

Greater Macarthur Land Release Investigation

Strategic Transport Plan to support the Greater Macarthur Land
Release Preliminary Strategy and Action Plan

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Client: Transport for New South Wales

ABN: 18 804 239 602

Prepared by

AECOM Australia Pty Ltd

Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia

T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com

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Prepared by Marcel Cruz, Brett Linnane

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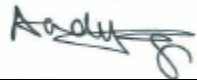
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Executive Summary

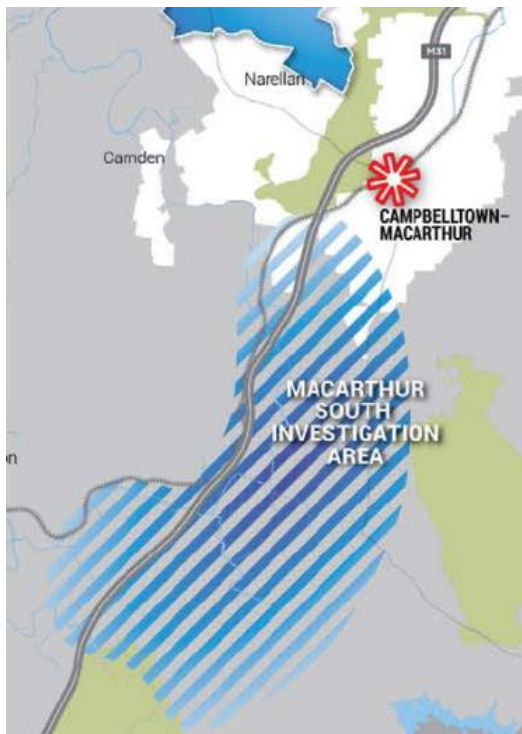
Introduction

The NSW Government has identified the need to plan for future growth and new areas in Sydney beyond the North West and South West Growth Centres. Investigations are under way for a potential new Growth Centre through the Greater Macarthur Land Release Investigation (GMLRI) Area. Should the area, or part of the area, be deemed suitable for urban development, a strategic framework will be established including a land use and infrastructure strategy to provide the Government (TfNSW and DP&E) the understanding of timing of required infrastructure as well as costs for additional infrastructure and service upgrades required to cater for additional release areas in GMLRI.

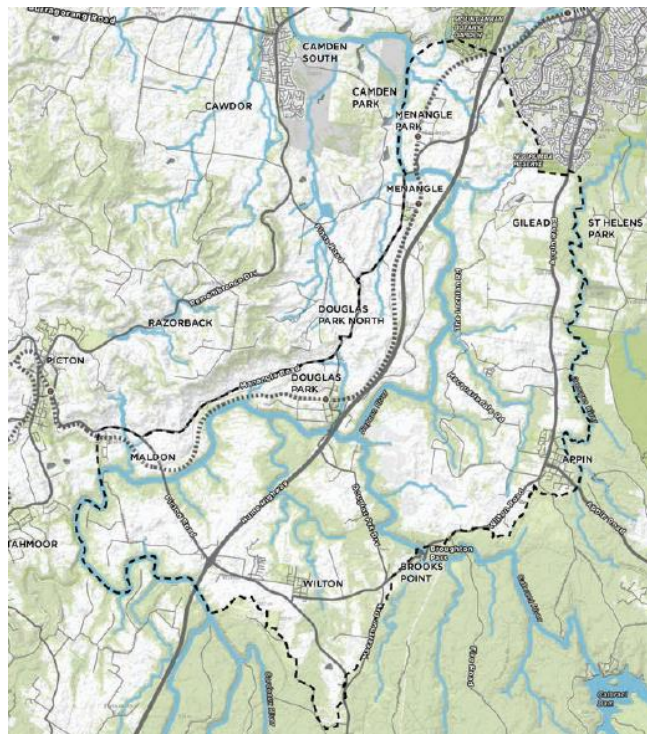
At this stage, costs for additional transport infrastructure and service upgrades required to support the Greater Macarthur Land Release are unfunded. The Greater Macarthur Land Release Preliminary Strategy and Action Plan notes that infrastructure requirements will need to be delivered through an appropriate mechanism. The preferred approach is a Special Infrastructure Contribution at no cost to Government, or alternatively by agreements between the NSW Government and relevant proponents. Funding for broader transport network impacts will also need to be considered as part of the land release.

