Attachment B11

Transport Study – Waterloo Estate (South) – Land and Housing Corporation

Waterloo South Planning Proposal

Transport Study

Final Report

20 March 2020

NSW Land and Housing Corporation

Project Name

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Document history and status

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A	20/02/2020	Draft report	AA, PT	DL	DL	DL
B	09/03/2020	Final draft report	AA, PT	DL	DL	DL
C	13/03/2020	Final draft report – revised	AA, PT	DL	DL	DL
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Contents

Executive summary

Waterloo South planning proposal – background

The Greater Sydney Region Plan and Eastern City District Plan seek to align growth with infrastructure, including transport, social and green infrastructure. With the catalyst of Waterloo Metro Station, there is an opportunity to deliver urban renewal to Waterloo Estate that will create great spaces and places for people to live, work and visit.

The proposed rezoning of Waterloo Estate is to be staged over the next 20 years to enable a coordinated renewal approach that minimises disruption for existing tenants and allows for the up-front delivery of key public domain elements such as public open space. Aligned to this staged approach, Waterloo Estate comprises three separate, but adjoining and inter-related stages:

- Waterloo South
- Waterloo Central
- Waterloo North.

Waterloo South has been identified as the first stage for renewal. The lower number and density social housing dwellings spread over a relatively large area makes Waterloo South ideal as a first sub-precinct, as new housing can be provided with the least disruption for existing tenants and early delivery of key public domain elements, such as public open space.

This report relates to the Waterloo South planning proposal. While it provides comprehensive baseline investigations for Waterloo Estate, it only assesses the proposed planning framework amendments and Indicative Concept Proposal for Waterloo South.

Strategic transport network analysis

Figure ES.1 compares the resident mode share for Waterloo, selected benchmark suburbs and the Sydney metropolitan area.

Compared to average Journey to Work (JTW) mode share across the Sydney metropolitan area, Waterloo and the selected benchmark suburbs have significantly lower car mode share. Mode share for public and active transport combined is much higher than the Sydney average. Car mode share is particularly low in areas with high quality mass transit links and close proximity to Sydney CBD.

Development of Waterloo South seeks to ensure that future residents and workers have the benefit of choice – not only for their travel mode, but for when and where they wish to travel for live, work and play activities

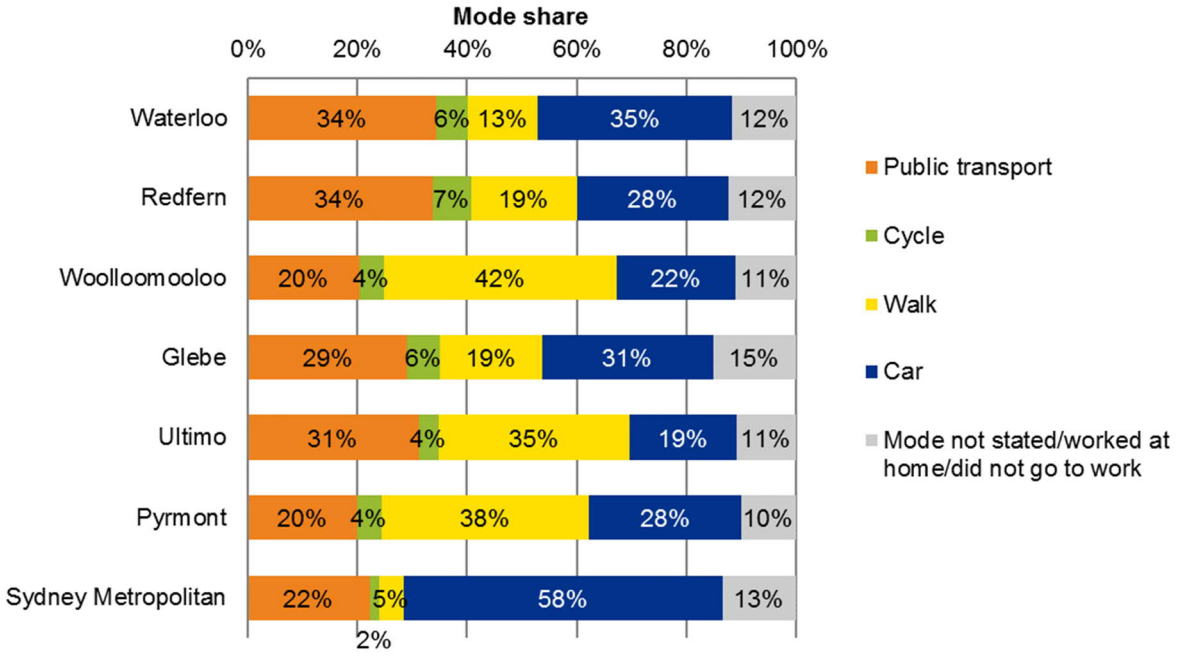


Figure ES.1: Resident mode share

Source: JTW Explorer (Transport for NSW, 2011)

Sydney Metro

Sydney Metro is a new standalone metro rail network. A component of Sydney Metro is Sydney Metro City & Southwest which is planned from Chatswood to Sydney CBD and Bankstown, due to commence operating in 2024. Services on the new line will run at a minimum of every four minutes in each direction, with an ultimate capacity for trains to carry up to 46,000 people per hour in one direction during the peak hour. Sydney Metro City & Southwest will remove T3 Bankstown Line trains from the City Circle, providing congestion relief and greater capacity for T2 Inner West & Leppington and T8 Airport & South Line trains. This will result in a moderate increase in train capacity at Redfern station from 2024. Preliminary forecasts for the 2036 morning peak hour indicate that around 3,700 customers would be entering and around 2,350 customers would be exiting the Waterloo Metro Station (Chatswood to Sydenham EIS, 2016).

The Sydney Metro network is shown in Figure ES.2.

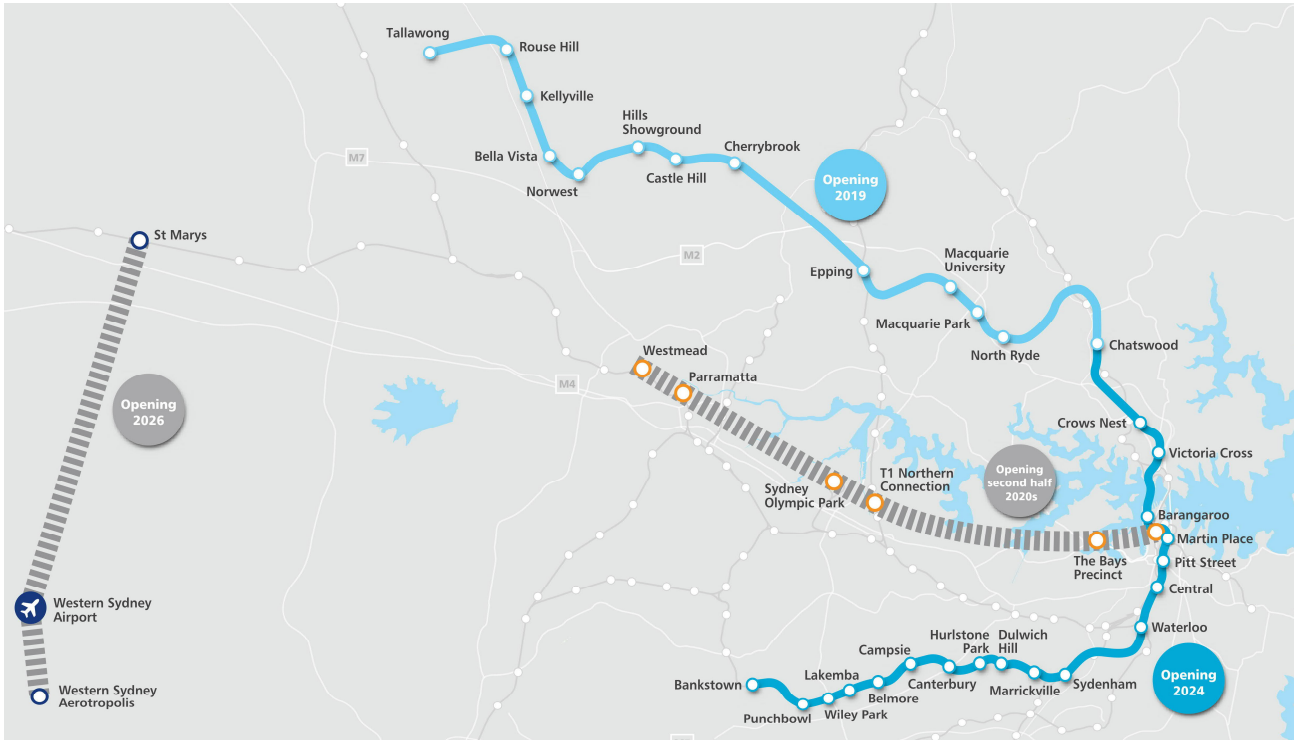


Figure ES.2: The Sydney Metro network

Source: Transport for NSW, 2018

Future mode share targets

An assessment of the potential future mode shares has been undertaken in consultation with Transport for NSW, Roads and Maritime and City of Sydney and is based on existing data and the strategic opportunities for the Waterloo Precinct. The mode share targets in the morning peak for all trip purposes are outlined in Figure ES.3.

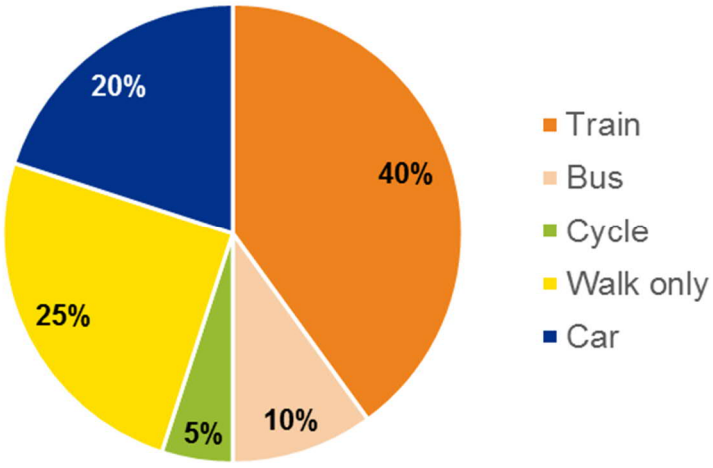


Figure ES.3: Waterloo Precinct future mode share targets

These targets are based on a number of factors, including:

- Proximity to Waterloo Metro Station, which will provide access to high-quality mass transit services on Sydney Metro City & Southwest.
- Densely located land uses, activities and attractors as well as proximity to Sydney CBD and Green Square, enabling shorter trip lengths that are more conducive to walking and cycling.
- Low existing traffic generation rates in recent high-density developments in Waterloo and Redfern, and high (81 per cent) morning peak non-car mode share observed at the Redfern traffic generation survey site (detailed further in Section 6.7.3).

Assumed enhancements to the bus network to strengthen east-west routes, enabled by Sydney Metro City & Southwest (yet to be announced by Transport for NSW), and improved cycling connections with key surrounding destinations.

Indicative Concept Proposal

The Indicative Concept Proposal comprises:

- Approximately 2.57 hectares of public open space representing 13.5 per cent of the total Estate (proposed to be dedicated to the City of Sydney Council), comprising:
  - Village Green – a 2.25-hectare park located next to the Waterloo Metro Station
  - Waterloo Common – a 0.32-hectare park located in the heart of the Waterloo South precinct.
- Retention of 52 per cent of existing high and moderate value trees (including existing fig trees) and the planting of three trees to replace each tree removed
- Coverage of 30 per cent of Waterloo South by tree canopy
- Approximately 257,000 square metres of GFA on the LAHC land, comprising:
  - Approximately 239,100 square metres of GFA for residential accommodation, providing for approximately 3,048 dwellings (comprising a mix of market, affordable and social housing dwellings)
  - Approximately 11,200 square metres of GFA for commercial premises, including, but not limited to, supermarkets, shops, food and drink premises and health facilities
  - Approximately 6,700 square metres of community facilities and early education and child care facilities.

The key features of the Indicative Concept Proposal are:

- It is a design and open space led approach.
- Creation of two large parks of high amenity by ensuring good sunlight access.
- Creation of a pedestrian priority precinct with new open spaces and a network of roads, lanes and pedestrian links.
- Conversion of George Street into a landscaped pedestrian and cycle friendly boulevard and creation of a walkable loop designed to cater to the needs of all ages.
- A new local retail hub located centrally within Waterloo South to serve the needs of the local community.
- A target of 80 per cent of dwellings to have local retail services and open space within 200 metres of their building entry.
- Achievement of a 6-star Green Star Communities rating, with minimum 5-star Green Star – Design and As-Built (Design Review certified).
- A range of Water Sensitive Urban Design (WSUD) features.

The Indicative Concept Proposal for Waterloo South is illustrated in Figure ES.4.

Figure ES.4: Indicative Concept Proposal

Source: Turner Studio

Proposal assessment

A detailed traffic and transport assessment of the proposal has been undertaken that considers:

- Public transport – assesses the bus, heavy rail and metro networks, including proposed infrastructure, service frequency, bus route and stop coverage and service accessibility
- Active transport – assesses the pedestrian and cycling networks including footpath and shared path widths, pedestrian crossings and access to and availability of pedestrian and cycle infrastructure
- Parking and demand management – assesses the number of parking spaces required to accommodate the proposal including on-road and off-road parking environments
- Road network – assesses the immediate and wider road network through microsimulation modelling to determine the performance of the future road network and identity any required upgrades
- Vehicle access – assesses the proposed access points throughout Waterloo South as well as identify the function of existing and proposed internal streets.

The assessment has found that the overall transport network will be sufficient to cater for all demands generated by Waterloo South assuming the following interventions (shown in Figure ES.5).

- The introduction of Sydney Metro City & Southwest, including the new Waterloo Metro Station
- Bus service improvements to integrate with the new station
- The delivery a fine grain urban grid with improved pedestrian permeability, through-site links and the transformation of George Street into an activity street
- The provision of safe and dedicated cycling routes along Wellington Street and George Street
- The extension of Pitt Street southwards to connect to McEvoy Street with a signalised intersection
- The potential for rat-running along Pitt Street north of McEvoy Street would be mitigated by the introduction of traffic calming measures including pedestrian crossings and threshold treatments, narrowing of the street and low speed limits. These measures would reinforce the local access function of Pitt Street.

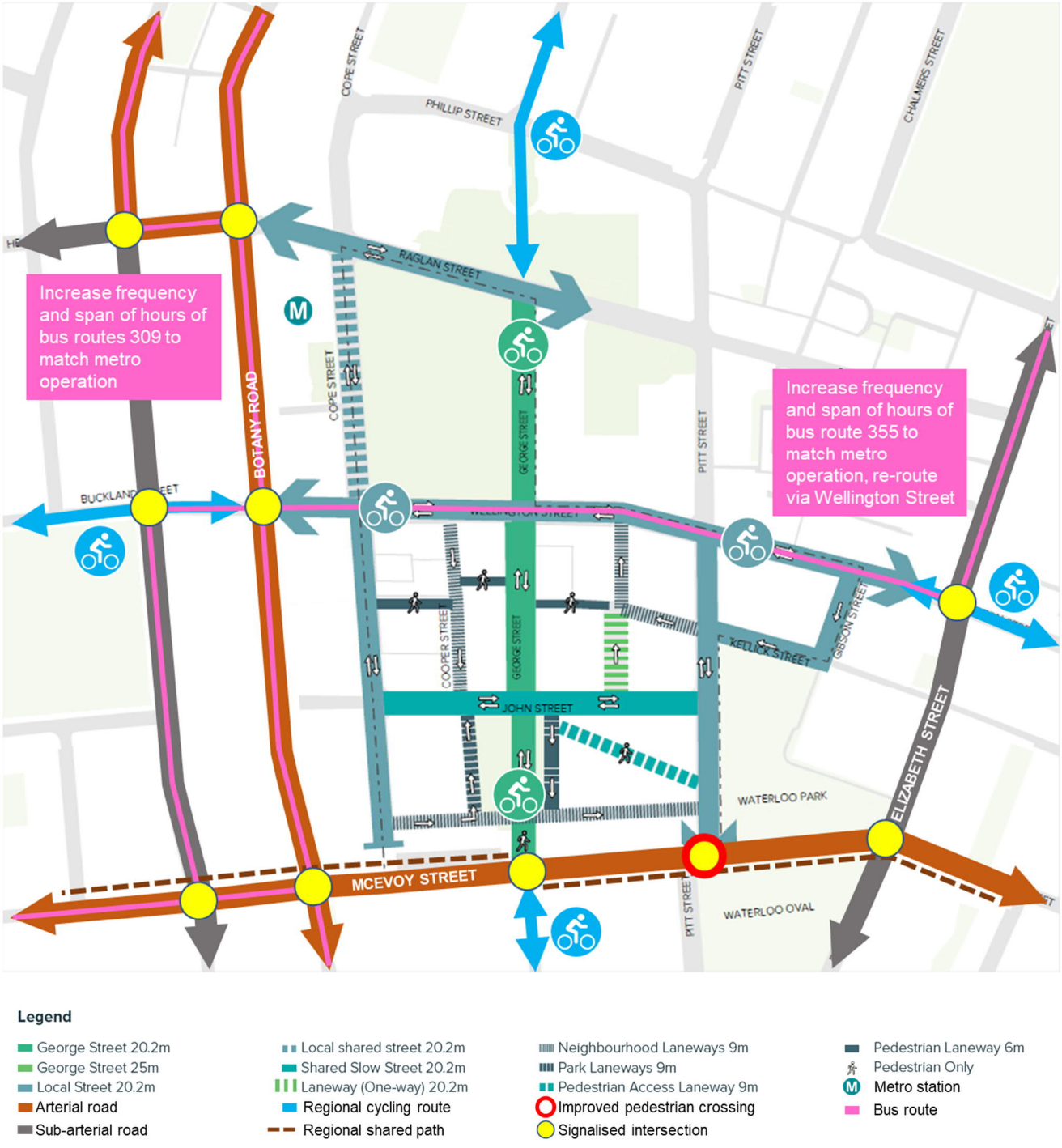


Figure ES.5: Summary of transport measures to support Waterloo South

1. Introduction

The Greater Sydney Region Plan and Eastern City District Plan seek to align growth with infrastructure, including transport, social and green infrastructure. With the catalyst of Waterloo Metro Station, there is an opportunity to deliver urban renewal to Waterloo Estate that will create great spaces and places for people to live, work and visit.

The proposed rezoning of Waterloo Estate is to be staged over the next 20 years to enable a coordinated renewal approach that minimises disruption for existing tenants and allows for the up-front delivery of key public domain elements such as public open space. Aligned to this staged approach, Waterloo Estate comprises three separate but adjoining and inter-related stages:

- Waterloo South
- Waterloo Central
- Waterloo North.

Waterloo South has been identified as the first stage for renewal. The lower number and density social housing dwellings spread over a relatively large area makes Waterloo South ideal as a first sub-precinct, as new housing can be provided with the least disruption for existing tenants and early delivery of key public domain elements, such as public open space.

A planning proposal for Waterloo South is being led by NSW Land and Housing Corporation (LAHC). This will set out the strategic justification for the proposal and provide an assessment of the relevant strategic plans, state environmental planning policies, ministerial directions and the environmental, social and economic impacts of the proposed amendment. The outcome of this planning proposal will be a revised planning framework that will enable future development applications for the redevelopment of Waterloo South. The proposed planning framework that is subject of this planning proposal, includes:

- Amendments to the Sydney Local Environmental Plan 2012 – this will include amendments to the zoning and development standards (i.e. maximum building heights and floor space ratio) applied to Waterloo South. Precinct-specific local provisions may also be included.
- A Development Control Plan (DCP) – this will be a new part inserted into 'Section 5: Specific Areas' of the Sydney DCP 2012 and include detailed controls to inform future development of Waterloo South.
- An infrastructure contributions framework – in depth needs analysis of the infrastructure required to service the needs of the future community including open space, community facilities and servicing infrastructure.

1.1 Waterloo Estate

Waterloo Estate is located approximately 3.3 kilometres south-south-west of the Sydney CBD in the suburb of Waterloo (refer to Figure 1.1). It is located entirely within the City of Sydney local government area (LGA). Waterloo Estate is situated approximately 0.6 kilometres from Redfern station and 0.5 kilometres from Australia Technology Park. The precinct adjoins the new Waterloo Metro Station, scheduled to open in 2024. The Waterloo Metro Quarter adjoins Waterloo Estate and includes the station and over station development and was rezoned in 2019. Waterloo Estate comprises land bounded by Cope Street, Phillip Street, Pitt Street and McEvoy Street, including an additional area bounded by Wellington Street, Gibson Street, Kellick Street and Pitt Street. It has an approximate gross site area of 18.98 hectares (14.4 hectares excluding roads). Waterloo Estate currently comprises 2,012 social housing dwellings owned by LAHC, 125 private dwellings, a small group of shops and community uses on the corner of Wellington Street and George Street, and commercial properties on the south-east corner of Cope Street and Wellington Street.

A map of Waterloo Estate and relevant boundaries is illustrated in Figure 1.2.

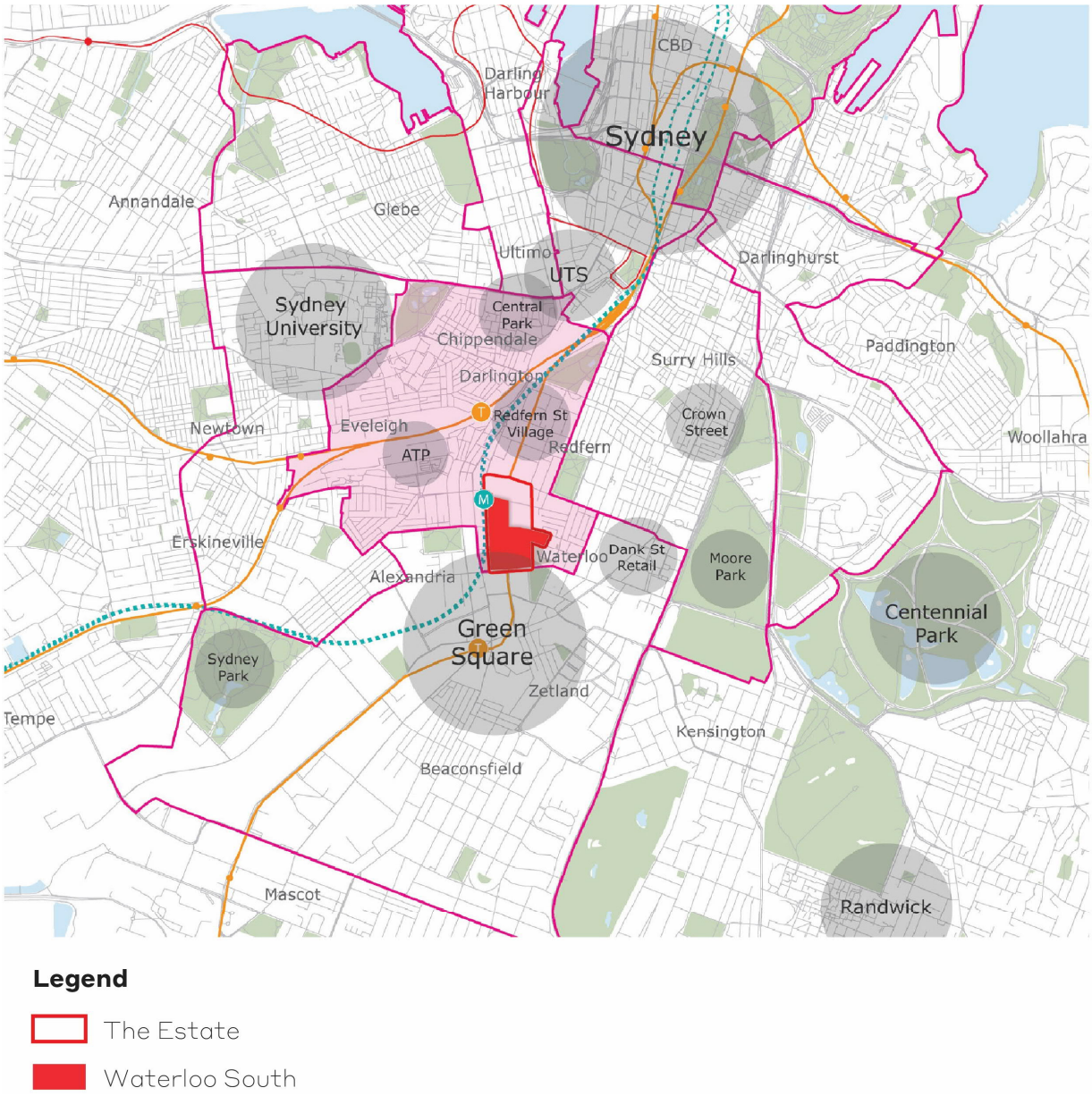


Figure 1.1: Location plan of Waterloo Estate and Waterloo South

Source: Turner Studio

1.2 Waterloo South

Waterloo South includes land bounded by Cope Street, Raglan Street, George Street, Wellington Street, Gibson Street, Kellick Street, Pitt Street and McEvoy Street and has an approximate gross site area of 12.32 hectares (approximately 65 per cent of the total Estate).

Waterloo South currently comprises 749 social housing dwellings owned by LAHC, 125 private dwellings and commercial properties on the south-east corner of Cope Street and Wellington Street. Existing social housing within Waterloo South is predominantly walk up flat buildings constructed in the 1950s and 1960s and mid-rise residential flat buildings (Drysdale, Dobell and 76 Wellington Street) constructed in the 1980s. Listed Heritage Items within Waterloo South include the Duke of Wellington Hotel, Electricity Substation 174 on the corner of George Street and McEvoy Street, the terrace houses at 229-231 Cope Street and the former Waterloo Pre-School at 225-227 Cope Street. The State Heritage listed 'Potts Hill to Waterloo Pressure Tunnel and Shafts' passes underneath the precinct.

A map of Waterloo South and relevant boundaries is illustrated in Figure 1.2.

Figure 1.2: Waterloo Precinct

Source: Ethos Urban

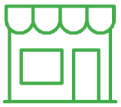
1.3 Renewal vision

The transition of Waterloo Estate will occur over a 20-year timeframe, replacing and providing fit for purpose social (affordable rental) housing as well as private housing to create a new integrated and inclusive mixed-tenure community. This aligns with Future Directions for Social Housing in NSW – the NSW Government's vision for social housing. It also aligns with LAHC's Communities Plus program, which is tasked with achieving three key objectives:

1) Provide more social housing
2) Provide a better social housing experience
3) Provide more opportunities and support for social housing tenants.

LAHC's Redevelopment Vision for Waterloo Estate is described in Table 1-1, which was derived from extensive consultation and technical studies.

Table 1-1: LAHC's redevelopment vision for Waterloo Estate

	Culture and Heritage ▪ Recognise and celebrate the significance of Waterloo's Aboriginal history and heritage across the built and natural environments ▪ Make Waterloo an affordable place for more Aboriginal people to live and work ▪ Foster connection to culture by supporting authentic storytelling and recognition of artistic, cultural and sporting achievements.
	Communal and Open Space ▪ Create high quality, accessible and safe open spaces that connect people to nature and cater to different needs, purposes and age groups ▪ Create open spaces that bring people together and contribute to community cohesion and wellbeing.
	Movement and Connectivity ▪ Make public transport, walking and cycling the preferred choice with accessible, reliable and safe connections and amenities ▪ Make Waterloo a desired destination with the new Waterloo Station at the heart of the Precinct's transport network – serving as the gateway to a welcoming, safe and active community.
	Character of Waterloo ▪ Strengthen the diversity, inclusiveness and community spirit of Waterloo ▪ Reflect the current character of Waterloo in the new built environment by mixing old and new.
	Local Employment Opportunities ▪ Encourage a broad mix of businesses and social enterprise in the area that provides choice for residents and creates local job opportunities.
	Community Services, Including Support for Those Who Are Vulnerable ▪ Ensure that social and human services support an increased population and meet the diverse needs of the community, including the most vulnerable residents ▪ Provide flexible communal spaces to support cultural events, festivals and activities that strengthen community spirit.
	Accessible Services ▪ Deliver improved and affordable services that support the everyday needs of the community, such as health and wellbeing, grocery and retail options.
	Design Excellence ▪ Ensure architectural design excellence so that buildings and surrounds reflect community diversity, are environmentally sustainable & people friendly – contributing to lively, attractive and safe neighbourhoods ▪ Recognise and celebrate Waterloo's history and culture in the built environment through artistic and creative expression ▪ Create an integrated, inclusive community where existing residents and newcomers feel welcome, through a thoughtfully designed mix of private, and social (affordable rental) housing.

