construction site would be temporarily relocated to an alternative site close to its current location. The potential impact to taxi customers is expected to be minor.

4.11.6 Impacts on the public transport network

Roads forming part of the Sydney Olympic Park metro station construction vehicle route that are also used by buses include Parramatta Road, Homebush Bay Drive, Australia Avenue and Olympic Boulevard. Impacts to buses would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network. During special events, construction vehicle movements would be limited where required to minimise impacts on special event bus services. No impacts are anticipated on the operation of regular passenger and special event bus stops.

The proposed alignment of Parramatta Light Rail (Stage 2) in the Sydney Olympic Park precinct includes Australia Avenue and Dawn Fraser Avenue. The construction vehicle routes would not interface directly with the proposed alignment, and therefore no impacts to the light rail network are anticipated during construction.

No impacts to the rail network are anticipated during construction.

4.11.7 Impacts on the active transport network

Showground Road would be partially pedestrianised. This would improve the pedestrian network by removing potential existing conflicts between pedestrians and vehicles.

Australia Avenue and Edwin Flack Avenue are designated on-road cycle environments of moderate difficulty. Impacts to cyclists on these roads would be minor given that cyclists would be interacting with a low number of additional heavy vehicles generated at the Sydney Olympic Park metro station construction site.

4.11.8 Special events

More than 5,000 events of varying size are held each year at Sydney Olympic Park, with the existing Olympic Park Station being a major transport hub for access to and from these events. Larger events held within the precinct include the following:

- Sydney Royal Easter Show
- Supanova Comic Con and Gaming
- Sydney Festival
- Music concerts
- Football matches (Rugby Union, Rugby League, Australian Football League)
- Soccer matches
- Other sporting events.

During major special events, there are high levels of pedestrian activity throughout the Sydney Olympic Park precinct. Venues in the precinct that cater to large scale events include ANZ Stadium, Qudos Bank Arena and Sydney Showground. Major pedestrian desire lines comprise trips between car parks, venues within the precinct, major event bus stops on Olympic Boulevard and the existing Olympic Park Station. These pedestrian desire lines would fall within the immediate vicinity of the Sydney Olympic Park metro station construction site with the potential for conflict between pedestrians and construction vehicles and impacts on pedestrian movement and accessibility. During major special events these impacts are considered major and would require mitigation measures to reduce the anticipated impacts. Further, movements to and from the construction site may be restricted during special events that involve the closure of the western end of Herb Elliot Avenue. The planning and development of appropriate restrictions to minimise impacts on the transport and traffic network during special events would be determined in consultation with the Transport for NSW including Transport Coordination and other relevant agencies.

Section 5 outlines mitigation measures that would be implemented to minimise impacts during special events, which would be detailed in future Construction Traffic Management Plans.

4.11.9 Construction impacts summary

Figure 4-27 provides a summary of construction impacts on road network performance. Figure 4-28 provides a summary of construction impacts on parking, access, public transport and active transport.

Figure 4-27: Road network performance summary – Sydney Olympic Park metro station construction site

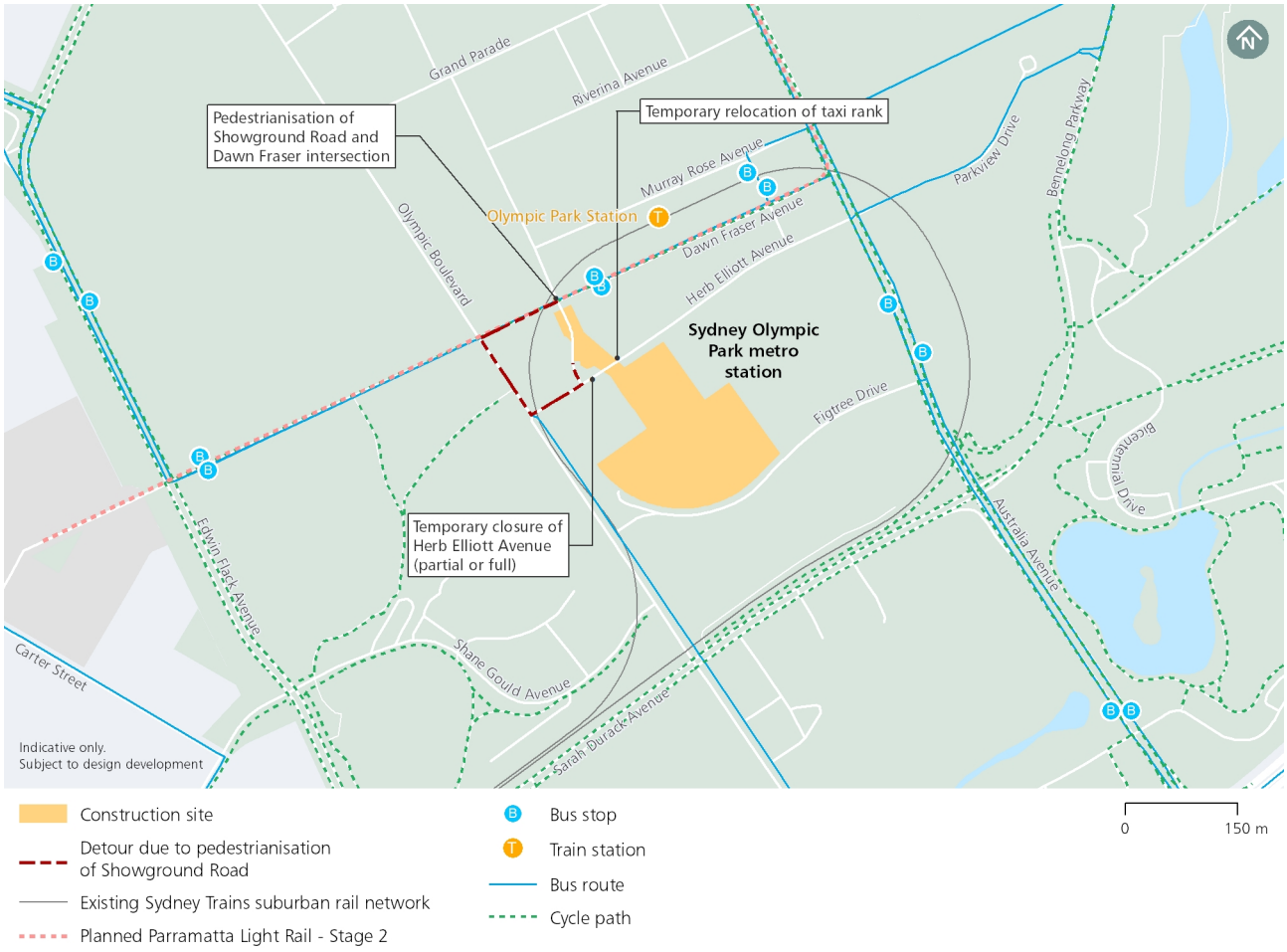

Figure 4-28: Parking, access, public transport and active transport construction impact summary – Sydney Olympic Park metro station construction site

4.12 North Strathfield metro station construction site

4.12.1 Worksite location and access

The North Strathfield metro station construction site is bound by Beronga Street, Queen Street and the T9 Northern Line. Roads forming part of the construction vehicle route include the M4 Western Motorway, Concord Road, Wellbank Street and Queen Street as shown in Figure 4-29. Two site access points are proposed, with left-in, right-out for the northern site access and right-in, left-out for the southern site access, to and from Queen Street.

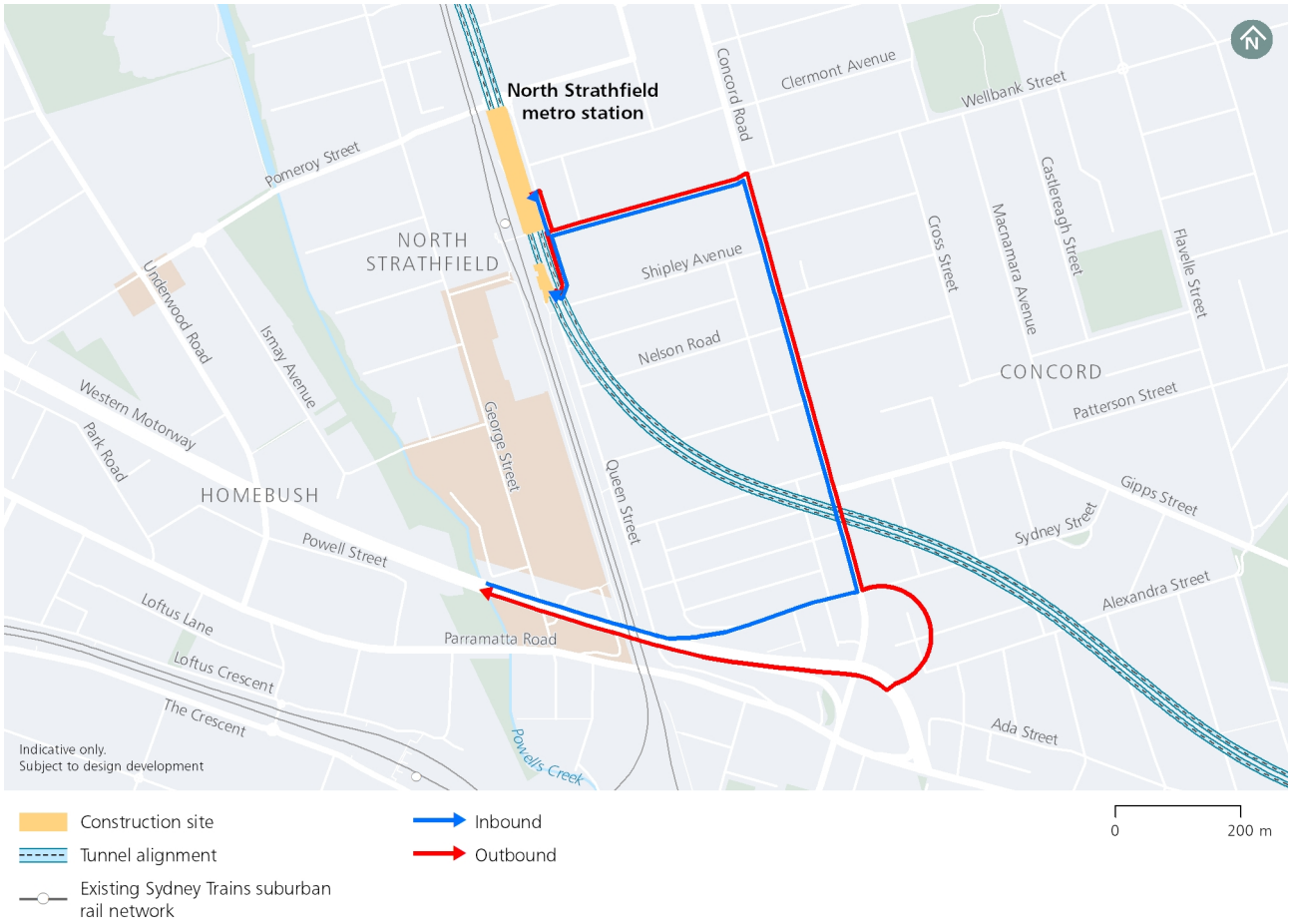

Figure 4-29: North Strathfield metro station construction site indicative construction vehicle routes

Road network changes as a result of the M4 East

Road network changes as part of the M4 East have been incorporated into the construction traffic modelling assessment for North Strathfield. These changes include:

- Reconfiguration of the M4 Western Motorway / Concord Road interchange with provision of the following:
  - M4 Western Motorway eastbound exit ramp to Concord Road northbound and southbound
  - M4 Western Motorway westbound entry ramp from Concord Road southbound
  - M4 East eastbound entry ramp from Concord Road northbound
  - M4 East eastbound entry ramp from Concord Road southbound
  - M4 East westbound exit ramp to Concord Road northbound
  - M4 East westbound exit ramp to Concord Road southbound.

4.12.2 Construction activities

Major construction activities anticipated at the North Strathfield metro station construction site include:

- Demolition and site establishment
- Piling
- Excavation.

4.12.3 Construction vehicle movements

Construction vehicles would access and egress the North Strathfield metro station construction site during standard hours, with the exception of oversize deliveries which may occur outside of these hours. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods, as well as keeping night time heavy vehicle movements to a low level.

The anticipated number of construction vehicles movement to and from the site per hour during the various phases of construction is shown in Figure 4-30 and Figure 4-31. Heavy vehicles have been assumed to travel to and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-16.

