

Technical Paper 1

Transport

Sydney Metro – Western Sydney Airport

Technical Paper 1: Transport

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ABN: 12354063515

Prepared by

M2A

Level 25, 680 George Street, Sydney NSW 2000
ABN: 60 549 956 366

Table of Contents

Glossary and terms of abbreviation	i
Executive Summary	iii
1 Introduction	1
1.1 Project context and overview	1
1.2 Key project features	1
1.2.1 Off-airport project components	2
1.2.2 On-airport project components	2
1.3 Project construction	4
1.4 Purpose of this technical paper	6
1.4.1 Assessment requirements	6
1.4.2 Structure of this technical paper	8
1.5 Study area	8
2 Methodology	10
2.1 Scope	10
2.2 Data sources	10
2.3 Walking and cycling	11
2.4 Road-based public transport and general traffic	11
2.4.1 Base year scenario	12
2.4.2 Construction scenario	12
2.4.3 Operational scenario	13
2.4.4 WRTM Model	14
2.5 Assumptions	17
2.5.1 Base year scenario	17
2.5.2 Construction scenario	17
2.5.3 Operational scenario	18
2.6 Assessment criteria	18
2.6.1 Mid-block performance	19
2.6.2 Intersection performance	20
3 Existing transport context	21
3.1 Study area overview	21
3.2 Off-airport existing environment	21
3.2.1 Land use context	21
3.2.2 Public transport	22
3.2.3 Pedestrian facilities	28
3.2.4 Cycling facilities	29
3.2.5 Freight rail network	31
3.2.6 Overview of road network	32
3.2.7 Road network performance	36
3.2.8 Road safety	38
3.2.9 Parking arrangements	41
3.3 On-airport existing environment	44
3.4 Proposed transport upgrades	44
3.4.1 Proposed public transport upgrades	45
3.4.2 Proposed walking and cycling upgrades	48
3.4.3 Proposed freight upgrades	51
3.4.4 Proposed road upgrades	53
4 Assessment of construction impacts	64
4.1 Overview	64
4.1.1 Construction traffic volumes	67
4.1.2 Expected traffic distribution	73
4.2 Off-airport impacts	73
4.2.1 Overview	73
4.2.2 Road network performance	76
4.2.3 Other road network adjustments	83
4.2.4 Road safety	84

	4.2.5	Access impacts	84
	4.2.6	Parking impacts	85
	4.2.7	Point-to-point impacts	86
	4.2.8	Walking and cycling impacts	87
	4.2.9	Public transport impacts	87
	4.3	On-airport impacts	88
	4.3.1	Road network performance	89
	4.3.2	Walking and cycling impacts	93
	4.3.3	Public transport impacts	93
5		Assessment of operational impacts	94
	5.1	Off-airport integration with other transport modes	94
	5.1.1	Overview	94
	5.1.2	Integration strategy	97
	5.2	On-airport integration with other transport modes	109
	5.2.1	Overview	109
	5.2.2	Integration strategy	109
	5.3	Off-airport 2026 future year	114
	5.3.1	Road network changes	114
	5.3.2	Mid-block performance	116
	5.3.3	Intersection performance	120
	5.3.4	Road safety	123
	5.3.5	Walking and cycling impacts	123
	5.3.6	Public transport impacts	123
	5.4	Off-airport 2036 future year	124
	5.4.1	Mid-block performance	124
	5.4.2	Intersection performance	128
	5.4.3	Road safety	131
	5.4.4	Walking and cycling impacts	131
	5.4.5	Public transport impacts	131
	5.5	On-airport 2026 future year	131
	5.5.1	Mid-block performance	132
	5.5.2	Intersection performance	134
	5.5.3	Walking and cycling impacts	136
	5.5.4	Public transport impacts	136
	5.6	On-airport 2036 future year	136
	5.6.1	Mid-block performance	137
	5.6.2	Intersection performance	139
	5.6.3	Walking and cycling impacts	141
	5.6.4	Public transport impacts	141
	5.7	Summary of impacts	141
	5.7.1	Walking and cycling	141
	5.7.2	Public transport	141
	5.7.3	Road network	142
6		Cumulative impacts	143
	6.1	Overview of projects	143
	6.1.1	Western Sydney International	143
	6.1.2	M12 Motorway	144
	6.1.3	The Northern Road	144
	6.1.4	St Marys Intermodal Facility	145
	6.2	Cumulative construction impacts	145
	6.2.1	Road network performance	145
	6.3	Cumulative operational impacts	151
7		Proposed management and mitigation measures	152
	7.1	Approach to management and mitigation	152
	7.2	Performance outcomes	152
	7.3	Proposed mitigation measures	153
8		Conclusion	155
	8.1	Construction impacts	155

8.2	Operational impacts	156
9	References	158
Appendix A		A
	Crash Analysis	A

List of Tables

Table 1-1	Secretary's Environmental Assessment Requirements	6
Table 2-1	Changes to the transport network during the future years 2026 and 2036	14
Table 2-2	Intersection control type at key intersection per scenario	15
Table 2-3	Typical theoretical mid-block capacities for urban roads with interrupted flows	19
Table 2-4	Mid-block level of service criteria	19
Table 2-5	SIDRA Intersection level of service criteria	20
Table 3-1	Bus routes and operators in the study area	23
Table 3-2	Bus service frequency (number of services) within the study area	25
Table 3-3	Rail services at the existing St Marys Station and Leppington Station	27
Table 3-4	Base year (2019) mid-block performance (based on traffic survey data)	36
Table 3-5	Base year 2019 intersection performance	38
Table 3-6	Available car parking in the St Marys precinct	42
Table 3-7	Sydney's Bus Future bus network	47
Table 3-8	Summary of The Northern Road staging upgrades	57
Table 4-1	Proposed truck types for construction	67
Table 4-2	Indicative peak construction vehicle movements for construction sites	67
Table 4-3	2023/2024 Peak construction year mid-block performance – off-airport	77
Table 4-4	Indicative intersection upgrades to facilitate road network access	79
Table 4-5	Peak construction year intersection performance – off-airport	81
Table 4-6	Peak construction year 2023/2024 mid-block performance – on-airport	90
Table 4-7	Peak construction year 2023/2024 intersection performance – on-airport	92
Table 5-1	Proposed interchange facilities at off-airport stations	96
Table 5-2	Indicative permanent road network changes	114
Table 5-3	2026 future year mid-block performance – Off-airport	118
Table 5-4	2026 future year intersection performance – Off-airport	121
Table 5-5	2036 future year mid-block performance – Off-airport	126
Table 5-6	2036 future year intersection performance – Off-airport	129
Table 5-7	2026 future year mid-block performance – On-airport	133
Table 5-8	2026 future year intersection performance – On-airport	135
Table 5-9	2036 future year mid-block performance – On-airport	138
Table 5-10	2036 future year intersection performance – On-airport	140
Table 6-1	2023/2024 Peak construction year cumulative mid-block performance	147
Table 6-2	2023/2024 Peak construction year cumulative intersection performance	150
Table 7-1	Performance outcomes for the project in relation to transport	152
Table 7-2	Mitigation measures for construction and operational transport impacts	153

List of Figures

Figure 1-1	Project alignment and key features	3
Figure 1-2	Overview of the construction footprint	5
Figure 1-3	Study area and local context	9
Figure 2-1	Assessment methodology	17
Figure 3-1	Existing bus routes servicing St Marys, Claremont Meadows, Erskine Park and Orchard Hills	24
Figure 3-2	Existing bus routes servicing Bringelly	25
Figure 3-3	Location of existing St Marys Station and Leppington Station in the Sydney Trains Network	28

Figure 3-4	Cycling infrastructure in St Marys, Claremont Meadows, St Clair and Orchard Hills	30
Figure 3-5	Cycling infrastructure in Orchard Hills, Luddenham, Badgerys Creek and Bringelly	31
Figure 3-6	Sydney rail freight corridors	32
Figure 3-7	Major road network within the study area	34
Figure 3-8	Location of crashes within the study area	39
Figure 3-9	Crashes by severity along each road corridor	40
Figure 3-10	Comparison of casualty crash rates with the Sydney Region Class Average	41
Figure 3-11	Parking within the St Marys Precinct	43
Figure 3-12	North South Rail Line and South West Rail Link Extension corridors	46
Figure 3-13	Rapid and Suburban bus routes supporting Western Sydney	48
Figure 3-14	Walking patterns across Sydney	49
Figure 3-15	5 km bike riding catchment from major activity centres and existing cycleways	50
Figure 3-16	Western Sydney Freight Line	52
Figure 3-17	Future M12 Motorway alignment	54
Figure 3-18	Outer Sydney Orbital corridor	55
Figure 3-19	The Western Sydney Infrastructure Plan	56
Figure 3-20	Realignment of Badgerys Creek Road	58
Figure 3-21	Mamre Road Upgrade – project alignment	60
Figure 3-22	Mamre Road Upgrade – preferred option	61
Figure 3-23	Elizabeth Drive Upgrade	63
Figure 4-1	Construction heavy vehicle haulage routes – North of Badgerys Creek	65
Figure 4-2	Construction heavy vehicle haulage routes – South of Badgerys Creek	66
Figure 4-3	Construction footprint and site access in St Marys, Claremont Meadows and Orchard Hills	69
Figure 4-4	Construction footprint and site access in Orchard Hills and Luddenham	70
Figure 4-5	Construction footprint and site access in Luddenham and Badgerys Creek	71
Figure 4-6	Construction footprint and site access in Luddenham, Badgerys Creek and Bringelly	72
Figure 4-7	Temporary changes to the road network and parking at St Marys	75
Figure 5-1	Modal access hierarchy	95
Figure 5-2	Forecast mode of arrival during the AM peak in 2036 at St Marys Station	98
Figure 5-3	St Marys interchange layout plan	100
Figure 5-4	Forecast mode of arrival during the AM peak in 2036 at Orchard Hills Station	101
Figure 5-5	Orchard Hills interchange layout plan	102
Figure 5-6	Forecast mode of arrival during the AM peak in 2036 at Luddenham Road Station	104
Figure 5-7	Luddenham Road interchange layout plan	105
Figure 5-8	Forecast mode of arrival during the AM peak in 2036 at Aerotropolis Core Station	107
Figure 5-9	Aerotropolis Core interchange layout plan	108
Figure 5-10	Forecast mode of arrival during the AM peak in 2036 at Airport Business Park Station	110
Figure 5-11	Forecast mode of arrival during the AM peak in 2036 at Airport Terminal Station	111
Figure 5-12	Airport Business Park layout plan	112
Figure 5-13	Airport Terminal layout plan	113

Glossary and terms of abbreviation

Term	Meaning
Average delay	Duration, in seconds, of the average vehicle waiting time at an intersection
CBD	central business district
Construction footprint	The total extent of land required for the construction of the project, including ancillary facilities and services and land temporarily required for construction (incorporating construction elements such as compounds, access tracks and construction sites)
CTMF	Construction Traffic Management Framework
CTMP	Construction Traffic Management Plan is a plan showing how traffic will be managed when construction works are being carried out. It describes the work activities proposed, their impacts on the roadway and on road users, and how these impacts are being addressed
Growth areas	Precinct planning in Sydney's south west undertaken as part of the South West Growth Area which aims to integrate new suburbs with Western Sydney Airport at Badgerys Creek and the broader Western Sydney Employment Area
FFS	Free-flow speed is based on the lane widths, shoulder widths and the average number of access points per kilometre
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
HV	Heavy vehicles
Kiss and ride	Trips involving a car dropping off or picking up a commuter at the station with minimal stopping time
LGA	local government area
LOS	Level of Service – An index of the operational performance of traffic on a given traffic lane, carriageway or road when accommodating various traffic volumes under different combinations of operating conditions
LV	Light vehicles
M12 Motorway	The future M12 Motorway is an east-west 16-kilometre motorway between the M7 Motorway, Cecil Hills and The Northern Road, Luddenham. The M12 Motorway is proposed to provide direct access to Western Sydney International at Badgerys Creek and connect to Sydney's motorway network. The motorway would be parallel to Elizabeth Drive
MFN	Metropolitan Freight Network
Mid-block performance	A capacity assessment of a road against typical mid-block capacities for urban roads
Movement	One-way traffic flow (both light and heavy vehicles unless specified) along a section of road or at an approach to an intersection
Park and ride	A trip where a commuter drives a car to the station and parks at the station commuter car park to then ride the metro to their destination
OSO	The Outer Sydney Orbital is a proposed north-south motorway and freight rail line corridor connecting Box Hill in the north and the Hume Motorway near Menangle in the south
PCU	Passenger Car Unit
Point-to-point	Point-to-point transport are services that can transport customers for a fare on the route they choose, at the time that suits them. This includes taxis, rideshare services, hire cars and tourist services

Term	Meaning
SCATS	Sydney Coordinated Adaptive Traffic System - An urban traffic control system that optimises traffic flow. SCATS respond automatically to fluctuations in traffic flow through the use of vehicle detectors
SEARs	Secretary's Environmental Assessment Requirements
SIDRA INTERSECTION	SIDRA INTERSECTION is a computer-based modelling package that calculates intersection performance. The commonly used measure of intersection performance, as defined by TfNSW is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the LOS
SSFL	Southern Sydney Freight Line
Sydney Metro – Western Sydney Airport (the project)	The proposed Sydney Metro – Western Sydney Airport between St Marys and Western Sydney Aerotropolis would comprise a new north-south Sydney Metro railway around 23 kilometres in length, creating passenger rail access to Western Sydney International, the Aerotropolis and a connection with the T1 Western Line
T1 Western Line	Sydney Trains line - Emu Plains or Richmond to City, City to Emu Plains or Richmond
T2 Inner West & Leppington Line	Sydney Trains line - Parramatta or Leppington to City, City to Parramatta or Leppington
T5 Cumberland Line	Sydney Trains line - Leppington to Richmond, Richmond to Leppington
TCS	Traffic control signal plans which detail the proposed positions of under road conduits installed for traffic signals and/or intelligent transport system infrastructure
TfNSW	Transport for New South Wales
TTLG	Traffic and Transport Liaison Group is a forum for key stakeholders, contractors, and Sydney Metro to discuss matters that could impact on the road network operations around the work sites. The TTLG also provides a forum through which information on proposed traffic changes is made available to key stakeholders
VCR	Volume-to-capacity ratio or degree of saturation is the ratio of demand or arrival flow to capacity, and can be larger than 1, representing oversaturation
Western Sydney Aerotropolis	Previously referred to as the Badgerys Creek Aerotropolis. It includes the land surrounding Western Sydney International (including Bringelly, Luddenham, Kemps Creek, Badgerys Creek and Rossmore) where there will be opportunities to deliver new jobs and homes supported by key infrastructure. This will include commercial and industrial precincts, and agricultural land, as well as proposed transport corridors
Western Sydney International	The Western Sydney International (Nancy-Bird Walton) Airport at Badgerys Creek
WSAP	The Western Sydney Aerotropolis Plan outlines the vision of the NSW Government for the Aerotropolis and presents the planning principles, land uses and infrastructure required to support the Aerotropolis development

Executive Summary

Project overview

The *Greater Sydney Region Plan* (Greater Sydney Commission, 2018a) sets the vision and strategy for Greater Sydney to become a global metropolis of three unique and connected cities; the Eastern Harbour City, the Central River City and the Western Parkland City.

Sydney Metro – Western Sydney Airport (the project) is identified in the *Greater Sydney Region Plan* as a key element to delivering an integrated transport system for the Western Parkland City. The project would traverse the Penrith and Liverpool local government areas (LGAs), providing a new metro railway between St Marys in the north and the Aerotropolis in the south, including passing through and providing access to Western Sydney International.

The project is characterised into components located outside Western Sydney International (off-airport) and components located within Western Sydney International (on-airport), to align with different planning approval pathways required under State and Commonwealth legislation.

The project involves the construction and operation of a metro railway line around 23 kilometres in length between St Marys in the north and the Aerotropolis in the south. Key features of the project comprise:

- a new metro station connecting to, and providing an interchange with, the T1 Western Line at St Marys
- two new metro stations between the T1 Western Line and Western Sydney International; one station at Orchard Hills and one station at Luddenham Road
- two new metro stations within the Western Sydney International site; one at the Airport terminal and one at the Airport business park
- a new metro station within the Aerotropolis Core, south of Western Sydney International.

The alignment of the new metro railway line would:

- include a combination of tunnel, cutting, surface and viaduct sections
- interface with key roads including the Great Western Highway, M4 Western Motorway, Luddenham Road, the future M12 Motorway, Elizabeth Drive and Badgerys Creek Road, as well as key utilities such as the Warragamba to Prospect Water Supply Pipelines (the pipelines)
- include waterway crossings of Blaxland Creek, Cosgroves Creek and Badgerys Creek.

The project would be a city-shaping project which would provide the initial spine of a transport network to service the Western Parkland City, providing a reliable, efficient public transport option for existing and future residents, customers and employees of Western Sydney International, the Aerotropolis and associated business lands in Western Sydney.

The project would help optimise land use and development, creating precincts and places with a high level of accessibility to jobs and services. The project would deliver a fast, safe and easy metro rail service providing better access to more employment opportunities, health and education services and leisure activities across Western Parkland City and Greater Sydney.

The project includes works required to support its construction and operation, including all operational systems and infrastructure.

A stabling and maintenance facility, service facility and operational control centre would be required to support operation of the project. The facility is proposed to be located in Orchard Hills to the south of Blaxland Creek between the proposed track alignment and the proposed Outer Sydney Orbital (OSO).

The project is described in more detail in Chapter 7 (Project description – Operation) and Chapter 8 (Project description – Construction).

This transport assessment

The Secretary's Environmental Assessment Requirements (SEARs) issued on 16 July 2020 by the NSW Department of Planning, Industry and Environment (DPIE) and Commonwealth requirements

issued on 29 January 2020 requires a transport impact assessment to support the Environmental Impact Statement being prepared for the project. This transport technical paper addresses the relevant transport requirements in the SEARs as well as the Commonwealth requirements. It provides an assessment of the forecast transport impacts on the surrounding transport network during the construction and operational stages of the project.

This assessment considered three key project scenarios: the peak year of construction (2023/2024) and two future operational scenarios (2026 at opening and 2036, 10 years after opening). The peak year of construction for the sites in and around Western Sydney International is expected to occur in 2024, while the remaining sites are expected to reach peak construction traffic during 2023. Cumulative construction and operational scenarios were also assessed to capture the cumulative impacts that may result from the project occurring alongside other projects. Appropriate performance outcomes and mitigation measures were identified, as required, to manage the potential impacts.

Transport assessment methodology

The study area for the transport assessment was determined based on the potential impacts of the project on the existing and future road and public transport network during the construction and operation phases. It includes intersections and road links likely to be affected by the project including the alignment, construction site locations, proposed station precincts and transport interchange infrastructure within the study area.

Transport data for 2019 was reviewed to establish a baseline dataset for the existing transport environment in the study area. Forecast traffic volumes for the 2023/2024 without project construction traffic scenario and the 2026 and 2036 future year without project scenarios were determined from the WestConnex Road Toll Model (WRTM) outputs developed for the Environmental Impact Statement for the future M12 Motorway project. The modelling outputs prepared for the Environmental Impact Statement for the future M12 Motorway were used to ensure cumulative impacts from the operation of the project along with other major projects such as the future M12 Motorway, Western Sydney International, as well as other road upgrade projects were considered in the assessment.

Assumptions adopted for the Environmental Impact Statement and outlined in Chapter 7 (Project description – operation) and Chapter 8 (Project description - construction) of the Environmental Impact Statement informed the construction traffic routes, construction traffic movement forecasts and distribution of construction traffic for each construction site. However, these routes are indicative and subject to further refinement and would be confirmed through the preparation of Construction Traffic Management Plans (CTMPs). A qualitative assessment of the construction impacts on the walking, cycling and public transport networks was also undertaken at each construction site.

Traffic likely to be generated by the project during the 2026 and 2036 future year with project scenarios at each station precinct was obtained from patronage forecast outputs provided by Sydney Metro. These volumes, in combination with background growth, were used to identify potential impacts during future operational years. This assessment also incorporated proposed road network upgrades in the area, based on publicly available information at the time of this assessment, and future bus services proposed in the study area. A qualitative review of pedestrian and cycling facilities and public transport access to and from each station precinct, and the proposed transport interchange facilities, was also considered.

A cumulative construction assessment considered the cumulative impacts from construction of the project, Western Sydney International and the future M12 Motorway. The operational assessment completed for 2026 and 2036 considered the impact of the future M12 motorway, Western Sydney International and other infrastructure and road upgrades described in Section 2.4.4.

The assessment of the intersection performance during the peak construction scenario in 2023/2024, the operational performance in 2026 and 2036 and the cumulative scenarios was undertaken using SIDRA INTERSECTION (version 8).

Potential construction impacts

During the peak year of construction (2023/2024 with project construction traffic), construction vehicle movements, particularly heavy vehicle movements, may temporarily affect the surrounding road network. The construction of the project is expected to occur concurrently with the future M12 Motorway project, with the peak for the M12 Motorway project forecast to occur in 2024. The

combined construction impact of the two projects is anticipated to be amplified where the projects affect the same intersections.

The transport impact assessment indicated that during 2023/2024 without project construction traffic scenario, sections of the assessed road network are forecast to operate at or above the theoretical capacity due to the increase in background traffic demand along key corridors of the road network. The addition of project related construction traffic would further impact on intersections within the road network. However, the project alone is not likely to have significant impacts on network performance.

Road network adjustments including road network modifications, road closures and/or diversions are required to enable the construction activities and allow construction vehicles to safely enter and exit construction sites. Other road network adjustments in the form of traffic signal works are proposed to facilitate construction vehicle access to construction sites and ensure the safe operation of the existing transport network. New intersection upgrades are required at Kent Road, Luddenham Road and Badgerys Creek Road. Localised network modifications are also required on Harris Street, Gipps Street, Kent Road, Lansdown Road, Luddenham Road and Derwent Road. As part of further design development and construction planning the requirement for these roads modifications would be further refined.

The construction of the project may require temporary traffic arrangements, cyclist and/or pedestrian diversions, road occupation, temporary road closures and temporary changes to speed limits to accommodate the project's construction traffic. However, it is not likely that there would be a significant impact on network performance as a result of these activities given their localised and short-term nature.

Construction activities within the St Marys precinct would result in some on-street parking being intermittently or permanently unavailable. The temporary and permanent removal of some off-street car parking facilities is also expected to be required as part of the construction activities at the St Marys Station precinct. However, parking surveys undertaken in the St Marys precinct have demonstrated there is spare capacity within other existing on-street and off-street parking locations within 400 m of the affected parking spaces. The existing multi-level commuter car park located at Harris Street would be retained and expanded to include two additional levels of commuter parking spaces (subject to a separate approval), further providing additional parking capacity and minimising the project construction impacts within the precinct. It is also noted that the construction footprint at St Marys Station is designed to minimise and reduce impacts on the existing road network during construction.

Potential operational impacts

The project would integrate with the existing transport facilities at St Marys Station, with rail-to-rail transfer expected to occur between the project and the T1 Western Line. Assessment of the capacity of the T1 Western Line at St Marys indicates that there is enough capacity to accommodate the forecast project transfers. However, it is also expected that there would be a need to increase the frequency of the T1 Western line in the future, even without the project. Station pedestrian and interchange modelling undertaken at St Marys Station indicates that no capacity constraints to entry/exit and transferring customers are expected in 2036, with all required performance criteria met in the future operational years.

Projected future traffic growth in the study area is forecast to be mainly from Western Sydney International, the future M12 Motorway and surrounding urban development, rather than the project. The additional road-based traffic, including park and ride, kiss and ride, point to point and bus movements forecast to be generated by the project is minimal compared to the forecast background traffic growth. It is also expected that the project may likely shift a part of the Western Sydney International customers and staff off the road, who would have otherwise used other modes of transport to get to the airport.

Given the surrounding road network upgrades in 2026 and 2036, the operational scenarios with the project are forecast to perform satisfactorily along the main transport corridors, including Mamre Road, Luddenham Road, Elizabeth Drive and The Northern Road. However, intersections north of the M4 Western Motorway around St Marys are forecast to operate with significant delays and limited capacity as a result of the forecast background traffic growth in the future years. Improvements to the

performance of these intersections is considered to be required to support the forecast population and employment growths as the Western Parkland City develops.

Permanent transport network upgrades would be required to facilitate access to the station precincts. In the St Marys precinct, some changes to the local road network would be required such as changing access arrangements, establishing traffic calming measures and providing new pedestrian access points. New signalised intersections are required to facilitate access to all other station precincts. These include the upgrade of the intersection of Kent Road/Lansdowne Road and a new signalised intersection at Kent Road/new precinct street in Orchard Hills, two new precinct street intersections on Luddenham Road, and a new signalised intersection at Badgerys Creek Road. Access to the on-airport stations within Western Sydney International would be provided by others as part of the development of Western Sydney International. As part of further design development the transport network upgrade requirements would be further refined.

Walking, cycling and public transport infrastructure were considered in the development of the proposed station precincts. All off-airport station precincts would include potential for transport interchange, facilitating connectivity with any future pedestrian, cycling and public transport networks, and providing opportunities for integration with future land uses and infrastructure. At the on-airport stations, walking and cycling networks would be developed as part of Western Sydney International, with bicycle parking proposed at Airport Business Park Station.

Environmental management

The Construction Traffic Management Framework (CTMF) contained in Appendix G of the Environmental Impact Statement, outlines the approach to construction traffic and transport management for the project to ensure the staging and movement of construction traffic is adequately managed. The framework would provide the overall strategy and approach for construction traffic management for the project and would be used as a basis for the development of the CTMPs for each of the proposed construction sites.

The CTMF also requires the establishment of a Transport Liaison Group (TTLG), which aims to coordinate, manage and minimise transport impacts during construction. The development of the traffic management measures would be carried out in consultation with the Traffic Control Group, TTLG, TfNSW, Sydney Coordination Office and other stakeholders. Consultation would also be carried out with affected community members in accordance with the Overarching Community Communication Strategy (Appendix C of the Environmental Impact Statement), to communicate potential impacts of the project. The project would ensure that the local community and road users are kept informed about construction activities and potential delays within the study area.

The project would meet the following transport performance outcomes to minimise potential construction and operational transport impacts:

- safe and efficient routes are provided for pedestrians, cyclists and road users at/near construction sites
- access to the existing St Marys Station is maintained while train services are operating
- safe access to properties and businesses is maintained during construction, unless alternatives are agreed with property owners and businesses
- heavy vehicles access the arterial network as soon as practicable on route to, and immediately after leaving, a construction site
- the local community and relevant authorities are informed of transport, access and parking changes/impacts to minimise inconvenience to the public
- safe and efficient interchanges are provided between transport modes
- transport interchange facilities provided at station precincts are designed in accordance with the modal access hierarchy
- each station and station plaza is provided with sufficient customer capacity to achieve a minimum Fruin's Level of Service C (for 2056 demand)

- stations and interchanges are fully accessible and compliant with the Disability Discrimination Act 1992 (Cth) and the Disability Standards for Accessible Public Transport (Australian Government, 2002)
- the project is designed to be compatible with existing infrastructure and future transport corridors.

Mitigation measures have been developed to ensure the potential construction and operational impacts of the project on the surrounding road network are managed and minimised.

1 Introduction

1.1 Project context and overview

The *Greater Sydney Region Plan* (Greater Sydney Commission, 2018a) sets the vision and strategy for Greater Sydney to become a global metropolis of three unique and connected cities; the Eastern Harbour City, the Central River City and the Western Parkland City. The Western Parkland City incorporates the future Western Sydney International (Nancy-Bird Walton) Airport (hereafter referred to as Western Sydney International) and Western Sydney Aerotropolis (hereafter referred to as the Aerotropolis).

Sydney Metro – Western Sydney Airport (the project) (see Figure 1-1) is identified in the Greater Sydney Region Plan as a key element to delivering an integrated transport system for the Western Parkland City. The project would be located within the Penrith and Liverpool local government areas (LGAs) and would involve the construction and operation of a new metro railway line around 23 kilometres in length between the T1 Western Line at St Marys in the north and the Aerotropolis in the south. This would include a section of the alignment which passes through and provides access to Western Sydney International.

The project is characterised into components that are located outside Western Sydney International (off-airport) and components that are located within Western Sydney International (on-airport), to align with their different planning approval pathways required under State and Commonwealth legislation.

1.2 Key project features

Key operational features of the project are shown on Figure 1-1 and would include:

- around 4.3 kilometres of twin rail tunnels (generally located side by side) between St Marys (the northern extent of the project) and Orchard Hills
- a cut-and-cover tunnel around 350 metres long (including tunnel portal), transitioning to an in-cutting rail alignment south of the M4 Western Motorway at Orchard Hills
- around 10 kilometres of rail alignment between Orchard Hills and Western Sydney International, consisting of a combination of viaduct and surface rail alignment
- around two kilometres of surface rail alignment within Western Sydney International
- around 3.3 kilometres of twin rail tunnels (including tunnel portal) within Western Sydney International
- around three kilometres of twin rail tunnels between Western Sydney International and the Aerotropolis Core
- six new metro stations:
 - four off-airport stations:
 - St Marys (providing interchange with the T1 Western Line)
 - Orchard Hills
 - Luddenham Road
 - Aerotropolis Core
 - two on-airport stations:
 - Airport Business Park
 - Airport Terminal

- grade separation of the track alignment at key locations including:
 - where the alignment interfaces with existing infrastructure such as the Great Western Highway, M4 Western Motorway, Lansdowne Road, Patons Lane, the pipelines, Luddenham Road, the future M12 Motorway, Elizabeth Drive, Derwent Road and Badgerys Creek Road
 - crossings of Blaxland Creek, Cosgroves Creek, Badgerys Creek and other small waterways to provide flood immunity for the project
- modifications to the existing Sydney Trains station and rail infrastructure at St Marys (where required) to support interchange and customer transfer between the new metro station and the T1 Western Line
- a stabling and maintenance facility and operational control centre located to the south of Blaxland Creek and east of the proposed metro track
- new pedestrian, cycle, park-and-ride and kiss-and-ride facilities, public transport interchange infrastructure, road infrastructure and landscaping as part of the station precincts.

The project would also include:

- turnback track arrangements (turnbacks) at St Marys and Aerotropolis Core to allow trains to turn back and run in the opposite direction
- additional track stubs to the east of St Marys Station and south of the Aerotropolis Core Station to allow for potential future extension of the line to the north and south respectively without impacting future metro operations
- an integrated tunnel ventilation system including services facilities at Claremont Meadows and at Bringelly
- all operational systems and infrastructure such as crossovers, rail sidings, signalling, communications, overhead wiring, power supply, lighting, fencing, security and access tracks/paths
- retaining walls at required locations along the alignment
- environmental protection measures such as noise barriers (if required), on-site water detention, water quality treatment basins and other drainage works.

1.2.1 Off-airport project components

The off-airport components of the project would include the track alignment and associated operational systems and infrastructure north and south of Western Sydney International, four metro stations, the stabling and maintenance facility, two service facilities and a tunnel portal.

1.2.2 On-airport project components

The on-airport components of the project would include the track alignment and associated operational systems and infrastructure within Western Sydney International, two metro stations and a tunnel portal.

The key project features and the design development process are described in more detail in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

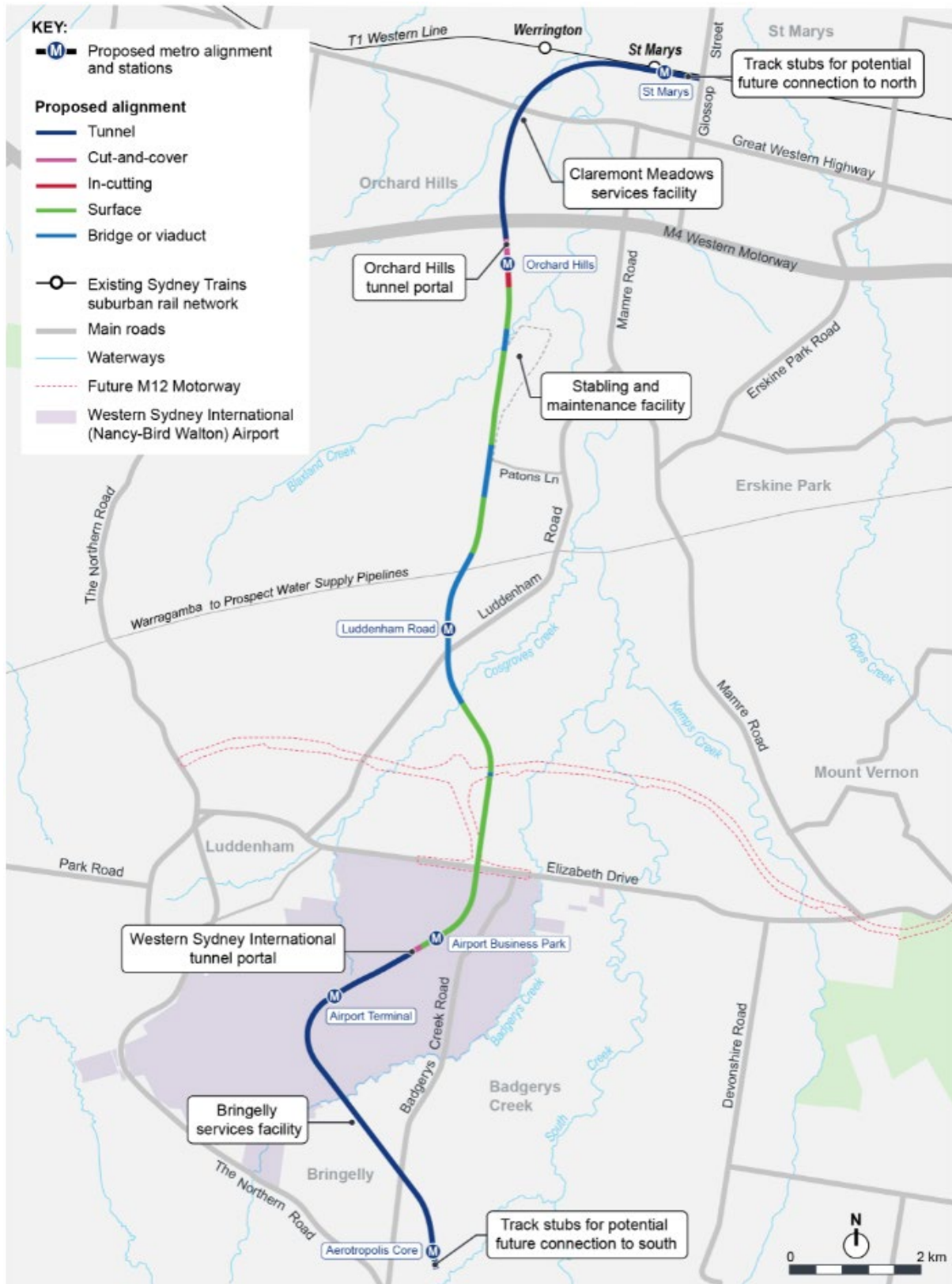


Figure 1-1 Project alignment and key features

1.3 Project construction

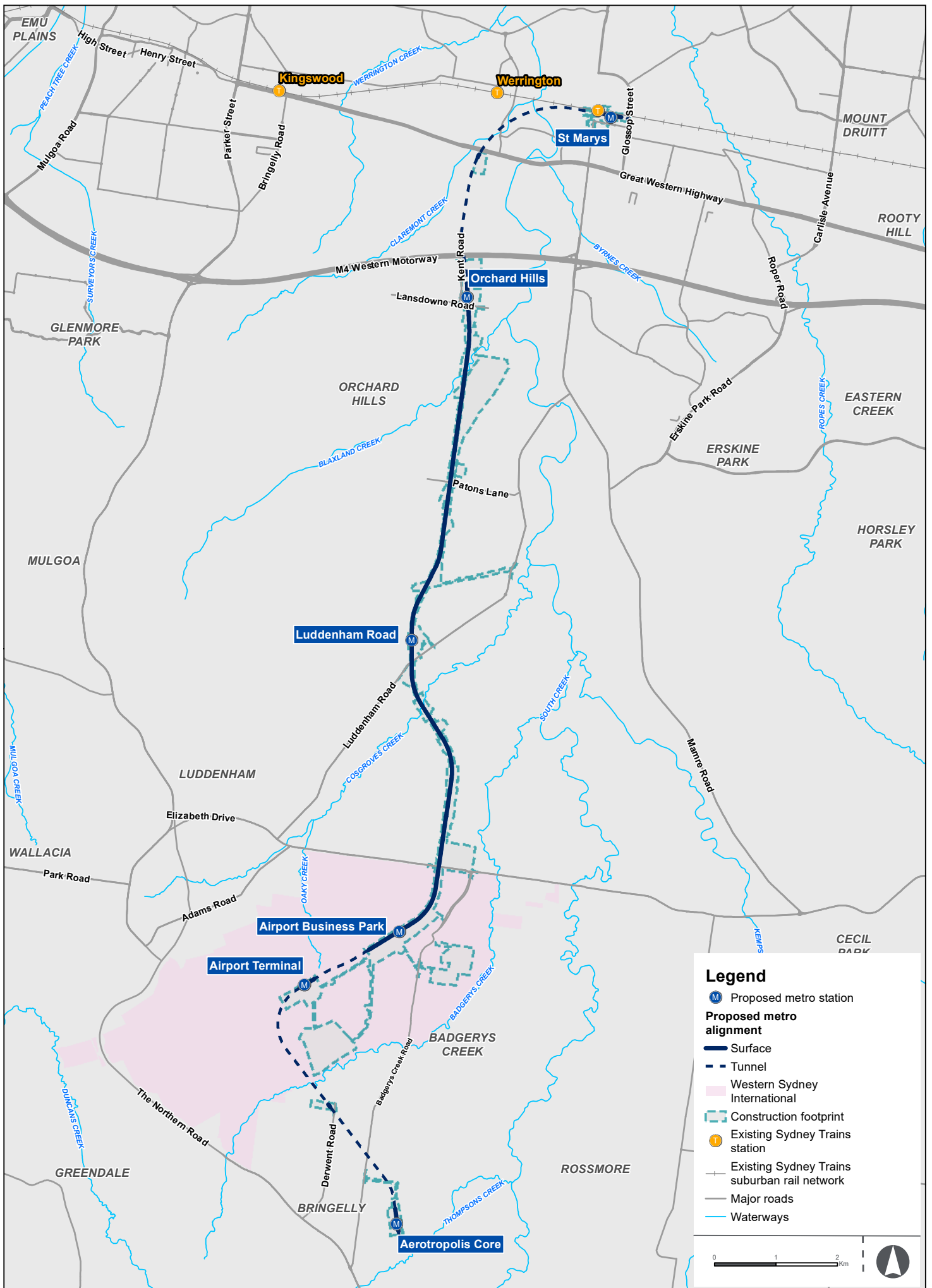
Construction of the project would involve the following key stages:

- enabling works
- main construction works, including:
 - tunnelling and associated works
 - corridor and associated works
 - stations and associated works
 - ancillary facilities and associated works
 - construction of ancillary infrastructure including the stabling and maintenance facility
- rail systems fitout
- finishing works and testing and commissioning.

These activities are described in more detail in Chapter 8 (Project description – construction) of the Environmental Impact Statement.

The construction footprint for the project is shown on Figure 1-2.

Construction of the project is expected to commence in 2021, subject to planning approval, and take around five years to complete. An overview of the construction program is included in Chapter 8 (Project description – construction) of the Environmental Impact Statement.



Construction footprint overview

Figure 1-2

Indicative only, subject to design development

1.4 Purpose of this technical paper

This technical paper, Technical Paper 1 (Transport), is one of a number of technical documents that forms part of the Environmental Impact Statement. The purpose of this technical paper is to provide a transport assessment which addresses the requirements outlined in Section 1.4.1. The technical paper provides an assessment of the forecast impacts of the project on the surrounding transport network, with special consideration for the peak construction scenario, as well as two future operational scenarios. Section 1.4.2 provides an overview of the structure of this technical paper.

1.4.1 Assessment requirements

The Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning, Industry and Environment (DPIE), relating to traffic and transport and where these requirements are addressed in this technical paper, are outlined respectively in Table 1-1.

Table 1-1 Secretary's Environmental Assessment Requirements

SEARs requirements	Where addressed in this document
17. Transport and Traffic	
1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	
a. Commitments made in Section 8.2.3 of the Scoping Report	
1. determination of transport impacts during construction phases of the project, including traffic, on-street parking impacts, bus operations, spoil movements, pedestrians, park & ride facilities and active transport	1. transport impacts during the construction phases are discussed in Section 4.2 for off-airport impacts and in Section 4.3 for on-airport impacts
2. assessment of construction impacts of the project on the surrounding road network for a peak construction year (2023/2024). This would include SIDRA intersection modelling at key existing intersections around the proposed construction sites during the AM and PM peak hours during weekday	2. assessment of construction impacts of the project on the surrounding road network during the peak period is discussed in Section 4.2.1 for off-airport and Section 4.3.1 for on-airport
3. identification of the need to close, divert or reconfigure the road network to facilitate the construction of the project	3. the need to close, divert or reconfigure the road network is discussed in Section 4.2
4. assessment of cumulative impacts of the construction of the project with other major infrastructure projects in the study area.	4. assessment of cumulative impacts is outlined in Section 6.
b. Private property access; and	b. Private property access impacts are discussed in Section 4.2.5.
c. construction worker parking and the availability of public parking in residential and commercial/business districts.	c. construction worker parking and the availability of public parking in residential and commercial/business districts is discussed in Section 4.2.6.

SEARs requirements	Where addressed in this document
17. Transport and Traffic	
2. The Proponent must assess (and model) the operational transport impacts of the project, including:	
a. commitments made in Section 8.2.3 of the Scoping Report; <ol style="list-style-type: none"> determination of future year traffic and transport operating conditions with and without the project e.g. road layouts, kiss and ride facilities, park and ride facilities, connecting public transport (bus) services, pedestrian and cycle links an assessment of the operational impacts of the project on the surrounding road network for two future operational year scenarios including opening year (2026) and future year (2036). This would include SIDRA intersection modelling at key existing intersections around the station precincts and stabling facility during the AM and PM weekday peak hours to determine the level of service (i.e. the effectiveness of those intersections under new traffic conditions) qualitative assessment of cumulative impacts of the operation of the project with other major infrastructure projects in the study area identify pedestrian and cycle network standards to be incorporated into the station precinct design 	<ol style="list-style-type: none"> future year traffic operating conditions are discussed in Section 5.1 for off-airport stations and Section 5.2 for on-airport stations. an assessment of the operational impacts of the project on the surrounding road network for the future operational year scenarios for on-airport environment is discussed in Section 5.3 for 2026 and Section 5.4 for 2036. The off-airport assessment is presented in Section 5.5 for 2026 and Section 5.6 for 2036. assessment of the cumulative operational impacts of the project with other major infrastructure projects in the study area are presented in Section 5.3 to 5.7 and Section 6.3. pedestrian network and cycle infrastructure are discussed in Section 5.1.1.
b. access routes to stations and interchanges and anticipated demand for kiss and ride facilities, active transport facilities and bus services;	b. access routes to stations and interchanges and anticipated demands are discussed in Section 5.1.1 and Section 5.1.2.
c. severance of current and integration of potential future local movement corridors;	c. severance of current and integration of potential future local movement corridors is discussed in Section 5.1.1 and 5.1.2.
d. permanent modification to the existing road network, public transport and active transport facilities; and	d. permanent modification to the existing road network, public transport and walking and cycling facilities is discussed in Section 5.1 to Section 5.7.
e. property and business access and on-street parking in existing commercial, industrial and residential areas.	e. property and business access and on-street parking in existing commercial, industrial and residential areas considered in Section 5.1.2.

The Commonwealth Minister for the Environment has advised that the on-airport components of the project would be assessed based on the provision of preliminary documentation. Further information was requested to guide the assessment of the on-airport components of the project. This information is included in Appendix J (EPBC Act Draft Environmental Impact Assessment of on-airport proposed action (EPBC 2019/8541)) of the Environmental Impact Statement.

1.4.2 Structure of this technical paper

This paper is structured as follows:

- Chapter 1 provides an overview and background context of the project
- Chapter 2 discusses the methodology adopted for the traffic and transport assessment, including key data sources and assumptions
- Chapter 3 establishes the existing transport context in the vicinity of the project, including consideration of the existing road network, public transport features, traffic volumes and historical crash data. This section further provides an overview of the future transport context in relation to transport policy and infrastructure in the study area
- Chapter 4 provides an overview of the impact of the additional construction-related traffic on the study area in the peak year of construction (2023/2024), including consideration of proposed heavy vehicle access and egress construction routes and construction staff movements
- Chapter 5 presents an assessment of the transport impacts of the project during the opening year in 2026 and a future year in 2036
- Chapter 6 provides an assessment of the cumulative impacts due to the project and two major transport projects; the future M12 Motorway and Western Sydney International
- Chapter 7 identifies the environmental management framework, performance outcomes and mitigation measures
- Chapter 8 provides a conclusion of the transport assessment
- Chapter 9 provides a list of references used for this technical paper.

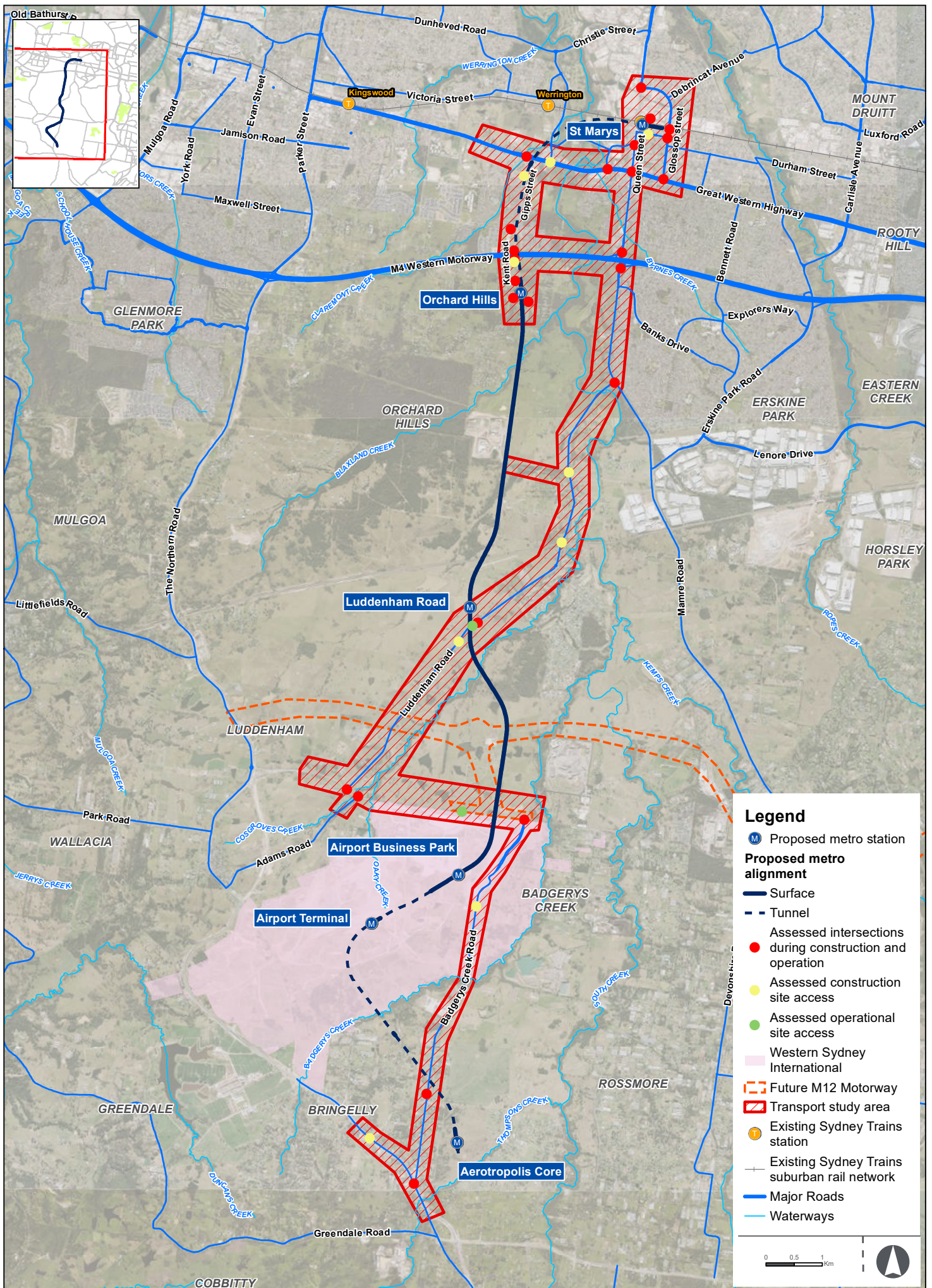
1.5 Study area

The project extends from the existing Sydney Trains station at St Marys in the north, and to the south-east of Badgerys Creek Road in Bringelly in the south.

The project alignment is located within Penrith and Liverpool LGAs and passes through the following suburbs: St Marys, Claremont Meadows, Orchard Hills, Luddenham, Badgerys Creek and Bringelly. The project is located mostly within greenfield areas of the South West Growth Area and the Western Sydney Aerotropolis.

The project alignment passes through predominantly rural and agricultural land use environments in Orchard Hills, Luddenham, Badgerys Creek and Bringelly, with some urban land uses, including pockets of recent residential development, commercial and industrial land uses around St Marys and Claremont Meadows.

Figure 1-3 shows the extent of the study area for the transport assessment and the road network covered by the project. The study area was determined based on the potential impacts of the project on the existing and future road and public transport network during the construction and operational phases of the project. It includes intersections and road links likely to be affected by the project including the alignment, construction site locations, proposed station precincts and transport interchange infrastructure within the study area.



2 Methodology

2.1 Scope

This technical paper provides an assessment of the potential impacts of the project on transport, traffic and access arrangements within the study area and addresses the relevant assessment requirements of the SEARs (see Section 1.4). The scope of this technical paper includes the following:

- assessment of the existing traffic and transport conditions in the study area
- assessment of the potential traffic generation caused by the construction and operational stages of the project
- assessment of the potential impact of the project on transport modes in the study area during both the construction and operation of the project.

Potential transport impacts during the construction phase include consideration for impacts on traffic, on-street parking, bus operations, pedestrians, park and ride facilities and walking and cycling at or around proposed construction sites. The construction assessment focusses on the peak construction year (2023/2024) and assesses the overall impact on the major arterial road network in the study area.

The operational assessment of the project was undertaken for the opening year (2026), as well as a future year (2036). The operational impacts include consideration of potential impacts on the road network, public transport network and walking and cycling networks surrounding the station precincts and stabling facility.

The project scope further includes an assessment of the potential impacts in combination with other major projects in the vicinity of the project and identifying mitigation measures to manage potential impacts associated with these cumulative impacts, as required.

The road-based impacts of the project on the surrounding road network during the peak construction year (2023/2024) and the 2026 and 2036 future operational years, as well as during the cumulative construction scenario were assessed using SIDRA INTERSECTION 8, a computer-based modelling package that calculates intersection performance.

2.2 Data sources

The following data was used to inform this transport assessment:

- aerial photography and other GIS mapping information
- site observations collected during a site visit conducted during June 2019
- intersection turning movement counts, undertaken during June 2019, between 6:00 am and 9:00 am and 4:00 pm and 7:00 pm
- mid-block traffic counts over a seven-day period during June 2019
- car parking surveys undertaken within the St Marys precinct during a typical weekday and weekend during the first week of December 2019
- crash data provided by TfNSW for state and local authority-controlled roads within the study area for a five-year period from 2013
- construction information for the proposed construction sites required to support the project including construction traffic numbers and access, work hours and workforce numbers (as detailed in Chapter 8 (Project description – construction) of the Environmental Impact Statement)
- strategic travel demand model (WestConnex Road Toll Model (WRTM) (v2.1)) outputs prepared for the Environmental Impact Statement for the future M12 Motorway project, provided by TfNSW in July 2019. The WRTM model considers all other future projects in the area, in addition to the future M12 Motorway project as detailed in Section 2.4.3. These outputs were used to estimate the future background traffic within the study area for the peak year of construction (2023/2024),

the opening year (2026) and the future year (2036). More details on the WRTM model is included in Section 2.4.2

- operational passenger demand at each station precinct, transport integration and precinct interchange diagrams as outlined in this technical paper and Chapter 7 (Project description – operation) of the Environmental Impact Statement.

2.3 Walking and cycling

A qualitative assessment of the pedestrian and cycling network considered the following aspects of the project:

- review of the existing walking and cycling network conditions to establish a baseline for the study area
- identification of potential impacts to the walking and cycling network during the peak year of construction (2023/2024)
- assessment of the transport interchange provision at station precincts during future operational year scenarios (2026 and 2036).

The assessment of potential impacts to walking and cycling during the construction and operational scenarios was carried out based on construction information and operational forecasts prepared at the time of this assessment.

The assessment of potential construction impacts reviewed potential changes to the walking and cycling network due to road closures or diversions and identified mitigation measures required to minimise impacts.

The assessment of potential operational impacts was based on the outputs of the passenger patronage forecast models provided by Sydney Metro in November 2019. The passenger forecasts provided the anticipated mode of arrival/departure from each station, which included the share for walking and cycling transport modes. The passenger patronage forecasts were provided for 2026 and 2036 based on information available at the time of this assessment, including future land use planning projections and the proposed Sydney Principal Bicycle Network (*Future Transport 2056* strategy). The assessment included a review of transport integration at each station and assessment of the potential transport impacts during the operational scenarios.