Source: Let's Talk Waterloo: Waterloo Redevelopment (Elton Consulting, 2019)

1.4 Waterloo South planning proposal

The planning proposal will establish new land use planning controls for Waterloo South, including zoning and development standards to be included in Sydney LEP 2012, a new section in Part 5 of the Sydney DCP 2012, and an infrastructure contributions framework. Turner Studio and Turf have prepared an Urban Design and Public Domain Study which establishes an Indicative Concept Proposal presenting an indicative renewal outcome for Waterloo South. The Urban Design and Public Domain Study provides a comprehensive urban design vision and strategy to guide future development of Waterloo South and has informed the proposed planning framework. The Indicative Concept Proposal has also been used as the basis for testing, understanding and communicating the potential development outcomes of the proposed planning framework.

The Indicative Concept Proposal comprises:

- Approximately 2.57 hectares of public open space representing 17.8 per cent of the total Estate (Gross Estate area – existing roads) proposed to be dedicated to the City of Sydney Council, comprising:
  - Village Green – a 2.25-hectare park located next to the Waterloo Metro Station
  - Waterloo Common and adjacent – a 0.32-hectares located in the heart of the Waterloo South precinct
  - The 2.57 hectares all fall within the Waterloo South Planning Proposal representing 32.3% of public open space (Gross Waterloo South area – proposed roads).
- Retention of 52 per cent of existing high and moderate value trees (including existing fig trees) and the planting of three trees to replace each tree high and moderate value removed
- Coverage of 30 per cent of Waterloo South by tree canopy
- Approximately 257,000 square metres of GFA on the LAHC land, comprising:
  - Approximately 239,100 square metres of GFA for residential accommodation, providing for approximately 3,048 dwellings comprising a mix of market and social (affordable rental) housing dwellings
  - Approximately 11,200 square metres of GFA for commercial premises, including, but not limited to, supermarkets, shops, food and drink premises and health facilities
  - Approximately 6,700 square metres of community facilities and early education and child care facilities.

The key features of the Indicative Concept Proposal are:

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- A new local retail hub located centrally within Waterloo South to serve the needs of the local community
- A target of 80 per cent of dwellings to have local retail services and open space within 200 metres of their building entry
- Achievement of a 6-star Green Star Communities rating, with minimum 5-star Green Star – Design and As-Built (Design Review certified)
- A range of Water Sensitive Urban Design (WSUD) features.

The proposed land allocation for the Waterloo South precinct is described in Table 1-2.

Table 1-2: Breakdown of allocation of land within Waterloo South

Land allocation	Existing	Proposed
Roads	3.12 ha / 25.3%	4.38 ha / 35.5%
Developed area (Private sites)	0.86 ha / 6.98%	0.86 ha / 7%
Developed area (LAHC property)	8.28 ha / 67.2%	4.26 ha / 34.6%
Public open space (proposed to be dedicated to the City of Sydney)	Nil / 0%	2.57ha / 20.9% (32.3% excluding roads)
Other publicly accessible open space (including former roads and private / LAHC land)	0.06 ha / 0.5%	0.25 ha / 2%
Total	12.32 ha	12.32 ha

The Indicative Concept Proposal for Waterloo South is illustrated in Figure 1.3.

Figure 1.3: Indicative Concept Proposal

Source: Turner Studio

1.5 Roads and Maritime and Transport for NSW

On 1 December 2019, Roads and Maritime Services (RMS) and Transport for NSW (TfNSW) joined together to create one integrated TfNSW to enable the delivery of better outcomes for customers and communities across NSW.

All references to RMS in this document should be taken to mean TfNSW.

1.6 Purpose

This report relates to the Waterloo South planning proposal. While it provides comprehensive baseline investigations for Waterloo Estate, it only assesses the proposed planning framework amendments and Indicative Concept Proposal for Waterloo South.

The key matters addressed as part of this study include:

- Strategic planning context, addressed in Chapter 2
- Land use and demographics, addressed in Chapter 3
- Strategic network analysis, addressed in Chapter 4
- Proposal assessment, addressed in Chapter 5
- Implementation plan and strategy, addressed in Chapter 6.

2. Study requirements

This chapter details the study requirements from the Minister for Planning and the City of Sydney, and how these have been addressed in this report.

2.1 Study requirements – Minister for Planning

In May 2017, the Minister for Planning issued study requirements for the Waterloo Estate. Study requirements that are relevant to the transport study and how they have been addressed in this report are shown in Table 2-1.

Table 2-1: Study requirements – Minister for Planning

Number	Study requirement	Where addressed in this report
1. Vision, Strategic Context and Justification		
1.2	Outline the strategic planning context for the proposal including an assessment of relevant State planning documents such as: ▪ NSW Long Term Transport Masterplan (December 2012).	Section 3.2 (Future Transport 2056 supersedes this document)
1.4	Consideration of Transport for New South Wales strategies and reports including, but not limited to: ▪ Sydney's Rail Future 2013 ▪ Sydney's Bus Future 2013 ▪ Sydney's Light Rail Future 2013 ▪ Sydney's Cycling Future 2013 ▪ Sydney's Walking Future 2013 ▪ Sydney City Centre Access Strategy 2013.	Section 3.2 (Future Transport 2056 supersedes these documents)
1.5	Consideration of City of Sydney planning documents, strategies and policies including, but not limited to: ▪ Connecting Our City - Transport Strategies and Actions – Summary Report 2012 ▪ Cycle Strategy and Action Plan 2007-2017 ▪ Walking Strategy and Action Plan.	Sections 3.6 and 3.7
1.6	Consideration of other relevant strategies, reports, policies and guides including, but not limited to: ▪ Guide to Traffic Generating Developments and TDT 2013/04a.	Section 6.7.3
3. Public Open Space and Streets		
3.7	Identify key intersections where there are high numbers of pedestrians, cyclists and/or vehicles and provide detail of how pedestrian and cyclist safety and comfort will be prioritised in these locations. Include any intersections that will be used by children to access schools as pedestrians or cyclists.	Sections 6.5.2 and 6.5.3
3.8	Provide a general arrangement plan for streets locating proposed kerb alignments, including intersection arrangements and mid-block crossing arrangements, overlaid with existing and future ownership boundaries.	Section 6.7.7

Number	Study requirement	Where addressed in this report
5. Transport		
5.1	Prepare a comprehensive transport impact assessment to understand the transport network context, service and network limitations, opportunities for improving customer experience and transport solutions that will accommodate planned growth through integrating land use and transport and better managing travel demand. Hold a scoping meeting to agree upon an acceptable methodology with Transport for NSW (TfNSW), Roads and Maritime Services (RMS) and the City of Sydney Council.	Whole report Scoping meeting held on 2 May 2017
5.2	The assessment should consider, but not be limited to: ▪ a broad review of the existing and future land use and transport context within the study precinct, access and connectivity with assessment of the overall precinct and its relationship to the surrounding transport network and land uses;	Chapters 4 and 5
	▪ appraisal of current site travel mode share including walking, cycling, public transport and private vehicles, including shared vehicles;	Section 5.1
	▪ how the transport outcomes and the effect of the transport network will support the urban and place-making outcomes for the precinct;	Section 5.5 and Chapter 6
	▪ the needs of different customers within the precinct,	Section 5.5 and Chapter 6
	▪ access to key destinations and infrastructure in the local area; in particular, schools, community facilities and other local services;	Sections 4.1 and 5.3
	▪ the safety of all road users; in particular, pedestrians and cyclists;	Section 6.5
	▪ performance of the existing and future cycling, public transport and road network surrounding the Waterloo Estate and in addition map the agreed public transport initiatives linked to the development of the Waterloo Metro Quarter, the Central to Eveleigh Urban Transformation Strategy (noting that the study area must be agreed with TfNSW and RMS) and WestConnex and associated projects;	Chapters 5 and 6
	▪ existing trip generation by mode based on the current land use and transport context including walking, cycling, public transport, taxi, ride share (e.g. Uber) and private vehicles;	Section 5.1.4
	▪ review the trip generating potential for all modes and purposes (including education) associated with the proposal. Trip generation rates are to be prepared specifically for the precinct based on evidence-based review of standard rates, intended urban form and travel characteristics of the precinct and consultation with key stakeholders. Trip generation rates are to be agreed by Transport for NSW, Roads and Maritime Services and the City of Sydney;	Section 6.3 and throughout Chapter 6
	▪ cumulative growth of surrounding area based on committed and planned developments such as Australian Technology Park and proposed infrastructure (such as WestConnex and associated projects),	Chapters 5 and 6
	▪ impact of additional travel demands (across all modes) on the transport network serving the site;	Chapter 6

Number	Study requirement	Where addressed in this report
	▪ benchmark the travel mode share and trip generation profile through undertaking trip generation surveys for all modes of a development site of similar scale and geographic context;	Sections 6.3 and 6.7.3
	▪ provide an understanding of the travel behaviours and patterns (across all modes) of future residents, workers and visitors of the proposal through benchmarking, forecast modelling tools and other sources of evidence;	Sections 5.1, 5.6 and Chapter 6
	▪ develop a traffic model to determine the road network improvements required to support the proposal (scope, parameters and methodology to be agreed with Roads and Maritime Services and should be carried out in accordance with RMS Traffic Modelling Guidelines 2013) including street hierarchy and spatial provision for all modes of travel;	Section 6.7
	▪ consider the role of shared vehicles in managing travel demand and provide any recommendations for implementation of shared vehicle solutions;	Section 6.6
	▪ benchmark and provide recommendations for the land use mix profile that will ensure customer outcomes are met and assist in management of travel demand and create a walkable neighbourhood;	Sections 1.4 and 5.5
	▪ benchmark and provide recommendations on the provision of bicycle parking and end trip facilities (showers, lockers etc) to help promote alternative travel choices including walking, cycling and public transport;	Sections 6.5 and 6.6
	▪ provide recommendations for car parking rates to reduce private vehicle travel demand and that help promote sustainable travel choices such as walking, cycling and public transport;	Section 6.6
	▪ detail the access and egress requirements in accordance with RMS and City of Sydney guidelines and relevant Australian Standards;	Section 6.8
	▪ detail the transport infrastructure and servicing improvements, including identification of both the land (corridor preservation) and capital components to support the proposal including costings and funding responsibilities;	Section 6.10
	▪ establish a flexible and resilient system of access corridors (that considers the City of Sydney's Liveable Green Network) within the precinct (streets, walkways, open spaces) to connect and serve the precinct and local area, including demonstrating how integrated solutions are achieved for connecting the metro station with the surrounding community;	Sections 6.7.6 and 6.7.7
	▪ prepare a staging plan that has trigger points for potential future development based on the delivery of transport infrastructure and service improvements;	Chapter 7
	▪ prepare a Travel Plan detailing all modes of transport available to future residents, visitors and employees of the site and proposed mechanisms for maximising travel by walking, cycling and public transport; and	Section 6.6.3
	▪ prepare the required DCP provisions.	Chapter 7
5.3	Provide an overview of potential impacts of construction traffic on potential future development. Identify a strategic construction approach, including identification of potential staging that broadly outlines the construction footprint and construction related traffic access.	Section 6.9

Number	Study requirement	Where addressed in this report
7. State and Regional Infrastructure		
7.1	Outline the impact of the proposal on State and regional infrastructure, including public transport, roads, schools, utilities, regional stormwater and drainage, human services and health facilities required to meet the characteristics and likely needs of the current population during the development period, and future population, including the estimated costs (inclusive of land and capital) and timing of the works. Include reference to the findings of the Social Sustainability Assessment (see section 23).	Chapter 6 (for public transport and roads only)

2.2 Study requirements – City of Sydney

In February 2020, the City of Sydney issued study requirements for the Waterloo South planning proposal. Study requirements that are relevant to the transport study and how they have been addressed in this report, are shown in Table 2-2.

Table 2-2: Study requirements – City of Sydney

Study requirement	Where addressed in this report
Prepare a transport impact assessment to understand the transport network context, service and network limitations. The assessment should include:	
Existing and future land use and transport context, including an assessment of: ▪ Public transport routes and services ▪ Cycling routes and bicycle parking ▪ Pedestrian networks and distribution ▪ Sustainable transport options and initiatives.	Chapters 4 and 5
The current mode share of the site and future mode share target	Sections 5.1.1 and 5.6
Access to key destinations, trip generators and infrastructure in the local area	Sections 4.1 and 5.3
Performance of the existing and future cycling, public transport and road network surrounding the precinct	Chapters 5 and 6
Trip generation potential associated with the proposal, with reference to existing trip generation of uses on the site	Section 6.3 and throughout Chapter 6
Consideration of cumulative growth of the surrounding area based on committed and planned developments and proposed infrastructure	Chapters 5 and 6
Anticipated freight, loading and servicing demands associated with the proposal, with recommended on-site service vehicle parking rates and loading zone capacity to enable the development to meet all servicing needs without on-street parking (whether in line with or beyond the requirements of DCP Section 7.8)	Section 6.8
An assessment of the impact of additional travel demands (across all modes) on the transport network serving the site, using benchmarks from existing development sites of a similar scale and geographic context	Chapter 6

Study requirement	Where addressed in this report
Consideration of weekend congestion on the local road network associated with demographic vehicle use patterns	Section 5.4.1
SIDRA intersection models to demonstrate the safe operation and functionality of key intersections	Section 6.7 (Aimsun was used to model intersections rather than SIDRA, as agreed with RMS)
Consideration of the role of shared vehicles in managing travel demand and provide recommendations for implementation of shared vehicle solutions	Section 6.6
Recommended parking rates to result in no net additional traffic impact on the local road network	Section 6.6
Identification of current and planned cycling routes identified in the City of Sydney Cycling Strategy and Action Plan 2018-2030, with recommendations for building access that will maximise easy connections for cyclists and avoid conflicts with vehicles	Section 6.5.4
An overview of potential impacts from construction traffic to vehicles, pedestrians and cyclists, including: ▪ Construction worker parking ▪ Existing traffic on construction access routes ▪ Access constraints and impacts on public transport, pedestrians and cyclists ▪ Any potential need to close, divert or reconfigure elements of the road, pedestrian or cycle network ▪ Temporary and permanent impacts to on-street parking.	Section 6.9

3. Strategic planning context

This chapter summarises the strategic transport and planning context within which this assessment has been undertaken.

3.1 Alignment with transport policies and plans

The Waterloo South planning proposal aligns with and is supported by a number of strategic plans including:

- Future Transport Strategy 2056 (2018)
- Building Momentum – State Infrastructure Strategy 2018-2038 (2018)
- A Metropolis of Three Cities – The Greater Sydney Region Plan (2018)
- Central to Eveleigh Urban Transformation Strategy (2016)
- City of Sydney 2016 – 2021 Strategy and Action Plan (2017)
- Connecting Our City – Transport Strategy Actions Summary Report (2017).

These plans and their relationship to the Waterloo South planning proposal are detailed below.

3.2 Future Transport Strategy 2056

The Future Transport Strategy 2056 (Future Transport) is an update of the NSW Long Term Transport Master Plan and is a 40-year strategy for mobility for Sydney and regional NSW. It sets out a vision, strategic directions and customer outcomes with a focus on technology and innovation across the transport system to transform the customer experience, improve communities and boost economic performance.

The strategy supports the development of liveable communities such as the Waterloo Precinct, where transport is vital to mobility as a 'placemaker'. The project would integrate with the Sydney Metro City & Southwest network, improving the liveability and character of the precinct. This would lead to the realisation of wider benefits from investment and encourages more desirable patterns of development, fulfilling a desired outcome identified in the strategy.

3.3 Building Momentum – State Infrastructure Strategy 2018-2038

Building Momentum - State Infrastructure Strategy 2018-2038 (SIS) is a 20-year strategy that identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth. Infrastructure NSW's assessment of the State's existing infrastructure highlighted critical deficiencies in Sydney's road capacity. The SIS identifies strategic infrastructure options to meet the challenges of growth in travel demand and substantial increases in freight volumes.

Specifically, the SIS identifies Waterloo as a strategic urban renewal corridor required to accommodate the expected growth in housing and employment in the area. The strategy also recognises the importance of LAHC's role in delivering a commercially feasible, high-quality urban development in Waterloo, balancing housing supply against the consideration of urban design and place-making.

3.4 A Metropolis of Three Cities – The Greater Sydney Region Plan

A Metropolis of Three Cities – The Greater Sydney Region Plan establishes a 40-year strategic land use plan for Sydney. The plan was developed concurrently with Future Transport and the SIS, aiming to deliver better connections for people across Greater Sydney. The land use vision for Greater Sydney is a metropolis of three cities (Eastern Harbour City, Central River City and Western Parkland City). Consistent with Future Transport, one of the key elements of the plan is the vision of a 30-minute city regardless of location. The goal for this vision is to provide transport infrastructure that allows people to reach their nearest metropolitan or strategic centre within 30 minutes, seven days a week.

Waterloo is identified in the plan as part of the Eastern Harbour City where urban renewal driven by Sydney Metro City & Southwest would occur. The project, in conjunction with Sydney Metro and other projects, would therefore complement the Greater Sydney Commission's framework for a liveable, productive and sustainable Eastern Harbour City. Potential indicators to deliver the plan that would be relevant to Waterloo include:

- Increased 30-minute access to metropolitan centres and clusters
- Increased use of public resources such as open space and community facilities
- Increased walkable access to local centres
- Increased housing completions
- Increased access to open spaces
- Increased jobs in metropolitan and strategic centres
- Increased urban tree canopy.

3.5 Central to Eveleigh Urban Transformation Strategy

The Waterloo Precinct is one of several precincts that form part of the Central to Eveleigh (C2E) Urban Transformation Corridor. The Corridor covers an area of 80 hectares and stretches three kilometres. The Corridor includes Central, Redfern, Macdonaldtown and Erskineville stations, the Australian Technology Park and Eveleigh Rail Yards. The Central to Eveleigh Urban Transformation Strategy was finalised in November 2016 and is now being implemented via a number of separate projects, including the Waterloo South planning proposal.

The strategy is underpinned by A Plan for Growing Sydney and City of Sydney's Sustainable Sydney 2030 strategies. The vision for C2E includes a range of related transport and land use considerations, categorised in four key areas:

- Living: providing 14,000 new dwellings, including social and affordable housing, an expanded cycleway network, well-connected neighbourhoods, new public spaces and jobs close to homes
- Community: redevelopment of Redfern station, new Waterloo Metro Station, enhanced connectivity and access and 400 metre walk to public open spaces
- Working: providing 21,000 new jobs (including knowledge intensive and innovation industries), new links improving connectivity between work and education hubs, world class cultural infrastructure and a creative hub promoting distributed workplaces.
- Environment: providing 73,000 square metres of new public open space, 23 per cent uptake in car share and higher public and active transport mode share.

3.6 City of Sydney 2016 – 2021 Strategy and Action Plan

The City of Sydney's 2016 – 2021 Strategy and Action Plan details how the City of Sydney will deliver its strategic plan through the implementation of specific actions across a range of areas. To support this, separate cycling and walking plans have also been developed – Cycling Strategy and Action Plan and Walking Strategic and Action Plan.

Waterloo South is closely aligned with the objectives of these long-term plans. Key objectives from the plans such as the integration of land use and transport, improving the mode share of walking and cycling, improving the overall health of the population and enhancing amenity and access will all be met through the development of Waterloo South.

3.7 Connecting Our City – Transport Strategy Actions Summary Report

Connecting Our City – Transport Strategy Actions Summary Report is a supporting document to the City of Sydney's 2016 – 2021 Strategy and Action Plan that was endorsed by the City of Sydney in 2017. This document sets out the City of Sydney's vision for a world-class transport system for the City which supports a strong and growing economy, a more sustainable environment and a diverse and connected community.

Waterloo South is aligned with the key priorities stated in the report including:

- Giving more priority to pedestrians and providing safer and more enticing streets to walk in
- Enhancing the environment for bicycle use through safe and accessible bike paths and routes
- Managing the volume of cars through our streets while maintaining access commercial and delivery vehicles.

4. Land use and demographics

This chapter details the existing land use environment and provides the demographic context within which this assessment has been undertaken.

4.1 Centres, population and employment

Several key centres are located near Waterloo including Green Square, Mascot and Australian Technology Park. In addition, the metropolitan centre of Sydney CBD is located around 2.8 kilometres to the north. Figure 4.1 illustrates the hierarchy of centres and strategic public transport network surrounding Waterloo.

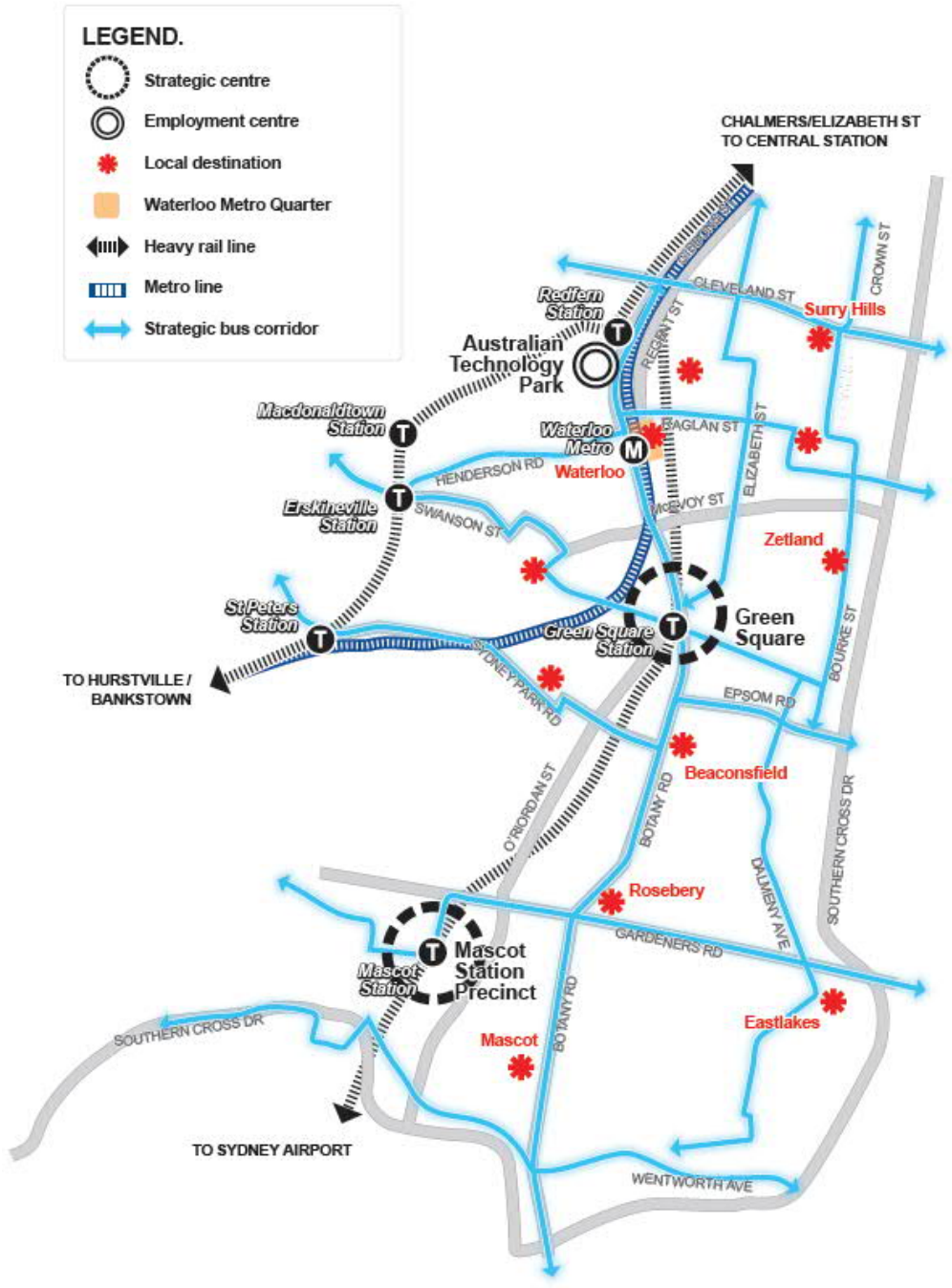


Figure 4.1: Centres and strategic traffic and transport network surrounding Waterloo

The emerging Green Square strategic centre is located around one kilometre to the south, focussed around Green Square station and the future Green Square Town Centre. This will be a major retail, commercial and employment hub in the future. Australian Technology Park and Mascot strategic centre, located west and south of Waterloo, respectively, are key employment nodes. Stretching between Waterloo and Mascot is the Southern Sydney Employment Lands.

Future transport networks will need to consider options for connecting the hierarchy of centres within the region. Sydney Metro City & Southwest will provide connections from Waterloo to the Sydney CBD while connections to key centres at Green Square, Redfern and Mascot will need to be provided by alternative options.

School and community facilities located near the Waterloo Precinct include Our Lady of Mount Carmel Primary School, Alexandria Park Community School and Green Square School (see Figure 4.2). Safe access to these destinations is an important component of the Waterloo Precinct given the number of pedestrians using these facilities. The trips generated by these pedestrians may also involve crossing roads that carry high traffic volumes and freight trips such as Botany Road and McEvoy Street.

Figure 4.2: Local schools in the vicinity of the Waterloo Precinct

Table 4-1 shows the existing and future population and employment distribution for the broader Southern Sydney region based on TfNSW projections for 2036 (TZP16[1]).

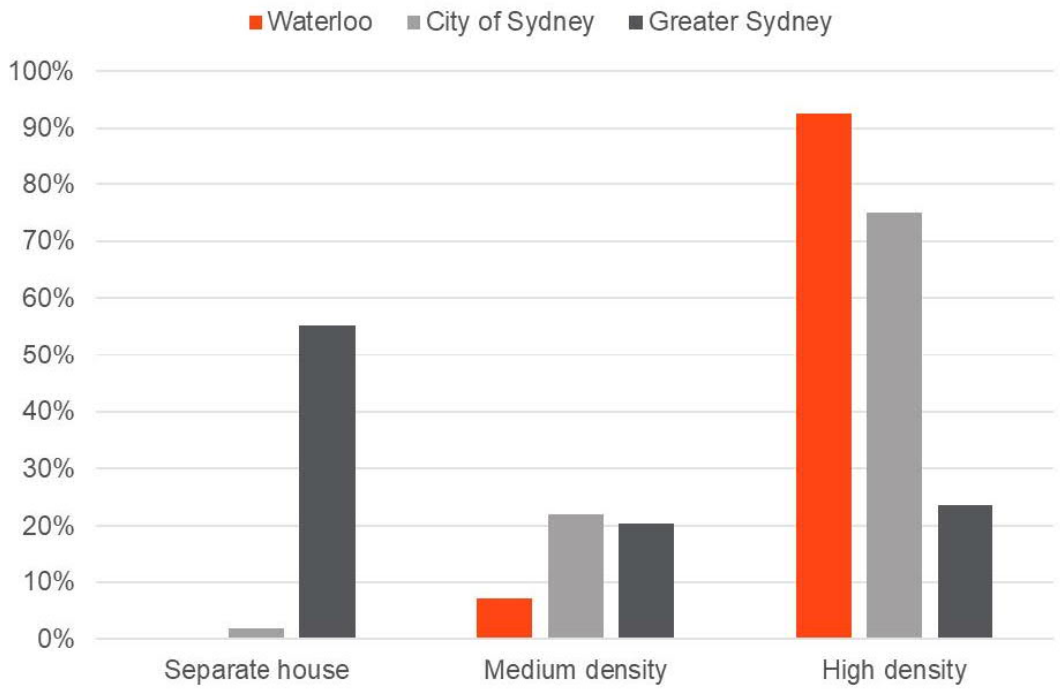
The base case projections for the region show that from 2016 to 2036, the population is projected to almost double from 76,000 to 134,000 residents. During the same period, employment is projected to grow from 80,000 to 105,000 jobs.