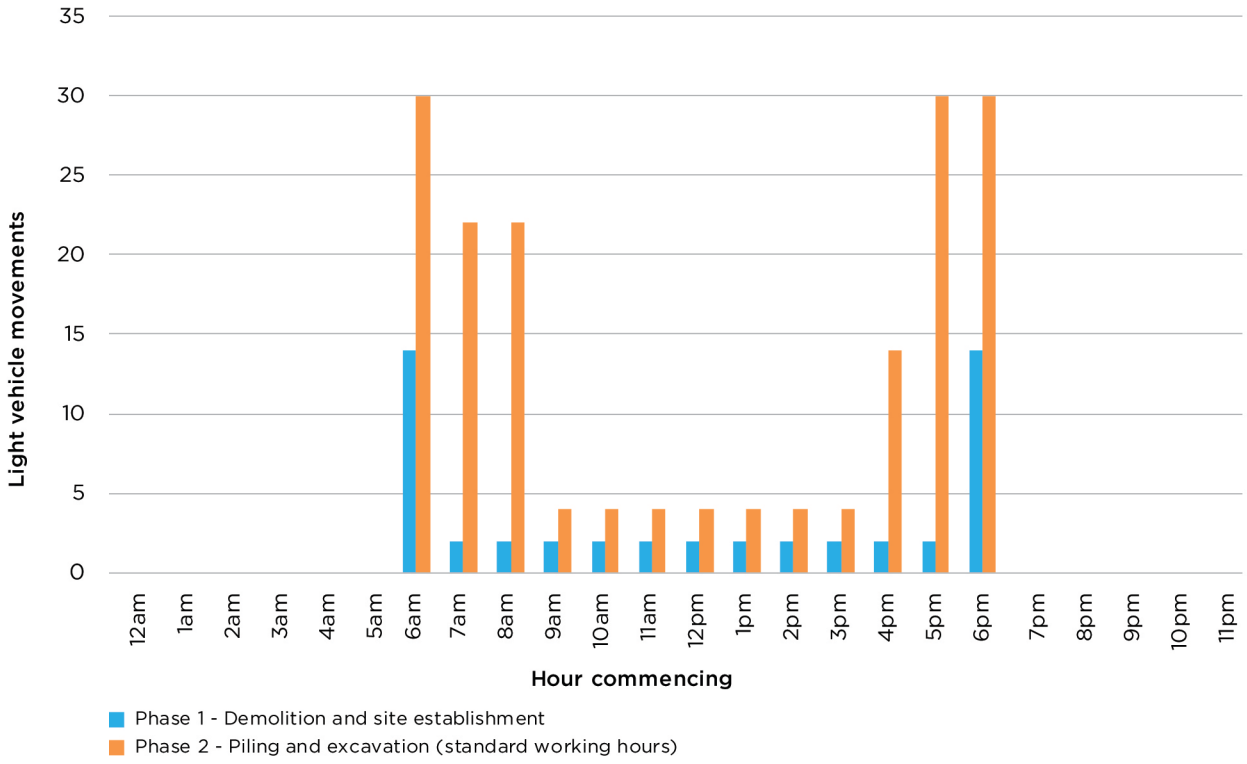

Figure 4-30: Hourly light vehicle movements (arrival and departure) at the North Strathfield metro station construction site

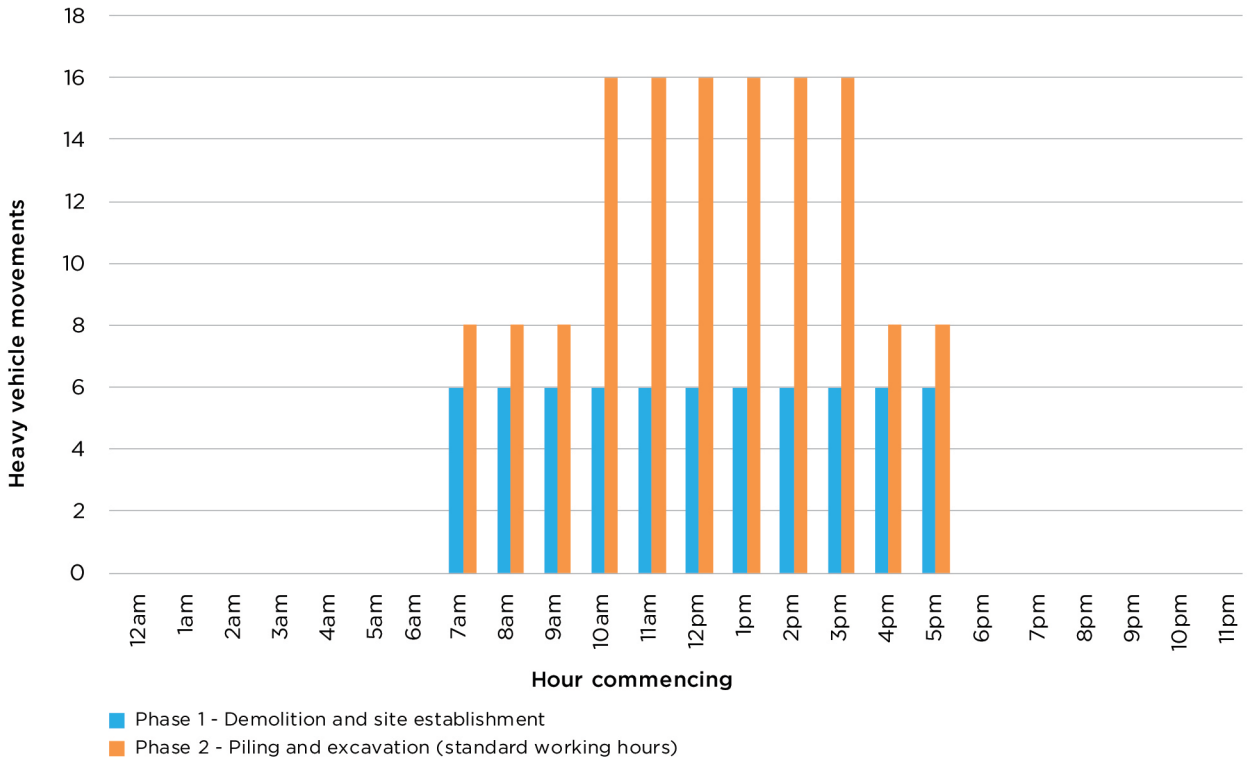

Figure 4-31: Hourly heavy vehicle movements (arrival and departure) at the North Strathfield metro station construction site

Table 4-16: Daily construction movements per day by phase – North Strathfield metro station construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment	50	66	116
Phase 2 – Piling and excavation (standard working hours)	176	136	312

4.12.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-17 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (7 am to 8 am), it is anticipated that the construction site would generate 22 light vehicle movements (22 light vehicles travelling to the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the construction site would generate 30 light vehicle movements (30 light vehicles travelling from the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). As discussed in

Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Concord Road / Patterson Street during the morning peak hour – from Level of Service D to E. Without construction traffic, average delay at the intersection is 53 seconds, which is close to the threshold between Level of Service D and E. With construction traffic, average delay increases by six seconds which would not substantially change the operational performance of the intersection.
- M4 Western Motorway / Concord Road during the evening peak hour – from Level of Service D to E. Average delay at the intersection increases by 20 seconds with the addition of construction traffic. This is the result of additional construction vehicles travelling through the intersection to access and egress from the M4 Western Motorway, with increased queue lengths on the eastbound and southbound approaches.

Analysis of modelled intersection performance results shows that at some locations, the addition of construction traffic would result in a small reduction in demand flow due to the following factors:

- Additional 'latent' or 'unreleased' demand, which is traffic that is not able to be assigned in the model during the morning and/or evening peak period. These trips are assumed to still exist, however, these trips would be delayed and not completed until after the peak period, effectively increasing the duration of the peak period
- Fewer vehicles passing through an intersection due to the addition of construction-related heavy vehicles, which have a slower acceleration profile compared to light vehicles. This would likely result in an increase to average delay.

In reality, from an operational perspective, the performance of an intersection where the modelling results show a small reduction in demand flow and / or average delay would remain very similar with and without construction traffic.

As discussed further in Section 4.12.7, there would be the need to modify the Queen Street / Wellbank Street intersection, which may involve changes to the zebra crossings or signalisation. This may have impacts on traffic and pedestrian access and movements, however would improve pedestrian safety, accessibility and connectivity during construction. The results presented in this assessment are for an unsignalised intersection.

Sydney Metro is continuing to investigate construction site access arrangements to reduce potential impacts and minimise conflicts with heavy vehicle movements. This may include the use of Waratah Street for haulage, localised changes to traffic circulation, and / or changes to traffic control and pedestrian crossing facilities at the Queen Street / Wellbank Street intersection.

Table 4-17: Modelled intersection performance (2023) – North Strathfield metro station construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Concord Road / Parramatta Road / Leicester Avenue										
Morning	4,363	>100	F	NB	445	4,319	>100	F	NB	445
				EB	165				EB	165
				SB	245				SB	255
				WB	255				WB	255
Evening	4,627	92	F	NB	220	4,337	>100	F	NB	205
				EB	165				EB	165
				SB	220				SB	255
				WB	255				WB	255
Concord Road / Patterson Street										
Morning	2,937	53	D	NB	175	2,842	59	E	NB	175
				EB	-				EB	-
				SB	235				SB	245
				WB	330				WB	345
Evening	2,853	19	B	NB	175	2,640	24	B	NB	185
				EB	-				EB	-
				SB	120				SB	245
				WB	85				WB	175
Concord Road / Wellbank Street										
Morning	2,884	26	B	NB	100	2,916	27	B	NB	100
				EB	105				EB	115
				SB	80				SB	80
				WB	135				WB	135
Evening	2,446	29	B	NB	95	2,355	28	B	NB	100
				EB	115				EB	210
				SB	95				SB	105
				WB	65				WB	65

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Queen Street / Parramatta Road										
Morning	2,371	>100	F	NB	-	2,398	>100	F	NB	-
				EB	50				EB	50
				SB	50				SB	45
				WB	<5				WB	<5
Evening	2,538	87	F	NB	-	2,479	60	E	NB	-
				EB	50				EB	50
				SB	30				SB	50
				WB	95				WB	95
Wellbank Street / Queen Street										
Morning	967	89	F	NB	60	1,012	97	F	NB	60
				EB	-				EB	-
				SB	45				SB	70
				WB	170				WB	175
Evening	1,002	>100	F	NB	60	981	>100	F	NB	65
				EB	-				EB	-
				SB	65				SB	70
				WB	165				WB	170
M4 Western Motorway / Concord Road										
Morning	2,837	99	F	NB	240	2,779	107	F	NB	240
				EB	345				EB	360
				SB	150				SB	150
				WB	-				WB	-
Evening	2,805	44	D	NB	165	2,566	64	E	NB	175
				EB	85				EB	135
				SB	115				SB	155
				WB	-				WB	-

4.12.5 Impacts on parking and property access

Queen Street would be reduced in width to allow construction vehicles to safely enter and exit the site, and to provide longitudinal access outside of the station box footprint. This would lead to the temporary loss of about 20 on-street parking spaces on the western side of Queen Street between Wellbank Street and Pomeroy Street. These parking spaces are time-restricted to one or two hours. Nearby streets have limited capacity to accommodate additional parking demand, and it is unlikely that all lost parking spaces could be accommodated for. Therefore the impact to parking on the surrounding local road network would be moderate. Opportunities to mitigate impacts of on-street car parking would be explored in consultation with the City of Canada Bay Council during construction planning (refer to Section 5).

The kiss and ride zone on the western side of Queen Street north of Wellbank Street would also be temporarily relocated during construction. The kiss and ride zone would be relocated to the closest practical alternative to minimise disruption to users and therefore impacts are anticipated to be minor.

4.12.6 Impacts on the public transport network

The bus stop on the western side of Queen Street north of Wellbank Street would be temporarily relocated during construction. This bus stop serves nine school bus routes. Bus operators, Transport for NSW, the City of Canada Bay and the affected schools would be consulted about the new bus stop location. This would not impact the operation of school bus services that use this stop, however may result in some customers having to walk slightly further distances to or from the bus stop. The impact of the increased walking distances for customers is considered minimal.

Concord Road is currently used by buses and also forms part of the North Strathfield metro station construction vehicle route. Minimal impacts to buses are expected and would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network.

Rail services at the existing North Strathfield Station would not be impacted by the construction works. If works are required within the rail corridor, these would be carried out during rail track possessions. These works would be coordinated within the Sydney Trains standard possession schedule. Alternative bus services would be provided during these possession works.

Possession of the freight line may also be required during construction. Australian Rail Track Corporation and Sydney Trains would be consulted prior to any possession works, with works coordinated to minimise impacts to the operation of the freight rail network.

4.12.7 Impacts on the active transport network

The western footpath on Queen Street adjacent to the construction site would be temporarily removed. Pedestrians would be diverted to the footpath on the eastern side of Queen Street. The Queen Street / Wellbank Street intersection would need to be modified to accommodate heavy vehicles movements and provide safe pedestrian access. Modification of the intersection may include signalisation and/or changes to zebra crossings.

There are currently three short footpaths near the Queen Street / Wellbank Street intersection which converge at the pedestrian overbridge, providing access to the existing North Strathfield Station and the western side of the rail line. During construction, some of these footpaths may be closed, however access to the existing North Strathfield Station would be maintained. There would be no impacts to the lift provided access to the existing station.

Collectively the adjustment of the pedestrian network would minimally temporarily increase the travel distance of pedestrians and therefore impacts are anticipated to be minor.

No impacts to the cycle network are anticipated during construction.

4.12.8 Construction impacts summary

Figure 4-32 provides a summary of construction impacts on road network performance. Figure 4-33 provides a summary of construction impacts on parking, access, public transport and active transport.

Figure 4-32: Road network performance summary – North Strathfield metro station construction site

Figure 4-33: Parking, access, public transport and active transport construction impact summary – North Strathfield metro station construction site

4.13 Burwood North Station construction site

4.13.1 Worksite location and access

The Burwood North Station construction site would comprise two separate sites, a northern site and a southern site on either side of Parramatta Road. The northern site is along Parramatta Road between Burwood Road and Loftus Street. The southern site is on the corner of Parramatta Road and Burwood Road.

Roads forming part of the construction vehicle route for the northern site include the M4 Western Motorway, Parramatta Road, Loftus Street, Burton Street, Burwood Road, Gipps Street and Broughton Street as shown in Figure 4-34. Access to the site would be left-in from Burton Street for light vehicles and left-in from Parramatta Road for heavy vehicles. During standard construction hours, light vehicle egress from the site would be left-out to Burton Street while heavy vehicle egress would be left-out to Loftus Street (90 per cent of heavy vehicles) and Burwood Road (10 per cent of construction vehicles). Outside of these hours, access arrangements remain the same, except for heavy vehicles which would egress from the northern site via Burwood Road only.

Roads forming part of the construction vehicle route for the southern site include the Parramatta Road, Burwood Road and the M4 Western Motorway as shown in Figure 4-34. Access to the site would be left in from Burwood Road and egress from the site would be left out to Parramatta Road.