The Greater Macarthur Investigation Area (GMIA) is identified as an investigation area in *A Plan for Growing Sydney* (referenced as the Macarthur South Investigation Area). The area forms an extension to Sydney's existing urban footprint in the south-west, in proximity to the proposed Regional City Centre of Campbelltown-Macarthur.

Using the approximate area defined in *A Plan for Growing Sydney* (APGS) as a starting point (see below left), preliminary analysis of the surrounding natural and built environment was led by DP&E in order to determine 'urban capable' land, which has led to the development of the 'urban capable' boundary (see below right) that has formed the basis of the investigation from an integrated land use and transport perspective.



GMIA study area (Source: A Plan for Growth Sydney, 2015)



GMIA urban capable footprint (Source: DP&E, 2015)

Policy context

The Government has prepared a number of plans and strategies that highlight the need for additional infrastructure to address existing and planned constraints in the road and rail networks as well as to cater for future population and employment growth targets in Western Sydney through proposals such as: the Western Sydney Infrastructure Plan, Outer Sydney Orbital, High Speed Rail, South West Rail Link Extension to St Marys and Macarthur, Maldon-Dombarton Rail Line, Georges River Parkway, Spring Farm Link Road, Camden Valley Way and Narellan Road upgrades, Picton Road and Appin Road upgrades, as well as walking and cycling strategies.

The development of a transport infrastructure plan for the GMIA has been considered in the context of all these existing plans and policies such that they can be applied / extended to provide a multi-modal transport strategy for the GMIA serving future population and employment growth in the area, and connecting to surrounding major centres and transport hubs.

Changes in land use

The 2011 census indicates that the GMIA has in the order of 1,811 dwellings comprising a population of 5,120 residents. The 2011 journey to work data further suggests approximately 2,800 people work within the study area.

The Department of Planning and Environment (DP&E) has led investigations into the potential for urban development in Greater Macarthur. The investigations have identified land that is suitable for urban development, based on analysis of existing land use values and constraints. The investigation process has led to the development of an indicative urban structure that includes the following key features:

- Menangle Park, Mount Gilead and Wilton are proposed to become Priority Precincts, by including them in the *State Environmental Planning Policy 2006*. There would be immediate opportunities to deliver up to 18,100 homes in Menangle Park and Mount Gilead and 16,600 new homes in a new town at Wilton.
- The above residences would be supported by employment in a proposed Major Centre in Wilton Junction, Town Centres in Menangle Park and Mount Gilead, Village Centres in Glenlee, Gilead, Wilton, Maldon and western Wilton Junction, as well as employment lands (service industry / large floor retail) in Maldon.
- Areas outside Menangle Park, Mount Gilead and Wilton will provide opportunities for longer term housing supply. Up to 2036 these areas will remain rural in nature. Beyond 2036 there would be opportunities to provide another 33,000 homes and strategic employment opportunities.

The above proposal translates to a population in the order of 100,000 people in the GMIA by 2036. Estimates provided by TfNSW, for the purposes of transport network assessment, indicate that this would be accompanied by an increase of approximately 21,000 employees within GMIA centres and employment lands by 2036.

An analysis of housing market needs has been undertaken to assist Government in understanding market demand / need. Approximately 70% to 80% of dwellings are anticipated to be in the form of medium to large lot detached housing, 15% to 20% semi-detached housing and the remainder flats/units. As such, it is anticipated that residential lands will be generally low-density in nature.

Changes in travel demand

Strategic estimates of peak hour travel demand generated by GMIA based on the demographic forecasts are summarised below. These estimates indicate that in the focal year of 2036, the GMIA will generate in the order of 28,000 vehicle trips in the morning peak hour. This is a significant increase in travel demand in the area in the context of the existing transport network, and will generate the need for a large investment in supporting transport infrastructure. Based on the land use and travel pattern analysis undertaken, it is anticipated that:

- A significant portion of the home-based work trips will be destined for the external employment areas to the north and northeast, particularly Campbelltown-Macarthur as well as Camden and Liverpool.
- A relatively small portion of home-based work trips to occur to the Illawarra area via Bulli-Appin Road or Picton Road.
- A low to moderate proportion of the total trip demand (approximately 31%) will be self-contained within the GMIA, partially accounting for the trips generated by the forecast GMIA workers.
- The remainder of inbound worker trips will likely come from the Wollongong area as well as the existing residential areas to the north / northeast.