Table 4-1: Population and employment comparison

Area	2016		2036	
	Population	Employment	Population	Employment
Redfern / Waterloo	25,000	14,000	42,000	22,000
Green Square / Alexandria	26,000	36,000	54,000	48,000
Mascot / Eastlakes	25,000	30,000	38,000	35,000
Total	76,000	80,000	134,000	105,000

4.2 Character

Waterloo is currently characterised by a mix of medium and high-density development, consisting of townhouses, terraces, several high-rise residential towers and some detached dwelling houses. Figure 4.3 shows the mix of dwellings in the Waterloo Precinct compared to the City of Sydney LGA and Greater Sydney region.



Source: Australian Bureau of Statistics, Census of Population and Housing, 2016.

Figure 4.3: Dwelling types (2016)

Source: Waterloo South Population and Demographic Study (.id, February 2020, page 40)

[1] TZP16 is the 2016 Travel Zone projection by TPA used to represent the most likely urban future based on current data, trends and an understanding of policy / structural changes that may impact the future.

4.3 Demographics

4.3.1 Age

The age profile of residents in the Waterloo Precinct, City of Sydney LGA and Greater Sydney region is shown in Figure 4.4.

The Waterloo Precinct has an older resident population, with just under a third of residents aged over 65 years compared to eight per cent for the City of Sydney. This is likely to be related to the significant proportion of social housing within the precinct, with many residents living there for a significant period of time.

Renewal in the precinct is likely to result in a shifting age profile, with a younger demographic moving into new housing stock. As a significant proportion of housing will still be reserved for social housing, there is still likely to be a slightly older age profile than other areas of the City of Sydney. This will need to be considered in the development of networks, particularly local connections to key services such as hospitals.

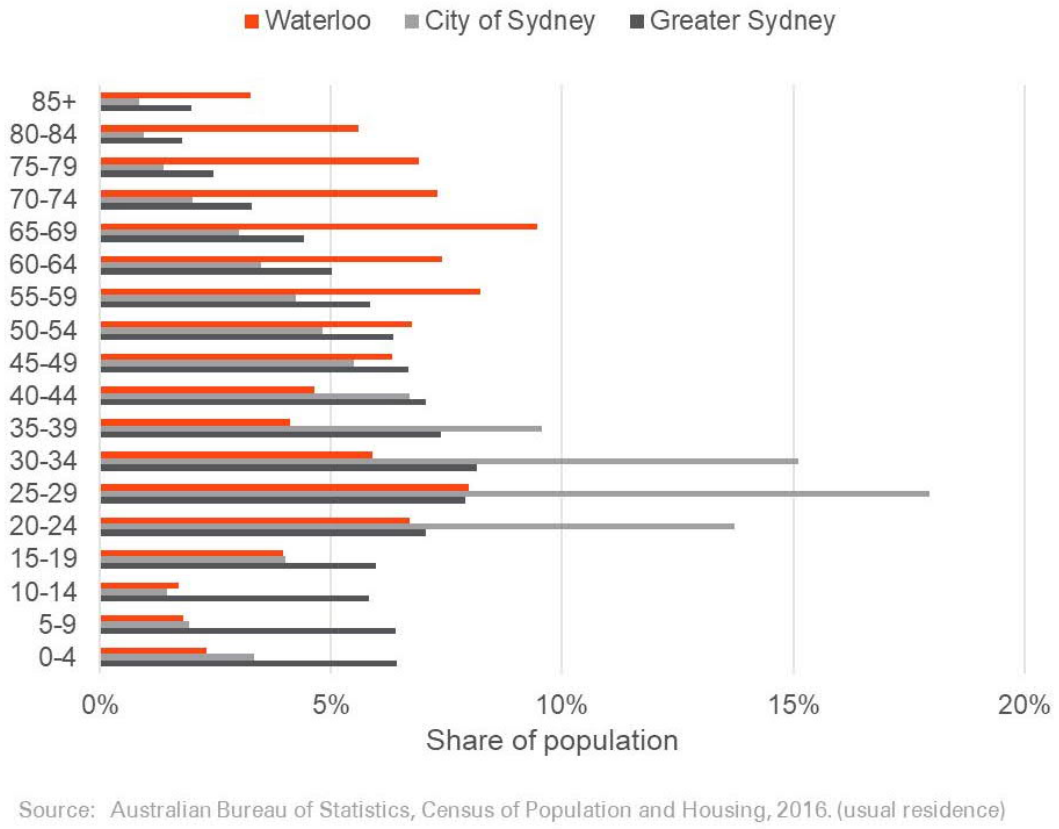


Figure 4.4: Age profile (2016)

Source: Waterloo South Population and Demographic Study (.id, February 2020, page 32)

4.3.2 Employment

Employment rates for the Waterloo Precinct, City of Sydney LGA and Greater Sydney region are shown in Figure 4.5.

In the Waterloo Precinct, the unemployment rate is 18.6 per cent for those in the labour force, compared to six per cent in the City of Sydney LGA. This trend is strongly linked to the existing social housing provision in Waterloo. A shifting demographic profile and a younger professional workforce is likely to move into new housing stock alongside existing social housing tenants. The transport network will be required to serve the needs of all residents as well as workers and visitors to the precinct. Employed residents will require efficient connections to the employment centres such as the Sydney CBD whilst older residents and social housing tenants are likely to have a stronger reliance on local services connecting to community, health and retail areas.

Figure 4.5: Employment and labour force status (2016)

Source: Waterloo South Population and Demographic Study (.id, February 2020, page 46)

5. Strategic transport network analysis

This chapter details existing travel behaviour and transport networks and provides the transport context within which this assessment has been undertaken.

5.1 Travel behaviour

5.1.1 Mode share

Three areas have been used to investigate existing and potential mode share for Waterloo South:

- Waterloo Precinct: a single Travel Zone (TZ), representative of Waterloo South
- Waterloo suburb: the extent of the suburb of Waterloo
- Waterloo-Redfern wider area: a wider area for understanding travel patterns.

Key characteristics and the TZs representing these areas are shown in Table 5-1.

Waterloo suburb and Waterloo-Redfern wider area have been included to provide regional context to current travel patterns in Waterloo Precinct. Key travel characteristics for these areas are also compared to the City of Sydney LGA, Randwick LGA and Greater Sydney region in order to understand similarities and differences in travel behaviour relative to other parts of Sydney.

Table 5-1: Assumed travel zones and key characteristics

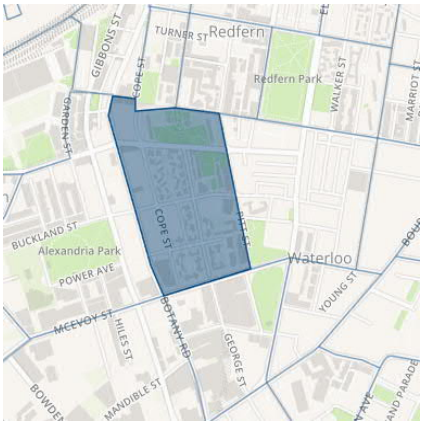
Waterloo Precinct	Waterloo suburb	Waterloo-Redfern wider area
		
Travel zone: 270	Travel zones: 270, 271, 272, 273, 274, 275, 276	Travel zones: 210, 211, 212, 213, 214, 215, 217, 218, 219, 220, 221, 270, 271, 272, 273, 274, 275, 276
Employed residents: 535	Employed residents: 4,586	Employed residents: 11,129
Jobs: 580	Jobs: 5,457	Jobs: 11,650

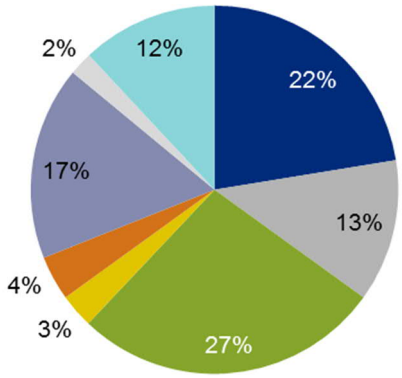
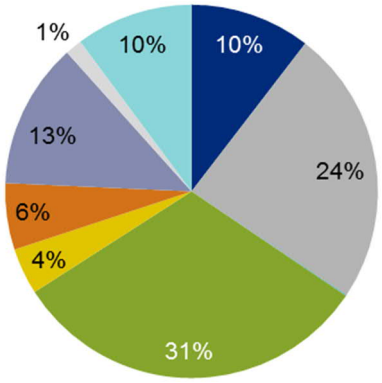
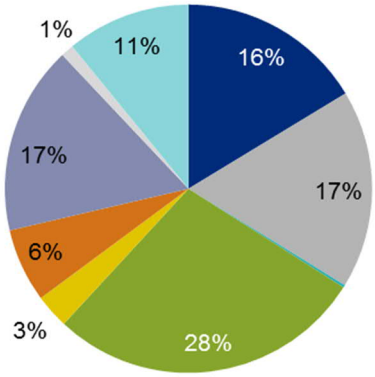
Table 5-2 compares current Journey to Work (JTW) mode share for resident travel out of the Waterloo Precinct, Waterloo suburb and the Waterloo-Redfern wider area.

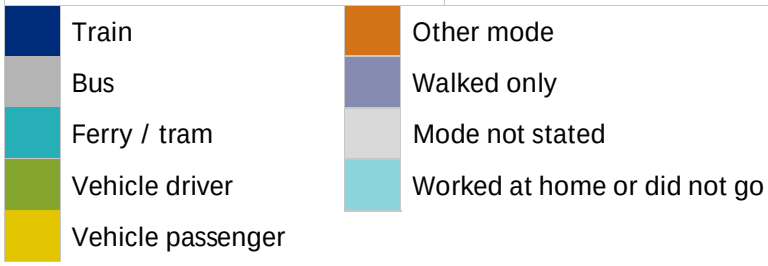
In all three areas, public transport is the most popular mode used for work trips, ranging from 33 to 35 per cent mode share. This is closely followed by private vehicles (30 to 35 per cent) and walking (13 to 17 per cent). Heavy rail and bus mode share are similar across all areas, while residents of the Waterloo Precinct were more likely to use heavy rail than in other areas.

Walking accounts for a relatively high proportion of trips to work; the walking mode share in Waterloo Precinct was similar to the Waterloo-Redfern wider area (17 per cent), while it was slightly lower in Waterloo suburb (13 per cent). Cycling trips (included in 'Other mode') accounted for up to four per cent of work trips in Waterloo Precinct and up to six per cent of trips in other areas.

A significant proportion of people work at home (or did not travel to work on Census day), ranging from 10 to 12 per cent mode share. This is highest in the Waterloo Precinct and lowest in Waterloo suburb, which may be reflective of the types of jobs worked by residents in these areas.

Table 5-2: 2011 JTW mode share, resident travel out of Waterloo

Waterloo Precinct	Waterloo suburb	Waterloo-Redfern wider area
		



Source: JTW Explorer (TfNSW, 2011)

Comparison to other areas

Resident mode share in the suburb of Waterloo has been compared to other inner-city suburbs in the City of Sydney LGA including Redfern, Woolloomooloo, Glebe, Ultimo and Pyrmont.

These suburbs have been selected based on an extensive benchmarking process, based on a range of data sources including the 2011 SEIFA index[2], public transport timetable data, Census 2011 data and JTW 2011 data.

Five suburbs were identified as broadly comparable in to Waterloo on the basis of:

- Socio-economic status
- Proportion of social and affordable housing
- Proportion of households with no motor vehicles
- Average public transport travel times to Sydney CBD, Parramatta CBD and Macquarie Park.

These locations are outlined in Table 5-3.

[2] The SEIFA Index ranks areas in Australia according to relative socio-economic advantage and disadvantage.

Table 5-3: Suburbs comparable to Waterloo for mode share benchmarking process

Location	2011 SEIFA index	Social and affordable housing (%)	Households with no motor vehicles (%)	Average public transport travel time, morning peak (8.00 am to 9.00 am) (mins)		
				Sydney CBD	Parramatta CBD	Macquarie Park
Waterloo	941	24%	29%	21	45	56
Redfern	973	19%	35%	14	38	50
Woolloomooloo	945	18.%	38%	11	50	52
Glebe	1,001	16%	30%	25	50	55
Ultimo	974	8%	47%	22	50	55
Pyrmont	1,055	7%	26%	20	55	52

Greater than 60 mins

30 to 60 mins

Less than 30 mins

Figure 5.1 compares the resident mode share for Waterloo, selected benchmark suburbs and the Sydney metropolitan area.

Compared to average JTW mode share across the Sydney metropolitan area, Waterloo and the selected benchmark suburbs have significantly lower car mode share. Mode share for public and active transport combined is much higher than the Sydney average. Non-car mode share for the selected City of Sydney LGA benchmark suburbs ranges between 53 and 70 per cent, compared with 28 per cent on average across the Sydney metropolitan area. Car mode share is particularly low in areas with high quality mass transit links and close proximity to Sydney CBD.

This comparison highlights the impact on travel mode choices of densely located land uses, activities and attractors typical of inner-city locations. The availability of high-quality public transport infrastructure and services, permeable and connected street networks and high-quality walking and cycling facilities are also highly important and complimentary.

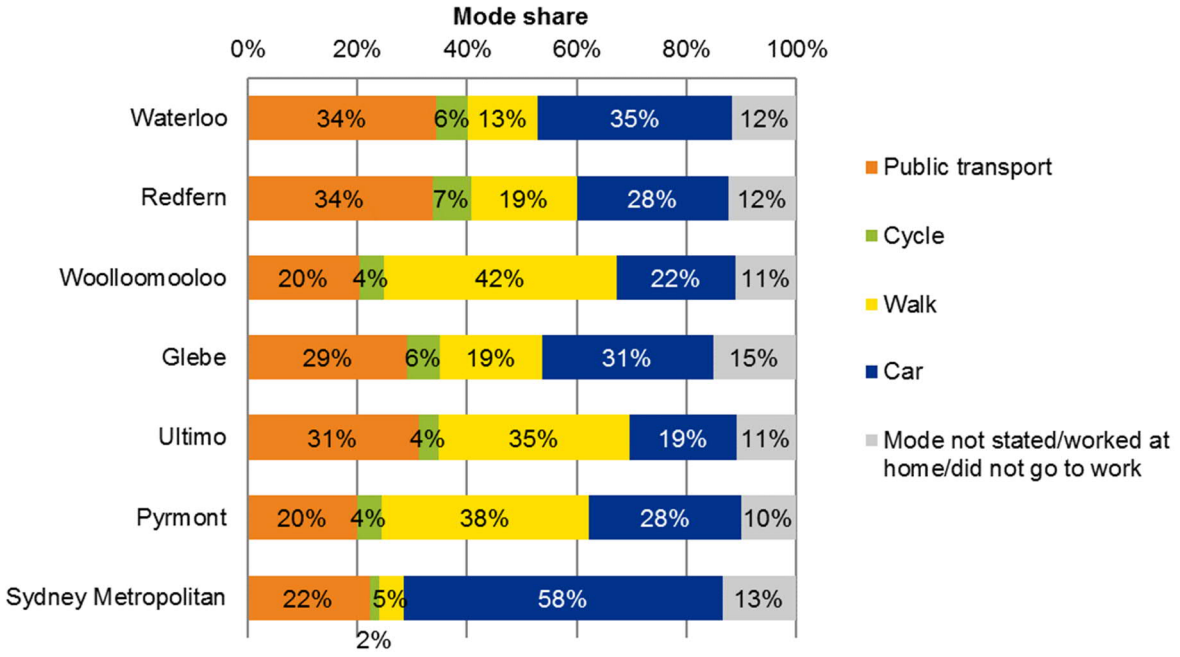


Figure 5.1: Resident mode share[3]

Source: JTW Explorer (TfNSW, 2011)

5.1.2 Origins and destinations

Figure 5.2 and Figure 5.3 show the top origins and destinations into and out of the Waterloo Precinct. Sydney Inner City, which includes Sydney CBD, is the most popular destination, accounting for over half of all work trips. This reinforces that Waterloo is an ideal location given its proximity to Sydney CBD and surrounding centres such as Australian Technology Park. The focus of work trips will continue to be the Sydney CBD and the primary public and active transport networks should reflect this.

Similarly, trips from Sydney Inner City to the Waterloo Precinct represent the highest proportion of all work travel origins, followed by the Eastern Suburbs. This is due to employment in Waterloo comprising largely population-serving industries such as retail, with a largely localised workforce. Future employment within the Waterloo Precinct is likely to continue to comprise this type of employment and therefore a focus on mixed-use, local connectivity and affordable housing provision should support this outcome.

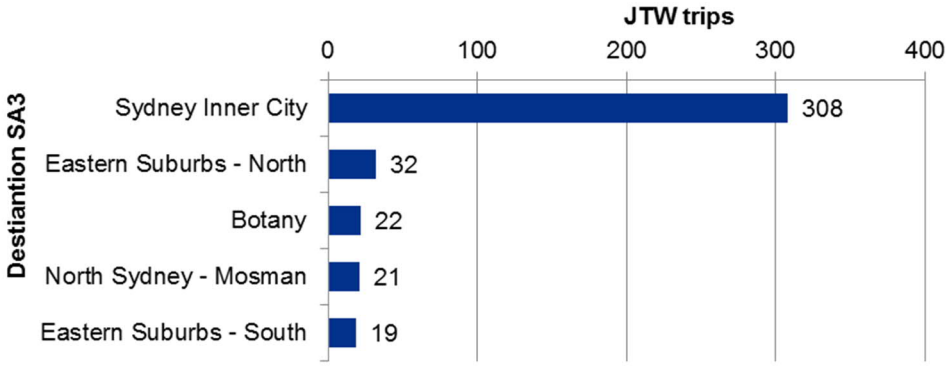


Figure 5.2: Top five destinations (resident travel out of the Waterloo Precinct)

[3] Note: under the defined JTW categories, the proportion of "other mode" trips has been assumed to represent cycle mode share.

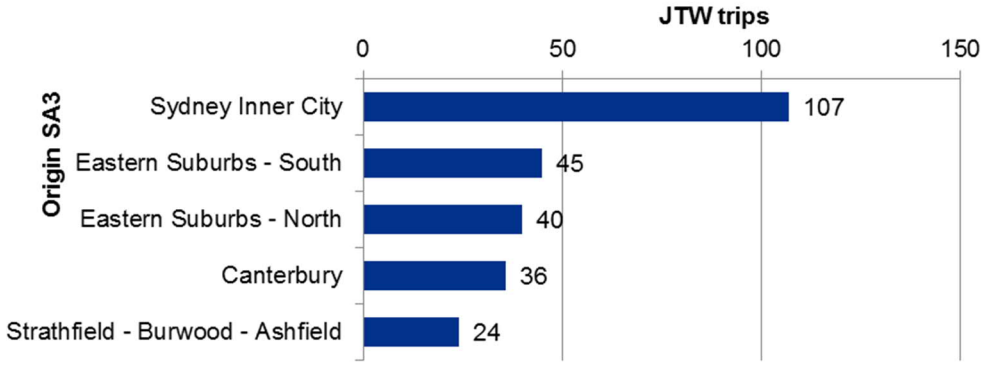


Figure 5.3: Top five origins (employee travel into the Waterloo Precinct)

5.1.3 Trip purpose and length

Using 2014/15 Household Travel Survey (HTS) data, key trip characteristics in the City of Sydney LGA, adjoining Randwick LGA and the Sydney metropolitan area have been compared. HTS data sample size only supports its effective use for analysis of larger areas, rather than the smaller areas able to be analysed with JTW data. As Waterloo is located within the City of Sydney LGA, it would tend to reflect the travel patterns of a central Sydney location.

Overall, the indicators below reflect the denser nature of activities and attractions in the City of Sydney LGA, and to a lesser extent Randwick LGA, than across much of the Sydney metropolitan area. This results in a higher number of trips undertaken per person, but with shorter average trip lengths. Travel distances are shorter due to land use density and greater availability of alternative travel options including public transport, walking and cycling for many trips. There are also many more social and recreational trips made in the City of Sydney LGA.

Trips per person

The number of weekday trips undertaken per person is greater in the City of Sydney LGA than Randwick LGA, and both are greater than across the Sydney metropolitan area as shown in Figure 5.4.

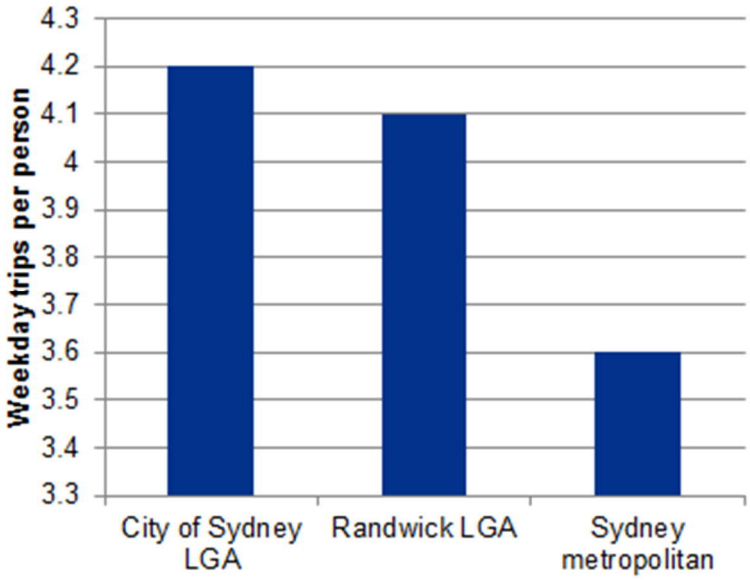


Figure 5.4: Weekday trips per person

Average trip length

The average trip length in the City of Sydney LGA is lower than in Randwick LGA and significantly lower than across the Sydney metropolitan area as shown in Figure 5.5.

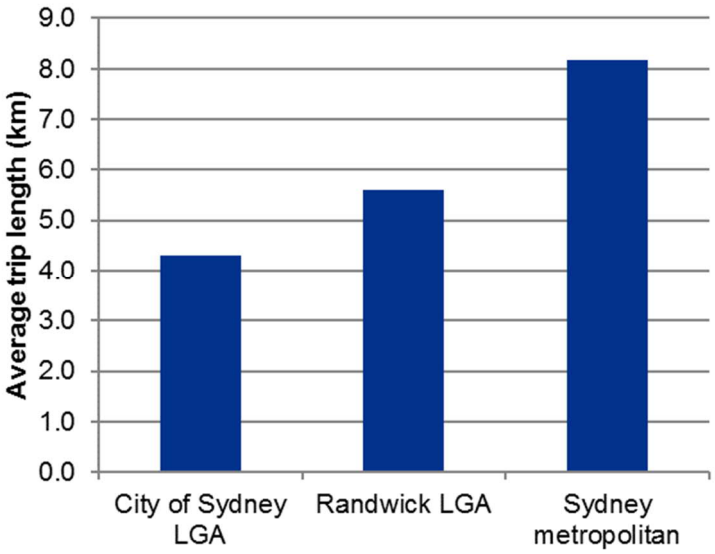


Figure 5.5: Average trip length

Vehicle kilometres travelled

Vehicle kilometres travelled (VKT) per person in the City of Sydney LGA are lower compared with Randwick LGA and less than half compared with the Sydney metropolitan area as shown in Figure 5.6.

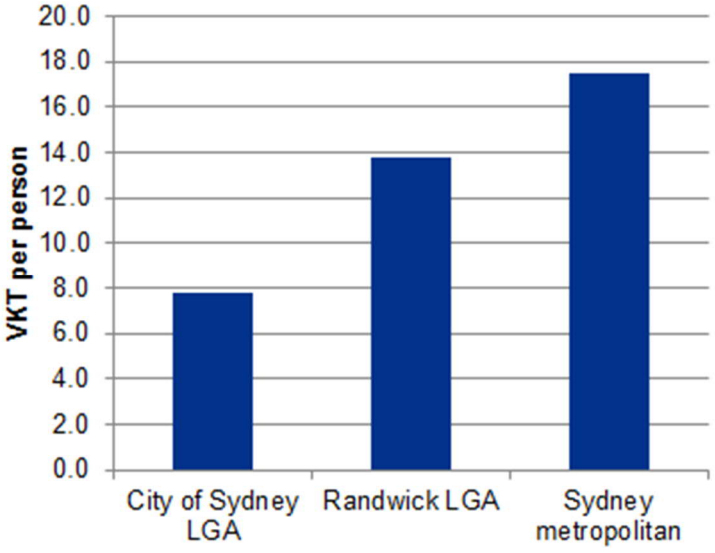


Figure 5.6: Vehicle kilometres travelled per person

Trip purpose

The purpose of trips undertaken differs noticeably between areas. Commute trips account for a larger proportion of trips than in Randwick LGA and metropolitan Sydney. Social recreation trips are much higher in the City of Sydney LGA and Randwick LGA than metropolitan Sydney. Shopping and personal business trips are much less common in the City of Sydney LGA and Randwick LGA than across metropolitan Sydney as shown in Figure 5.7.

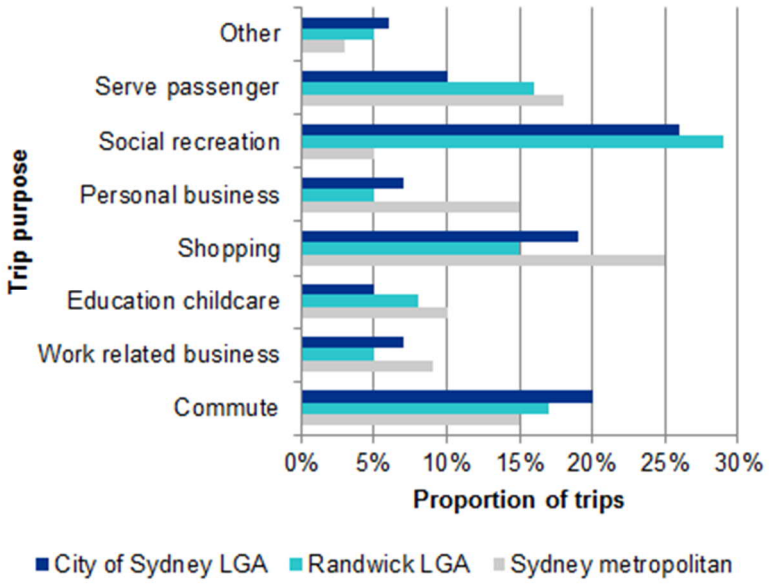


Figure 5.7: Trip purpose[4]

5.1.4 Existing trip generation

Based on an assessment of person trip rates from trip generation surveys (see Section 6.7.3) and the RMS Guide to Traffic Generating Developments, a development of 2,137 dwellings such as the current Waterloo Precinct would generate approximately 1,400 peak hour person trips. Applying the observed mode share to these trips leads to the trip breakdown shown in Table 5-4. It is recognised that many existing residents do not own a car and travel generated by the Estate often occurs outside of the peak periods on the surrounding network.