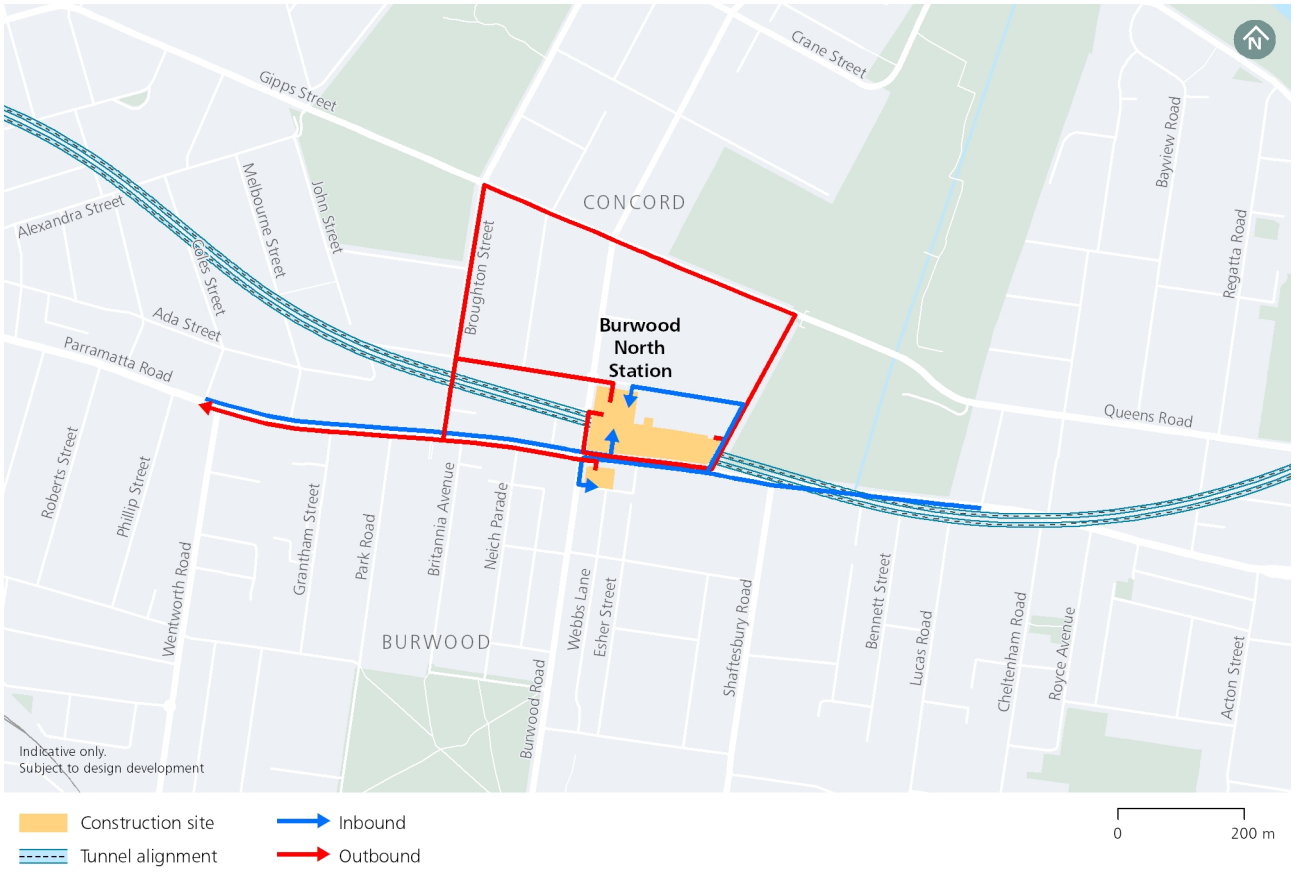

Figure 4-34: Burwood North Station construction site indicative construction vehicle routes

4.13.2 Construction activities

Major construction activities anticipated at the Burwood North Station construction site include:

- Demolition and site establishment
- Piling
- Excavation.

4.13.3 Construction vehicle movements

Construction vehicles would access and egress the Burwood North Station northern and southern construction sites 24 hours a day during excavation (once acoustic sheds have been erected), with construction vehicles generated for all other activities to access and egress both construction sites during standard hours. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods, as well as keeping night time heavy vehicle movements to a low level.

The anticipated number of construction vehicle movements to and from the sites per hour during the various phases of construction is shown in Figure 4-35 and Figure 4-36 for the northern construction site and Figure 4-37 and Figure 4-38 for the southern construction site. Heavy vehicles have been assumed to travel to and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-18.

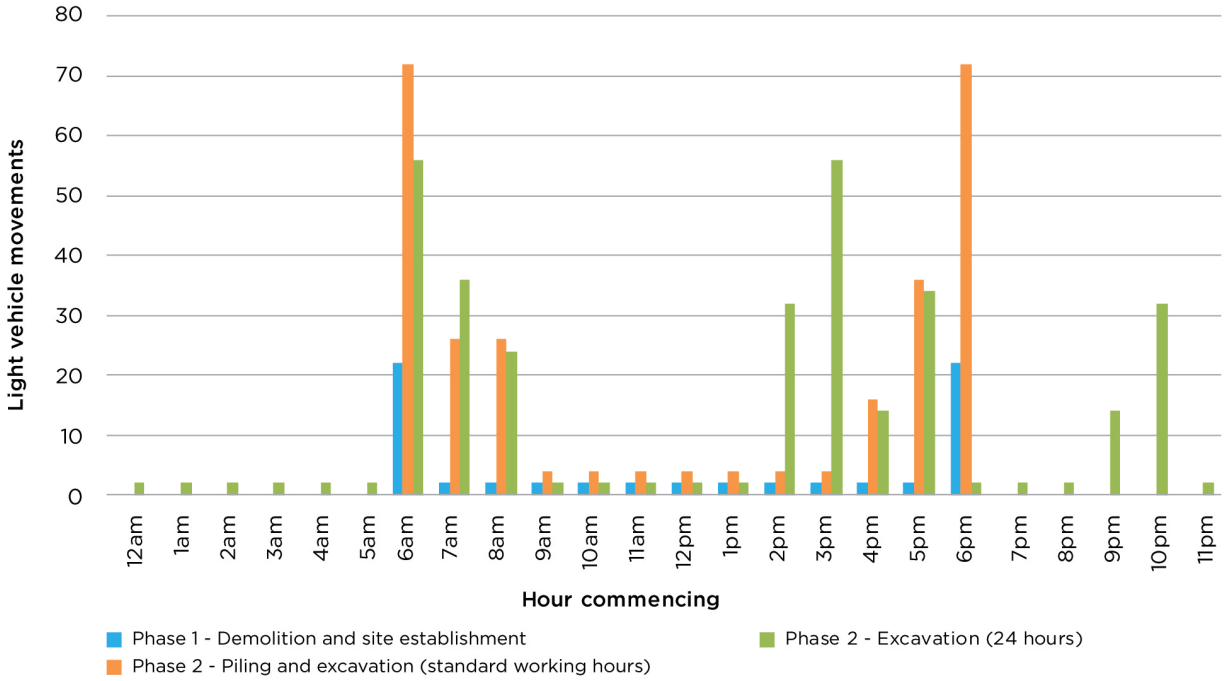

Figure 4-35: Hourly light vehicle movements (arrival and departure) at the Burwood North Station northern construction site

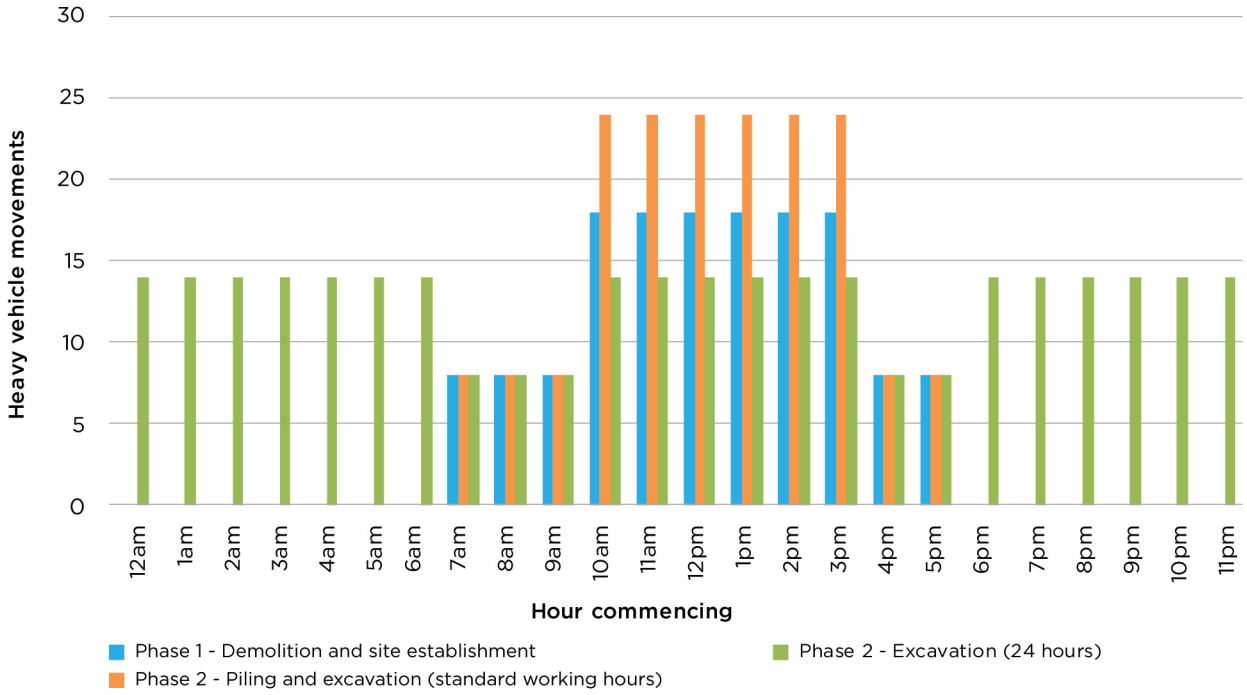

Figure 4-36: Hourly heavy vehicle movements (arrival and departure) at the Burwood North Station northern construction site

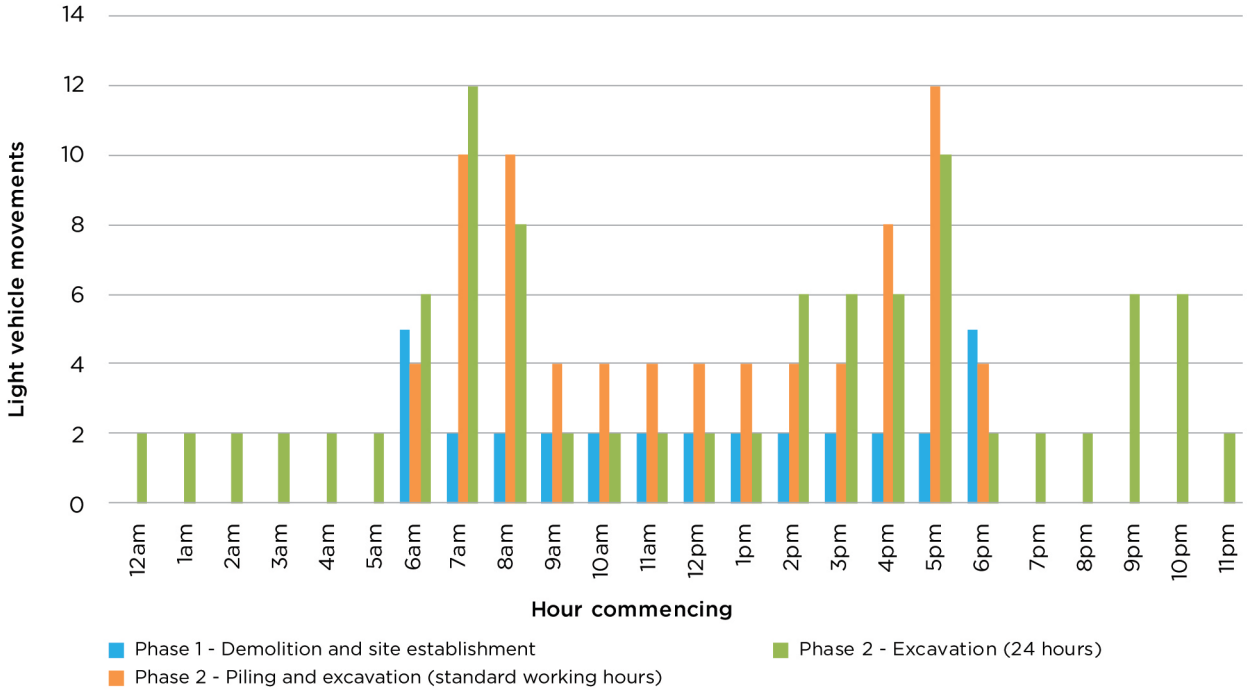

Figure 4-37: Hourly light vehicle movements (arrival and departure) at the Burwood North Station southern construction site

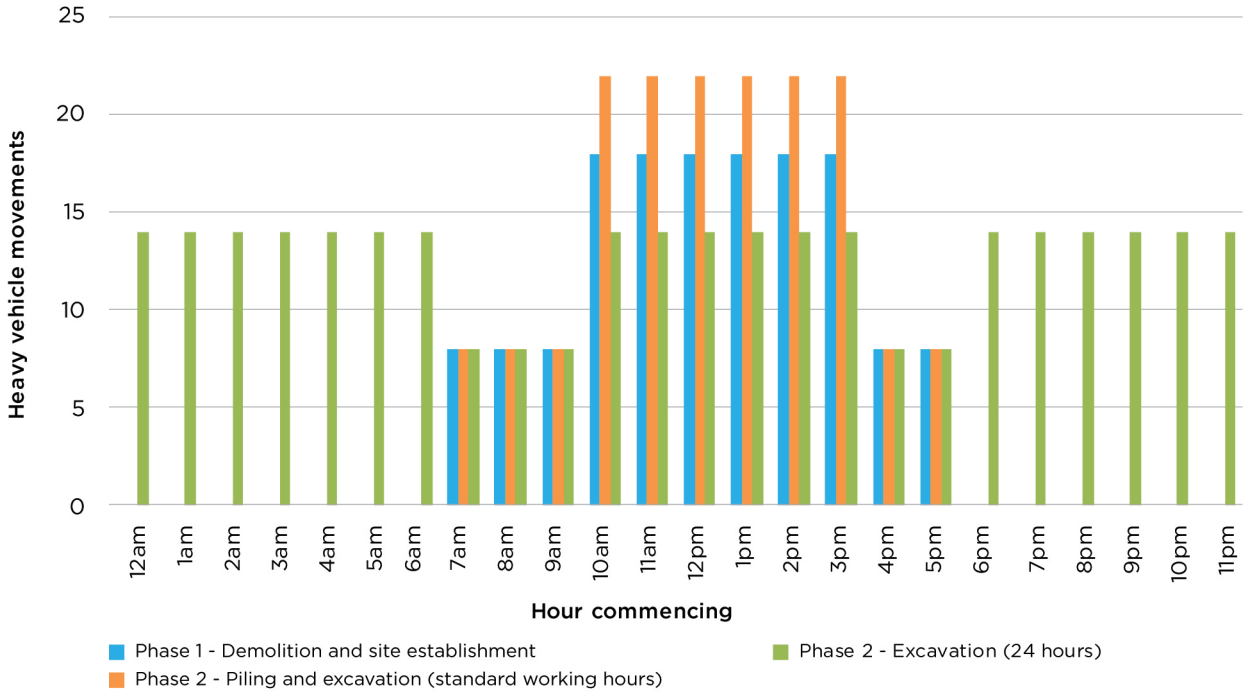

Figure 4-38: Hourly heavy vehicle movements (arrival and departure) at the Burwood North Station southern construction site

Table 4-18: Daily construction movements per day by phase – Burwood North Station construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment			
Northern construction site	66	148	214
Southern construction site	32	148	180
Phase 2 – Piling and excavation (standard working hours)			
Northern construction site	276	184	460
Southern construction site	76	172	248
Phase 2 – Excavation (24 hours)			
Northern construction site	328	306	634
Southern construction site	96	306	402

4.13.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-19 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (7 am to 8 am), it is anticipated that the northern construction site would generate 36 light vehicle movements (36 light vehicles travelling to the northern construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the northern construction site), and the southern construction site would generate 12 light vehicle movements (12 light vehicles travelling to the southern construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the southern construction site).