Transport network to support the 2036 vision of Greater Macarthur

A preliminary transport framework has been proposed to support the proposed Priority Precincts to 2036. This network has been proposed based on the results of prior transport network development and testing, undertaken to inform the investigation process. The assumed proposed transport network includes the following:

- Public transport features:
 - Potential extension of the electrified rail line from Macarthur Station to Menangle Park Station (subject to further investigation), along with extended suburban rail services to the proposed Menangle Park Town Centre.
 - A bus network consistent with that assumed for the strategic-level assessment of the broader GMIA. The routes proposed include bus services to each of the Priority Precincts and have been adopted for the purposes of preliminary assessment only.
- Road network upgrades:
 - Full construction of Spring Farm Link Road as well as an all movements interchange with the M31 Hume Motorway
 - Widening of the M31 Hume Motorway from Picton Road to Raby Road.
 - Widening of Appin Road to four lane arterial to the southern extent of the Menangle Park and Mount Gilead Priority Precinct.
 - Widening of Menangle Road to four lane arterial from Macarthur to the Nepean River.
 - A new arterial / sub-arterial road through the Menangle Park and Mount Gilead Priority Precinct with bus priority features or separated transit way.
 - Widening of Picton Road to four lanes to the east and west of the M31 Hume Motorway.
 - Improved accessibility to Wilton Junction and Wilton via an upgraded M31 Hume Motorway / Picton Road interchange, as well as new north-facing ramps to the north of Picton Road connecting the M31 Hume Motorway with a proposed internal road network for Wilton and Wilton Junction.

Transport modelling

Preliminary transport modelling has been undertaken using the Western Sydney Strategic Model (WSSM). For the purposes of assessing DP&E's indicative urban structure, the WSSM has been used to estimate forecast travel demand on the transport network in 2036 and conduct a preliminary assessment of the proposed road and public transport infrastructure and services.

In order to establish approximate quantum, modal distribution and other travel characteristics of GMIA trips, information was extracted from the WSSM 2036 AM peak model. The outputs indicated that:

- The GMIA is anticipated to generate approximately 45,160 total trips in the 2036 two-hour AM peak period, including approximately 13,900 (31%) self-contained trips.
- A majority of the transport task will be undertaken using private vehicles, with approximately 88% of the mode share. Public transport utilisation for the GMIA will be relatively modest at around 12% of the mode share. These above mode shares are consistent with that currently observed in other Western Sydney LGA's such as Campbelltown.
- Utilisation of rail is particularly low, accommodating only approximately 3% of trips. This indicates little benefit to the provision of extending electrified suburban rail services to Menangle Park.
- Overall, GMIA AM peak trips have similar travel times and distances to those currently experienced in other LGA's in Western Sydney.

Link flow plots and volume-to-capacity (VCR) plots were extracted from WSSM, illustrating the anticipated traffic loads and traffic performance on key links in the GMIA area respectively. A strategic level assessment has been undertaken in which the appropriateness of assumed road infrastructure capacity (i.e. lane numbers) for trunk roads has been assessed based on preliminary model outputs. The outputs from WSSM indicated that:

- The proposed road network is generally within capacity.
- The Hume Motorway is performing well within capacity based on a typical AM peak assessment. However, a need has been identified to design for seasonal peak traffic loading scenarios (100th highest hour (annual)) in order to ensure the functionality of the highway is maintained during seasonal peak periods.
- Spring Farm Link Road is anticipated to perform within capacity with four lanes. The volumes of traffic traversing through the SFLR / Menangle Road / Hume Motorway interchange area may require large-scale infrastructure / connections.
- Menangle Road will generally operate within capacity. However, the large link flows north of SFLR indicate that further widening may be required through certain sections.

Further investigations

The outcomes of this preliminary assessment indicate that the proposed transport framework generally has sufficient capacity to support the travel demand generated by DP&E's proposed strategy to 2036. Whilst the preliminary modelling has yielded some positive feedback on the transport framework, further modelling / investigations / analysis would be required to refine the network. This would help ensure an efficient network and help support further decision-making.