Table 5-4: Existing trip generation

Mode	Peak hour trips
Train	350
Bus	210
Private vehicle	435
Walk only	280
Other (including rideshare)	125

[4] Note: 'Serve passenger' applies to trips undertaken for the purposes of accompanying another person undertaking a trip, for example a carer accompanying a person requiring assistance.

5.2 Public transport network

5.2.1 Heavy rail

The Waterloo Precinct is located approximately one kilometre from both Redfern and Green Square stations. Redfern station is one of the busiest stations on the Sydney Trains network which provides frequent services to a large range of destinations, including Sydney CBD and Parramatta CBD. Green Square station is served by the T8 Airport & South Line, providing access to Sydney CBD and Sydney Airport.

5.2.2 Sydney Metro

Sydney Metro is a new standalone metro rail network. A component of Sydney Metro is Sydney Metro City & Southwest which is planned from Chatswood to Sydney CBD and Bankstown, due to commence operating in 2024. Services on the new line will run at a minimum of every four minutes in each direction, with an ultimate capacity for trains to carry up to 46,000 people per hour in one direction during the peak hour. Sydney Metro City & Southwest will remove T3 Bankstown Line trains from the City Circle, providing congestion relief and greater capacity for T2 Inner West & Leppington and T8 Airport & South Line trains. This will result in a moderate increase in train capacity at Redfern station from 2024. Preliminary forecasts for the 2036 morning peak hour indicate that around 3,700 customers would be entering and around 2,350 customers would be exiting the Waterloo Metro Station (Chatswood to Sydenham EIS, 2016).

The Sydney Metro network is shown in Figure 5.8, while Figure 5.9 shows the rail network around Waterloo including Sydney Metro City & Southwest.

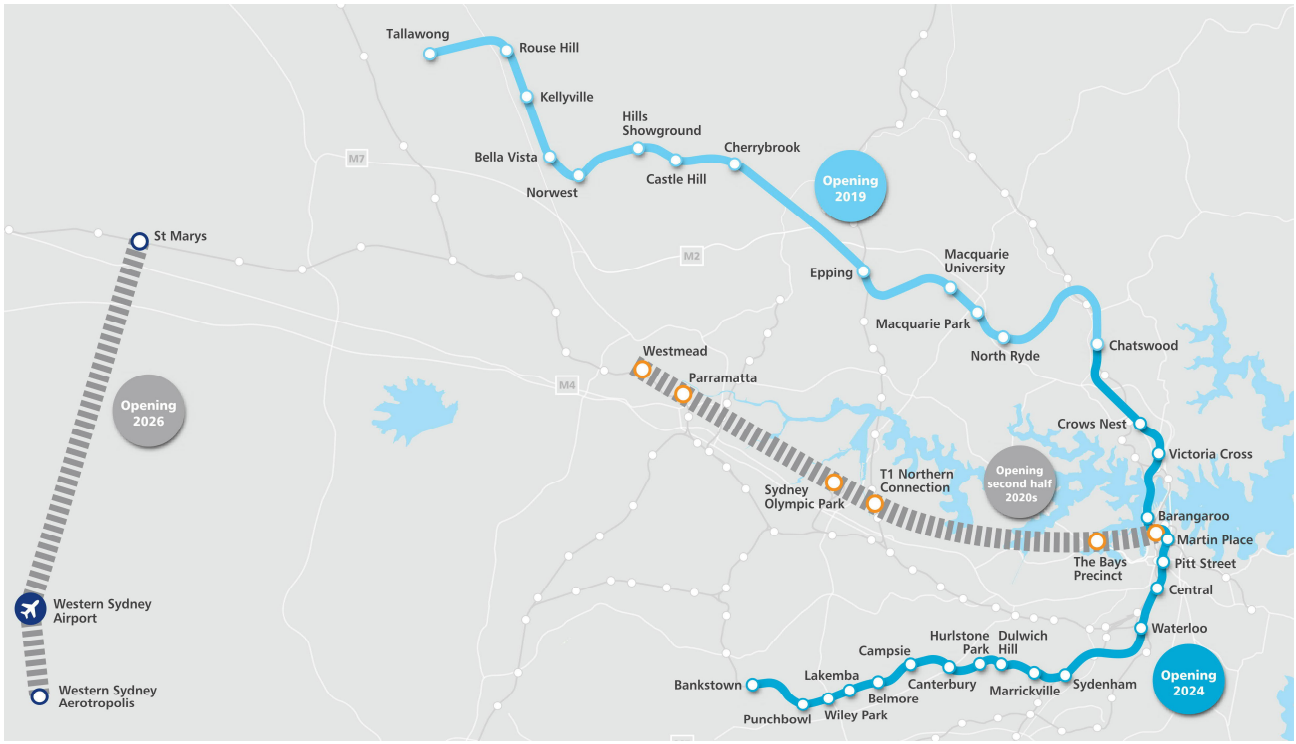


Figure 5.8: The Sydney Metro network

Source: TfNSW, 2018

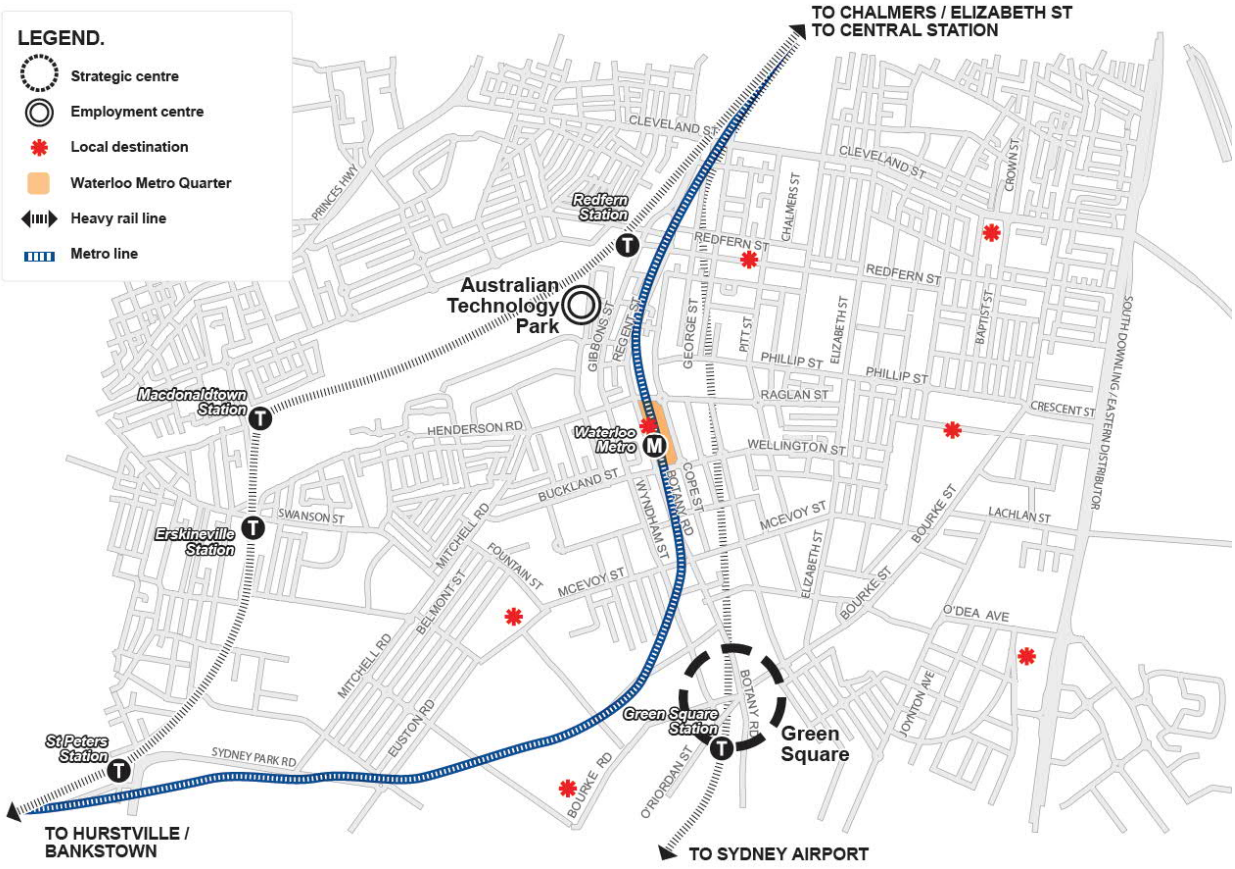


Figure 5.9: Rail network around Waterloo

Access to Waterloo Metro Station would be located at the northern end of the station on the corner of Raglan Street and Cope Street, with a second entry off Cope Street. Changes to bus stops have been identified during the Sydney Metro EIS process and include the relocation of the southbound Botany Road stop further north to integrate with the station entrance. In addition, point to point facilities and a taxi rank would be provided on Cope Street, further improving the amenities available to customers of the metro network.

The forecast mode of arrival during the 2036 morning peak hour as identified in the Sydney Metro EIS is presented in Figure 5.10. The majority of customers are anticipated to walk to the station from the local area while around 19 per cent of customers are expected to interchange between bus services and the metro network. These forecasts also account for cumulative growth in the broader area, including redevelopment of the Waterloo Precinct.

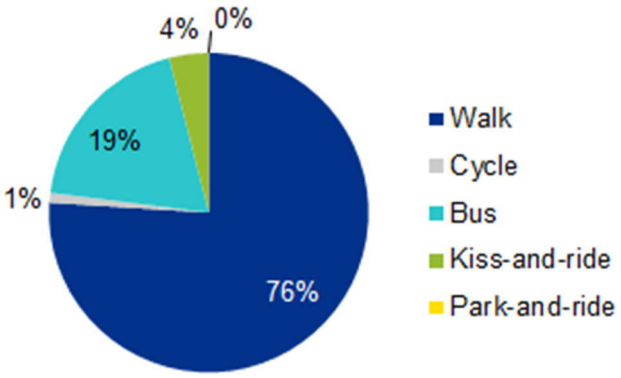


Figure 5.10: Forecast morning peak arrival mode at Waterloo Metro Station

Source: Sydney Metro EIS Technical Paper 1: Traffic and Transport, 2016

5.2.3 Bus services

The existing bus network in and around Waterloo is heavily focussed on north-south travel, particularly for access to Sydney CBD as shown in Figure 5.11. Botany Road is a key bus corridor for these services which connects Sydney CBD with Redfern, Waterloo, Alexandria, Green Square, Mascot and Botany. These north-south routes are typically frequent and operate a wide span of hours. Bus services also operate east-west routes, linking Randwick, Coogee, Bondi Junction, Moore Park and Kingsford to the east with Glebe, Newtown, Marrickville and Sydenham to the west. As the area surrounding Waterloo Precinct is rapidly developing, bus routes serving the area are subject to change as bus passenger demands increase, particularly in Green Square and Zetland.

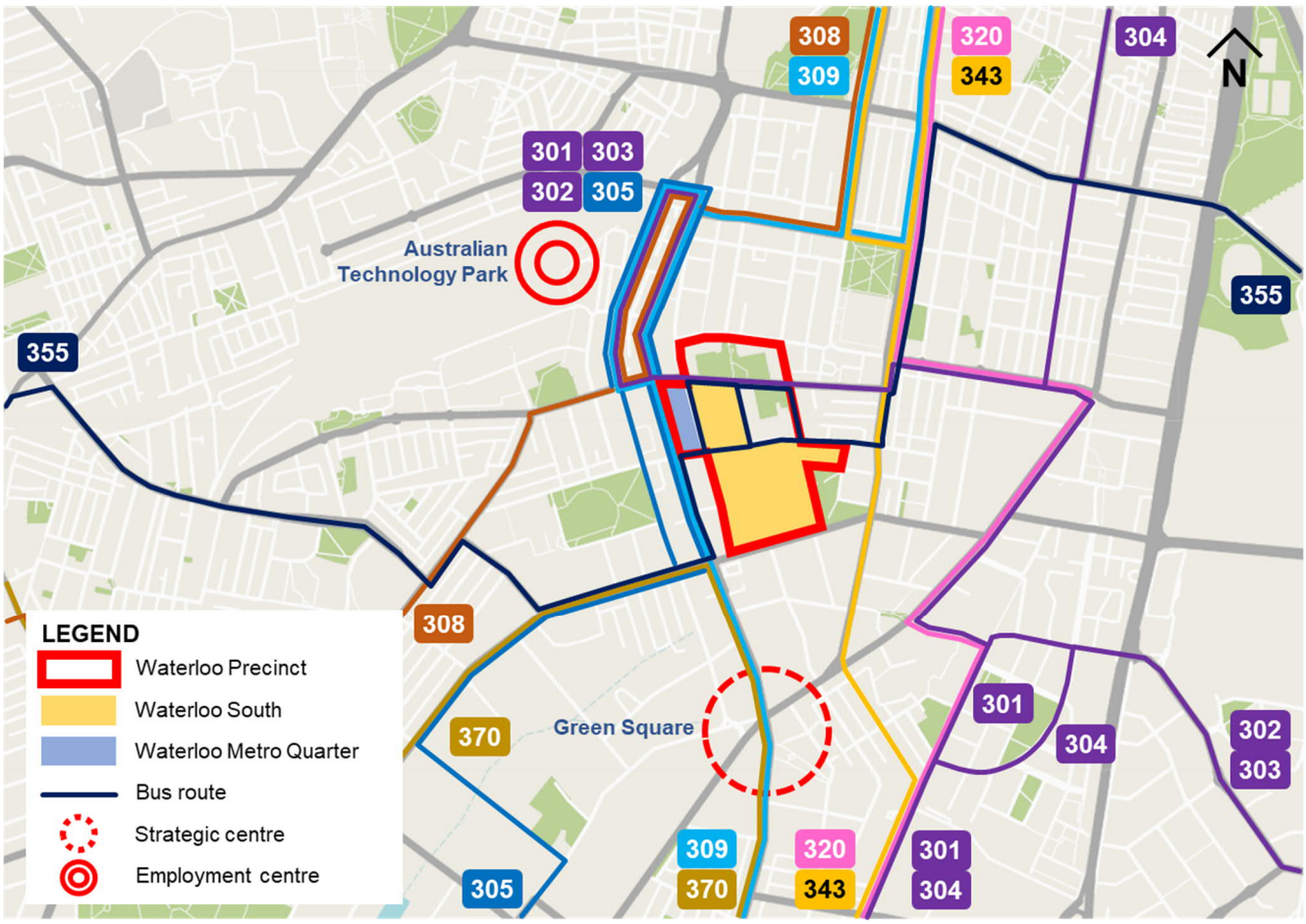


Figure 5.11: Existing bus network around Waterloo

5.3 Active transport

5.3.1 Cycle network

The regional cycle network surrounding Waterloo is shown in Figure 5.12.

The cycle network currently provides access to a range of key destinations including the University of Sydney, Redfern station, Sydney CBD, Newtown and Moore Park. East-west movement is constrained by the existing heavy rail corridor to the west, which limits access to the north of the rail line and to Carriageworks and the University of Sydney. There are limited and sparsely located crossing opportunities, including Lawson Street at Redfern station.

The City of Sydney, as part of its cycle network strategy, has identified ten priority cycle routes across the inner-city including through the Waterloo Precinct. Key routes include:

- City North to Green Square: running north-south through the Waterloo Precinct, complete as far as Green Square with a separated cycleway on George Street through Waterloo. This route would be the most direct north-south connection to the Waterloo Metro Station; however, the proposed alignment along George Street through the Waterloo Precinct would result in the potential for conflict between high-speed commuter cycle trips and other users along the proposed activity street that would run along George Street through Waterloo Precinct between Phillip Street and McEvoy Street.
- Sydney Park to Central Park: running east-west through the Waterloo Precinct, upgrades are identified on Buckland Street, Wellington Street, Morehead Street and Phillip Street, Waterloo. This route would be the most direct east-west connection to the Waterloo Metro Station.
- Newtown to Bondi Junction: running east-west through Redfern on Wells Street and Turner Street, upgrades are currently in progress
- University of Sydney to University of New South Wales: running east west through Alexandria
- Sydney Harbour to Botany Bay: running north-south along Bourke Street, complete with separated cycleway for much of its length.

As part of the Alexandria to Moore Park Connectivity Upgrade, a shared path is proposed along the northern side of McEvoy Street west of George Street, continuing on the southern side of McEvoy Street east of George Street. Cyclists would be required to cross McEvoy Street at its intersection with George Street. If approved, the upgrade would facilitate east-west movements to and from the Waterloo Precinct.

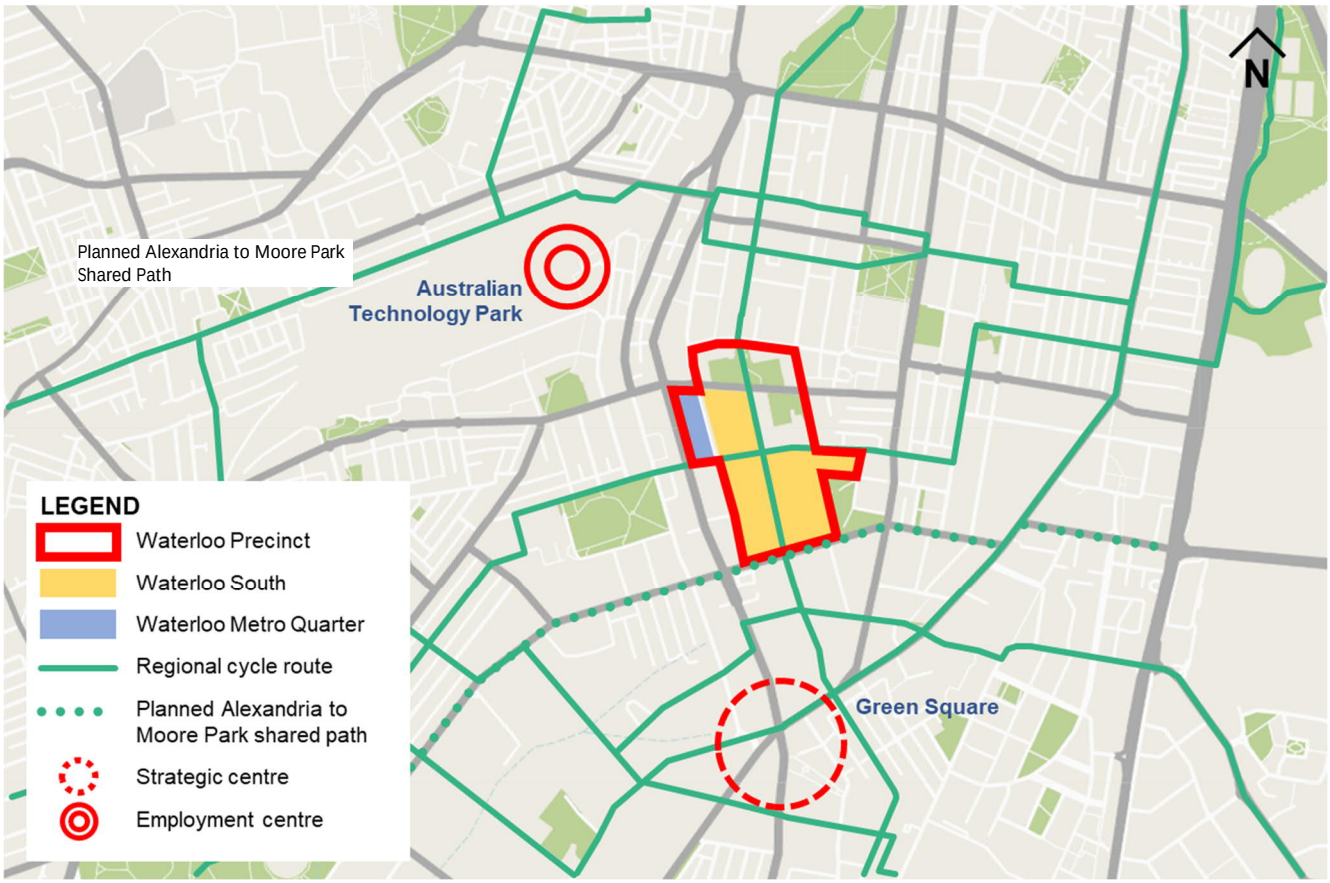


Figure 5.12: Existing and planned cycle connectivity around Waterloo

5.3.2 Pedestrian network

The existing structure of the street network in and around the Waterloo Precinct is generally well suited to walking. A clear grid pattern of streets allows for direct connections to be made and provides good legibility for pedestrians. The topography begins to rise immediately east of Waterloo Precinct. In addition, the footpaths surrounding the precinct are cracked and show signs of wear and tear, requiring resheeting to improve pedestrian safety.

The provision of pedestrian facilities at intersections surrounding the Waterloo Precinct include:

- Signalised pedestrian crossings on all approaches of the Botany Road / Raglan Street / Henderson Road intersection.
- Signalised pedestrian crossings on all approaches of the Botany Road / Wellington Street / Buckland Street intersection.
- Signalised pedestrian crossings on all approaches of the George Street / McEvoy Street intersection.
- Marked mid-block pedestrian crossings at:
  - Cope Street, north of Raglan Street
  - Raglan Street at George Street
  - Wellington Street at George Street.

Upgrades to pedestrian facilities throughout the Waterloo Precinct will be necessary to accommodate the large pedestrian demand expected in the area, particularly towards the metro station on Raglan Street and Cope Street.

Ensuring high-quality urban design and streetscape outcomes for the development of the Waterloo Precinct would be required to enhance the pedestrian network. Major roads such as Botany Road and McEvoy Street, which form a barrier to pedestrian movements and access across these streets, would need to be carefully planned.

5.4 Road network

5.4.1 Key roads

The road network in and around the Waterloo Precinct is fairly constrained. Most local streets in the area have 50 kilometres per hour speed limits and are two lanes wide, with some streets designated as 40 kilometres per hour zones including George Street and Redfern Street. Major arterial roads include Botany Road, Wyndham Street and Henderson Road.

Traffic data collected in May 2017 shows traffic volumes greater than 1,000 vehicles per hour during the peak hour on Botany Road, Elizabeth Street, Henderson Road and McEvoy Street. Botany Road and Wyndham Street operate as a north-south one-way pair between Cleveland Street and Henderson Road, providing a key link between Sydney Airport and its surrounding suburbs to the Sydney CBD and Inner West; it is also a designated route for dangerous goods, providing an alternative for trucks that would otherwise travel through the Eastern Distributor tunnels. McEvoy Street and Henderson Road both run east-west, providing links between the inner-southern suburbs and the Sydney CBD or Eastern Suburbs. Key roads and current peak hour volumes are outlined in Table 5-5.

Table 5-5: Traffic volumes (bi-directional) and heavy vehicle proportions (2017)

Road	Morning peak hour (8.00 am to 9.00 am)		Evening peak hour (5.00 pm to 6.00 pm)	
	Volume (vehicles)	Proportion of heavy vehicles	Volume (vehicles)	Proportion of heavy vehicles
Botany Road between Wellington Street and Raglan Street	1,860	7%	1,820	5%
Wyndham Street between Buckland Street and Henderson Road	610	10%	590	3%
Henderson Road between Wyndham Street and Botany Road	1,950	5%	2,110	2%
Raglan Street between Botany Road and Cope Street	580	4%	580	1%
McEvoy Street between Wyndham Street and Botany Road	1,710	9%	1,690	3%
McEvoy Street between Botany Road and George Street	1,190	8%	1,050	2%
Elizabeth Street between Raglan Street and Wellington Street	1,660	8%	1,970	4%
Wellington Street between Botany Road and Cope Street	370	3%	330	3%
Cope Street between Raglan Street and Wellington Street	170	5%	160	3%

Source: Traffic counts collected in May 2017

Traffic volume data collected at the permanent RMS count station located on O'Riordan Street, 100 metres north of Johnson Street in Alexandria, shows that peak weekend traffic volumes are slightly lower than peak weekday traffic volumes. Therefore, the performance assessment of the road network presented in Section 6.7.4, which is of the morning and evening peaks, represents a worst-case scenario.

Figure 5.13 shows the key regional roads surrounding Waterloo.

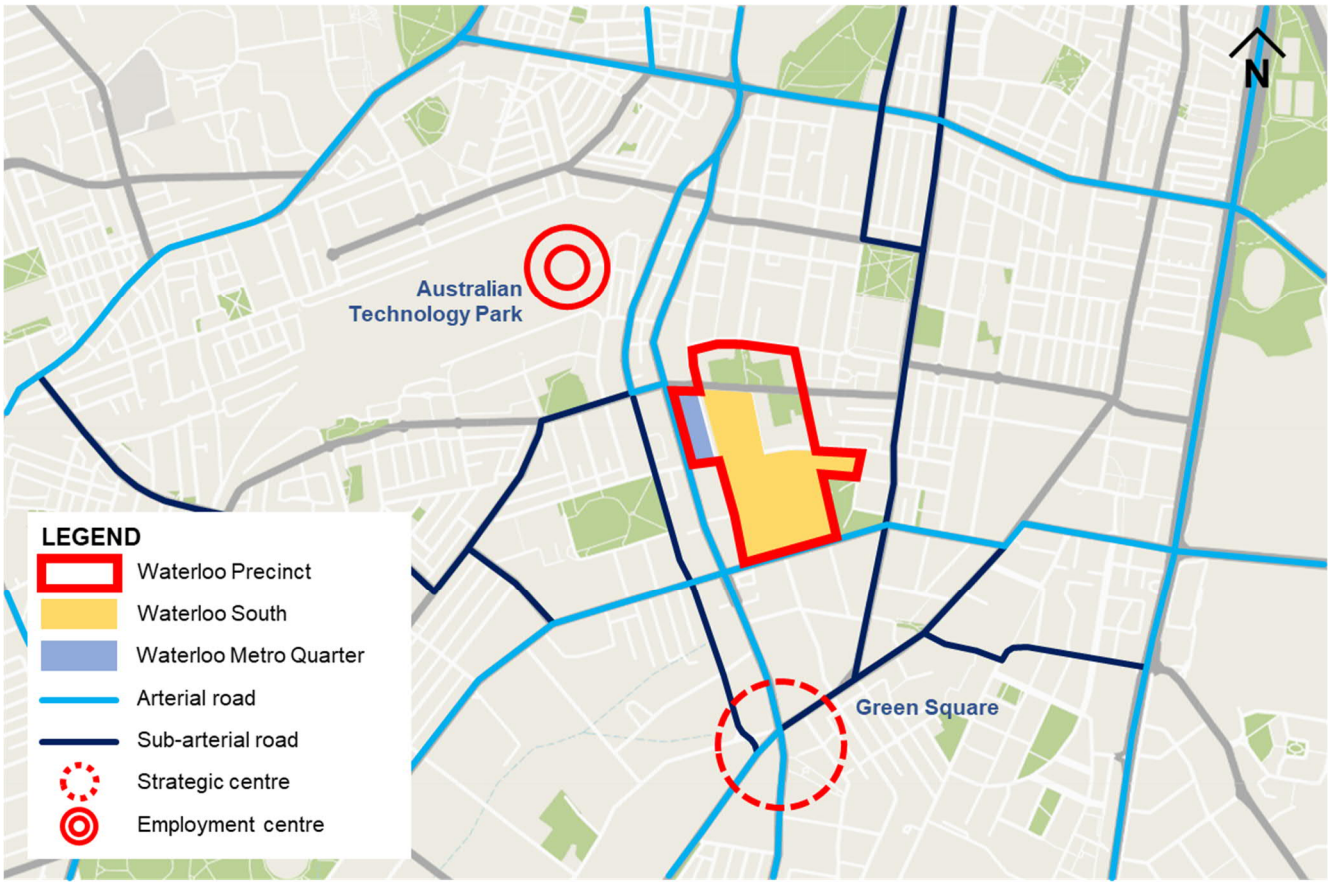


Figure 5.13: Arterial road network around Waterloo

Traffic congestion during peak periods is typically observed at the following locations surrounding the Waterloo Precinct:

- Raglan Street on approach to Botany Road
- Cope Street on approach to Botany Road
- McEvoy Street between Elizabeth Street and Botany Road.