During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the northern construction site would generate 36 light vehicle movements (36 light vehicles travelling from the northern construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the northern construction site), and the southern construction site would generate 12 light vehicle movements (12 light vehicles travelling from the southern construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the southern construction site).

As discussed in Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that the Parramatta Road / Broughton Street intersection would experience a deterioration in performance from Level of Service B to C. However, this intersection would still operate with spare capacity.

Overall, all intersections would perform satisfactorily at Level of Service D or better with construction traffic.

Compared to existing conditions, there is a substantial decrease in demand flow at intersections along Parramatta Road. This is due to the progressive opening of WestConnex stages, where a considerable proportion of traffic that currently travels on Parramatta Road is forecast to shift onto WestConnex by 2023.

Sydney Metro is continuing to investigate opportunities to provide construction vehicle access and egress directly to Parramatta Road and minimise the use of Loftus Street by construction heavy vehicles.

Table 4-19: Modelled intersection performance (2023) – Burwood North Station construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Broughton Street / Gipps Street										
Morning	2,481	33	C	NB	170	2,489	32	C	NB	165
				EB	-				EB	-
				SB	200				SB	200
				WB	85				WB	80
Evening	2,573	40	C	NB	65	2,590	40	C	NB	60
				EB	-				EB	-
				SB	200				SB	200
				WB	50				WB	65

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Burton Street / Broughton Street										
Morning	866	22	B	NB	30	867	17	B	NB	30
				EB	30				EB	30
				SB	60				SB	45
				WB	35				WB	15
Evening	882	20	B	NB	30	973	22	B	NB	15
				EB	50				EB	45
				SB	50				SB	60
				WB	30				WB	45
Gipps Street / Burwood Road										
Morning	2,394	29	C	NB	165	2,404	30	C	NB	175
				EB	45				EB	60
				SB	100				SB	100
				WB	135				WB	135
Evening	2,660	25	B	NB	185	2,680	24	B	NB	175
				EB	70				EB	65
				SB	80				SB	80
				WB	115				WB	105
Gipps Street / Loftus Street										
Morning	1,784	22	B	NB	25	1,784	27	B	NB	25
				EB	175				EB	175
				SB	-				SB	-
				WB	<5				WB	<5
Evening	1,968	25	B	NB	30	1,972	28	B	NB	30
				EB	220				EB	150
				SB	-				SB	-
				WB	15				WB	15

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Loftus Street / Burton Street										
Morning	286	<5	A	NB	<5	343	<5	A	NB	<5
				EB	15				EB	15
				SB	10				SB	15
				WB	-				WB	-
Evening	192	<5	A	NB	<5	175	<5	A	NB	<5
				EB	10				EB	10
				SB	10				SB	10
				WB	-				WB	-
Parramatta Road / Broughton Street										
Morning	3,147	28	B	NB	-	3,228	27	B	NB	-
				EB	95				EB	100
				SB	130				SB	130
				WB	45				WB	45
Evening	2,941	28	B	NB	-	3,037	35	C	NB	-
				EB	120				EB	120
				SB	80				SB	130
				WB	85				WB	45
Parramatta Road / Burwood Road										
Morning	3,329	20	B	NB	150	3,434	20	B	NB	150
				EB	60				EB	35
				SB	135				SB	80
				WB	30				WB	25
Evening	3,504	41	C	NB	175	3,511	41	C	NB	175
				EB	50				EB	45
				SB	115				SB	80
				WB	30				WB	30

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Parramatta Road / Loftus Street										
Morning	2,645	21	B	NB	-	2,738	20	B	NB	-
				EB	25				EB	30
				SB	50				SB	45
				WB	<5				WB	<5
Evening	2,442	17	B	NB	-	2,450	16	B	NB	-
				EB	50				EB	45
				SB	30				SB	30
				WB	<5				WB	<5

4.13.5 Impacts on parking and property access

Northern construction site

Off-street private parking for properties fronting Burwood Road and Parramatta Road within the Burwood North Station northern construction site boundary would be permanently removed. These parking spaces serve properties that would be demolished during construction and therefore parking impacts due to these lost private parking spaces would be negligible.

About four on-street parking spaces would be temporarily removed on the western side of Loftus Street adjacent to the Burwood North Station northern construction site boundary. These spaces are time-restricted to 30 minutes. Parking impacts would be minimal given the low number of lost parking spaces and the availability of parking on nearby streets. Opportunities to mitigate impacts of on-street car parking would be explored in consultation with the City of Canada Bay during construction planning (refer to Section 5).

Neichs Lane would be acquired as part of Stage 1 and permanently closed between Parramatta Road and Burwood Road.

There would be no impacts to private property access.

Southern construction site

Access to the residential development located on the south-eastern corner of the Burwood Road / Esher Lane intersection and rear access to 1 Esher Street would be maintained during construction.

4.13.6 Impacts on the public transport network

Four bus stops would be temporarily relocated during construction:

- The bus stop on the northern side of Parramatta Road between Burwood Road and Loftus Street, adjacent to the Burwood North Station northern construction site

- The bus stop of the eastern side of Burwood Road between Neichs Lane and Parramatta Road, adjacent to the Burwood North northern construction site
- The bus stop on the southern side of Parramatta Road between Burwood Road and Esher Street, adjacent to the Burwood North Station southern construction site
- The bus stop on the eastern side of Burwood Road between Parramatta Road and Esher Lane, adjacent to the Burwood North Station southern construction site.

The bus stops on Parramatta Road serves seven bus routes including four NightRide bus routes, while the bus stop on Burwood Road serves five other bus routes. Bus operators, Transport for NSW, the City of Canada Bay and Burwood Council (as relevant) would be consulted about the new bus stop locations. This would not impact the operation of bus services that use these stops, however may result in some customers having to walk slightly further distances to or from the bus stops. The impact of the increased walking distances for customers is considered minimal.

In addition to Parramatta Road and Burwood Road, buses also travel along Gipps Street. These roads form part of the construction vehicle routes generated at the Burwood North Station construction site. Minor impacts to buses are expected and would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network.

4.13.7 Impacts on the active transport network

No impacts to pedestrians are anticipated during construction.

Gipps Street between Loftus Street and Broughton Street is designated as a moderate or high difficulty on-road cycle route. This section of Gipps Street would also be used by egressing construction vehicles generated at the northern construction site. While cyclists on Gipps Street would be interacting with a low number of additional heavy vehicles generated at the Burwood North Station northern construction site, further mitigation to address safety conflicts in provided in Section 5.

4.13.8 Construction impacts summary

Figure 4-39 provides a summary of construction impacts on road network performance. Figure 4-40 provides a summary of construction impacts on parking, access, public transport and active transport.

Figure 4-39: Road network performance summary – Burwood North Station construction site

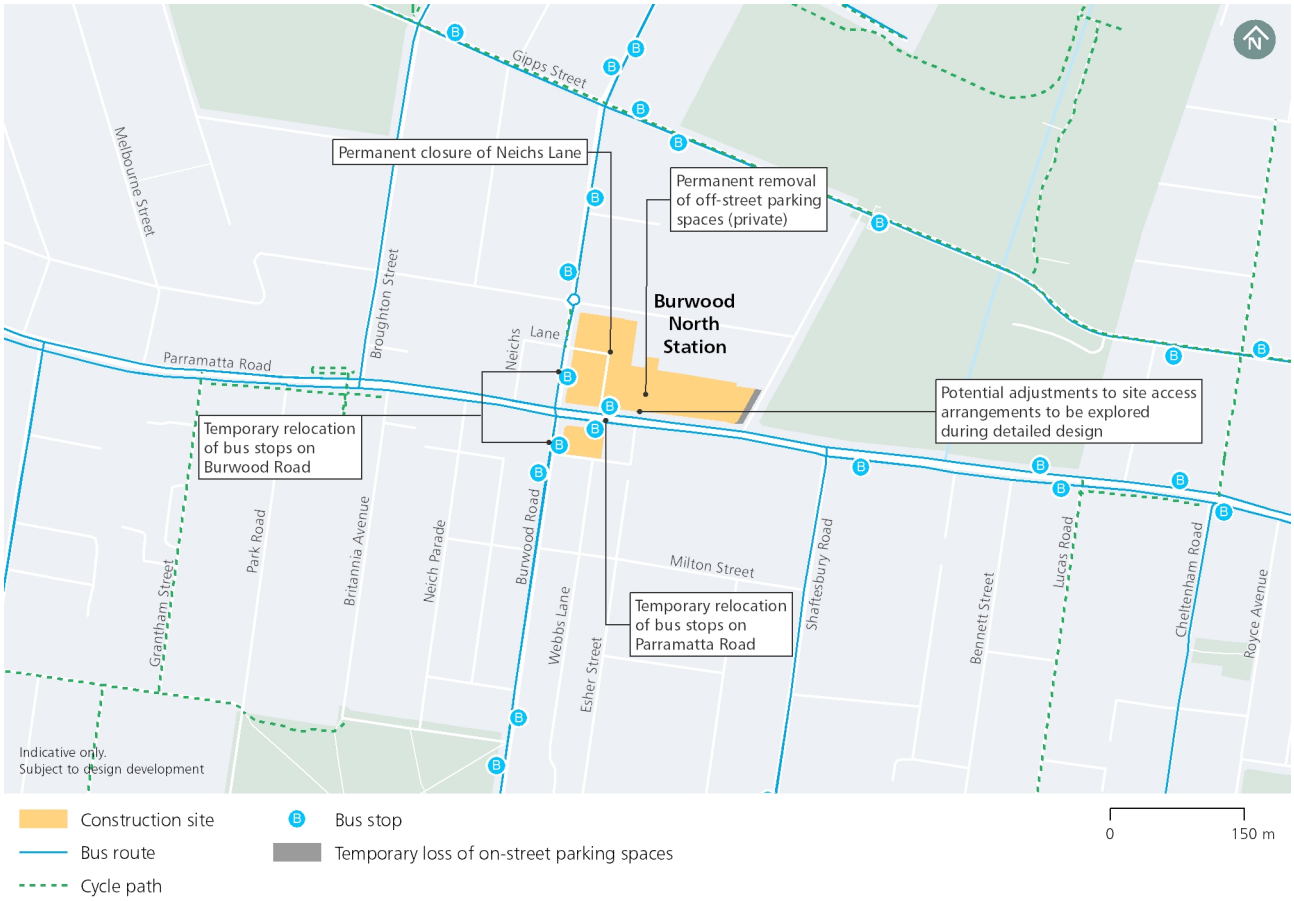

Figure 4-40: Parking, access, public transport and active transport construction impact summary – Burwood North Station construction site

4.14 Five Dock Station construction site

4.14.1 Worksite location and access

The Five Dock Station construction site would comprise two separate sites, a western site and an eastern site on either side of Great North Road. The Five Dock Station western construction site would be between Great North Road and East Street to the north of Fred Kelly Place. The Five Dock Station eastern construction site would be on the corner of Waterview Street and Second Avenue.

Roads forming part of the construction vehicle route for the Five Dock Station western construction site include Parramatta Road, Great North Road and Lyons Road as shown in Figure 4-41. Site access would be left-in, left-out via Great North Road.

Roads forming part of the construction vehicle route for the Five Dock Station eastern construction site include Parramatta Road, Great North Road, First Avenue, Waterview Street and Second Avenue as shown in Figure 4-41. Access to the site would be left-in from Waterview Street and egress from the site would be left-out to Second Avenue.

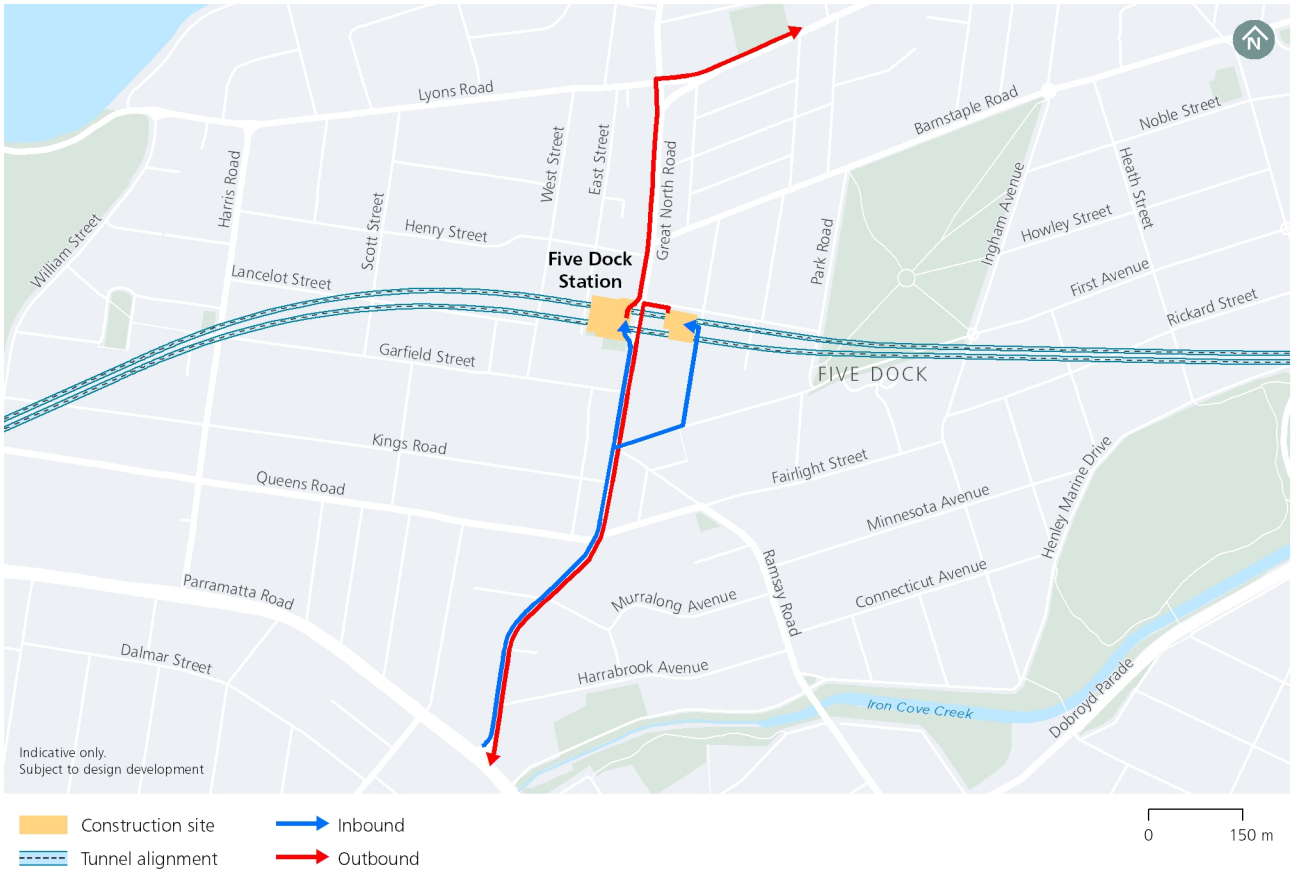

Figure 4-41: Five Dock Station construction site indicative construction vehicle routes

4.14.2 Construction activities

Major construction activities anticipated at the Five Dock Station construction site include:

- Demolition and site establishment
- Piling
- Excavation.