The assessment also includes a summary of outcomes from the pedestrian and interchange modelling undertaken at St Marys Station in 2036.

2.4 Road-based public transport and general traffic

The transport assessment considered the following aspects of the project:

- review of the current performance of the public transport and road network to establish a baseline within the study area (base year scenario)
- potential construction impacts of the project on the surrounding road network during the peak construction year (2023/2024)
- potential cumulative construction impacts from the project and other major infrastructure projects being delivered in the study area
- potential operational impacts of the project on the surrounding road network during two future operational scenarios: opening year (2026) and future year (2036)
- mitigation measures to manage impacts of the project on the surrounding road network during construction and operation.

The road-based public transport modes are likely to be impacted in the same way as general traffic. Therefore, the traffic assessment considered potential impacts to road-based public transport modes along with general traffic for all scenarios outlined in Section 2.4.1 to 2.4.3. The assessment also reviewed the forecast road-based public transport mode share at the proposed station precincts and its potential impacts on the capacity of the future network.

2.4.1 Base year scenario

It is a standard modelling practice to create base year models that replicate existing traffic conditions before developing any future year scenarios. A network base year peak hour for 2019 was adopted for this assessment. The peak hour was determined based on an assessment of individual intersection peak hours as well as combined peaks for intersections located within the same station precinct to ensure that these peak movements were comparable. Assessment of project impacts based on a combined network peak hour provides a better basis for comparison between the base and future scenarios.

The base year peak hour volumes for each intersection were then compared with the average weekday peak hour volumes based on mid-block traffic counts. This comparison confirmed that the surveyed day was representative of the average weekday traffic flows through each of the study area intersections.

Based on the above, the base year assessments were undertaken for the morning peak hour between 7:30 am and 8:30 am and the evening peak hour between 4:30 pm and 5:30 pm. Base year model assumptions are presented in Section 2.5.1.

2.4.2 Construction scenario

The indicative construction staging for the project discussed in Chapter 8 (Project description – construction) of the Environmental Impact Statement, shows that peak construction activity would occur between late 2023 and mid-2024 given the staged nature of construction works. As such, traffic network peaks were determined for construction sites based on their geographic locations, the interactions between construction sites and background traffic growth expected within each geographical sub-area. The peak year of construction for the sites in and around Western Sydney International is expected to occur in 2024, while the remaining sites are expected to have peak construction traffic movements during 2023. Therefore, the analysis of construction traffic movements has been based on construction traffic movements predicted to occur in 2023 for construction sites located north of Western Sydney International and during 2024 for all other construction sites including the ones within Western Sydney International, to capture the worst-case scenario.

Assessment of the potential transport and traffic impacts during construction considered two scenarios:

- 2023/2024 without project construction traffic
- 2023/2024 with project construction traffic.

The assessment of the 2023/2024 without project construction traffic scenario was informed by outputs from the WRTM modelling prepared for the Environmental Impact Statement for future M12 Motorway project. The forecast background traffic growth during 2023/2024 was estimated using the outputs from the without M12 Motorway scenario in the WRTM model and then added to the base year 2019 traffic volumes. The forecast background traffic growth from the WRTM model does not take into account construction traffic volumes from other projects during 2023/2024.

The construction information used for this assessment is included in Section 2.2 and contained anticipated daily volumes of light and heavy vehicles at each construction site. This information was used to make assumptions regarding the distribution of the estimated construction traffic volumes on the surrounding road network. Light vehicle access was assumed to follow the existing traffic distribution, while heavy vehicle distribution considered construction site locations, proposed spoil haulage routes and the general traffic pattern in the surrounding arterial network. The construction traffic volumes during the construction peak year were determined based on a standard 11-hour work day and were then added onto the 2023/2024 without project construction traffic scenario to obtain the traffic volumes for the 2023/2024 with project construction traffic scenario. Further construction year model assumptions are presented in Section 2.5.2.

Assessment of the potential cumulative construction impacts on the traffic and transport network as a result of the combined impacts of the project and other major projects in the area was also undertaken. Other projects considered in the cumulative impact assessment included the future M12 Motorway, Western Sydney International, The Northern Road upgrade and St Marys Intermodal Facility. Estimated construction volumes and traffic distributions for these projects were sourced from

the respective Environmental Impact Statements. The Environmental Impact Statement for the future M12 Motorway indicates the peak construction scenario for the project occurs in 2024. The Construction Plan for Western Sydney International anticipates peak construction activity for the project to occur in year 2022 and 2023. However, this assessment assumes peak construction activity for all projects occurs at the same time. As a result, the cumulative construction assessment presented in this technical paper represents a worst-case scenario.

Construction impacts included an assessment of temporary diversions or road closures required as part of the construction works, in addition to pedestrians, cyclists, public transport, pick up/drop off facilities and private property access directly impacted by the project. On-street and off-street parking facilities directly impacted by the project were also assessed. The assessment highlighted the need to temporarily or permanently remove parking, with an assessment of available car parking spaces within the precincts and identification of mitigations required as part of the project impacts.

2.4.3 Operational scenario

Assessment of the potential transport impacts during the future operational years of the project was carried out using a similar methodology to the assessment of construction impacts.

The operational impacts were assessed at the project opening year in 2026 and 10 years after the opening of the project, to test if the road network surrounding the project continues to operate in a satisfactory manner. The transport impact assessment considered the following future scenarios:

- 2026 future year without the project – includes forecast traffic growth to 2026 with future road upgrades including The Northern Road upgrade, Bringelly Road upgrade, Elizabeth Drive upgrade and Mamre Road upgrade, the future M12 Motorway, as well as the operation of Western Sydney International, with new access locations along Elizabeth Drive
- 2026 future with the project – as per 2026 without the project scenario but includes the traffic associated with the project operating
- 2036 future without the project – includes forecast traffic growth to 2036, in addition to all upgrades assumed in 2026 without the project scenario as well as additional intersection upgrades as per publicly available information at the time of this assessment. This scenario also includes the operation of the M12 Motorway and Western Sydney International
- 2036 future with the project – as per 2036 without the project scenario but includes the traffic associated with the operation of the project.

Similar to the methodology used to assess the construction impacts, the assessment of the future operational years without the project was informed by outputs from the WRTM modelling. TfNSW undertook WRTM model runs without the project being operational, which provided an estimate of private vehicle trips likely to access the study area without the project being operational. It should also be noted that changes in traffic pattern due to the construction of the Elizabeth Drive overpass has been captured as part of the WRTM modelling undertaken for the future M12 Motorway project. The impact assessment completed as part of this EIS, therefore, considered the new configuration of Elizabeth Drive at-grade, as modelled by the M12 Motorway project. The traffic growth predicted from the WRTM model for both future operational years, 2026 and 2036, was estimated and used to determine the future year base traffic volumes without the project. These volumes were then used to assess the 2026 and 2036 future year without the project scenarios. Further operational model assumptions are presented in Section 2.5.3.

For the future operational years with the project, the traffic volume forecasts were informed by the outputs from the WRTM modelling prepared for the future M12 Motorway project. These WRTM model runs included the project being operational during both 2026 and 2036 and therefore, considers the broader mode-shift from private transport to the project during the future operational years. The traffic growth predicted from the WRTM model with the project, for both future operational years, 2026 and 2036, were estimated and used to determine the future year base traffic volumes with the project. In addition, anticipated station access and egress trips for different transport modes at each station were then added to the future year base volumes to determine operational traffic volumes for the future operational scenarios with the project.

The distribution of light vehicles arriving and departing at each station precinct was guided by the existing traffic distribution, precinct location, proposed future developments and the proposed location of transport facilities. These road-based traffic volumes included park and ride, kiss and ride, point to point services and bus movements. Precinct interchange diagrams, transport integration and passenger operational demand at each station precinct are contained in Sections 5.1 and 5.2.

The transport operational assessment includes a summary of the future operational performance of St Marys Station as a result of the forecast rail-to-rail transfers. The assessment also includes the integration of the project with the proposed station precincts at other locations along the project. The walking and cycling facilities proposed by others at all the station precinct surrounding the project in 2026 and 2036 were reviewed to ensure safe and efficient integration with the pedestrian and cycle facilities proposed within the stations as part of the project.

The assessment of the 2026 and 2036 future year with and without the Project scenarios considers future road upgrades as well as the operation of Western Sydney International, future M12 Motorway project and other projects within the transport study area, as described in Section 2.4.4. As a result, this assessment also represents the cumulative operational assessment.

2.4.4 WRTM Model

Transport modelling for the Environmental Impact Assessment for the M12 Motorway project was carried out by TfNSW using a combination of different transport models. The future forecasts in travel demand from the Sydney Strategic Travel Model (STM) were extracted based on land use transport network inputs and land use assumptions. The assumptions in the model included the following:

- the demands of Western Sydney International, population and employment projections
- the construction of the proposed Western Sydney Freight Line
- the provision of rapid bus services from the metropolitan centres of Penrith, Liverpool and Campbelltown to Western Sydney International by 2026
- the opening of the project by 2026.

The WRTM then used these forecast numbers (car and heavy vehicles) from the STM to forecast future traffic volumes and induced traffic demand for the years 2026 and 2036. The WRTM model refines the traffic predicted to occur from the operation of Western Sydney International, anticipates future road infrastructure projects and considers driver behaviour, including patronage of toll roads. The forecast traffic growth during the future operational years 2026 and 2036 were based on the Land Use projections released by TfNSW in 2014 (LU14 standard land use scenario) as well as the operation of the Western Sydney International and the business park.

The assessment of the project was based on these WRTM outputs prepared for the Environmental Impact Statement for the future M12 Motorway project obtained from TfNSW in July 2019, as this was the data available at the time of the assessment.

Changes to the transport network for the 2026 and 2036 forecast year included in the WRTM model developed for the future M12 Motorway Environmental Impact Statement are outlined in Table 2-1.

Table 2-1 Changes to the transport network during the future years 2026 and 2036

Changes	2026 future year	2036 future year
Road network	<p>The following road projects are assumed to be in place during 2026:</p> <ul style="list-style-type: none"> • M12 Motorway: under investigation • Bringelly Road upgrade: under construction • The Northern Road upgrade: under construction • Elizabeth Drive upgrade (intersection upgrades only): under investigation. 	<p>The following road projects are assumed to be in place by 2036 in addition to the ones included in 2026 scenario:</p> <ul style="list-style-type: none"> • Elizabeth Drive upgrade (M7 Motorway to The Northern Road): under investigation • Mamre Road and Devonshire Road realignment: under investigation • Luddenham Road and Adams road realignment: under investigation

Changes	2026 future year	2036 future year
		<ul style="list-style-type: none"> The M7 Motorway upgrade: identified through traffic modelling as required to meet forecast demands Cowpasture Road Upgrade: under investigation Fifteenth Avenue Upgrade: under investigation.
Public transport network	The project, between Western Sydney International and St Marys	Extension of the project to Macarthur
Pedestrian and cycle network	The following pedestrian and cycle network changes are assumed during 2026 and 2036: <ul style="list-style-type: none"> Shared user path adjacent to The Northern Road as part of The Northern Road upgrade from Narellan to Penrith Shared user path adjacent to Bringelly Road as part of the Bringelly Road upgrade project between Camden Valley Way and The Northern Road. 	
Parking and access	There are no proposed changes to parking and access assumed.	

Note: The current state of the road, public transport, pedestrian and cycle networks as well as the parking and access upgrades is shown in the table.

Source: Based on the M12 Motorway project EIS

It should further be noted that the future operational year in the 2036 scenario included future road upgrade projects such as the widening of the M7 Motorway and the upgrade of Luddenham Road, which are currently under early stages of investigation but are not committed projects. These projects were included in the modelling as they were considered to be integral to future network operations.

Based on the information available from the WRTM model prepared for the Environmental Impact Statement for the future M12 Motorway project, The Northern Road upgrade and realignment of Badgerys Creek Road, the intersection control types at the key intersections are presented in Table 2-2. These intersections are shown in Figure 1-3.

Table 2-2 Intersection control type at key intersection per scenario

Intersection	Control type per scenario			
	2019 base year	2023/2024 construction peak year	2026 future year	2036 future year
Glossop Street/Forrester Road	signalised	signalised	signalised	signalised
Glossop Street/Harris Street	priority	priority	priority	priority
Glossop Street/Phillip Street	signalised	signalised	signalised	signalised
Queen Street/Charles Hackett Drive	signalised	signalised	signalised	signalised
Glossop Street/Great Western Highway	signalised	signalised	signalised	signalised
Queen Street/Great Western Highway/Mamre Road	signalised	signalised	signalised	signalised
Charles Hackett Drive/Great Western Highway/Pages Road	signalised	signalised	signalised	signalised
Mamre Road/M4 Western Motorway Eastbound Ramp	signalised	signalised	signalised	signalised
Mamre Road/M4 Western Motorway Westbound Ramp	signalised	signalised	signalised	signalised

Intersection	Control type per scenario			
	2019 base year	2023/2024 construction peak year	2026 future year	2036 future year
Great Western Highway/Gipps Street	signalised	signalised	signalised	signalised
Gipps Street/Sunflower Drive	signalised	signalised	signalised	signalised
Kent Road/Caddens Road	signalised	signalised	signalised	signalised
Kent Road/M4 Western Motorway On-ramp	signalised	signalised	signalised	signalised
Kent Road/M4 Western Motorway Off-ramp	signalised	signalised	signalised	signalised
Kent Road/Lansdowne Road	priority	priority	priority ¹	priority ¹
Mamre Road/Luddenham Road	priority	priority	signalised	signalised
Luddenham Road/Elizabeth Drive	priority	priority	signalised ²	signalised ²
Elizabeth Drive/Adams Road	priority	priority		
Elizabeth Drive/Badgerys Creek Road	priority	roundabout	signalised	signalised
Badgerys Creek Road/The Northern Road	roundabout	signalised	signalised	signalised

Notes:

1) The project proposes to upgrade the intersection of Kent Road/Lansdowne Road as a signalised intersection. Therefore, the assessments for with the project scenarios during 2026 and 2036 considers a signalised intersection at this location.

2) The intersections of Luddenham Road/Elizabeth Drive and Elizabeth Drive/Adams Road are combined into a signalised intersection in the future year 2026 and 2036 as per the WRTM model prepared for the future M12 Motorway project.

Intersection control type for the construction site accesses required during the peak year of construction in 2023/2024, the proposed station accesses during the future operational years 2026 and 2036 and proposed intersection upgrades being proposed by the project are presented in Section 4 and Section 6 respectively.

The methodology used for transport assessments is presented in Figure 2-1.

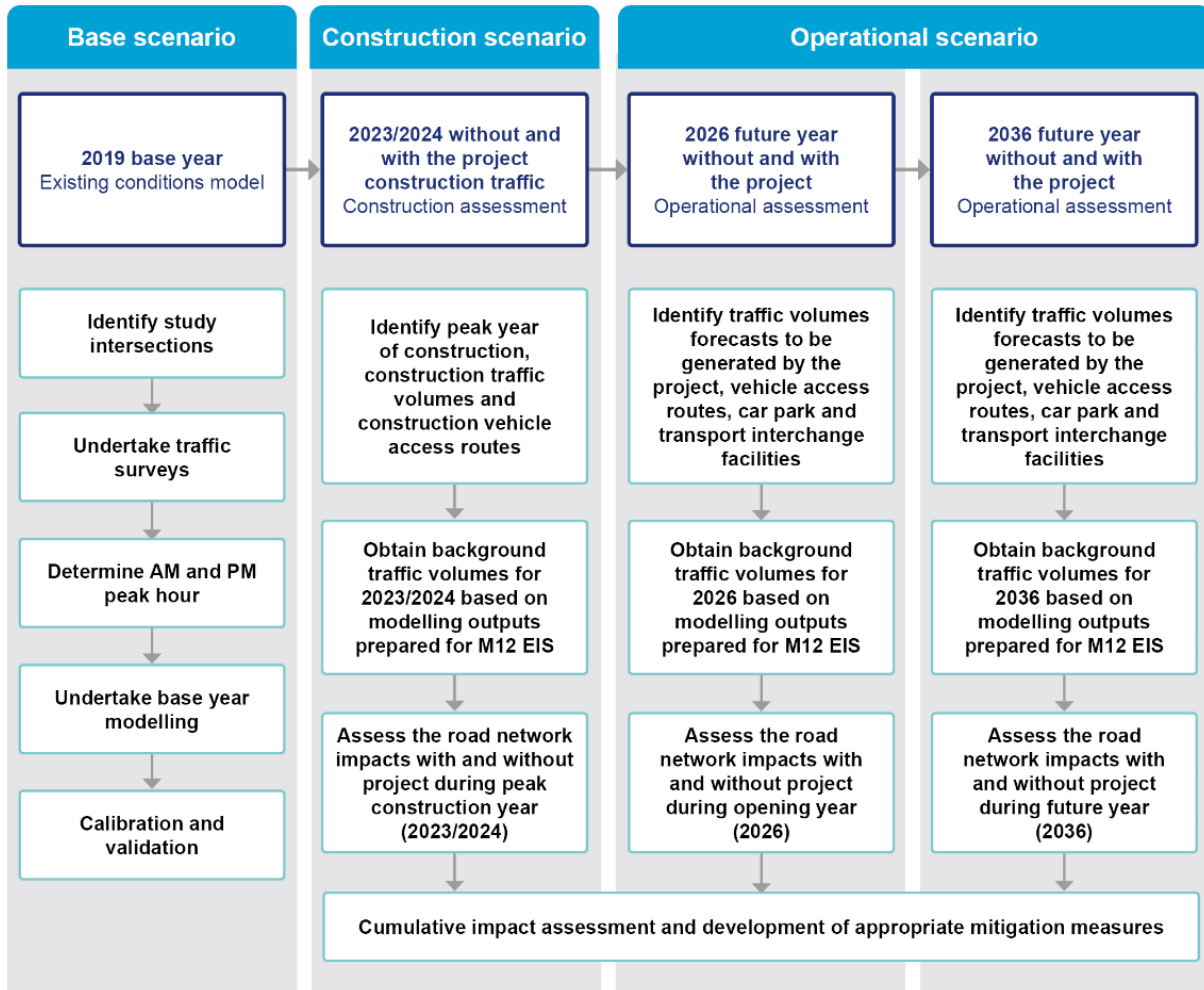


Figure 2-1 Assessment methodology

2.5 Assumptions

The assessment of the base year, peak year of construction and the future operational scenarios were based on the following assumptions:

2.5.1 Base year scenario

- intersection layouts were prepared based on available aerial photography, site observations, Traffic Control Signal (TCS) plans and information from intersection surveys
- signal phasing and timing for signalised intersections was based on intersection traffic signal plans and the Sydney Coordinated Adaptive Traffic System (SCATS) data provided by TfNSW
- intersections were assessed as standalone sites using SIDRA INTERSECTION 8 software
- calibration of the base year models was completed based on available aerial photography, site observations and SCATS data. Queue length observations were used to validate the performance of the base models.

2.5.2 Construction scenario

- the peak construction year of 2023/2024 was determined based on an assessment of the indicative construction staging plan and based on the traffic network peak as per geographical location of the construction site
- it is expected that most of the above ground construction activities including station fit-out works would be carried out during standard construction hours: Monday to Friday from 7:00 am to 6:00

pm, Saturday from 8:00 am to 1:00 pm and no works on Sunday or public holidays. As such, an 11-hour work day was assumed to determine the peak hour construction volumes

- given the scale and complexity of works required for the construction of the project, some works would need to be undertaken outside standard construction working hours, with some activities required to be carried out up to 24 hours per day, seven days per week. Based on the hours of construction activities and peak hours used for the assessments, it is assumed that shift overlap would occur outside of the surrounding road network peak hours. At the construction sites within the airport site, it is anticipated that some construction works would need to be undertaken 24 hours per day for extended periods
- construction site locations, access and routes were based on information included in Chapter 8 (Project description – construction) of the Environmental Impact Statement
- traffic distribution for construction staff was assumed to be consistent with the existing light vehicle distribution in the study area. The heavy vehicle distribution was identified based on construction information included in Chapter 8 (Project description – construction) of the Environmental Impact Statement and general vehicle distribution expected along major roads in the study area. The anticipated light and heavy vehicles have been distributed across the surrounding road network through to the arterial road network
- future intersection layouts follow those identified in the WRTM modelling developed for the M12 Motorway Environmental Impact Statement for the respective future years. Proposed construction site accesses were modelled as stop-controlled intersections
- the cumulative construction impact assessment considers the potential cumulative impacts of the project, the M12 Motorway and Western Sydney International. It is noted that peak construction activities occur in 2024 for the construction of the future M12 Motorway while the peak occurs in year 2022 and 2023 for the construction of Western Sydney International. As such, peak overlap is not likely to occur for the construction of these projects in conjunction with the project. However, for the purposes of a worst-case assessment, the peak construction movements for these projects are assessed together with the project peak.

2.5.3 Operational scenario

Similar assumptions to those outlined for the assessment of the construction peak were assumed for the assessment of the operational scenario, in addition to:

- traffic movements for the 2026 and 2036 future year without project scenarios were informed by outputs from WRTM modelling prepared for the future M12 Motorway project together with the 2019 base year traffic volumes
- future intersection layouts in 2026 and 2036 were based on the proposed future layouts as sourced from the outputs of the WRTM modelling prepared for the M12 Motorway project
- traffic movements for the 2026 and 2036 future year with project scenarios were informed by the outputs from WRTM modelling prepared for the future M12 Motorway project with the project considered operational during both future years. In addition to these base future year volumes, transport integration presented in Sections 5.1 and 5.2 of this technical paper and operational passenger demand by mode at each station, which included park and ride, kiss and ride, point to point services and bus movements was used as a basis to determine the operational traffic numbers
- it was assumed that all approved future road upgrade projects are included in the WRTM modelling prepared for the future M12 Motorway project.

2.6 Assessment criteria

Traffic operational performance can be assessed in several ways, including at a mid-block level, showing the changes in traffic volumes or to travel routes, or at an intersection level, showing changes to the performance of an intersection.

The assessment criteria adopted for this technical paper are outlined in the following sections.

2.6.1 Mid-block performance

The *Austrroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis* provides typical mid-block capacities for urban roads. These are summarised in Table 2-3.

Table 2-3 Typical theoretical mid-block capacities for urban roads with interrupted flows

Type of lane	One-way mid-block capacity (pcu/h) ¹
Median or inner lane	
Divided road	1,000
Undivided road	900
Median lane (of a three-lane carriageway)	
Divided road	900
Undivided road	1,000
Kerb lane	
Adjacent to parking lane	900
Occasional parked vehicles	600
Clearway conditions	900

Source: Table 5.1 of *Austrroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis*
1. Pcu- passenger car unit

As shown in Table 2-3, the mid-block capacity of a road is in the order of 900-1,000 passenger car units (pcus¹) per hour per traffic lane for urban roads (interrupted flows), assuming clearway conditions. These volumes are theoretical capacities for mid-block, with the level of service experienced by drivers, subject to the exact quantum of traffic, which can be influenced by downstream conditions and vehicles queuing back from intersections.

Analysis of mid-block level of service (LOS) was conducted based on criteria set out by the *Austrroads Guide to Traffic Management – Part 3* as summarised in Table 2-4.

Table 2-4 Mid-block level of service criteria

Level of service	Interrupted flow facilities (arterial and collector roads)	Volume to capacity ratio (VCR) range
A	Primarily free flow operations at average travel speeds, usually about 90 per cent of the free flow speed (FFS) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is minimal.	≤ 0.34
B	Reasonably unimpeded operations at average travel speeds, usually about 70 per cent of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted and control delays at signalised intersections are not significant.	0.35 to 0.50
C	Stable operations; however, ability to manoeuvre and change lanes in mid-block locations may be more restricted than at LOS B, and longer queues, adverse signal coordination or both may contribute to lower average travel speeds of about 50 per cent of the FFS for the street class.	0.51 to 0.74

¹ PCU = passenger car unit. This accounts for the amount of road space differing types of vehicles use, with heavy vehicles or buses taking up more space than cars or light commercial vehicles.

Level of service	Interrupted flow facilities (arterial and collector roads)	Volume to capacity ratio (VCR) range
D	A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes or a combination of these factors. Average travel speeds are about 40 per cent of FFS.	0.75 to 0.89
E	Characterised by significant delays and average travel speeds of 33 per cent of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections and inappropriate signal timing.	0.90 to 0.99
F	Characterised by urban street flow at extremely low speeds, typically 25 per cent to 33 per cent of the FFS. Intersection congestion is likely at critical signalised locations, with high delays, high volumes and extensive queuing.	1.0 or greater

Source: Based on Austroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis

2.6.2 Intersection performance

The operation of the key intersections within the study area have been assessed using SIDRA INTERSECTION 8.

The commonly used measure of intersection performance, as defined by TfNSW, is vehicle delay. SIDRA INTERSECTION 8 determines the average delay that vehicles encounter and provides a measure of the LOS.

Table 2-5 shows the criteria that SIDRA INTERSECTION 8 adopts in assessing the LOS.

Table 2-5 SIDRA Intersection level of service criteria

Level of service (LOS)	Average delay per vehicle (secs/veh)	Traffic signals, roundabout	Give way and stop sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

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

3 Existing transport context

3.1 Study area overview

This section outlines the existing transport environment, including the public transport, walking and cycling environments, the traffic conditions and the existing road network performance on the key roads within the study area, outlined in Section 1.5.

3.2 Off-airport existing environment

3.2.1 Land use context

The project alignment travels through the Penrith LGA via St Marys, Claremont Meadows, Orchard Hills, Luddenham and Badgerys Creek. The alignment then crosses the Liverpool LGA through Luddenham, Badgerys Creek and Bringelly.

Land uses in St Marys and Claremont Meadows predominantly consist of low to high density residential areas, mixed land uses and public recreation land uses. Land uses south of the M4 Western Motorway, between Orchard Hills and Bringelly predominantly consist of rural land uses and undeveloped lands.

Chapter 2 (Strategic need and justification) and Chapter 14 (Land use and property) of the Environmental Impact Statement provides further information regarding existing and future land uses in the study area. The integration of the project with land use changes in the Western Parkland City is described in Chapter 3 (Project location and setting) of the Environmental Impact Statement.

For the purposes of describing the land uses associated with the off-airport sections of the project, the alignment was divided into four sections, based on the existing development characteristics or planned land uses, as discussed below. The nature of these existing land uses is expected to change with the development of the town centres and precincts surrounding the new stations as well as future land use planning including the development of the Western Sydney Aerotropolis and the Greater Penrith to Eastern Creek Growth Investigation Area.

St Marys to M4 Western Motorway

St Marys is identified as a strategic centre in the *Western City District Plan* (Greater Sydney Commission, 2018b). St Marys Town Centre is one of the two main retail/commercial centres in the Penrith LGA. The town centre predominantly consists of commercial and retail land uses served by the T1 Western Line and extends south of the Great Western Highway. The T1 Western Line also forms a northern boundary to the town centre, separating the town centre from Dunheved Business Park to the north which is comprised of a mix of industrial premises.

The Queen Street shopping strip forms the central spine of the town centre, with off-street car parking provided to the rear of the shops on both sides of the street. A significant amount of on-street parking also occurs on the streets intersecting with and parallel to Queen Street. The town centre is surrounded primarily by low density residential, education and open space and recreation areas adjacent to South Creek in the west. A mix of low to medium scale multi-residential unit developments are located in the vicinity of the existing Sydney Trains station at St Marys and to the east of the town centre.

Outside of the town centre, land uses transition to a more residential urban setting around the suburbs of Werrington, Claremont Meadows and Caddens. Werrington comprises a mix of educational, institutional, low density residential, industrial, open space and recreation uses interspersed with vacant rural land. Further south, Caddens and Claremont Meadows are residential suburbs bounded by the Great Western Highway to the north, South Creek to the east, the M4 Western Motorway to the south and Kingswood to the west. These suburbs are being developed in stages, with development of Caddens following Claremont Meadows. The developed areas of both suburbs are typical of residential suburbs in western Sydney and are characterised by detached dwellings on relatively small lots.

Patches of bushland and open space are also interspersed with some smaller rural land uses. The Gipps Street landfill site is located between the Great Western Highway and the M4 Western Motorway.

Orchard Hills to the pipelines

Orchard Hills extends from the M4 Western Motorway south to the pipelines. Areas of Orchard Hills north of Blaxland Creek comprise rural lifestyle properties that are typically characterised by large residential dwellings on landscaped lots, including The Vines subdivision. Some small-scale agricultural land uses and patches of bushland are also present, in particular around South Creek and Blaxland Creek.

South of Blaxland Creek, existing land uses transition into generally rural uses combined with rural-residential dwellings, large scale horticultural uses and a waste management facility on Patons Lane at a former quarry site. The rural land uses are traversed by a number of infrastructure elements including the pipelines, a series of high voltage powerline corridors, and Luddenham Road.

Orchard Hills includes the Defence Establishment Orchard Hills which is owned by the Australian Government Department of Defence and is primarily used for munitions storage, maintenance and testing. The site is about 2000 hectares in area and is bounded by The Northern Road to the west and the pipelines to the south.

Luddenham to Elizabeth Drive

This area includes the suburbs of Luddenham, Badgerys Creek and Kemps Creek, located to the north and east of the Western Sydney International site. The land uses in this area predominantly comprise large rural properties with some semi-rural residential properties bordering Luddenham Road within an open, rural landscape. The area also includes a number of agricultural uses including equine and poultry facilities and market gardens. There is a waste management facility on the eastern side of Luddenham Road.

The University of Sydney owns and operates two commercial farms in Badgerys Creek and Kemps Creek that provide agricultural teaching and learning opportunities.

Other land uses along this section of the project alignment include the Twin Creeks residential golf course estate and an existing private airfield located adjacent to the southern side of the pipelines.

A series of vegetated watercourses also run in a generally north-south direction and include South Creek, Badgerys Creek, Cosgroves Creek and Oakey Creek.

Bringelly and Western Sydney Aerotropolis

To the south of Badgerys Creek and Western Sydney International are the suburbs of Bringelly and Rossmore. Existing land uses in this area comprise a mixture of market gardens, rural industries and rural-residential properties. Land use to the west of South Creek is predominantly rural in character with a rural-residential subdivision at Kelvin Park. Bringelly village (located at the intersection of Bringelly Road and The Northern Road) provides local retail facilities. There is also a small neighbourhood centre at Rossmore located north of Bringelly Road, and Rossmore Public School on the south side of Bringelly Road.

Towards the southern end of the project alignment, the site of the Royal Australian Air Force Telecommunications Unit is located on Commonwealth Land. This site is largely vacant with the exception of a single dwelling, some shed structures and scattered vegetation.

3.2.2 Public transport

The study area has generally limited public transport services due to the current low population density and consequent low demand for public transport services. However, the area around St Marys has an extensive public transport network comprising rail and bus services connecting to the surrounding town centres and the Sydney CBD.

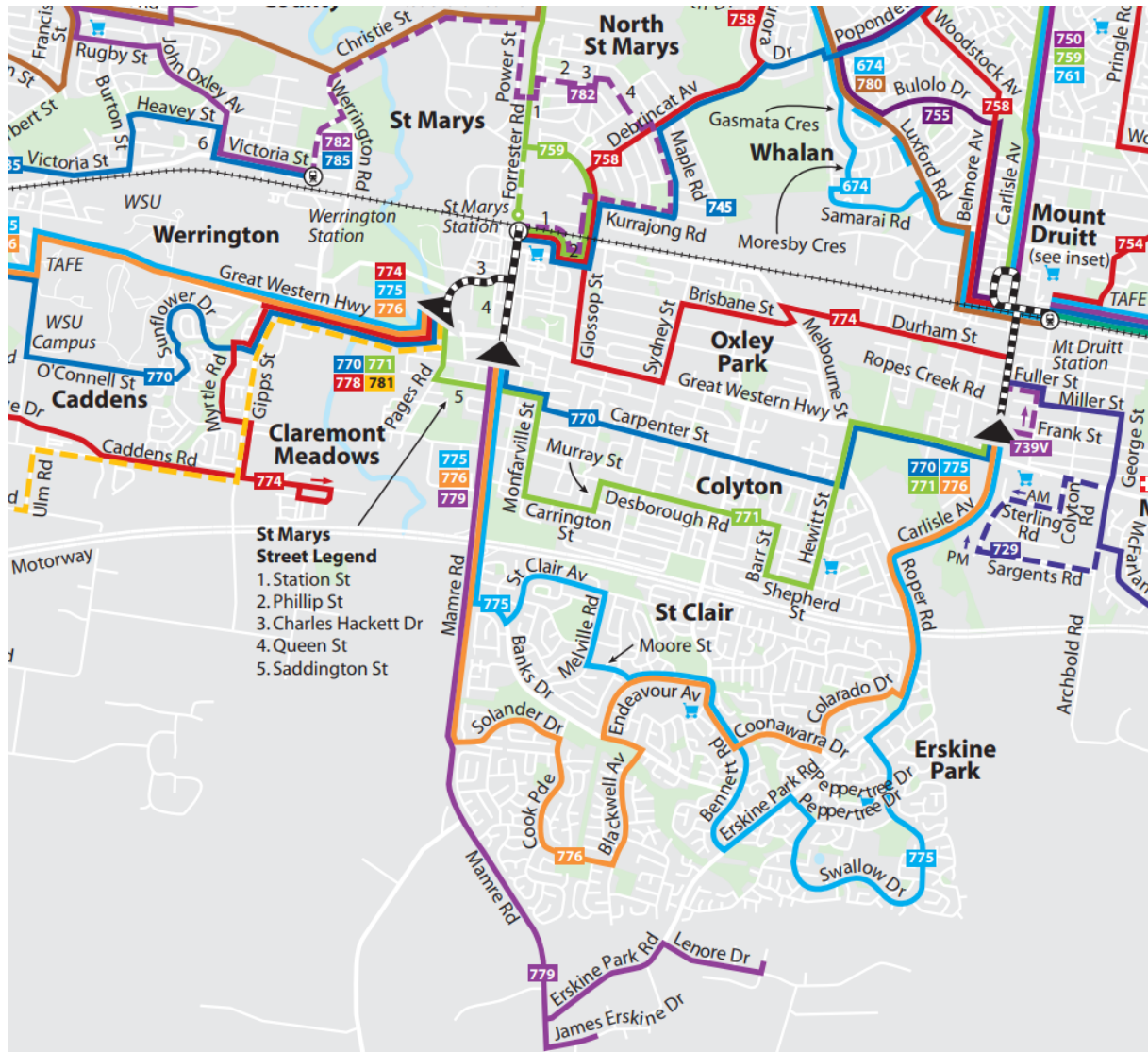
Bus services

The study area is serviced by 15 bus routes as summarised in Table 3-1.

Table 3-1 Bus routes and operators in the study area

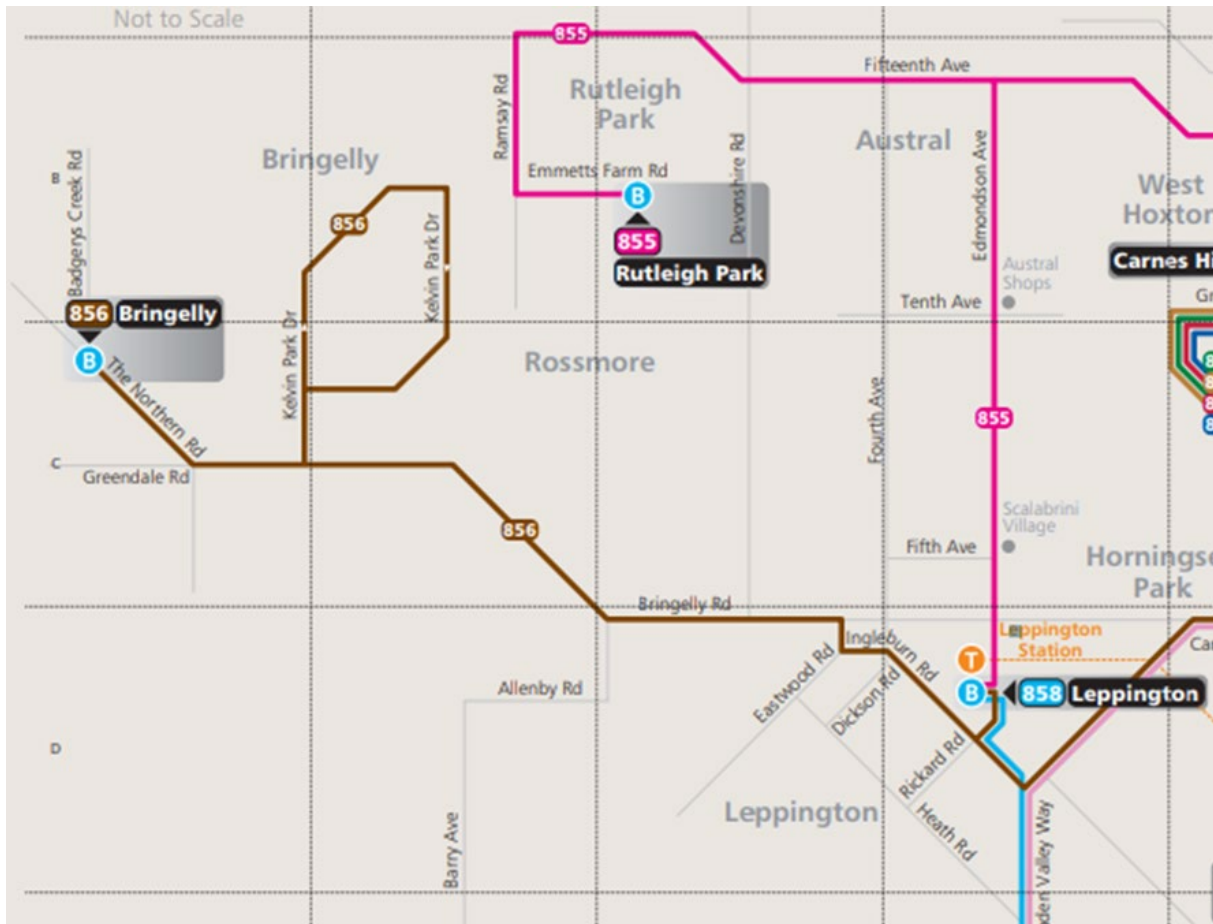
Route	Description	Operator	Key roads along the route
745	St Marys to Norwest Hospital via Stanhope Gardens	Busways	Station Street, Lethbridge Street, Phillip Street, Glossop Street, Gidley Street
758	St Marys to Mount Druitt via Tregear and Shalvey	Busways	Station Street, Lethbridge Street, Phillip Street, Glossop Street, Gidley Street
759	St Marys to Mount Druitt via Ropes Crossing	Busways	Station Street, Lethbridge Street, Phillip Street, Glossop Street, Forrester Road, Gidley Street
770	Mount Druitt to Penrith via St Marys	Busways	Mamre Road, Queen Street, Station Street, Charles Hackett Drive, Great Western Highway
771	St Marys to Mount Druitt via Colyton	Busways	Station Street, Queen Street, Charles Hackett Drive
774	Mount Druitt to Penrith via Nepean Hospital	Busways	Great Western Highway, Glossop Street, Phillip Street, Gidley Street, Station Street, Queen Street, Charles Hackett Drive, Lethbridge Street
775	Mount Druitt to Penrith via Erskine Park	Busways	Great Western Highway, Charles Hackett Drive, Queen Street, Station Street, Mamre Road
776	Mount Druitt to Penrith via St Clair	Busways	Mamre Road, Queen Street, Station Street, Charles Hackett Drive, Great Western Highway
779	St Marys to Erskine Park	Busways	Station Street, Queen Street, Mamre Road
781	St Marys to Penrith via Glenmore Park	Busways	Station Street, Queen Street, Charles Hackett Drive, Great Western Highway, Gipps Street
782	St Marys to Penrith via Werrington	Busways	Station Street, Lethbridge Street, Phillip Street, Glossop Street, Gidley Street
801	Badgerys Creek to Liverpool	Transit Systems	Badgerys Creek Road, Elizabeth Drive
835	University of Western Sydney to Prairiewood	Transit Systems	Great Western Highway, Charles Hackett Drive, Queen Street, Station Street, Lethbridge Street, Phillip Street, Glossop Street, Gidley Street
856	Bringelly to Liverpool	Interline bus services	The Northern Road, Bringelly Road
S11	St Clair to St Marys	Busways	Station Street, Lethbridge Street, Phillip Street, Glossop Street, Gidley Street

These bus routes connect residential areas, community services, schools, retail precincts and transport interchanges, as shown in Figure 3-1 and Figure 3-2. Dedicated school buses also directly service a number of local schools through the St Marys bus interchange.



Source: Busways network maps, Timetable network map, accessed May 2019

Figure 3-1 Existing bus routes servicing St Marys, Claremont Meadows, Erskine Park and Orchard Hills



Source: Interline Bus Services, Network map, accessed May 2019

Figure 3-2 Existing bus routes servicing Bringelly

Bus services operating in the study area primarily provide local coverage and generally operate at low frequency as shown in Table 3-2. In St Marys and Orchard Hills, bus services have an average frequency between 30 minutes and 40 minutes during the morning and evening peaks. Bus routes 782 and S11 service St Marys Station outside of the peak hours. In Bringelly, route 856 runs only once during both peak hours.

Table 3-2 Bus service frequency (number of services) within the study area

Route	Description	Frequency (number of services)	
		Weekday AM (7:00 am – 9:00 am)	Weekday PM (4:00 pm – 6:00 pm)
745	St Marys to Norwest Hospital via Stanhope Gardens	3	2
	Norwest Hospital to St Marys via Stanhope Gardens	2	2
758	St Marys to Mount Druitt via Tregear and Shalvey	4	4
	Mount Druitt to St Marys via Shalvey Tregear	4	3
759	Mount Druitt to St Marys via Ropes Crossing	3	4
	St Marys to Mount Druitt via Ropes Crossing	3	5
770	Penrith to Mount Druitt via St Marys	4	4
	Mount Druitt to Penrith via St Marys	3	4
771	St Marys to Mount Druitt via Colyton	4	5

Route	Description	Frequency (number of services)	
		Weekday AM (7:00 am – 9:00 am)	Weekday PM (4:00 pm – 6:00 pm)
	Mount Druitt to St Marys via Colyton	4	4
774	Penrith to Mount Druitt via Nepean Hospital	4	4
	Mount Druitt to Penrith via Nepean Hospital	3	4
775	Penrith to Mount Druitt via Erskine Park	3	5
	Mount Druitt to Penrith via Erskine Park	4	4
776	Penrith to Mount Druitt via St Clair	5	4
	Mount Druitt to Penrith via St Clair	4	5
779	St Marys to Erskine Park	1	-
	Erskine Park to St Marys	0	4
781	Penrith to St Marys via Glenmore Park	3	1
	St Marys to Penrith via Glenmore Park	2	1
782	Penrith to St Marys via Werrington	-	-
	St Marys to Penrith via Werrington	-	-
801	Liverpool to Badgerys Creek	-	2
	Badgerys Creek to Liverpool	2	-
835	Prairiewood to University of Western Sydney	5	4
	University of Western Sydney to Prairiewood	4	4
856	Liverpool to Bringelly	1	1
	Bringelly to Liverpool	1	1
S11	St Clair to St Marys	-	-

Source: TfNSW, 2019

Rail network

Train lines currently operating within and adjacent to the study area include:

- T1 Western Line – St Marys interchange
- T2 Inner West and Leppington Line – Leppington interchange
- T5 Cumberland Line – Leppington interchange.

Leppington interchange is included as it is adjacent to the study area and the proposed South West Rail Link would connect the project to Leppington Station. The South West Rail Link Extension would lengthen the existing passenger rail line from Leppington Station to the Aerotropolis and providing a direct link to Western Sydney Aerotropolis and the surrounding business areas.

The number of rail services servicing the stations during the AM and PM two-hour peak periods is shown in Table 3-3.

Figure 3-3 shows the existing St Marys and Leppington stations in the context of the Sydney Trains network. Rail services at the existing Sydney Trains station at St Marys and Leppington provide access to the wider rail network with many services provided during the peak periods at good frequencies. In St Marys, rail services operate on average every 10 minutes during both peak periods.

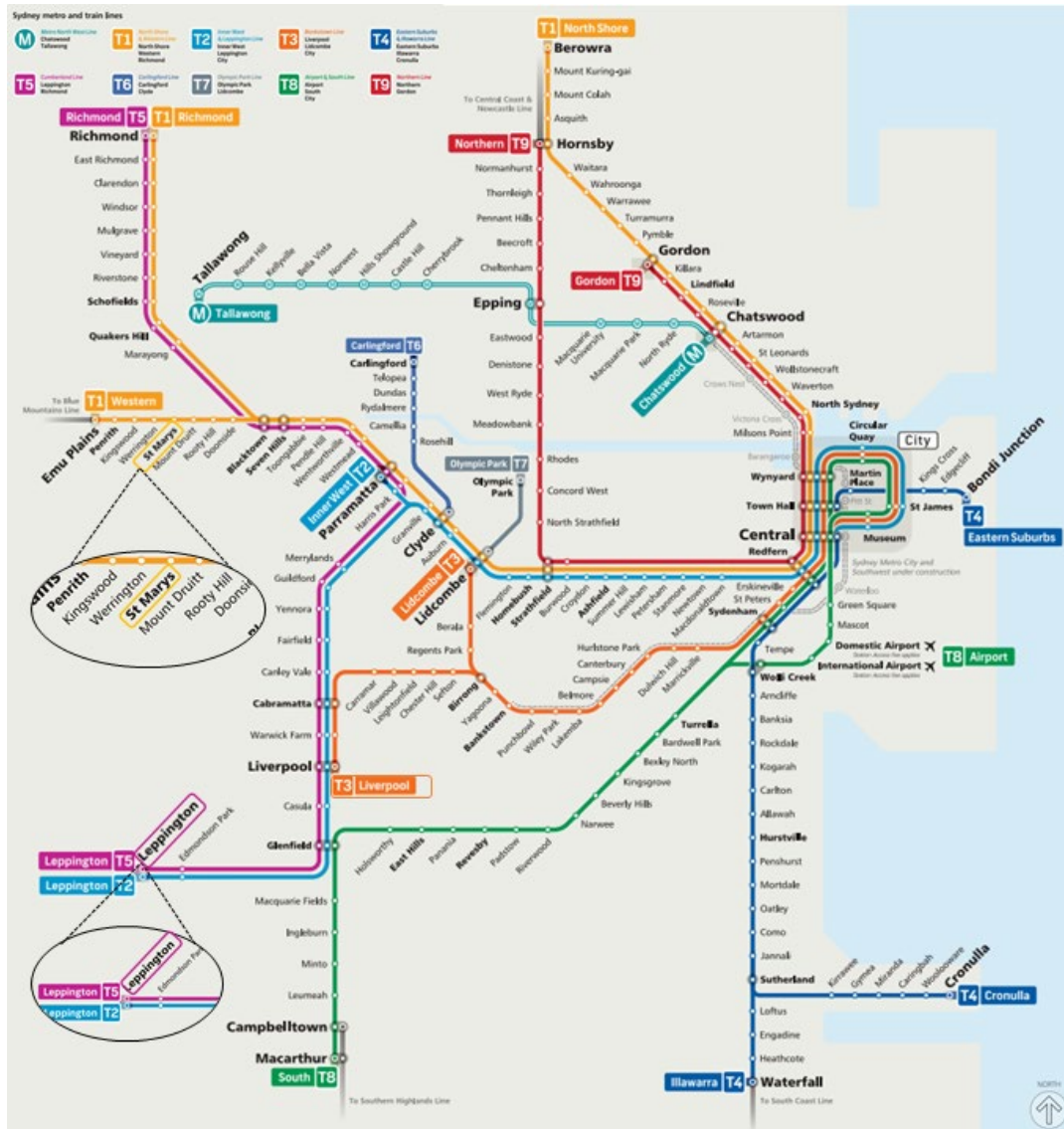
The high number of unrestricted car parking spaces available within the station precinct encourages commuters to drive to the station and catch the train to their destination. Site observations indicated

that both TfNSW commuter and Penrith Council car parking facilities provided within 400 metres of the existing Sydney Trains station at St Marys are generally fully utilised by 9:00 am, with facilities further from the station retaining some capacity.

Table 3-3 Rail services at the existing St Marys Station and Leppington Station

Direction	Weekday AM (7:00 am – 9:00 am)	Weekday PM (4:00 pm – 6:00 pm)
T1 Western Line		
Emu Plains or Richmond to City	16 services	8 services
City to Emu Plains or Richmond	8 services	9 services
T2 Inner West and Leppington Line		
Parramatta or Leppington to City	14 services	12 services
City to Parramatta or Leppington	11 services	15 services
T5 Cumberland Line		
Leppington to Richmond	3 services	4 services
Richmond to Leppington	3 services	4 services

Source: Sydney Trains, 2019



Source: Sydney Trains, 2019 (modified by AECOM 2019)

Figure 3-3 Location of existing St Marys Station and Leppington Station in the Sydney Trains Network

3.2.3 Pedestrian facilities

St Marys to Great Western Highway

Footpaths are generally provided on both sides of the road network within St Marys. Near the existing Sydney Trains station at St Marys, pedestrian access to the concourse of the station is provided via footpaths to the north and south of the station. A pedestrian crossing (zebra crossing) is provided at the corner of Station and Queen streets, providing direct access to the southern station entrance. Wider footpaths are generally provided on both sides of Queen Street near the station.

Along Glossop Street, between the Great Western Highway and Forrester Road, footpaths are generally provided on both sides of the road. Overall, there are limited crossing opportunities provided along Glossop Street. Multiple pedestrians were observed crossing Glossop Street outside of the designated pedestrian crossings, with a number of near misses observed during the site visit.

Great Western Highway to M4 Western Motorway

Along Mamre Road, between the Great Western Highway and the M4 Western Motorway, footpaths are generally provided on both sides of the road with pedestrian crossings provided only at signalised

intersections. Near the M4 Western Motorway ramps, footpaths are provided along both sides of the Mamre Road bridge.

In addition, footpaths are only provided on the western side of Kent Road near the M4 Western Motorway. Footpaths are provided along the dedicated walking and cycling bridge, crossing the M4 Western Motorway adjacent to the road bridge.

M4 Western Motorway to Western Sydney Aerotropolis

To the south of the M4 Western Motorway are the suburbs of Orchard Hills, Luddenham, Badgerys Creek and Bringelly, where pedestrian connectivity is generally poor. This is due to the area being largely undeveloped. However, it is expected that once the area becomes more developed, pedestrian connectivity in these precincts would improve.

3.2.4 Cycling facilities

St Marys to Great Western Highway

Cycling facilities in the northern area in St Marys generally consist of on-road cycling facilities. These facilities are provided along the road network immediately surrounding the existing Sydney Trains station in St Marys, including Station Street, Phillip Street, Queen Street and Charles Hackett Drive.

Great Western Highway to M4 Western Motorway

Along Mamre Road, on-road cycleways are only provided to the north of the M4 Western Motorway.

A two-way shared path is also provided along the southern end of the Great Western Highway, west of Queen Street. This shared path extends to Kingswood in the west, connecting to Western Sydney University's Penrith campus (at Kingswood and Werrington). This route provides safe a connection between St Marys Station and the residential areas located west of the station.

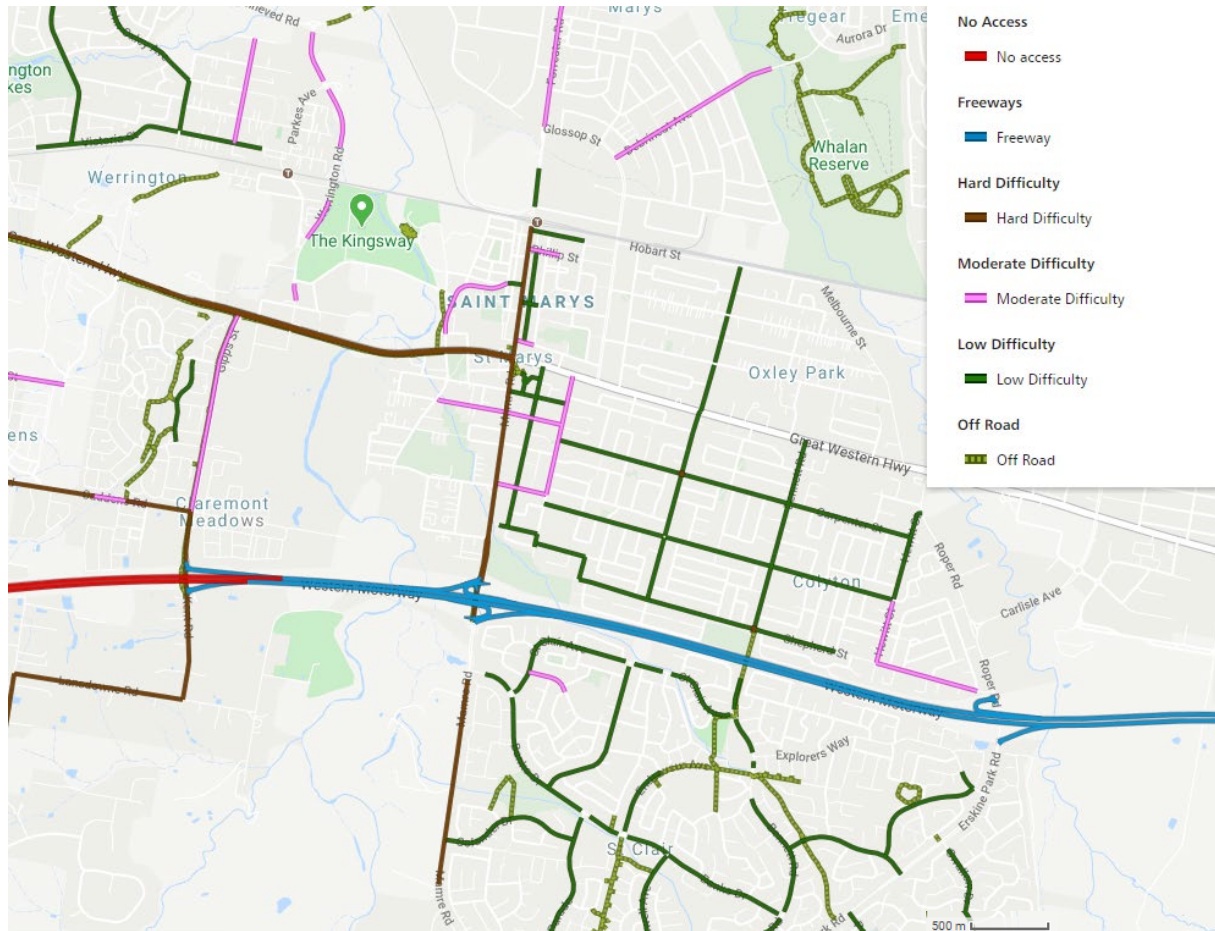
In addition, a two-way shared path is also provided along the western side of Kent Road, north of the M4 Western Motorway and extends via Gipps Street to the north until its intersection with the Great Western Highway.