This peak period congestion indicates that the roads surrounding the Waterloo Precinct, particularly at the interface with the Botany Road and Wyndham Street corridor, are performing at or close to capacity during peak periods.

5.4.2 Alexandria to Moore Park Connectivity Upgrade

RMS has developed concept designs for the Alexandria to Moore Park Connectivity Upgrade, which will involve upgrades along the corridor between the WestConnex interface at Euston Road and Anzac Parade. This includes intersection improvements and clearways on McEvoy Street, to the south of the Waterloo Precinct, realignment of the intersection of Bourke Street / McEvoy Street / Lachlan Street to the east and widening of Lachlan Street. Additional capacity created by these works has the potential to reduce demand on lower-order east-west corridors through the Waterloo Precinct such as Henderson Road, Raglan Street and Wellington Street. A Review of Environmental Factors for the connectivity upgrade was exhibited in 2019.

5.5 Strategic opportunities

The strategic analysis has highlighted characteristics of the existing travel behaviour and transport network that can be built upon for the Waterloo Precinct. The main strategic opportunities that will inform the principles and assessment process for the Waterloo Precinct are highlighted below.

5.5.1 Proximity to Sydney Trains network and future metro will provide excellent rail access

Sydney Metro City & Southwest will directly improve public transport access between the Waterloo Precinct and a range of destinations including Sydney CBD, North Sydney, Chatswood, Macquarie Park, Sydenham and Bankstown. It will also indirectly provide improved travel times and connections with other parts of Sydney by providing interchange opportunities with other public transport services at key locations. Sydney Metro will operate a wide span of hours, from early in the morning to late at night, seven days a week. This will provide a high level of service and access into and out of the Waterloo Precinct across the whole day, supporting 24/7 activity.

The new Sydney Metro station at Waterloo provides a unique opportunity to support low private vehicle usage in the Waterloo Precinct. Together with the existing rail access provided at Redfern and Green Square stations, there would be a significantly diminished need to use motor vehicles for most travel into and out of the Waterloo Precinct in the future. This would result in less traffic on local streets, less added traffic on the wider road network and would provide greater accessibility and mobility for residents without the need to service the significant cost of a vehicle.

5.5.2 Improved public transport to local destinations

Acting as the key north-south link through the Waterloo Precinct, Sydney Metro will be a catalyst for improving the local public transport network. The metro offers the opportunity of building a denser public transport network with more frequent services (in all directions) to serve the subregion surrounding Waterloo. In particular, there is an opportunity to enable stronger east-west connections, providing cross-regional links and feeding major rail lines.

Currently, bus services provide frequent north-south connections. However, east-west connections are often infrequent and served by long routes that have reduced reliability. With Sydney Metro, greater emphasis could be placed on east-west bus connections which feed into heavy rail and metro hubs. The east-west bus network services origin-destinations that have a strong relationship such as Newtown, Green Square, Surry Hills, Glebe, the University of Sydney and the University of New South Wales.

Services on Botany Road will also continue to be important as they provide access to the Southern Sydney Employment Lands and interchange to the metro to access CBD destinations. This second factor would be particularly attractive for people wishing to access mid-CBD and northern CBD areas, including North Sydney.

5.5.3 Street network structure and traffic management to limit impacts in and around Waterloo

In order to achieve positive transport and land use outcomes and minimise traffic impacts of the Waterloo Precinct on the surrounding road network, it is necessary to set a strategic framework to ensure any subsequent proposals are consistent with the future role and function of a particular street. This framework is a vital step in transport planning for the Waterloo Precinct and is heavily influenced by the land use plans. In turn, the framework informs the land use and can create opportunities or constraints for the type of land use that can occur along a particular street.

The framework defines the future function of the street network on the basis of land use and transport objectives and desired outcomes for the Waterloo Precinct. The roads within and around the precinct provide two primary functions for transport customers:

- Movement: the ability to travel between places
- Place: the ability to access origins and destinations of travel.

An understanding of the two functions of a street are vital when the two functions are competing, such as through increased movement requirements or improved place amenity. The movement and place function of a street informs planning for the level of access across each of the transport modes.

The Waterloo Precinct is bounded on two sides by Botany Road and McEvoy Street, both busy arterial road corridors with significant movement functions. In the vicinity of the precinct, Botany Road also has a place function due to the presence of retail and commercial land uses fronting the road.

Within the Waterloo Precinct, Cope Street and Raglan Street east of Cope Street will have a prioritised place function, given the proximity of Waterloo Metro Station entrance in this area. This would shift the focus of these streets to minimise the movement function and prioritise access for people instead.

5.5.4 An urban form that promotes walking and cycling

Active transport will play a significant role in short and medium distance trips to, from and within the Waterloo Precinct.

As shown in Figure 5.14, the density of land uses and permeability of the street network results in the 800 metre walking catchments of Redfern station, Waterloo Metro Station and Green Square Station overlapping one another. This indicates significant potential for walking for many trips, particularly in combination with mass transit.

Dedicated north-south cycle facilities are currently provided on George Street. This provides strong connections to jobs, retail and leisure activities in Sydney CBD and Green Square, with the latter projected to grow significantly in the future with the development of Green Square Town Centre. A priority regional cycle route from Sydney Park to Central Park, one of ten identified in City of Sydney's regional cycling network, passes through the Waterloo Precinct in an east-west direction. Upgrades to accommodate this regional cycling route are identified on Buckland Street, Wellington Street, Morehead Street and Phillip Street.

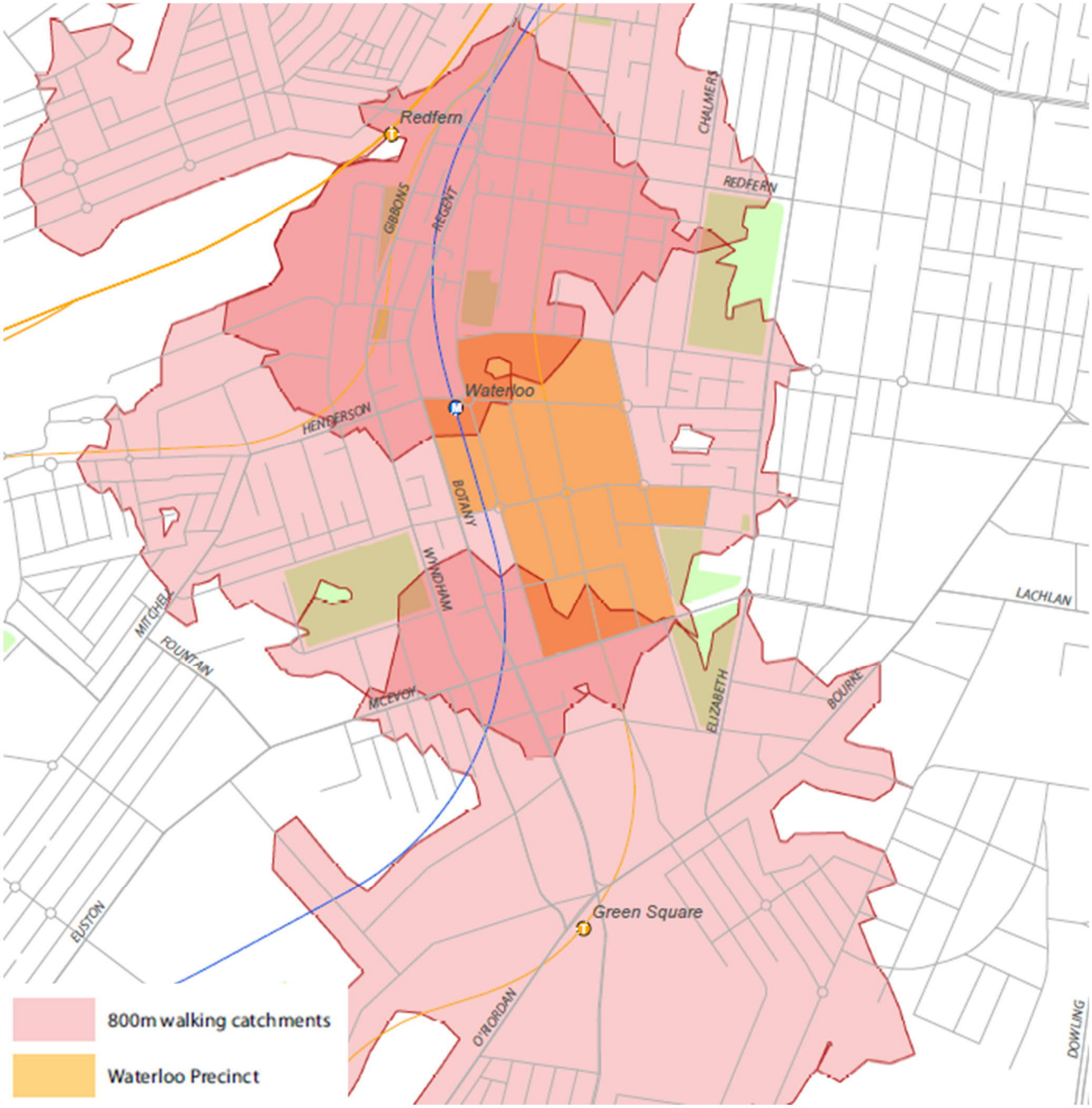


Figure 5.14: 800 metre walking catchments; Redfern station, Waterloo station and Green Square station

5.5.5 Appropriate future parking rates

Parking for residential, commercial and retail uses could be reduced to below the legislated maximum parking rates permitted in Sydney LEP 2012 (SLEP 2012). This would put downward pressure on private vehicle mode share and trip generation.

Under SLEP 2012 the Waterloo Precinct is currently located in Category B for residential car parking. Reducing parking provision would be appropriate considering Waterloo's inner-city location, proximity to Sydney CBD and future access with Sydney Metro. Category A rates from SLEP 2012, which are more restrictive and generally apply to dense inner-city areas close to Sydney CBD, are a more appropriate starting point when considering appropriate parking rates for the Waterloo Precinct. Maximum residential parking rates per dwelling for Category A and Category B are shown in Table 5-6.

Table 5-6: Maximum residential parking rates per dwelling (SLEP 2012)

Dwelling type	Category A rate	Category B rate
Studio	0.1 spaces	0.2 spaces
1 bedroom	0.2 spaces	0.4 spaces
2 bedrooms	0.7 spaces	0.8 spaces
3 or more bedrooms	1 space	1.1 spaces

5.5.6 Self-containment

The right balance and mix of land uses could enable a high level of trip self-containment within the Waterloo Precinct and surrounds. This could involve providing more opportunities to work, shop and engage in recreational pursuits in and around the precinct, minimising the number and distance of trips required to be undertaken by future residents of the precinct.

5.6 Future mode share targets

An assessment of the potential future mode shares has been undertaken in consultation with TfNSW, RMS and City of Sydney and is based on existing data and the strategic opportunities for the Waterloo Precinct. The mode share targets in the morning peak for all trip purposes are outlined in Figure 5.15.

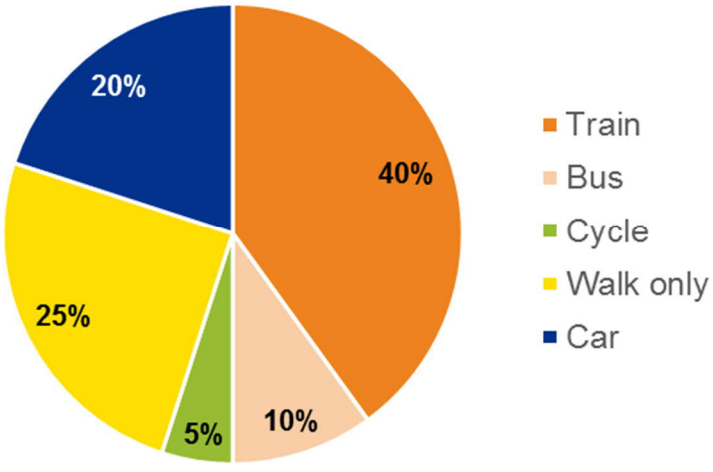


Figure 5.15: Waterloo Precinct future mode share targets

These targets are based on a number of factors, including:

- Proximity to Waterloo Metro Station, which will provide access to high-quality mass transit services on Sydney Metro City & Southwest
- Densely located land uses, activities and attractors as well as proximity to Sydney CBD and Green Square, enabling shorter trip lengths that are more conducive to walking and cycling
- Low existing traffic generation rates in recent high-density developments in Waterloo and Redfern and high (81 per cent) morning peak non-car mode share observed at the Redfern traffic generation survey site (detailed further in Section 6.7.3)
- Assumed enhancements to the bus network to strengthen east-west routes, enabled by Sydney Metro City & Southwest (yet to be announced by TfNSW) and improved cycling connections with key surrounding destinations.

6. Proposal assessment

6.1 Overview

This chapter details the appraisal of the proposal from a transport perspective and addresses the study requirements stipulated by the Minister for Planning and City of Sydney. The additional demands on the transport network as a result of the Waterloo South planning proposal have been quantified and the impacts to all transport modes have been assessed. Mitigation measures have been proposed where required in order to maximise safety and efficiency for all road and public transport users.

Scoping meetings were held with RMS and TfNSW to confirm the methodology of this assessment on 2 May 2017. Other transport-related issues have been investigated including on and off-street parking provision, bicycle facilities and vehicle access considerations.

6.2 Guiding transport principles

The planning of the transport network for the Waterloo Precinct has been informed by a guiding set of principles. These principles seek to ensure that the future residents and workers of the precinct will have the benefit of choice – not only for their travel mode, but for when and where they wish to travel for live, work and play activities. The principles build on the strategic opportunities for the precinct identified in Section 5.5. These principles have been reviewed by TfNSW, RMS and City of Sydney during the planning process.

Principle 1: Support the development of transport networks that provide 24 hour / 7 days a week access

Ensure that residents and workers are provided with multiple high-quality transport options to reach a variety of destination(s) for live, work and play activities in a 24 hour / 7 day a week economy and to support connections to the metro system.

Principle 2: Encourage access by public transport, walking and cycling to reduce car dependence

Provide high-quality public and active transport linkages and sustainable approaches to parking provision that encourages residents to live car-independent lifestyles if they choose to do so.

Principle 3: Support walkable urban environments

Ensure an integrated land use and transport outcome that supports walkable streets and high-quality urban outcomes within the precinct, including active street frontages, fine-grained development pattern and a connected, permeable street network.

Principle 4: Strengthen east-west connections

Take advantage of the north-south connectivity provided by the metro by strengthening east-west connections, particularly for active transport and buses.

Principle 5: Minimise impacts to regional connections

Ensure that any impacts to regional connections for public transport and freight, such as Botany Road, are minimised where possible.

Principle 6: Support a hierarchy of access based on time of day

Develop and implement a hierarchy of access that prioritises access for people and goods based on time of day using the movement and place approach.

6.3 Future transport demand

The transport demand generated by the Waterloo South planning proposal has been calculated based on the future mode share targets outlined in Section 5.6 and an analysis of total travel demand based on trip generation surveys for sites of a similar nature. Waterloo South demand as well as background movements have also been informed by consideration of the cumulative impacts of known surrounding developments such as Australian Technology Park.

Residential trips

The RMS Guide to Traffic Generating Developments – Updated traffic surveys (TDT 2013/04a) provides data on the number of person trips per dwelling for eight high-density sites in the Sydney metropolitan area, within walking distance of mass transit. This data, combined with the additional surveys undertaken for this study (see Section 6.7.3), suggests an appropriate average trip generation rate of 0.71 person trips (all modes) per dwelling in the peak hour. This trip rate accounts for all trip purposes.

Considering the 3,048 dwellings in the Waterloo South planning proposal and applying the assumed mode shares leads to the peak hour trip volumes shown in Table 6-1. These demands have been used as the basis of the transport assessment presented in the remainder of this section. While the final mix of apartment types could vary the final dwelling numbers, this will not materially affect the traffic generation of the site.

Table 6-1: Waterloo South morning peak one-hour trip generation by mode

Trips per dwelling (all modes)	Number of dwellings in Waterloo South	Waterloo South trips (morning peak hour)					
		All modes	Rail (40%)	Bus (10%)	Cycling (5%)	Walk (25%)	Car (20%)
0.71	3,048	2,164	866	216	108	541	433

Note – the trip generation by mode calculated in this table does not take into account infrastructure interventions including the Alexandria to Moore Park Connectivity Upgrade and WestConnex

Non-residential trips

Proposed non-residential uses in Waterloo South are small in scale compared to the residential land use and will be designed to primarily support local residents, with limited peak hour non-car demand expected to be generated from outside the precinct. i.e. it is assumed that the above non-car demands include trips to / from non-residential land uses.

Non-residential car trips have been calculated based on an assessment of the type and scale of proposed land use, the accessibility to public and active transport and the scale of parking to be provided. Considering the local nature of proposed retail uses and the expected high non-car mode share of trips, it is assumed that each retail parking space will generate 0.4 trips in the morning peak hour and 0.8 trips in the evening peak hour. Considering the proposed 199 retail car spaces, this leads to 80 morning peak hour trips and 160 evening peak hour trips.

Trip distribution

Figure 6.1 shows the distribution of trips from the Waterloo Precinct that is forecast under the 2036 Project Scenario in the morning peak 3.5-hour period and the extents of the travel zone from which this distribution has been derived. These distributions have been derived from outputs of TfNSW's Public Transport Project Model modelling. The largest proportion of trips from the precinct are northbound trips (36 per cent), indicating travel towards Sydney CBD. A moderate proportion of trips are to the east (25 per cent) and south (21 per cent). Westbound trips (17 per cent) constitute the lowest proportion of trips by direction.

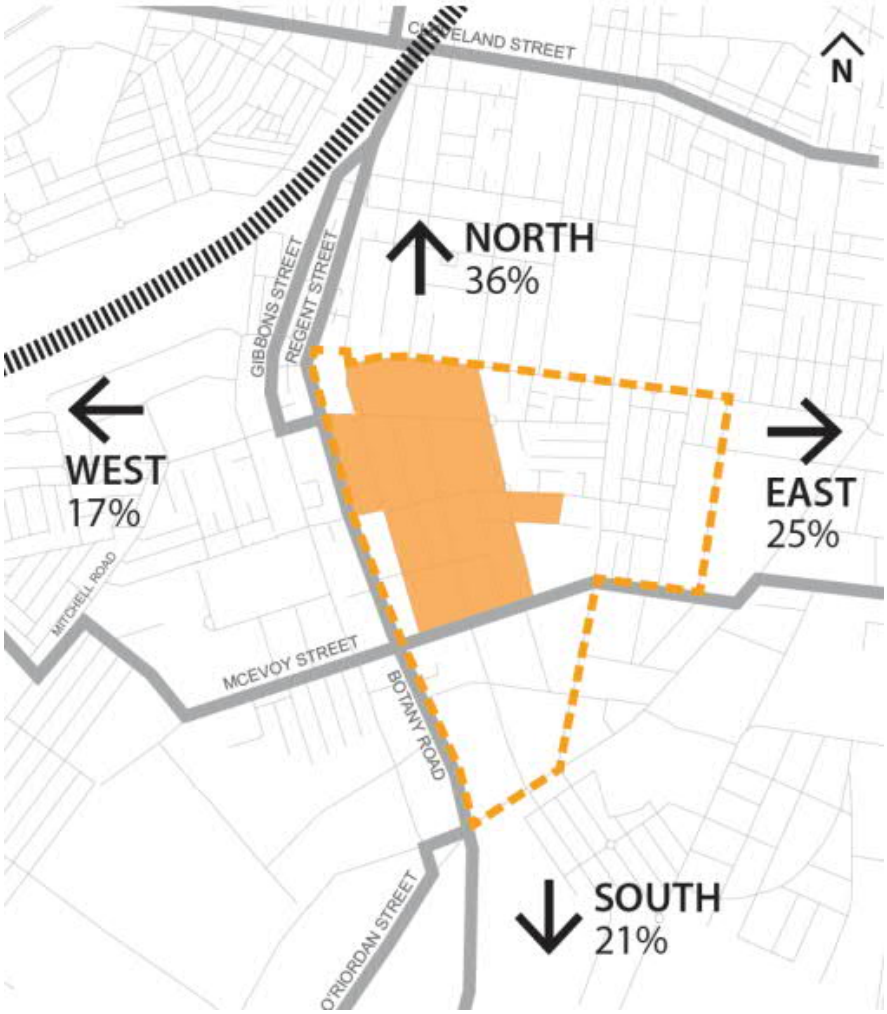


Figure 6.1: Direction of trips from the Waterloo Precinct (2036 morning peak)

6.4 Public transport

6.4.1 Rail

During the morning peak hour, 43 suburban trains heading towards Central station stop at Redfern station. In addition, a limited number of intercity trains also stop at Redfern station during the morning peak hour. Average spare capacity on inbound trains during the morning peak period and outbound trains during the evening peak period at Redfern station is limited. This is particularly evident on the T1 Western Line during the morning peak period and the T4 Illawarra Line during the evening peak period (refer to Figure 6.2 and Figure 6.3), where the majority of services operate at a load factor above 100 per cent. In these instances, there are not enough seats for every passenger. A load factor greater than 135 per cent, represented by the red columns, indicates that passengers experience crowding, and dwell times may impact the on-time running performance of the service.

Similarly, spare capacity on inbound train services stopping at Green Square Station during the morning peak period, particularly between 7.30 am and 9.00 am, is limited as shown in Figure 6.4. During the morning peak hour, ten trains stop at Green Square station for travel towards Central station.

The introduction of Sydney Metro would increase the capacity of the rail network in Sydney. The metro line is anticipated to have a target capacity of 46,000 customers per hour in one direction (Sydney Metro City & Southwest Final Business Case Summary, October 2016). The capacity of the Sydney Metro is almost double that of an existing heavy rail line. As such, capacity issues evident on services passing through or stopping at Redfern and Green Square stations are likely to be relieved once Sydney Metro is operational as existing customers at

these two stations would have the opportunity to use metro services at Waterloo station. A service capacity of 46,000 customers per hour in one direction combined with the existing heavy rail network is therefore considered sufficient to cater for forecast demand (866 peak hour trips) generated by Waterloo South, including the cumulative demand from future developments in the vicinity of the study area such as at Australian Technology Park.

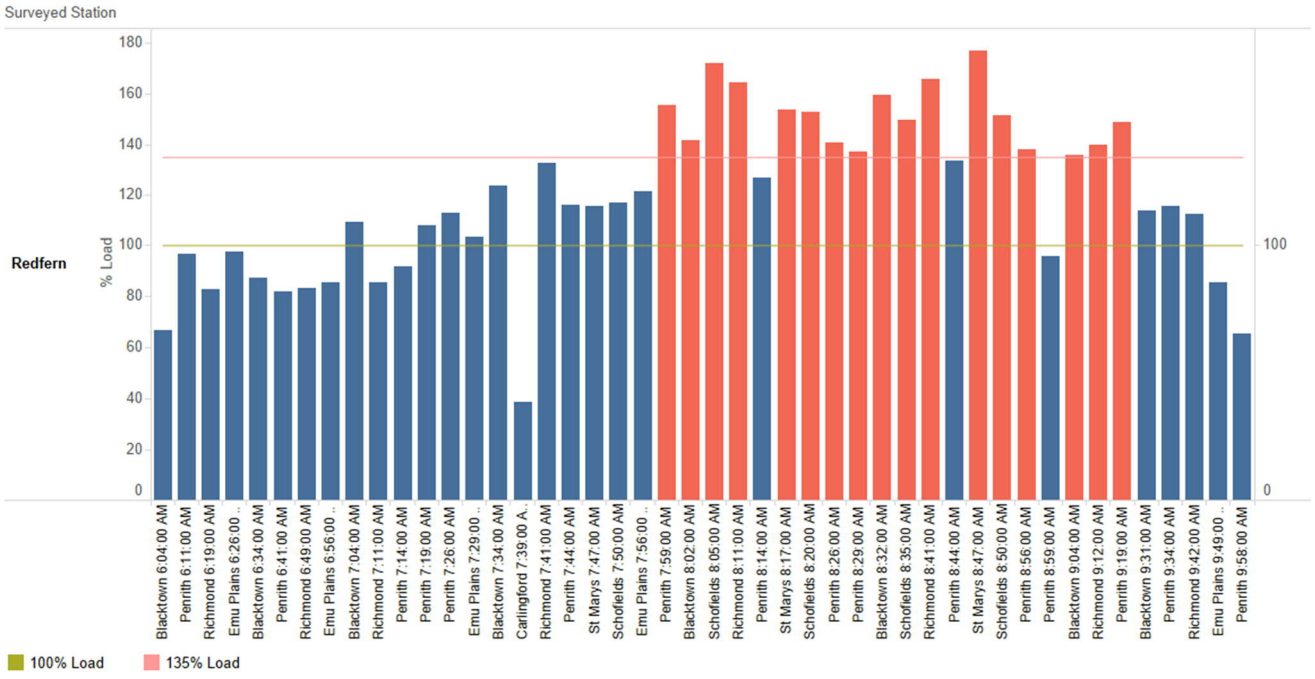


Figure 6.2: Passenger loading on the T1 Western Line at Redfern station during the morning peak period (inbound)

Source: TfNSW – Train loads, 2016

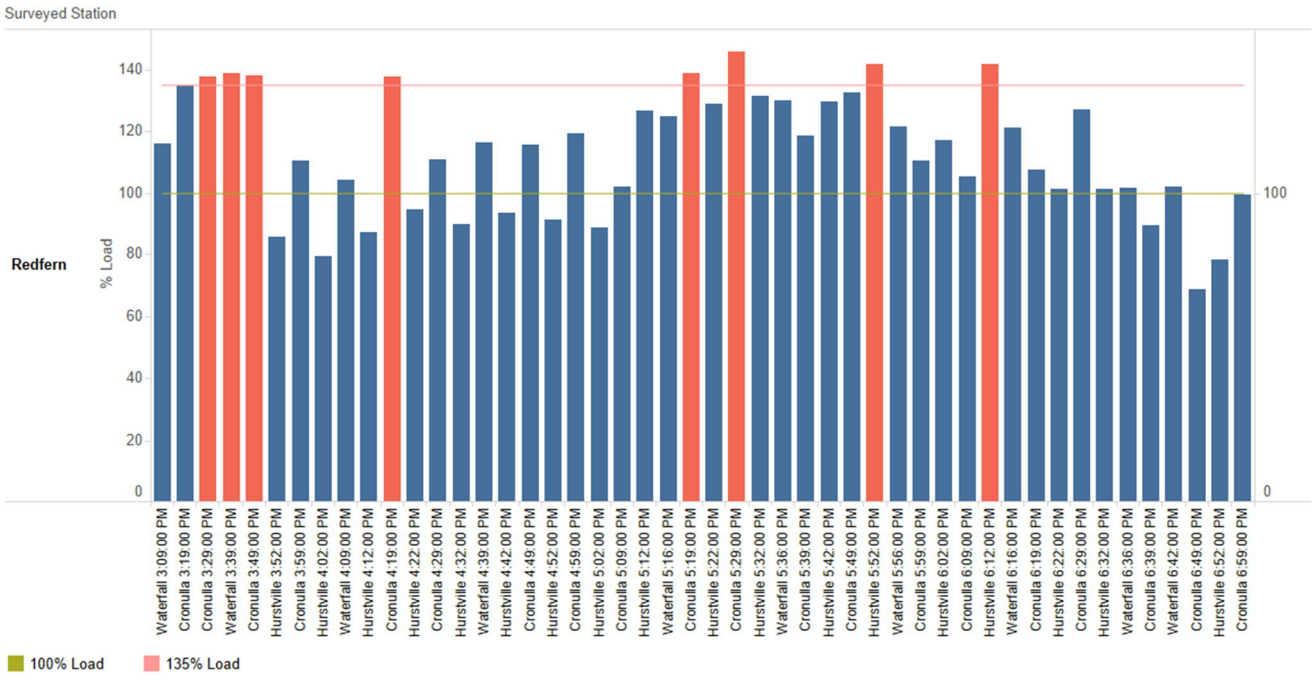


Figure 6.3: Passenger loading on the T4 Illawarra Line at Redfern station during the evening peak period (outbound)

Source: TfNSW – Train loads, 2016

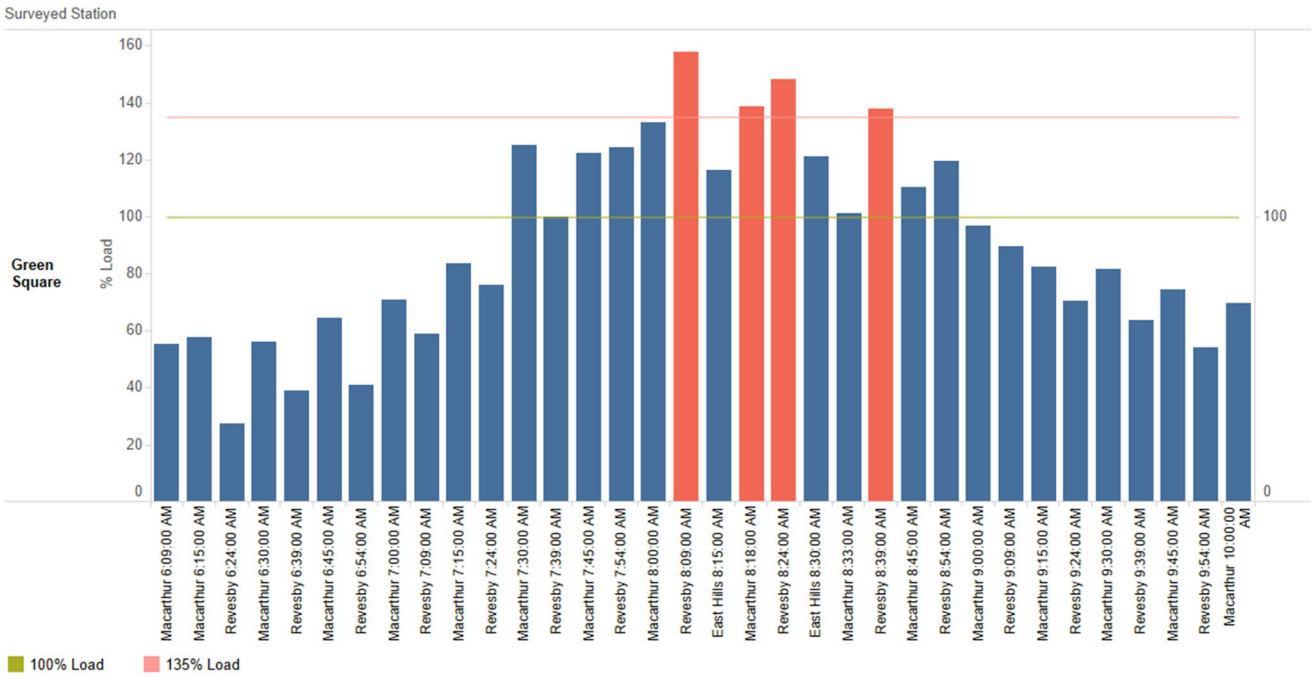


Figure 6.4: Passenger loading on the T8 Airport & South Line at Green Square Station during the morning peak period (inbound)

Source: TfNSW – Train loads, 2016

6.4.2 Bus

Figure 6.5 and Figure 6.6 show loading on two key routes serving the Waterloo Precinct. Citybound route 309 services operating along Botany Road exceed seated capacity on some services in the morning peak hour. However, many of these customers alight services at Green Square station, meaning capacity becomes available once services reach Waterloo.