Based on the preliminary assessment of the transport network undertaken thus far, the following actions are recommended in order to further progress the network development and assist the decision-making process:

- A more disaggregated model in terms of zone and link structure be developed to allow a more detailed and accurate assessment.
- Further analysis with the public transport network be undertaken to consider:
 - The feasibility of electrification of the Southern Highlands Line to Menangle Park, and / or further south to Wilton Junction in the long term (beyond 2036).
 - Augmentation of the bus network to complement the 2036 Strategy, and outcomes of the rail electrification tests. Investigations into alternate service options that may increase overall public transport utilisation compared to that currently forecast.
- Further explore the impacts of the potential SWRL extension, and Outer Sydney Orbital investigation, on the GMLRI.
- More refined traffic modelling / investigations to confirm that the road infrastructure requirements developed from the strategic traffic assessment undertaken are suitable, as well as develop a more detailed road hierarchy including sub-arterial and local collector level roads.
- Further modelling to confirm the requirement for, and form of, Georges River Parkway. It is recommended that a targeted investigation be undertaken that addresses the combined impacts of cumulative proposed development in southwest Sydney, including but not limited to Greater Macarthur, the Glenfield to Macarthur Urban Activation Corridor and the Moorebank Intermodal Terminal.

Undertaking further investigations such as those identified above, would provide the opportunity to further refine the transport network to support the GMIA, allowing a more comprehensive evidence base from which to ensure an efficient transport network, inform decision making and incorporate the necessary infrastructure into planning.

1.0 Introduction

AECOM has been commissioned by Transport for New South Wales (TfNSW) and the Department of Planning and Environment (DP&E) for the provision of integrated transport and land use planning services as input to the Greater Macarthur Land Release Investigation (GMLRI).

1.1 Context

The Government's vision for Sydney, as outlined in *A Plan for Growing Sydney*, is: a strong global city, a great place to live.

To achieve this vision, the Government has set down goals that Sydney will be:

- A competitive economy with world-class services and transport.
- A city of housing choice with homes that meet our needs and lifestyles.
- A great place to live with communities that are strong, healthy and well connected.
- A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

Sydney is a rapidly growing city with current forecasts suggesting that more than 1.6 million additional people will be living in Sydney by 2031, requiring around 664,000 more homes. In response to this forecast, government is currently undertaking investigations into the suitability of various areas within the greater Sydney area to support this growth. These investigation areas include a mix of Greenfield sites on the fringe of Sydney's current footprint (such as Greater Macarthur) and Brownfield sites along transport corridors in Sydney's metropolitan area.

The DP&E Priority Precincts program (formerly Urban Activation Precincts) has been established with the overarching objective of developing detailed precinct plans to enable additional dwellings in places with access to infrastructure, transport, services and jobs. Furthermore, the NSW Government has identified the need to plan for future growth and new areas in Sydney beyond the North West and South West Growth Centres. This has driven investigations into a potential new growth centre in the Macarthur area.

The investigation process, managed by DP&E, has identified land within Greater Macarthur that is suitable for urban development, and how Greater Macarthur would be connected to jobs and other services in other parts of metropolitan Sydney. DP&E's *Preliminary Strategy and Action Plan* identifies areas within Greater Macarthur that are proposed to become Priority Precincts accommodating housing demand in the short and medium term, whilst also identifying the remaining urban suitable areas that will remain predominantly rural in nature until additional residential capacity is required in the long term.

1.2 Purpose

The main objectives of the broader transport study undertaken as part of the GMLRI have been to:

- Create an evidence-based existing conditions assessment and to identify current strategic constraints and opportunities for the development of transport infrastructure in the GMLRI.
- Develop and confirm, in conjunction with relevant stakeholders, a series of strategic transport objectives that supports the long-term development of GMLRI.
- Support TfNSW to develop and refine the future transport network to integrate with the land use scenarios for GMLRI.
- Assess and understand the impacts of the proposed land use scenarios prepared by DP&E on the transport network and to determine a preliminary future transport network based on network modelling using the WSSM (undertaken by others).

The particular focus of this report is to identify the trunk transport infrastructure proposed to support the land use scenario identified in DP&E's *Preliminary Strategy and Action Plan* for Greater Macarthur.