4.14.3 Construction vehicle movements

Construction vehicles would access and egress the Five Dock Station western and eastern construction sites 24 hours a day during excavation (once acoustic sheds have been erected), with construction vehicles generated for all other activities to access and egress both construction sites during standard hours. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods, as well as keeping night time heavy vehicle movements to a low level.

The anticipated number of construction vehicle movements to and from the sites per hour during the various phases of construction is shown in Figure 4-42 and Figure 4-43 for the western construction site and Figure 4-44 and Figure 4-45 for the eastern construction site. Heavy vehicles have been assumed to travel to and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-20.

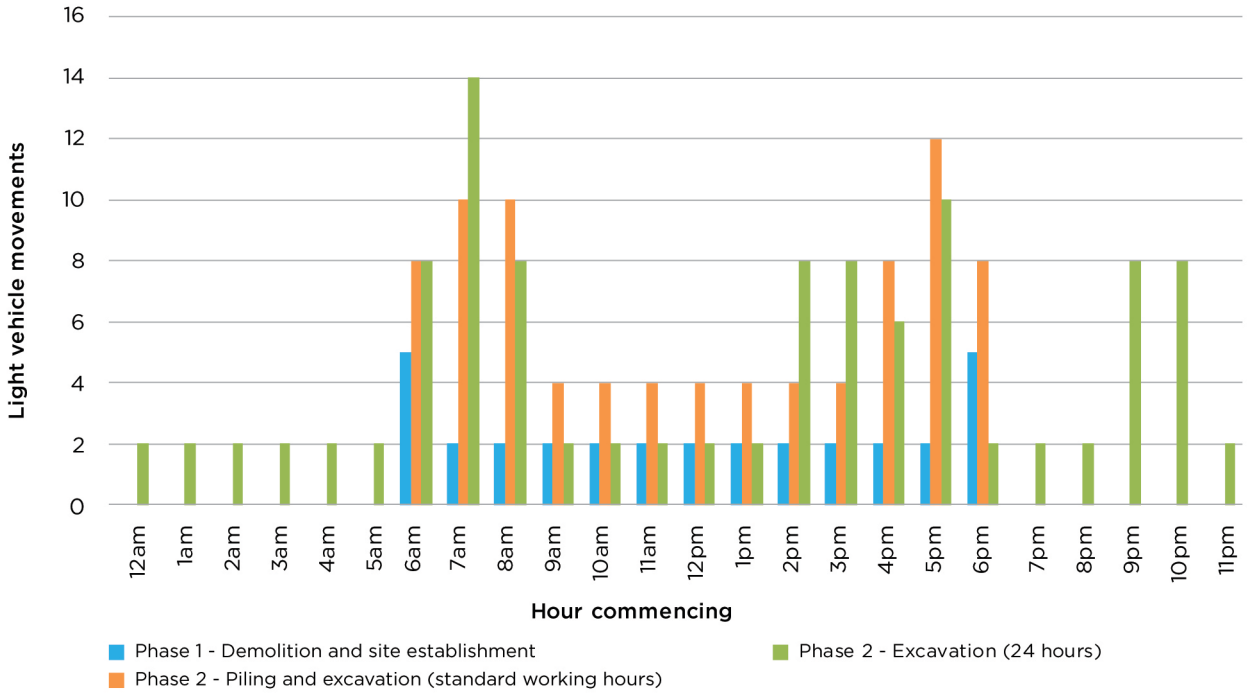

Figure 4-42: Hourly light vehicle movements (arrival and departure) at the Five Dock Station western construction site

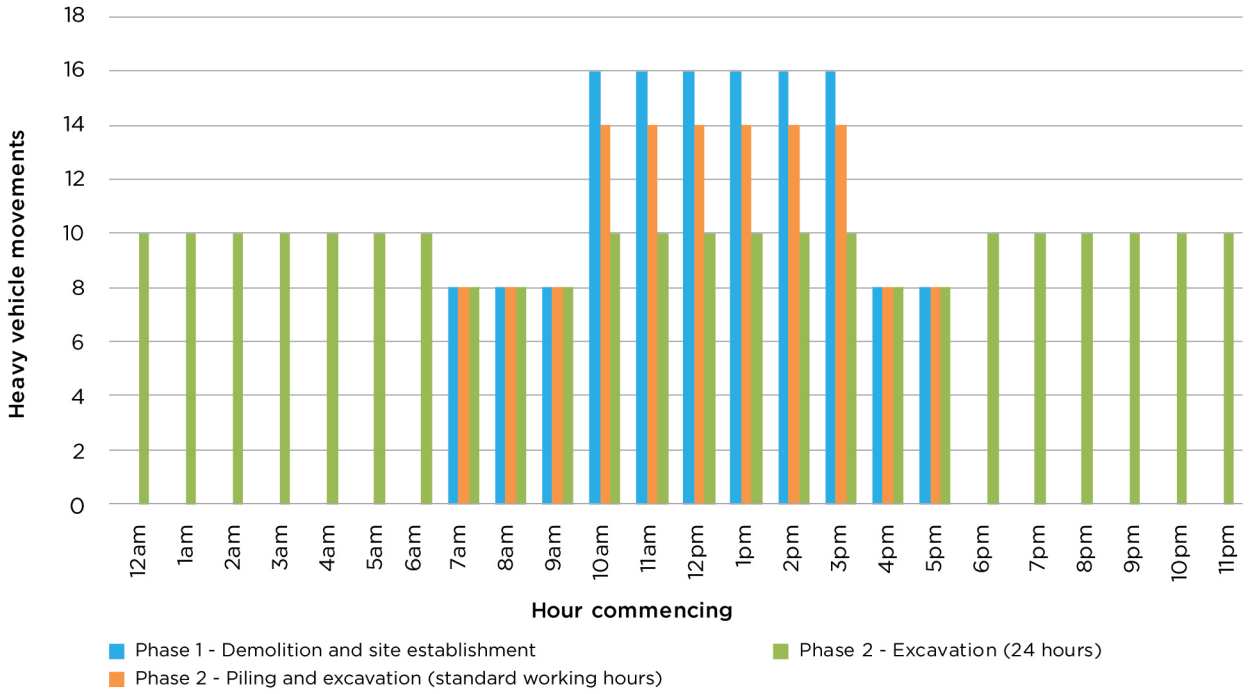

Figure 4-43: Hourly heavy vehicle movements (arrival and departure) at the Five Dock Station western construction site

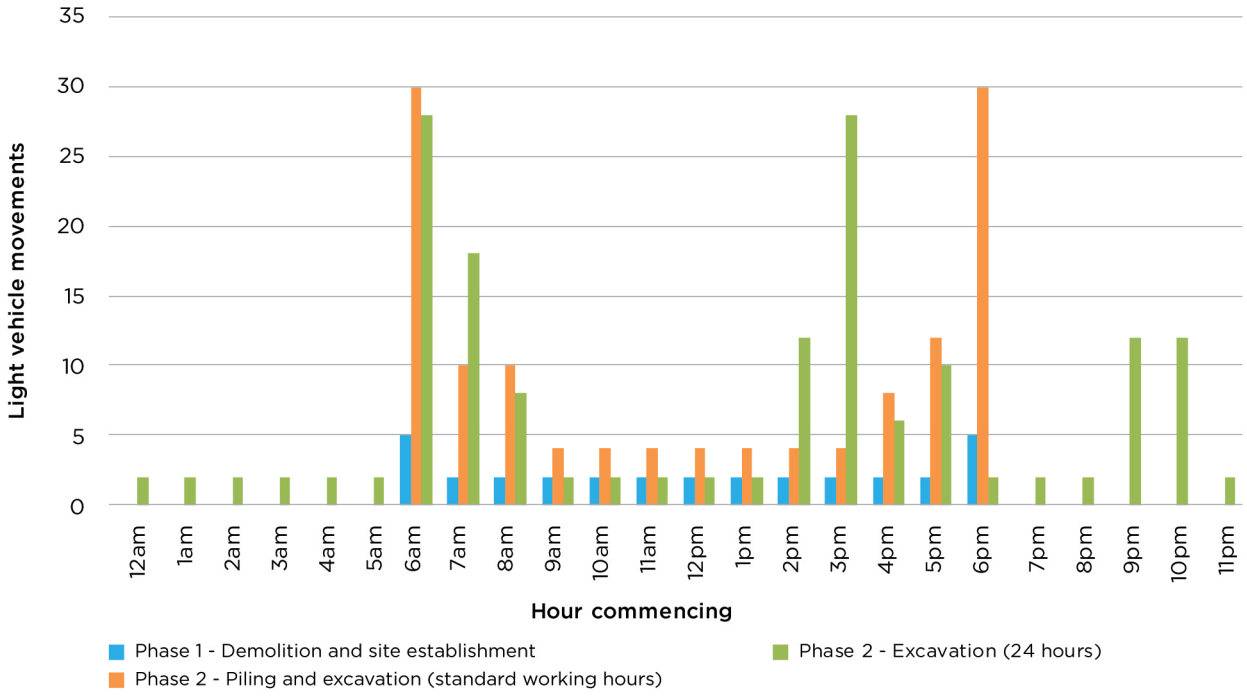

Figure 4-44: Hourly light vehicle movements (arrival and departure) at the Five Dock Station eastern construction site

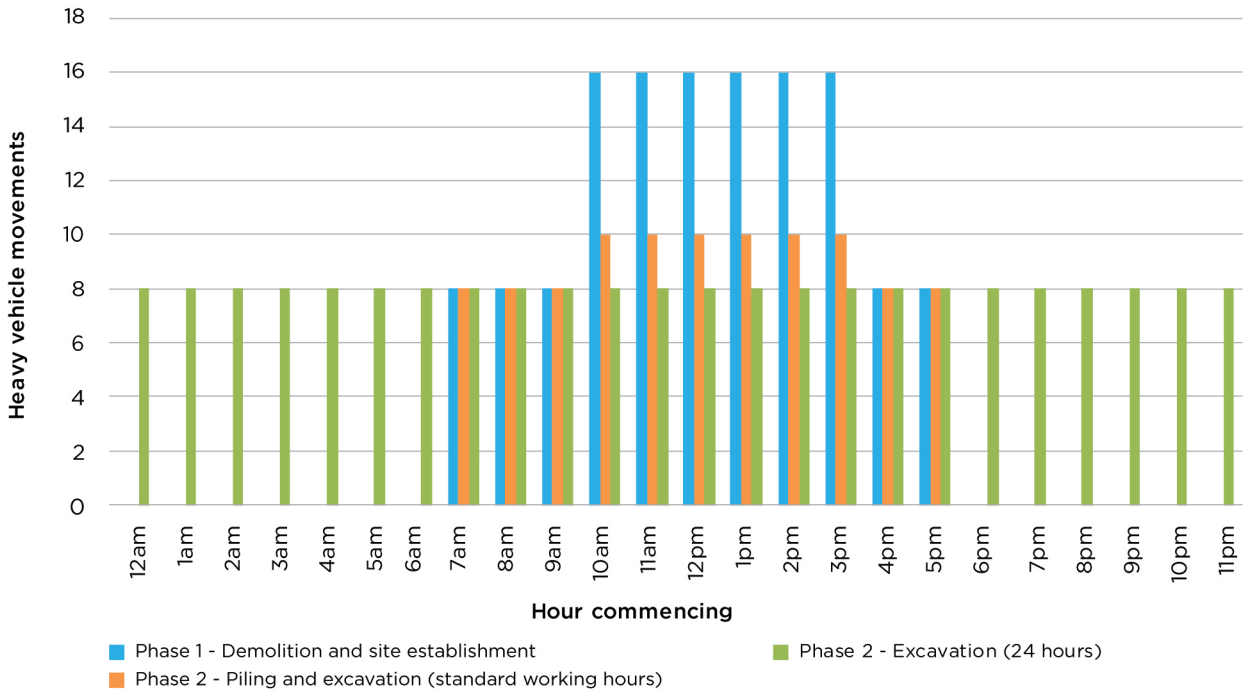

Figure 4-45: Hourly heavy vehicle movements (arrival and departure) at the Five Dock Station eastern construction site

Table 4-20: Daily construction movements per day by phase – Five Dock Station construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment			
Western construction site	32	136	168
Eastern construction site	32	136	168
Phase 2 – Piling and excavation (standard working hours)			
Western construction site	84	124	208
Eastern construction site	128	100	228
Phase 2 – Excavation (24 hours)			
Western construction site	108	230	338
Eastern construction site	164	192	356

4.14.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-21 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (7 am to 8 am), it is anticipated that the western construction site would generate 14 light vehicle movements (14 light vehicles travelling to the western construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the western construction site), and the eastern construction site would generate 18 light vehicle movements (18 light vehicles travelling to the eastern construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the eastern construction site).

During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the western construction site would generate 12 light vehicle movements (12 light vehicles travelling from the western construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the western construction site), and the eastern construction site would generate 12 light vehicle movements (12 light vehicles travelling from the eastern construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the eastern construction site).