M4 Western Motorway to Western Sydney Aerotropolis

Within the southern precincts, on-road cycleways are provided along Mamre Road in Orchard Hills, Elizabeth Drive in Luddenham, near Devonshire Road in Badgerys Creek and along The Northern Road in Bringelly. TfNSW identifies these road environments as high difficulty on-road environments, as shown in Figure 3-4.

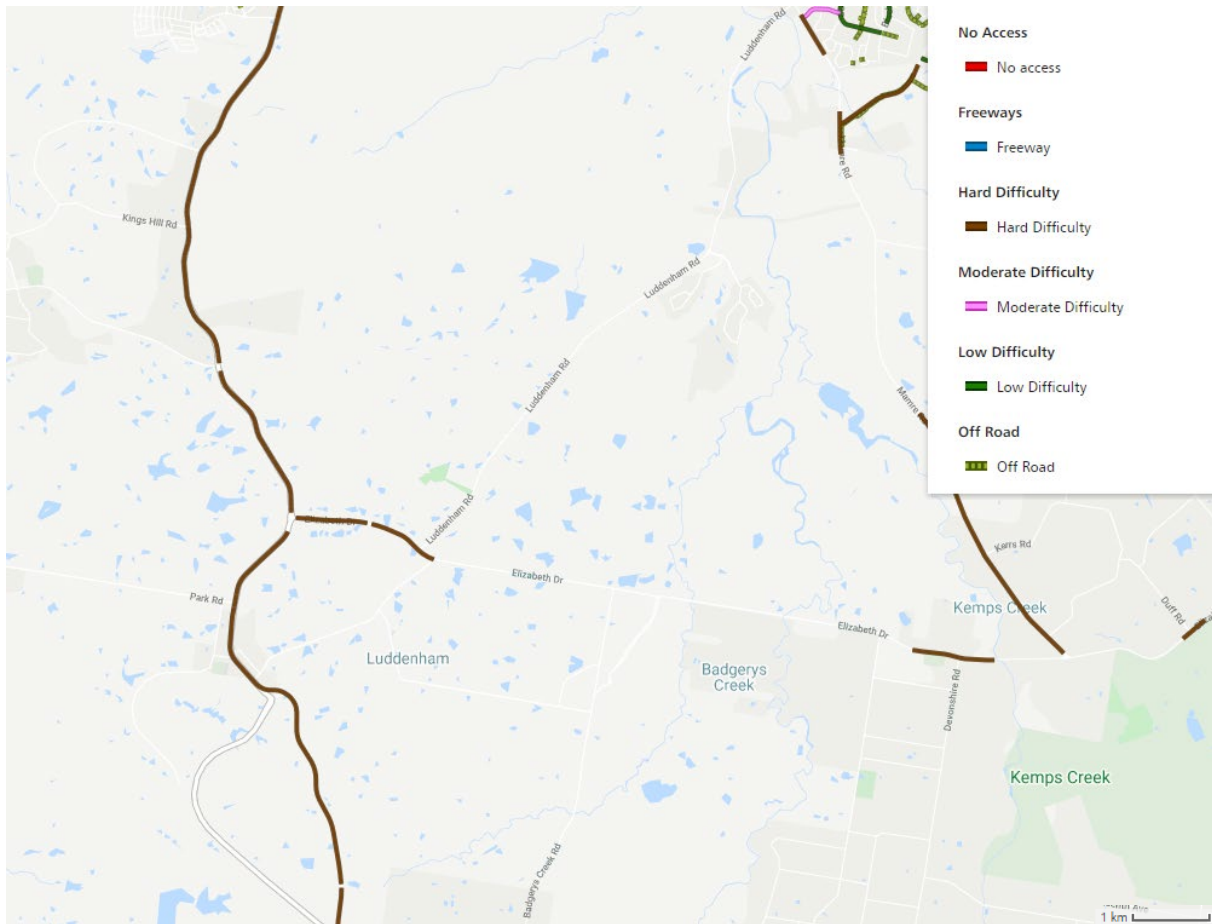
Penrith LGA border with the Liverpool LGA is rural residential at present with no cycleways provided. The Liverpool Bike Plan 2018-2023 outlines several planned on-road and off-road paths for the study area. In the long term, as the growth areas develop, potential links in the form of bike shoulders will traverse Elizabeth Drive and meet The Northern Road. These links may also be provided at Devonshire Road (northbound and southbound via a new four-way intersection) and Mamre Road.

Overall, site observations indicated that cycle demand within the study area is low, with very low volumes of cyclists observed using the available facilities. In addition, cycle connectivity of the available facilities to the wider cycle network is limited. The existing cycling infrastructure within the study area is shown in Figure 3-4.



Source: TfNSW, CyclewayFinder, accessed August 2020

Figure 3-4 Cycling infrastructure in St Marys, Claremont Meadows, St Clair and Orchard Hills



Source: TfNSW, CyclewayFinder, accessed August 2020

Figure 3-5 Cycling infrastructure in Orchard Hills, Luddenham, Badgerys Creek and Bringelly

3.2.5 Freight rail network

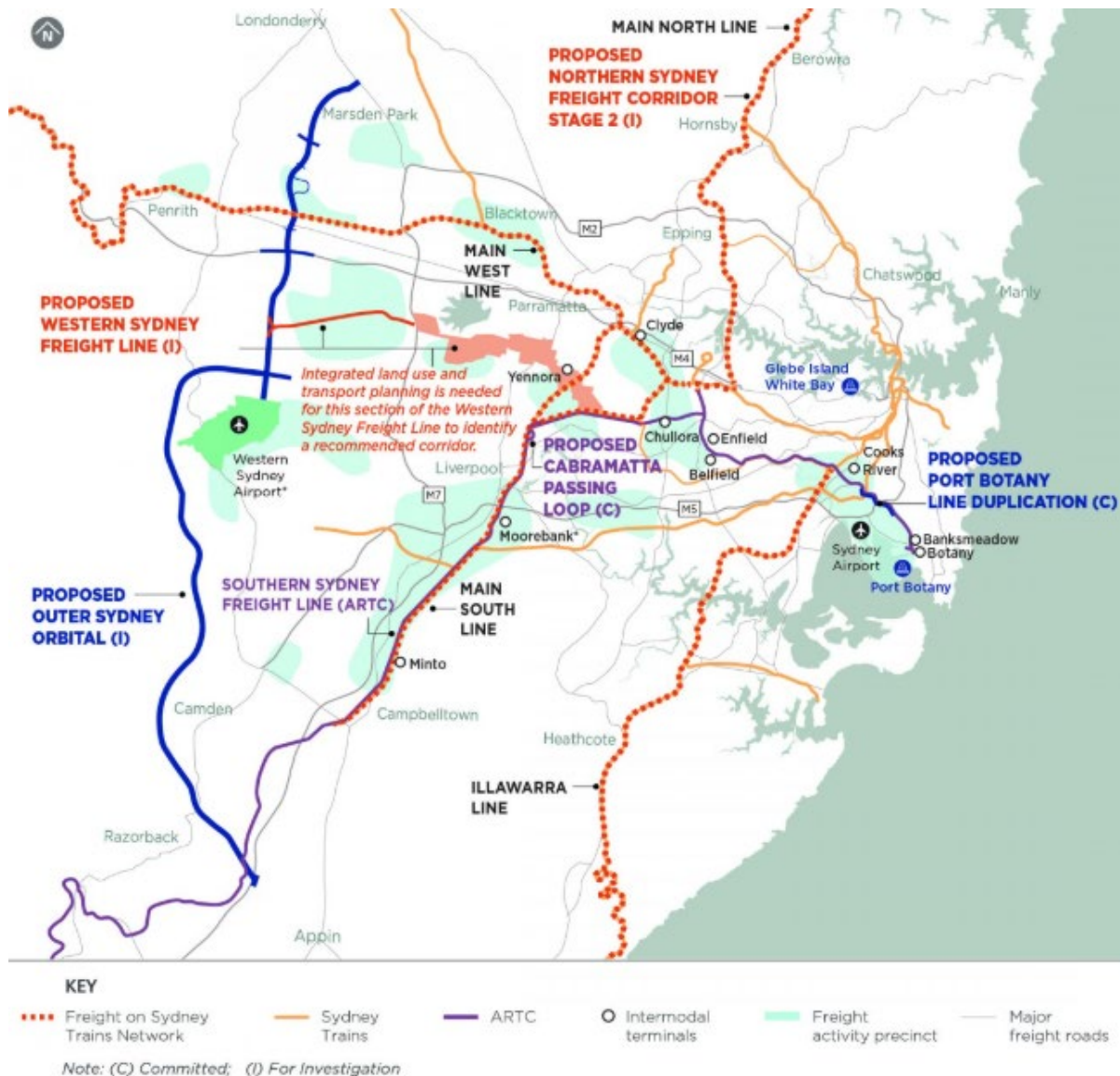
The Sydney Freight Network, managed by the Australian Rail Track Corporation, is a network of dedicated railway lines for freight in Sydney linking the state's rural and interstate rail network with the city's main yards at Enfield and Port Botany. Its primary components are the Southern Sydney Freight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

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

There are three freight rail lines close to the project, which include:

- the Western line, which extends from an interface with the MFN at Lidcombe/North Strathfield in the east through Blacktown in the west
- the Main South line, which links Granville in the north to Cabramatta in the south
- the SSFL, which extends from an interface with the MFN at Sefton Park Junction to beyond Macarthur, which is the limit of the Sydney suburban network.

Figure 3-6 shows the rail freight corridors near the project in addition to other rail infrastructure projects in the Greater Sydney area.



Source: Greater Sydney Rail Infrastructure Projects Map, TfNSW, accessed August 2020

Figure 3-6 Sydney rail freight corridors

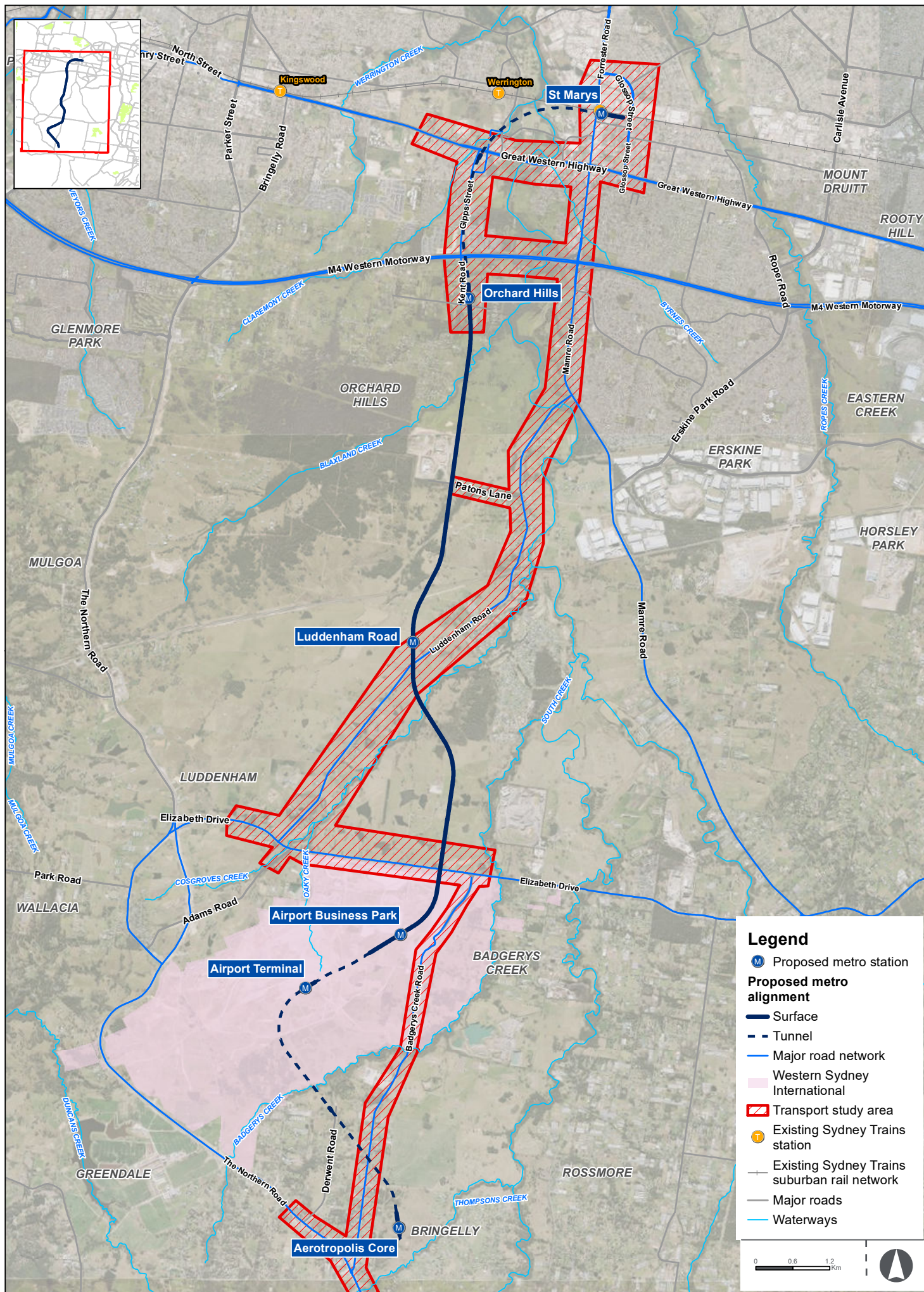
3.2.6 Overview of road network

This section outlines key roads within the road network considered in this technical paper and provides a description of the key roads within the study area. Roads outlined in this section are based on key roads forecast to be impacted by the project and that directly interface with the project.

Key roads within the study area include the Great Western Highway, Glossop Street, Forrester Road, Queen Street, Kent Road, the M4 Western Motorway, Mamre Road, Luddenham Road, Elizabeth Drive, Adams Road, Badgerys Creek Road and The Northern Road, as shown in Figure 3-7.

The road environment in Orchard Hills, Luddenham, Badgerys Creek and Bringelly is predominantly characterised by unsealed road shoulders, with poor pedestrian and cycle facilities. It is however expected that these facilities would be improved in the long term, as the growth areas develop. It should be noted that several access roads and intersections along Elizabeth Drive and Badgerys Creek Road in Luddenham and Badgerys Creek were closed off at the time of this assessment due to the construction of Western Sydney International. Construction works associated with the upgrade of Bringelly Road were underway at the time of this assessment.

The project would provide a new transport mode in the study area, where private vehicle access is generally the primary mode of travel. The project, along with the future M12 Motorway and other road network upgrades proposed in the study area, is expected to impact the future travel patterns of residents and visitor to the study area. The impacts on the wider transport network due to opening of the project has been captured in the WRTM modelling undertaken for the future M12 Motorway project.



Major road network within the study area

Figure 3-7

Indicative only, subject to design development

Forrester Road

Forrester Road is a collector road aligned in a north-south direction. It connects to Glossop Street in the east and provides access to St Marys Station in the south. Forrester Road has an undivided carriageway with two lanes in each direction north of Glossop Street and one lane in each direction south of Glossop Street. Forrester Road has a sign posted speed limit of 50 km/h and kerbside parking is generally provided on the east side of the road.

Glossop Street

Glossop Street functions as a collector road generally aligned in a north-south direction. It connects to the Great Western Highway in the south and Forrester Road in the north. Glossop Street has a divided carriageway with two lanes in each direction and has a sign posted speed limit of 60 km/h.

Queen Street

Queen Street is a collector road connecting St Marys Station in the north to the Great Western Highway in the south. The carriageway is undivided with one travel lane and one parking lane in each direction and a sign posted speed limit of 40 km/h.

Great Western Highway

The Great Western Highway is an arterial road and, in the vicinity of St Marys, is aligned in an east-west direction. It connects to The Northern Road in the west and the Westlink M7 Motorway in the east. The Great Western Highway has a divided carriageway with three lanes in each direction and has a posted speed limit of 60 km/h near Gipps Street and 80 km/h near Gipps Street and south of Banks Drive.

Mamre Road

Mamre Road is an arterial road which connects the Great Western Highway in St Marys in the north to Elizabeth Drive in the south. Mamre Road has an undivided carriageway with one lane in each direction and has a sign posted speed limit of 80 km/h. TfNSW have proposed upgrades proposed along Mamre Road. Details regarding proposed upgrades are included in Section 3.4.4.

Kent Road

Kent Road is a sub-arterial road connecting to Gipps Street and the Great Western Highway in the north and providing access to the M4 Western Motorway in the south via ramps. The carriageway is undivided generally with one lane in each direction and a sign posted speed limit of 70 km/h.

M4 Western Motorway

The M4 Western Motorway is an arterial road which connects western Sydney to the wider arterial network and provides an uninterrupted journey to the M7 Motorway. In the vicinity of Orchard Hills, the M4 Western Motorway has three lanes in each direction divided by a grass median of around 17 metres wide. The M4 Western Motorway enables travel at variable speeds of up to 110 km/h. It connects to Kent Road in the west and Mamre Road in the east.

Luddenham Road

Luddenham Road is a collector road in a rural environment connecting Elizabeth Drive at Luddenham in the south to Mamre Road in the north. The carriageway is undivided with one lane in each direction and a variable speed limit.

Elizabeth Drive

Elizabeth Drive is an arterial road which connects The Northern Road at its western end and Liverpool via crossings of the M7 and Cowpasture Road at its eastern end. Between The Northern Road and Mamre Road, Elizabeth Drive has an undivided carriageway with one lane in each direction and a sign posted limit of 80 km/h. The intersection of Elizabeth Drive and Badgerys Creek has been upgraded to a roundabout as part of the realignment of Badgerys Creek and the construction works at Western Sydney International. TfNSW has allocated funding to investigate improvements to Elizabeth Drive between the M7 Motorway at Cecile Hills and The Northern Road. Details regarding proposed upgrades are included in Section 3.4.4.

Adams Road

Adams Road is a collector road to the west of Western Sydney International connecting Luddenham in the south to Elizabeth Drive in the north, with a future signalised interchange with the upgraded The Northern Road at its midpoint (due to open in 2021-2022). The carriageway is undivided with one lane in each direction and has variable posted speeds.

Badgerys Creek Road

Badgerys Creek Road is a collector road in a rural environment which connects The Northern Road at a roundabout to the south through the airport site to Elizabeth Drive in the north. Badgerys Creek Road is around seven kilometres in length and has an undivided carriageway with one lane in each direction, unsealed shoulders and a sign posted speed limit of 80 km/h for the majority of its length. Badgerys Creek Road has been realigned between Elizabeth Drive and Longleys Road, as part of the early earthworks for the new Western Sydney International site.

The intersection of Badgerys Creek and Elizabeth Drive has been upgraded to a roundabout as part of these realignment works and the construction of Western Sydney International. This section of the road was opened to traffic in February 2020. Further details regarding the realignment of Badgerys Creek Road are included in Section 3.4.4. During the future years 2026 and 2036, this intersection is proposed to be upgraded to a signalised intersection as part of proposed upgrades to Elizabeth Drive as per information available in the EIS for the future M12 Motorway project.

The Northern Road

The Northern Road is an arterial road that connects Narellan in the south west to the Great Western Highway in Penrith. In the vicinity of the study area, The Northern Road has an undivided carriageway with one lane in each direction and a sign posted speed limit of 80 km/h. The Australian and NSW governments are upgrading The Northern Road as part of the Western Sydney Infrastructure Plan, which aims to deliver major road infrastructure upgrades and road investment programs for western Sydney. The Northern Road to Peter Brock Drive, Oran Park was opened to traffic in 2018, with construction works continuing on The Northern Road and Bringelly Road, between Glenmore Parkway and Jamison Road and Mersey Road and Glenmore Parkway. The portion of the Northern Road between Mersey Road and Eaton Road was open to traffic in April 2020. Details regarding proposed upgrades of The Northern Road between The Northern Road at Narellan and Jamison Road at South Penrith are included in Section 3.4.4. An at-grade connection with the future M12 Motorway is further proposed at The Northern Road, north of Elizabeth Drive.

3.2.7 Road network performance

The road network performance during the base year scenario (2019) was assessed to understand the existing performance of the road network.

Mid-block performance

An assessment of existing weekday AM peak and PM peak hour traffic volumes was completed to determine the general performance of the current road network configuration in the study area. The findings of this assessment are presented in Table 3-4.

Table 3-4 Base year (2019) mid-block performance (based on traffic survey data)

Location	Direction	Theoretical capacity (pcu/h)	AM Peak		PM Peak	
			Volume (pcu/h)	LOS	Volume (pcu/h)	LOS
Glossop Street (north of the Great Western Highway)	NB	1900	1010	C	970	C
	SB	1900	1000	C	1100	C
Great Western Highway (east of Queen Street)	EB	2800	1540	C	1230	B
	WB	2800	1330	B	1860	C
Great Western Highway (west of Queen Street)	EB	2800	1290	B	1000	B
	WB	2800	920	A	1420	C

Location	Direction	Theoretical capacity (pcu/h)	AM Peak		PM Peak	
			Volume (pcu/h)	LOS	Volume (pcu/h)	LOS
Queen Street (north of Great Western Highway)	NB	1500	580	B	510	A
	SB	1500	330	A	570	B
Mamre Road (south of the Great Western Highway)	NB	1800	1000	C	1010	C
	SB	1800	850	B	1250	C
Great Western Highway (east of Gipps Street)	EB	2800	1800	C	1700	C
	WB	2800	1440	C	1570	C
Great Western Highway (west of Gipps Street)	EB	2800	1460	C	1730	C
	WB	2800	1680	C	1450	C
Kent Road (north of the M4)	NB	1900	1140	C	1080	C
	SB	1900	940	B	1010	C
Kent Road (south of the M4)	NB	900	420	B	130	A
	SB	900	110	A	240	A
Mamre Road (north of Luddenham Road)	NB	900	990	F	1060	F
	SB	900	1310	F	1100	F
Luddenham Road (west of Mamre Road)	NB	900	580	C	250	A
	SB	900	180	A	580	C
Luddenham Road (north of Elizabeth Drive)	NB	900	440	B	210	A
	SB	900	160	A	470	C
Elizabeth Drive (west of Badgerys Creek Road)	EB	900	670	C	460	C
	WB	900	440	B	690	D
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	880	E	490	C
	WB	900	470	C	820	E
Badgerys Creek Road (south of Elizabeth Drive)	NB	900	380	B	230	A
	SB	900	200	A	360	B
Badgerys Creek Road (north of The Northern Road)	NB	900	350	B	180	A
	SB	900	180	A	370	B
The Northern Road (west of Badgerys Creek Road)	EB	900	700	D	720	D
	WB	900	660	C	670	C
The Northern Road (east of Badgerys Creek Road)	NB	900	970	F	830	E
	SB	900	840	E	1060	F

Note: Traffic volumes have been rounded to the nearest 10.

Source: Based on traffic survey data collected in June 2019

The base year mid-block assessment indicates that the current configuration of Elizabeth Drive (east of Badgerys Creek Road) is operating close to its theoretical capacity. However, Mamre Road (north of Luddenham Road) and The Northern Road (east of Badgerys Creek) operate above their theoretical capacities during both peak hours in the base year.

Intersection performance

The operational performance of the study area intersections during the base year (2019) were assessed using SIDRA INTERSECTION 8. Table 3-5 presents a summary of the performance of the study area intersections during base year 2019.

Table 3-5 Base year 2019 intersection performance

Intersection	AM Peak		PM Peak	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Glossop Street/Forrester Road (S)	35	C	23	B
Glossop Street/Harris Street (P)	9	A	9	A
Glossop Street/Phillip Street (S)	14	A	17	B
Queen Street/Charles Hackett Drive (S)	18	B	26	B
Glossop Street/Great Western Highway (S)	36	D	37	D
Queen Street/Great Western Highway/Mamre Road (S)	48	D	46	D
Charles Hackett Drive/Great Western Highway/Pages Road (S)	30	C	35	D
Mamre Road/M4 Western Motorway Eastbound Ramp (S)	39	C	21	B
Mamre Road/M4 Western Motorway Westbound Ramp (S)	21	B	20	B
Great Western Highway/Gipps Street (S)	24	C	25	C
Gipps Street/Sunflower Drive (S)	12	B	9	A
Kent Road/Caddens Road (S)	19	B	23	B
Kent Road/M4 Western Motorway On-ramp (S)	5	A	5	A
Kent Road/M4 Western Motorway Off-ramp (S)	21	B	18	B
Kent Road/Lansdowne Road (P)	9	A	8	A
Mamre Road/Luddenham Road (P)	11	A	21	B
Luddenham Road/Elizabeth Drive (P)	18	B	20	B
Elizabeth Drive/Adams Road (P)	15	B	16	B
Elizabeth Drive/Badgerys Creek Road (P)	33	C	21	B
Badgerys Creek Road/The Northern Road (R)	7	A	6	A

Note:

[1] Assessments have been undertaken using SIDRA INTERSECTION 8.

[2] For traffic signals, the average movement delay and level of service over all movements is taken. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is taken.

[3] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised).

Source: Assessments based on traffic survey data collected in June 2019 and modelled using SIDRA INTERSECTION 8

Table 3-6 indicates all intersections analysed currently operate at LOS D or better with spare capacity. The intersection of Mamre Road/M4 Western Motorway Eastbound Ramp operates at LOS C during the AM peak, however experiences some capacity constraints due to a high degree of saturation on the western approach.

3.2.8 Road safety

Crash data for the key road corridors in the study area was provided by TfNSW for the period from 2013 to 2018. Figure 3-10 shows the location of crashes within the study area. The crash analysis indicates that the number of crashes recorded in the study area are highest around the St Marys

precinct and the section of the road network between the Great Western Highway and the M4 Western Motorway.

A detailed analysis of crash data is presented in Appendix A of this technical paper.



Figure 3-8 Location of crashes within the study area

Crash data for the key road corridors within the study area was further analysed for the five-year period between 2013 and 2017. This analysis indicates that a total of 467 crashes occurred along the key road corridors. The highest proportion of crashes was recorded along the M4 Western Motorway between Mamre Road and Kent Road with 121 crashes, followed by Glossop Street between the Great Western Highway and Forrester Road with 99 crashes. Five fatal crashes and 79 crashes leading to serious injury occurred along the key corridors. Pedestrians were involved in 15 crashes, where five crashes resulted in serious injury.

A breakdown of crashes by severity per road corridor is presented in Figure 3-9.

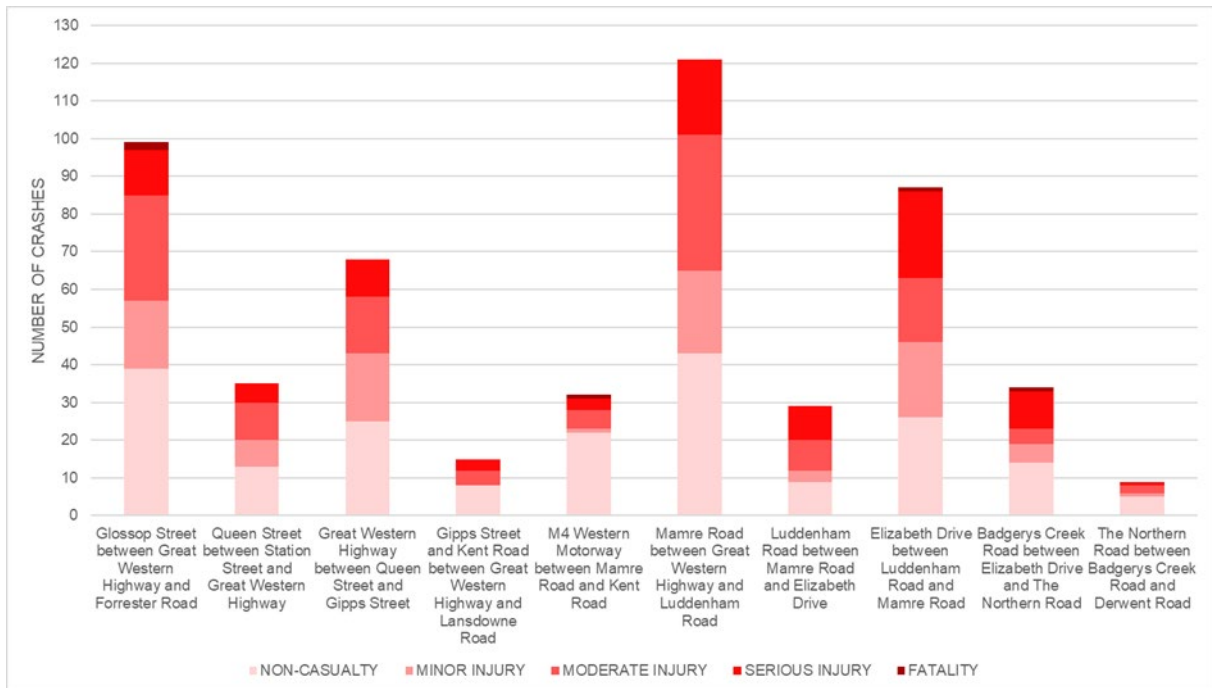


Figure 3-9 Crashes by severity along each road corridor

The crash data obtained also provides the breakdown of the recorded crashes by Road User Movement (RUM) group for each of the segments. The highest number of crashes relate to the RUM group representing vehicles travelling in the same direction, with about 42 per cent of all crashes. The most common movement type for the recorded crashes in each segment is a rear end crash (RUM 30), accounting for 27 per cent of all crashes.

Figure 3-10 compares the crash severity index for each major road within the study area with the Sydney crash severity index. The average Sydney crash severity index is represented as zero, and the crash severity index of key roads in the study area are highlighted as being above or below this level. In comparison to other road segments within the study area, Queen Street performs significantly above the Sydney crash severity index, while the Western Motorway and The Northern Road performs below. A summary of key observations along with crash types are included in Appendix A of this technical paper.

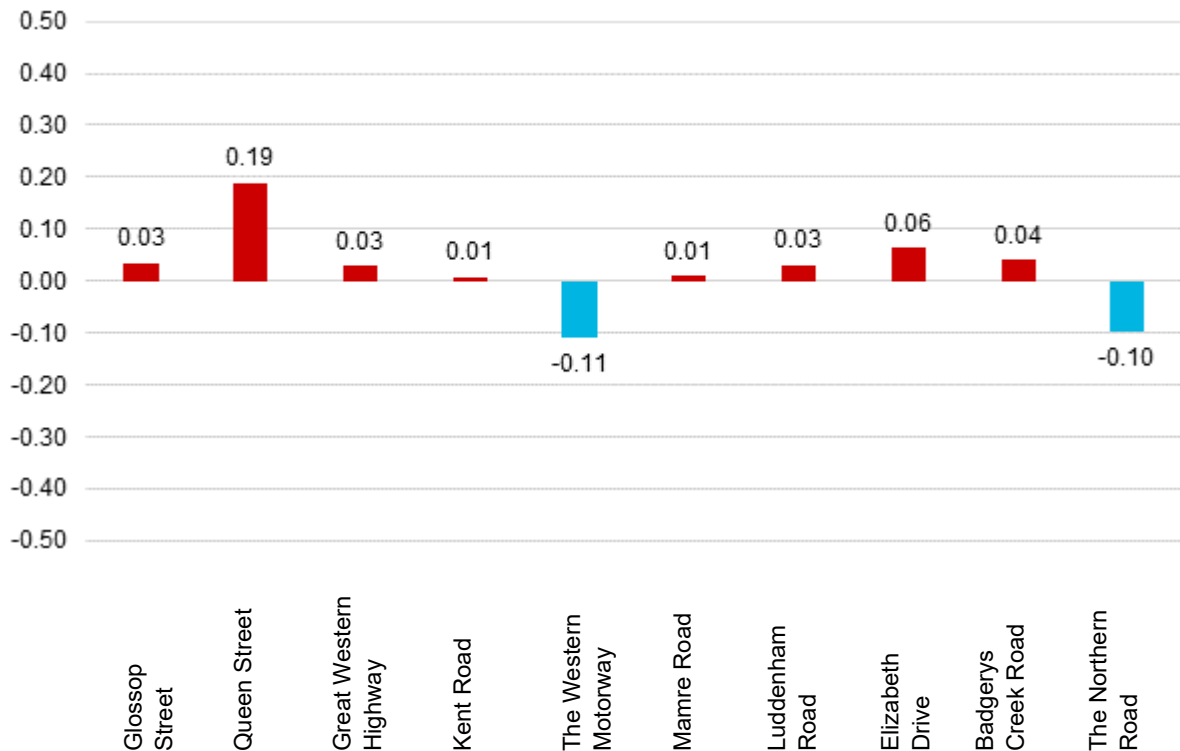


Figure 3-10 Comparison of casualty crash rates with the Sydney Region Class Average

3.2.9 Parking arrangements

St Marys to Great Western Highway

St Marys Town Centre and surrounding streets currently have considerable car parking capacity, reflecting the dominant mode of access to and from the town centre and station. Car parking capacity within the St Marys precinct comprises over 4,500 spaces which are provided in the form of on-street kerbside parking and off-street car parking facilities.

Car parking facilities are currently provided on both sides of St Marys Station. A commuter car park is provided to the north of St Marys Station and can be accessed from Harris Street. To the south of the Station, a number of off-street car parking facilities are provided and can primarily be accessed from Gidley Street and Carinya Avenue via Queen, Phillip and Station streets and the Great Western Highway. On-street car parking varies in terms of restriction and use depending on adjacent land uses, with car parking around Queen Street generally being time-restricted parking, and streets further from this town centre spine being unrestricted.

Car parking surveys undertaken in the St Marys Town Centre suggests high turnover occurs on streets with retail frontages, significant commuter parking occurs on streets close to St Marys Station, and significant unrestricted parking exists in nearby largely residential streets, though overall this remains underutilised.

A summary of the available car parking provisions and restrictions within the St Marys precinct is included in Table 3-6. Available on-street parking and off-street parking facilities within the St Marys precinct are shown in Figure 3-11. It should be noted that this information only covers the area within the town centre and immediately surrounding St Marys Station.

Table 3-6 Available car parking in the St Marys precinct

Car parking	Parking restrictions	Car parking spaces
On-street	Restricted	300
	Unrestricted	1300
	Sub-total	1600*
Off-street	Restricted	505
	Unrestricted	676
	Commuter	618
	Disabled	25
	Other	1,091
	Sub-total	2,915
Total		4,515

***Note:** The actual capacity of on-street parking within the St Marys precinct will vary by time of day and associated uses. An estimate is provided here for indication of on-street capacity.
 Source: Parking Surveys, December 2019



Source: Parking Surveys, December 2019

Figure 3-11 Parking within the St Marys Precinct

Parking demand surveys were undertaken within the St Marys precinct during a typical weekday in the first week of December 2019.

The parking demand survey results indicate that free and unrestricted off-street commuter parking becomes occupied at a quicker rate than other parking types and is fully occupied by 8:00 am. Other unrestricted off-street parking becomes occupied at a steady rate, with restricted off-street parking not experiencing higher occupancy levels until later in the day. This aligns with the opening times for the local businesses that are served by these parking spaces. Streets closer to the station such as Forrester Road, Harris Street, Station Street and the northern ends of Carinya Avenue and West Lane become highly occupied by 8:00 am.

In the evening peak period, the off-street commuter parking is 85 per cent full at 4:00 pm, suggesting some users from the morning peak period leave before the evening peak period. Over the evening peak period, all parking types decrease at a steady rate with occupancies ranging from 10 to 25 per cent by the end of the evening peak period. Occupancy on a number of streets decreases throughout the evening peak period, including Forrester Road, Harris Street, Station Street and Phillip Street, suggesting these streets are predominantly being used by commuters given their proximity to the station. Although decreasing, some on-street parking has a high occupancy during the evening peak period suggesting some residents use these facilities in the evenings.

The existing commuter car park located at Harris Street is proposed to be expanded to a multi-level car park (subject to a separate approval), providing additional parking capacity for commuters within the St Marys precinct. This is likely to be completed prior to the 2023/2024 peak year of construction of the project.

Great Western Highway to Western Sydney Aerotropolis

North of the M4 Western Motorway, on-street car parking is not permitted along Great Western Highway, Mamre Road and Kent Road within the study area, and off-street car parking is generally not provided. However, around the southern end of the St Marys Town Centre about 200 spaces are provided for business/retail use.

South of the M4 Western Motorway, there is limited demand for on-street car parking along Mamre Road, Luddenham Road, Elizabeth Drive and Badgerys Creek Road. This is due to the surrounding land uses predominantly consisting of undeveloped lands and rural and agricultural lands. Car parking primarily consists of informal parking, with no off-street parking facilities provided.

3.3 On-airport existing environment

The airport site is located in Badgerys Creek and Luddenham, in the Liverpool LGA. The northern boundary of the airport site adjoins the Penrith LGA boundary along the alignment of Elizabeth Drive. The land is Commonwealth land. Previous land uses at the site included rural residential, agricultural, community and extractive industry land uses, however these land uses have since been removed as part of preparatory works for Western Sydney International Stage 1 Construction Impact Zone. The zoning context within the on-airport environment is described in Chapter 14 (Land use and property) of the Environmental Impact Statement. This chapter also provides further information regarding future land uses in the study area. The integration of the project with land use changes in the Western Parkland City is described in Chapter 3 (Project location and setting) of the Environmental Impact Statement.

For the commencement of operation of the project, the land use is assumed to consist of the Stage 1 Construction Impact Zone of Western Sydney International.

Pedestrian and cycle infrastructure is currently not provided within the on-airport environment. The road network within the on-airport environment is currently also limited, with roads expected to be constructed as the airport site is developed. The existing road network surrounding the airport site is described in detail in Section 3.2.6.

The road network within and surrounding the airport site is currently being upgraded by the Australian and NSW governments. In preparation for the development of Western Sydney International, road and transport infrastructure upgrades are proposed to be undertaken. Major road upgrades are identified in Section 3.4 of this technical paper and include The Northern Road, Bringelly Road and the future M12 Motorway, discussed in Section 3.4.3. In addition to major infrastructure works, road upgrades are also proposed on Cowpasture Road, Camden Valley Way, Narellan Road and the M4 Western Motorway with development of a managed motorway system. Other infrastructure investigations underway include corridor preservation activities for the Outer Sydney Orbital (OSO) discussed in Section 3.4.3 and the extension of the South West Rail Link discussed in Section 3.4.1.

3.4 Proposed transport upgrades

This section details the transport network upgrades proposed in the study area.

The State and regional planning framework, the strategic land-use planning framework and the strategic transport planning framework for the study area are further discussed in detail in Chapter 2 (Strategic need and justification) of this Environmental Impact Statement.

3.4.1 Proposed public transport upgrades

Extensions of Sydney Metro – Western Sydney Airport, potential future East West Rail Link and South West Rail Link Extension

Future potential transport corridors for passenger rail lines are being investigated by the NSW Government, and include the East West Rail Link and the South West Rail Link Extension. The aim of the *Draft North-South Rail Line and South West Rail Link Extension Corridors Strategic Environmental Assessment* (Transport for NSW, 2018a) is to protect these two rail corridors in Western Sydney for future rail infrastructure for passenger train services. The *Western Sydney City Deal* also describes the NSW Government's commitment to protecting these corridors.

The Australian and NSW Governments have jointly undertaken a scoping study to determine the passenger rail needs in Western Sydney and Western Sydney International. The report was released in March 2018 and aims to investigate the economic, demographic and commercial drivers for passenger rail in the region through community consultation and stakeholder engagement. A preferred long-term rail network that balances the needs of the region with those of Western Sydney International was identified and consists of a North-South Link via Western Sydney International to shape the future of Western Sydney, an East-West link to Greater Paramatta via Western Sydney International to connect between Western Parkland City, the Central River City and the Eastern Harbour City, rail links that support growth in Western Sydney and the airport and rail links better connecting Western Sydney with Greater Sydney. The East-West link aims to provide rail connectivity between the three cities and support the urban and airport needs of Western Sydney by connecting key urban growth areas and strategic centres with the airport. The report identifies this passenger rail could be serviced by a rapid metro style train that delivers a competitive journey time between the three cities and provides opportunities for airport customer needs.

In June 2020, the NSW Government confirmed the final alignments of the future Sydney Metro – Western Sydney Airport and future extensions, the South West Rail Link Extension as well as the Western Sydney Freight Line, discussed in Section 3.4.3.

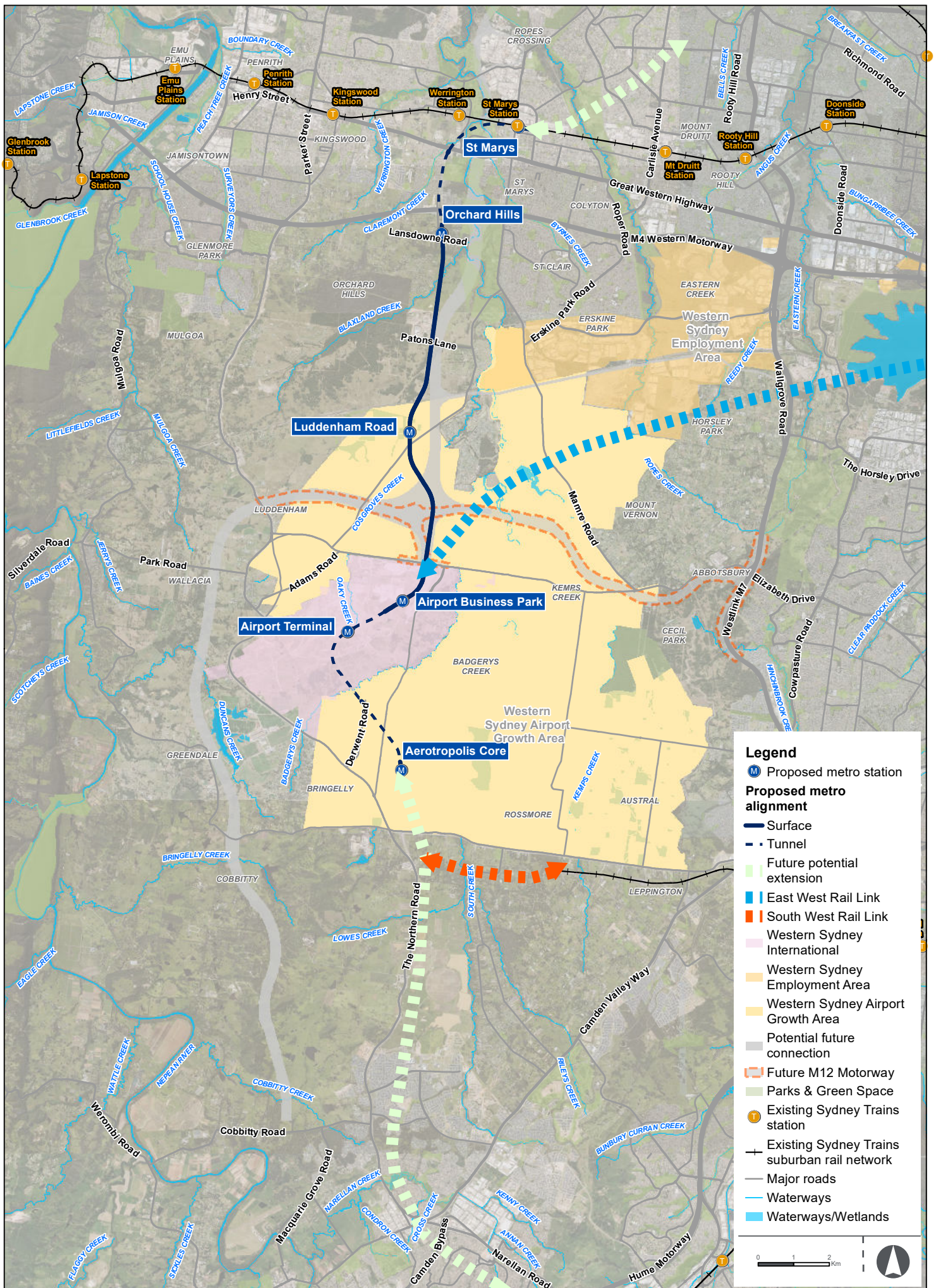
The North South Rail Line corridor would support the delivery of the project and its subsequent stages. The South West Rail Link Extension would lengthen the existing passenger rail line from Leppington Station to the Aerotropolis and providing a direct link to the Western Sydney Aerotropolis and the surrounding business areas. It would link the Aerotropolis to Leppington through Kelvin Park and Rossmore to join the rail network at Leppington.

The NSW government is investigating additional public transport corridors in Western Sydney, to ensure critical public transport services can be delivered in line with the growing needs of Western Sydney, providing a major link between the North West, Western Sydney International, South West and Greater Macarthur Growth Areas. TfNSW has identified corridors, to support integrated land use and transport planning and to make the Western Parkland City one of the most connected cities. The corridors help enable the NSW Government vision to achieve a 30-minute city and are identified as key priority in the NSW Long Term Transport Master Plan, Greater Sydney Region Plan, District Plans, the Western Sydney Rail Needs Study and *Future Transport 2056* strategy, which guide the delivery of transport services, infrastructure and technology in NSW over the next 40 years.

The corridors would provide for future passenger rail lines and:

- provide a major transport link between the North West, Western Sydney International, South West and Greater Macarthur Growth Areas
- provide transport options to support population, jobs and economic growth across Western Sydney and for the planned Western Sydney International
- support future town centres to be designed and planned around future transport infrastructure.

The proposed extension corridors, in relation to areas of growth and development in Western Sydney, are shown in Figure 3-12.



Sydney's Bus Future

The NSW Government has a long-term plan to introduce rapid bus routes and suburban bus routes to connect major centres for jobs, shopping and services. *Sydney's Bus Future* plan prepared by the NSW Government in 2013, highlights a three-tiered integrated bus network, with the routes and their key features outlined in Table 3-7.

Table 3-7 Sydney's Bus Future bus network

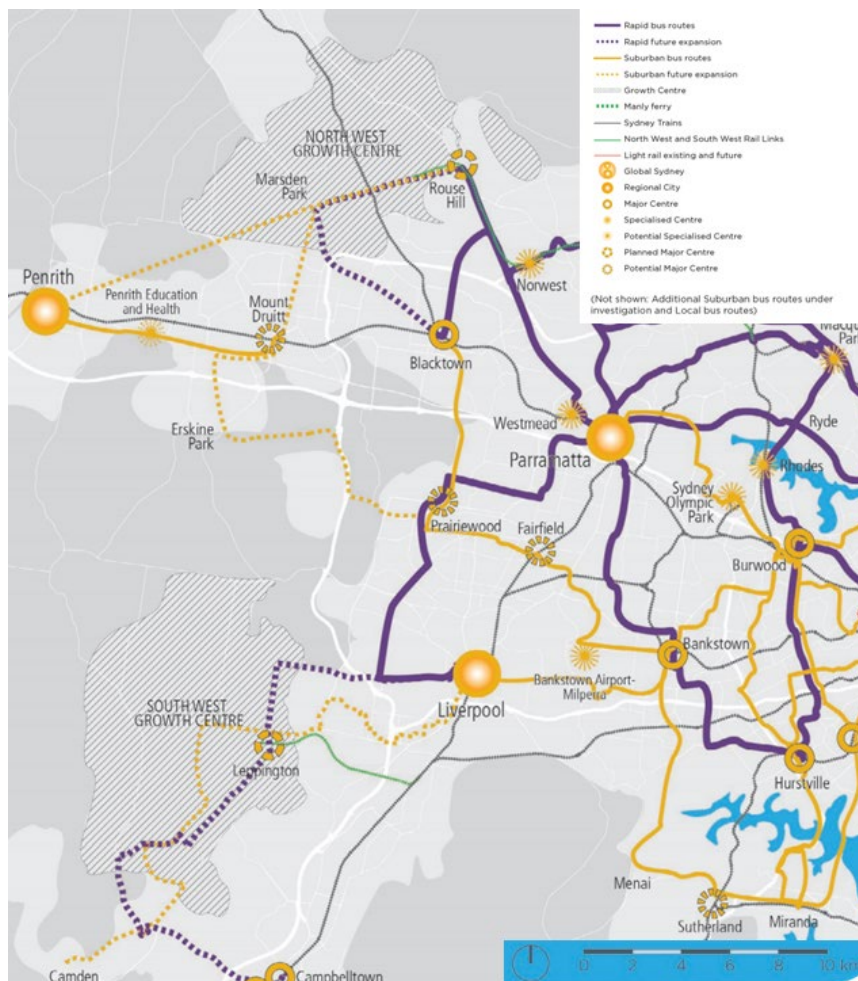
Route type	Purpose	Service levels
Rapid	Fast and reliable bus travel for customers between major centres	<ul style="list-style-type: none"> • frequent 'turn up and go' services without the need for consulting a timetable • no more than 10-minute wait times between 6:00 am and 7:00 pm from Monday to Friday • no more than 15-minute wait times during weekends • stops every 800 m to 1 km
Suburban	Provide access to local and neighbourhood destinations and create opportunities to interchange between bus routes and with rail	<ul style="list-style-type: none"> • a mix of frequent 'turn up and go' and timetabled services • peak services turn up and go at least every 10 minutes • about 400 m between stops
Local	Provide access to local and neighbourhood destinations and opportunities to interchange	<ul style="list-style-type: none"> • timetabled services • stops every 400 m • services use local streets and roads and bus priority for peak express connections

Source: NSW Government, 2013

In Parramatta and Western Sydney, where most of the growth is projected, bus networks are proposed to integrate with the wider transport network, providing high frequency rapid services for travel between suburbs and centres not directly connected by rail, as shown in Figure 3-13.

Near the project, new and upgraded rapid routes would be provided between Parramatta, Liverpool, the North West Growth Centre and central Sydney. In addition to the rapid routes, City Deal buses are also likely to be operational to or near the Western Sydney International and Aerotropolis from Campbelltown, Liverpool and Penrith.

Rapid bus routes constitute a key part of the future bus network in Sydney, particularly in Western Sydney, allowing connections between key growth centres as well as Sydney's existing transport network.



Source: NSW Government, 2013

Figure 3-13 Rapid and Suburban bus routes supporting Western Sydney

3.4.2 Proposed walking and cycling upgrades

Future Transport 2056 strategy developed by Transport for NSW has investment priorities for Greater Sydney that will be guided by the vision of a metropolis of three cities as outlined in the Greater Sydney Region Plan. *Future Transport 2056* strategy is also supported by the Greater Sydney Services and Infrastructure Plan (Transport for NSW, 2018c) which includes a number of initiatives for delivery or investigation in the short-to-medium term. The plan details how transport networks will need to expand to provide improved access to each metropolitan centre (including the metropolitan cluster of centres in the Western Parkland City) and facilitate the development of Sydney's Principal Bicycle Network. These networks would be progressively developed through a range of infrastructure investments that would make key improvements to the city-shaping and road networks as well as upgrade local roads, walking and bicycle paths.

Western Sydney Aerotropolis - *Land Use and Infrastructure Implementation Plan* (Department of Planning and Environment, 2018) (Aerotropolis LUIIP) was prepared to guide land use and development in this area and around Western Sydney International. The *Western Sydney Aerotropolis Plan* (WSAP) was subsequently released in 2019 and presents an update on the Stage 1 LUIIP. The WSAP outlines the vision of the NSW Government for the Aerotropolis and presents the planning principles, land uses and infrastructure required to support the Aerotropolis development. The WSAP plan therefore aims to guide future land-use outcomes to capitalise on significant infrastructure investment in the region including in public transport, walking, cycling and road connections and freight.

The focus for the growth of the Western Parkland City is providing well-connected and walkable places and local centres that build on local strengths and deliver quality public places. The development of

new open spaces would connect to the Greater Sydney Green Grid to support walking, cycling and community access to open space.