At this stage, costs for additional transport infrastructure and service upgrades required to support the Greater Macarthur Land Release are unfunded. The Greater Macarthur Land Release Preliminary Strategy and Action Plan notes that infrastructure requirements will need to be delivered through an appropriate mechanism. The preferred approach is a Special Infrastructure Contribution at no cost to Government, or alternatively by agreements between the NSW Government and relevant proponents. Funding for broader transport network impacts will also need to be considered as part of the land release.

1.3 Site context

The broader Greater Macarthur Investigation Area (GMIA) is identified as an investigation area in *A Plan for Growing Sydney* (referenced as the Macarthur South Investigation Area). The geographical area illustrated within the Plan is shown in Figure 1. The area forms an extension to Sydney's existing urban footprint in the south-west, in proximity to the Campbelltown-Macarthur centre. The GMIA comprises an area of approximately 17,600 hectares and is located approximately 70km south-west of the Sydney CBD.

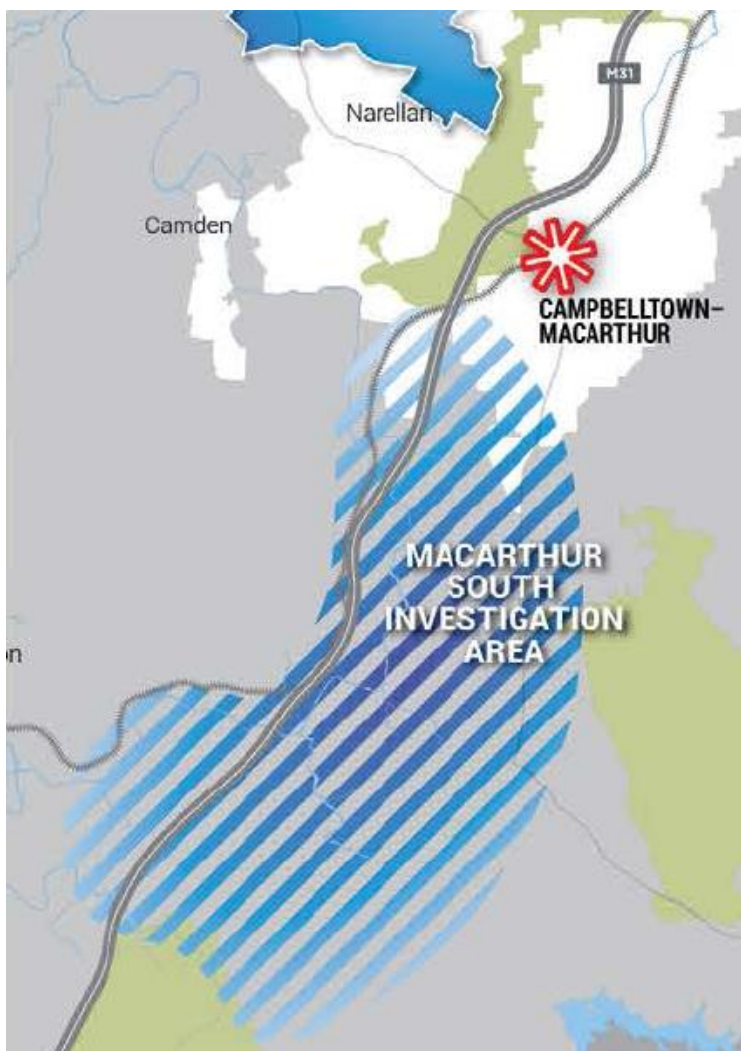


Figure 1 Greater Macarthur Investigation Area (Source: A Plan for Growth Sydney, 2015)

Using this approximate area as a starting point, preliminary analysis of the surrounding natural and built environment was led by DP&E in order to determine 'urban capable' land, and develop a more refined boundary for the investigation. The analysis led to the development of the 'urban capable' boundary illustrated in Figure 2, which has formed the basis of the investigation from an integrated land use and transport perspective. Further analysis has also been carried out to define 'urban suitable' land within which urban development could be accommodated.

The refined 'urban capable' area is comprised of lands that stretch from Menangle Park in the Campbelltown LGA to Wilton in the Wollondilly LGA. A majority of the area is currently comprised of low density residential, with some level of focussed development around the small centres of Appin, Wilton, Menangle and Douglas Park.

There is a number of existing urban release proposals within the investigation area at various stages of planning process. These include large area proposals such as Wilton Junction, West Appin, South Campbelltown, Menangle Park and Mount Gilead as well as several smaller proposals in the Appin and Menangle areas. These current proposals would have a combined total yield in the order of 50,000 dwellings along with proposed education facilities as well as town, neighbourhood and employment centres.