As discussed in Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Compared to existing conditions, there is a substantial decrease in demand flow at intersections along Parramatta Road. This is due to the progressive opening of WestConnex stages, where a considerable proportion of traffic that currently travels on Parramatta Road is forecast to shift onto WestConnex by 2023.

Modelled intersection performance with construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Great North Road / Garfield Street during the evening peak hour – from Level of Service D to F
- Great North Road / Lyons Road during the evening peak hour – from Level of Service E to F
- Great North Road / Queens Road / Fairlight Street during the evening peak hour – from Level of Service D to E
- Great North Road / Ramsay Road / First Avenue during the morning and evening peak hour – from Level of Service B to C and Level of Service E to F, respectively
- Great North Road / Second Avenue during the evening peak hour – from Level of Service B to F.

The impacts of construction traffic on intersection performance in the evening peak hour in an already congested network are considered major due to the following:

- A number of intersections would experience a substantial increase in average delay as indicated by a Level of Service E or F during construction
- A number of intersections that operate with spare capacity prior to construction would be at or over-capacity during construction
- Construction vehicles would be travelling within a constrained environment, with Great North Road generally limited to a single lane in each direction
- The increase in vehicles on Great North Road during construction results in increased congestion at the Great North Road / Garfield Street intersection, which also impacts the operational performance of the Great North Road / Second Avenue intersection
- Great North Road / Second Avenue is an unsignalised intersection, with the worst movement reported as the overall performance of the intersection, which corresponds to the westbound approach where construction vehicles turning left would experience difficulty finding a suitable gap in traffic due to queueing along Great North Road in the southbound direction.

Therefore, mitigation measures would be required to reduce the anticipated impacts.

Sydney Metro is continuing to investigate construction site access arrangement to reduce potential impacts and minimise conflicts with heavy vehicle movements. This includes the potential conversion of Waterview Street (north of the car park) to one-way northbound circulation.

Table 4-21: Modelled intersection performance (2023) – Five Dock Station construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Great North Road / Garfield Street										
Morning	1,420	30	C	NB	70	1,423	38	C	NB	70
				EB	155				EB	185
				SB	155				SB	150
				WB	-				WB	-
Evening	1,486	43	D	NB	70	1,464	>100	F	NB	70
				EB	410				EB	415
				SB	155				SB	165
				WB	-				WB	-
Great North Road / Lyons Road										
Morning	2,923	46	D	NB	120	2,923	46	D	NB	150
				EB	185				EB	185
				SB	130				SB	130
				WB	170				WB	170
Evening	3,179	68	E	NB	305	3,170	73	F	NB	295
				EB	445				EB	455
				SB	85				SB	85
				WB	470				WB	480

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Great North Road / Queens Road / Fairlight Street										
Morning	2,576	48	D	NB	170	2,607	54	D	NB	240
				EB	245				EB	255
				SB	95				SB	95
				WB	175				WB	175
Evening	2,511	56	D	NB	290	2,569	62	E	NB	395
				EB	245				EB	255
				SB	100				SB	95
				WB	175				WB	175
Great North Road / Ramsay Road / First Avenue										
Morning	1,654	26	B	NB	105	1,687	30	C	NB	115
				EB	65				EB	85
				SB	65				SB	65
				WB	130				WB	150
Evening	1,654	68	E	NB	115	1,661	79	F	NB	130
				EB	100				EB	100
				SB	70				SB	70
				WB	165				WB	165
Parramatta Road / Great North Road										
Morning	3,561	36	C	NB	-	3,619	36	C	NB	-
				EB	120				EB	115
				SB	170				SB	155
				WB	270				WB	270
Evening	2,861	35	C	NB	-	2,915	36	C	NB	-
				EB	130				EB	130
				SB	170				SB	170
				WB	115				WB	115

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Great North Road / Second Avenue										
Morning	1,203	15	B	NB	25	1,157	23	B	NB	15
				EB	-				EB	-
				SB	80				SB	80
				WB	15				WB	30
Evening	1,257	19	B	NB	15	1,243	>100	F	NB	25
				EB	-				EB	-
				SB	80				SB	85
				WB	45				WB	45
First Avenue / Waterview Street										
Morning	526	<5	A	NB	-	558	<5	A	NB	-
				EB	10				EB	10
				SB	10				SB	10
				WB	<5				WB	<5
Evening	580	<5	A	NB	-	565	<5	A	NB	-
				EB	10				EB	10
				SB	15				SB	15
				WB	25				WB	15
Second Avenue / Waterview Street										
Morning	141	6	A	NB	15	138	6	A	NB	15
				EB	10				EB	10
				SB	10				SB	10
				WB	<5				WB	<5
Evening	273	8	A	NB	15	272	8	A	NB	15
				EB	10				EB	10
				SB	30				SB	30
				WB	<5				WB	15

4.14.5 Impacts on parking and property access

Western construction site

Off-street parking accessible at the southern end of East Street that is provided for customers of 165-167 Great North Road, and private parking for 169 Great North Road, would be removed during construction. These properties would be demolished during construction and would result in negligible parking impacts.

About 12 on-street parking spaces may be temporarily removed along the western side of Great North Road to the north of Fred Kelly Place, adjacent to the Five Dock Station western construction site. These parking spaces are time-restricted to 30 minutes. Opportunities to mitigate impacts of on-street car parking would be explored in consultation with the City of Canada Bay Council during construction planning (refer to Section 5).

There is the potential for conflict between vehicles exiting the Five Dock Station western construction site and vehicles exiting the St Albans Anglican Church driveway. Construction vehicle movements would be managed during church service times so that the potential for conflict with church patrons is minimised. There would be no other impacts to private property access.

Eastern construction site

Twelve off-street restricted parking spaces that are accessible from Second Avenue between Great North Road and Waterview Street would be permanently removed during construction. In addition, up to 10 on-street parking spaces may be temporarily removed near the site access and egress points along Waterview Street (unrestricted parking) and Second Avenue (time-restricted parking), respectively, to accommodate construction vehicle movements.

Summary

Although there is limited spare parking capacity available on the local road network in Five Dock, the cumulative net loss of parking due to both construction sites is anticipated to have a minor impact given that properties within the construction footprint that currently generate parking demand would be demolished during construction. Opportunities to mitigate impacts of on-street car parking would be explored in consultation with the City of Canada Bay Council during construction planning (refer to Section 5).

4.14.6 Impacts on the public transport network

Roads forming part of the Five Dock Station construction vehicle routes that are also used by buses include Lyons Road, Great North Road, First Avenue and Parramatta Road. Impacts to buses would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network. No impacts are anticipated on the operation of bus stops.

4.14.7 Impacts on the active transport network

First Avenue is designated as an on-road cycle route of moderate difficulty. Cyclists would potentially interact with a low number of additional heavy vehicles generated at the Five Dock Station construction site. To address potential conflicts, mitigation measures as provided in Section 5 would be implemented during construction.

The Five Dock Station western construction site is located adjacent to Fred Kelly Place, which generates a substantial amount of pedestrian activity. Appropriate controls would be employed so that pedestrian safety is maintained throughout construction, as discussed in Section 4.3. No other impacts to pedestrians are anticipated during construction.

4.14.8 Construction impacts summary

Figure 4-46 provides a summary of construction impacts on road network performance. Figure 4-47 provides a summary of construction impacts on parking, access, public transport and active transport.

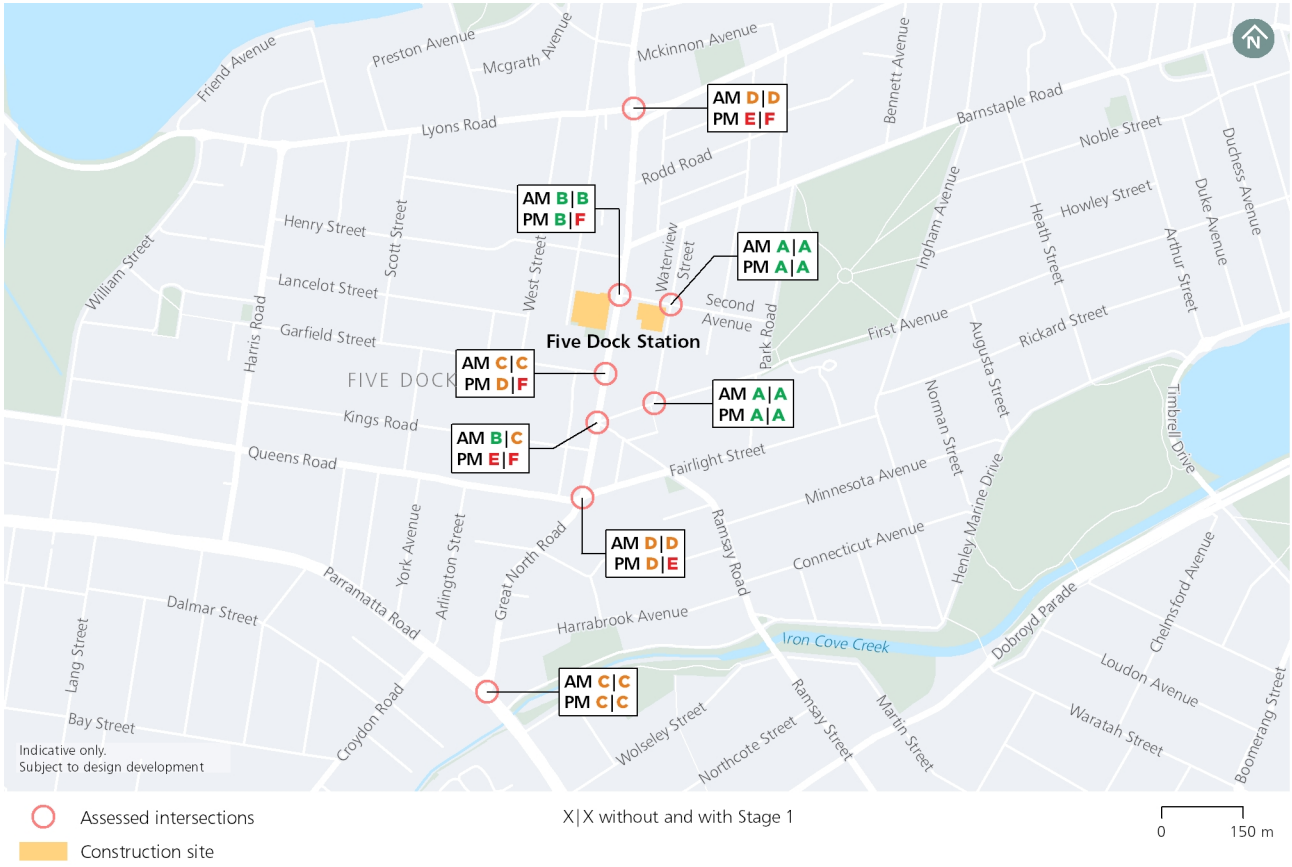

Figure 4-46: Road network performance summary – Five Dock Station construction site

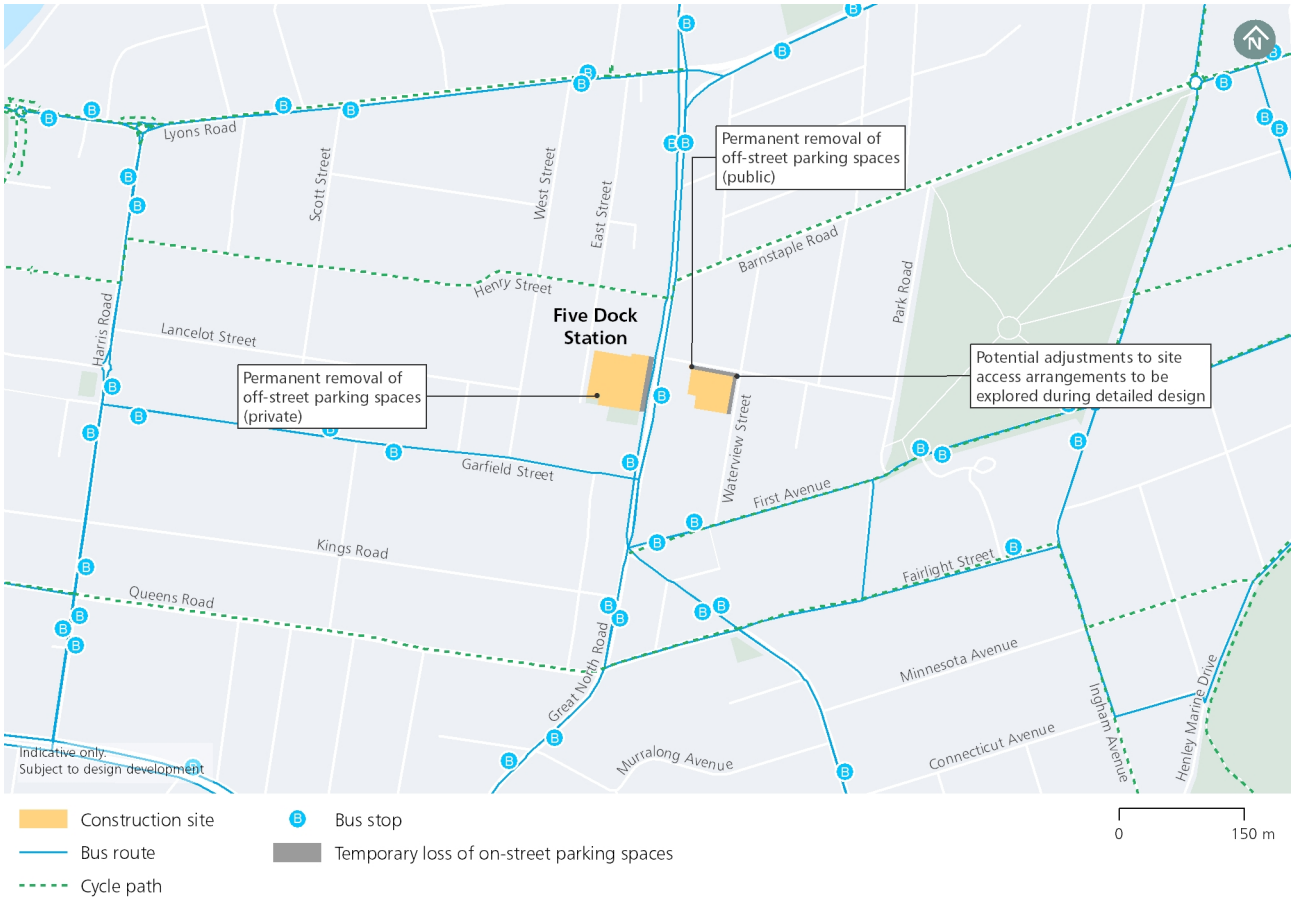

Figure 4-47: Parking, access, public transport and active transport construction impact summary – Five Dock Station construction site

4.15 The Bays Station construction site

4.15.1 Worksite location and access

The Bays Station construction site is bound by Victoria Road, Robert Street and White Bay. Roads forming part of the construction vehicle route include City West Link, The Crescent, James Craig Road, Sommerville Road and Solomons Way as shown in Figure 4-48. Site access would be right-in, left-out via Solomons Way.