Bus route 355 serving east-west trips in the area via Raglan Street and Wellington Street has spare capacity available on all services. Route 355 also serves a vital social function by providing access for many social housing tenants in the Waterloo Precinct; particularly those that are mobility impaired.

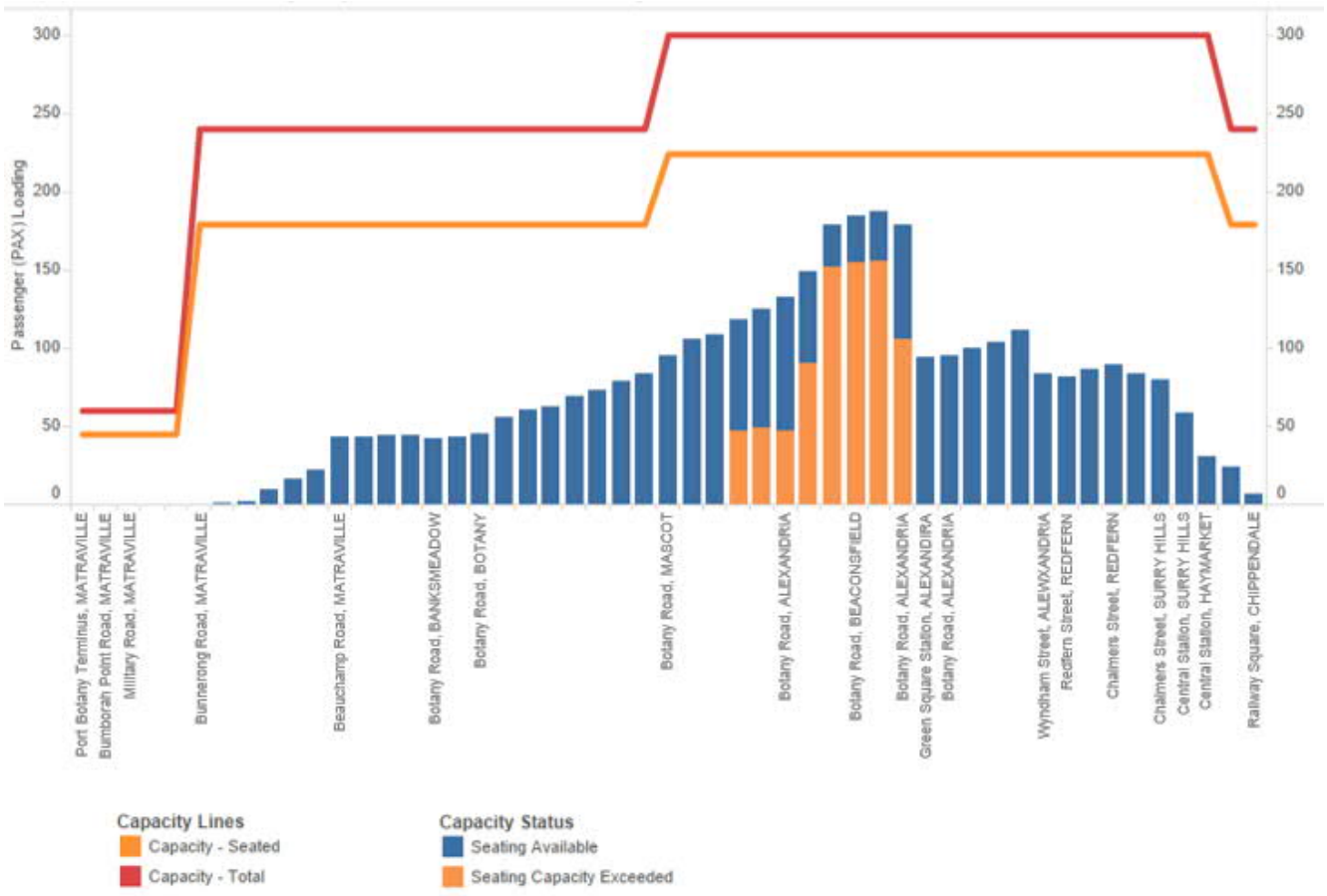


Figure 6.5: Bus service passenger loading on route 309 during the morning peak period (inbound)

Source: TfNSW – Opal data, 2017

Figure 6.6: Bus service passenger loading on route 355 during the morning peak period (inbound)

Source: TfNSW – Opal data, 2017

With the introduction of the Waterloo Metro Station, some localised changes to the bus network may be appropriate. These changes could also benefit the future residents within the Waterloo Precinct. Two primary changes could be:

- Route 355: Bondi Junction to Marrickville Metro via Waterloo. Increase frequency and span of hours to match metro operation and re-route via Wellington Street to more directly serve the station.
- Route 309: Port Botany to Central via Botany Road. Increase frequency and span of hours to match metro operation and serve significant bus-rail interchange demand.

Future residents of the Waterloo Precinct will have a range of transport needs. Mass transit connections to key employment centres will be facilitated by Sydney Metro and the existing heavy rail network to serve the needs of working age residents undertaking trips for employment. Improved local bus services will serve the needs of older residents, social housing tenants and school age children to access community, health and retail facilities located close to the Waterloo Precinct.

6.5 Active transport

6.5.1 Walking

The design of the internal streets and connections within Waterloo South has been undertaken with pedestrian safety, amenity and efficiency as a priority. Figure 6.7 outlines the proposed layout and hierarchy of the internal streets within Waterloo South. George Street will form the main walking ‘spine’ through the provision of an activity street approximately 25 metres wide. This corridor will attract nearby pedestrians of all levels of mobility, undertaking trips of varied purpose and allowing them to do so in a safe, comfortable and enjoyable environment. Locations where the activity street crosses existing or proposed roads in the precinct will be treated

with marked pedestrian crossings to provide pedestrian priority and safety. Two-way forecast vehicle flows at these locations are low, which will ensure safe and efficient movement for all road users is maintained at these locations.

Existing streets are proposed to be provided with new upgraded footpaths whilst the redevelopment will include the creation of a significant number of new streets and through-site links. The permeability afforded by these new connections will ensure that all walking trips are direct and legible and will enable a high level of active transport within the precinct.

Nearly 550 pedestrian trips are expected to be generated by the development in the peak one-hour weekday period and a significant number is also expected on weekends. The proposed level of dedicated pedestrian infrastructure, priority in shared zones and crossing facilities are considered appropriate to safely cater for this demand. High-quality and safe walking facilities will also ensure that active transport trips are maximised and car reliance is reduced for residents and visitors of Waterloo South.

6.5.2 Botany Road / Raglan Street intersection

The Botany Road / Raglan Street intersection was identified during the Metro Quarter SSP Transport Study as a critical location for future pedestrian movements, due to its proximity to the main metro station entrance. Work undertaken by Sydney Metro found that proposed widening of the pedestrian crossing on the southern leg of the intersection along with significant new footpath provision on Raglan Street will be sufficient to cater for demand from the metro station – including projected pedestrian demand from the Waterloo Metro Quarter and Waterloo South.

6.5.3 Botany Road / Wellington Street crossing facilities

The intersection of Botany Road and Wellington Street has been identified as a location which may be used by a significant number of pedestrians during peak periods. In particular, students walking from Waterloo South to Alexandria Park Community School may use this intersection to cross Botany Road. An assessment of the potential demand for this crossing and the adequacy of existing facilities has been undertaken.

Metro Quarter demand

The Metro Quarter SSP Transport Study notes that approximately 117 pedestrians will proceed westwards across Botany Road from the Metro Quarter in the morning peak hour. This is approximately 30 per cent of the total southbound pedestrian demand from the Metro Quarter.

The Waterloo State Significant Precinct Study – Metro Quarter – Population and Demographics Study (.id July 2018, page 97) estimates 83 school aged children living in the Metro Quarter in 2036. Assuming the same 30 per cent split (28 children), there is potential for a total of 145 pedestrians to proceed westwards across Botany Road via the northern leg of the Botany Road / Wellington Street intersection.

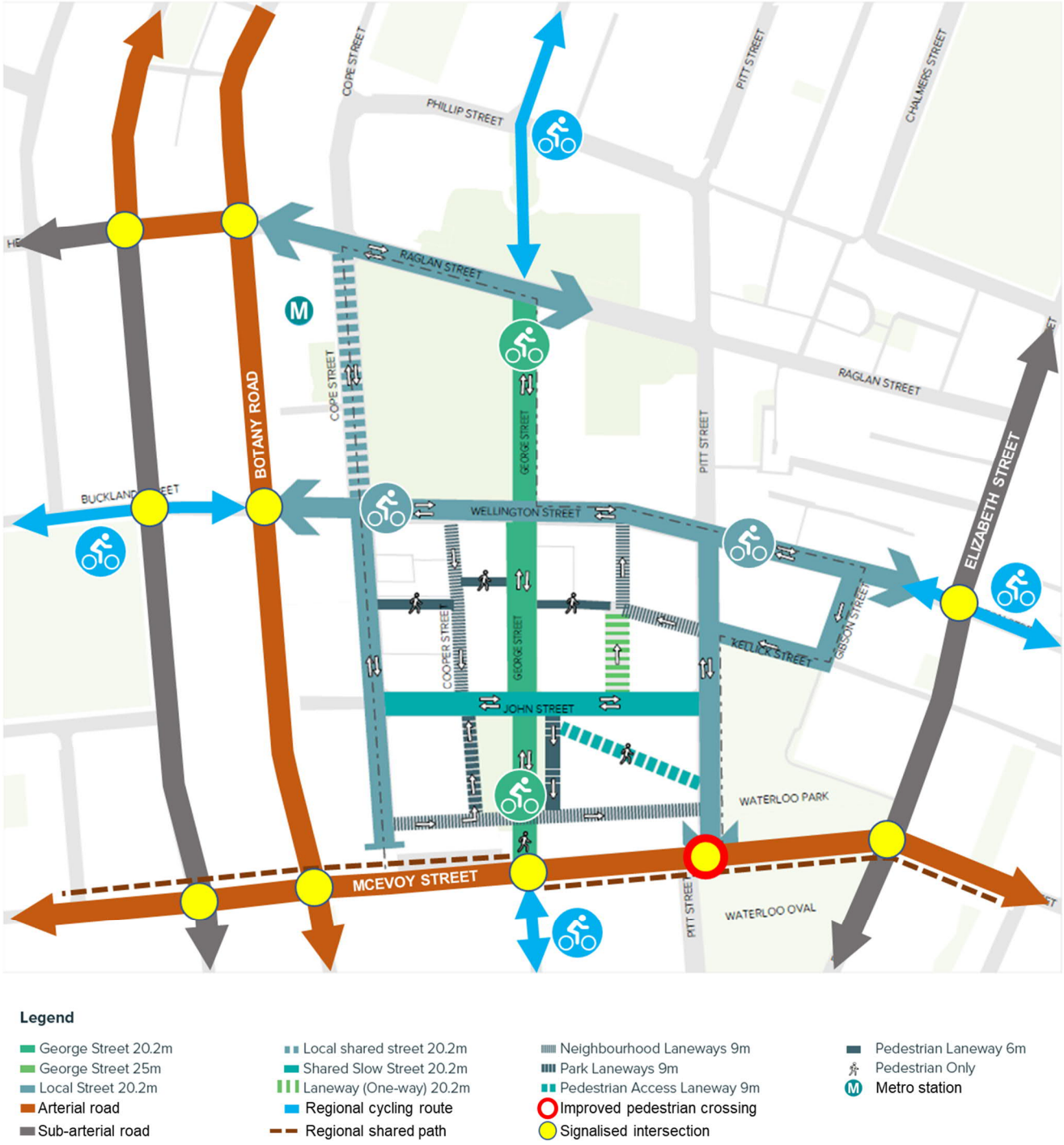


Figure 6.7: Proposed street layout and pedestrian connections

Waterloo South demand

The Waterloo South – Population and Demographics Study (.id February 2020, page 107) estimates 234 children aged 5 – 14 years living in Waterloo South in 2036. It is assumed 30 per cent will attend private schools (based on an analysis of Census data) with the remaining 70 per cent of students split evenly between Alexandria Park Community School and other schools. This will equate to approximately 82 children from Waterloo South attending Alexandria Park Community School.

Possible crossing locations for these students and an assumed distribution is presented below:

- Botany Road / Raglan Street intersection southern leg – ten per cent (eight pedestrians)
- Botany Road / Wellington Street intersection northern leg – 45 per cent (37 pedestrians)
- Botany Road / Wellington Street intersection southern leg – 40 per cent (33 pedestrians)
- Botany Road / McEvoy Street intersection northern leg – five per cent (four pedestrians).

The critical leg would therefore be the northern leg of the Botany Road / Wellington Street intersection with a combined estimated morning peak hour demand of 182 pedestrians (145 + 37). Assuming a cycle time of 120 seconds and an even distribution of trips, there would be an average of approximately six pedestrian trips per signal cycle. The pedestrian facilities at this intersection are considered sufficient to cater for this level of demand, particularly noting the proposed improved footpath provision on the north-east corner of the intersection as part of the proposed Metro Quarter development.

6.5.4 Cycling

Proposed cycling routes through Waterloo South are shown in Figure 6.7. The alignment of the proposed City of Sydney regional cycle route passes through Waterloo South along the activity street on George Street. Community consultation identified significant concerns that regional / commuter cyclists travelling along George Street would conflict with other users of the proposed activity street. Existing issues with regional cyclists conflicting with open space users in the precinct, particularly those with mobility impairments, were also raised. It is considered that the proposed width of the activity street on George Street (25 metres) mitigates these concerns. Additional design measures to address potential conflict between cyclists and pedestrians would be explored during the detailed design phase.

Access between individual development sites and the regional cycle network will be provided via a network of shared and slow streets which will provide safe cycling connections to both Wellington Street and George Street.

Outside of the immediate surrounds of Waterloo South, George Street forms a major north-south cycling corridor providing connections to Sydney CBD to the north and Green Square / Southern Sydney Employment Lands to the south. Planned City of Sydney cycling upgrades including the Wellington Street cycleway will greatly improve the safety and efficiency of cycling trips throughout the precinct. The proposed Alexandria to Moore Park works include a shared path along the northern side of McEvoy Street west of George Street, and along the southern side of McEvoy Street east of George Street, providing an additional east-west cycling route.

Botany Road, Wellington Street and George Street have been identified in the City of Sydney's Liveable Green Network as roads which are proposed to form part of an integrated pedestrian and cycling network throughout the City of Sydney. Waterloo South would help facilitate the aims of the Liveable Green Network by providing direct access to the network and increase the attractiveness of active transport modes through improved urban amenity.

Waterloo South is forecast to generate approximately 108 peak hour cycling trips once fully complete. Approximately 68 are forecast to travel north or south via the activity street along George Street with the remaining 40 expected to travel east-west, predominantly using the Wellington Street facility. This level of demand can be safely and efficiently accommodated on the future cycling network. The existing peak hour cycling demand on George Street is approximately 70 cyclists per hour.

6.6 Parking and demand management

6.6.1 Off-street parking

Off-street parking provision has been considered based on the relative accessibility of Waterloo South compared to other sites within the City of Sydney. A benchmarking exercise has been undertaken, comparing residential, commercial and retail parking rates found in the Sydney Local Environment Plan 2012. Categories within the existing LEP are defined by the level of public transport accessibility, with Category A (residential) and Category D (non-residential) representing the highest accessibility locations. Waterloo South is currently classified as Category B (residential) and Category F (non-residential). It is expected that the provision of the metro station will allow for much more restrictive parking controls than the existing categories.

Benchmark parking rates for the two highest accessibility categories are compared in Figure 6.8.

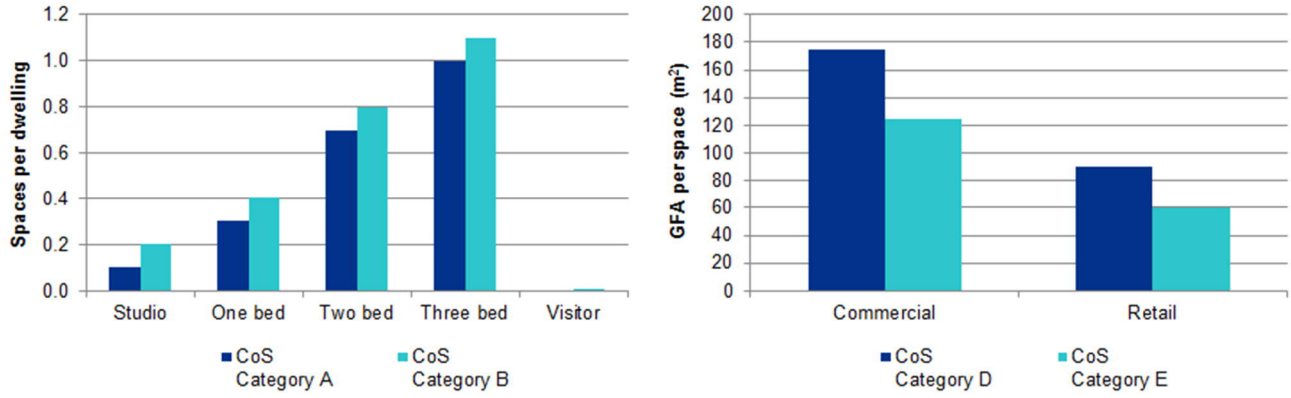


Figure 6.8: Benchmark parking rates residential (left) and non-residential (right)

Parking provision has been proposed to be included as maximum controls for Waterloo South. This provision is based on an assessment of existing supply and also considers the needs of the large number of social housing tenants who will reside in Waterloo South. The provision also considers the important role that car share vehicles can play in reducing the need for car ownership and leading residents to revaluate the need to make a car-based trip. Parking provision has been based on Category A and D rates, which are City of Sydney's most restrictive parking rates.

The proposed maximum parking provision for Waterloo South is:

Category A:

- 1,463 resident spaces
- 90 visitor spaces

Category D:

- 199 retail spaces
- 72 car share spaces (mixture of on-street and basement locations).

This total of 1,824 spaces is less than what would be allowed under City of Sydney's most restrictive Category A and D rates. LAHC will continue to work on reducing parking rates below Category A and D rates, especially for retail land use, with a target of 190 retail spaces.

Provisions will also be made to provide bike parking in line with the requirements of the Sydney DCP 2012 (i.e. one residential space per dwelling and one visitor space per ten dwellings).

6.6.2 On-street parking

The on-street parking approach is designed to avoid creating unrestricted long stay parking and minimise traffic and amenity impacts on Waterloo South and the wider road network. Table 6-2 outlines the approach to on-street parking for the Waterloo Precinct.

City of Sydney's Neighbourhood Parking Policy manages on-street parking supply and demand using a range of parking controls and a parking permit scheme, applying throughout the City of Sydney LGA. Waterloo Precinct currently falls within the Redfern (Area 41) permit zone. The recommended controls and permit scheme conditions relevant to an urban renewal area outlined in this policy have been used to develop the on-street parking approach for the Waterloo Precinct.

The on-street parking approach proposes controls and permit scheme conditions for areas within 400 metres of Waterloo Metro Station, as well as areas greater than 400 metres. This is to acknowledge the high pedestrian activity that will take place in the vicinity of the station and to limit unnecessary vehicle movements around the station precinct.

Within 400 metres of Waterloo Metro Station, short-stay parking on selected local streets may be permitted. Permit holders would be prohibited from using these spaces for longer stays in this area. Exceptions may be granted to care workers in accordance with City of Sydney policies.

In areas greater than 400 metres from Waterloo Metro Station, short-stay parking may be permitted on local streets. Permit holders could be exempted from these conditions in selected areas.

New developments are proposed to be ineligible for parking permits, including residents and businesses, in line with the Neighbourhood Parking Policy. The proximity of the Waterloo Metro Station and its urban context are expected to reduce the need for private vehicle use significantly and the supply of on-street parking would be limited accordingly.

Table 6-2: Proposed on-street parking approach for the Waterloo Precinct

Area	Land use characteristics	Parking controls	Permit scheme controls
Within 400 m of Waterloo Metro Station	▪ Mainly mixed-use with retail and related non-retail ▪ High-density residential ▪ Waterloo Metro Station	▪ 'Point to point' and taxi drop-off / pick-up at Waterloo Metro Station ▪ Restricted parking accommodating short stay users only on designated streets	▪ No permits for new developments ▪ No permit holder exemptions (with exception of approved carers)
Greater than 400 m from Waterloo Metro Station	▪ Predominantly high-density residential ▪ Ground floor non-residential	▪ Restricted parking accommodating short and medium stay users	▪ No permits for new developments ▪ Permit holder exceptions in place in designated areas

6.6.3 Travel plans

Travel demand within Waterloo South will be managed to reduce car dependency. This can be implemented through workplace travel plans and green travel plans which typically involve a set of practical initiatives that are put in place by employers or building managers before occupying a new or existing development that encourages staff and residents to choose alternatives to driving that are healthier and more sustainable. For travel plans to be successful in reducing vehicular travel demand, they should be developed in a tailored manner that respects the specific needs of each location / organisation.

Elements of such travel plans can include information programs for sustainable transport, active transport initiatives, flexible work hours, proactive cooperation with transport agencies to tailor public transport facilities to the site and employer-initiated parking policies that support public transport use. Future developers of Waterloo South will be required to support the development, delivery and monitoring of travel plans within the development site in accordance with City of Sydney guidelines. Expected outcomes of the plans (e.g. mode share targets) should be monitored on an ongoing basis.

6.7 Road network

6.7.1 Aimsun traffic model

An Aimsun traffic model for the area surrounding Waterloo was developed to test future land use and road network options for the now-superseded Waterloo Estate State Significant Precinct and updated to reflect Waterloo South as the first stage for renewal. The base model has been calibrated and validated to weekday peak periods using intersection counts, travel time surveys and origin-destination surveys. The purpose of the model is to assess cumulative road network impacts within the highest demand weekday period. This approach and the study area extents were agreed with TfNSW, City of Sydney and RMS via email on 29 May 2017.

A range of traffic and transport data was collected to calibrate and validate transport models. Data collected included:

- Intersection counts of light vehicles, heavy vehicles, buses, pedestrians and cyclists covering all key intersection in the study area. Counts cover a typical weekday between the hours of 6.00 am to 10.00 am and 3.00 pm to 7.00 pm.
- Travel time surveys on the key routes through the study area including Botany Road, McEvoy Street and Elizabeth Street. Counts cover a typical weekday between the hours of 6.00 am to 10.00 am and 3.00 pm to 7.00 pm.
- Origin-destination surveys matching key entry / exit points within the surrounding area including Botany Road, O'Riordan Street, Bourke Street, Elizabeth Street, McEvoy Street and Henderson Road. Counts cover a typical weekday between the hours of 6.00 am to 10.00 am and 3.00 pm to 7.00 pm.
- Traffic generation surveys of comparable residential / mixed used developments in Waterloo and Redfern including counts of pedestrians and cyclists. Counts cover a typical weekday between the hours of 6.00 am to 10.00 am and 3.00 pm to 7.00 pm. Intersection data was also collected at the same time to ensure volumes were comparable to previously collected days.

The base model was reviewed by RMS on 16 May 2018 and revised based on their feedback. The agreed final model was issued on 24 May 2018. For the purposes of this report for Waterloo South, the base model was not reviewed again as the base model was not changed.

The model covers a region broadly defined by the following roads (refer Figure 6.9):

- Phillip Street / Henderson Road to the north
- Wyndham Street to the west
- Bourke Street / Bourke Road to the south
- Elizabeth Street to the east.