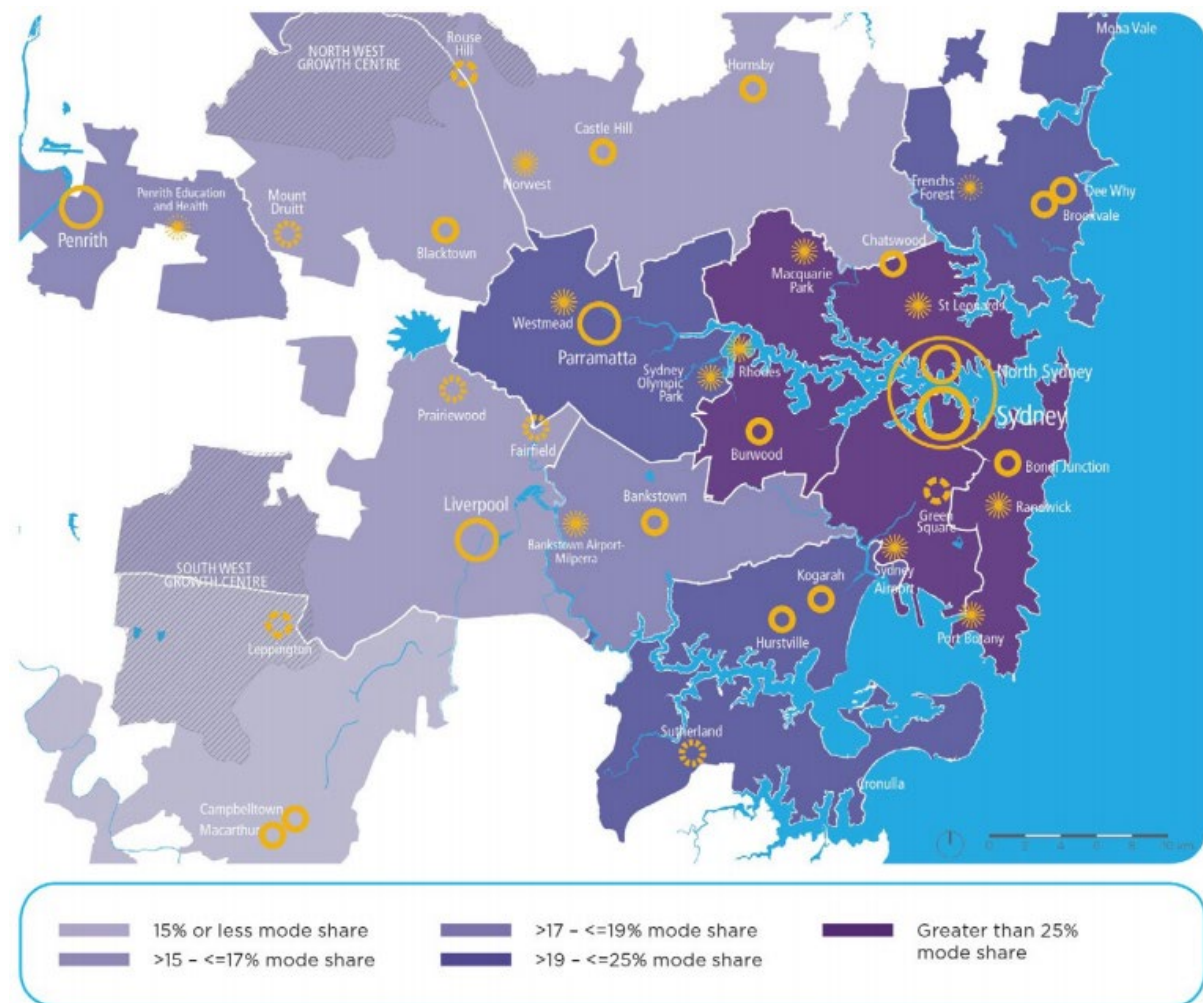
Sydney's Walking Future

TfNSW proposes to create a culture of walking as a viable and attractive transport choice. TfNSW would like to increase walking trips to reduce the pressure on the road network and public transport system.

The three pillars of Sydney's walking future include the following key aspects:

- promoting walking for transport
- connecting people to places through safe walking networks around centres and public transport interchanges
- engaging with partners across government, with councils, non-government organisations and the private sector to maximise effectiveness.

Figure 3-14 shows that the Penrith LGA is located in the 17 per cent to 19 per cent walking mode share range, while the South West Growth Centre is located in the 15 per cent to 17 per cent walking mode share range. Overall, travelling from west towards east, there is a gradual increase in the walking modal share as we approach areas of high density, employment areas and the Sydney CBD.



Source: Sydney's Walking Future, NSW Government, December 2013

Figure 3-14 Walking patterns across Sydney

Sydney's Cycling Future

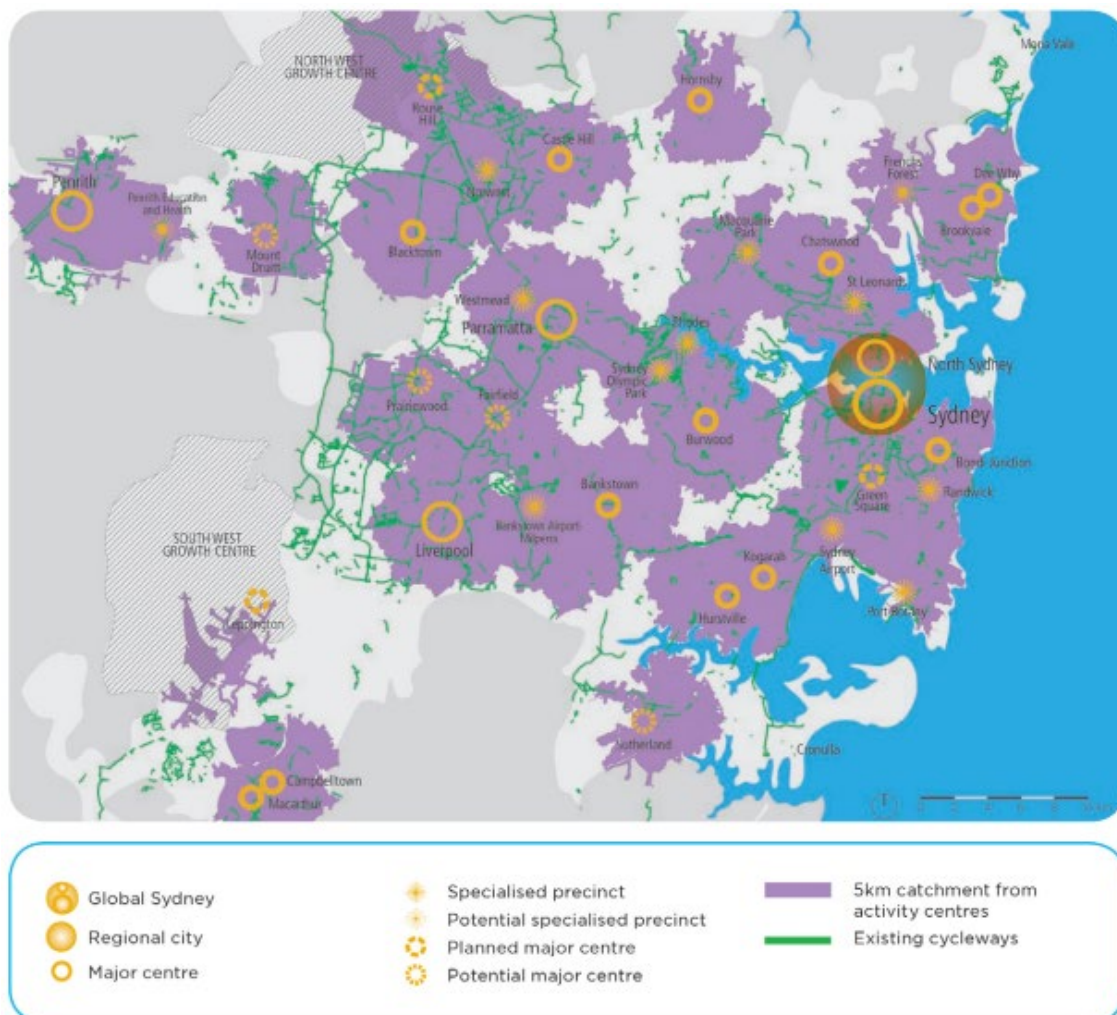
TfNSW is planning to increase the mode share of cycling in the Sydney metropolitan region for short trips ranging between 20 and 30 minutes through developing a range of customer initiatives. These initiatives aim to raise the number of people riding a bike for transport as this would have a positive impact on travel time for people using other modes of transport.

TfNSW is intending to make bicycle riding a feasible transport mode through achieving the following:

- investing in separated cycleways and providing connected bicycle networks to major centres and transport interchanges
- promoting better use of the existing network
- engaging with partners across government, councils, developers and bicycle users.

In western Sydney, TfNSW is aiming to complete the missing links in the existing bicycle network and improve connections to the surrounding centres to achieve a cohesive network which supports the varied needs of those cycling for leisure, personal business and commuting.

Figure 3-15 shows the riding catchments from major activity centres and existing cycleways across Sydney. Sydney's Cycling Future notes that 70 percent of NSW residents would ride a bike more for everyday transport if it was safer and more convenient. Sydney's Cycling Future aims to fix the missing links in the cycle network so that people can cycle to town centres, including railway stations, in a safer manner.



Source: Sydney's Cycling Future, NSW Government, December 2013

Figure 3-15 5 km bike riding catchment from major activity centres and existing cycleways

3.4.3 Proposed freight upgrades

St Marys Intermodal Facility

The St Marys Intermodal Facility is an approved development that includes the staged construction and operation of an intermodal road and rail terminal and container park. The project aims to develop a freight hub at St Marys in Western Sydney and facilitate freight mode shift with the aim to reduce road congestion and support an efficient supply-chain.

The freight hub is located in St Marys within the Penrith LGA and is anticipated to support a yearly operating capacity of 300,000 twenty-foot equivalent units (TEU) (shipping containers) and remove 10 million truck kilometres per year from the state and regional road network. This includes primary freight routes servicing Port Botany.

The facility is proposed to be operated 24/7 with a cease of operation from 2:00 pm on Saturday to 4:00 am on Sunday. Intermodal operations for rail are also anticipated to operate 24/7 with empty depot operations proposed to be 24 hours. The construction program prepared for the project and included in the Environmental Impact Statement indicates that construction activities would be undertaken under a staged program, with construction works anticipated to commence in mid-2019 and be completed in early 2020. However, the project was since delayed and approval for the project was only obtained in June 2020.

The St Marys Intermodal Facility is considered in the cumulative assessment of the project, which is discussed in further detail in Section 6.1.4.

Western Sydney Freight Line corridor

Western Sydney Freight Line corridor protection by the NSW Government is part of planning for the long-term transport needs of western Sydney and investigates future rail connections to serve Western Sydney International, connect Port Botany to Western Sydney and Western NSW and support the movement of freight by rail across Greater Sydney.

TfNSW is identifying land for the Western Sydney Freight Line corridor which would provide a future freight rail line connecting Port Botany to Western Sydney. The project forms part of the future planning for the transformation of Western Sydney, with the population in Western Sydney projected to be one of the fastest growing in NSW. In addition, the opening of Western Sydney International and the construction of surrounding employment lands is expected to create additional jobs and attract residents to the region.

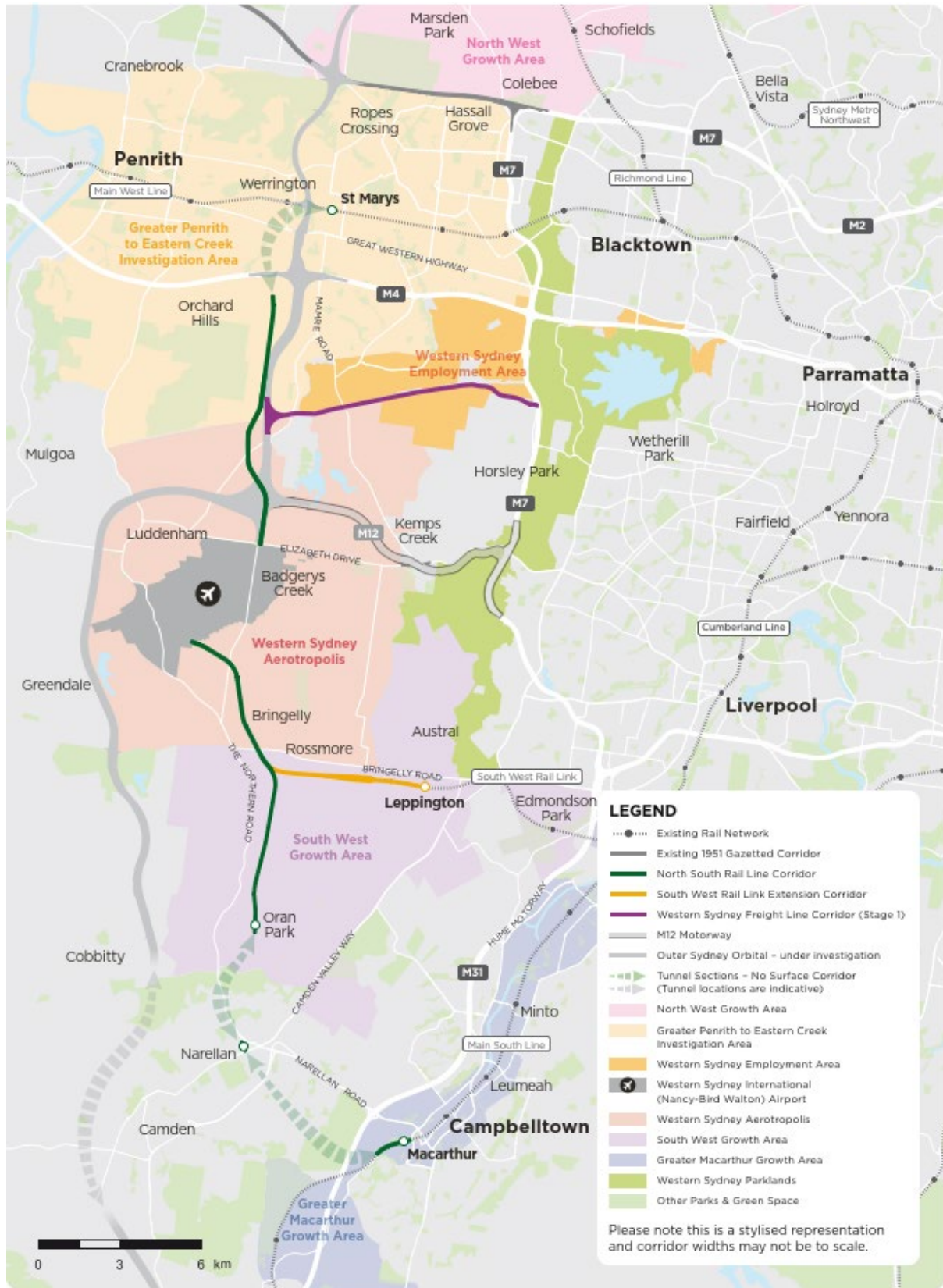
In June 2020, the NSW Government confirmed the alignment of the Western Sydney Freight Line. The project would join a future section through Wetherill Park, linking to the Southern Sydney Freight Line at Leightonfield, which connects to Port Botany.

Stage 1 of the project would be a dedicated freight line that runs from the future Outer Sydney Orbital at Luddenham, discussed in Section 3.4.4, to the M7 Motorway at Horsley Park. It aims to reduce congestion on local roads and allow for goods to be transported by rail across Western Sydney. Stage 1 would also link growing industrial areas and distribution centres, in addition to feeding up the Main West Rail Line to take up more passenger services. Stage 2 of the project is currently under investigation. This Stage aims to provide a link to the Southern Sydney Freight Line and Port Botany.

Key features of the future rail line corridor include:

- provide a freight rail connection between Western Sydney and Port Botany
- support the movement of freight across Greater Sydney
- serve employment and future industrial areas across the Western Sydney Airport Growth Area.

The proposed Western Sydney Freight Line Stage 1 alignment within Western Sydney is shown in Figure 3-16.



Source: NSW Government, 2020

Figure 3-16 Western Sydney Freight Line

3.4.4 Proposed road upgrades

M12 Motorway

A new motorway is being delivered between the M7 Motorway, Cecil Hills and The Northern Road in Luddenham over a distance of about 16 kilometres. The project would connect to Sydney's motorway network and would provide direct access to Western Sydney International as shown in Figure 3-17.

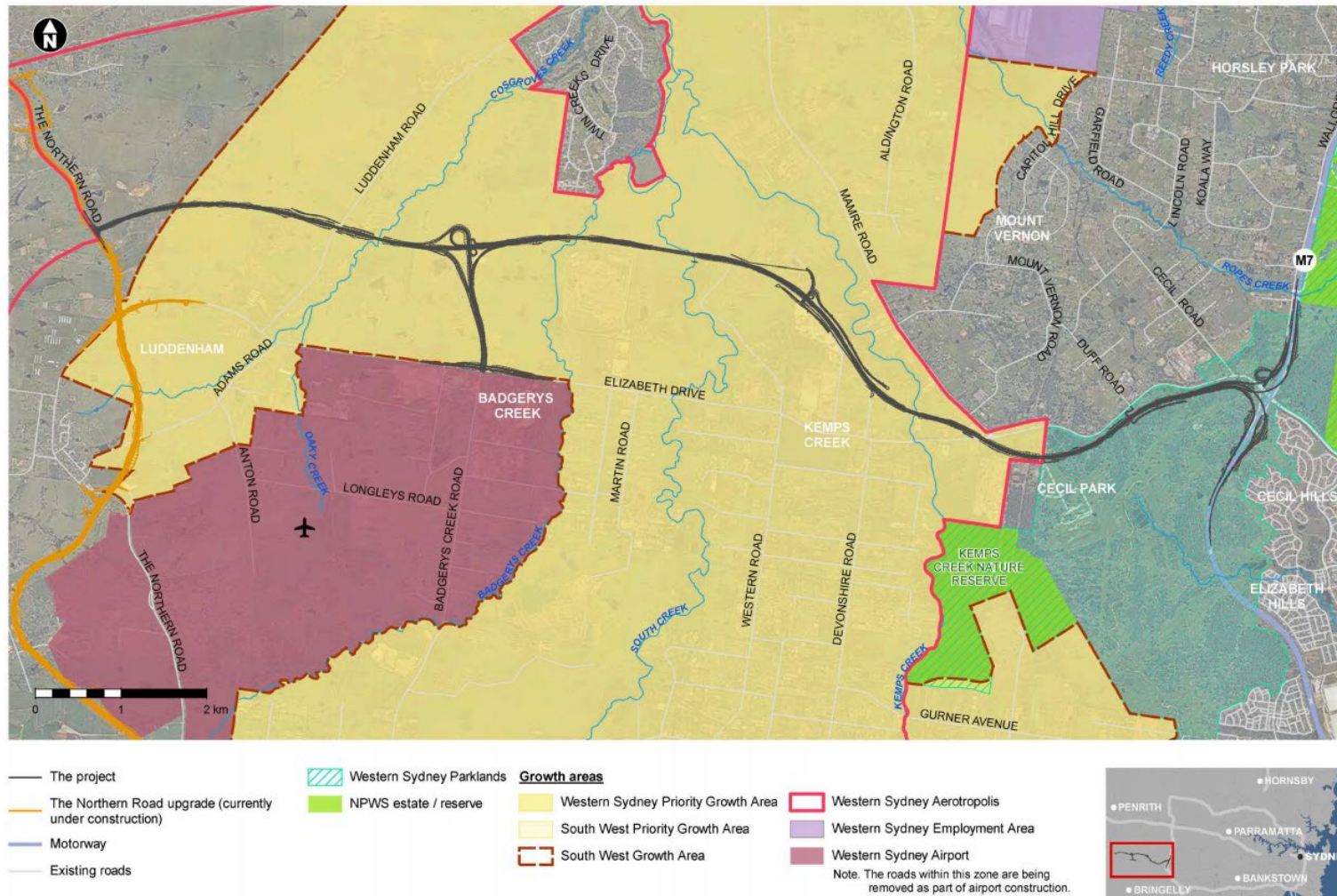
The proposed corridor is anticipated to provide increased road capacity and reduce congestion and travel times in the future. The project would also improve the movement of freight in and through western Sydney and is expected to serve the Western Sydney Aerotropolis and the South West Priority Growth Area.

Construction of the project is expected to start in 2022 and be open to traffic before the opening of the Western Sydney International in 2026. The construction works would occur concurrently across the full length of the construction footprint during this period.

The future M12 motorway will have the following key features:

- four lanes (with provision for up to six lanes) with a median
- a direct connection to Western Sydney International
- a new connection to The Northern Road with traffic lights
- a motorway-to-motorway interchange at the M7 Motorway
- pedestrian and cyclist infrastructure.

Funding is committed for the design and construction of the future M12 Motorway, which would include an overpass crossing Elizabeth Drive from the north into Western Sydney International.



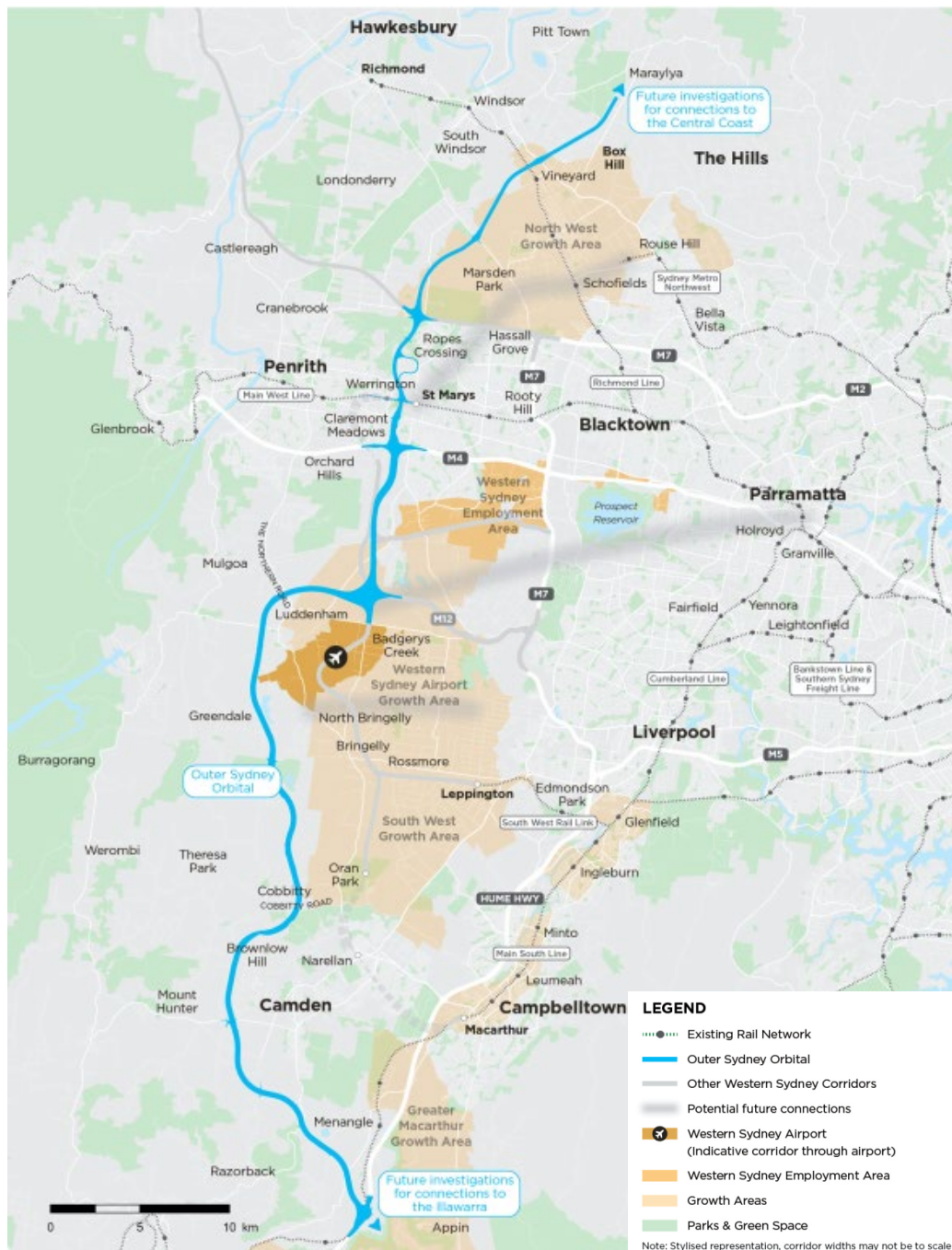
Source: NSW Government, 'M12 Motorway Environmental Impact Statement', October 2019

Figure 3-17 Future M12 Motorway alignment

Outer Sydney Orbital

The Outer Sydney Orbital (OSO) is a multi-modal transport corridor that would connect existing and planned road and rail networks north and south of Sydney. The corridor aims to provide improved north-south regional connectivity and would connect between Box Hill in the north and the Hume Motorway near Menangle in the south, with plans to investigate potential connections to the Illawarra and the Central Coast. The transport corridor further aims to provide connection for a future motorway and freight rail with supporting intermodal terminal and passenger rail.

The project forms part of the long term planning transport needs of Western Sydney and is currently in the corridor preservation stage, a process that aims to identify and preserve areas of land for future transport use. The identified corridor for the OSO is shown in Figure 3-18.



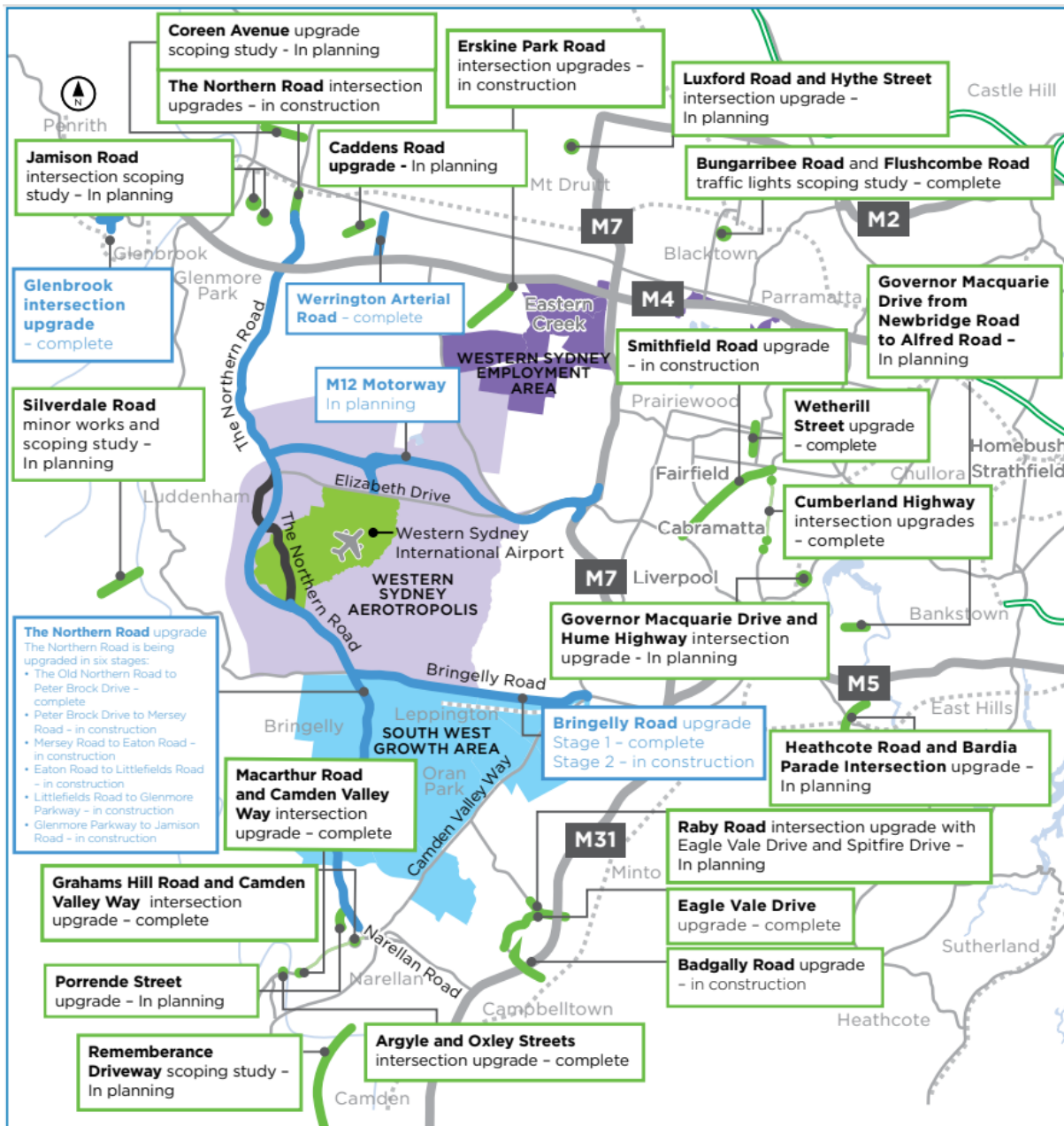
Source: TfNSW, 2019

Figure 3-18 Outer Sydney Orbital corridor

The Northern Road Upgrade

The project consists of upgrade of a 35 kilometre section of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway in Glenmore Park, as shown in Figure 3-19.

The Northern Road is a key north-south arterial link between Richmond Road and Camden Valley Way. It is approximately 51 kilometres long and connects the North West Growth Area, Western Sydney International and South West Growth Area. The Northern Road upgrades forms part of the Western Sydney Infrastructure Plan, which are infrastructure improvements aimed at helping accommodate future community and population needs in western Sydney.



Source: The Australian and NSW Government, Western Sydney Infrastructure Plan, December 2019

Figure 3-19 The Western Sydney Infrastructure Plan

The Northern Road upgrades are being delivered in stages with some stages completed and the final stages having started construction in 2019, as summarised in Table 3-8.

Table 3-8 Summary of The Northern Road staging upgrades

Stage	Description	Status
1	Between The Northern Road, Narellan and Peter Brock Drive, Oran Park	Completed
2	Between Peter Brock Drive, Oran Park and Mersey Road	Under construction
3	Between Glenmore Parkway, Glenmore Park and Jamison Road, South Penrith	Under construction
4	Between Mersey Road, Bringelly and Eaton Road, Luddenham	Completed
5	Between Littlefields Road, Luddenham and Glenmore Parkway, Glenmore Park	Under construction
6	Between Eaton Road, Luddenham and Littlefields Road, Luddenham	Under construction

Source: Transport for NSW, 2020

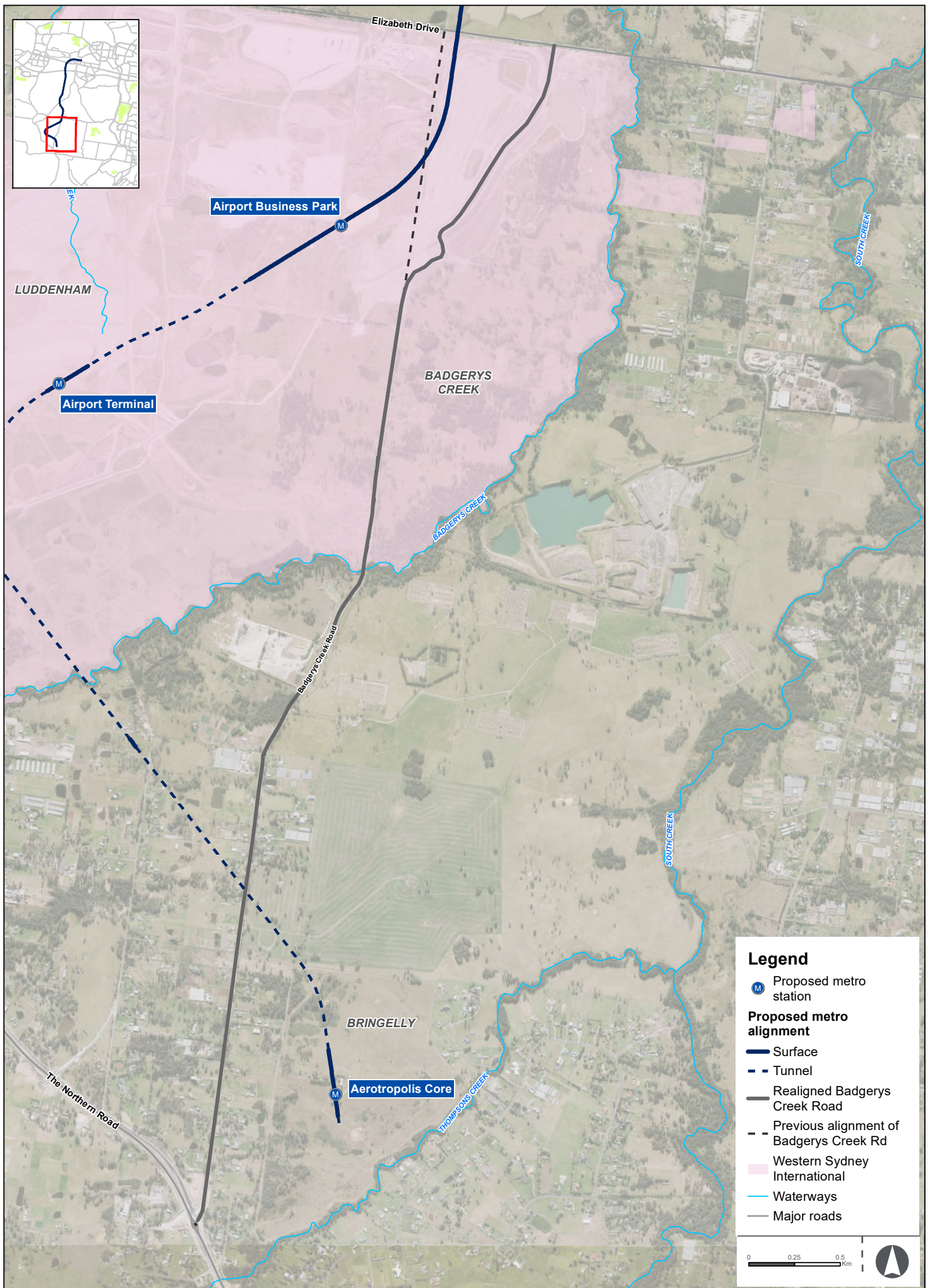
Badgerys Creek Road realignment

As part of preparatory works for Western Sydney International, the existing Badgerys Creek Road has been realigned for the section between Elizabeth Drive and Longleys Road and the intersection of Badgerys Creek and Elizabeth Drive has been upgraded to a roundabout. This section of the road was opened to traffic in February 2020.

Early earthworks for this project have now been completed with the northern section having been realigned providing a new connection point to Elizabeth Drive. By opening year of the project in 2026, the intersection of Badgerys Creek Road and Elizabeth Drive will be signalised as part of the M12 Motorway/Elizabeth Drive works.

The realignment would further allow for the future M12 Motorway to connect to the Western Sydney International site and would allow access to the construction sites for the project located along Badgerys Creek Road as well as to the Aerotropolis Core station.

Construction works for Badgerys Creek Road realignment are shown in Figure 3-20



Mamre Road Upgrade

The NSW Government started planning for a future upgrade of Mamre Road between the M4 Western Motorway and Kerrs Road. Stage 1 of the upgrade includes the section of road between the M4 Motorway in St Claire and Erskine Park Road in Erskine Park, while Stage 2 includes the section of the road from Erskine Park Road to Kerrs Road in Kemps Creek, as shown in Figure 3-21. The upgrades aim to support the future population and economic growth projected in the area. The NSW Government has now committed \$220 million to Stage 1. Investigations to inform the concept design are currently underway.

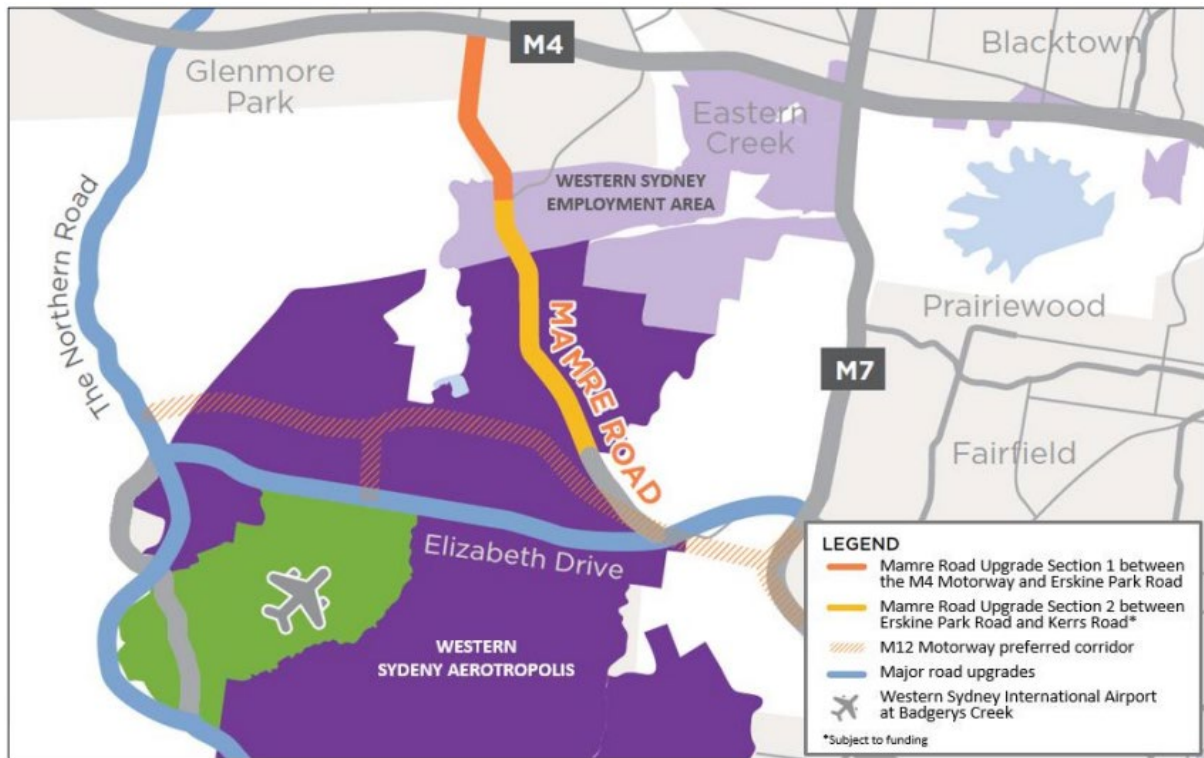
In May 2017, TfNSW released a community update indicating that field work and technical studies were being undertaken. This included surveys, traffic modelling and environmental and heritage investigations. An Options Report was subsequently prepared and details the analysis of corridor options and the process used to select the preferred option.

The preferred option is shown in Figure 3-22 and includes the following features:

- two lanes in each direction with wide central median between the M4 Western Motorway and Kerrs Road
- provision for a future third lane in each direction
- shared bicycle and pedestrian paths
- new signalised intersection at Luddenham Road
- upgrade to signalised intersection at Banks Drive
- provision of a future grade-separated interchange and link between Mamre Road and Devonshire Road at the proposed M12 Motorway corridor.

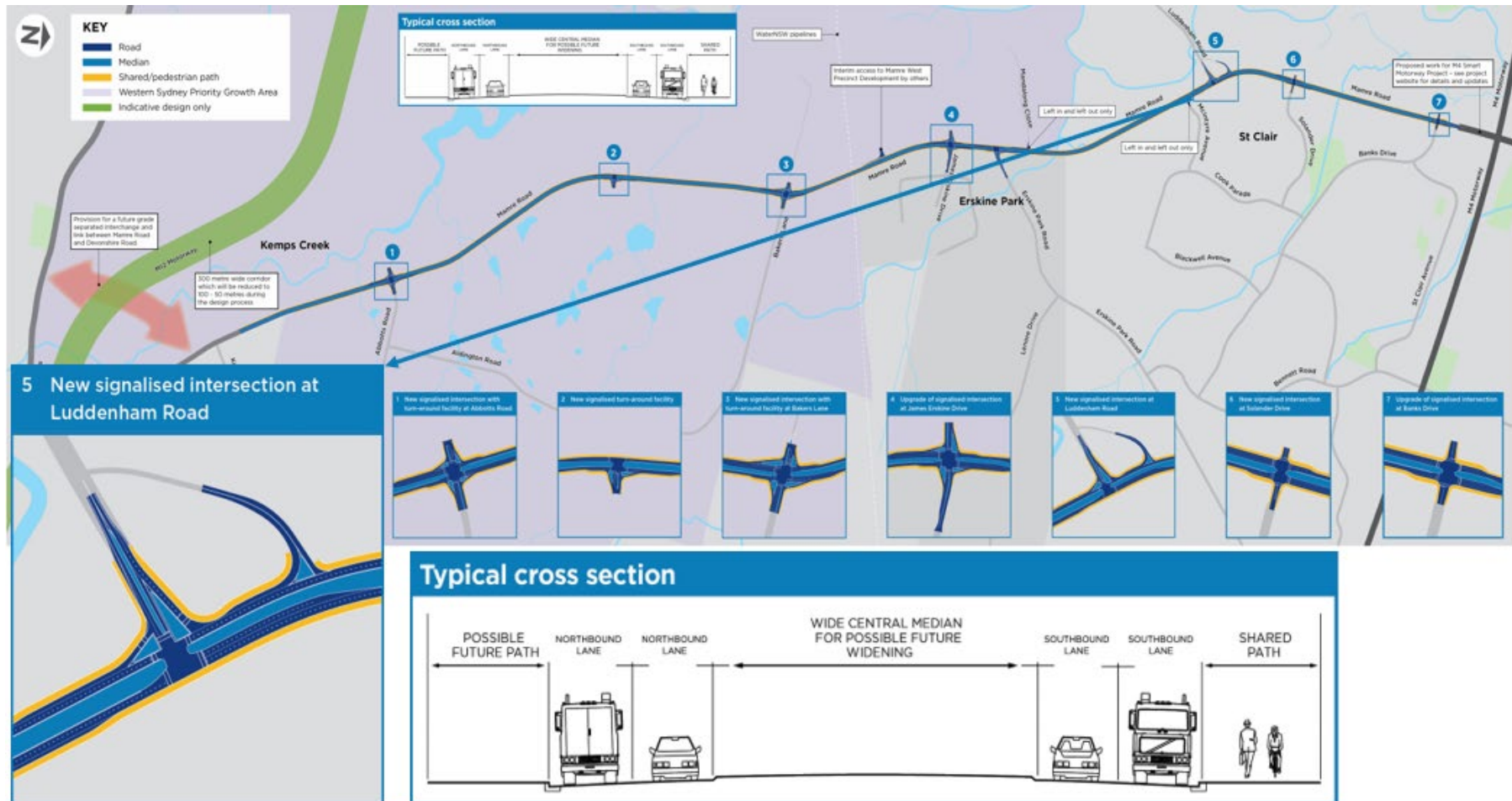
In addition, the NSW Government announced the rezoning of the Mamre Road Precinct within the Western Sydney Employment Area in June 2020. The precinct would deliver about 850 hectares of industrial land and preserve land for environmental conservation and open space, as well as protect land for a potential Western Sydney freight intermodal terminal.

The WRTM model prepared for the Environmental Impact Statement for the M12 Motorway was developed when the Mamre Road upgrade was in the investigation stages and prior to the rezoning of the Mamre Road Precinct as discussed in Section 2.4.4. As such, these proposed projects would be required to consider the impacts of the project as part of their investigations.



Source: The NSW Government, 'Mamre Road upgrade Stage 1 Community Update', March 2020

Figure 3-21 Mamre Road Upgrade – project alignment



Source: TfNSW, 'Mamre Road upgrade Community Consultation Report', May 2019

Figure 3-22 Mamre Road Upgrade – preferred option

Elizabeth Drive Upgrade

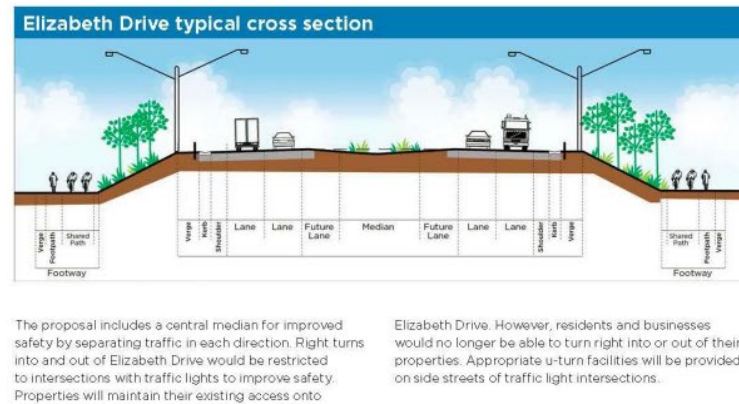
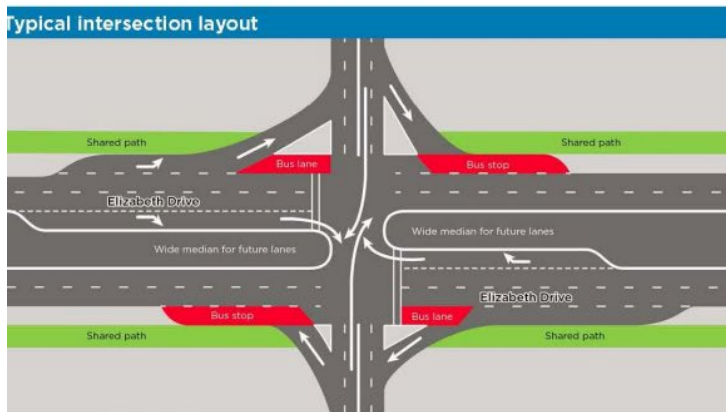
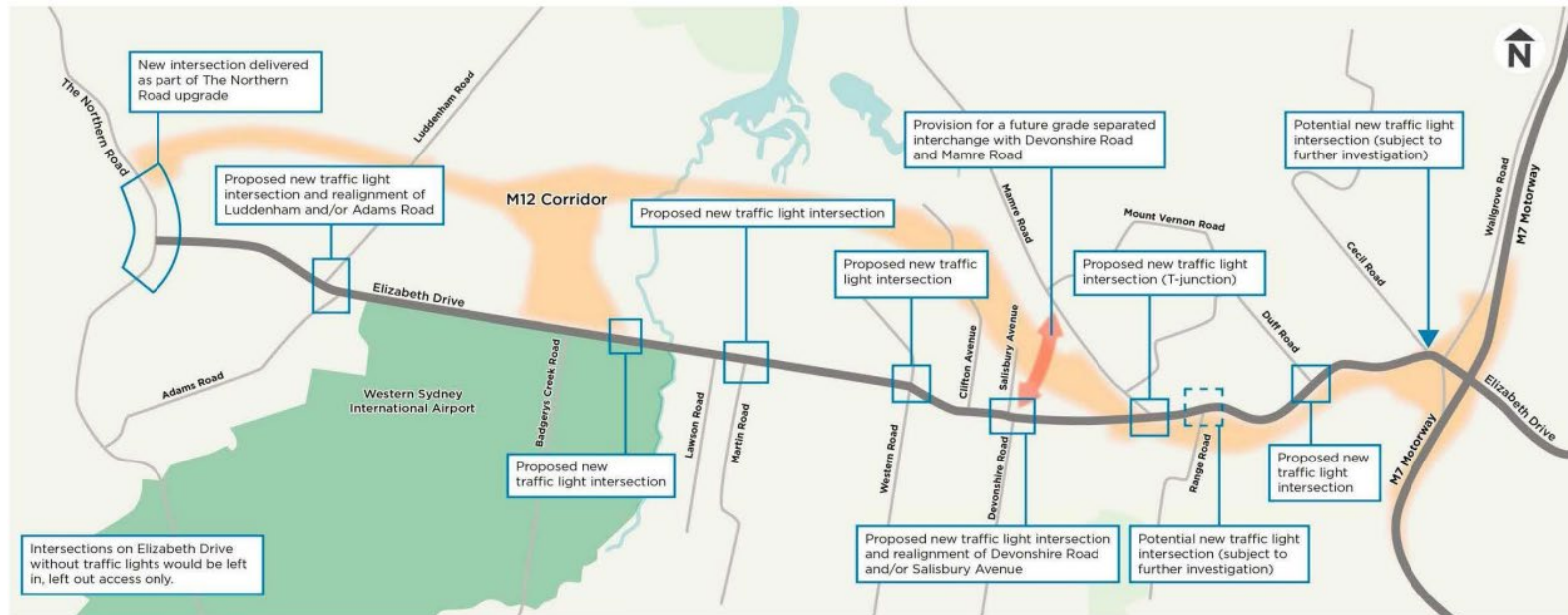
The Elizabeth Drive upgrade consists of an upgrade of Elizabeth Drive directly in front of the Airport. Elizabeth Drive will be upgraded, and grade-separated over the project and the M12 Motorway entry to Western Sydney International.

TfNSW has allocated funding to investigate improvements to Elizabeth Drive between the M7 Motorway and The Northern Road with the aim of supporting the planned development in the region. The upgrade of Elizabeth Drive would support the delivery of Western Sydney International and Western Parkland City. Investigations have already started and include early planning, environmental field investigations and strategic traffic modelling and community consultation was undertaken in June 2019. A community consultation report released in March 2020 by the NSW Government indicates the access strategy for the proposed upgrade of Elizabeth Drive includes the key features shown in Figure 3-23 as follows:

- an upgraded four lane road with a central median, with provision for up to six lanes between the M7 Motorway and The Northern Road (14 kilometre length)
- new traffic lights at multiple intersections
- left in, left out access only at intersections without traffic lights.

TfNSW has identified a need for pedestrian, cycling and bus stop infrastructure along Elizabeth Drive due to limited facilities currently provided along the corridor.

Access to the Western Sydney International from Elizabeth Drive would be provided through the realigned Badgerys Creek Road. In addition, funds have been committed for the design and construction of the overpass that enables the future M12 Motorway to cross Elizabeth Drive into Western Sydney International.



Source: TfNSW, 'Elizabeth Drive upgrade Community Consultation Report, March 2020

Figure 3-23 Elizabeth Drive Upgrade

4 Assessment of construction impacts

4.1 Overview

The combined traffic profiles for construction sites within a geographical sub-area indicates that peak construction activity occurs between late 2023 and mid-2024 given the staged nature of construction works for the project. Peak construction year is forecast to occur during 2023 for construction sites north of Western Sydney International and 2024 for all other construction sites including the ones within Western Sydney International. As such, the analysis of construction traffic movements was undertaken based on the construction traffic volumes forecast to be generated during the construction peak in 2023 and 2024 for the respective sites. The indicative construction methodology and construction traffic profiles are outlined in Chapter 8 (Project description – construction) of the Environmental Impact Statement. The methodology and assumptions associated with the peak construction traffic volumes are outlined in Section 2.4.2 of this technical paper.

Construction hours are detailed in Chapter 8 (Project description – construction) of the Environmental Impact Statement. It is expected that majority of the above ground construction activities and station fit-out and other works would be carried out during standard construction hours as follows:

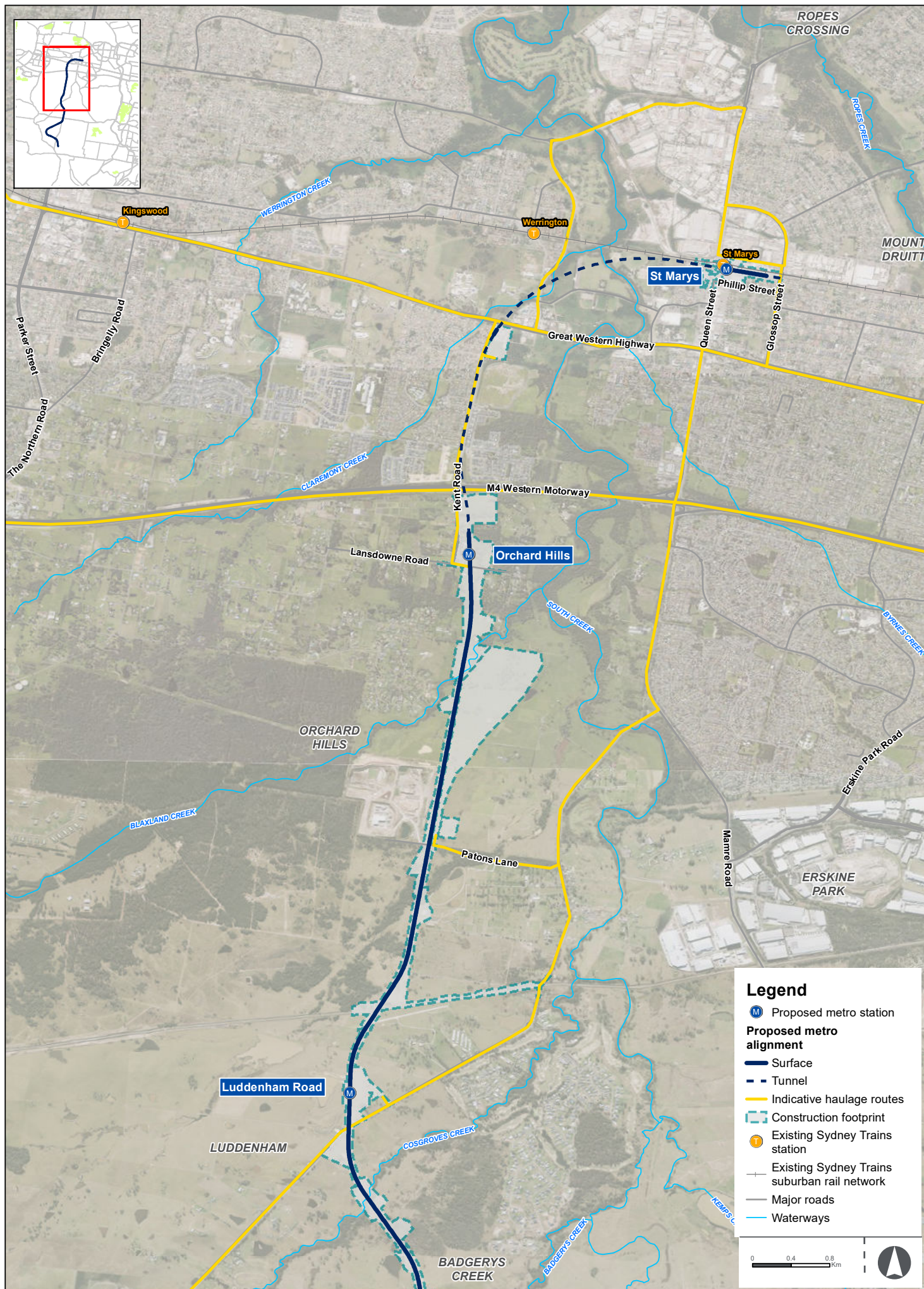
- Monday to Friday: 7:00 am to 6:00 pm
- Saturdays: 8:00 am to 1:00 pm
- No works on Sundays or public holidays.