4.15.2 Construction activities

Major construction activities anticipated at The Bays Station construction site include:

- Demolition and site establishment
- Piling
- Excavation
- Tunnel boring machine launch and support (including spoil removal).

Figure 4-48: The Bays Station construction site indicative construction vehicle routes

4.15.3 Construction vehicle movements

Construction vehicles would access and egress The Bays Station construction site 24 hours a day during excavation and tunnel boring machine launch and support, with construction vehicles generated for all other activities to access and egress the construction site during standard hours and extended day-time hours on Saturdays. The arrival and departure pattern of construction vehicles aims to minimise the impact of construction activity during the network peak periods.

The anticipated number of construction vehicle movements to and from the site per hour during the various phases of construction is shown in Figure 4-49 and Figure 4-50. Heavy vehicles have been assumed to travel to and from the construction site within the hour, for example eight heavy vehicle movements during an hour would comprise four heavy vehicle movements to the construction site and four heavy vehicle movements from the construction site.

The total daily number of construction vehicle movements for each stage is provided in Table 4-22.

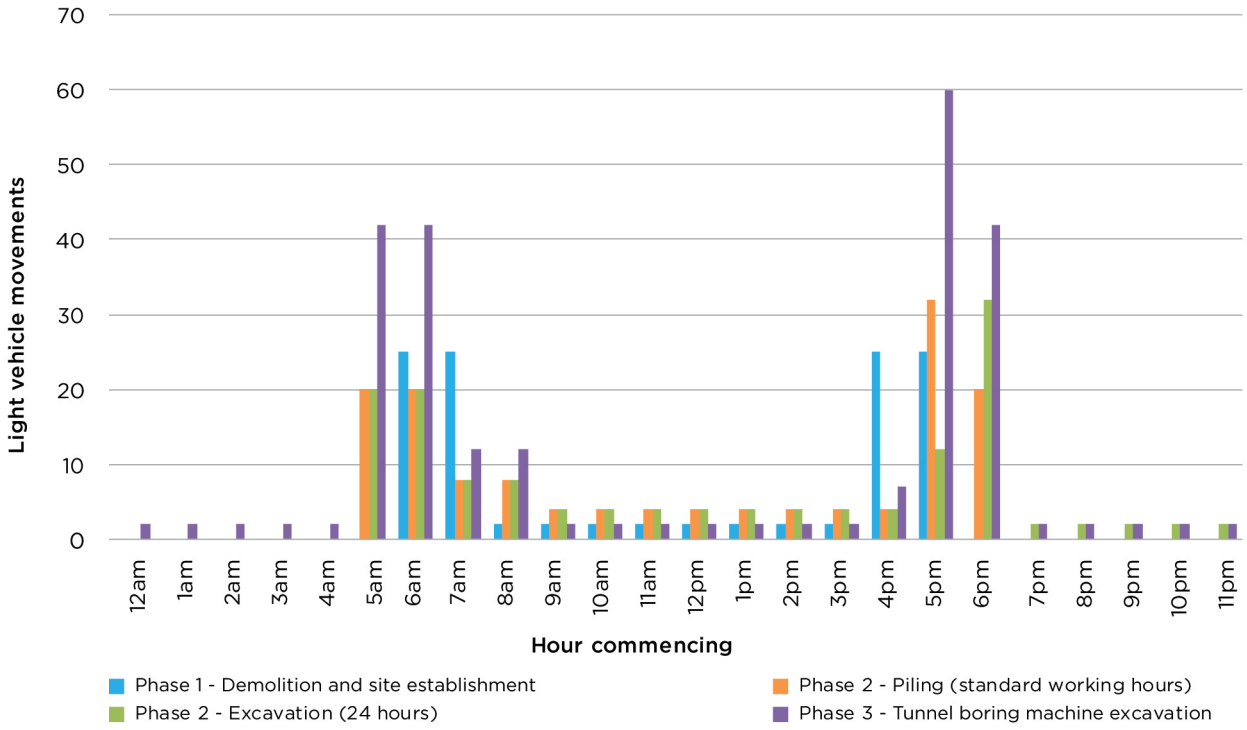

Figure 4-49: Hourly light vehicle movements (arrival and departure) at The Bays Station construction site

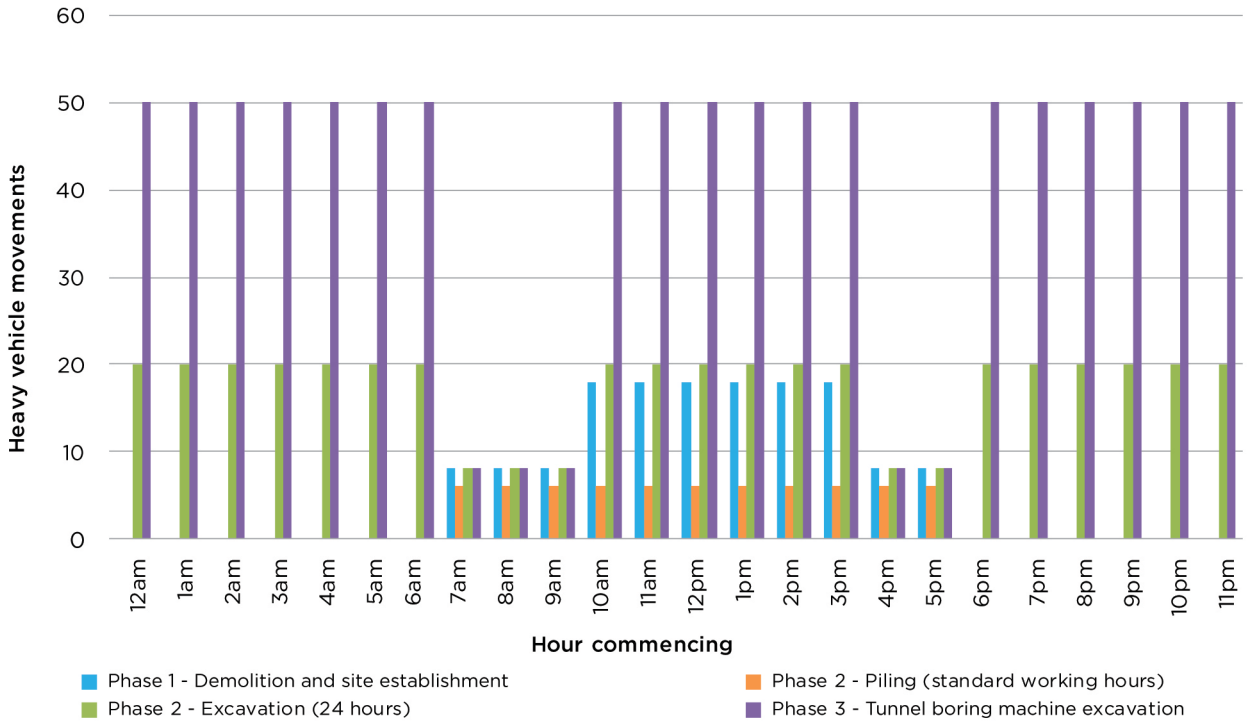

Figure 4-50: Hourly heavy vehicle movements (arrival and departure) at The Bays Station construction site

Table 4-22: Daily construction movements per day by phase – The Bays Station construction site

Phase	Total movements per day		
	Light vehicles	Heavy vehicles	Total
Phase 1 – Demolition and site establishment	116	148	264
Phase 2 – Piling (standard working hours)	140	66	206
Phase 2 – Excavation (24 hours)	142	420	562
Phase 3 – Tunnel boring machine excavation	251	990	1,241

4.15.4 Impacts on road network performance

Intersection performance results under the '2023 without Stage 1' (without construction vehicles) and '2023 with Stage 1' (with construction vehicles) scenarios are summarised in Table 4-23 for the morning and evening peak hours.

During the morning peak hour presented in this assessment (8 am to 9 am), it is anticipated that the construction site would generate two light vehicle movements (two light vehicles travelling to the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). During the evening peak hour presented in this assessment (5 pm to 6 pm), it is anticipated that the construction site would generate 60 light vehicle movements (60 light vehicles travelling from the construction site) and eight heavy vehicle movements (four heavy vehicles travelling to and from the construction site). As discussed in Section 2.2, the peak hour presented in this assessment was selected to represent when background traffic demand is at its greatest.

Modelled intersection performance with construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Victoria Road / Robert Street during the morning peak hour – from Level of Service D to E
- The Crescent / James Craig Road during the morning peak hour – from Level of Service A to B.

Analysis of modelled intersection performance results shows that at some locations, the addition of construction traffic would result in a small reduction in demand flow due to the following factors:

- Additional 'latent' or 'unreleased' demand, which is traffic that is not able to be assigned in the model during the morning and/or evening peak period. These trips are assumed to still exist, however, these trips would be delayed and not completed until after the peak period, effectively increasing the duration of the peak period
- Fewer vehicles passing through an intersection due to the addition of construction-related heavy vehicles, which have a slower acceleration profile compared to light vehicles. This would likely result in an increase to average delay.

In reality, from an operational perspective, the performance of an intersection where the modelling results show a small reduction in demand flow and / or average delay would remain very similar with and without construction traffic.

Table 4-23: Modelled intersection performance (2023) – The Bays Station construction site

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Victoria Road / Robert Street										
Morning	5,862	56	D	NB	-	5,862	58	E	NB	-
				EB	250				EB	250
				SB	260				SB	265
				WB	160				WB	165
Evening	6,755	66	E	NB	-	6,762	59	E	NB	-
				EB	255				EB	255
				SB	220				SB	190
				WB	170				WB	170
Victoria Road / The Crescent										
Morning	9,532	37	C	NB	-	9,560	36	C	NB	-
				EB	155				EB	155
				SB	270				SB	270
				WB	325				WB	335
Evening	11,297	51	D	NB	-	11,227	51	D	NB	-
				EB	185				EB	185
				SB	260				SB	230
				WB	>500				WB	>500
The Crescent / James Craig Road										
Morning	4,992	33	C	NB	40	5,063	32	C	NB	45
				EB	215				EB	215
				SB	-				SB	-
				WB	185				WB	185
Evening	6,269	14	A	NB	45	6,253	17	B	NB	55
				EB	190				EB	205
				SB	-				SB	-
				WB	175				WB	180

Intersection and peak hour	2023 without Stage 1					2023 with Stage 1				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
City West Link / The Crescent										
Morning	4,885	>100	F	NB	265	4,967	>100	F	NB	260
				EB	>500				EB	>500
				SB	-				SB	-
				WB	175				WB	170
Evening	6,448	37	C	NB	245	6,413	42	C	NB	255
				EB	350				EB	390
				SB	-				SB	-
				WB	210				WB	210
City West Link / Catherine Street										
Morning	3,857	90	F	NB	80	3,910	87	F	NB	80
				EB	390				EB	390
				SB	110				SB	110
				WB	270				WB	270
Evening	5,030	43	C	NB	75	5,046	43	C	NB	75
				EB	45				EB	110
				SB	105				SB	100
				WB	>500				WB	500

4.15.5 Impacts on parking and property access

No impacts to parking or property access are anticipated during construction.

4.15.6 Impacts on the public transport network

The Crescent is used by buses and also forms part of the construction vehicle route for The Bays Station construction site. Minimal impacts to buses are expected and would be limited to a potential minor increase in travel time due to the additional construction vehicles on the road network. No impacts are anticipated on the operation of bus stops.

No impacts to the light rail network or the White Bay Cruise Terminal are anticipated during construction.

4.15.7 Impacts on the active transport network

A number of changes to the active transport network are proposed as part of the approved WestConnex M4-M5 Link project. These include the following:

- Removal of two existing pedestrian bridges, one near the east approach at the Victoria Road / The Crescent intersection and the other adjacent to Lilyfield Road. The bridge adjacent to Lilyfield Road would be replaced with an underpass below Victoria Road that would connect Lilyfield Road and the ANZAC Bridge shared path.
- Rozelle Rail Yards link: provision of an off-road active transport east-west connection between The Bay Run and Greenway in the west to ANZAC Bridge and Sydney CBD in the east
- Whites Creek link: provision of a link between Callan Park, Rozelle Rail Yards and Parramatta Road via a predominately off-road active transport link along Whites Creek to Easton Park
- Rozelle land bridge: provision of a link from Bicentennial Park and Glebe foreshore to Rozelle Rail Yards and Easton Park, providing north-south connectivity between Glebe, Annandale, Rozelle and Balmain.

In the vicinity of The Bays construction site, no impacts to pedestrians and cyclists are anticipated given that shared paths adjacent to James Craig Road and The Crescent would remain open during construction.

4.15.8 Construction impacts summary

Figure 4-51 provides a summary of construction impacts on road network performance. There are no major construction impacts on parking, access, public transport and active transport.

Figure 4-51: Road network performance summary – The Bays Station construction site

4.16 Cumulative construction impacts

4.16.1 Assessment methodology

Projects which have been considered for the cumulative construction assessment are those which fall within the construction footprint of Stage 1, as well as construction vehicle routes that use roads near the Stage 1 construction sites. Projects deemed relevant for the cumulative construction assessment are:

- Parramatta Light Rail (Stage 1) – which has potential cumulative impacts with the Westmead metro station and Parramatta metro station construction sites
- Sydney Metro City & Southwest, including the White Bay truck marshalling yard – which has potential cumulative impacts with The Bays Station construction site
- Glebe Island Multi-User Facility – which has potential cumulative impacts with The Bays Station construction site
- WestConnex M4-M5 Link – which has potential cumulative impacts with The Bays Station construction site
- Western Harbour Tunnel – which has potential cumulative impacts with The Bays Station construction site.

The construction program of each project (using publicly available documents) has been analysed to determine the year that peak construction would occur, which corresponds to the maximum number of construction vehicles on the road network (worst-case scenario). If the year of peak construction is prior to 2023 (the construction year assessed for Stage 1), a qualitative assessment has been undertaken. If the year of peak construction is 2023 or later, a quantitative assessment has been undertaken.