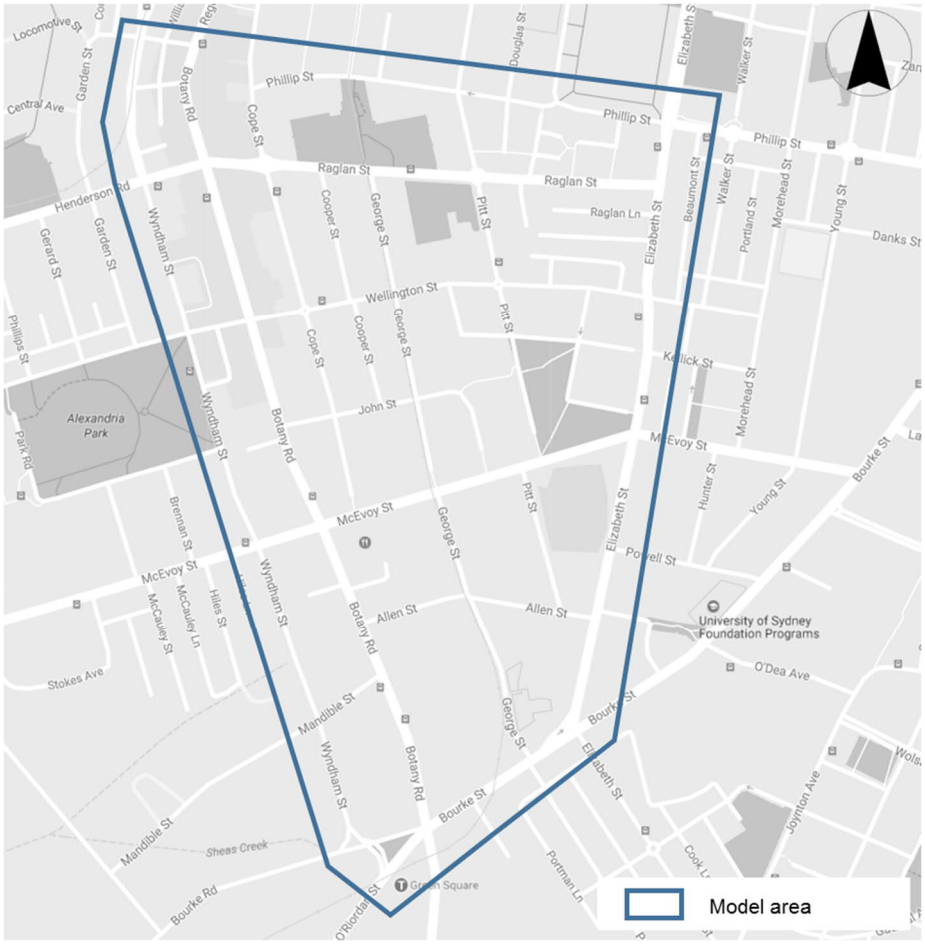


Figure 6.9: Aimsun model extents

6.7.2 Road network performance

Analysis of the base Aimsun model developed for the Waterloo Precinct indicates that the road network currently experiences congestion during both morning and evening weekday peak periods with vehicles travelling at low speeds compared to the speed limit. Constrained intersections where this is particularly evident include:

- Botany Road / Henderson Street and Wyndham Street / Henderson Road
- Botany Road / McEvoy Street and Wyndham Street / McEvoy Street
- Botany Road / Bourke Street and O'Riordan Street / Wyndham Street / Bourke Road
- Elizabeth Street / Bourke Street.

These results represent a constrained and congested road network around the Waterloo Precinct. This supports the approach that the future car mode share for the Waterloo Precinct should be minimised as much as possible. The majority of new trips from the precinct will be undertaken by public transport and active transport.

6.7.3 Traffic generation

Traffic generation rates are an influential component of the transport assessment process, directly related to and impacting on mode share. Traffic generation rates for developments are influenced by the following key factors:

- The quality of public transport services and facilities
- Active transport links and street environment
- Levels of car parking provision and car ownership
- Demographics of the area (which may be influenced by the proportion of social housing provided)
- Density and intensity of development
- Activities in the surrounding urban environment.

Traffic generation rates are subsequently very site-specific due to the interplay of these and other factors. As part of determining a meaningful base trip generation rate for the Waterloo Precinct, a number of comparable high-density developments have been selected and surveyed to determine the existing traffic generation rates for all modes of travel. This approach has been used rather than adopting a blanket standard trip generation rate, such as those provided in the RMS Guide to Traffic Generating Developments, which is currently being updated by TfNSW and RMS.

To select appropriate developments to undertake traffic generation surveys, a benchmarking process has been undertaken in order to select sites that were reflective of the future land use and transport scenario envisaged for Waterloo.

The location and site selection process involved two keys stages:

- Stage 1: identifying locations comparable to Waterloo socio-economically and geographically, using the 2011 SEIFA index, Census data including household size, housing tenure, motor vehicle ownership and population data and public transport timetable data
- Stage 2: identify and select suitable survey sites in comparable locations, based on accessibility to public transport, development density, age of development and the extent of parking supply restrictions.

The final shortlist of comparable locations for Stage 1 was identified previously in Table 5-3. Based on the Stage 2 criteria, two survey sites were identified; Site 1: 40-46 McEvoy Street, Waterloo and Site 2: 7-9 Gibbons Street, Redfern and are shown in Figure 6.10.

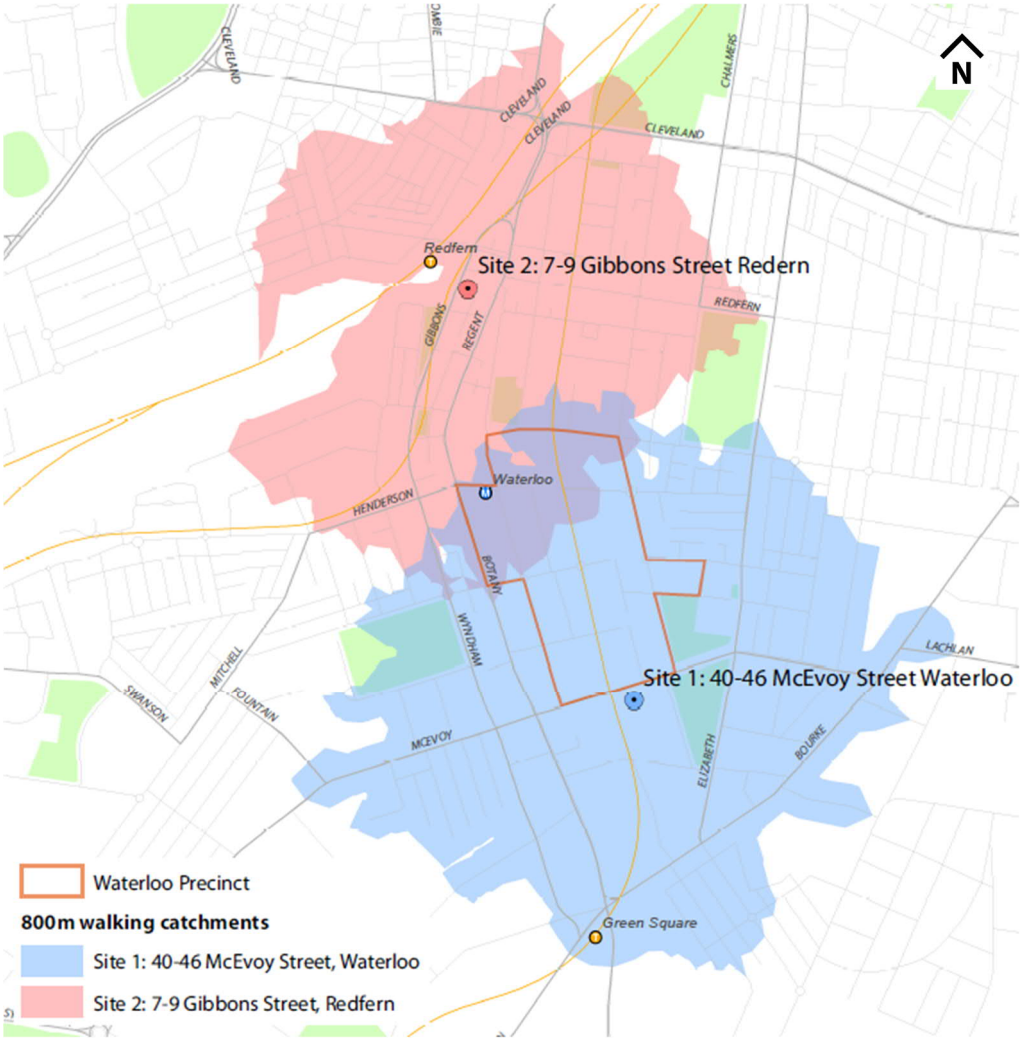


Figure 6.10: Trip generation survey sites and walking catchment

Site 1 in Waterloo had a consistent morning and evening peak hour car trip generation rate of 0.14 vehicle trips per dwelling. This site is located within walking distance to Green Square station and has significant levels of bus access to Sydney CBD.

Site 2 in Redfern had a car trip generation rate of 0.09 and 0.08 vehicles trips per dwelling during the morning and evening peak hour, respectively. This site is located near Redfern station, which provides access to a wide range of destinations on the heavy rail network.

Overall traffic generation rates from the two survey sites are lower than the high-density average rate (0.19 and 0.15 vehicle trips per unit during the morning and evening peak hour, respectively) in the RMS Guide to Traffic Generating Developments – Updated traffic surveys (TDT 2013/04a) and comparable to specific RMS survey sites in Strathfield, St Leonards, Pyrmont and Chatswood as shown in Figure 6.11.

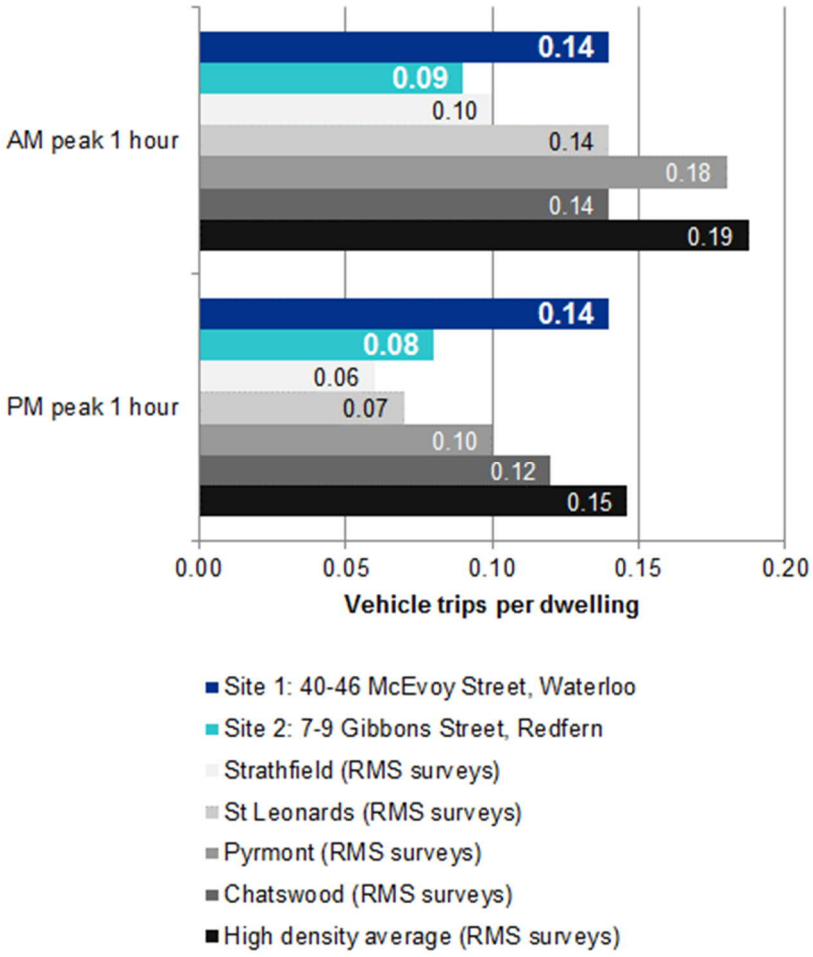


Figure 6.11: Trip generation rate per dwelling

A trip generation rate of 0.14 vehicle trips per dwelling (based on Site 1 in Waterloo and agreed to by RMS, TfNSW and City of Sydney) was used in the assessment. The proposed 3,048 dwellings leads to 427 forecast vehicle trips in the peak one-hour period. In reality, this represents an upper limit of traffic generation, as this does not account for the proportion of social housing dwellings that will remain in Waterloo South. As the peak period trip generation for social housing dwelling is generally lower, reflecting fewer journeys to work, Waterloo South is likely to generate fewer trips than is accounted for by benchmarking to other private housing developments in the area.

Proposed non-residential uses in Waterloo South are small in scale compared to the residential land use and will be designed to primarily support local residents. Trips generated by non-residential uses are expected to be predominantly via active transport from nearby developments and parking provision will be low. Vehicle trip generation is therefore not expected to be significant.

Non-residential car trips have been calculated based on an assessment of the type and scale of proposed land use, the accessibility to public and active transport and the scale of parking to be provided. Considering the local nature of proposed retail uses and the expected high non-car mode share of trips, it is assumed that each retail parking space will generate 0.4 vehicle trips in the morning peak hour and 0.8 vehicle trips in the evening peak hour. Considering the proposed 199 retail car spaces, this leads to 80 morning peak hour vehicle trips and 160 evening peak hour vehicle trips.

Total vehicle trip generation therefore equates to 507 (427 + 80) trips in the morning peak hour and 587 (427 + 160) trips in the PM peak hour.

6.7.4 Future network modelling

Network performance

The forecast trip generation potential of Waterloo South was used to generate future 'with development' scenario traffic demands. These demands were assigned to the future Aimsun road network model in order to test the impacts of the Waterloo South development. The 'with development' scenario was compared to the future 'do minimum' in order to clearly isolate the traffic impacts of Waterloo South.

The 'do minimum' network includes proposed road upgrades as part of the Alexandria to Moore Park Connectivity Upgrade. The traffic demand is based on forecast growth derived from TfNSW's Public Transport Project Model, a multi-modal model that forecasts patronage and demand-related impacts of public transport projects and policies. This demand includes the impacts of cumulative growth from known nearby projects such as employment uplift at Australian Technology Park but does not include the development associated with Waterloo South.

Modelling results in this section include:

- Simulated density – a measure of the number of vehicles per kilometre of road length. Lower densities indicate free flowing conditions whilst higher densities indicate vehicles spending more time queuing or travelling slowly
- Intersection level of service – the weighted averaged delay of all intersection movements is used to classify intersections from A to F, based on criteria outlined in the RMS Guide to Traffic Generating Developments.

Figure 6.12 outlines the 'do minimum' and 'with development' simulated density results for the 2036 morning peak period.

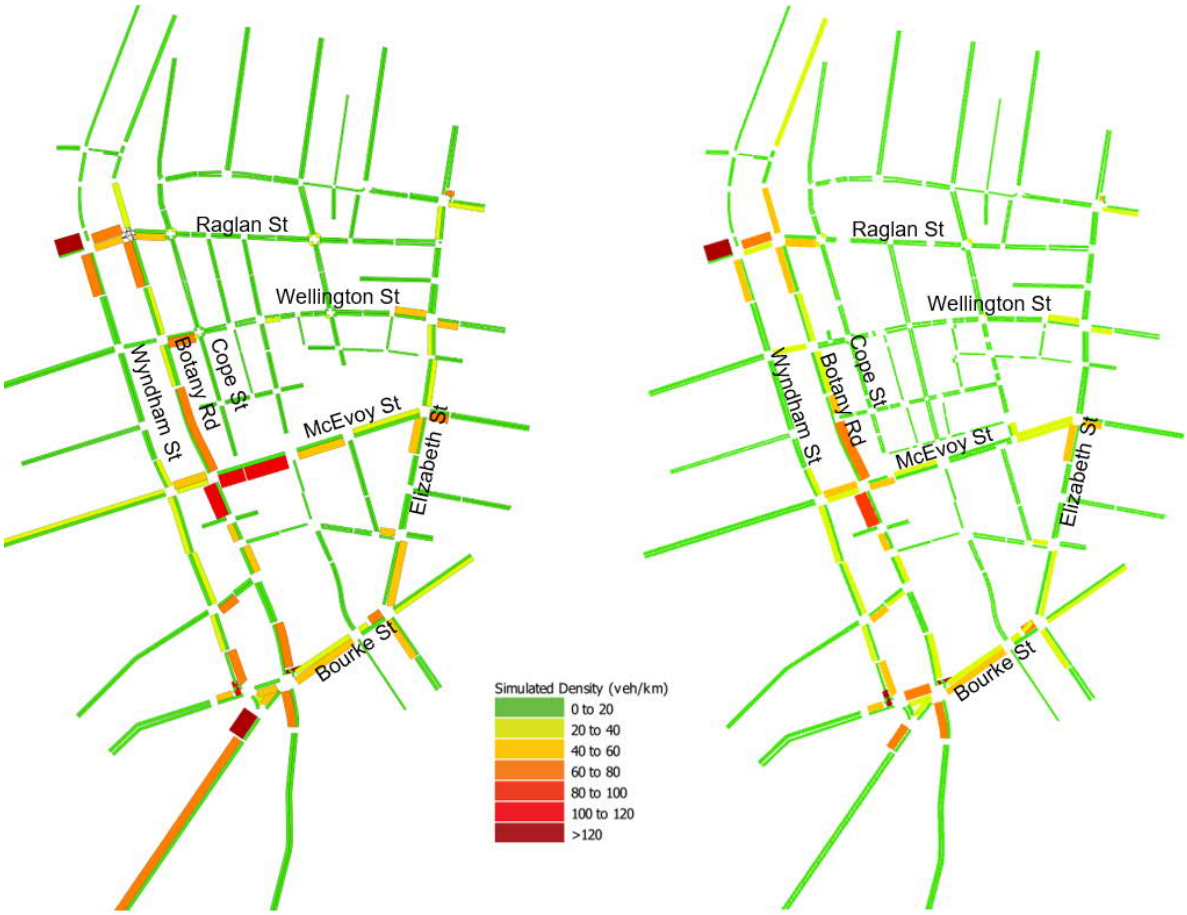


Figure 6.12: Simulated density 2036 morning peak: do minimum (left) and with development (right)

Simulation traffic modelling of the road network with and without the development during the morning peak shows that:

- Traffic performance is forecast to be generally consistent across both scenarios, particularly for key movement corridors of Botany Road and McEvoy Street.
- The westbound McEvoy Street approach to Botany Road is forecast to experience moderate congestion in both scenarios. It is, however, noted that forecast congestion is slightly improved in the 'with development' scenario. This is primarily due to the new Pitt Street access (see Section 6.7.5) which removes a significant number of right turn movements from the Botany Road / McEvoy Street intersection.

Figure 6.13 outlines the 'do minimum' and 'with development' simulated density results for the 2036 evening peak period.

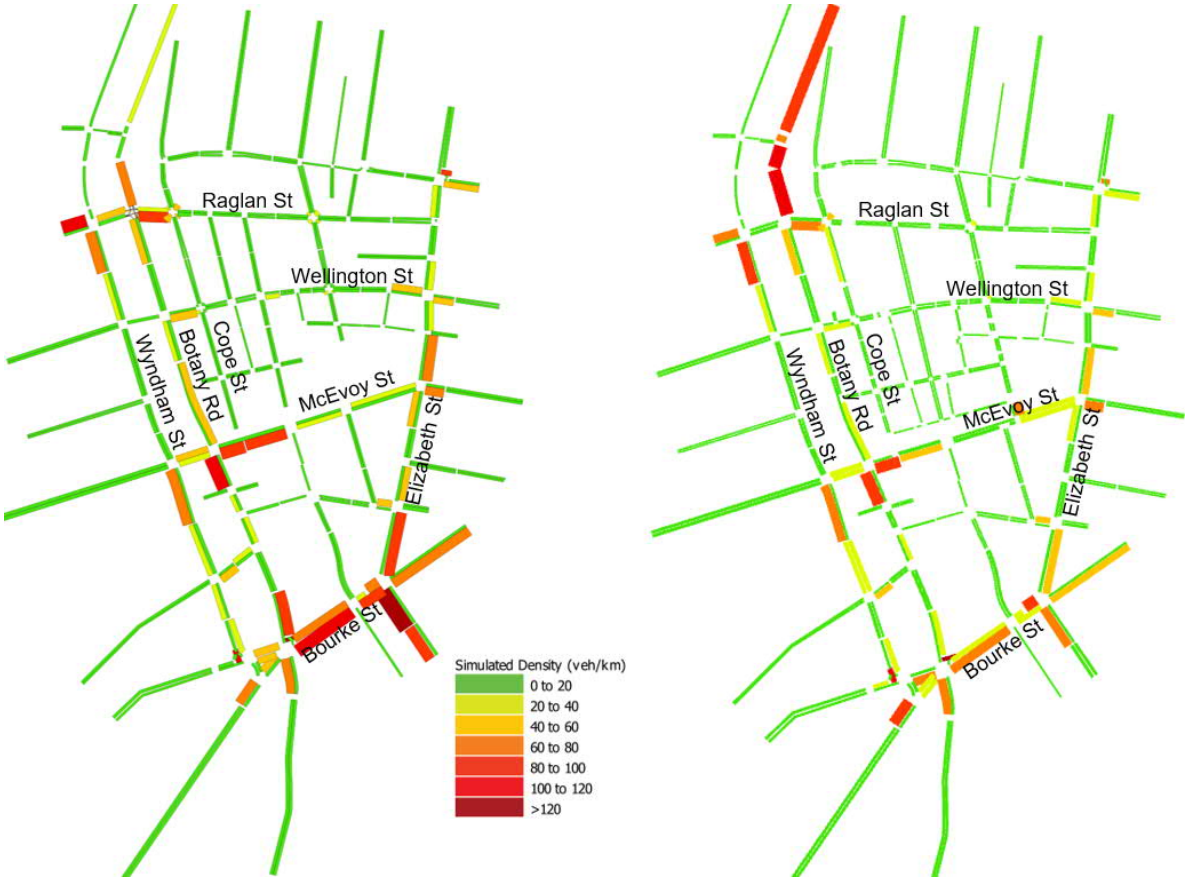


Figure 6.13: Simulated density 2036 evening peak: do minimum (left) and with development (right)

Simulation traffic modelling of the road network with and without the development during the evening peak shows that:

- Traffic performance is forecast to be generally consistent across both scenarios, particularly for key movement corridors of Botany Road and McEvoy Street
- The westbound McEvoy Street approach to Botany Road is forecast to experience moderate congestion in both scenarios
- Moderate congestion is forecast on Bourke Street between Elizabeth Street and Botany Road in both scenarios
- The southbound Botany Road approach to Raglan Street is forecast to experience an increase in localised congestion in the 'with development' scenario.

Intersection performance

Intersection level of service results for the external road network are presented in Table 6-3 (morning peak) and Table 6-4 (evening peak). It is observed that average delay is generally consistent across the 2036 'do minimum' and 'with development' scenarios. Intersections where level of service degrades compared to the 'do minimum' scenario are highlighted in orange. Improvements are highlighted in green.

Table 6-3: Intersection level of service results for the external road network – morning peak

Intersection	2017 base		2036 do minimum		2036 with development	
	Average delay (sec)	Level of service	Average delay (sec)	Level of service	Average delay (sec)	Level of service
Botany Road / Bourke Road / O'Riordan Street	40	C	41	C	42	C
Botany Road / Buckland Street	<10	A	18	B	25	B
Botany Road / Mandible Street	12	A	14	A	14	A
Botany Road / McEvoy Street	45	D	73	F	57	D
Botany Road / Raglan Street	28	B	42	C	40	C
Elizabeth Street / Phillip Street	11	A	15	B	15	A
McEvoy Street / Elizabeth Street	22	B	25	B	26	B
McEvoy Street / Pitt Street	<10	A	<10	A	17	B
Wellington Street / Elizabeth Street	14	A	15	A	18	B
Wyndham Street / Boundary Street	<10	A	<10	A	2	A
Wyndham Street / Bourke Road / O'Riordan Street	26	B	37	C	44	D
Wyndham Street / Buckland Street	21	B	14	A	14	A
Wyndham Street / Henderson Road	36	C	45	D	35	C
Wyndham Street / Mandible Street	35	C	26	B	25	B
Wyndham Street / McEvoy Street	21	B	25	B	23	B
McEvoy Street / George Street	<10	A	14	A	11	A
Bourke Street / George Street	<10	A	<10	A	8	A
Bourke Street / Elizabeth Street	29	B	38	C	28	B
Elizabeth Street / Allen Street	<10	A	<10	A	6	A

Table 6-4: Intersection level of service results for the external road network – evening peak

Intersection	2017 base		2036 do minimum		2036 with development	
	Average delay (sec)	Level of service	Average delay (sec)	Level of service	Average delay (sec)	Level of service
Botany Road / Bourke Road / O'Riordan Street	50	D	60	E	56	D
Botany Road / Buckland Street	17	B	16	B	12	A
Botany Road / Mandible Street	11	A	11	A	8	A
Botany Road / McEvoy Street	93	F	60	E	53	D
Botany Road / Raglan Street	78	F	43	C	51	D
Elizabeth Street / Phillip Street	17	B	18	B	19	B
McEvoy Street / Elizabeth Street	22	B	29	B	28	B
McEvoy Street / Pitt Street	<10	A	<10	A	13	A
Wellington Street / Elizabeth Street	15	A	13	A	13	A
Wyndham Street / Boundary Street	<10	A	<10	A	4	A
Wyndham Street / Bourke Road / O'Riordan Street	29	B	20	B	25	B
Wyndham Street / Buckland Street	19	B	12	A	13	A
Wyndham Street / Henderson Road	27	B	29	B	26	B
Wyndham Street / Mandible Street	23	B	19	B	22	B
Wyndham Street / McEvoy Street	33	C	27	B	18	B
McEvoy Street / George Street	23	B	20	B	9	A
Bourke Street / George Street	<10	A	28	B	32	C
Bourke Street / Elizabeth Street	29	B	66	E	70	F
Elizabeth Street / Allen Street	<10	A	14	A	19	B

Intersection level of service results for the internal road network within Waterloo South for the 2036 'with development' scenario are presented in Table 6-5. It is observed that all intersections perform at level of service A or B with minimal delays and spare capacity.

Table 6-5: Intersection level of service results within Waterloo South

Intersection	2036 with development – morning peak		2036 with development – evening peak	
	Average delay (sec)	Level of service	Average delay (sec)	Level of service
Raglan Street / Cope Street	< 5	A	18	B
Raglan Street / Pitt Street	< 5	A	< 5	A
Wellington Street / Cope Street	< 5	A	< 5	A
Wellington Street / Pitt Street	< 5	A	< 5	A
Cope Street / John Street	< 5	A	< 5	A
Pitt Street / John Street	< 5	A	< 5	A
Raglan Street / George Street	< 5	A	< 5	A
Wellington Street / George Street	< 5	A	< 5	A
George Street / John Street	< 5	A	< 5	A

The results of the traffic modelling presented in this section demonstrate that the forecast traffic generated by the proposed development is not expected to have a significant impact to the road network. Additional capacity provided by the Alexandria to Moore Park Connectivity Upgrade as well as the expected low level of private car use will ensure that the future road network will operate safely and efficiently for all road users.

6.7.5 Pitt Street connection to McEvoy Street

The existing access arrangements to and from the southern section of Waterloo South would lead to circuitous access arrangements to Waterloo South via constrained intersections at Botany Road or Elizabeth Street, due to a lack of direct access from McEvoy Street. In order to minimise these impacts, it is proposed that the existing alignment of Pitt Street north of McEvoy Street be opened to traffic at McEvoy Street along its current alignment, allowing all movements into and out of Waterloo South. The existing intersection with Pitt Street south of McEvoy Street is proposed to be modified to 'left-in left-out' to minimise conflicts and maintain efficiency of McEvoy Street in line with the Alexandria to Moore Park Connectivity Upgrade. The proposed changes would provide direct access to Waterloo South from McEvoy Street and minimise the impacts of development traffic on surrounding intersections.

Traffic modelling has indicated that up to 100 right turn movements per hour would be removed from Botany Road intersections at Wellington Street and McEvoy Street, significantly improving the efficiency of the road network at these locations. A new connection would also reduce traffic flows on local internal streets such as Wellington Street and Raglan Street, improving the pedestrian amenity and safety of the precinct.