Given the scale and complexity of works required for the construction of the project, some works would need to be undertaken outside standard construction working hours. The tunnel boring machine (TBM) sites would operate continuously and as such, the tunnelling, excavation and associated support activities would need to be carried out up to 24 hours per day, seven days per week. For the purposes of this assessment, construction hours for the project have been assumed as a standard 11-hour work day, which from a traffic perspective provides a worst-case scenario.

The location of each construction site along the corridor and the construction access routes per vehicle type, the permitted turning movements at each access location and any identified intersection upgrades are further detailed in Chapter 8 (Project description – construction) of the Environmental Impact Statement.

There would be some on-site parking provided for construction workers at construction sites. Construction sites would be managed to minimise construction worker parking on surrounding streets. In St Marys, given the site's proximity to high frequency public transport services, all workers would be encouraged to use public transport when travelling to and from the site. Construction worker parking would be managed as per the guidelines included in the Construction Traffic Management Framework (CTMF) appended to this Environmental Impact Statement.

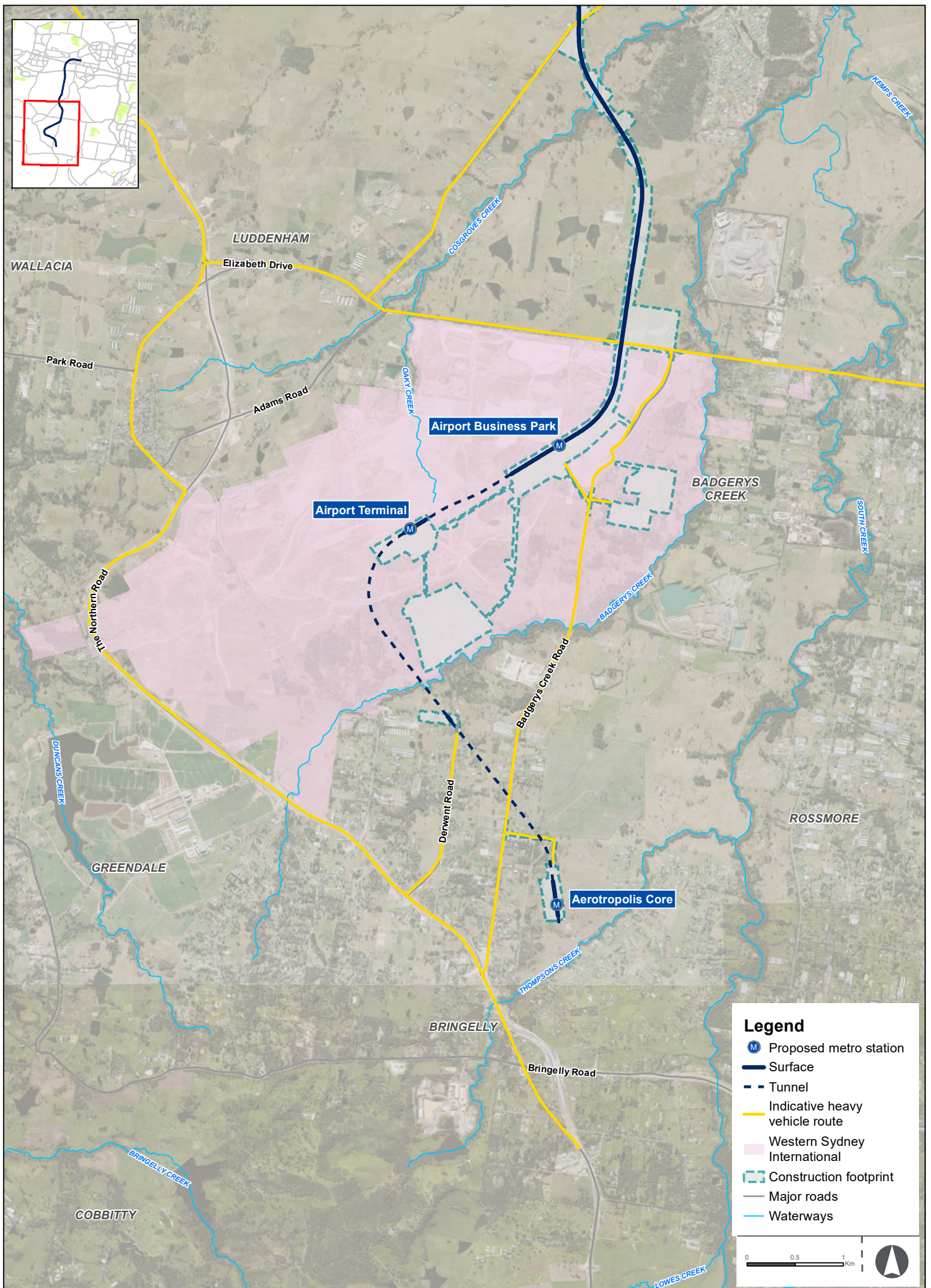
Figure 4-1 and Figure 4-2 outlines the location of each construction site within the study area, with site access locations indicated for each site along with construction heavy vehicle haulage routes. Although Luddenham Road is identified as part of the construction haulage routes to be used by the project, the road is not a designated B-Double route. As such, use of this road by B-Doubles during construction of the project would require obtaining approval from relevant road authorities. It is anticipated that this would be managed during subsequent design stages in coordination with relevant stakeholders. It should also be noted that these access routes are only indicative and are subject to change during subsequent design stages.



Construction heavy vehicle haulage routes – North of Luddenham Road

Figure 4-1

Indicative only, subject to design development



Construction heavy vehicle haulage routes – South of Luddenham Road

Figure 4-2

Indicative only, subject to design development

4.1.1 Construction traffic volumes

Chapter 8 (Project description – construction) of the Environmental Impact Statement details the estimated construction traffic volumes, including staff movements, light deliveries and heavy vehicle movements expected at each construction site.

Anticipated construction traffic volumes between 6:00 am and 9:00 am were considered and indicate that haulage trucks are expected to start arriving up to an hour after the expected staff arrivals. The majority of the construction staff are expected to arrive before 7:00 am and the haulage trucks are expected to start arriving around 7:30 am. In addition, during staff arrivals, background traffic is expected to be less than the assessed network peak. Based on this and the proposed hours of work, it is expected that only 50 per cent of the construction personnel would travel to/from the construction site during the assessed peak hours. It is further expected that no staff would exit the site during the morning peak hour or enter the site during the evening peak hour.

The assessed peak hours for the construction scenarios are consistent with those identified in the base year assessment: 7:30 am to 8:30 am for the morning peak hour and 4:30 pm to 5:30 pm for the evening peak hour. For light deliveries and heavy vehicles accessing the construction sites, it was assumed that these movements would likely be equally distributed throughout the shift hours for the respective sites. All light deliveries and heavy vehicle movements were also assumed to enter and exit the site during the same hour. The types of heavy vehicles likely to be used at various construction sites are summarised in Table 4-1.

Table 4-1 Proposed truck types for construction

Truck type	Capacity (in tonnes)
Body Truck (12-20t type)	15
Semi-trailer	25
Truck and Dog	30
Dry Cement Semi-trailer	25
B-Double (42t)	42

Table 4-2 summarises peak staff movements, light deliveries and heavy vehicle movements expected at each site.

Table 4-2 Indicative peak construction vehicle movements for construction sites

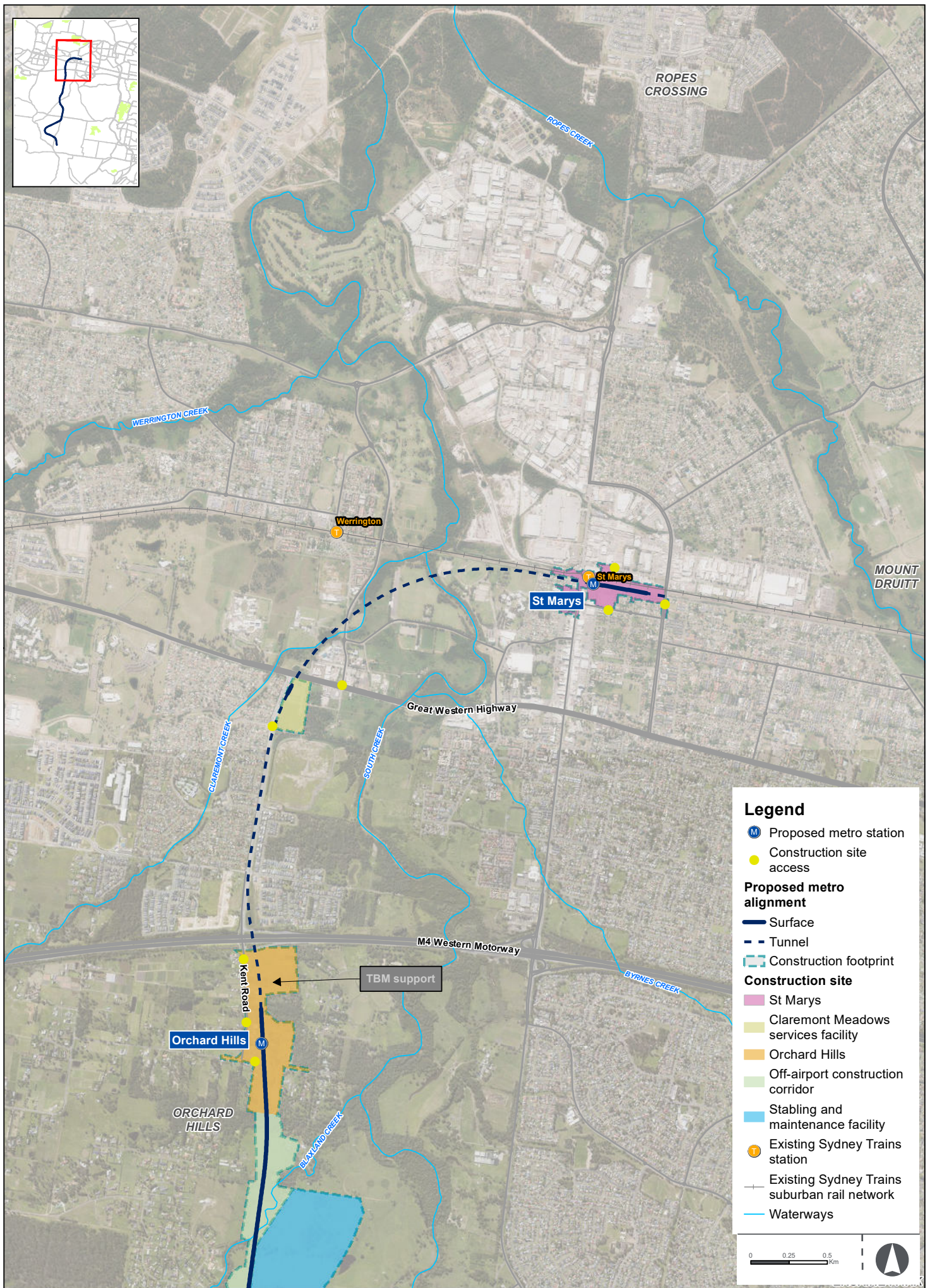
Site ID	Vehicle Type ¹	Peak construction movements ²					
		AM peak			PM peak		
		IN	OUT	Total	IN	OUT	Total
Off-airport							
St Marys	LV Staff	212	0	212	0	212	212
	LV Deliveries	2	2	4	2	2	4
	HV	8	8	16	8	8	16
Claremont Meadows services facility	LV Staff	50	0	50	0	50	50
	LV Deliveries	1	1	2	1	1	2
	HV	6	6	12	6	6	12
Orchard Hills	LV Staff	178	0	178	0	178	178
	LV Deliveries	2	2	4	2	2	4
	HV	20	20	40	20	20	40

Site ID	Vehicle Type ¹	Peak construction movements ²					
		AM peak			PM peak		
		IN	OUT	Total	IN	OUT	Total
Stabling and maintenance facility	LV Staff	56	0	56	0	56	56
	LV Deliveries	1	1	2	1	1	2
	HV	11	11	22	11	11	22
Off-airport construction corridor	LV Staff	281	0	281	0	281	281
	LV Deliveries	4	4	8	4	4	8
	HV	29	29	58	29	29	58
Bringelly services facility	LV Staff	31	0	31	0	31	31
	LV Deliveries	1	1	2	1	1	2
	HV	5	5	10	5	5	10
Aerotropolis Core	LV Staff	110	0	110	0	110	110
	LV Deliveries	1	1	2	1	1	2
	HV	13	13	26	12	13	26
On-airport							
Airport Business Park	LV Staff	213	0	213	0	213	213
	LV Deliveries	1	1	2	1	1	2
	HV	6	6	12	6	6	12
On-airport construction corridor (Western Sydney International to Airport Business Park)	LV Staff	48	0	48	0	48	48
	LV Deliveries	1	1	2	1	1	2
	HV	10	10	20	10	10	20
On-airport corridor construction (Airport Business Park to Airport Terminal)	LV Staff	177	0	177	0	177	177
	LV Deliveries	1	1	2	1	1	2
	HV	10	10	20	10	10	20
On-airport corridor construction (Airport Terminal to Aerotropolis)	LV Staff	238	0	238	0	238	238
	LV Deliveries	1	1	2	1	1	2
	HV	16	16	32	16	16	32
Viaduct and tunnel segment yard	LV Staff	142	0	142	0	104	142
	LV Deliveries	1	1	2	1	1	2
	HV	3	3	6	3	3	6

[1] LV= light vehicle, HV= heavy vehicle

[2] Peak construction volumes per hour per shift

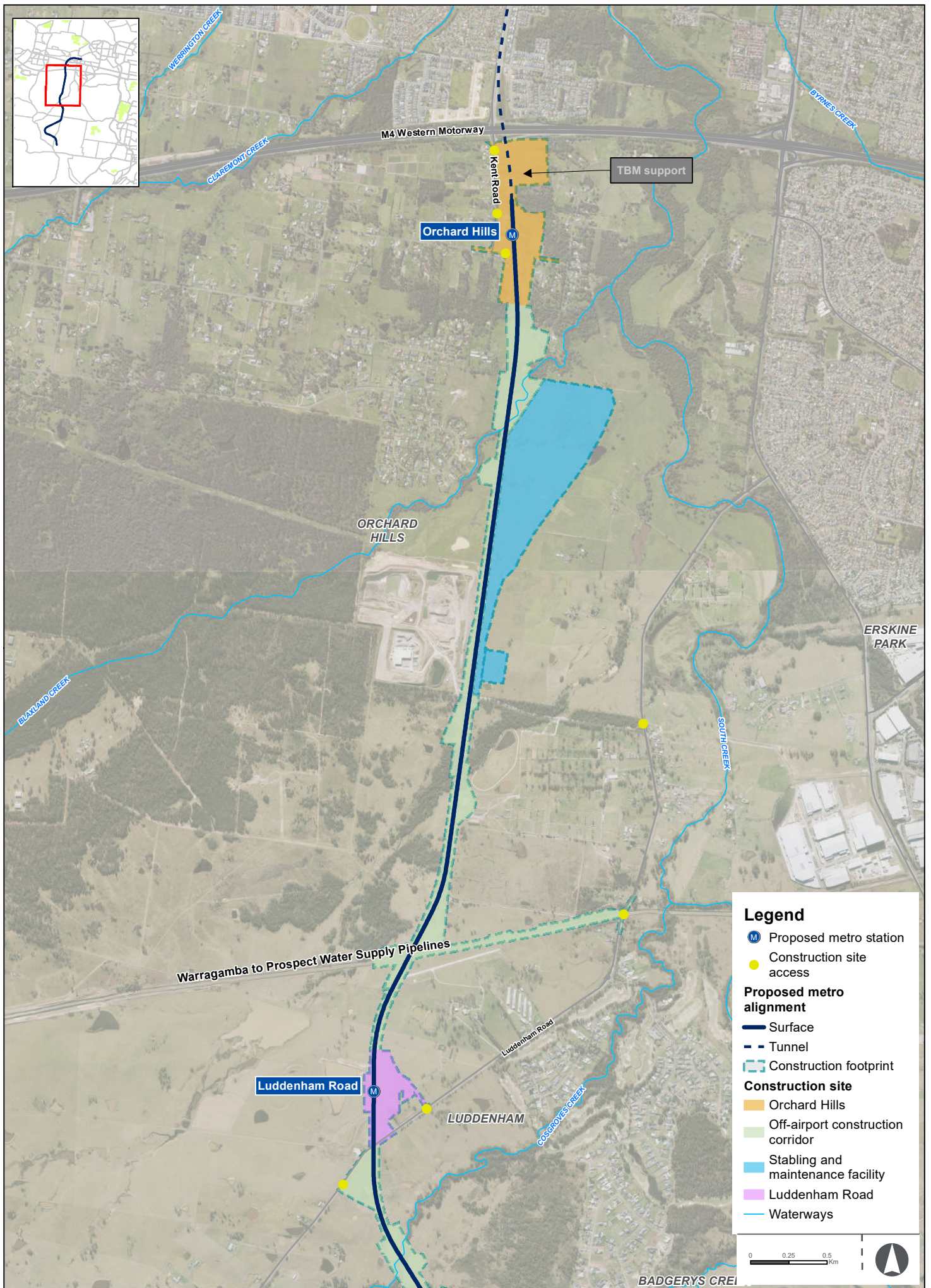
The construction footprint and the construction site access for each site within the study area are shown in Figure 4-3, Figure 4-4, Figure 4-5 and Figure 4-6.

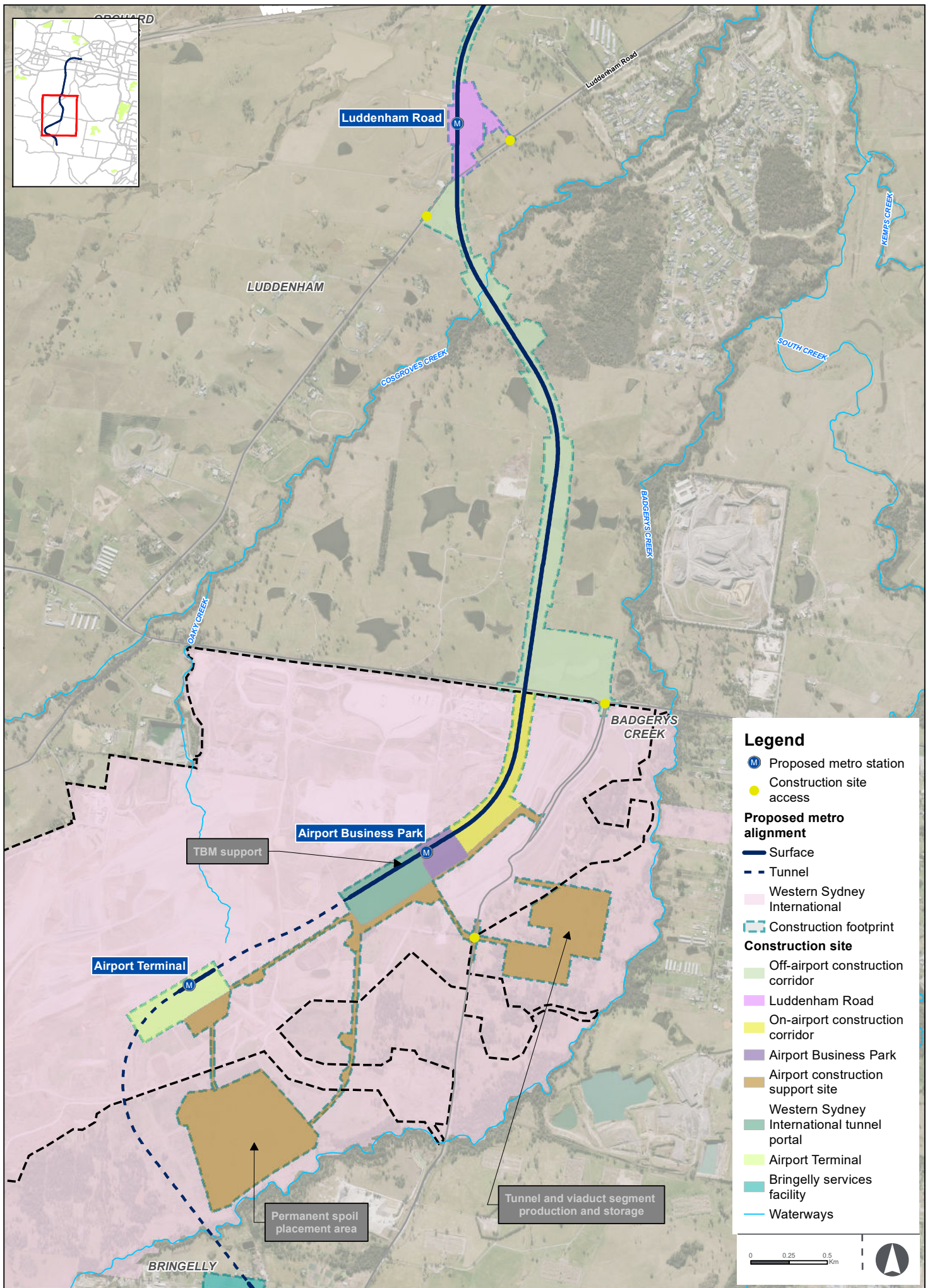


Construction footprint in St Marys, Claremont Meadows and Orchard Hills

Figure 4-3

Indicative only, subject to design development

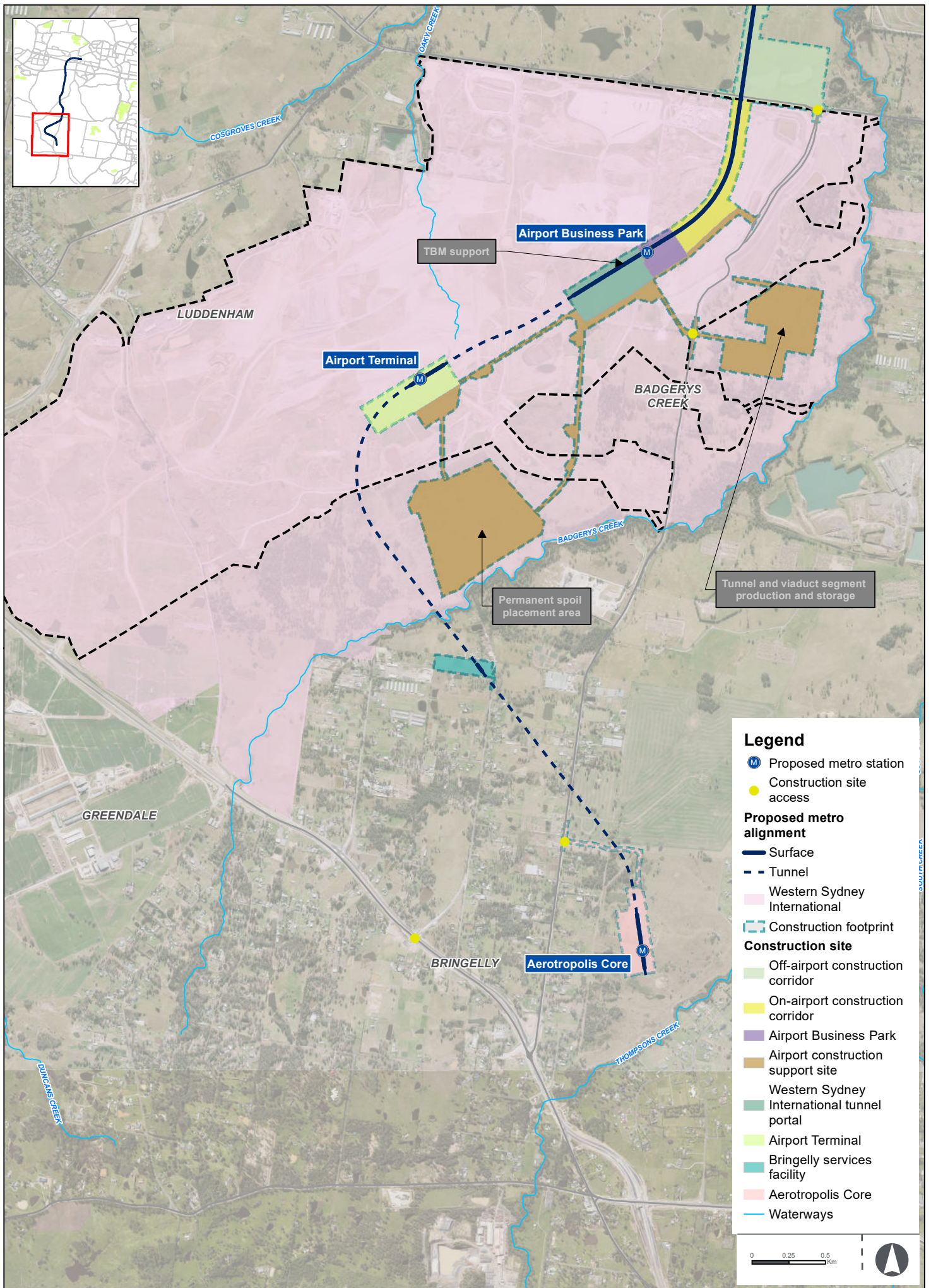




Construction footprint in Luddenham and Badgerys Creek

Figure 4-5

Indicative only, subject to design development



Construction footprint in Luddenham, Badgerys Creek and Bringelly

Figure 4-6

Indicative only, subject to design development

4.1.2 Expected traffic distribution

The distribution of vehicles associated with the construction scenarios follow the construction access and egress routes identified in Chapter 8 (Project description – construction) of the Environmental Impact Statement. The anticipated traffic distribution for staff and heavy vehicles has been carried across the road network through to the surrounding arterial road network.

The distribution for staff light vehicles is assumed to be consistent with the existing distribution of light vehicles in the study area.

The distribution of heavy vehicles accessing the construction sites are influenced by the proposed construction access and egress routes, spoil haulage routes identified in Chapter 8 (Project description – construction) of the Environmental Impact Statement and likely sources for materials required for construction. Most construction trucks and vehicle deliveries accessing construction sites located between St Marys and Luddenham are expected to primarily approach/depart via the Great Western Highway and the M4 Western Motorway. Construction sites and delivery vehicles for sites located in Luddenham are expected to approach the site via the M4 Western Motorway from the north or The Northern Road and the M7 via Elizabeth Drive from the south. Similarly, for construction sites located south of Western Sydney International, access to/from these sites is primarily expected via Elizabeth Drive and The Northern Road.

Based on these factors, the following assumptions were made to identify the likely heavy vehicle distribution:

- Great Western highway: 50 per cent from the east and 50 per cent from the west
- Mamre Road: 50 per cent from the north and 50 per cent from the south
- Luddenham Road: 50 per cent from the north and 50 per cent from the south
- Elizabeth Drive: 50 per cent from the east and 50 per cent from the west
- Badgerys Creek Road: 40 per cent from the north and 60 per cent from the south
- The Northern Road: 40 per cent from the east and 60 per cent from the west.

Light vehicle deliveries are also assumed to follow the same distribution as heavy vehicles. The construction movements associated with the construction activity have been distributed onto the intersections within the study area based on the assumptions outlined above.

4.2 Off-airport impacts

4.2.1 Overview

A number of construction sites are required for the construction of the project as outlined in Chapter 8 (Project description – construction) of the Environmental Impact Statement. Laydown areas and site offices would be established along the project alignment requiring the removal or relocation of existing facilities at or around proposed construction sites.

This section summarises the anticipated impacts of the construction activities on the road network, access, parking, point-to-point as well as public transport and walking and cycling networks. Indicative construction impacts at the station sites on the road network and car parking facilities are further discussed in Chapter 8 (Project description – construction) of this Environmental Impact Statement.

St Marys Town Centre would be impacted by construction activities. Construction activities would result in road network modifications, road closures and/or street reconfiguration, removal of parking and relocation of bus facilities as well as some impacts to pedestrian and cycling access. Anticipated construction impacts at St Marys are presented in Figure 4-7 and include the following:

- temporary partial closure of Station Street, from Lethbridge Street to the eastern extent of station plaza east of Gidley Street
- minor temporary localised modifications at Harris Street and Glossop Street and temporary access modifications within the St Marys precinct, including at Harris Street, Glossop Street, Belar Street, Carinya Avenue, West Lane, Nariel Street and Queen Street

- temporary or permanent removal of about 435 car parking spaces within the St Marys precinct, including 310 off-street parking spaces and 125 on-street parking spaces and comprising restricted and unrestricted spaces
- temporary relocation of the St Marys Bus Terminal to Nariel Street and West Lane and establishment of a turnaround facility south of Nariel Street
- temporary impacts to the Harris Street footpath due to the movement of construction vehicles and temporary removal of pedestrian access to Station Street
- temporary changes to pedestrian access to residential properties on Station Street through local traffic control measures.

Some construction vehicles may need to temporarily use Lethbridge Street until heavy vehicle routes have been established within the construction footprint.

The road network outside of the St Marys Town Centre is expected to experience minimal impacts as a result of the construction of the project. This is due to these areas being largely greenfield areas.

Construction impacts of the project on the road network, access, parking, walking and cycling networks and the public transport network are described in detail in Section 4.2.2 to 4.2.9.



4.2.2 Road network performance

Mid-block performance

An assessment of the weekday AM peak and PM peak hour traffic volumes was completed to determine the general performance of the road network configuration during the peak construction year without and with construction activity in the study area. The findings of this assessment are summarised in Table 4-3.

The assessment indicates that the sections of Mamre Road and Luddenham Road, within the study area, are forecast to operate at or above theoretical capacity during the peak construction year without the addition of construction traffic generated by the project.

However, the following sections of the study area road network are forecast to operate at or above theoretical capacity due to the addition of construction traffic likely to be generated by the project:

- Luddenham Road west of Mamre Road at LOS F (southbound) during the PM peak
- Luddenham Road north of Elizabeth Drive at LOS F (southbound) during the PM peak
- Elizabeth Drive west of Badgerys Creek Road at LOS E (westbound) during the PM peak
- Elizabeth Drive east of Badgerys Creek Road at LOS E (eastbound) during the AM and PM peaks
- Badgerys Creek Road north of The Northern Road at LOS F (northbound) during the AM peak and (southbound) during the PM peak
- The Northern Road east of Badgerys Creek Road at LOS F (northbound) during the AM peak and (southbound) during the PM peak.

The impacts forecast along Luddenham Road are due to construction vehicle movements to the off-airport construction corridor sites, including the Luddenham Road station site and stabling and maintenance facility construction site. Impacts forecast along Elizabeth Drive, Badgerys Creek Road and The Northern Road are due to the combined construction vehicle movements to the sites located around Western Sydney International. However, it is anticipated that the use of a permanent spoil placement site within Western Sydney International is likely to mitigate potential impacts on the road network. Other mitigation measures to minimise these impacts have been identified in Section 7 of this technical paper.

Table 4-3 2023/2024 Peak construction year mid-block performance – off-airport

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Future year without construction scenario		Future year with construction scenario		Future year without construction scenario		Future year with construction scenario	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Glossop Street (north of the Great Western Highway)	NB	1900	1120	C	1330	C	1150	C	1190	C
	SB	1900	1180	C	1230	C	1240	C	1450	D
Great Western Highway (east of Queen Street)	EB	2800	1780	C	1870	C	1400	B	1470	C
	WB	2800	1570	C	1640	C	2190	D	2290	D
Great Western Highway (west of Queen Street)	NB	2800	1510	C	1590	C	1150	B	1210	B
	SB	2800	1080	B	1140	B	1820	C	1900	C
Queen Street (north of Great Western Highway)	NB	900	620	C	620	C	540	C	540	C
	SB	900	350	B	350	B	620	C	620	C
Mamre Road (south of the Great Western Highway)	NB	1800	1080	C	1120	C	1150	C	1200	C
	SB	1800	960	C	1010	C	1310	C	1350	D
Great Western Highway (east of Gipps Street)	EB	2800	2000	C	2010	C	1870	C	1920	C
	WB	2800	1650	C	1700	C	1870	C	1870	C
Great Western Highway (west of Gipps Street)	EB	2800	1670	C	1720	C	1900	C	1900	C
	WB	2800	1880	C	1890	C	1740	C	1790	C
Kent Road (north of the M4 Western Motorway)	NB	1900	1230	C	1260	C	1270	C	1350	C
	SB	1900	1090	C	1160	C	1130	C	1160	C
Kent Road (south of the M4 Western Motorway)	NB	900	550	C	630	C	340	B	550	C
	SB	900	230	A	440	B	300	A	380	B
Mamre Road (north of Luddenham Road)	NB	900	1630	F	1670	F	1570	F	1670	F
	SB	900	1800	F	1900	F	1460	F	1500	F

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Future year without construction scenario		Future year with construction scenario		Future year without construction scenario		Future year with construction scenario	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Luddenham Road (west of Mamre Road)	NB	900	1020	F	1070	F	660	C	790	D
	SB	900	300	A	430	B	850	E	900	F
Luddenham Road (north of Elizabeth Drive)	NB	900	1080	F	1280	F	590	C	660	C
	SB	900	300	A	370	B	860	E	1070	F
Elizabeth Drive (west of Badgerys Creek Road)	EB	900	560	C	720	D	580	C	680	D
	WB	900	690	D	790	D	730	D	880	E
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	770	D	840	E	620	C	850	E
	WB	900	930	F	1160	F	1000	F	1070	F
Badgerys Creek Road (south of Elizabeth Drive)	NB	900	420	B	510	C	380	B	690	D
	SB	900	440	B	750	D	610	C	710	D
Badgerys Creek Road (north of The Northern Road)	NB	900	500	C	1320	F	340	B	440	B
	SB	900	280	A	400	B	550	C	1370	F
The Northern Road (west of Badgerys Creek Road)	NB	1900	880	B	960	C	770	B	840	B
	SB	1900	1100	C	1170	C	1100	C	1180	C
The Northern Road (east of Badgerys Creek Road)	NB	1900	1550	D	2330	F	1380	C	1440	D
	SB	1900	1110	C	1180	C	1260	C	2040	F

Notes:

[1] Assessments have been undertaken using SIDRA INTERSECTION 8.

[2] Traffic volumes have been rounded to the nearest 10.

[3] Peak hour construction traffic forecast to be generated by the project from each construction site have been distributed as per assumptions stated above and added to the forecast future year network traffic without the project.

Intersection performance

A summary of the performance of intersections within the study area in the peak periods during the peak construction year without and with construction traffic is summarised in Table 4-5. The control type at each intersection is also indicated (P: Priority-controlled, R: Roundabout, S: Signalised).

Temporary and permanent road network adjustments, including road modifications and traffic signal works are proposed to facilitate construction vehicle access to construction sites and ensure the safe operation of the existing transport network (refer to Figure 4-7 and section 4.2.1 and section 4.2.3). These adjustments would be subject to further design development and construction planning and would be developed in consultation with relevant stakeholders and managed as per the guidelines included in the CTMF.

The indicative road network adjustments are described in detail in Chapter 8 (Project description – construction) of this Environmental Impact Statement, with intersection upgrades required for the construction of the project summarised in Table 4-4. These intersection upgrades were considered as part of the construction peak year assessments.

Table 4-4 Indicative intersection upgrades to facilitate road network access

Site ID	Indicative road network adjustments
Off-airport	
St Marys	<ul style="list-style-type: none"> temporary localised modifications at the Harris Street construction site access to allow for construction vehicles access (refer to Figure 4-7)
Claremont Meadows services facility	<ul style="list-style-type: none"> modification to the intersection of Gipps Street and Sunflower Drive to include a new eastern approach and a northbound right turn lane from Gipps Street into the construction site as well as associated changes to traffic signals (subject to separate design, approval and delivery)
Orchard Hills	<ul style="list-style-type: none"> modification to Kent Road to include two new accesses at the TBM and Station construction sites to allow for heavy vehicle movements upgrade of the Kent Road/Lansdowne Road intersection to allow for heavy vehicle movements
Off-airport construction corridor	<ul style="list-style-type: none"> construction of a new construction site access on Lansdowne Road to allow for construction vehicle access to the construction corridor localised upgrades of the intersection of Luddenham Road and Patons Lane at Orchard Hills to support access to the construction corridor localised upgrades of Luddenham Road at the pipelines to support access to the construction corridor construction of a new northbound exit for the Elizabeth Drive/Badgerys Creek Road intersection (roundabout) to facilitate construction vehicle access to the off-airport construction corridor
Luddenham Road	<ul style="list-style-type: none"> localised upgrade of Luddenham Road at two locations to support provision of construction access and subsequent permanent access arrangements into the Luddenham Road Station precinct
Bringelly services facility	<ul style="list-style-type: none"> upgrade of Derwent Road including provision of turning lanes to provide access to the services facility
Aerotropolis Core	<ul style="list-style-type: none"> upgrade of Badgerys Creek Road between Western Sydney International and The Northern Road including provision of turning lanes to provide access to the construction site
On-airport	
Airport construction support site	<ul style="list-style-type: none"> upgrade to Badgerys Creek Road to provide heavy vehicle access to Western Sydney International and the viaduct and tunnel segment yard construction sites via a new four leg roundabout

The assessment presented in Table 4-5 indicate that during the peak construction year without construction traffic, all intersections operate at LOS D or better, except the following intersections:

- Queen Street/Great Western Highway/Mamre Road (PM peak) is forecast to operate at LOS E
- Mamre Road/M4 Western Motorway Eastbound Ramp (AM peak and PM peak) is forecast to operate at LOS F
- Mamre Road/M4 Western Motorway Westbound Ramp is forecast to operate at LOS E (PM peak)
- Mamre Road/Luddenham Road is forecast to operate at LOS F (AM and PM peak).

Most intersections in the study area are not forecast to be impacted as a result of the construction traffic being added to the road network and are expected to continue to operate similarly to the peak construction year without construction scenario.

The Mamre Road/M4 Motorway Eastbound Ramp and Westbound Ramp intersections are proposed to be used by construction staff vehicles and serve as a key interchange for facilitating construction heavy vehicle movements. This interchange is forecast to operate at capacity during the future year without construction traffic. Therefore, the addition of construction traffic generated by the project is likely to impact it further during the peak year of construction. The increase in average delay at the Mamre Road/M4 Motorway Eastbound Ramp is forecast to be about 50 seconds during the AM peak and 35 seconds during the PM peak.

The intersection of Mamre Road/Luddenham Road is forecast to be oversaturated in the peak construction year without construction traffic added; therefore, experiencing significant delays and queuing. The addition of construction vehicles at this intersection is forecast to further increase delays and queuing at this intersection due to the oversaturated conditions.

Due to the addition of construction traffic generated by the project, Luddenham Road/Patons Lane is forecast to operate at LOS D instead of LOS B. The average delay at this intersection during both AM and PM peak is expected to increase by about 30 seconds due to the addition of construction traffic. Potential mitigation measures have been identified in Section 7 of this technical paper to minimise these impacts.

Table 4-5 Peak construction year intersection performance – off-airport

Intersection	AM Peak				PM Peak			
	Future year without construction scenario		Future year with construction scenario		Future year without construction scenario		Future year with construction scenario	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Glossop Street/Forrester Road (S)	29	C	30	C	35	C	46	D
Glossop Street/Harris Street (P)	9	A	8	A	10	A	11	A
Harris Street/Harris Street Site Access (P)	-	-	9	A	-	-	9	A
Glossop Street/Phillip Street (S)	13	A	15	B	17	B	17	B
Queen Street/Charles Hackett Drive (S)	15	B	15	B	25	B	25	B
Glossop Street/Great Western Highway (S)	33	C	37	D	39	D	42	D
Queen Street/Great Western Highway/Mamre Road (S)	45	D	49	D	55	E	67	E
Charles Hackett Drive/Great Western Highway/ Pages Road (S)	26	C	26	C	43	D	44	D
Mamre Road/M4 Western Motorway Eastbound Ramp (S)	>100	F	>100	F	75	F	>100	F
Mamre Road/M4 Western Motorway Westbound Ramp (S)	48	D	52	D	61	E	67	E
Great Western Highway/Gipps Street (S)	35	C	41	D	30	C	32	C
Gipps Street/Sunflower Drive (S)	11	B	12	B	13	B	16	B
Kent Road/Caddens Road (S)	25	B	24	B	26	B	24	B
Kent Road/M4 Western Motorway On-ramp (S)	5	A	7	A	5	A	6	A
Kent Road/M4 Western Motorway Off-ramp (S)	21	B	23	B	19	B	22	B
Kent Road/Orchard Hills TBM Site Access (P)	-	-	24	B	-	-	17	B
Kent Road/Orchard Hills Station Site Access (P)	-	-	20	B	-	-	13	A
Kent Road/Lansdowne Road (P)	7	A	12	A	18	B	21	B

Intersection	AM Peak				PM Peak			
	Future year without construction scenario		Future year with construction scenario		Future year without construction scenario		Future year with construction scenario	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Lansdowne Road/Orchard Hills Site Access (P)	-	-	10	A	-	-	7	A
Mamre Road/Luddenham Road (P)	>100	F	>100	F	>100	F	>100	F
Luddenham Road/Patons Lane (P)	22	B	53	D	27	B	44	D
Luddenham Road/Warragamba Site Access (P)	-	-	40	C	-	-	48	D
Luddenham Road/Station Site Access West (P)	-	-	42	C	-	-	34	C
Luddenham Road/Station Site Access East (P)	-	-	50	D	-	-	47	D
Luddenham Road/Elizabeth Drive (P)	10	A	15	B	12	A	16	B
Elizabeth Drive/Adams Road (P)	9	A	13	A	16	B	32	C
Elizabeth Drive/Badgerys Creek Road (R)	13	A	17	B	14	A	28	B
Badgerys Creek Road/Badgerys Creek Site Access (R)	-	-	33	C	-	-	36	C
Badgerys Creek Road/Aerotropolis Site Access (P)	-	-	43	D	-	-	42	C
Badgerys Creek Road/The Northern Road (S)	34	C	53	D	28	B	32	C
The Northern Road/Derwent Road (S)	6	A	7	A	6	A	6	A

Notes:

[1] Assessments have been undertaken using SIDRA INTERSECTION 8.

[2] Peak construction traffic likely to be generated in 2023 by the construction sites north of Western Sydney International have been used for the assessments. For all other construction sites, peak construction traffic forecast in 2024 have been used for the assessments.

[3] For traffic signals, the average movement delay and level of service over all movements is used. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is used.

[4] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised).

[5] The intersection of Kent Road/Lansdowne Road experiences the worst movement delay for through traffic approaching from the west on Lansdowne Road during the base scenario due to low traffic volumes (less than 5 veh/hr). However, the delay is not representative of the overall intersection performance. Therefore, the movement that corresponds to the next highest delay is reported here to provide an indication of the intersection performance.

[6] Dashes indicate new construction site accesses that would only be constructed and used by construction vehicles and hence would not exist during the future year scenario without construction.

4.2.3 Other road network adjustments

The construction of the project would require a number of temporary road modifications, closures or diversions to enable construction activities as described in Chapter 8 (Project description – construction) of the Environmental Impact Statement.

In addition to the intersection upgrades outlined in Section 4.2.2, this section outlines the other road network adjustments required to facilitate construction of the project. These are also described in Chapter 8 (Project description – construction) of the Environmental Impact Statement.

At St Marys, temporary road modifications would be required to facilitate the construction works. These modifications are shown in Figure 4-7 and include:

- Harris Street and Glossop Street would require minor temporary localised modifications to facilitate construction vehicle access to the construction site.
- Station Street would be partially closed during construction. The section of the road from Lethbridge Street to the eastern extent of station plaza east of Gidley Street would need to be temporarily converted to one-way (westbound). Residents would be required to enter Station Street via Lethbridge Street and exit via a new connection to Phillip Street along the eastern extent of the existing station plaza.
- Phillip Street, near Blair Avenue, would require some modifications to allow egress for construction vehicles.
- Queen Street and East Lane would remain open to traffic. North of Nariel Street, Queen Street would be limited to vehicles less than 3 tonnes. Access to Station Street from Queen Street would only be allowed for local access. As such, residents accessing Station Street from the east would need to be diverted through the local road network at St Marys, via Phillip Street. This may result in longer travel distances, increasing travel times for vehicles accessing Station Street.
- the local road network in St Marys, including Belar Street, Carinya Avenue, West Lane, Nariel Street and Queen Street would require temporary alterations to facilitate the relocation of bus services.

South of the St Marys precinct, a range of road network adjustments including road closures and/or diversions are required to enable construction activities and allow construction vehicles to safely enter and exit construction sites, including the following:

- construction activities are required to facilitate trenching works for the temporary construction power connections for the Claremont Meadows and the Kemps Creek construction power routes. In addition, trenching works are also required for the construction of the permanent power supply route at Erskine Park. Short-term lane reduction, lane closure or road closure and local diversions may temporarily be required to facilitate construction works. Construction of slip lanes to facilitate access for the construction power connections or the power supply route may also be required. However, given the short-term nature of these works, the traffic impacts associated with these construction works are expected to be limited.
- temporary diversions would also be required at Lansdowne Road for the construction of the road over rail bridge. Short-term lane reduction, closure or temporary local diversions would be required at multiple locations, including the intersection of Gipps Street and Sunflower Drive/Fowler Street/Caddens Road and the intersection of Gipps Street and Kent Road to facilitate trenching works for the construction power connections.
- implementation of temporary traffic control and diversions during construction of a viaduct over Luddenham Road would also be required.
- at Patons Lane, road modifications including upgrade, implementation of temporary one-way traffic or diversions might be required as part of construction works to maintain access to the nearby waste management facility while using this road for corridor and construction site access.
- on Luddenham Road, low volumes of heavy vehicles are expected to enter the off-airport construction corridor via a proposed site access near the pipelines and exit the site via The

Northern Road in the south. However, the impacts associated with these vehicle movements are expected to be limited.

- additional diversions or temporary traffic control would be required at Derwent Road and Badgerys Creek Road.
- Badgerys Creek Road would be required to be upgraded during construction to provide turning lanes at construction sites. New access roads to Western Sydney International and the viaduct and tunnel segment yard construction sites would be provided via a new four leg roundabout on Badgerys Creek Road. The tunnel lining segment facility would be located near the viaduct segment facility and would be accessed via the newly constructed intersection.
- access to the Bringelly service facility would be provided from Derwent Road via The Northern Road. As such, some upgrades would be needed at Derwent Road to allow construction vehicle access to the construction footprint.

The modifications to the road network highlighted above are expected to generate limited impacts on the overall operation of the road network, given their localised and short-term nature and given the majority of these roads provide local access. Network performance as a result of the diversions and road closures is not expected to deteriorate significantly due to these works not occurring simultaneously and mostly occurring outside of the peak periods analysed. In addition, these impacts would be managed through the preparation of CTMPs, which would ensure safe passage for all road users passing these work sites and provide diversion routes, where required. As such, although there are likely to be some negative impacts during the construction of the project as a result of temporary road diversions/modifications, the impacts are not expected to be significant due to the proposed mitigation measures that would be put in place to reduce these impacts. The temporary road diversions/modifications are subject to further design development, and would be managed through the CTMF.

Further details regarding changes proposed around St Marys Town Centre during construction are also included in Chapter 8 (Project description – construction) of this Environmental Impact Statement.

4.2.4 Road safety

Construction traffic volumes are expected to be low when compared to future base traffic volumes on key arterial roads connecting to the construction site locations. The greatest increase is forecast to occur on The Northern Road, east of Badgerys Creek Road and on Badgerys Creek Road, north of The Northern Road. As such, the effects of this short-term low volume increase on the road network is not expected to substantially impact road safety in the study area.

There is still a risk with construction traffic interacting with pedestrians, cyclists and general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites. As indicated in the crash assessment in Section 3.2.6, there exists a higher incident rate around the St Marys precinct and the section of the road network between the Great Western Highway and the M4 Western Motorway.

At all construction sites, any foreseen impacts on road safety for all users during construction would be mitigated as much as possible through the provision of CTMPs and other measures discussed in Section 7.

4.2.5 Access impacts

During construction of the project, it is anticipated that access would generally be maintained for local vehicles, pedestrians and cyclists, however, some diversions may be required, and space may be constrained. Some delays may also be experienced due to the presence of construction vehicles. These impacts would be experienced by pedestrians, cyclists and vehicles accessing properties within the local network.

Access to the existing St Marys Station would be maintained during construction. Road and pedestrian routes that connect to the station may be impacted during construction. Access to properties near the project would be maintained at all times. In St Marys, access to East Lane and Chesham Street would be maintained during construction. Outside of St Marys, impacts to property access are generally limited given the project would largely be located in rural areas. In the event that access to a property is impacted as a result of the project, affected properties would have their access reinstated via

diversion in consultation with the property owner, unless property acquisition or amalgamation would make this unnecessary.

Access would also be maintained for emergency, delivery and waste collection vehicles during the construction period of the project. In the St Marys precinct, where relevant, waste bins may need to be relocated to areas accessible for collection by the waste collection service and in an area that does not disrupt access to the work site. This may result in minor impacts to the efficiency of the waste collection in terms of longer turnaround times.

Access to the Claremont Meadows services facility construction site, located south of the Great Western Highway, would be provided via an additional access from Reserve Road via Putland Street, if required. Access would be facilitated via a left-in/left-out arrangement from/to the Great Western Highway. It is anticipated that minor volumes of heavy vehicles would enter the site via this access route, with access to the construction site expected to be primarily via the intersection of Gipps Street and Sunflower Drive. This intersection would need to be upgraded with an east leg to allow construction vehicles to access the construction site.

Access impacts to properties would be managed in line with the CTMF (Appendix G of the Environmental Impact Statement).

4.2.6 Parking impacts

The St Marys Town Centre is likely to experience the most impacts during construction. The St Marys construction site would be located around the existing Sydney Trains station in St Marys and the T1 Western Line, with construction activities including supporting TBM retrieval, cut-and-cover station construction and excavation works. The construction footprint at St Marys is designed to minimise and reduce impacts on the existing road network during construction. However, these construction activities would require some temporary and permanent modifications to parking.

During construction, some street parking would be intermittently or permanently unavailable (see Figure 4-7). The following modifications to on-street car parking are expected to be required as part of the construction activities at the St Marys precinct:

- permanent removal of on-street car parking on Station Street (around 41 spaces)
- temporary removal of on-street car parking on Lethbridge Street (around 16 spaces)
- temporary removal of on-street parking on Nariel Street (around 17 car park spaces), Carinya Avenue (around six car park spaces) and West Lane (around 18 car park spaces) to facilitate the relocation of the temporary bus interchange to Nariel Street
- temporary removal of on-street parking on Phillip Street (around 27 car park spaces).

In addition, the permanent removal of spaces on Nariel Street for use by the point-to-point vehicle facility is also required as discussed in Section 4.2.7.

The temporary or permanent removal of some off-street car parking facilities is also expected to be required at the St Marys Station precinct as part of the construction activities. Anticipated off-street car parking impacts would include:

- permanent removal of the at-grade car park on Harris Street in 2023 (around 130 to 140 commuter parking spaces) after the extension of the multi-level commuter car park (subject to a separate approval) is completed
- as a worst-case scenario, temporary removal of around 130 to 140 spaces from the Station Street car park to provide a construction compound. However, as shown on Figure 4-7, for the purposes of providing public parking to the employment centres on Phillip Street, about 30 spaces may be able to be retained. This site is also subject to ongoing investigation, in consultation with Council and relevant stakeholders, for use as the temporary bus interchange
- temporary removal of unrestricted spaces from the existing Belar car park located south of Nariel Street (around 30 car park spaces) to facilitate the relocation of the temporary bus interchange to Nariel Street.

In total, about 435 car parking spaces are impacted within the St Marys precinct and the road network immediately surrounding the station. This includes about 310 off-street parking spaces and 125 on-street parking spaces, which comprise restricted and unrestricted spaces. These car parking spaces are generally used for on-street parking by the commercial establishments and retail buildings in this area as well as commuters of St Marys Station. Site observations have further indicated that car parking facilities provided within 400 metres of the existing Sydney Trains station in St Marys are generally fully utilised by 9:00 am. The high number of car parking spaces available within the station precinct encourages commuters to drive to the station and take the train to their final destination.