A cumulative construction traffic impact assessment has not been carried out at locations where publicly available information for projects near a construction site is not available and/or where the cumulative number of construction vehicles generated near a construction site would be low. These locations are:

- Clyde stabling and maintenance facility construction site
- Silverwater services facility construction site
- Sydney Olympic Park metro station construction site
- North Strathfield metro station construction site
- Burwood North Station construction site
- Five Dock Station construction site.

4.16.2 Westmead metro station construction site

Construction of Parramatta Light Rail (Stage 1) commenced in late 2018 and is scheduled for completion in 2023. A review of the construction program indicates that main construction works would be completed in the first quarter of 2022, with testing and commissioning to be completed in the first quarter of 2023.

Parramatta Light Rail (Stage 1) construction vehicle routes in Westmead include the following roads:

- Railway Parade
- Darcy Avenue
- Hawkesbury Road north of Railway Parade
- Park Avenue.

These roads are located north of the Westmead metro station construction site.

Given that a low number of construction vehicles would be generated during the testing and commissioning phase in 2023, and Parramatta Light Rail (Stage 1) construction vehicle routes do not directly interface with Stage 1 construction vehicle routes, cumulative construction impacts at the Westmead metro station construction site are anticipated to be minimal.

4.16.3 Parramatta metro station construction site

Parramatta Light Rail (Stage 1) construction vehicle routes in Parramatta include the following roads:

- Great Western Highway
- O'Connell Street
- Pitt Street
- Macquarie Street
- Harris Street
- Victoria Road
- Parkes Street
- Macarthur Street.

Some of these roads are common to those used by construction vehicles for Stage 1 including Great Western Highway, O'Connell Street and Pitt Street. As discussed above, peak construction for Parramatta Light Rail (Stage 1) would be complete in the first quarter of 2022. Therefore, low construction vehicle volumes would be generated in 2023 during the Stage 1 peak construction year. Hence, cumulative construction impacts at the Parramatta metro station construction site are anticipated to be minor.

4.16.4 The Bays Station construction site

Construction of WestConnex M4-M5 Link commenced in mid-2018 and is scheduled for completion in 2023. A review of the construction program indicates that main construction works would be occurring in 2023 at the Rozelle civil and tunnel site and the Iron Cove Link civil site. Similarly, major construction works are anticipated to be carried out in 2023 for the proposed Western Harbour Tunnel at sites such as Rozelle Rail Yards, Victoria Road and White Bay.

Major construction works associated with Sydney Metro City & Southwest, including the White Bay truck marshalling yard, which fall directly within the construction footprint of The Bays Station construction site, are anticipated to be complete by 2020. Similarly, construction of the Glebe Island Multi-User Facility is anticipated to be complete by 2021. Therefore, these projects have not been included in the quantitative cumulative assessment below.

As discussed in Section 3.10.4, the relocation of Port Access Road would be completed prior to the commencement of site establishment for Stage 1 and has also been excluded from the quantitative cumulative assessment below.

Cumulative construction vehicle movements

The anticipated number of construction vehicle movements generated by Stage 1, WestConnex M4-M5 Link and Western Harbour Tunnel during the morning and evening peak hour is provided in Table 4-24.

Table 4-24: Number of cumulative construction vehicle movements

Project	Construction site	Morning peak hour		Evening peak hour	
		Light vehicle movements	Heavy vehicle movements	Light vehicle movements	Heavy vehicle movements
Stage 1	The Bays Station construction site	2	8	60	8
WestConnex M4-M5 Link	Rozelle civil and tunnel site	100	46	350	46
	Iron Cove Link civil site	15	4	140	4
Western Harbour Tunnel and Warringah Freeway Upgrade	Rozelle Rail Yards construction support site	45	14	30	14
	Victoria Road construction support site	41	37	71	37
	White Bay construction support site	40	63	140	63

Impacts on road network performance

Intersection performance results under the '2023 with Stage 1' (with Stage 1 construction vehicles) and '2023 with cumulative construction' (with Stage 1, WestConnex M4-M5 Link and Western Harbour Tunnel construction vehicles) scenarios are summarised in Table 4-25 for the morning and evening peak hours.

Modelled intersection performance with cumulative construction traffic indicates that the following intersections would experience a deterioration in Level of Service:

- Victoria Road / The Crescent during the evening peak hour – from Level of Service D to F
- City West Link / The Crescent during the evening peak hour – from Level of Service C to D
- City West Link / Catherine Street during the evening peak hour – from Level of Service C to E.

Analysis of modelled intersection performance results shows that at some locations, the addition of cumulative construction traffic would result in a large reduction in demand flow due to the following factors:

- Additional 'latent' or 'unreleased' demand, which is traffic that is not able to be assigned in the model during the morning and/or evening peak period. These trips are assumed to still exist, however, these trips would be delayed and not completed until after the peak period, effectively increasing the duration of the peak period
- Fewer vehicles passing through an intersection due to the addition of construction-related heavy vehicles, which have a slower acceleration profile compared to light vehicles. This would likely result in an increase to average delay.

In reality, from an operational perspective, this means that the road network is already operating at capacity and the cumulative impact of construction vehicles would result in increased intersection delays and queue lengths.

The impacts of cumulative construction traffic on intersection performance in the evening peak hour in an already congested network are considered major due to the following:

- A number of intersections would experience a substantial increase in average delay as indicated by a Level of Service E or F during construction

- A number of intersections that already operate close to or at capacity would deteriorate even further with cumulative construction
- Cumulative construction vehicles would be travelling within an already congested environment

Therefore, mitigation measures would be required to reduce the anticipated impacts. However, WestConnex M4-M5 Link is expected to be operational in 2023 and should provide some improvement to the operational performance of the road network in the vicinity of The Bays Station construction site.

Table 4-25: Modelled intersection performance with cumulative construction (2023) – The Bays Station construction site

Intersection and peak hour	2023 with Stage 1					2023 with cumulative construction				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
Victoria Road / Robert Street										
Morning	5,862	58	E	NB	-	5,933	55	D	NB	-
				EB	250				EB	250
				SB	265				SB	265
				WB	165				WB	155
Evening	6,762	59	E	NB	-	5,929	68	E	NB	-
				EB	255				EB	255
				SB	190				SB	265
				WB	170				WB	160
Victoria Road / The Crescent										
Morning	9,560	36	C	NB	-	9,606	36	C	NB	-
				EB	155				EB	155
				SB	270				SB	270
				WB	335				WB	340
Evening	11,227	51	D	NB	-	9,651	88	F	NB	-
				EB	185				EB	145
				SB	230				SB	260
				WB	>500				WB	>500

Intersection and peak hour	2023 with Stage 1					2023 with cumulative construction				
	Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)		Demand flow (vehicles per hour)	Average delay (seconds per vehicle)	Level of service	Maximum queue length by directional approach (metres)	
The Crescent / James Craig Road										
Morning	5,063	32	C	NB	45	5,204	31	C	NB	55
				EB	215				EB	215
				SB	-				SB	-
				WB	185				WB	185
Evening	6,253	17	B	NB	55	5,811	25	B	NB	115
				EB	205				EB	170
				SB	-				SB	-
				WB	180				WB	180
City West Link / The Crescent										
Morning	4,967	>100	F	NB	260	5,229	95	F	NB	265
				EB	>500				EB	>500
				SB	-				SB	25
				WB	170				WB	185
Evening	6,413	42	C	NB	255	6,141	53	D	NB	230
				EB	390				EB	210
				SB	-				SB	50
				WB	210				WB	220
City West Link / Catherine Street										
Morning	3,910	87	F	NB	80	4,266	70	F	NB	80
				EB	390				EB	390
				SB	110				SB	110
				WB	270				WB	290
Evening	5,046	43	C	NB	75	5,046	61	E	NB	75
				EB	110				EB	40
				SB	100				SB	100
				WB	500				WB	>500

Figure 4-52 provides a summary of cumulative construction impacts on road network performance. There are no major cumulative construction impacts on parking, access, public transport and active transport.

Figure 4-52: Road network performance summary (cumulative construction) – The Bays Station construction site

5. Mitigation and management measures

The planning for Stage 1 and the arrangements of the construction sites have been developed to avoid and minimise transport and traffic related impacts where possible. This has included the following:

- Haulage routes have been developed in consultation with Transport for NSW including Transport Coordination and have aimed to minimise the use of local roads and use the most efficient route to the arterial road network
- Selection of truck sizes at each construction site has considered a balance between reducing overall truck movements and manoeuvrability to, from and within the construction sites.

The approach to transport and traffic management during the construction phase, including the process for the development of all Traffic Management Plans, is outlined in Appendix F (Construction Traffic Management Framework) (CTMF) of the Environmental Impact Statement.

The CTMF is a Sydney Metro framework which sets out the management approach and suite of document for construction traffic management. It provides a linking document between the planning approval documentation and the construction traffic management documentation to be developed by the Principal Contractors relevant to their scope of works.

Residual impacts of Stage 1 that arise from engineering constraints or from construction activities, and which cannot be removed through the design are considered manageable. The mitigation measures would be reconfirmed as Stage 1 progresses to detailed design, and as more detailed construction management plans are developed. A summary of mitigation measures identified for Stage 1 is provided in Table 5-1. These would be supplemented by mitigation measures detailed in Chapter 27 (Synthesis of the Environmental Impact Statement) of the Environmental Impact Statement with respect to cumulative impacts.

Table 5-1: Summary of Stage 1 transport and traffic mitigation measures

Reference	Mitigation measure	Location[1]
TT1	The community would be notified in advance of proposed road and pedestrian network changes through appropriate forms of community liaison.	All
TT2	In the event of a traffic related incident, coordination would be carried out with the Transport Coordination and/or the Transport Management Centre's Operations Manager.	All
TT3	Access to properties for emergency vehicles would be provided at all times.	All
TT4	Vehicle access to and from construction sites would be managed to maintain pedestrian, cyclist and motorist safety. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals and modifications to existing signals or, on occasions, police presence.	All

Reference	Mitigation measure	Location[1]
TT5	Additional enhancements for pedestrian, cyclist and motorist safety near the construction sites would be implemented during construction. This would include measures such as: • Assessing the suitability of construction haulage routes through sensitive land use areas with respect to road safety • Deployment of speed awareness signs in conjunction with variable message signs near construction sites to provide alerts to drivers • Providing community education and awareness about sharing the road safely with heavy vehicles • Specific construction driver training to understand route constraints, safety and environmental considerations such as sharing the road safely with other road users and limiting the use of compression braking • Requiring technology and equipment to improve vehicle safety, eliminate heavy vehicle blind spots, and monitor vehicle location and driver behaviour.	All
TT6	All trucks would enter and exit construction sites in a forward direction, where feasible and reasonable.	All
TT7	Construction site traffic would be managed to minimise movements during peak periods.	All
TT8	Construction site traffic immediately around construction sites would be managed to minimise vehicle movements through school zones during pick up and drop off times.	WMS, PMS, BNS, FDS
TT9	Opportunities to minimise impacts at the Alexandra Avenue/Bridge Road intersection would be determined in consultation with Transport for NSW.	WMS
TT10	Where existing parking is removed to facilitate construction activities, consultation would occur with the relevant local council to investigate opportunities to provide alternative parking facilities.	All
TT11	Construction sites would be managed to minimise the number of construction workers parking on surrounding streets by: • Encouraging workers to use public or active transport • Encouraging ride sharing • Provision of alternative parking locations and shuttle bus transfers where feasible and reasonable.	All
TT12	Any relocation of bus stops and kiss-and-ride facilities would be carried out in consultation with Transport for NSW including Transport Coordination (for relevant locations), the relevant local council and bus operators. Wayfinding and customer information would be provided to notify customers of relocated bus stops.	WMS, NSMS, BNS
TT13	Opportunities to improve bus priority along the temporary detour at Westmead metro station construction site would be investigated during detailed design.	WMS
TT14	Pedestrian and cyclist access would be maintained during the temporary closure of Alexandra Avenue. Wayfinding and customer information would be provided to guide pedestrians and cyclists to alternative routes.	WMS

Reference	Mitigation measure	Location[1]
TT15	Where existing cyclist facilities (e.g. bicycle parking) would be temporarily unavailable to facilitate construction activities, suitable replacement facilities would be provided for this duration.	WMS, PMS
TT16	Any relocation of taxi ranks would be carried out in consultation with Transport for NSW, the relevant local council and taxi operators. Wayfinding and customer information would be provided to notify customers of relocated taxi ranks.	SOPMS
TT17	During major special events, impacts to the transport and traffic network would be reduced by (as necessary): • Minimising the level of construction activity, and if necessary, ceasing all construction activity • Maintaining appropriate access to all areas within the event precinct • Erection of hoardings, site fencing and gates at key locations within the construction site boundary to permit pedestrian movements adjacent to the construction site and separate pedestrians from construction vehicles • Scheduling deliveries to the construction site outside of event periods. For special events that require specific traffic measures, those measures would be developed in consultation with t Transport for NSW including Transport Coordination (for relevant locations) and the organisers of the event.	PMS, CSMF, SOPMS
TT18	Access to existing properties and buildings would be maintained in consultation with property owners.	All
TT19	Traffic control measures required at the Parramatta metro station construction site access on George Street would be determined in consultation with Transport for NSW.	PMS
TT20	Adjustments to site access arrangements and the local road network would be explored during detailed design to minimise conflicts with heavy vehicle movements.	NSMS, FDS
TT21	Construction site traffic generated at the Five Dock Station construction site would be managed to avoid or minimise travel during the evening peak period.	FDS
TT22	Construction site traffic generated at the Five Dock Station construction site would be managed to minimise movements during church service times at St Albans Anglican Church.	FDS
TT23	Opportunities to provide vehicle access and egress directly to Parramatta Road and minimise the use of Loftus Street at the Burwood North Station construction site would be explored during detailed design.	BNS
TT24	Co-ordination of traffic management arrangements between major construction projects would occur in consultation with Transport for NSW including Transport Coordination.	TBS

[1] WMS: Westmead metro station; PMS: Parramatta metro station; CSMF: Clyde stabling and maintenance facility; SSF: Silverwater services facility; SOPMS: Sydney Olympic Park metro station; NSMS: North Strathfield metro station; BNS: Burwood North Station; FDS: Five Dock Station; TBS: The Bays Station; Metro rail tunnels: Metro rail tunnels not related to other sites (eg tunnel boring machine works); PSR: Power supply routes.

6. References

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