Modelling has demonstrated that the proposed arrangement would operate satisfactorily at level of service B and queues on McEvoy Street would be contained within the midblock sections of adjacent intersections.

The proposed 'left-in left-out' arrangement at Pitt Street south of McEvoy Street would lead to the redistribution of existing traffic making right turn movements at this location. Demand for both of these movements is forecast to be less than 50 vehicles per hour in all peak periods for the 2036 forecast scenario. Available alternative routes exist via George Street and Elizabeth Street. The impact of this redistribution is considered to be negligible in terms of additional distance travelled and impacts to surrounding intersections, which have sufficient capacity to accommodate this redistributed demand.

The proposed arrangement has been developed in conjunction with RMS, including members of the Alexandria to Moore Park Connectivity Upgrade project team.

Potential for through traffic on Pitt Street

The inclusion of a new access to Waterloo South at McEvoy Street would also introduce the ability for traffic to travel through the Waterloo Precinct as a potential rat-run to avoid Elizabeth Street. Traffic modelling indicates that this route would be highly undesirable for through traffic as travel speeds along Botany Road and Elizabeth Street are likely to be higher than local roads within the precinct after the Alexandria to Moore Park Connectivity Upgrade project is completed. A summary of traffic volumes along Pitt Street separated by local and through traffic is provided in Table 6-6.

Table 6-6: Pitt Street (north of McEvoy Street) traffic volume breakdown (2036 scenario)

Peak period	Local traffic (veh/hr)	Through traffic (veh/hr)	Total (veh/hr)
Morning peak	163	67	230
Evening peak	187	106	293

Although through traffic volumes on Pitt Street north of McEvoy Street are likely to be very low, the proposed layout would reinforce the role of Pitt Street as a primarily local street and discourage through-use of the new access. The use of traffic calming measures including pedestrian crossings and threshold treatments, narrowing of the street and low speed limits would further reinforce this local function.

6.7.6 Street hierarchy

In order to achieve good transport and land use outcomes and minimise traffic impacts on the Waterloo Precinct, it is necessary to set a strategic framework to ensure any subsequent proposals are consistent with the future role and function of a particular street. The roads within and around Waterloo South provide two primary functions for transport customers:

- Movement: The ability to travel between places
- Place: The ability to access origins and destinations of travel.

An understanding of the two functions of a street are vital when the two functions are competing, such as through increased movement requirements or improved place amenity. The movement and place function of a street informs planning for the level of access across each of the transport modes.

As shown in Figure 6.14, Waterloo South is bounded by higher order roads including Botany Road, McEvoy Street and Elizabeth Street.

A place-based street management approach is proposed within the Waterloo Precinct which emphasises the need for places for people in areas of high activity and maintains local traffic access. The approach supports the high activity, mixed use and high-density urban environment of Waterloo South.

Key criteria used to identify movement and place functions of streets in and around the Waterloo Precinct include:

- Proximity to major public transport nodes
- Public transport function
- Presence of active street frontages
- Traffic volumes
- Regional connectivity.

Figure 6.14: Road network hierarchy surrounding Waterloo Precinct

Figure 6.15 illustrates the place-based street management approach for the Waterloo Precinct and surrounding areas.

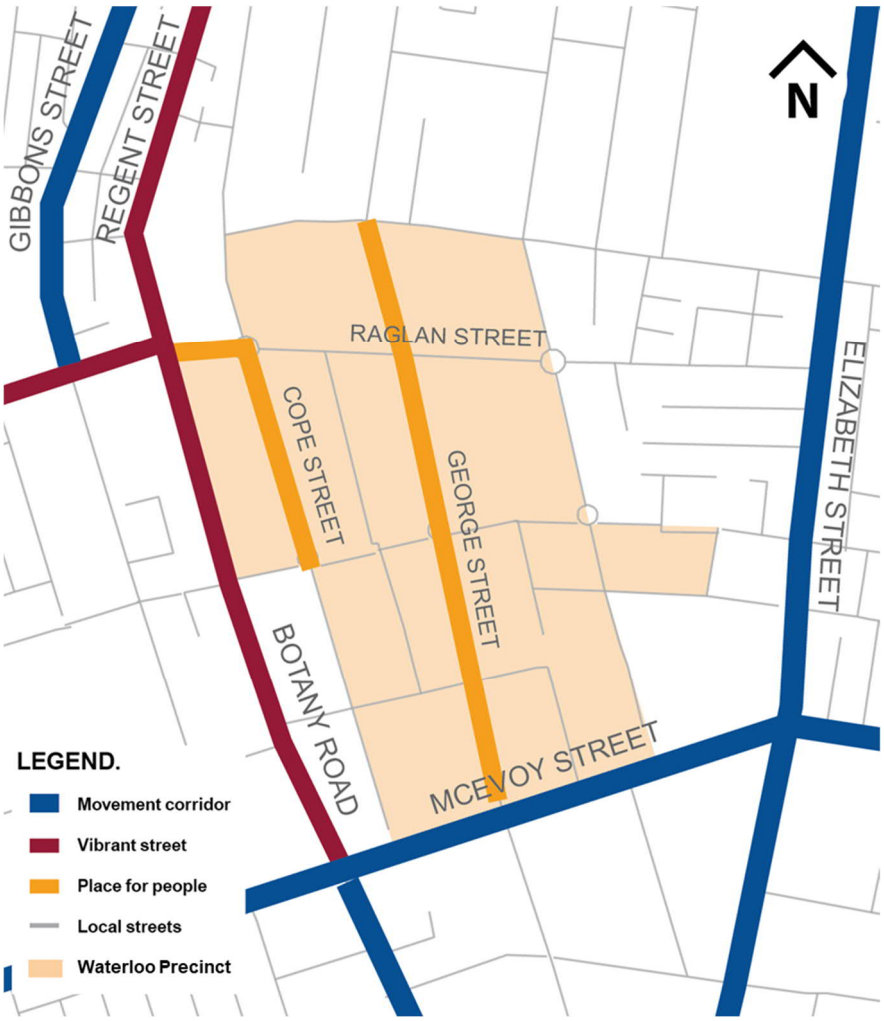


Figure 6.15: Place-based street management approach for the Waterloo Precinct

Places for people are shown in the vicinity of Waterloo Metro Station, where significant activity is expected as people access and egress the station and use related retail services. This includes Raglan Street between Botany Road and Cope Street, and Cope Street between Raglan Street and Wellington Street. The activity street on George Street is also shown as a place for people although it is noted it will still provide movement functionality for pedestrians and cyclists.

Botany Road is shown as a Vibrant street north of McEvoy Street. This is consistent with RMS's recently completed Road Network Plan for this corridor. Although classified as an arterial road, a mix of place and movement functions will occur here in the future, supported by a mix of land uses and active street frontages.

All other streets in the Waterloo Precinct are local streets, providing access for people and local traffic.

Outside of the Waterloo Precinct, McEvoy Street and Elizabeth Street are shown as Movement corridors, reflecting the road hierarchy shown in Figure 6.14. Although shown as movement corridors, the function of these roads varies along their length depending on land uses, street frontages and local connections. For example, Elizabeth Street has a stronger movement function to the north of Redfern Street, where the road is one way for southbound movement. The movement function is less prominent to the south of Redfern Street, where the mix of land uses and greater retail street frontages shift Elizabeth Street to a higher place function.

6.7.7 Internal street network

Within Waterloo South, an internal street network has been proposed that extends from and connects to public space, serving to connect the community as shown in Figure 6.7. To provide this internal connectivity, a hierarchy of street typologies has been proposed that are aimed at ensuring pedestrian priority and is comprised of the following:

- George Street (20 to 25 metres) – transformation of George Street into an activity street, with the width varying between 20 and 25 metres
- Local streets (20.2 metres) – existing local streets that are 20.2 metres in width to be redefined as slow streets with footpath widening, traffic calming devices, street planting and reduced vehicle speeds. These streets will prioritise pedestrian safety and a safe environment for the community.
- Shared slow street (20 metres) – shared slow streets to include a shared carriageway, buffered by planting on either side. The design speed of all slow streets is below 40 kilometres per hour.
- Neighbourhood laneways (nine to ten metres) – wider laneway connection between existing local streets. The laneways will be a pedestrian priority shared zone for pedestrians, cyclists and vehicles.
- Park laneways (nine metres) – park laneways run alongside the Village Green and Waterloo Common. It provides a secondary north-south connection within Waterloo South.
- Pedestrian laneways (nine metres) – are shared laneways for pedestrians and cyclists only
- Pedestrian laneways (six metres) – are pedestrian-only laneways.

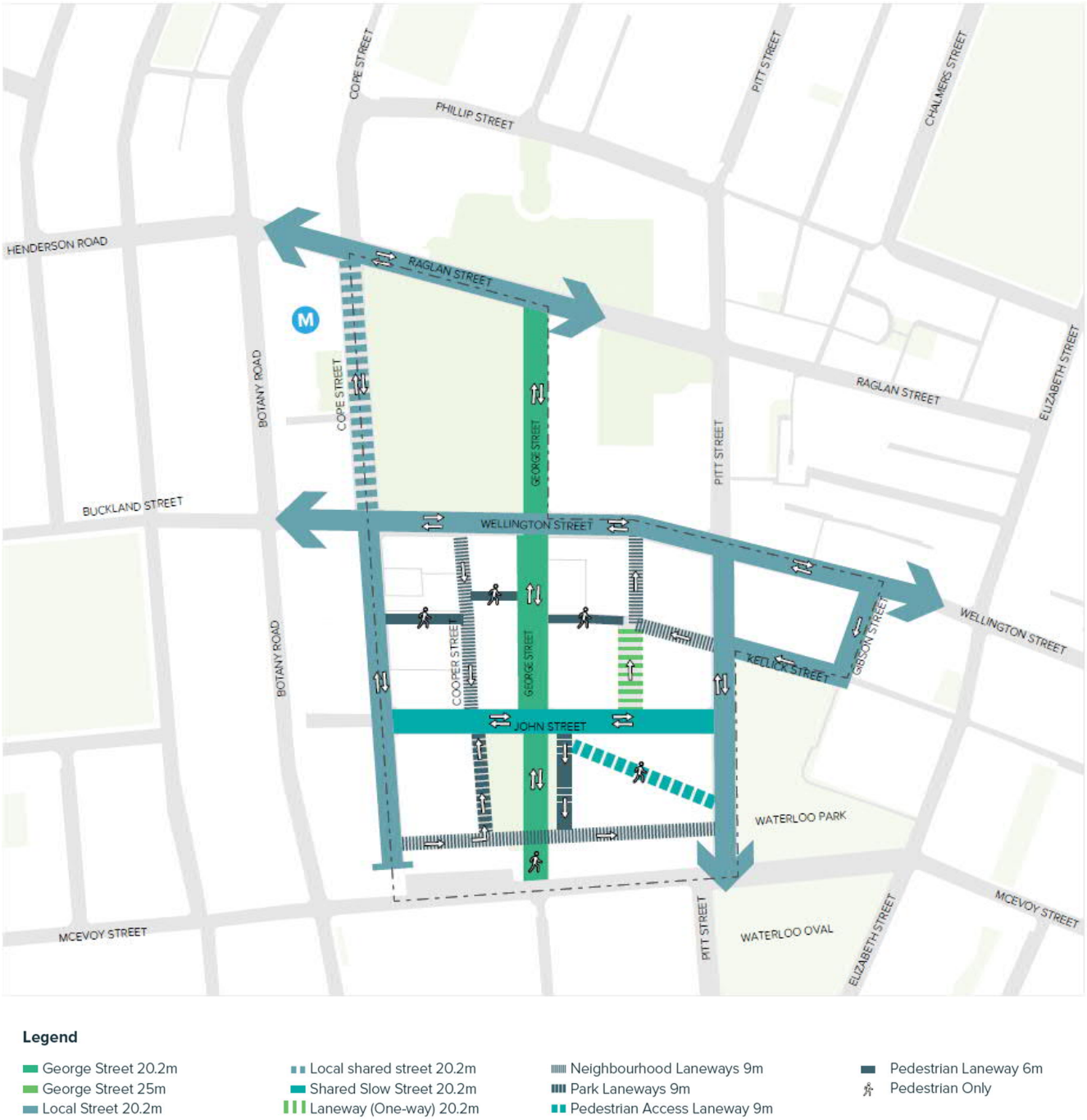


Figure 6.16: Overview of internal street network

6.8 Vehicle access

6.8.1 Basement access

Indicative basement vehicle access locations throughout Waterloo South are shown in Figure 6.17. In general, access is proposed via the network of laneways. The majority of accesses are forecast to be utilised by less than 100 vehicles per hour in peak periods. This level of usage is considered appropriate for the proposed laneways and would not lead to operational or safety issues from conflicts with other road users.

Basement accesses will be designed in accordance with AS 2890 and relevant RMS and City of Sydney guidelines, in particular in terms of adequate distance between driveways and adjacent intersections. Accesses will be subject to further investigation and refinement during the detailed design process.

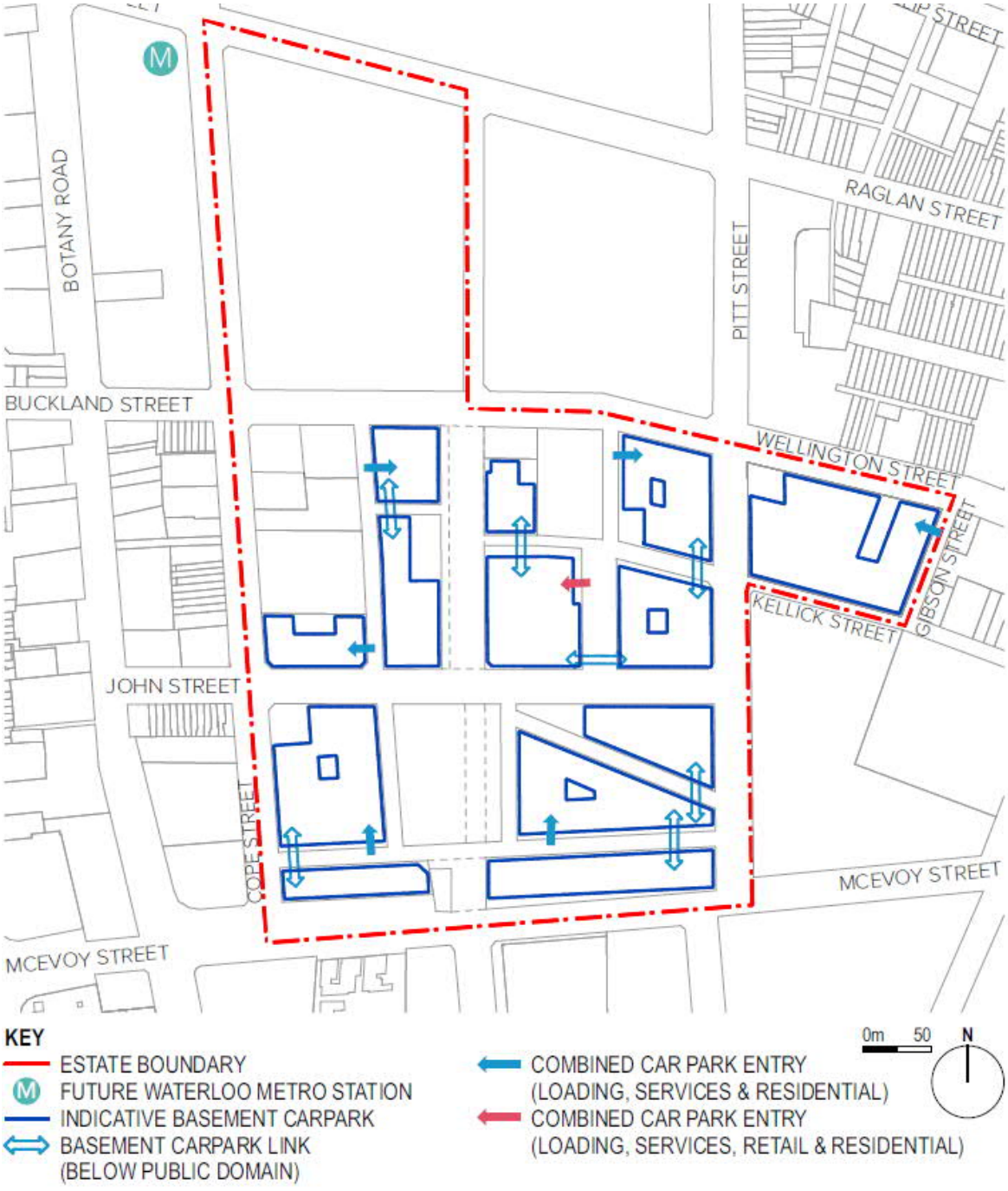


Figure 6.17: Proposed basement access locations

6.8.2 Service vehicles

Potential service vehicle parking provision has been calculated based on an assessment of the land use mix in the Indicative Concept Proposal and the Sydney DCP 2012. This results in following required provision of service vehicle parking across the Estate:

- 31 spaces for residential use
- 18 spaces for retail use.

It is noted that the DCP makes provision for reducing the total requirement of spaces for large developments with GFAs over 50,000 square metres. Service vehicle requirements will be confirmed at the Development Application stage of each proposed development. However, noting the scale of the proposed Waterloo South development and the proposed connections between basements, it is considered feasible to reduce the overall service vehicle requirements, particularly for residential uses.

6.8.3 Emergency vehicle access

All streets will be deigned to allow emergency vehicle access. Access for emergency vehicles has therefore not been precluded. It is recommended that the detailed design of the internal street network intersections and vehicle access locations considers the needs of emergency service vehicles to ensure safe and easy access to all areas of the site.

6.9 Construction of the proposal

A Construction Traffic Management Plan (CTMP) would be prepared as part of any Development Application lodged for works within Waterloo South. The CTMP would outline the guidelines, general requirements and specific procedures to be used for any works that may have an impact on traffic operation. The plan would be prepared in accordance with the City of Sydney's Standard Requirements for Construction Traffic Management Plan.

Items to be addressed would include but not be limited to:

- The safety of all road users
- Details of routes and roads to be used by construction vehicles
- Construction vehicle access arrangements
- Construction vehicle types
- Any temporary adjustments to existing traffic and transport infrastructure that may be required
- Details of any applications required to organise appropriate approvals for works zones and / or road closures, use of driveways, cranes, barricades or hoarding and consent of construction hours
- Management of traffic including the use of traffic controllers to direct vehicles, pedestrians or cyclists.

6.10 Infrastructure preservation and capital costing

There is no requirement for land acquisition external to the Waterloo Precinct to provide the proposed transport infrastructure. All works can be implemented within the boundaries of Waterloo South. The proposed extension of Pitt Street southwards to connect to McEvoy Street and associated traffic signal adjustments (see section 6.7.5) are the only required transport works which directly interfaces with infrastructure outside of Waterloo South.

Capital costing of transport items and assignment of funding responsibilities has not been undertaken and will be determined at a later date as the proposal progresses.

7. Implementation plan and strategy

7.1 Public transport

Public transport usage will form the foundation of a successful transport outcome for Waterloo South. The existing and planned future network will ensure that the majority of trips from Waterloo South can be efficiently made through the use of sustainable public transport modes.

Rail

The introduction of Sydney Metro would increase the capacity of the rail network in Sydney. The metro line is anticipated to have a target capacity of 46,000 customers per hour in one direction (Sydney Metro City & Southwest Final Business Case Summary, October 2016). The capacity of the Sydney Metro is almost double that of an existing heavy rail line. As such, capacity issues evident on services passing through or stopping at Redfern and Green Square stations are likely to be relieved once Sydney Metro is operational. A service capacity of 46,000 customers per hour in one direction combined with the existing heavy rail network is therefore considered sufficient to cater for forecast demand (866 peak hour trips) generated by Waterloo South, including the cumulative demand from future developments in the vicinity of the study area such as at Australian Technology Park.

Bus

Any bus improvements to serve the future needs of Waterloo South will primarily be implemented as part of network improvements to support Sydney Metro City & Southwest. Such changes are yet to be announced by TfNSW, however this study has identified possible improvements:

- Route 355: Bondi Junction to Marrickville Metro via Waterloo. Increase frequency and span of hours to match metro operation and re-route via Wellington Street to more directly serve the station.
- Route 309: Port Botany to Central via Botany Road. Increase frequency and span of hours to match metro operation and serve significant bus-rail interchange demand.

7.2 Active transport

Walking

The design of the internal streets and connections within Waterloo South has been undertaken with pedestrian safety, amenity and efficiency as a priority. George Street will form the main walking ‘spine’ through the provision of an activity street approximately 25 metres wide. This corridor will attract nearby pedestrians of all levels of mobility, undertaking trips of varied purpose and allow them to do so in a safe, comfortable and enjoyable environment.

Existing streets are proposed to be provided with new upgraded footpaths whilst the re-development will include the creation of a significant number of new streets and through-site links. The permeability afforded by these new connections will ensure that all walking trips are direct and legible and will enable a high level of active transport within the precinct.

Cycling

Outside of the immediate surrounds of Waterloo South, George Street forms a major north-south cycling corridor providing connections to Sydney CBD to the north and Green Square / Southern Sydney Employment Lands to the south. Planned City of Sydney cycling upgrades including the Wellington Street cycleway will greatly improve the safety and efficiency of cycling trips throughout the precinct. The proposed Alexandria to Moore Park works include a shared path along the northern side of McEvoy Street west of George Street, and along the southern side of McEvoy Street east of George Street, providing an additional east-west cycling route.

Within Waterloo South, George Street will form the major north-south cycling corridor. Access between individual development sites and the regional cycle network will be provided via a network of shared and slow streets which will provide safe cycling connections to both Wellington Street and George Street.

It is considered that the proposed width of the activity street on George Street (25 metres) mitigates concerns regarding potential conflict between pedestrians and cyclists. Additional design measures to address potential conflict between cyclists and pedestrians would be explored during the detailed design phase.

7.3 Parking and demand management

Maximum parking provision has been proposed to be included in the development controls for Waterloo South. This provision considers the needs of the large number of social housing tenants who will reside in Waterloo South and also considers the important role that car share vehicles can play in reducing the need for car ownership and leading residents to revaluate the need to make a car-based trip. This aligns with the City of Sydney's requirement for parking rates to result in no net additional traffic impact on the local road network.

Parking provision has been based on Category A and D rates, which are City of Sydney's most restrictive parking rates. The proposed maximum parking provision for Waterloo South is:

Category A:

- 1,463 resident spaces
- 90 visitor spaces

Category D:

- 199 retail spaces
- 72 car share spaces (mixture of on-street and basement locations).

This total of 1,824 spaces is less than what would be allowed under City of Sydney's most restrictive Category A and D rates. LAHC will continue to work on reducing parking rates below Category A and D rates, especially for retail land use, with a target of 190 retail spaces.

Provisions will also be made to provide bike parking in line with the requirements of the Sydney DCP 2012 (i.e. one residential space per dwelling and one visitor space per ten dwellings).

Future developers of Waterloo South will be required to support the development, delivery and monitoring of travel plans within the development site, in accordance with City of Sydney guidelines. Expected outcomes of the plans (e.g. mode share targets) should be monitored on an ongoing basis.

7.4 Road

The future road network surrounding Waterloo South has been found to be sufficient to cater for the forecast future traffic demands generated by the development. Additional capacity provided by the Alexandria to Moore Park Connectivity Upgrade as well as the expected low level of private car use will ensure that the future road network will operate safely and efficiently for all road users.

The extension of Pitt Street southwards to connect with McEvoy Street is the only significant works proposed to the external road network as a result of the Waterloo South development. The staging of this work will need to be coordinated with the Alexandria to Moore Park Connectivity Upgrade scope of works. The Alexandria to Moore Park Connectivity Upgrade would be delivered very early in the Waterloo South redevelopment process which would ensure the Pitt Street extension is provided well in advance of traffic being generated by the new development.

The internal road network will be delivered in stages consistent with the delivery of new housing in Waterloo South.

7.5 Summary strategy

A summary of the transport measures to support Waterloo South is shown in Figure 7.1.

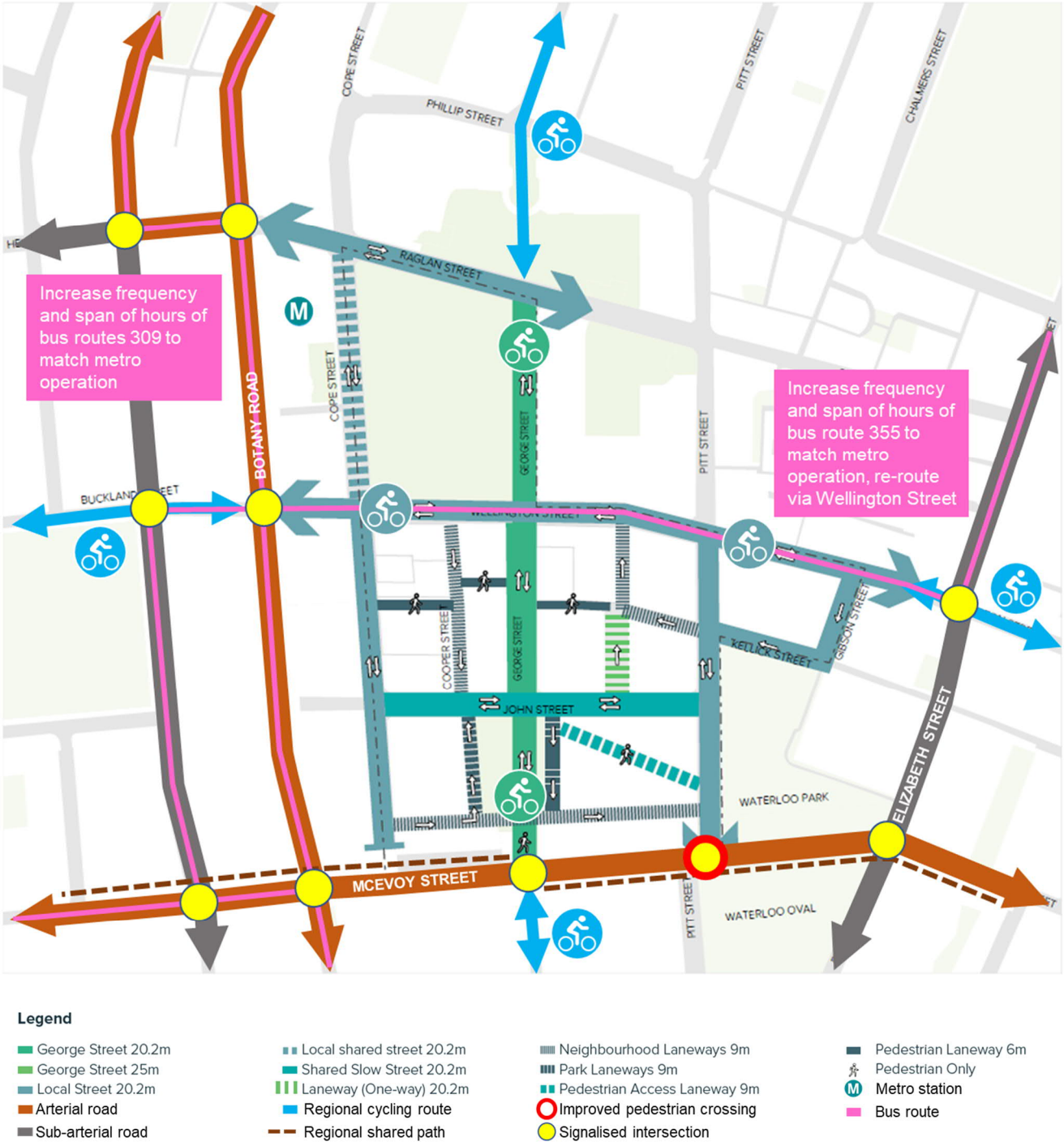


Figure 7.1: Summary of transport measures to support Waterloo South