Enabling works at St Marys may include the provision of additional parking through extending the existing multi-level car park on Harris Street by two additional levels of commuter parking spaces. These spaces are intended to replace a part of the commuter parking spaces lost as a result of the construction of the project and are anticipated to further offset the parking demand within the St Marys precinct and minimise associated access impacts on nearby commercial properties. However, it is noted that these adjustments would be subject to a separate approval and would be confirmed during design development and construction planning in consultation with relevant stakeholders.

Furthermore, the car parking survey assessment presented in Section 3.2.6 indicates there is existing on-street and off-street capacity within the town centre at St Marys to accommodate lost car parking spaces. Generally, parking capacity is available on-street within 400 metres of these lost parking spaces. During the weekday morning peak, timed and untimed on-street parking is primarily available along Gidley Street, West Lane, Camira Street, Nariel Street, Chesham Street and Phillip Street towards Glossop Street, as well as off-street within the car park located south of Phillip Street between Gidley Street and East Lane and the car park north of Crana Street. During the afternoon weekday peak, on-street and off-street car parking is predominantly available across the street network. Queen Street remains busy throughout peak periods and across the day, suggesting parking removal or replacement should not be accommodated in this key corridor.

As such, the above assessment indicates that despite the construction impacts, the demand for on-street and off-street parking can be accommodated within the St Marys precinct, especially given the proposal to expand the existing multi-level car park at Harris Street (subject to a separate approval). Some Penrith City Council car parking spaces may be converted to unrestricted parking to accommodate parking needs within the study area, if required. In addition, there is further capacity within the streets beyond the study area that provide further unrestricted on-street parking capacity. The relocation to an alternate off-street site would increase travel distances for the community and commuters requiring access to their vehicles. The removal and relocation of car parking spaces would also be managed in consultation with relevant stakeholders, including Penrith City Council and Sydney Trains. Potential mitigation measures to minimise the impacts are included in Section 7.

Outside of the St Marys precinct, construction of the project is not anticipated to impact on-street parking arrangements, given the existing land uses in the remaining precincts largely comprise greenfield and rural lands. In these precincts, available on-street car parking is limited and largely consists of informal parking as discussed in Section 3.2.6.

Construction worker parking

Minimal construction worker parking would be provided at construction sites. These provisions may not meet the demand based on construction workforce. A parking management plan would be developed, prior to start of construction, in line with the CTMF to manage construction worker parking and minimise the impacts on the surrounding road environment. This is further discussed in Section 7 of this technical paper.

4.2.7 Point-to-point impacts

The point-to-point (including taxi) vehicle facility on the southern side of Station Street (around 10 spaces) at the existing station plaza would be relocated to Nariel Street during construction. The point-to-point facility shall be retained on Nariel Street during the end state operations. This would require around 10 spaces along Nariel Street to be permanently removed. The alternative arrangements would be confirmed during design development and construction planning, in consultation with relevant stakeholders. Potential mitigation measures to minimise the impacts are included in Section 7.

The existing kiss and ride facilities located at St Marys Station, north of Station Street would be maintained during the construction phase. Similarly, the existing kiss and ride and point-to-point facilities at the southern end of Forrester Road would also be retained during construction.

4.2.8 Walking and cycling impacts

As described in Section 3.2.3 and Section 3.2.4, existing pedestrian and cycle infrastructure is primarily limited to the following locations:

- St Marys construction site
- Claremont Meadows services facility construction site
- Orchard Hills construction site.

Pedestrian access to St Marys Station would be maintained at all times and access to the station and the pedestrian precinct area via the normal routes and overpass would be maintained. During rail possessions and engineering hours, access may be altered to facilitate construction activities. However, construction works might temporarily restrict access to pedestrian facilities and cycle routes surrounding the station. Pedestrian access to Station Street would be temporarily blocked during construction. As such, pedestrian access to the existing Sydney Trains station in St Marys would be maintained through diversions via Phillip Street, requiring pedestrians to walk up to an additional 250 metres (around three additional minutes) to access the station.

Pedestrian access to residential properties along Station Street would be maintained via local traffic control measures. Construction vehicle access to the new Harris Street construction site may potentially impact the existing footpath on Harris Street and local traffic control measures would be provided to maintain pedestrian access.

At the Claremont Meadows services facility construction site, the intersection of Gipps Street and Sunflower Drive would be upgraded to construct a new eastern leg for access to the site. Access along the existing informal pedestrian access along Gipps Street opposite Sunflower Drive would be maintained, with the upgrade for the intersection to include a pedestrian phase.

In the Orchard Hills precinct, short-term local pedestrian diversions may be required throughout the Orchard Hills construction site. It is expected that local pedestrian and cyclist diversions would be accommodated within the existing road environment.

Temporary local pedestrian diversions may be required within the residential area west of Gipps Street and temporary pedestrian and cyclist diversions may also be required for the shared pathway and the footpath located to the west and east of Gipps Street and Kent Road respectively as a result of the Claremont Meadows temporary construction power route. It is expected that local pedestrian and cyclist diversions would be accommodated within the existing road environment.

Temporary local pedestrian and cyclist diversions may also be required for the shared path to the south of Erskine Park Road due to the permanent power route at Erskine Park. It is anticipated that any proposed local pedestrian and cyclist diversions would be accommodated within the existing walking and cycling environment.

Temporary pedestrian and cycle routes provided as part of diversions would be required to meet minimum specifications outlined in Australian Standards, with appropriate signposting provided along the routes. Other pedestrian facilities or accesses to residential properties and cyclist routes within the study area would be maintained.

Potential mitigation measures to minimise the impacts are included in Section 7.

4.2.9 Public transport impacts

In St Marys, the existing bus interchange and layover on Station Street is proposed to be decommissioned and temporarily relocated to Nariel Street for the duration of construction to facilitate construction activities. The temporary removal of around 30 off-street parking spaces at the Belar car park south of Nariel Street and 41 on-street parking spaces (around 17 spaces on Nariel Street, 6 spaces on Carinya Avenue and 18 spaces on West Lane) would be required to facilitate the temporary relocation of the bus interchange and associated facilities. In addition, an off-street option for the

temporary relocation of the bus interchange to Station Street car park, in consultation with relevant stakeholders, is also being investigated.

Pedestrian access to the existing Sydney Trains station in St Marys for bus customers would be maintained during construction. Some minor kerb works, linemarking and street furniture adjustments would be required at West Lane, Nariel Street and Queen Street to ensure bus movements can be made at key intersections. Capacity for bus layover and associated facilities would also be required for terminating services. Relocation works would be completed prior to the decommissioning of the existing interchange to ensure disruption to bus services is minimised. As such, it is anticipated that some customers requiring access to the relocated bus facilities would need to walk longer distances to their desired bus stops (up to 200 meters). Pedestrians would be expected to utilise the surrounding existing footpaths to access the relocated bus stops, as these facilities would not be impacted by the project.

Some construction activities within the rail corridor would require track possessions, where train services are temporarily not provided. Track possessions would generally occur over the weekend and at night and replacement services (for example buses) would be provided for rail customers. Other works within the rail corridor would generally be carried out during standard construction hours and would not disrupt existing rail services. No other impacts are anticipated on the operation of buses or existing rail network within the study area.

Changes to the existing public transport network during the construction of the project would be limited to the St Marys precinct. Any relocation of bus facilities would be undertaken such that disruptions to access and walking distances are minimised. Temporary pedestrian facilities provided as part of the relocations would be required to cater for current demands and meet minimum specifications outlined in Australian Standards, with appropriate signposting provided along the new facilities. Ongoing consultation would be carried out with TfNSW, Sydney Trains, bus operators and other relevant authorities to minimise public transport impacts during construction. Community consultation information and notifications would be issued in advance prior to any public transport disruptions.

Other bus services outside of the St Marys precinct would only be minimally impacted during construction, with minor delays due to temporary traffic diversions. There would be no changes to infrastructure supporting the existing public transport network at other locations.

Temporary changes to the public transport network would be reviewed during further design development and construction planning with the objective of minimising disruptions to public transport services. Potential mitigation measures to minimise the impacts are included in Section 7.

4.3 On-airport impacts

A range of rail corridor construction activities would be carried out within the Western Sydney International site between Elizabeth Drive and Badgerys Creek to construct the on-airport project alignment. The on-airport construction sites include Airport Business Park Station and Airport Terminal Station at Badgerys Creek.

The impacts due to construction activities proposed within the airport for the peak construction year scenario during 2023/2024 were captured as part of the assessments of the road network surrounding Western Sydney International and detailed in the off-airport assessments in Section 4.2. Construction vehicle movements to the on-airport construction sites, within Western Sydney International, would be managed in coordination with Western Sydney Airport and their contractors. Some construction trucks would require the use of internal construction routes also used for the construction of Western Sydney International as described in Section 4.1. As such further traffic management measures would need to be developed in consultation with Western Sydney Airport to manage access to construction sites as well as the cumulative construction impacts, as discussed in Section 7. The overall approach for construction traffic management for the project on-airport would be consistent with the Construction Environmental Management Plans (CEMPs) prepared for Western Sydney International.

During the peak construction scenario in 2024, construction works for the airport would still be progressing at the airport site. As such, public access to the airport would be restricted, and transport related impacts would be limited. Impacts due to light vehicle and heavy vehicle access on the surrounding (off-airport) road network are captured in Section 4.2.1. Furthermore, it is expected that construction vehicle movements for the project would be planned in conjunction with the airport

construction works as per the guidelines included in the CTMF appended to this EIS. The Traffic and Transport Liaison Group would be established to coordinate, manage and minimise transport impacts during construction and would include Western Sydney Airport, TfNSW, Sydney Coordination Office and other stakeholders. Development of the traffic management measures would be carried out in consultation with the Traffic and Transport Liaison Group. Potential mitigation measures to minimise impacts during construction are included in Section 7.

4.3.1 Road network performance

Mid-block performance

An assessment of the weekday AM peak and PM peak hour traffic volumes was completed to determine the general performance of the road network configuration during the peak construction year without and with construction activity in the study area. The findings of this assessment are summarised in Table 4-6.

The assessment indicates that sections of Luddenham Road and Elizabeth Drive within the on-airport study area are forecast to operate at or above theoretical capacity during the peak construction year without the addition of construction traffic generated by the project. However, the assessment has found that some sections of the road network are forecast to operate at or above their theoretical capacity due to the addition of construction traffic likely to be generated by the project. These locations include Luddenham Road in the PM peak and Elizabeth Drive, Badgerys Creek and The Northern Road during both AM and PM peaks.

The impacts forecast along these roads are due to construction vehicle movements accessing the on-airport construction corridor sites using these roads. Impacts forecast along Elizabeth Drive, Badgerys Creek Road and The Northern Road are due to the combined construction vehicle movements to the sites located around Western Sydney International. Mitigation measures to minimise these impacts have been identified in Section 7 of this technical paper.

Table 4-6 Peak construction year 2023/2024 mid-block performance – on-airport

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Future year without construction scenario		Future year with construction scenario		Future year without construction scenario		Future year with construction scenario	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Luddenham Road (north of Elizabeth Drive)	NB	900	1080	F	1280	F	590	C	660	C
	SB	900	300	A	370	B	860	E	1070	F
Elizabeth Drive (west of Badgerys Creek Road)	EB	900	560	C	720	D	580	C	680	D
	WB	900	690	D	790	D	730	D	880	E
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	770	D	840	E	620	C	850	E
	WB	900	930	F	1160	F	1000	F	1070	F
Badgerys Creek Road (south of Elizabeth Drive)	NB	900	420	B	510	C	380	B	690	D
	SB	900	440	B	750	D	610	C	710	D
Badgerys Creek Road (north of The Northern Road)	NB	900	500	C	1320	F	340	B	440	B
	SB	900	280	A	400	B	550	C	1370	F
The Northern Road (west of Badgerys Creek Road)	NB	1900	880	B	960	C	770	B	840	B
	SB	1900	1100	C	1170	C	1100	C	1180	C
The Northern Road (east of Badgerys Creek Road)	NB	1900	1550	D	2330	F	1380	C	1440	D
	SB	1900	1110	C	1180	C	1260	C	2040	F

Notes:

[1] Assessments have been undertaken using SIDRA INTERSECTION 8.

[2] Traffic volumes have been rounded to the nearest 10.

[3] Peak hour construction traffic forecast to be generated by the project from each construction site have been distributed as per assumptions stated above and added to the forecast future year network traffic without the project.

Intersection performance

Construction traffic movements within Western Sydney International would affect the intersection performance of surrounding intersections located off-airport. These potential impacts have been assessed in Section 4.2.1. A summary of the on-airport intersections likely to be impacted during construction activities is presented in Table 4-7.

All intersections expected to be impacted by the on-airport construction activities are forecast to perform satisfactorily with acceptable delays and spare capacity during future year conditions in 2023/2024 without construction. During the peak year with construction scenario, intersections likely to be impacted by the construction activities planned in the on-airport environment are forecast to operate at LOS D or better.

Table 4-7 Peak construction year 2023/2024 intersection performance – on-airport

Intersection	AM Peak				PM Peak			
	Future year without construction scenario		Future year with construction scenario		Future year without construction scenario		Future year with construction scenario	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Luddenham Road/Elizabeth Drive (P)	10	A	15	B	12	A	16	B
Elizabeth Drive/Adams Road (P)	9	A	13	A	16	B	32	C
Elizabeth Drive/Badgerys Creek Road (R)	13	A	17	B	14	A	28	B
Badgerys Creek Road/Badgerys Creek Site Access (R)	-	-	33	C	-	-	36	C
Badgerys Creek Road/Aerotropolis Site Access (P)	-	-	43	D	-	-	42	C
Badgerys Creek Road/The Northern Road (S)	34	C	53	D	28	B	32	C
The Northern Road/Derwent Road (S)	6	A	7	A	6	A	6	A

Notes:

[1] Assessments have been undertaken using SIDRA INTERSECTION 8.

[2] Peak construction traffic forecast to be generated by the construction sites in 2024 have been used for the assessments.

[3] For traffic signals, the average movement delay and level of service over all movements is used. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is used.

[4] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised).

[5] Dashes indicate new construction site accesses that would only be constructed and used by construction vehicles and hence would not exist during the future year scenario without construction.

[6] It should be noted that these intersections are located off-airport, surrounding Western Sydney International

4.3.2 Walking and cycling impacts

During the peak year of construction of the project, the airport is forecast to be under construction and therefore walking and cycling links are not anticipated to exist within Western Sydney International. Therefore, no impacts to walking and cycling networks are expected within and adjacent to the on-airport environment.

4.3.3 Public transport impacts

During the peak year of construction of the project, the airport is forecast to be under construction and therefore public transport services are not forecast to be operational within the on-airport environment. Therefore, no impacts to public transport networks are expected within the on-airport environment.

5 Assessment of operational impacts

The new metro railway would be a city-shaping project which would help optimise land use and development, creating precincts and places with a high level of accessibility to jobs and services. A fast, safe and easy metro rail service would deliver better access to more employment opportunities, health and education services and leisure activities across the Western Parkland City and Greater Sydney.

The project would provide the initial spine of a transport network to service the Western Parkland City, providing a reliable, efficient public transport option for existing and future residents, customers and employees of the Aerotropolis and Western Sydney International and associated businesses in Western Sydney.

In summary, the project would:

- improve Western Sydney's self-containment and help grow the regional economy
- facilitate sustainable, long-term development outcomes, allowing land use planning to respond to mass transit capacity early in the development cycle
- save future investment costs associated with retrofitting mass transit into a developed Western Parkland City
- provide a structural framework for the development of future transport, education, health and social infrastructure in the region around a mass transit corridor
- unlock economic development and employment generation activity around St Marys, the Aerotropolis and Western Sydney International
- provide opportunities for placemaking at the stations, such as public domain improvements, and act as a catalyst for future development in the station precincts
- provide a sustainable, low carbon travel mode that would reduce private vehicle use and road congestion and improve accessibility to air travel for people living in Western Sydney
- support the successful development of Western Sydney International as a nationally significant economic driver.

5.1 Off-airport integration with other transport modes

5.1.1 Overview

Assessment of operational impacts was based on the demands, characteristics, access modes and precinct design plans for each of the planned stations. Key project features at each station precinct and specific design elements relating to each station are described in detail in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

The planning of stations has considered the convenient and safe transfer of customers between the stations and other transport modes. The proposed station plans take into consideration the existing and proposed development parcels around each station precinct, future master plans, infrastructure projects and network upgrades.

Interchange requirements included in the proposed station plans were designed to maximise the seamless travel experience for all customer groups transferring between the project and other transport modes. Transport modes expected to be integrated at each station include train, walking, cycling, bus, coach, point-to-point, kiss and ride and park and ride. Stations would be designed for ease of interchange from the different modes including pedestrian and cycle facilities. Station design would aim to minimise disruptions to public transport users and the surrounding road network.

The modal access hierarchy for the off-airport station precincts is shown in Figure 5-1 and discussed below. The objective of the hierarchy is to allow the most prominent locations within an interchange precinct to be allocated to the most efficient and sustainable modes.

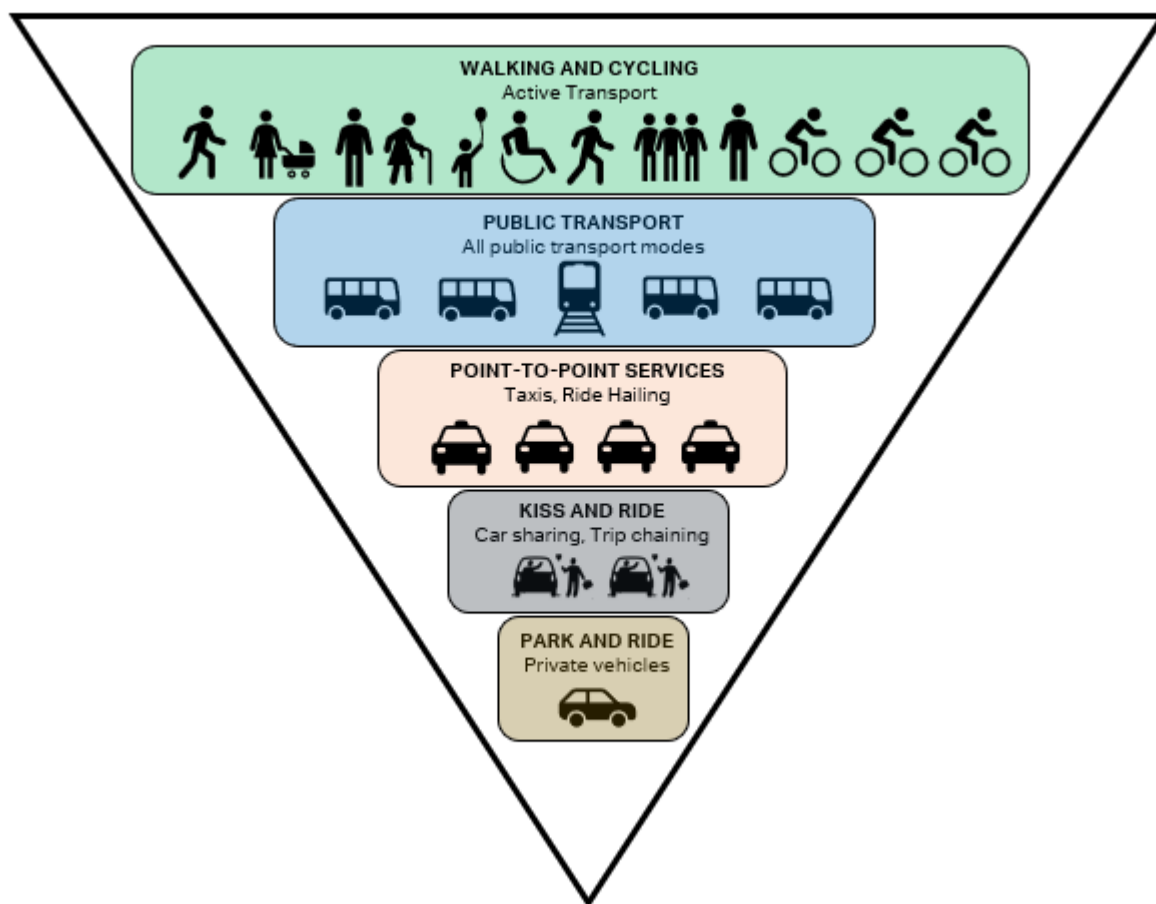


Figure 5-1 Modal access hierarchy

- **Walking and cycling:** identified as the highest priority access modes to rail as they are the most sustainable, cost-effective, equitable and accessible modes. Pedestrians and cyclists have the lowest environmental impact and (typically) spatial requirements, while they also contribute to personal safety, urban and commercial viability. As most stations are not located within established centres, walking and cycling facilities would be required to meet minimum specifications outlined in Australian Standards. Footpaths and cycle parking would be designed and provided to accommodate forecast demand
- **Public transport:** the second highest priority in station planning is typically focussed on facilitating interchange to other public transport modes. Seamless interchange is required to maximise the uptake of linked trips within the public transport network
- **Point-to-point services:** the highest ranked of all the car-based modes, supplementing the public transport system for access to destinations separated from the public transport network
- **Kiss and ride:** the preferred mode of those accessing the station by private vehicle, but a relatively low priority. Kiss and ride supports the concept of car sharing and trip chaining, reducing the number of single-occupant trips and, in some instances, parking demand
- **Park and ride:** the lowest priority of all modes. Given the aspirations for high accessibility to sustainable transport modes in the western Sydney area, formal parking facilities are only considered outside of major centres.

Interchange facilities provided at each off-airport station are shown in Table 5-1.

Table 5-1 Proposed interchange facilities at off-airport stations

Station	Walking	Cycling	Train	Bus	Point-to-point	Kiss and ride	Park and ride
St Marys	●	●	●	●	●	●	●
Orchard Hills	●	●		●	●	●	●
Luddenham Road	●	●		●	●	●	●
Aerotropolis Core*	●	●		●	●	●	●

* Temporary commuter car parking would initially be provided at Aerotropolis Core Station to cater for planned developments to the south of the station. However, these spaces would be removed once the new Aerotropolis and transport systems develop.

St Marys Station would allow for integration with the existing Sydney trains network, connecting to the T1 Western Line. Coaches are not proposed at the off-airport station precincts. Point-to-point, kiss and ride and park and ride facilities are proposed to be provided at most of the off-airport stations, these stations would introduce traffic demand to and from these facilities once operational.

The existing car parking facilities at St Marys Station would be retained and expanded, while new park and ride facilities would be provided at Orchard Hills Station and Luddenham Road Station. Temporary park and ride facilities would be provided at Aerotropolis Core Station to cater for the initial developments planned south of the station. However, these facilities would subsequently be removed once the Aerotropolis and transport systems develop. Car parking demand at these stations was determined based on demand modelling at each station, with consideration given to the intended role of these stations as identified in Chapter 7 (Project description – operation) of the Environmental Impact Statement. The provision of park and ride facilities at Orchard Hills, Luddenham and Aerotropolis Core stations also reflects the future nature of these precincts and their role in connecting commuters to employment and mixed-use land uses.

Severance of existing and future movement and transport corridors is not anticipated as part of the project. Public transport routes and road network configuration would be maintained once the project is operational.

Future walking and cycling network

The walking objectives for each station include providing safe and efficient interchange between transport modes, including minimising conflicts between pedestrians and other modes of transport.

Cycling as a mode of transport has also been considered in the design of the stations. Off-airport stations consider transport interchange points such as cycle storage areas in addition to station access cycleways and other cycle facilities. Cycle parking would be provided close to station entrances where possible and be secure such that customers can safely secure their bikes and catch the metro.

Precinct elements provided as part of the project for the off-airport stations comprise the enhancement to or provision of footpaths in the immediate vicinity of the station, as indicated in the station interchange layout plans in Figure 5-3, Figure 5-5, Figure 5-7 and Figure 5-9. This includes station access walkways and cycleways and other pedestrian and cycle facilities as described in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

Walking and cycling facilities would be required to meet minimum specifications outlined in Australian Standards. This includes compliance with Austroads *Guide to Road Design Part 6A* and TfNSW guidelines for cycling, including *NSW Bicycle Guidelines*. Pedestrian and cycle facilities would also be included in accordance to Penrith City Council and Liverpool City Council requirements for walking and cycling. Appropriate footpath widths and gradients would be provided to ensure safe and equitable pedestrian access. Customers with special access requirements including vision and mobility impaired customers would be considered in the design.

It is noted that the project does not preclude the provision of new or planned pedestrian and cycling services as considerations have been given to ensure grade separation is maintained at the proposed crossing points in the form of viaduct crossings.

Future public transport network

Metro stations would be designed to provide safe and efficient interchange between transport modes, including minimising conflicts between bus movements and other modes of transport. Station design does not preclude the provision of future public transport upgrades by providing space for future customer interchange at the stations.

As part of the Western Sydney City Deal, rapid bus services from the metropolitan centres of Penrith, Liverpool and Campbelltown to the Western Sydney Aerotropolis and to Western Sydney International have been committed for delivery by the Australian and NSW Governments within the study area. Regional and local bus routes would also be provided, linking the project to the local and wider surrounding centres.

Further investigations would be undertaken to integrate future bus routes into the project. This would be achieved in collaboration with relevant stakeholders.

5.1.2 Integration strategy

This section outlines the transport provisions at each off-airport station precinct. Details of station precinct elements, interchange facilities and indicative layouts for each station precinct are further discussed in Chapter 7 (Project description – operation) of the Environmental Impact Statement. Transport integration plans would be developed in consultation with relevant stakeholders including TfNSW, Councils and Western Parkland City Authority (formerly known as Western City and Aerotropolis Authority (WCAA)).

St Marys Station

St Marys Station would be located in an existing centre. The station would constitute an origin station of importance due to its location at the northern end of the project alignment, allowing a connection to the T1 Western Line. Customer access to the existing Sydney Trains station in St Marys is expected to significantly increase as a result of the project, especially given plans to further intensify development, population and employment around the interchange precinct.

Transport interchange facilities proposed at this station are generally consistent with the existing transport facilities. Station Street would be activated to create a pedestrian friendly environment. Bus pick-up and drop-off facilities have been retained along the southern road frontage of the station on both sides of Station Street. The existing bus layover facility would be replaced by a new dedicated bus layover facility, proposed directly east of the new metro station. The access to the new layover facility would be provided from Station Street.

Point-to-point and kiss and ride facilities are proposed west of Queen Street, on Nariel Street to reduce private vehicle access along Station Street. As a result, the point-to-point (including taxi) vehicle facility on the southern side of Station Street (around 10 spaces) and the kiss and ride facility north of Station Street would be removed. Existing point-to-point and kiss and ride facilities at the southern end of Forrester Road would be retained.

The following modifications to on-street and off-street parking are proposed at St Marys in the end state:

- removal of on-street car parking on Station Street (around 41 spaces)
- removal of on-street parking on Nariel Street (around 10 spaces)
- removal of the at-grade car park on Harris Street (around 134 commuter parking spaces) after the extension of the multi-level commuter car park (subject to a separate approval) is completed
- removal of Station Street car park (around 116 spaces), subject to ongoing investigations and consultation with key stakeholders.

Park and ride facilities would also be retained to the north of the station, with access provided from Harris Street, to encourage private vehicles to approach the station from the north and removing traffic from the town centre. As described in Section 4.2.6, it is also proposed to provide additional commuter parking through extending the existing multi-level car park on Harris Street by two additional levels (subject to a separate approval). Therefore, it is expected that there is no net parking loss at St Marys in the end state.

Both entrances to the station along Station Street and at the end on Forrester Road present opportunities for a plaza and provide an access point for walking and cycling. Secure bicycle parking with up to 125 spaces, would be provided close to the station entrances at Station Street and south of the commuter car park on Harris Street, in addition to the existing bicycle parking facilities available at St Marys.

Station design would not preclude the provision of future public transport upgrades by providing space for future customer interchange at the stations. Potential additional regional bus services linking St Marys Station to the wider network surrounding the station, including the suburbs of Penrith, Mt Druitt, Leppington, Liverpool, and Parramatta; and local bus routes linking St Marys to Penrith, Mount Druitt and Castle Hill are being investigated by Transport for NSW within the study area, linking the project to the local surrounding centres.

Preliminary forecasts for the 2036 AM peak hour (busiest hour) indicate about 2,200 customers entering and about 950 customers exiting the station, reflecting the area is primarily serving residents. The forecast mode of arrival at the station is shown in Figure 5-2. The forecasts indicate more than half of the morning peak arrivals are forecast to access the station using walking, cycling or public transport, with 41 per cent would walk to the station. This demonstrates the need to provide appropriate pedestrian facilities in the vicinity of the station.

The interchange layout plan for St Marys Station is shown in Figure 5-3, and all elements included in the interchange layout plan are proposed to be delivered on opening of the station.

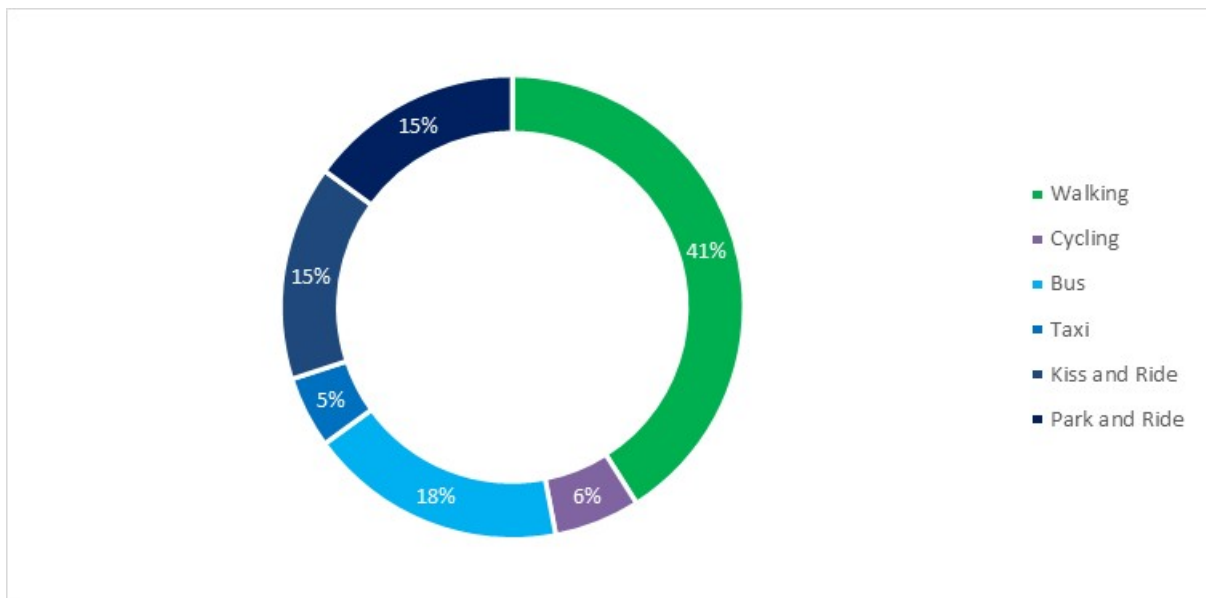


Figure 5-2 Forecast mode of arrival during the AM peak in 2036 at St Marys Station

Rail-to-rail transfer between the project and the T1 Western Line is expected to occur at St Marys Station. During 2026 (AM peak hour), about 1,100 customers are expected to transfer between the project and T1 Western Line. Of these customers, about 80 per cent are forecast to transfer from the project to the T1 Western Line. In the T1 Western Line towards City direction, about five per cent of customers shift to the project, compared to 23 per cent in the T1 Western Line from City direction.

During 2036 (AM peak hour), about 4,300 customers are expected to transfer between the project and the T1 Western Line at St Marys Station. Of these customers, about 70 per cent are forecast to transfer from the project to the T1 Western Line. For the T1 Western Line towards City direction, about five per cent of customers shift to the project, while the shift in the T1 Western Line from City direction represents about 30 per cent of customers.

The project is designed to facilitate transfers between the project and the existing T1 Western Line at St Marys Station as detailed in Chapter 7 (Project description – operation). Assessment of the capacity of the T1 Western Line at St Marys indicates that there is enough capacity to accommodate the project transfers. Irrespective of the project, there is likely to be a need to increase services on the T1 Western Line to support the anticipated growth of patronage on the Sydney Trains network and

population growth within the Western Parkland City. Improvements to the T1 Western Line would be considered by TfNSW and any additional services at St Marys are expected to further support the project.

Station pedestrian and interchange modelling undertaken at St Marys Station indicates that no capacity constraints are expected by 2036 to handle the entry/exit and transfer customers. Pedestrian modelling completed for St Marys also indicates that the required criteria, including platform clearance time, time spent in queue, circulation performance and active platform queuing are met during the future operational years in 2036 and 2056.

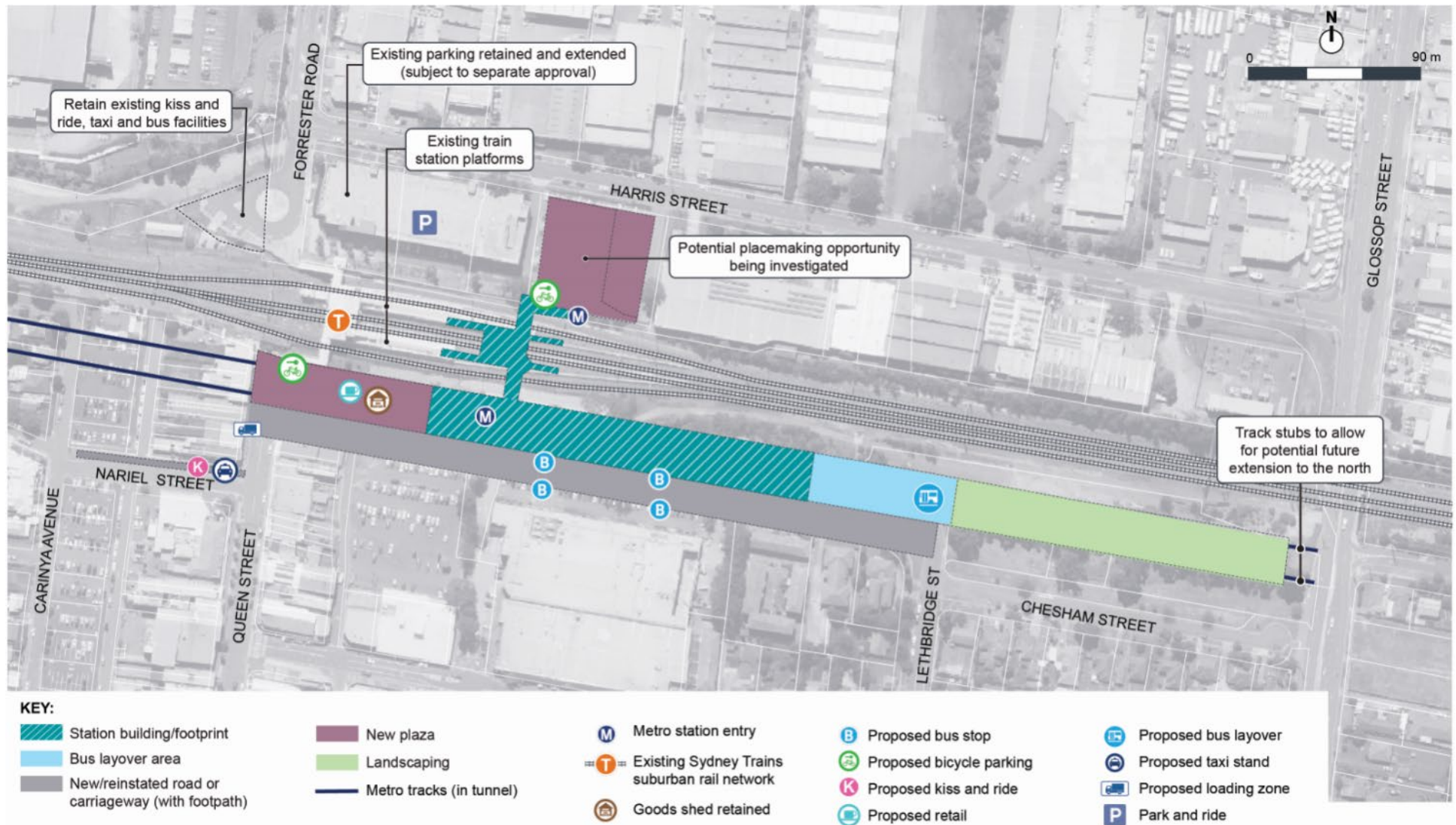


Figure 5-3 St Marys interchange layout plan

Orchard Hills Station

The proposed Orchard Hills Station precinct would service a future residential, commercial and mixed-use precinct, transforming the area into a compact high-amenity and walkable new community. Given the proximity of the station to the M4 Western Motorway, the station presents a suitable park and ride location for the surrounding suburbs.

Customers would access the station via a new plaza area to the west of the station, providing a single access point. All interchange facilities would be located on the north-south street that borders the eastern side of the station, east of Kent Road, to activate frontages and promote street activity. Secure bicycle parking with up to 100 spaces are proposed close to the station entrance. Bus bays and shelters, proposed on both sides of the road near the station entrance, would provide convenient pedestrian movement to the station. Commuter parking includes up to 500 spaces and has been located to provide direct access from Lansdowne Road and in close proximity to Kent Road and the M4 Western Motorway. This location aims to reduce the volume of traffic immediately outside of the station and should be integrated into other land uses to maximise the potential of the precinct.

Upgrades to the existing road reserve for Kent Road and Lansdowne Road including intersections with new precinct roads and pedestrian crossings are proposed as part of the station, emphasising the need to maintain reliable traffic access to and from the M4 Western Motorway.

Station design would not preclude the provision of future public transport upgrades by providing space for future customer interchange at the stations. Potential additional local bus routes are proposed by TfNSW within the study area, linking the project to the local surrounding centres.

On-street car parking and future access arrangements between the station and any future residential and retail and commercial developments envisaged within the town centre at Orchard Hills would be provided as the precinct develops and as part of the wider plans for the area.

Preliminary forecasts for the 2036 AM peak hour indicate about 1,100 customers entering and about 80 customers exiting the station. This indicates the station would be predominantly serving future residents of the area. The forecast mode arrival during the AM peak hour for the station is shown in Figure 5-4. The forecasts indicate a large proportion of residents are forecast to access the station in the morning by walking with 42 per cent, followed by park and ride with 19 per cent.

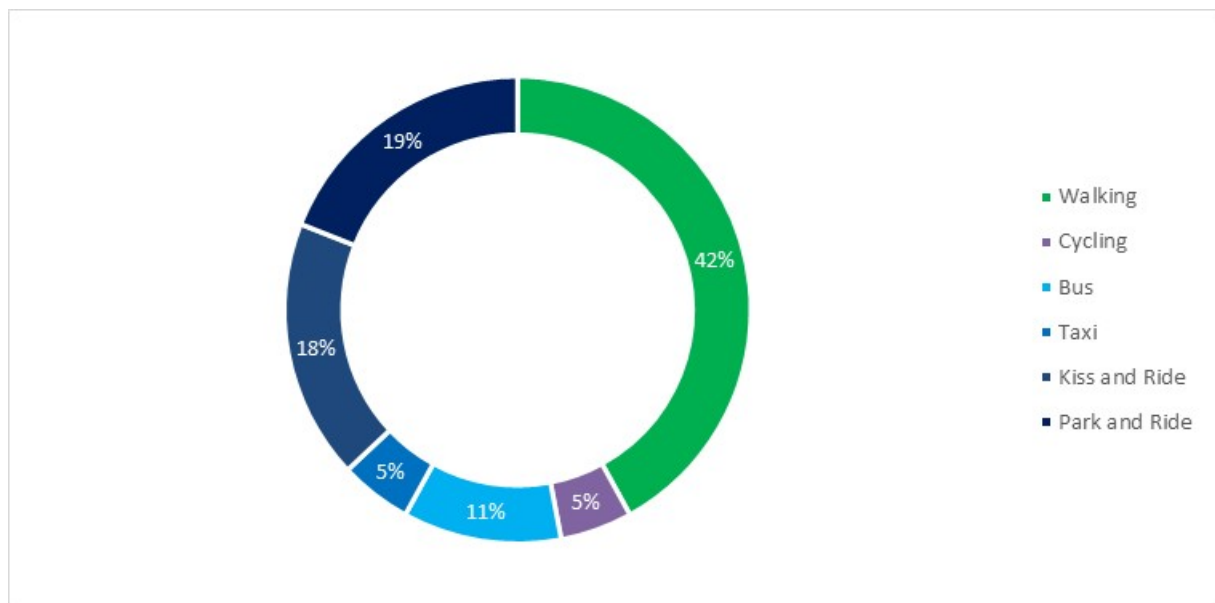


Figure 5-4 Forecast mode of arrival during the AM peak in 2036 at Orchard Hills Station



Figure 5-5 Orchard Hills interchange layout plan

Luddenham Road Station

The Luddenham Road Station precinct would be located to the west of Luddenham Road within the proposed Western Sydney Aerotropolis Northern Gateway precinct area, which forms part of Western Sydney Aerotropolis. The masterplan for the area aims to deliver a mix of employment and housing bordering the station. The current greenfield area offers an opportunity to foster sustainable modes of travel and the proposed masterplan can be used to support aspirations for travel trends to be oriented around walking, cycling and public transport. Future access arrangements between the station and the wider precinct, in addition to on-street car parking within the precinct, would be developed as part of the masterplan for the area.

Customers would access the station via a new station plaza and concourse area proposed at the northern end of the station to enhance walking and cycling as alternative modes of travel. The masterplan for the business park provides walking and cycling corridors that connect the station precinct to the wider precinct. Around 60 secure bicycle parking spaces would be provided at the station. Transport interchange facilities would be delivered on the eastern side of the station plaza, with access from Luddenham Road. Bus layover facilities are proposed south of the station.

Point-to-point, kiss and ride and park and ride facilities are provided on the eastern side of the precinct, reducing private vehicle impacts on the internal street network of the station. Commuter parking facilities would include up to 200 at-grade spaces, with access to the new commuter car park provided directly from Luddenham Road. The demand for car parking spaces at Luddenham Road Station was identified based on demand modelling. However, the station design does not preclude the potential to increase spaces in a multi-storey arrangement, should this be required due to future demand at the station.

Station design would not preclude the provision of future public transport upgrades by providing space for future customer interchange at the stations. Potential additional regional bus services may be provided by TfNSW within the study area to enable connectivity between surrounding local and regional centres.

Preliminary forecasts for the 2036 AM peak hour indicate about 350 customers entering and about 560 customers exiting the station. This reflects the mixed-use nature projected for the area, serving both residents and workers. The forecast mode of arrival for the station during the AM peak hour is shown in Figure 5-6. The forecasts indicate half of residents in the area are forecast to walk to the station in the morning. Over 20 per cent of customers are forecast to arrive via point-to-point services while 16 per cent are forecast to arrive by private car and utilise park and ride facilities. A larger proportion of private vehicle access is anticipated to occur during the year of opening in 2026 however, this is forecast to reduce by 2036.

The interchange layout plan for Luddenham Road Station is shown in Figure 5-7, and all elements included in the interchange layout plan are proposed to be delivered on opening of station. Walking and cycling facilities proposed by others as part of precinct developments surrounding the station during and beyond opening year in 2026 and 2036 were reviewed to ensure efficient and safe integration with proposed walking and cycling facilities as part of the project. These facilities would continue to be reviewed during further design development and access programs and schemes would also be developed in consultation with relevant authorities and stakeholders to ensure an integrated approach.

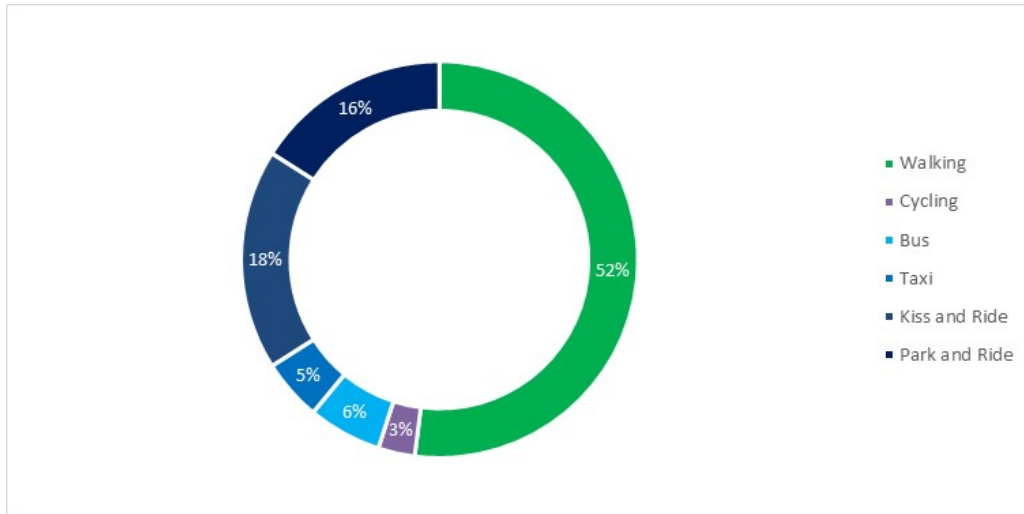


Figure 5-6 Forecast mode of arrival during the AM peak in 2036 at Luddenham Road Station



Figure 5-7 Luddenham Road interchange layout plan

Aerotropolis Core Station

The Aerotropolis Core Station would be located within the core of Sydney's third metropolis, the Western Parkland City. The precinct would be located in a greenfield space and provide opportunities to enhance user experience, focus on sustainable modes of travel and provide seamless interchanges between modes. The station design would be integrated into the wider plans for Western Parkland City, including consideration for access between the station, land uses surrounding the station and on-street car parking.

Access to the station would be provided at the northern end of the station as part of a new station plaza and concourse area. The plaza would be accessed by a new road provided as part of the Aerotropolis Core precinct. Bus bays and associated shelters as well as bus layover would be accessed from a bus-only corridor that would run in an east-west direction, creating a smooth interchange for transferring customers. These bus services are proposed to access the station via Badgerys Creek Road. Dedicated walking and cycling route would be provided at the station and would link to the new road network to be provided as part of the Aerotropolis Core. Up to 100 secure bicycle parking spaces are proposed to be provided near the station entrance.

Point-to-point services and pick up and drop off facilities are provided east of the plaza. In addition, temporary car parking facilities would be provided south of the station, within the space provisioned for potential future rail corridor, with access provided via Badgerys Creek Road.

Commuter car parking would initially provide up to 300 spaces at-grade to cater for planned developments to the south of the station. However, these spaces would be removed once the town centre and transport systems develop. Aerotropolis Core Station is planned to be a major transport hub providing the future Aerotropolis and surrounding employment and residential precincts key links and connections to Sydney's public transport network. As such the provision of additional car parking spaces is not required or appropriate to support the transport system for a city core area.

Station design would not preclude the provision of future public transport upgrades by providing space for future customer interchange at the stations. As part of the Western Sydney City Deal, the Australian and NSW Governments have committed to delivering new rapid bus routes to link the Aerotropolis, Western Sydney International and Penrith, Liverpool and Campbelltown. Local bus services would also be provided to link the station to its surroundings.

Preliminary forecasts for the 2036 AM peak hour indicate about 730 customers entering and about 580 customers exiting the station. The forecast mode arrival for the station is shown in Figure 5-8. The forecasts indicate that a significant transfer from bus is forecast at the station with 27 per cent of customers alighting at the station. Around 16 per cent of customers would access the station via the park and ride mode share and 11 per cent for kiss and ride. About 35 per cent of customers are expected to walk to the station. A larger number of customers are anticipated to access the station by private car and use the park and ride facilities during the year of opening in 2026, however, this is forecast to reduce by 2036.

The interchange layout plan for Aerotropolis Core Station is shown in Figure 5-9, and all elements included in the interchange layout plan are proposed to be delivered on opening of station. Walking and cycling facilities proposed by others as part of the development precincts surrounding the station and the Aerotropolis in 2026 and 2036 were reviewed to ensure efficient integration with the walking and cycling facilities proposed as part of the project. These facilities would continue to be reviewed during further design development to ensure an integrated approach. Access programs and schemes would further be developed at the station in consultation with relevant authorities and stakeholders.

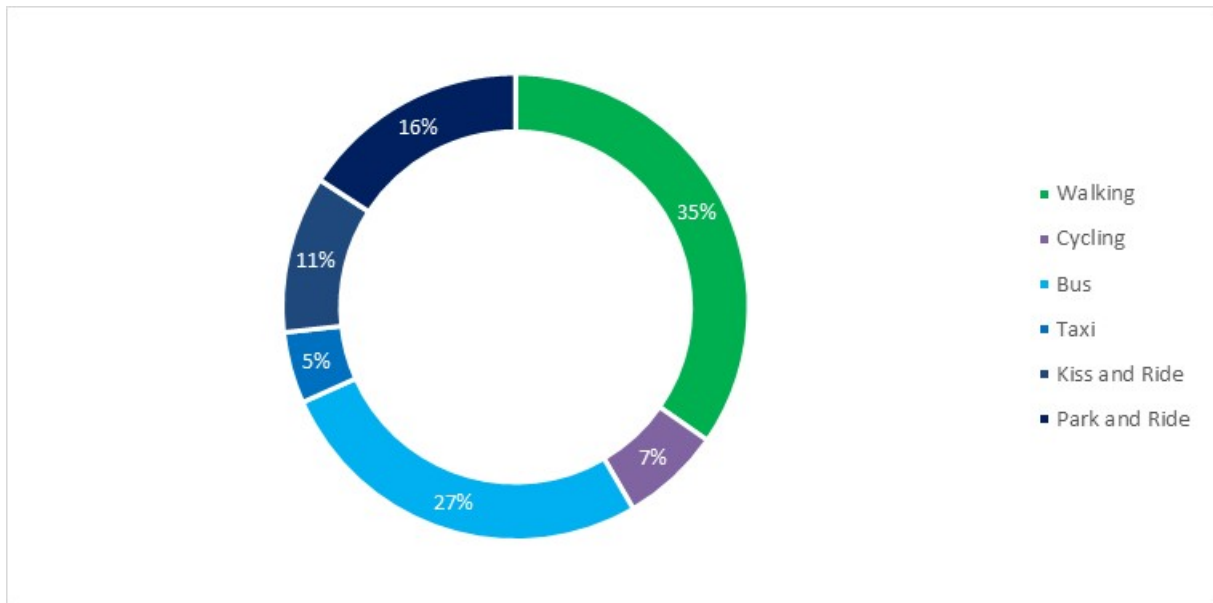


Figure 5-8 Forecast mode of arrival during the AM peak in 2036 at Aerotropolis Core Station

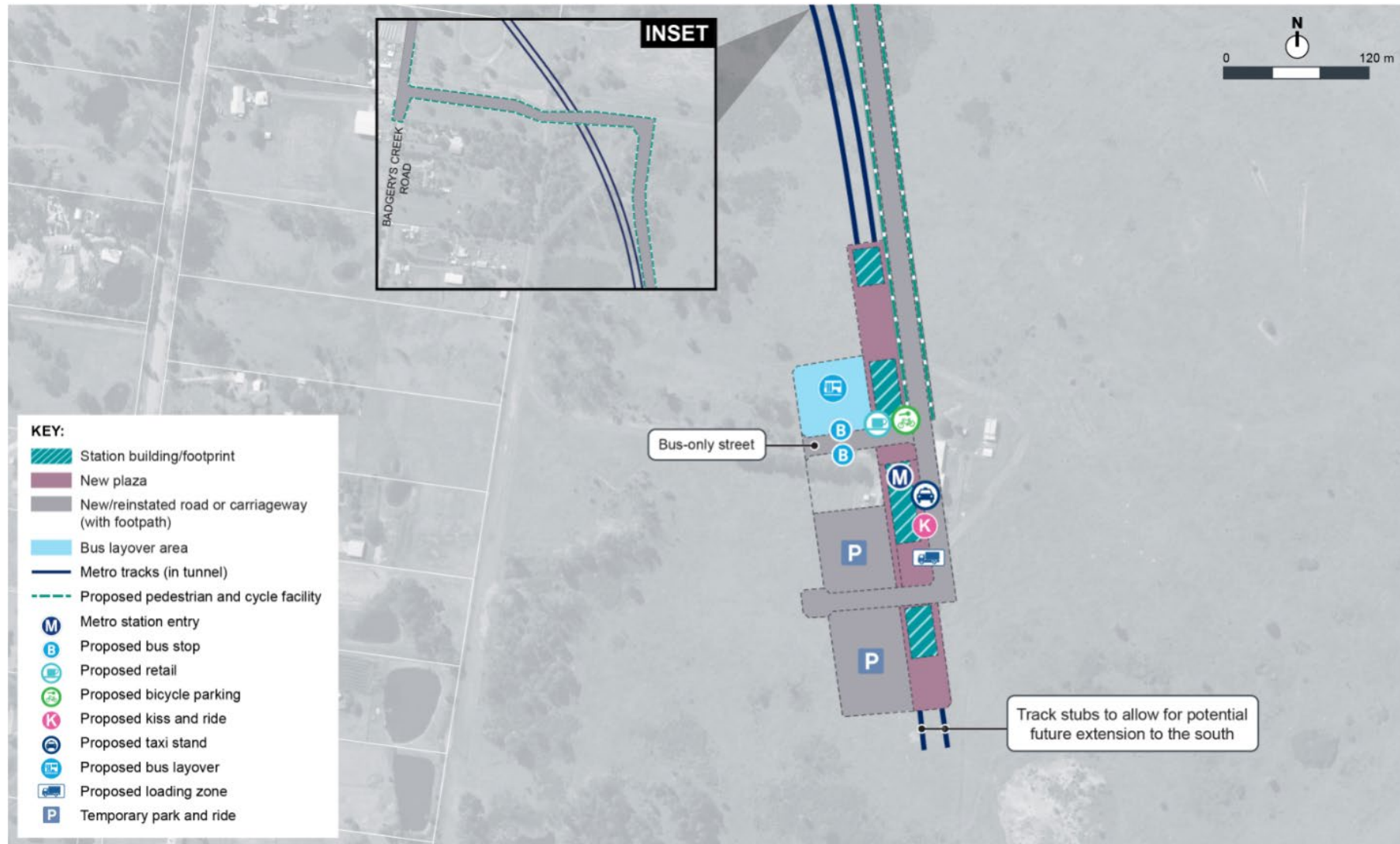


Figure 5-9 Aerotropolis Core interchange layout plan

5.2 On-airport integration with other transport modes

5.2.1 Overview

Similar to the off-airport station precincts, the operational impact assessment for the on-airport station precincts was based on the demands, characteristics, access modes and station and precinct design plans for each of the planned stations. Transport interchange requirements for the Airport Business Park Station and Airport Terminal are being developed by Western Sydney Airport. Indicative requirements for the on-airport stations are outlined in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

The modal access hierarchy for the Airport Business Park Station would include all modes, with walking, cycling, bus, point-to-point and kiss and ride facilities available at the station. At the Airport Business Park Station, coaches are also proposed to operate in addition to these access modes.

The Airport Terminal Station would be the main connection between the project and the future airport terminal. Customer access would primarily be provided via an airport terminal connection with Western Sydney International (to be provided as part of the airport construction). Other interchange opportunities including bus stops would be provided by others as part of the wider development of the precinct and are outside the scope of this project.

The forecast mode shares for point-to-point services, park and ride and kiss and ride are low for the Airport Business Park Station, as these modes would be provided as part of the development of Western Sydney International and the business park. The Airport Terminal station is not expected to have mode shares associated with private car-based trips accessing the station. As such, these stations are expected to introduce limited traffic demand once operational.

5.2.2 Integration strategy

This section outlines the transport provisions at each on-airport station precinct. Details of station precinct elements, facilities and indicative layouts for each station precinct are further discussed in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

The layout plans for Airport Business Park Station and Airport Terminal Station are shown in Figure 5-12 and Figure 5-13 respectively. All elements included in the layout plans are proposed to be delivered on opening of the stations. Walking and cycling facilities proposed at Western Sydney International and the surrounding business areas to be developed by others were reviewed as part of the station design development to ensure efficient and safe integration with the walking and cycling facilities proposed as part of the project. These facilities would continue to be reviewed during further design development and access programs and schemes would also be developed in consultation with relevant authorities and stakeholders to ensure an integrated approach.

Airport Business Park Station

The Airport Business Park Station would be located within the new Western Sydney International, bounded by Elizabeth Drive to the north, Badgerys Creek to the east and The Northern Road to the west and south. Transport requirements for this station are being developed by Western Sydney Airport and are outlined in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

Customers would access the station from the south via a pedestrian bridge connecting the station to the future road network of the business park, which would be developed by others as part of the new airport. The station entrance would be located at the eastern end of the station as part of a new concourse area. Bus interchange facilities would also be provided near the station accesses, with bus shelters and road kerb to enable customer transfer and kiss-and-ride facilities. These facilities would be provided by others as part of the wider development of Western Sydney International.

As part of the Western Sydney City Deal, the Australian and NSW Governments have committed to delivering new rapid bus routes to link the Aerotropolis, Western Sydney International and Penrith, Liverpool and Campbelltown. Local bus services would also be provided to link the station to its surrounding area.

Preliminary forecasts for the 2036 AM peak hour indicate about 200 customers entering and about 350 customers exiting the station, reflecting the predominant commuter use of the station to access

employment centres within the business park. Bus transfers are forecast to be the predominant mode of access at the station with 73 per cent, followed by park and ride with nine per cent. The customers accessing the station using the park and ride are expected to use on-street parking spaces or other adjacent parking facilities. All other modes account for five per cent or less each. Customer access using park and ride is anticipated to be higher during the year of station opening in 2026. However, it is forecast that access using this mode is likely to reduce by 2036. The forecast mode arrival for the station is shown in Figure 5-10.

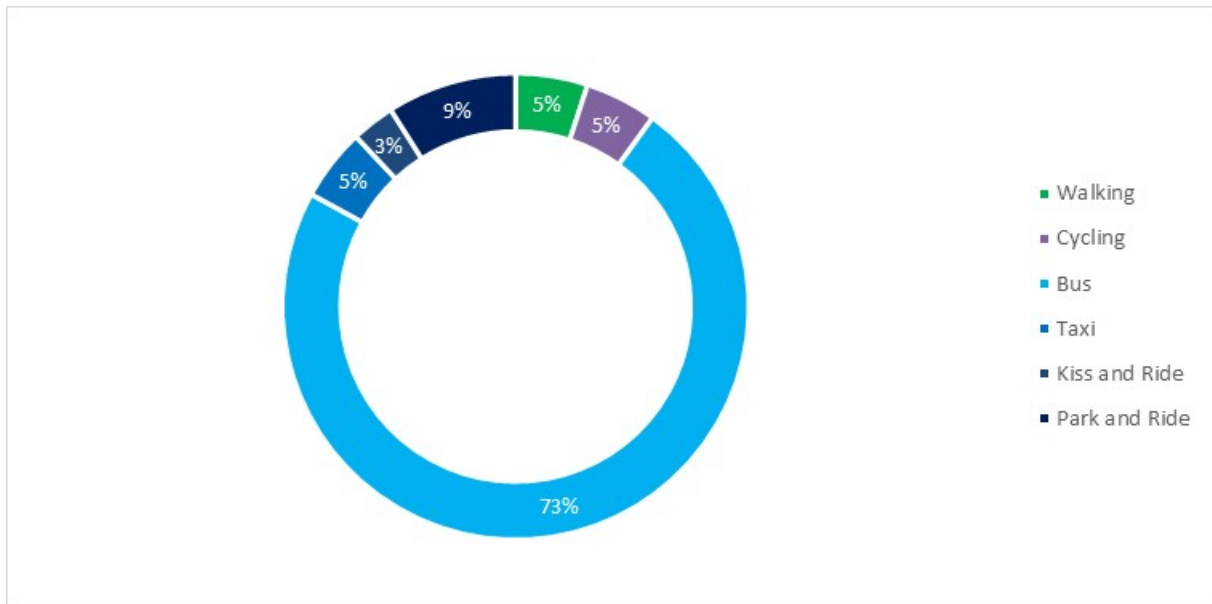


Figure 5-10 Forecast mode of arrival during the AM peak in 2036 at Airport Business Park Station

Airport Terminal Station

The Airport Terminal Station would be close to the Terminal at the centre of the Western Sydney International site. Transport requirements for this station are being developed by Western Sydney Airport and are outlined in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

Customer access would primarily be provided via an airport terminal connection with Western Sydney International (to be developed by others). Kiss and ride is proposed to be provided for the aviation customers of Western Sydney International as part of the wider development of the Airport. However, these facilities could also be used by project customers.

The Airport Terminal Station would also be serviced by bus routes servicing the Airport Business Park Station. Rapid bus routes committed for delivery by the Australian and NSW Governments as part of the Western Sydney City Deal and discussed in Section 3.4.1 would link the Airport Terminal Station to surrounding metropolitan centres of Penrith, Liverpool and Campbelltown. In addition, some additional regional and local bus services are proposed to service the station.

Preliminary forecasts for the 2036 AM peak hour indicate about 730 customers entering and about 580 customers exiting the station. The forecast mode arrival for the station is shown in Figure 5-11. The forecasts indicate 89 per cent of customers are forecast to walk to the station given the station would be located near Western Sydney International and customers are expected to be predominantly aviation customers or airport staff. About 11 per cent of customers are forecast to access the station by bus.

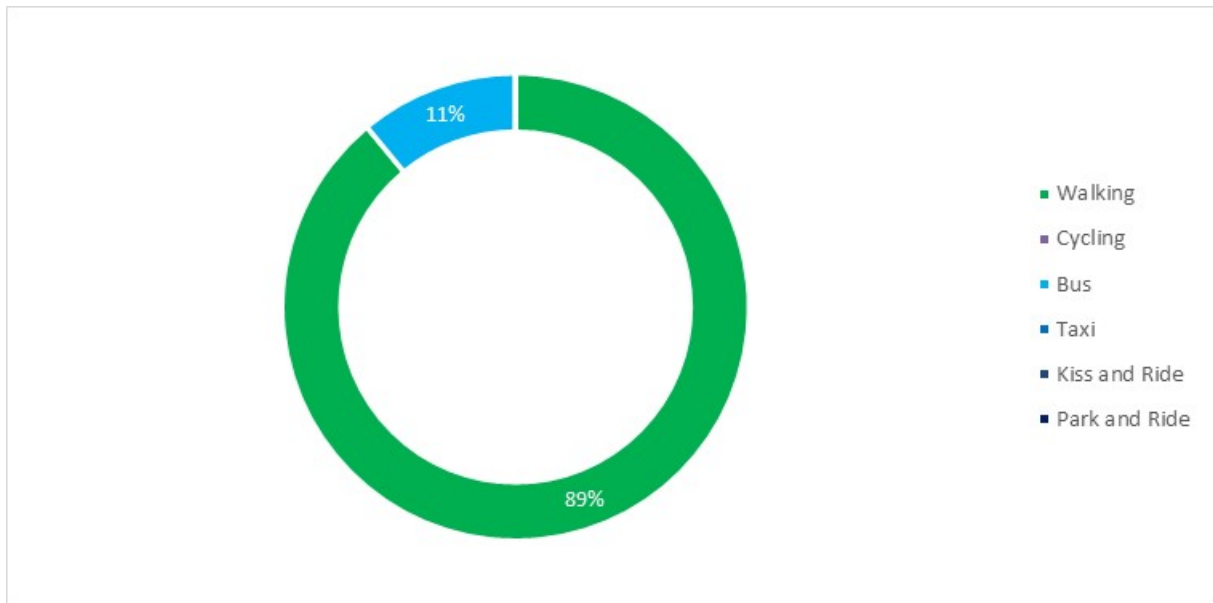


Figure 5-11 Forecast mode of arrival during the AM peak in 2036 at Airport Terminal Station

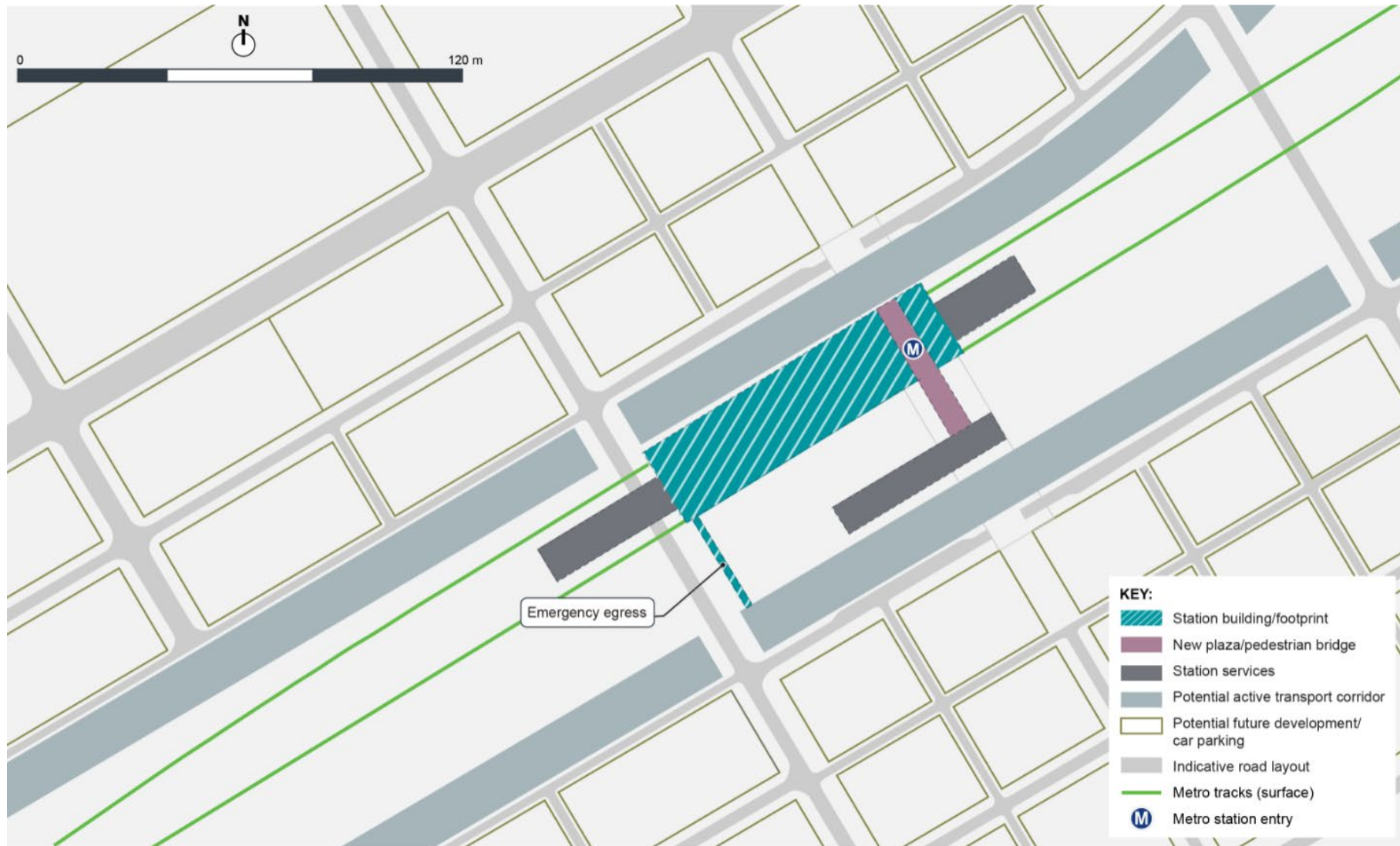


Figure 5-12 Airport Business Park layout plan



Figure 5-13 Airport Terminal layout plan

5.3 Off-airport 2026 future year

The assessment of the 2026 future year without the project scenario was informed by the outputs of the WRTM modelling developed for the future M12 Motorway Environmental Impact Statement. The assessment included the changes to the transport network anticipated for the 2026 forecast year, accounting for forecast traffic growth and incorporating other road infrastructure expected to be operational in the study area, as discussed in Section 3.4. The assessment reflects the forecast operations of the road network under the assumption that the M12 Motorway and Western Sydney International would be operational. The assessment of intersection performance during the with and without project scenarios were undertaken using SIDRA INTERSECTION 8.

The assessment of the 2026 future year with the project scenario was informed by the outputs of the WRTM modelling developed for the M12 Motorway Environmental Impact Statement with the project and the preliminary passenger demand forecasts for 2026 at each station. The assessment included the changes to the transport network anticipated for the 2026 future year as detailed in Section 3.4 and the forecast mode of arrival and departure at each station during the 2026 future year detailed in Section 5.1 and 5.2.

For the assessment of the 2026 future year with the project scenario, access routes to and from the proposed stations during both the AM and PM peak hours considered the proposed land use changes forecast in the study area, including the future growth associated with the development of the South West Growth Area, Western Sydney Aerotropolis, associated business park, proposed location of commuter car parks and other planned road upgrades in the study area. Bus access to each station considered future bus services and routes proposed within the study area in 2026. Further details regarding provision of commuter car park at the station precincts are detailed in Chapter 7 (Project Description Operation) of this Environmental Impact Statement.

5.3.1 Road network changes

As part of the establishment of the future stations, a number of changes would be required in the surrounding road network to integrate the station design into existing and future land uses as part of Day 1 opening in 2026. These changes include traffic calming measures, pedestrian crossings, signals, pedestrian zones, the relocation of some existing facilities and adjustments to phasing and bus priority measures. The required road network changes are described in detail in Chapter 7 (Project Description Operation) of this Environmental Impact Statement and discussed below. These road network changes are subject to ongoing design development and would be determined in consultation with relevant stakeholders.

Road network adjustments in the form of road modifications, pedestrian crossings and traffic signal works are proposed to facilitate access to future stations and ensure the safe integration of the project to the existing transport network. Some modification works may be delivered by others as part of road upgrades within the precinct ahead of the operation of the project.

The indicative permanent road network adjustments are described in detail in Chapter 7 (Project Description - Operation) of this Environmental Impact Statement, with some changes required for the operation of the project summarised in Table 4-4. Proposed signalised intersection and pedestrian crossing upgrades would be undertaken in collaboration with TfNSW and WCAA.

Table 5-2 Indicative permanent road network changes

Site ID	Indicative permanent road network adjustments
Off-airport	
St Marys	<ul style="list-style-type: none"> change from the access arrangement on Station Street to restricted access for properties and service access for buses traffic calming and bus priority measures on Station Street and addition of up to three new pedestrian crossing points, which may be signalised for pedestrians closure of northern intersection of Gidley Street with Station Street traffic calming measures or conversion to pedestrian zone between Station Street and Phillip Street.

Site ID	Indicative permanent road network adjustments
	<ul style="list-style-type: none"> removal of on-street parking on Nariel Street to allow for new point-to-point vehicle facilities and kiss-and-ride bays retain the existing access to the Harris Street car park
Orchard Hills	<ul style="list-style-type: none"> upgrade to the intersection including addition of traffic signals to facilitate vehicle movements into the station precinct at the intersection of Lansdowne Road and Kent Road provision of new signalised crossing at a new precinct street and Kent Road to facilitate vehicle movements into the station precinct provision of new signalised pedestrian crossing on Kent Road provision of unsignalised intersection at the station car park
Luddenham Road	<ul style="list-style-type: none"> provision of new signalised intersection and pedestrian crossing to facilitate vehicles and pedestrian movements into the station precinct at a new precinct street (north) and Luddenham Road intersection provision of new signalised intersection and pedestrian crossing to facilitate vehicles and pedestrian movements into the station precinct at a new precinct street (south) and Luddenham Road intersection provision of unsignalised intersection at the station car park
Aerotropolis Core	<ul style="list-style-type: none"> provision of new signalised intersection at Badgerys Creek Road and pedestrian crossing to facilitate vehicles and pedestrian movements into the station precinct provision of unsignalised intersection at the station car park
On-airport	
Airport Business Park and Airport Terminal	<ul style="list-style-type: none"> access to the proposed on-airport stations within Western Sydney International would be provided as part of the wider development of Western Sydney International (to be provided by others)

Further details about the justification for some of these road network changes are detailed in the following sections.

St Marys Station

In the St Marys precinct, Station Street would move from the current two-way access arrangement to restricted access for properties and service access for buses, establishing a bus priority along the road. Private driveways would be removed or relocated where possible within the interchange vicinity and on-street parking would be converted to bus bays or no parking zones to permit bus operations. Traffic calming measures would be introduced, in addition to three pedestrian crossing points. These changes are subject to further investigation and design review. The intersection of Station Street and Gidley Street would be closed and potential traffic calming measures or a new pedestrian zone would be introduced.

In Nariel Street, town-centre parking would be removed to allow for new point to point and kiss and ride spaces. Operational changes would also be introduced along a number of key roads within the town centre to facilitate bus movements. These changes include potential changes to on-street parking at Lethbridge, Queen and Phillip streets and signal phasing at the Phillip Street and Glossop Street intersection. Minor improvements such as linemarking the construction of kerb ramps would be required to permit pedestrian and cyclist access at Camira and Chesham streets.

In addition, on-street parking along Harris Street would potentially be removed to permit more direct pedestrian access near the future plaza area at St Marys Station.

Orchard Hills Station

Road network improvements works would be required in Orchard Hills. These upgrades include an upgrade and likely signalisation of the intersection of Lansdowne Road and Kent Road and the provision of a new signalised crossing at the intersection of Kent Road and the Future Precinct Street

as well as a signalised crossing at Kent Road to permit vehicle movements into the station precinct. These upgrades may include provisions for an additional approach, pedestrian and bicycle crossings and potential bus priority.

Luddenham Road Station

In the Luddenham Road precinct, the provision of traffic signals including signalised pedestrian crossings at the intersection of Luddenham Road and the Future Precinct Street (north) and Luddenham Road and the Future Precinct Street (south) may be required to permit vehicle movements into the station precinct. These upgrades may include provisions for an additional approach, pedestrian and bicycle crossings and potential bus priority.

Aerotropolis Core Station

As part of the Aerotropolis operational needs, the provision of a new signalised crossing at the intersection of Badgerys Creek Rd and New Precinct Street may be required to permit vehicle movements into the station precinct. Provisions for an additional approach and new pedestrian and bicycle crossings may also be required.

5.3.2 Mid-block performance

An assessment of the weekday AM and PM peak hour traffic volumes was completed to determine the general performance of the road network configuration in the 2026 future year. The findings of this assessment are summarised in Table 5-3.

The traffic volumes across the study area are forecast to increase, primarily due to the growth associated with Western Sydney Airport, developments in the Western Sydney Aerotropolis, Greater Penrith to Eastern Creek and the South West Growth Area. The forecast traffic volumes along Mamre Road and Luddenham Road are expected to exceed their capacity, during both the AM and PM peak hours for the without and with project scenarios. It is noted that TfNSW is currently undertaking studies for the upgrade of the Mamre Road, details of which are presented in Section 3.4.4.

During the without project scenario, Table 5-3 indicates that the following road sections are forecast to operate near or at the theoretical capacity in 2026:

- Mamre Road north of Luddenham Road at LOS F (northbound and southbound) during the AM peak and LOS F(northbound) during the PM peak
- Luddenham Road west of Mamre Road at LOS F (northbound) during the AM peak and LOS F (northbound and southbound) during the PM peak
- Luddenham Road north of Elizabeth Drive at LOS F (northbound) during the AM peak and LOS F (southbound) during the PM peak
- Elizabeth Drive east of Badgerys Creek Road at LOS F (westbound) during the AM and PM peak
- The Northern Road east of Badgerys Creek Road at LOS E (westbound) during the AM peak.

During the project scenario, Table 5-3 indicates that the following road sections are forecast to operate near or at the theoretical capacity:

- Great Western Highway east of Queen Street at LOS E (westbound) during the PM peak
- Mamre Road north of Luddenham Road at LOS F (northbound and southbound) during the AM peak and LOS F(northbound) during the PM peak
- Luddenham Road west of Mamre Road at LOS F (northbound) during the AM peak and LOS F (northbound and southbound) during the PM peak
- Luddenham Road north of Elizabeth Drive at LOS F (northbound) during the AM peak and LOS F (northbound and southbound) during the PM peak
- Elizabeth Drive east of Badgerys Creek Road at LOS F (westbound) during the AM and PM peak
- The Northern Road, east of Badgerys Creek Road at LOS E (northbound) during the AM peak.

The assessment indicates that the project scenario is not forecast to cause significant impacts to the study area road network compared with the without project scenario, except for the section of Great

Western Highway east of Queen Street. This section of the Great Western Highway is forecast to operate near theoretical capacity (LOS E) in the PM peak. Increase in the number of bus services and enhancements to the walking and cycling facilities for the St Marys precinct are likely to reduce the car dependency. These changes are expected to minimise the impacts to this section of the study area road network. Potential mitigation measures are included in Section 7 to minimise these impacts.

Table 5-3 2026 future year mid-block performance – Off-airport

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Without project		With project		Without project		With project	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Glossop Street (north of the Great Western Highway)	NB	1900	1090	C	1270	C	1220	C	1220	C
	SB	1900	1180	C	1180	C	1280	C	1280	C
Great Western Highway (east of Queen Street)	EB	2800	1850	C	2080	C	1470	C	1620	C
	WB	2800	1650	C	1810	C	2360	D	2510	E
Great Western Highway (west of Queen Street)	EB	2800	1590	C	1670	C	1230	B	1230	B
	WB	2800	1140	B	1140	B	2040	C	2040	C
Queen Street (north of Great Western Highway)	NB	900	640	C	800	D	560	C	700	D
	SB	900	350	B	510	C	640	C	780	D
Mamre Road (south of the Great Western Highway)	NB	1800	1050	C	1050	C	1190	C	1190	C
	SB	1800	960	C	960	C	1310	C	1310	C
Kent Road (north of the M4 Western Motorway)	NB	1900	1240	C	1280	C	1390	C	1440	D
	SB	1900	1160	C	1160	C	1200	C	1230	C
Kent Road (south of the M4 Western Motorway)	NB	900	630	C	680	D	480	C	570	C
	SB	900	310	A	410	B	330	B	380	B
Mamre Road (north of Luddenham Road)	NB	1900	1980	F	1990	F	1920	F	1930	F
	SB	1900	2070	F	2090	F	1650	D	1660	D
Luddenham Road (west of Mamre Road)	NB	900	1310	F	1330	F	950	F	990	F
	SB	900	370	B	410	B	1010	F	1030	F
Luddenham Road (north of Elizabeth Drive)	NB	900	1310	F	1340	F	730	D	760	D
	SB	900	340	B	380	B	980	F	1000	F

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Without project		With project		Without project		With project	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Elizabeth Drive (west of Badgerys Creek Road)	EB	2800	490	A	510	A	610	A	630	A
	WB	2800	730	A	760	A	730	A	750	A
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	690	D	720	D	640	C	700	D
	WB	900	1030	F	1100	F	1030	F	1050	F
Badgerys Creek Road (south of Elizabeth Drive)	NB	1900	410	A	440	A	430	A	490	A
	SB	1900	510	A	580	A	700	B	730	B
Badgerys Creek Road (north of The Northern Road)	NB	900	550	C	610	C	390	B	430	B
	SB	900	300	A	350	B	610	C	680	D
The Northern Road (west of Badgerys Creek Road)	NB	1900	1340	C	1350	C	1290	C	1320	C
	SB	1900	750	B	780	B	720	B	720	B
The Northern Road (east of Badgerys Creek Road)	NB	1900	1840	E	1880	E	1600	D	1610	D
	SB	1900	1000	C	1010	C	1260	C	1260	C

Note: Traffic volumes rounded to the nearest 10

Source: Traffic volumes used for the assessments was informed by the outputs of the WRTM modelling developed for the M12 Motorway Environmental Impact Statement

5.3.3 Intersection performance

A summary of the performance of the intersections within the study area in the peak periods during the future year 2026 is summarised in Table 5-4. The control type at each intersection is also indicated (P: Priority-controlled, R: Roundabout, S: Signalised).

During the without project scenario, Table 5-4 indicates that during the 2026 future year, the majority of the intersections operate at LOS D or better, except:

- Queen Street/Great Western Highway/Mamre Road (PM peak) is forecast to operate at LOS E
- Mamre Road/M4 Western Motorway Eastbound Ramp (PM peak) is forecast to operate at LOS F
- Mamre Road/M4 Western Motorway Westbound Ramp (AM and PM peak) is forecast to operate at LOS F
- Mamre Road/Luddenham Road (AM and PM peak) is forecast to operate at LOS F
- Badgerys Creek Road/The Northern Road (AM peak) is forecast to operate at LOS F.

The assessment indicates that the above intersections are forecast to operate at or above capacity due to the forecast growth in background traffic demand within the study area during the without project scenario. This is likely to result in significant delays and queuing at these intersections, which is expected to increase with the addition of traffic forecast to be generated by the project due to the oversaturated conditions.

During 2026 future year with the project scenario, Table 5-4 indicates that with the exception of the above intersections, all other intersections are forecast to operate at LOS D or better. This indicates that the project is not forecast to impact the study area intersections. For the intersections that are forecast to operate at or above capacity during 2026 during both without and with project, the increase in average delay due to the addition of traffic generated by the project is forecast to be between 5 seconds and 60 seconds during the peak hours.

The addition of traffic likely to be generated by the project in 2026 is forecast to increase the average delays at the intersection of Queen Street/Great Western Highway/Mamre Road by about 60 seconds during both AM and PM peaks. This is primarily due to the oversaturated conditions prevailing at this intersection during without the project scenario in 2026. The increase in average delay at the intersection of Badgerys Creek Road/The Northern Road is forecast to be less than 5 seconds during the AM peak in 2026 with the project.

Table 5-4 2026 future year intersection performance – Off-airport

Intersection	AM Peak				PM Peak			
	Without project		With project		Without project		With project	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Glossop Street/Forrester Road (S)	30	C	34	C	37	C	37	C
Glossop Street/Harris Street (P)	9	A	10	A	11	A	11	A
Harris Street/St Marys Station Car park Access (P)	-	-	5	A	-	-	5	A
Glossop Street/Phillip Street (S)	13	A	14	A	15	B	15	B
Queen Street/Charles Hackett Drive (S)	16	B	18	B	18	B	18	B
Glossop Street/Great Western Highway (S)	32	C	37	D	43	D	43	D
Queen Street/Great Western Highway/Mamre Road (S)	44	D	92	F	65	E	>100	F
Charles Hackett Drive/Great Western Highway/Pages Road (S)	23	C	33	C	46	D	47	D
Mamre Road/M4 Western Motorway Eastbound Ramp (S)	25	B	25	B	>100	F	>100	F
Mamre Road/M4 Western Motorway Westbound Ramp (S)	85	F	85	F	>100	F	>100	F
Kent Road/Caddens Road (S)	25	B	25	B	24	B	24	B
Kent Road/M4 Western Motorway On-ramp (S)	5	A	7	A	5	A	5	A
Kent Road/M4 Western Motorway Off-ramp (S)	21	B	22	B	20	B	22	B
Kent Road/Orchard Hills Station Access (S)	-	-	17	B	-	-	13	A
Kent Road/Lansdowne Road (S)	7	A	31	C	10	A	31	C
Lansdowne Road/Orchard Hills station Car park Access (P)	-	-	6	A	-	-	6	A
Mamre Road/Luddenham Road (S)	72	F	73	F	86	F	97	F
Luddenham Road/Station Access (North) (S)	-	-	11	A	-	-	11	A

Intersection	AM Peak				PM Peak			
	Without project		With project		Without project		With project	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Luddenham Road/Station Access (South) (S)	-	-	11	A	-	-	9	A
Luddenham Road Station Car park Access (P)	-	-	6	A	-	-	6	A
Luddenham Road/Elizabeth Drive/Adams Road (S)	29	C	29	C	52	D	54	D
Elizabeth Drive/Western Sydney International Access (S)	15	B	15	B	16	B	16	B
Elizabeth Drive/Badgerys Creek Road (S)	13	B	13	B	13	B	13	B
Badgerys Creek Road/Aerotropolis Core Station Access (S)	-	-	13	A	-	-	12	A
Aerotropolis Car park Access (P)	-	-	6	A	-	-	6	A
Badgerys Creek Road/The Northern Road (S)	>100	F	>100	F	28	B	28	B

Notes:

[1] Assessments have been undertaken using SIDRA INTERSECTION 8.

[2] For traffic signals, the average movement delay and level of service over all movements is used. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is used.

[3] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised).

[4] The intersection of Kent Road/Lansdowne Road is a priority controlled intersection and experiences the worst movement delay for through traffic approaching from the west on Lansdowne Road during the without project scenario due to low traffic volumes (less than 5 veh/hr). However, the delay is not representative of the overall intersection performance. Therefore, the movement that corresponds to the next highest delay is reported here to provide an indication of the intersection performance. During with the project, this intersection is proposed to be upgraded to a signalised intersection.[5] Dashes indicate new operational site accesses that would only be used once the project is operational and hence would not exist during the 2026 future year without the project scenario.

5.3.4 Road safety

The frequency of crashes in the study area is expected to change relative to the forecast traffic volumes on the road network, assuming everything else remains the same. The additional traffic volumes forecast to be generated by the project in 2026 are expected to be low when compared to the background growth in traffic volumes near the station precincts.

The greatest increase in background growth is forecast to occur on the Great Western Highway, east of Queen Street, in the St Marys precinct. Compared to existing traffic volumes, additional traffic at this location would be less than ten per cent of peak hour traffic on the Great Western Highway during both peak hours. The second largest increase in traffic is expected to occur along Queen Street, north of the Great Western Highway in the St Marys Precinct.

It is assumed that the future type, and severity of crashes would be consistent with historic trends and is not likely to change significantly given the relatively low traffic generated by the project. As indicated in the crash assessment in Section 3.2.6, there exists a higher incident rate around the St Marys precinct and the section of the road network between the Great Western Highway and the M4 Western Motorway. As described in Section 5.3.1, some traffic calming measures are planned to be introduced as part of the project and would help improve safety around the precincts with higher incident rates. Potential mitigation measures to improve road safety around station precincts are identified in Section 7.

5.3.5 Walking and cycling impacts

There are no major changes to the walking and cycling network proposed during the 2026 future year without the project scenario and therefore no significant impacts are expected to the walking and cycling network.

During the 2026 future year with the project, the design of station precincts is proposed to provide pedestrian and cycle facilities as well as road modifications and intersection treatments to support walking and cycling to the stations. These provisions are described in Section 5.1 and Section 5.2 as well as Chapter 7 (Project description – operation) of the Environmental Impact Statement. The proposed infrastructure facilities at the station precincts to provide priority to walking and cycling facilities are as follows:

- walking and cycling facilities at the station precincts
- additional pedestrian crossing points for easy access to the station, provision of traffic calming measures on Gidley Street or conversion to pedestrian zone between Station Street and Phillip Street and facilitation of pedestrian access from Harris Street at St Marys
- new signalised pedestrian crossing on Kent Road at Orchard Hills
- new signalised pedestrian crossing to facilitate pedestrian movements into the station at Luddenham
- new pedestrian crossing to facilitate pedestrian movements at Badgerys Creek Road intersection at Western Sydney Aerotropolis.

The project does not preclude the provision of new or planned pedestrian and cycle transport services in areas around the station entrances, along the project corridor or within future precincts surrounding the project. Considerations have been given to ensure new cycling facilities, including shared paths or on-road cycle routes associated with major road upgrades or those proposed along creek corridors which the alignment would cross over, would be able to integrate with the design of the stations precincts and allow access to the station entrances and connect to any existing cycle route facilities. All new walking and cycling infrastructure provided at stations as part of the project would aim to achieve a minimum Fruin LOS C. This would be considered during design development for the stations. It is also noted that the project interfaces with proposed walking and cycling links planned to be in the form of viaduct crossings, thereby minimising impacts.

5.3.6 Public transport impacts

The road-based public transport modes are likely to be impacted in the same way as general traffic. Therefore, the assessment in Section 5.3.1 and Section 5.3.3 includes potential impacts to road-based public transport modes along with general traffic during the 2026 future year. In general, most

intersections are forecast to operate satisfactorily, with delays observed on the road network as a result of the base traffic in 2026.

Rail-to-rail transfer is expected to occur at St Marys between the project and the T1 Western Line. The interchange function of St Marys Station is discussed in detail in Section 5.1.2 and indicates that there is sufficient capacity on the T1 Western Line trains at St Marys Station to accommodate customers transferring from/to the project.

Forecasts at the proposed stations indicate customer transfers are expected between rail customers and buses, as discussed in Section 5.1.2. This demonstrates a need for seamless public transport integration at the new stations and augmentation of capacity of the bus network to cater for this additional demand. As part of the Western Sydney City Deal, the Australian and NSW Governments has committed to delivering new rapid bus services to link the metropolitan centres of Penrith, Liverpool and Campbelltown to the Western Sydney Aerotropolis and to Western Sydney International. Regional and local bus services would also be provided to link the project to its local and wider surroundings. The frequencies of these bus services would be determined based on the demand for travel at these stations.

5.4 Off-airport 2036 future year

The assessment of the 2036 future year without the project scenario was informed by outputs of the WRTM modelling developed for the M12 Motorway Environmental Impact Statement. The assessment included the changes to the transport network anticipated for the 2036 forecast year, accounting for forecast traffic growth and incorporating other road infrastructure expected to be operational in the study area, as discussed in Section 3.4, in addition to Western Sydney International. The assessment reflects the forecast operations of the road network under the assumption that the proposed M12 Motorway and Western Sydney International would be operational.

The assessment of the 2036 future year with the project scenario was informed by the outputs of the WRTM modelling developed for the M12 Motorway Environmental Impact Statement and the preliminary passenger demand forecasts for 2036 at each station. The assessment included the changes to the transport network anticipated for the 2036 future year as detailed in Section 3.4 and the forecast mode of arrival and departure at each station during the 2036 future year as outlined in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

The 2036 future year with the project scenario was assessed using the same methodology as the 2026 future year with the project scenario. Bus access to each station considers future bus services and routes proposed within the study area in 2036.

5.4.1 Mid-block performance

An assessment of the weekday AM and PM peak hour traffic volumes was completed to determine the general performance of the road network configuration in the 2036 future year. The findings of this assessment are summarised in Table 5-5.

The traffic volumes in the key roads across the study area are forecast to increase during the 2036 future year without the project scenario.

During the without Project scenario, Table 5-5 indicates that the following road sections are forecast to operate near or at the theoretical capacity:

- Great Western Highway east of Queen Street at LOS E (westbound) during the PM peak
- Great Western Highway west of Queen Street at LOS E (westbound) during the PM peak
- Mamre Road north of Luddenham Road at LOS E and LOS F (northbound and southbound respectively) during the AM peak and LOS F (northbound) during the PM peak
- Luddenham Road west of Mamre Road at LOS F and LOS E (northbound and southbound respectively) during the AM peak and LOS F (northbound and southbound) during the PM peak
- Luddenham Road north of Elizabeth Drive at LOS F (northbound) during the AM peak and LOS E and LOS F (northbound and southbound respectively) during the PM peak

- Elizabeth Drive east of Badgerys Creek Road at LOS F (eastbound and westbound) during both peaks
- The Northern Road west of Badgerys Creek Road at LOS F (northbound) during the AM peak
- The Northern Road east of Badgerys Creek Road at LOS E (southbound) during the PM peak.

During the with project scenario, Table 5-5 indicates that the following road sections are forecast to operate near or at the theoretical capacity:

- Great Western Highway east of Queen Street at LOS E (eastbound) during the AM peak and LOS F (westbound) during the PM peak
- Great Western Highway west of Queen Street at LOS E (westbound) during the PM peak
- Queen Street north of Great Western Highway at LOS F (northbound) during the AM peak and LOS E and LOS F (northbound and southbound respectively) during the PM peak
- Kent Road south of the M4 Western Motorway at LOS E (northbound) in the AM peak and LOS F (northbound) in the PM peak
- Mamre Road north of Luddenham Road at LOS E and LOS F (northbound and southbound respectively) during the AM peak and LOS F (northbound) during the PM peak
- Luddenham Road west of Mamre Road at LOS F (northbound and southbound) during both AM and PM peak
- Luddenham Road north of Elizabeth Drive at LOS F and LOS E (northbound and southbound respectively) during the AM peak and LOS E and LOS F (northbound and southbound respectively) during the PM peak
- Elizabeth Drive east of Badgerys Creek Road at LOS F (eastbound and westbound) during both peaks
- The Northern Road west of Badgerys Creek Road at LOS F (northbound) during the AM peak
- The Northern Road east of Badgerys Creek Road at LOS E (southbound) during the PM peak.

The above locations all operate in a similar manner to the 2026 future year without the project scenario, except for Great Western Highway, Queen Street, Kent Road south of Great Western Highway and Luddenham Road west of Mamre Road, which are forecast to operate at or above their theoretical capacity.

Table 5-5 2036 future year mid-block performance – Off-airport

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Without project		With project		Without project		With project	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Glossop Street (north of the Great Western Highway)	NB	1900	1460	D	1630	D	1570	D	1570	D
	SB	1900	1520	D	1520	D	1220	C	1220	C
Great Western Highway (east of Queen Street)	EB	2800	2460	D	2780	E	2230	D	2480	D
	WB	2800	2250	D	2500	D	2760	E	3010	F
Great Western Highway (west of Queen Street)	EB	2800	2380	D	2450	D	2100	D	2100	D
	WB	2800	1940	C	1940	C	2520	E	2520	E
Queen Street (north of Great Western Highway)	NB	900	660	C	910	F	600	C	850	E
	SB	900	370	B	620	C	790	D	1040	F
Mamre Road (south of the Great Western Highway)	NB	1800	1360	D	1360	D	1290	C	1290	C
	SB	1800	1240	C	1240	C	1560	D	1560	D
Kent Road (north of the M4 Western Motorway)	NB	1900	1250	C	1320	C	1210	C	1300	C
	SB	1900	1260	C	1260	C	1140	C	1200	C
Kent Road (south of the M4) Western Motorway	NB	900	730	D	840	E	760	D	910	F
	SB	900	420	B	580	C	380	B	480	C
Mamre Road (north of Luddenham Road)	NB	1900	1730	E	1760	E	1950	F	1990	F
	SB	1900	2440	F	2490	F	1670	D	1690	D
Luddenham Road (west of Mamre Road)	NB	900	1140	F	1200	F	1020	F	1110	F
	SB	900	810	E	910	F	1060	F	1120	F
Luddenham Road (north of Elizabeth Drive)	NB	900	930	F	990	F	810	E	850	E
	SB	900	780	D	850	E	1020	F	1080	F

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Without project		With project		Without project		With project	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Elizabeth Drive (west of Badgerys Creek Road)	EB	2800	1430	C	1470	C	1280	B	1320	B
	WB	2800	1020	B	1070	B	1690	C	1740	C
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	1450	F	1520	F	1440	F	1560	F
	WB	900	1280	F	1410	F	1760	F	1830	F
Badgerys Creek Road (south of Elizabeth Drive)	NB	1900	140	A	220	A	330	A	450	A
	SB	1900	370	A	510	A	230	A	300	A
Badgerys Creek Road (north of The Northern Road)	NB	900	120	A	260	A	220	A	270	A
	SB	900	230	A	310	A	370	B	500	C
The Northern Road (west of Badgerys Creek Road)	NB	1900	2090	F	2130	F	1210	C	1280	C
	SB	1900	920	B	990	C	1590	D	1590	D
The Northern Road (east of Badgerys Creek Road)	NB	1900	1230	C	1300	C	940	B	980	C
	SB	1900	1180	C	1220	C	1840	E	1840	E

Note: Traffic volumes rounded to the nearest 10

5.4.2 Intersection performance

A summary of the performance of the intersections within the study area in the peak periods during the 2036 future year is outlined in Table 5-6. The control type at each intersection is also indicated (P: Priority-controlled, R: Roundabout, S: Signalised).

Table 5-6 indicates that during the 2036 future year without the project scenario, intersections generally operate at LOS D or better, except:

- Glossop Street/Phillip Street (PM peak) is forecast to operate at LOS F
- Glossop Street/Great Western Highway (AM peak) is forecast to operate at LOS E
- Queen Street/Great Western Highway/Mamre Road (AM and PM peak) is forecast to operate at LOS F
- Charles Hackett Drive/Great Western Highway/Pages Road (AM and PM peak) is forecast to operate at LOS F
- Mamre Road/Western Motorway Eastbound Ramp (AM and PM peak) is forecast to operate at LOS F
- Mamre Road/Western Motorway Westbound Ramp is forecast to operate at LOS E (AM peak) and LOS F (PM peak)
- Mamre Road/Luddenham Road is forecast to operate at LOS E (AM peak) and LOS F (PM peak)
- Badgerys Creek Road/The Northern Road (AM peak) is forecast to operate at LOS F.

The assessment indicates that the above intersections are forecast to operate at or above capacity in 2036 due to the forecast growth in background traffic demand within the study area during the without project scenario. This is likely to result in significant delays and queuing at these intersections, which is expected to increase with the addition of traffic forecast to be generated by the project due to the oversaturated conditions.

During the project scenario in 2036, Table 5-6 indicates that in addition to the above intersections, the following intersections are also forecast to operate at or above capacity:

- Glossop Street/Forrester Road (PM peak) is forecast to operate at LOS E
- Glossop Street/Great Western Highway is forecast to operate at LOS F (AM peak) and LOS E (PM peak).

The increase in average delay at these intersections are forecast to be in the order of 12 to 30 seconds. Increase in the number of bus services and enhancements to the walking and cycling facilities for the St Marys precinct are likely to reduce the car dependency. These changes are expected to minimise the impacts to these intersections. Other mitigation measures for the St Marys precinct are discussed in Section 7.

Over saturated traffic conditions are forecast at the intersection of Queen Street/Great Western Highway/Mamre Road and Mamre Road/Luddenham Road during the without project scenario in 2036. The addition of traffic forecast to be generated by the project in 2036 is expected to increase the average delays at these intersections in the range of 60 to 80 seconds during the peak hours.

During the project scenario in 2036, the intersections of Badgerys Creek Road/The Northern Road (AM peak) and Glossop Street/Great Western Highway (AM and PM peaks) are forecast to experience an increase in average delay between 10 seconds and 30 seconds due to the addition of traffic forecast to be generated by the project.

All other intersections are forecast to operate at LOS D or better. This indicates that the addition of traffic forecast to be generated by the project is not forecast to significantly impact the study area intersections.

Table 5-6 2036 future year intersection performance – Off-airport

Intersection	AM Peak				PM Peak			
	Without project		With project		Without project		With project	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Glossop Street/Forrester Road (S)	43	D	51	D	47	D	63	E
Glossop Street/Harris Street (P)	11	A	11	A	19	B	20	B
Harris Street/St Marys Station Car park Access (P)	-	-	5	A	-	-	5	A
Glossop Street/Phillip Street (S)	16	B	18	B	>100	F	>100	F
Queen Street/Charles Hackett Drive (S)	22	B	22	B	19	B	28	B
Glossop Street/Great Western Highway (S)	73	E	>100	F	47	D	69	E
Queen Street/Great Western Highway/Mamre Road (S)	>100	F	>100	F	>100	F	>100	F
Charles Hackett Drive/Great Western Highway/Pages Road (S)	>100	F	>100	F	>100	F	>100	F
Mamre Road/M4 Western Motorway Eastbound Ramp (S)	>100	F	>100	F	>100	F	>100	F
Mamre Road/M4 Western Motorway Westbound Ramp (S)	57	E	57	E	>100	F	>100	F
Kent Road/Caddens Road (S)	20	B	20	B	32	C	32	C
Kent Road/M4 Western Motorway On-ramp (S)	6	A	7	A	5	A	6	A
Kent Road/M4 Western Motorway Off-ramp (S)	21	B	22	B	23	B	23	B
Kent Road/Orchard Hills Station Access (S)	-	-	15	B	-	-	15	B
Kent Road/Lansdowne Road (S)	7	A	48	D	15	B	35	C
Lansdowne Road/Orchard Hills station Car park Access (P)	-	-	6	A	-	-	6	A
Mamre Road/Luddenham Road (S)	69	E	>100	F	96	F	>100	F
Luddenham Road/Station Access (North) (S)	-	-	12	A	-	-	13	A

Intersection	AM Peak				PM Peak			
	Without project		With project		Without project		With project	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Luddenham Road/Station Access (South) (S)	-	-	12	A	-	-	12	A
Luddenham Road Station Car park Access (P)	-	-	6	A	-	-	6	A
Luddenham Road/Elizabeth Drive/Adams Road (S)	30	C	31	C	54	D	54	D
Elizabeth Drive/Western Sydney International Access (S)	13	B	13	B	18	B	19	B
Elizabeth Drive/Badgerys Creek Road (S)	11	B	13	B	15	B	18	B
Badgerys Creek Road/Aerotropolis Core Station Access (S)	-	-	21	B	-	-	19	B
Aerotropolis Car park Access (P)	-	-	6	A	-	-	6	A
Badgerys Creek Road/The Northern Road (S)	>100	F	>100	F	34	C	35	C

Notes:

[1] Assessments have been undertaken using SIDRA INTERSECTION 8.

[2] For traffic signals, the average movement delay and level of service over all movements is used. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is used.

[3] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised).

[4] The intersection of Kent Road/Lansdowne Road is a priority controlled intersection during without the project scenario. During with the project, this intersection is proposed to be upgraded to a signalised intersection.

[5] Dashes indicate new operational site accesses that would only be used once the project is operational and hence would not exist during the 2036 future year without the project scenario.

5.4.3 Road safety

The frequency of crashes in the study area is expected to change relative to the forecast traffic volumes on the road network, assuming everything else remains the same. The additional traffic volumes forecast to be generated by the project in 2036 are expected to be low compared to future base traffic volumes.

The greatest increase in traffic generated by the project is forecast on the Great Western Highway, east of Queen Street, near the St Marys precinct. The additional traffic at this location forecast to be generated by the project is less than ten per cent of peak hour traffic on the Great Western Highway during both peak hours. The second largest increase in traffic is expected to occur along Queen Street, north of the Great Western Highway in the St Marys precinct.

It is assumed that the future type, and severity of crashes would be consistent with historic trends and is not likely to change significantly given the relatively low traffic generated by the project. As indicated in the crash assessment in Section 3.2.6, there exists a higher incident rate around the St Marys precinct and the section of the road network between the Great Western Highway and the M4 Western Motorway. As described in Section 5.3.1, some traffic calming measures are planned to be introduced as part of the project and would help improve safety around the precincts with higher incident rates. Potential mitigation measures to improve road safety around station precincts are identified in Section 7.

5.4.4 Walking and cycling impacts

Pedestrian and cycle facilities would be provided at off-airport stations during the 2036 future year scenario with the project. These facilities would aim to achieve a minimum Fruin LOS C. In addition to the provision of these facilities, road modifications and intersection treatments are also proposed within station precincts to enable safe and convenient access to the stations.

It is also noted that the project interfaces with other proposed walking and cycling links are planned to be delivered in the form of viaduct crossings, thereby minimising impacts.

Transport integration at each station precinct are described in Section 5.1.2 and Section 5.2.2 of this technical paper, with further details are available in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

5.4.5 Public transport impacts

The road-based public transport modes are likely to be impacted in the same way as general traffic. Therefore, the transport assessment included in Section 5.3.1 and 5.3.3 includes potential impacts to road-based public transport modes along with general traffic during the 2036 future year without the project scenario. In general, most intersections are forecast to operate satisfactorily, with some delays observed on the road network in 2036.

Forecasts at the proposed stations indicate customer transfers are expected between rail and bus, as discussed in Section 5.1.2, demonstrating a need for seamless public transport integration at the new stations and augmentation of capacity on the public transport network. As part of the Western Sydney City Deal, the Australian and NSW Governments have committed to delivering rapid bus routes linking the project to the metropolitan centres of Penrith, Liverpool and Campbelltown. Regional and local bus services would also be provided to service the stations, linking the project to the local and wider surrounding centres. The frequencies of these bus services would be determined based on the demand for travel at these stations and were considered as part of this assessment.

5.5 On-airport 2026 future year

The impacts on the on-airport transport environment for the 2026 future year without the project scenario was assessed as part of the Western Sydney Airport Environmental Impact Statement. The Western Sydney Airport Environmental Impact Statement provides a detailed assessment of the transport impacts within the airport site during the construction and operation of the future airport and identifies mitigation measures necessary to address these impacts.

The impacts within the on-airport environment during the 2026 future year without the project scenario is forecast to be as per the Western Sydney Airport Environmental Impact Statement as described in Section 6.

However, for the purpose of this assessment, the impacts due to the on-airport operational activities without the project are captured as part of the assessments of the road network surrounding the Western Sydney International site boundary and detailed in the off-airport assessment in Section 5.3.

The impacts of the project on the on-airport transport environment for the future year 2026 are forecast to be minimal as the majority of the customers using the proposed stations within the on-airport environment are expected to be generated by Western Sydney International or the Airport Business Park. However, the impacts from passenger demand generated off-airport are captured in the assessment of the off-airport impacts.

During the 2026 future year with the project scenario, the transport movements generated by the project within the on-airport environment are negligible compared to the future background traffic without the project. The forecast mode shares for point-to-point services, park and ride and kiss and ride provided at the on-airport sites in 2026 are limited, as discussed in Section 5.2.2. As such, these stations are expected to introduce limited traffic demand once operational.

In addition, access to the Western Sydney International would be limited to passenger and employee access and no public road network is proposed to be provided. As a result, the project is not forecast to have an impact on the transport network within the on-airport network.

5.5.1 Mid-block performance

An assessment of the weekday AM and PM peak hour traffic volumes was completed to determine the general performance of the on-airport road network configuration in the 2026 future year. The findings of this assessment are summarised in Table 5-7.

The traffic volumes across the study area are forecast to increase. This is primarily due to the growth developments in the Western Sydney Aerotropolis, Greater Penrith to Eastern Creek, the South West Growth Area as well as the growth associated with Western Sydney Airport.

The forecast traffic volumes on Luddenham Road are expected to exceed their capacity, during both the AM and PM peak hours for the without and with project scenarios. Elizabeth Drive also performs above its theoretical capacity in the afternoon peak during both with and without the project scenario. Similarly, The Northern Road is observed to operate at its theoretical capacity in the morning peak during both scenarios.

Table 5-7 2026 future year mid-block performance – On-airport

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Without project		With project		Without project		With project	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Luddenham Road (north of Elizabeth Drive)	NB	900	1310	F	1340	F	730	D	760	D
	SB	900	340	B	380	B	980	F	1000	F
Elizabeth Drive (west of Badgerys Creek Road)	EB	2800	490	A	510	A	610	A	630	A
	WB	2800	730	A	760	A	730	A	750	A
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	690	D	720	D	640	C	700	D
	WB	900	1030	F	1100	F	1030	F	1050	F
Badgerys Creek Road (south of Elizabeth Drive)	NB	1900	410	A	440	A	430	A	490	A
	SB	1900	510	A	580	A	700	B	730	B
Badgerys Creek Road (north of The Northern Road)	NB	900	550	C	610	C	390	B	430	B
	SB	900	300	A	350	B	610	C	680	D
The Northern Road (west of Badgerys Creek Road)	NB	1900	1340	C	1350	C	1290	C	1320	C
	SB	1900	750	B	780	B	720	B	720	B
The Northern Road (east of Badgerys Creek Road)	NB	1900	1840	E	1880	E	1600	D	1610	D
	SB	1900	1000	C	1010	C	1260	C	1260	C

Note: Traffic volumes rounded to the nearest 10

Source: Traffic volumes used for the assessments was informed by the outputs of the WRTM modelling developed for the M12 Motorway Environmental Impact Statement

5.5.2 Intersection performance

The off-airport assessment also captures the intersections around Western Sydney International that are forecast to be impacted by the on-airport operations. A summary of the assessment of these intersections is presented in Table 5-8.

The intersections are forecast to operate satisfactorily at LOS D or better during the 2026 future year without the project scenario, except the Badgerys Creek/The Northern Road intersection.

During the 2026 with the project scenario, all intersections are forecast to maintain their operational performance with the addition of project generated traffic. The Badgerys Creek/The Northern Road intersection continues to operate at LOS F, with a minor increase in delay (less than 5 seconds). This indicates that the project does not cause any additional impacts to this intersection during the future year 2026.

Table 5-8 2026 future year intersection performance – On-airport

Intersection	AM Peak				PM Peak			
	Without Project		With Project		Without Project		With Project	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Luddenham Road/Elizabeth Drive/Adams Road (S)	29	C	29	C	52	D	54	D
Elizabeth Drive/Western Sydney International Access (S)	15	B	15	B	16	B	16	B
Elizabeth Drive/Badgerys Creek Road (S)	13	B	13	B	13	B	13	B
Badgerys Creek Road/Aerotropolis Core Station Access (S)	-	-	13	A	-	-	12	A
Badgerys Creek Road/The Northern Road (S)	>100	F	>100	F	28	B	28	B

Notes:

[1] For traffic signals, the average movement delay and level of service over all movements is used. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is used.

[2] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised).

[3] Dashes indicate new operational site accesses that would only be used once the project is operational and hence would not exist during the 2026 future year without the project scenario.

5.5.3 Walking and cycling impacts

The impacts on the on-airport pedestrian and cycling network for the 2026 future year without the project scenario were assessed as part of the Western Sydney Airport Environmental Impact Statement.

The pedestrian and cycling network is forecast to operate as detailed in the Western Sydney Airport Environmental Impact Statement during the 2026 future year without the project scenario. The Environmental Impact Statement prepared for Western Sydney International indicates that the proposed M12 Motorway project, The Northern Road and Bringelly Road upgrades are expected to provide walking and cycling infrastructure as part of the project delivery. TfNSW also proposes to provide walking and cycling links along Elizabeth Drive as part of the proposed upgrades. These provisions would improve the walking and cycling environment in the vicinity of Western Sydney International, therefore increasing the walking and cycling mode share to the airport. Also, the Environmental Impact Statement prepared for the Western Sydney International found that the future walking and cycling upgrades proposed in the vicinity of the Western Sydney International would have sufficient capacity to cater for expected airport passenger and employee demand.

The on-airport walking and cycling network for the 2026 future year with the project scenario is proposed to be developed by Western Sydney International. It is envisaged that safe, convenient and direct connections would be provided within Western Sydney International, including to Airport Terminal and Business Park stations (to be developed by others). At Airport Business Park Station, customers would enter station from the south via a pedestrian bridge provided as part of the project and connecting the station to the future road network of the business park (to be provided by others).

Proposed station precincts at each station within the on-airport environment are further discussed in Section 5.2.2 of this technical paper, with detailed information available in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

5.5.4 Public transport impacts

The road-based public transport modes are likely to be impacted in the same way as general traffic. Therefore, the transport assessment included in the Western Sydney Airport Environmental Impact Statement includes potential impacts to road-based public transport modes along with general traffic during the 2026 future year without the project scenario. In general, intersections are forecast to operate satisfactorily, with the exception of the intersection of Badgerys Creek/The Northern Road.

The transport assessment included in Section 5.4.1 includes potential impacts to road-based public transport modes along with general traffic during the 2026 future year without the project scenario. In general, intersections are forecast to operate satisfactorily, with the exception of the intersection of Badgerys Creek/The Northern Road.

Forecasts at the proposed stations indicate some customer transfers are expected from bus, as discussed in Section 5.2.2, demonstrating a need for seamless public transport integration at the on-airport station. As part of the Western Sydney City Deal, the Australian and NSW Governments have committed to delivering new rapid bus routes to link the metropolitan centres of Penrith, Liverpool and Campbelltown via the Western Sydney Aerotropolis and to Western Sydney International. The proposed frequencies of these services, provided by TfNSW, were considered as part of this assessment.

5.6 On-airport 2036 future year

The impacts on the on-airport transport environment for the 2036 future year without the project scenario was assessed as part of the Western Sydney Airport Environmental Impact Statement. The Western Sydney Airport Environmental Impact Statement provides a detailed assessment of the transport impacts within the on-airport site during the construction and operation of the future airport and identifies mitigation measures necessary to address the impacts. The impacts within the on-airport environment during the 2036 future year without the project scenario is forecast to be as per the Western Sydney Airport Environmental Impact Statement.

However, the potential impacts on the surrounding road network during the 2036 future year are captured are part this assessment of off-airport impacts without the project and detailed in Section 5.4.

The impacts of the project on the on-airport transport environment for the 2036 future year are forecast to be minimal as the majority of the customers using the proposed stations within the on-airport environment are expected to be generated within the on-airport site by Western Sydney International or the Airport Business Park. However, the impacts due to the general traffic accessing the on-airport environment are captured in the assessment of the off-airport impacts.

During the 2036 future year, the transport movements generated by the project within the on-airport environment are negligible compared to the future background traffic without the project. The forecast mode shares for point-to-point services, park and ride and kiss and ride provided at the on-airport sites in 2036 are limited, as discussed in Section 5.2.2. As such, these stations are expected to generate limited car traffic demand once operational. As a result, the project is not forecast to have an impact on the transport network within the on-airport environment.

5.6.1 Mid-block performance

The impacts due to the on-airport operational activities during the 2036 future year are captured at the mid-block locations surrounding Western Sydney International. The findings of this assessment are summarised in Table 5-9.

The traffic volumes in the key roads across the study area are forecast to increase during the 2036 future year without the project scenario. Luddenham Road, Elizabeth Drive and The Northern Road are all forecast to operate near or at the theoretical capacity in peak periods during the without the project scenario. During the 2026 future year with project scenario, these roads continue to operate in a similar manner to the without the project scenario, at or above their theoretical capacity.

Table 5-9 2036 future year mid-block performance – On-airport

Location	Direction	Theoretical capacity (pcu/h)	AM Peak				PM Peak			
			Without Project		With Project		Without Project		With Project	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Luddenham Road (north of Elizabeth Drive)	NB	900	930	F	990	F	810	E	850	E
	SB	900	780	D	850	E	1020	F	1080	F
Elizabeth Drive (west of Badgerys Creek Road)	EB	2800	1430	C	1470	C	1280	B	1320	B
	WB	2800	1020	B	1070	B	1690	C	1740	C
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	1450	F	1520	F	1440	F	1560	F
	WB	900	1280	F	1410	F	1760	F	1830	F
Badgerys Creek Road (south of Elizabeth Drive)	NB	1900	140	A	220	A	330	A	450	A
	SB	1900	370	A	510	A	230	A	300	A
Badgerys Creek Road (north of The Northern Road)	NB	900	120	A	260	A	220	A	270	A
	SB	900	230	A	310	A	370	B	500	C
The Northern Road (west of Badgerys Creek Road)	NB	1900	2090	F	2130	F	1210	C	1280	C
	SB	1900	920	B	990	C	1590	D	1590	D
The Northern Road (east of Badgerys Creek Road)	NB	1900	1230	C	1300	C	940	B	980	C
	SB	1900	1180	C	1220	C	1840	E	1840	E

Note: Traffic volumes rounded to the nearest 10

5.6.2 Intersection performance

The impacts due to the on-airport operational activities during the 2036 future year are captured at the intersections surrounding Western Sydney International. A summary of the operation of these intersections likely to be impacted due to on-airport operations is presented in Table 5-10.

The intersections are forecast to operate satisfactorily at LOS D or better during the 2036 future year without the project scenario, except the Badgerys Creek/The Northern Road intersection. The assessment indicates that this intersection may need to be upgraded to support the forecast growth in background traffic demand within the study area.

The intersections are forecast to operate satisfactorily at LOS D or better during the 2036 future year with the project scenario, except the Badgerys Creek/The Northern Road intersection. The assessment indicates that the addition of project generated traffic is forecast to increase the average delay at this intersection by about 10 seconds.

Table 5-10 2036 future year intersection performance – On-airport

Intersection	AM Peak				PM Peak			
	Without Project		With Project		Without Project		With Project	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Luddenham Road/Elizabeth Drive/Adams Road (S)	30	C	31	C	54	D	54	D
Elizabeth Drive/Western Sydney International Access (S)	13	B	13	B	18	B	19	B
Elizabeth Drive/Badgerys Creek Road (S)	11	B	13	B	15	B	18	B
Badgerys Creek Road/Aerotropolis Core Station Access (S)	-	-	21	B	-	-	19	B
Badgerys Creek Road/The Northern Road (S)	>100	F	>100	F	34	C	35	C

Notes:

[1] For traffic signals, the average movement delay and level of service over all movements is used. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is used.

[2] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised)

[3] Dashes indicate new operational site accesses that would only be used once the project is operational and hence would not exist during the 2036 future year without the project scenario.

5.6.3 Walking and cycling impacts

The impacts on the on-airport walking and cycling network for the 2036 future year without the project scenario was assessed as part of the Western Sydney Airport Environmental Impact Statement. The transport network is forecast to operate as detailed in the Western Sydney Airport Environmental Impact Statement during the 2036 future year without the project scenario.

The on-airport walking and cycling network for the 2036 future year with the project scenario is proposed to be developed by Western Sydney Airport. It is envisaged that safe, convenient and direct connections would be provided within Western Sydney International, including to Airport Terminal station and Airport Business Park station (both to be developed by others). Proposed station precincts at each station within the on-airport environment are discussed in Section 5.2.2 of this technical paper, with more detailed information available in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

5.6.4 Public transport impacts

The road-based public transport modes are likely to be impacted in the same way as general traffic. Therefore, the transport assessment included in the Western Sydney Airport Environmental Impact Statement includes potential impacts to road-based public transport modes along with general traffic during the 2036 future year without the project scenario. In general, intersections are forecast to operate satisfactorily, with the exception of the intersection of Badgerys Creek/The Northern Road.

The transport assessment included in Section 5.4.1 includes potential impacts to road-based public transport modes along with general traffic during the 2036 future year with the project scenario. In general, intersections are forecast to operate satisfactorily, with the exception of the intersection of Badgerys Creek/The Northern Road.

Forecasts at the proposed stations indicate some passenger transfers are expected from bus, as discussed in Section 5.2.2, demonstrating a need for seamless public transport integration at the on-airport station. Rapid bus services are proposed to link the project to the metropolitan centres of Penrith, Liverpool and Campbelltown. These services are committed for delivery by the Australian and NSW Governments as part of the Western Sydney City Deal. The proposed frequencies of these services, provided by TfNSW, were considered as part of this assessment.

5.7 Summary of impacts

5.7.1 Walking and cycling

Pedestrian and cycle facilities would be provided at off-airport stations during the future year with the project in 2026 and 2036. These walking and cycling facilities would aim to achieve a minimum Fruin LOS C. Road modifications, intersection treatments and other ancillary facilities are also proposed at off-airport stations during 2026 and 2036 to enable to safe and convenient access to the stations.

Proposed walking and cycling facilities at each station are discussed in Section 5.1.2 and Section 5.2.2 of this Technical Paper, with detailed information available in Chapter 7 (Project description – operation) of the Environmental Impact Statement.

The project interfaces with proposed walking and cycling links within the study area, planned to be in the form of viaduct crossings, thereby minimising impacts.

5.7.2 Public transport

The integration strategy for the proposed stations prioritises public transport as a means of access and provides efficient interchanges at each station. Several new bus services and future routes are proposed in 2026 and 2036 as part of the project. In addition, key bus corridors have been developed to service the South West Growth Area, the Western Sydney Aerotropolis and Western Sydney International.

As additional capacity is being provided to cater for the future demand for public transport, the project is not forecast to impact on existing bus routes and bus stops within the study area. Rapid bus services from the metropolitan centres of Penrith, Liverpool and Campbelltown are committed for delivery by the Australian and NSW Governments as part of the Western Sydney City Deal. The

frequencies of these bus services would be determined based on the demand for travel to the proposed airport and were considered as part of this assessment.

At St Marys, existing bus stops located along Station Street, southeast of the station would be retained, with several new bus routes proposed to service the station. The operation of the project would not impact on existing rail services at St Marys.

5.7.3 Road network

Forecast traffic volumes across the study area indicate that the traffic growth associated with Western Sydney International, the M12 Motorway and other developments in the Western Sydney Aerotropolis and the South West Growth Area would result in increased traffic demands on many key arterial roads. During the 2026 and 2036 without project scenarios, traffic volumes on the main road network assessed generally exceed capacity during the AM and PM peaks.

The project is not forecast to result in significant impacts on the operation of the road network in 2026 and 2036. Only a small proportion of customers are anticipated to access the proposed stations via private vehicles and therefore the impact of stations on the operational performance of the road network in the vicinity of each station would not be significant.

Road network adjustments in the form of road modifications and traffic signal works are proposed to facilitate access to future stations and ensure the safe integration of the project to the existing transport network. Some modification works may be delivered by others as part of road upgrades within the precinct ahead of the operation of the project.

Point-to-point transport facilities are provided at the proposed stations, which would provide easy and convenient connections to the proposed station entrances. However, due to the low volume of the point-to-point services at each station during the peaks, it is not anticipated to have a material impact on the operation of the road network in the vicinity of the station.

The existing commuter car parking facilities at St Marys Station would be retained. New commuter car parking facilities are proposed to be provided at Orchard Hills and Luddenham Road stations, with a temporary park and ride facility proposed at Aerotropolis Core Station. Further details regarding provision of commuter car park at the station precincts are detailed in Chapter 7 (Project Description - Operation) of this Environmental Impact Statement.

The project would generally be located in rural areas with undeveloped land, which would minimise impacts on access to the surrounding properties during the construction of the project. Access to properties near the project would be maintained at all times. In the event that any property access is impacted as a result of the project, affected properties would have their access reinstated and mitigated in consultation with the property owner, unless property acquisition or amalgamation would make this unnecessary.

Additional details around properties impacted once the project is built, are included in Chapter 7 (Project description – Operation) and Chapter 15 (Land use and property) of this Environmental Impact Statement.

6 Cumulative impacts

There is the potential for cumulative transport impacts from the project and other proposed developments surrounding the project. The projects that have the potential to have a cumulative impact with the project were considered and screened in Chapter 27 (Cumulative impacts) of the Environmental Impact Statement. The projects considered to be relevant for this assessment include:

- Western Sydney International
- M12 Motorway
- The Northern Road
- St Marys Intermodal Facility.

A brief description of these projects and a qualitative assessment of associated potential cumulative impacts during construction and operation is provided below. The assessment of cumulative transport impacts was based on the most current publicly available information at the time of this assessment.

In addition to these projects, other major infrastructure projects outlined in Section 2.4.4 were also considered in this assessment. As noted in Section 2.4.4, other projects that are likely to be approved following the project would be required to consider the impacts of the project as part of their assessments.

Based on the construction program proposed for the project, it is expected the project would have some overlap with the construction activities associated primarily with Western Sydney International and the M12 Motorway projects, with limited overlap with the Northern Road upgrades and the St Marys Intermodal Facility works. Increased heavy vehicle impacts may be likely as a result of concurrent construction activities.

Although the peak year of construction for Western Sydney International Stage 1 Construction Impact Zone is not forecast to occur during the peak year of construction for the project, for the purposes of this cumulative impact assessment, peak construction activities for all projects are assumed to occur concurrently. As such, as discussed in Section 2.4, this assessment provides a worst-case assessment capturing the impacts of the project in combination with peak construction of Western Sydney International and the M12 Motorway projects occurring concurrently. This cumulative assessment was undertaken at locations where an overlap between all three projects would be likely to occur.

6.1 Overview of projects

The projects that were considered as part of the cumulative assessment are detailed in the following sections.

6.1.1 Western Sydney International

Peak construction for Western Sydney International Stage 1 Construction Impact Zone is associated with the bulk earthworks and aviation infrastructure activities. The Construction Plan prepared for Western Sydney International indicates that the bulk earthworks activities are assumed to commence early 2020 and be completed by the end of 2022. Aviation infrastructure activities including runway pavement, passenger terminal complex and landside civil and utilities are assumed to commence from mid-2021 through to end of 2022 and be completed by the end of 2025, with commissioning and operation assumed to occur in 2026. The Construction Plan anticipates peak construction activity for the project to occur in year 2022 and 2023. Sub-base material would be imported to the site on a 24 hour 7 days per week basis, as discussed in the Environmental Impact Statement prepared for the project. By importing subbase early and stockpiling on-site and therefore spreading the deliveries over a longer period, the envisaged traffic movement peak in year 2022 and 2023 is predicted to be substantially reduced.

Several site accesses would be established within the study area with provision for access by light and heavy vehicles. Access gates are provided along Elizabeth Drive, The Northern Road and Badgerys Creek Road. The Construction Plan indicates the potential for traffic, transport and access impacts follows the assessment presented in the Environment Impact Statement. As such, the construction

traffic generation and distribution adopted in this assessment also follow those identified in the Department of Infrastructure and Regional Development's Western Sydney Airport Environmental Impact Statement.

The Environmental Impact Statement indicates that the peak construction period for the Western Sydney International Stage 1 Construction Impact Zone development would generate an estimated 1,254 additional vehicle movements per day on the surrounding road network. Construction light and heavy vehicle generation anticipated is around 314 vehicle movements during the morning peak period (7:00 am to 9:00 am) and 292 vehicle movements during the evening peak period (3:00 pm to 6:00 pm). Heavy vehicles would operate to and from the site 24 hours per day during main construction activities.

The Environmental Impact Statement indicates that the additional construction movements would not result in additional impacts in the context of the capacity of the arterial roads and motorways in Western Sydney. Some oversized construction vehicle movements may require temporary road closures however, these would generally occur outside of peak hours.

The Environmental Impact Statement presents the operational assessment for the Western Sydney International Stage 1 Construction Impact Zone airport development, which is assumed to occur in 2031, around five years after operations commences. The operational assessment indicates that during Western Sydney International Stage 1 Construction Impact Zone operations, the project is expected to result in approximately 21,562 vehicles entering the site with 21,556 vehicles leaving the site each day. The Environmental Impact Statement indicates that the main public access to the airport during operation would be from the north via the future M12 motorway, which is expected to include a grade-separated interchange for the airport access.

Western Sydney International anticipates the generation of additional traffic volumes on Elizabeth Drive, the M12 Motorway, The Northern Road, Luddenham Road and Mamre Road. The assessment anticipates an increase in congestion on the M7 (south of the M4), on sections of the M12 (noting that the M12 is still well within capacity), on Elizabeth Drive (east and west of the M7, noting that Western Sydney International Stage 1 Construction Impact Zone development increases existing congestion levels) and on The Northern Road north of Elizabeth Drive, with a small decrease in congestion anticipated on Mamre Road, north of Elizabeth Drive.

However, Western Sydney International Stage 1 Construction Impact Zone operations is not anticipated to substantially impact the capacity of the surrounding road transport system. This is primarily due to the substantial package of road improvements proposed within the study area, including the introduction of the M12 Motorway, which would result in sufficient capacity to cater for the expected airport passenger and employee traffic demand in 2031.

The cumulative construction impact assessment of the project in combination with the peak construction for Western Sydney International is outlined in Section 6.2.1.

6.1.2 M12 Motorway

Construction timeframes for the future M12 Motorway project are forecast to have some overlap with the construction of the project. Construction of the project is expected to take around four years to complete and commissioning is likely to occur concurrently with the final stages of construction. The M12 Motorway Environmental Impact Statement estimates peak construction activity to occur in 2024.

The primary construction ancillary facilities where parking and site offices would be located within the Sydney Metro – Western Sydney Airport study area are primarily accessed via Elizabeth Drive. The forecast light and heavy vehicle traffic generation from each of the ancillary facilities was sourced from the M12 Motorway Environmental Impact Statement for this project. The cumulative construction impact assessment of the project in combination with the peak construction for the M12 Motorway is outlined in Section 6.2.1.

6.1.3 The Northern Road

The Australian and NSW governments are upgrading The Northern Road as part of the Western Sydney Infrastructure Plan, as discussed in Section 3.4.3. The construction activities for The Northern Road upgrade are expected to be completed by 2021, except for Stage 5, which covers the section of the road between Littlefields Road in Luddenham to Glenmore Parkway in Glenmore Park and is

expected to be completed in 2022. As such, the construction of the Northern Road is forecast to be completed before the peak construction year for the project, resulting in minimal overlap with the project construction activities. Therefore, this project has not been considered for the cumulative transport assessment during construction.

As the peak construction period for the project is likely to be during 2024 for construction sites located near The Northern Road, it is assumed that upgraded sections of The Northern Road would be available for use as a heavy vehicle haulage route. If the last stage of upgrade of The Northern Road is delayed, this would be during the early stages of the project where construction vehicle volumes are low, and so additional impacts on the road network would be limited.

6.1.4 St Marys Intermodal Facility

The St Marys Intermodal Facility is an approved development that includes the staged construction and operation of an intermodal road and rail terminal and container park, as discussed in Section 3.4.3.

The Environmental Impact Statement prepared for the St Marys Freight Hub indicates that construction activities for the project is anticipated to take around five months to complete, and the site would be operational based on approvals being in place by mid-February 2020. However, it is noted that the construction of the project was since delayed, with approval for the project only obtained in June 2020. As such, it is anticipated that the construction works for the St Marys Intermodal Facility would be completed in late 2020 or early 2021 prior to construction of the project construction commencing. Based on the above, it is anticipated that there would be limited overlap between the construction of the project and the intermodal facility, with the construction works only anticipated to overlap with the early works for the project.

Notwithstanding, the cumulative construction impacts of the St Marys Intermodal Facility were considered in combination with the project. For the purposes of this assessment, it is anticipated that the construction peak of the Intermodal facility would occur in early 2021, with the duration of the construction works anticipated to take five months. There is still expected to be limited impacts of the Intermodal in combination with the project given the limited overlap between the projects, with the construction traffic anticipated to be generated by the project during this period lower than the peak year of construction in 2023/2024.

The traffic and transport assessment prepared for the Environmental Impact Statement of the St Marys Intermodal Facility indicates that the projected number of daily truck movements during the construction period ranges between 100 and 140 movements per day. This represents about 8 to 12 truck movements per peak hour. As such, any overlap with the early works for the project would result in minimal impacts on the key intersections in combination with the project due to the low construction traffic likely to be generated by the project during this period.

However, as the construction activities for the St Marys Intermodal Facility are expected to be completed before 2023, this project has not been considered for the cumulative transport assessment during construction.

6.2 Cumulative construction impacts

6.2.1 Road network performance

Based on the outcomes of the discussion in Section 6.1.1 and 6.1.2, the quantitative assessment of the cumulative construction impacts presented in this section only considers the project in combination with the proposed M12 Motorway and Western Sydney International. The Northern Road upgrades and the St Marys Intermodal Facility project are not considered further, as discussed in Section 6.1.3 and Section 6.1.4.

The traffic movements associated with the construction activities for Western Sydney International and the M12 Motorway were distributed onto the network based on light and heavy vehicle volumes, distributions and access routes outlined in the respective Environmental Impact Statement for each project. These volumes were then added onto the 2023/2024 future year with construction scenario to determine the cumulative construction impacts.

Aside for the cumulative impacts associated with the project, the road network impacted by the construction of the project is likely to experience growth in background traffic as a result of broader development of the Western Parkland City. This growth is anticipated to result in reduced performance at certain locations within the road network (even without the project and assuming there are no further upgrades to the network over this period, other than the approved projects). Some mid-block sections are forecast to operate at or above capacity due to this forecast growth in background traffic demand within the study area, when compared to base conditions. The performance of mid-block sections and intersections likely to be affected by cumulative construction traffic is presented below.

Mid-block performance

An assessment of the weekday AM peak and PM peak traffic volumes was completed to determine the general performance of the road network configuration in 2023/2024 future year with construction activity likely to occur simultaneously for all three projects. The findings of this assessment are summarised in Table 6-1.

Table 6-1 2023/2024 Peak construction year cumulative mid-block performance

Location	Direction	Theoretical capacity (pcu/h)	Future year without construction scenario				Future year with construction scenario				Future year with cumulative construction scenario			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
Luddenham Road (north of Elizabeth Drive)	NB	900	1080	F	590	C	1280	F	660	C	1280	F	660	C
	SB	900	300	A	860	E	370	B	1070	F	370	B	1070	F
Elizabeth Drive (west of Badgerys Creek Road)	EB	900	560	C	580	C	720	D	680	D	740	D	740	D
	WB	900	690	D	730	D	790	D	880	E	840	E	910	F
Elizabeth Drive (east of Badgerys Creek Road)	EB	900	770	D	620	C	840	E	850	E	880	E	920	F
	WB	900	930	F	1000	F	1160	F	1070	F	1220	F	1100	F
Badgerys Creek Road (south of Elizabeth Drive)	NB	900	420	B	380	B	510	C	690	D	530	C	710	D
	SB	900	440	B	610	C	750	D	710	D	780	D	730	D
Badgerys Creek Road (north of The Northern Road)	NB	900	500	C	340	B	1320	F	440	B	1360	F	450	B
	SB	900	280	A	550	C	400	B	1370	F	410	B	1420	F

Location	Direction	Theoretical capacity (pcu/h)	Future year without construction scenario				Future year with construction scenario				Future year with cumulative construction scenario			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS	Volumes (pcu/h)	LOS
The Northern Road (west of Badgerys Creek Road)	NB	1900	880	B	770	B	960	C	840	B	960	C	880	B
	SB	1900	1100	C	1100	C	1170	C	1180	C	1190	C	1180	C
The Northern Road (east of Badgerys Creek Road)	NB	1900	1550	D	1380	C	2330	F	1440	D	2390	F	1450	D
	SB	1900	1110	C	1260	C	1180	C	2040	F	1190	C	2130	F

Notes:

[1] Traffic volumes have been rounded to the nearest 10.

[2] Cumulative construction impacts presented above only considers the project in combination with the M12 Motorway and Western Sydney International.

Table 6-1 indicates that compared to the 2023/2024 future year without construction scenario, the following sections of the road network are forecast to operate near or above the theoretical capacity as a result of the cumulative construction traffic being added to the road network:

- Luddenham Road north of Elizabeth Drive at LOS F (southbound) during the PM peak
- Elizabeth Drive west of Badgerys Creek Road at LOS E and LOS F (westbound) during the AM and PM peaks respectively
- Elizabeth Drive east of Badgerys Creek Road at LOS E and LOS F (eastbound) during the AM and PM peaks respectively
- Badgerys Creek Road north of The Northern Road at LOS F during the AM peak (northbound) and the PM peak (southbound)
- The Northern Road east of Badgerys Creek Road at LOS F during the AM peak (northbound) and the PM peak (southbound).

All mid-block sections are forecast to operate with a similar LOS in both the future year with project construction scenario and cumulative construction scenario, except Elizabeth Drive (west of Badgerys Creek) which is expected to change from LOS D to LOS E during the AM peak and from LOS E to LOS F during the PM peak, as well as Elizabeth Drive (east of Badgerys Creek) which is expected to change from LOS E to LOS F during the PM peak.

Intersection performance

A summary of the forecast performance of intersections within the study area during the peak year of construction due to the cumulative impacts is summarised in Table 6-2.

Table 6-2 indicates that during the peak construction year with cumulative construction scenario, all intersections operate at LOS D or better, except the intersection of Badgerys Creek Road/Badgerys Creek Road site access, which operates at LOS E during the AM peak. The Badgerys Creek Road/Badgerys Creek Road site access is proposed to be shared with the Western Sydney International construction access. However, it is noted that this intersection is forecast to operate at LOS D during the AM peak with only the project construction traffic added. Mitigation to manage this potential impact is outlined in Section 7.3.

Table 6-2 2023/2024 Peak construction year cumulative intersection performance

Intersection	AM Peak						PM Peak					
	Future year without construction scenario		Future year with construction scenario		Future year with cumulative construction scenario		Future year without construction scenario		Future year with construction scenario		Future year with cumulative construction scenario	
	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)	Average Delay (sec)	Level of Service (LOS)
Luddenham Road/Elizabeth Drive (P)	10	A	15	B	16	B	12	A	16	B	21	B
Elizabeth Drive/Adams Road (P)	9	A	13	A	18	B	16	B	32	C	53	D
Elizabeth Drive/Badgerys Creek Road (R)	13	A	17	B	25	B	14	A	28	B	48	D
Badgerys Creek Road/Badgerys Creek Site Access (P)	-	-	33	C	60	E	-	-	36	C	50	D
Badgerys Creek Road/Aerotropolis Site Access (P)	-	-	43	D	46	D	-	-	42	C	50	D
Badgerys Creek Road/The Northern Road (S)	34	C	53	D	56	D	28	B	32	C	33	C
The Northern Road/Derwent Road (S)	6	A	7	A	7	A	6	A	6	A	6	A

Notes:

[1] Cumulative construction impacts presented above only considers the project in combination with the M12 Motorway and Western Sydney International.

[2] For traffic signals, the average movement delay and level of service over all movements is used. For roundabouts and priority control intersections (with stop and give way signs), the critical movement for level of service assessment with the worst movement delay is used.

[3] Dashes indicate new construction site accesses that would only be constructed and used by construction vehicles and hence would not exist during the future year scenario without construction.

[4] Intersection control type as indicated against each (P: Priority-controlled, R: Roundabout, S: Signalised).

6.3 Cumulative operational impacts

Western Sydney International, the M12 Motorway, the Northern Road upgrades, the St Marys Intermodal Facility and the project are forecast to be operational during 2026 and 2036. The M12 Motorway is expected to carry the majority of traffic to and from Western Sydney International. As such, the operation of Western Sydney International, along with the traffic that is generated by it, is included in the WRTM model used for the impact assessment of the M12 Motorway project.

The WRTM model also includes future road and network upgrades committed and proposed within the study area, including the Northern Road upgrades and the St Marys Intermodal Facility. As the operational traffic modelling for the future years 2026 and 2036 are based on the outputs from the WRTM model used for the M12 Motorway project, they encompass the traffic generated by, and changed traffic patterns due to Western Sydney International, as well as the M12 Motorway project and other proposed future transport upgrades.

Therefore, the transport assessment presented in Section 5 of this technical paper provides a cumulative assessment during the future operational scenarios.

Aside for the cumulative impacts associated with the project, the road network impacted by the operation of the project is likely to experience growth in background traffic as a result of broader development of the Western Parkland City. This growth is anticipated to result in reduced performance at certain locations within the road network (even without the project and assuming there are no further upgrades to the network over this period, other than the approved projects). Some intersections and mid-block sections are forecast to operate at or above capacity due to this forecast growth in background traffic demand within the study area, when compared to base conditions. This is likely to result in significant delays and queuing at these intersections that would be expected to increase with the addition of traffic forecast to be generated by the project due to the oversaturated conditions. The increase in delay due to the addition of the project related traffic in the future year 2036 is forecast to be up to about 80 seconds during the peak hours.

7 Proposed management and mitigation measures

7.1 Approach to management and mitigation

This chapter describes the environmental management approach and framework for the project during construction and operation. Further details on the environmental management approach for the project are included in Chapter 25 of the Environmental Impact Statement (Environmental management and mitigation).

The approach to transport and traffic management during the construction phase, including the process for the development of all construction traffic management plans is outlined in the CTMF (Appendix G of the Environmental Impact Statement).

The CTMF provides the overall strategy and approach for construction traffic management for the project and an outline of the traffic management requirements and processes that would be common to each of the proposed construction sites. It establishes the traffic management processes and acceptable criteria to be considered and followed in managing roads and footpaths adjacent to construction sites.

The on-airport Traffic and Access CEMPs would address the overall approach for construction traffic management for the project on-airport and would be consistent with the Traffic and Access CEMPs prepared for Western Sydney International.

Site-specific CTMPs, along with Traffic Control Plans as required, would be prepared by the contractor to align with the contents, principles and objectives of the CTMF, as well as the mitigation measures outlined below and summarised in Section 7.3.

Sydney Metro and its contractors would liaise closely with relevant authorities during detailed construction planning and throughout the construction phase to minimise the potential construction traffic impacts, including potential cumulative impacts with other projects or special events. As detailed in the CTMF, a Traffic and Transport Liaison Group would be established to liaise with relevant stakeholders during the detailed construction planning and throughout the construction of the project. The required site specific plans in addition to the development of the traffic management measures would be carried out in consultation with the Traffic Control Group, Traffic and Transport Liaison Group and other stakeholders.

Modifications to the road network, including available pedestrian and cycle infrastructure, would be reviewed by the construction contractor during further design development and/or during the preparation of CTMPs, with the objective of minimising disruptions to the walking and cycling network, minimising and managing local area traffic impacts and ensuring property access.

In regards to the operational management of the project, stations have been designed to integrate with other transport modes as described in Section 5.1.2 and Section 5.2.2 of this Technical Paper.

The chapter includes a compilation of the performance outcomes as well as mitigation measures for the construction and operation of the project.

7.2 Performance outcomes

Performance outcomes have been developed consistent with the requirements of the SEARs for the project. The performance outcomes for the project are summarised below in Table 7-1 and identify measurable, performance-based standards for environmental management.

Table 7-1 Performance outcomes for the project in relation to transport

SEARS desired performance outcome	Project performance outcome	Timing
Network connectivity, safety and efficiency of the transport	Safe and efficient routes are provided for pedestrians, cyclists and road users at/near construction sites	Construction
	Access to the existing St Marys Station is maintained while train services are operating	Construction

SEARS desired performance outcome	Project performance outcome	Timing
<p>system in the vicinity of the project are managed to minimise impacts</p> <p>The safety of transport system customers is maintained</p> <p>Impacts on network capacity and the level of service are effectively managed</p>	Safe access to properties and businesses is maintained during construction, unless alternatives are agreed with property owners and businesses	Construction
	Heavy vehicles access the arterial network as soon as practicable on route to, and immediately after leaving, a construction site	Construction
	The local community and relevant authorities are informed of transport, access and parking changes/impacts to minimise inconvenience to the public	Construction
	Safe and efficient interchanges are provided between transport modes	Operation
	Transport interchange facilities provided at station precincts are designed in accordance with the modal access hierarchy	Operation
	Each station and station plaza is provided with sufficient customer capacity to achieve a minimum Fruin's Level of Service C (for 2056 demand)	Operation
	Stations and interchanges are fully accessible and compliant with the <i>Disability Discrimination Act 1992</i> (Cth) and the <i>Disability Standards for Accessible Public Transport</i> (Australian Government, 2002)	Operation
Works are compatible with existing infrastructure and future transport corridors	The project is designed to be compatible with existing infrastructure and future transport corridors	Operation

7.3 Proposed mitigation measures

In addition to the development and implementation of the management plans described in the CEMF, specific mitigation measures have been identified.

Proposed mitigation measures for construction and operation are detailed below in Table 7-1.

Table 7-2 Mitigation measures for construction and operational transport impacts

Ref	Mitigation measure	Applicable location(s)
Transport – Construction		
T1	Construction Traffic Management Plans would be prepared in accordance with the Construction Traffic Management Framework	All
T2	The Construction Traffic Management Plan for St Marys would be developed to ensure existing transport interchange infrastructure continues to operate effectively within the St Marys station precinct would be developed in consultation with the Traffic and Transport Liaison Group.	St Marys construction site
T3	Coordination with Western Sydney Airport and Transport for NSW would be undertaken through the Traffic and Transport Liaison Group to manage potential cumulative construction traffic impacts with M12 Motorway and Elizabeth Drive	All

Ref	Mitigation measure	Applicable location(s)
T4	Road Safety Audits would be carried out to address vehicular access and egress, and pedestrian, cyclist and public transport safety. Road Safety Audits would be carried out as per the guidelines outlined in Section 10 of the Construction Traffic Management Framework	All
T5	Maintain access for pedestrians and cyclists around construction sites as per the guidelines outlined in the Construction Traffic Management Framework. Appropriate signage and line marking would be provided to guide pedestrians and cyclists past construction sites and on the surrounding network to allow access to be maintained	All
T6	Access for construction vehicles to be planned as per the guidelines outlined in the Construction Traffic Management Framework. Construction site traffic would be managed to minimise movements during peak periods. Vehicle access to and from construction sites would be managed to maintain pedestrian, cyclist and motorist safety	All
T7	Temporary relocation of bus stops and bus layovers at St Marys relocations would be subject to further design development, including consideration of the use of the Station St carpark. Bus stop relocations would be implemented prior to impacts on existing bus facilities. Temporary relocation of bus stops and bus layover at St Marys would be carried out in consultation with the Traffic and Transport Liaison Group Transport for NSW, Penrith City Council and bus operators. Wayfinding and customer information would guide customers to temporary bus stop locations	St Marys construction site
T8	Transport for NSW would be consulted to discuss opportunities for their delivery of intersection upgrades at Mamre Road/M4 Western Motorway on and off ramps prior to the peak year of construction	Luddenham Road construction site
Transport - Operation		
T9	Interchange access plans would be prepared, in consultation with the Traffic and Transport Liaison Group, to ensure adequate pedestrian and cycle facilities and other transport interchange infrastructure is provided at each station precinct, in consultation with relevant authorities including Western Parkland City Authority	All
T10	The project would be designed such that access to properties and existing infrastructure neighbouring the proposed stations would be maintained	All
T11	Consultation and coordination would be undertaken with Transport for NSW through the Traffic and Transport Liaison Group to align proposed road and intersection upgrades with the year of opening, to enable safe and efficient interchanges between transport modes	All

8 Conclusion

This transport assessment presents potential impacts on road, public transport and walking and cycling networks during the construction and operation of the project.

Assessment of the existing road network indicates that sections of Elizabeth Drive, Mamre Road and The Northern Road operate near or at their theoretical capacity in the base year. The base year assessments also indicate that the signalised intersections along Mamre Road with the Great Western Highway and M4 Western Motorway operate at LOS E or below.

Construction and operational transport impact assessments were undertaken for the project, on its own and combined with other approved projects in the study area. Key outcomes of these assessments include:

8.1 Construction impacts

The potential construction impacts of the project include:

- During the peak year of construction, sections of Mamre Road and Luddenham Road are forecast to operate at their theoretical capacity due to the increase in background traffic demand along these corridors. The addition of construction traffic expected to be generated by the project during the peak year of construction is forecast to impact Luddenham Road during the PM peak, as well as Badgerys Creek, Elizabeth Drive and The Northern Road during both peak periods. In addition, the construction traffic generated by the project is also forecast to impact the intersections of Mamre Road/M4 Western Motorway and Luddenham Road/Patons Lane.
- A range of indicative road network adjustments in the form of road modifications, closures or diversions are required to facilitate the construction of the project. Intersection upgrades are also required to facilitate construction vehicle access to the construction sites, with new intersections required at Kent Road, Luddenham Road and Badgerys Creek Road. Localised upgrades are also required on Harris Street, Gipps Street, Kent Road, Lansdown Road, Luddenham Road and Derwent Road to allow for construction vehicle access to the construction corridor.
- Areas around the St Marys Town Centre are likely to be the most impacted during construction as a result of road closures and/or street reconfiguration and removal of parking. These impacts are proposed to be mitigated as per the guidelines outlined in the CTMF included in Appendix G of the Environmental Impact Statement.
- Some pedestrian and cycle facilities might be impacted during construction requiring diversions via the local road network or localised traffic control measures. However, access to the existing Sydney Trains station and private properties would be maintained at all times. Diversions would be communicated. Temporary pedestrian and cycle routes provided as part of diversions would be required to meet minimum specifications outlined in Australian Standards, with appropriate signposting provided along the routes.
- In St Marys, the existing bus interchange and layover on Station Street is proposed to be decommissioned and temporarily relocated to Nariel Street for the duration of construction. It is anticipated that customers requiring access to these facilities would need to walk longer distances to access the relocated bus facilities. Community consultation information and notifications would be issued in advance prior to any public transport disruptions.
- It is anticipated that around 435 car parking spaces would be impacted within the St Marys Precinct and the road network immediately surrounding the station. However, the demand for parking can be accommodated within the road network in St Marys, especially given that the existing multi-level commuter car park on Harris Street would be increased by two additional levels (subject to a separate approval). Some construction worker parking would be provided at construction sites. However, these provisions may not meet the demand based on construction workforce. Construction worker parking would be managed in accordance with the CTMF to minimise the impacts on the surrounding road environment.
- The works proposed at St Marys would preclude point-to-point activities (taxi) from occurring, and therefore temporary facilities would be provided on Nariel Street. The existing kiss and ride

facilities north of Station Street and south of Forrester Road would be retained during construction.

- The crash assessment indicates there is a higher incident rate around the St Marys precinct. As such, care should be taken when construction vehicles are interacting with general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites.

8.2 Operational impacts

The potential operational impacts of the project include:

- The project is not forecast to cause significant impacts to the study area transport network during the opening year (2026). However, the intersection of Queen Street/Great Western Highway/Mamre Road is forecast to be impacted by the project.
- The background traffic demand in the study area is forecast to increase significantly by 2036. The transport assessments indicate that most of the intersections north of the M4 Western Motorway may need upgrading to support this forecast growth in background traffic demand. The project is not forecast to cause significant impacts to the study area intersections during 2036.
- The impact of the project on the on-airport transport environment during the 2026 and 2036 future years with the project is forecast to be minimal as the majority of customers using the proposed stations are expected to be generated within the airport site by Western Sydney International or the Airport Business Park. Also, transport movements generated by the project within the on-airport environment are negligible compared to the future background traffic without the project. The impacts within the on-airport environment during the future years 2026 and 2036 would be as per the Department of Infrastructure and Regional Development's Western Sydney Airport Environmental Impact Statement.
- Permanent road network adjustments are required to the transport network for the operation of the project. Signalised intersection or pedestrian crossing upgrades are proposed within the St Marys precinct, at the intersection of Kent Road and Lansdown Road and the new precinct street at Orchard Hills Station precinct, two new signalised intersections on Luddenham Road at the station precinct as well as new signalised intersection on Badgerys Creek at the Aerotropolis precinct. Intersection upgrades would be undertaken in collaboration with TfNSW and WCAA. At Western Sydney International and the surrounding business areas, access would be provided by others as part of the wider development of Western Sydney International.
- During the 2026 and 2036 future year with project scenarios, the design of station precincts is proposed to provide pedestrian and cycle facilities to support walking and cycling to the stations. These facilities would be designed to achieve a minimum Fruin LOS C. In order to prioritise these movements and enable safe and convenient pedestrian and cyclist access to the stations, road modifications and intersection treatments in the form of additional pedestrian crossing points, new signalised pedestrian crossings and traffic calming measures are proposed within station precincts.
- As part of the Western Sydney City Deal, the Australian and NSW Governments have committed to delivering new rapid bus routes to link the stations to metropolitan centres of Penrith, Liverpool and Campbelltown. Regional and local bus services would also be provided, linking the station to wider and local surroundings. Station design does not preclude the provision or integration of future or planned public transport services.
- A high proportion of customers are forecast to access the station by walking, demonstrating the need to provide appropriate pedestrian facilities linking to the stations. Walking and cycling facilities would be required to meet minimum specifications outlined in Australian Standards.
- The project interfaces with other proposed walking and cycling links within the study area are planned to be in the form of viaduct crossings, thereby minimising impacts.
- Existing commuter car parking facilities are proposed to be retained and expanded at St Marys. New car parking facilities would be provided at Orchard Hills and Luddenham Road Stations, with a temporary park and ride facility proposed at Aerotropolis Core Station.

- Pick-up and drop-off activity occurring at the St Marys precinct on the southern side of Station Street at the existing station plaza would be required to be permanently removed during construction. Due to the operation of the future bus interchange, it is expected that these spaces would be relocated to Nariel Street once the station is operational.
- Rail-to-rail transfer between the project and the T1 Western Line is expected to occur at St Marys Station. The assessment of the capacity of the T1 Western Line at St Marys indicates that there is enough capacity to accommodate the project transfers.
- Station pedestrian and interchange modelling undertaken at St Marys Station indicates that no capacity constraints to entry/exit and transferring customers are expected by 2036, with all required performance criteria met in the future operational years.

9 References

- Australian Government 2016, Western Sydney Airport, Airport Plan*
- Australian Standards 2009, AS1742.3 Traffic Control for works on roads*
- Austroads 2017, Guide to Traffic Management Part 3: Traffic Studies and Analysis*
- Bitzios Consulting 2018, St Marys Freight Hub Traffic and Transport Assessment*
- Department of Infrastructure and Regional Development, 2019, Western Sydney Airport Remediation Action Plan, Prepared by GHD*
- Jacobs 2019, M12 Motorway Environmental Impact Statement*
- Liverpool City Council 2018, Liverpool Bike Plan 2018-2023*
- NSW Government 2018, Future Transport 2056 strategy*
- TfNSW Services 2013, Traffic Modelling Guidelines*
- TfNSW 2018, Traffic control at work sites manual*
- Western Sydney Airport 2019, Construction Plan – Stage 1 Development*

Appendix A

Crash Analysis

Appendix A

Crash Analysis

Crash data for the key road corridors in the study area was provided by TfNSW for a period from 2013 to 2018. The key findings from the analysis of crash data along with the crash locations are outlined in Section 3.2.6.

Summary of crash history

Location	Total Crashes	Fatality	Serious injury	Moderate injury	Minor injury	Non-casualty	Observations
Glossop Street between Great Western Highway and Forrester Road	99	2	12	28	18	39	<ul style="list-style-type: none"> Two fatal crashes occurred along Glossop Street, at its intersection with Adelaide Street and Forrester Road. A cluster of serious injury crashes is observed at the intersection of Glossop Street and Forthorn Place. The highest proportion of crashes recorded were rear end crashes, representing 27 per cent, followed by rear near crashes and right through crashes, each representing 15 per cent. Pedestrians were involved in five crashes, three of these crashes resulted in serious injury and two resulted in moderate injury. Cyclists were involved in one crash, which resulted in moderate injury. Trucks were involved in 12 crashes, four of these crashes resulted in serious injury. Speed was a contributing factor in eight crashes, while fatigue was a contributing factor in one crash.
Queen Street between Station Street and Great Western Highway	35	0	5	10	7	13	<ul style="list-style-type: none"> A cluster of serious injury crashes is observed at the intersection of Queen Street with the Great Western Highway and Mamre Road. The highest proportion of crashes recorded were rear end crashes with 12 crashes, or 34 per cent, followed by cross traffic crashes with 4 crashes, representing 11 per cent of all crashes. Pedestrians were involved in seven crashes, representing 20 per cent of all crashes. Five of these crashes, or 71 per cent, resulted in serious injury. A cluster of pedestrian crashes is observed at the intersection with Phillip Street. Cyclists were involved in one crash, which resulted in minor injury. Speed was a contributing factor in four crashes, or 11 per cent. Fatigue was a contributing factor in one crash.

Location	Total Crashes	Fatality	Serious injury	Moderate injury	Minor injury	Non-casualty	Observations
Great Western Highway between Queen Street and Gipps Street	68	0	10	15	18	25	<ul style="list-style-type: none"> A cluster of serious injury crashes is observed at the intersection of the Great Western Highway with Queen Street and Mamre Road. The highest proportion of crashes recorded were rear end crashes with 23 crashes, or 34 per cent, followed by right through crashes with 17 crashes, or 25 per cent. Pedestrians were involved in two crashes. One of these crashes occurred mid-block at the Great Western Highway between Pages Road and Princess Mary Street, due to a pedestrian emerging from a far side of the road and resulted in a minor injury. Speed was a contributing factor in five crashes, or seven per cent of all crashes.
Gipps Street and Kent Road between Great Western Highway and Lansdowne Road	15	0	3	4	0	8	<ul style="list-style-type: none"> Crash cluster of serious injury crashes are observed at the intersection with Sunflower Drive, Caddens Road and Lansdowne Road. The highest proportion of crashes recorded were rear end crashes with 4 crashes, or 27 per cent, followed by cross traffic crashes with three crashes, or 20 per cent. Heavy rigid vehicles were involved in two crashes, heavy trucks were involved in two crashes and light trucks were involved in one crash. Speed was a contributing factor in one crash and fatigue was a contributing factor in one crash, each representing six per cent of all crashes.

Location	Total Crashes	Fatality	Serious injury	Moderate injury	Minor injury	Non-casualty	Observations
M4 Western Motorway between Mamre Road and Kent Road	32	1	3	5	1	22	<ul style="list-style-type: none"> One crash, or three per cent of all crashes, resulted in a fatality. This crash occurred on the eastbound ramp off Mamre Road and involved a motorcycle striking an animal. Serious injuries resulted from three crashes, representing nine per cent. All crashes involved light vehicles and one crash was a lane side swipe crash. 14 crashes, or 44 per cent of all crashes, were rear end crashes. Six crashes, or 19 per cent of all crashes, resulted in vehicles leaving the carriageway on a straight section of the road. Light trucks were involved in nine crashes, or 28 per cent of all crashes. Speed was a contributing factor in eight crashes, or 44 per cent and fatigue was a contributing factor in four crashes, or 22 per cent.
Mamre Road between Great Western Highway and Luddenham Road	121	0	20	36	22	43	<ul style="list-style-type: none"> The highest proportion of crashes recorded were rear end crashes, representing 36 per cent, followed by right through crashes with 20 per cent. Pedestrians were involved in three crashes with one of these crashes resulting in serious injury while others resulted in moderate injuries. These crashes occurred at the intersections with Great Western Highway, Saddington Street and Banks Drive. Two of these crashes involved pedestrians emerging from the side of the road. Heavy rigid vehicles were involved in seven crashes, heavy trucks were involved in ten crashes while light trucks were involved in 37 crashes. Speed was a contributing factor in six crashes, or five per cent. Fatigue was a contributing factor in four crashes, or three per cent.

Location	Total Crashes	Fatality	Serious injury	Moderate injury	Minor injury	Non-casualty	Observations
Luddenham Road between Mamre Road and Elizabeth Drive	29	0	9	8	3	9	<ul style="list-style-type: none"> • Nine crashes, or 31 per cent of crashes, resulted in vehicles leaving the carriageway on a straight section of the road and eight crashes, or 28 per cent, resulted in vehicles leaving the carriageway on a curved section of the road. • Three crashes, or ten per cent of crashes, occurred as a result of a private vehicle striking an animal. • Light trucks were involved in five crashes with four crashes resulting in moderate injuries. • Speed was a contributing factor in eight crashes, or 28 per cent, and fatigue was a contributing factor in five crashes, or 17 per cent.
Elizabeth Drive between Luddenham Road and Mamre Road	87	1	23	17	20	26	<ul style="list-style-type: none"> • One fatality resulted from a crash that occurred between Badgerys Creek Road and Devonshire Road. This crash involved a motorcycle and resulted from the vehicle driving off the carriageway into the guardrails at the Elizabeth Drive bridge. • 27 crashes, or 20 per cent, resulted from vehicles travelling in the same direction and include 14 right rear crashes and 10 rear end crashes. • 14 crashes, or 16 per cent, resulted from vehicles leaving the carriageway on a straight section of the road. • Heavy rigid vehicles were involved in 11 crashes, heavy trucks were involved in 13 crashes while light trucks were involved in 24 crashes. • Speed was a contributing factor in six crashes, or seven per cent of crashes. • Fatigue was a contributing factor in 11 crashes, or 13 per cent of crashes.

Location	Total Crashes	Fatality	Serious injury	Moderate injury	Minor injury	Non-casualty	Observations
Badgerys Creek Road between Elizabeth Drive and The Northern Road	34	1	10	4	5	14	<ul style="list-style-type: none"> One fatality occurred at Badgerys Creek Road and resulted from a vehicle leaving the carriageway on a curved section of the road into a tree. A crash cluster is observed at the intersection of Badgerys Creek with Elizabeth Drive. Out of the 34 crashes recorded, nine crashes resulted from vehicles leaving the carriageway on a straight section of the road, seven were cross traffic crashes and three were rear end crashes. Heavy rigid vehicles were involved in two crashes which occurred at the intersection of Badgerys Creek Road and The Northern Road. One crash was a result of a head on collision. Light trucks were involved in nine crashes, representing 26 per cent of crashes. Speed was a contributing factor in five crashes, or 15 per cent and fatigue was a contributing factor in six crashes, or 18 per cent.
The Northern Road between Badgerys Creek Road and Derwent Road	9	0	1	2	1	5	<ul style="list-style-type: none"> A rear end crash occurred near the intersection of The Northern Road and Derwent Road. Light trucks were involved in three crashes, representing 33 per cent of crashes. Speed was a contributing factor in one crash and fatigue was a contributing factor in two crashes.