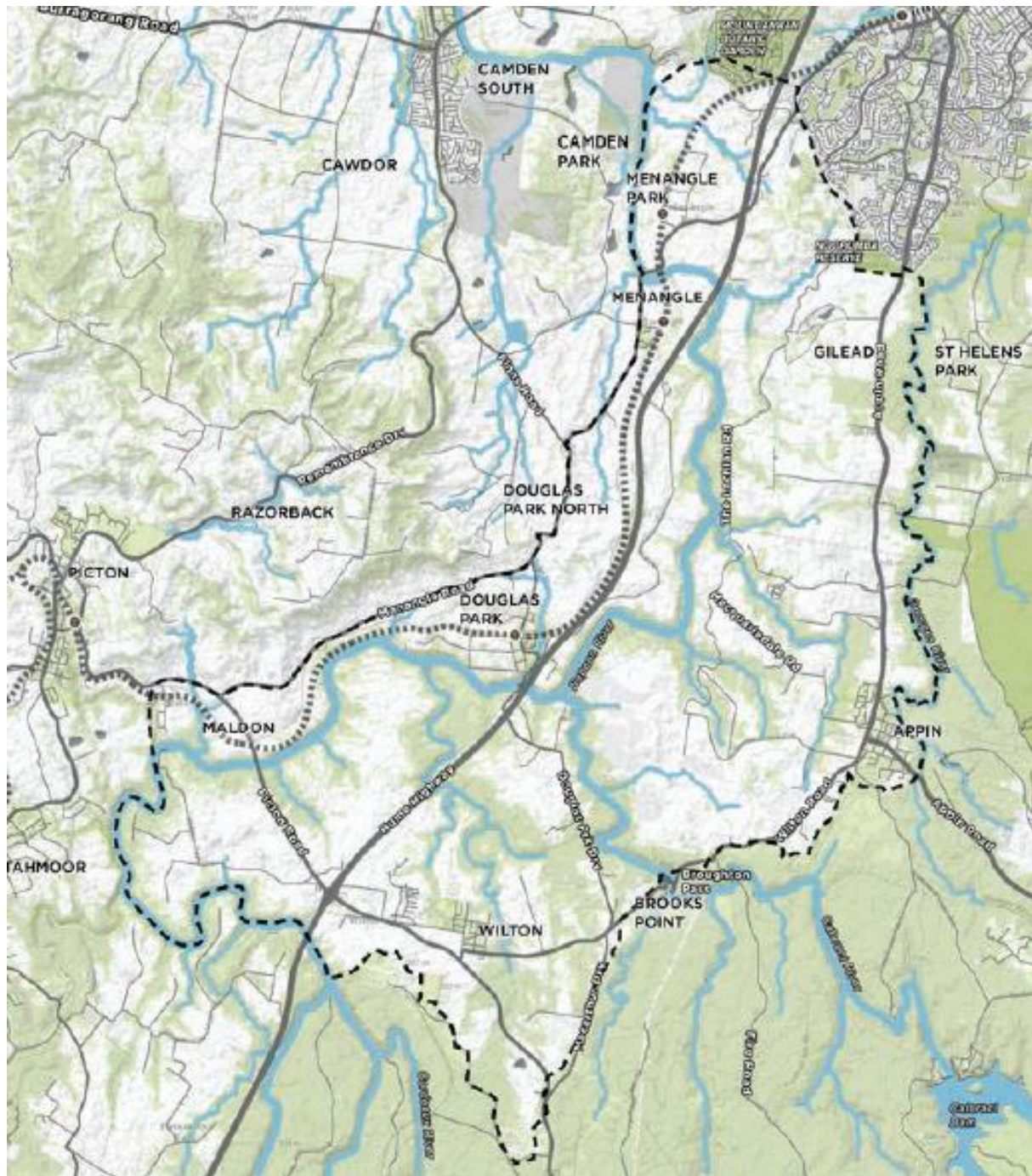


Figure 2 Greater Macarthur 'urban capable' boundary (Source: DP&E, 2015)

2.0 Policy context

NSW 2021 is the NSW Government's overarching ten year plan to make New South Wales number one. It is supported by three key transport and land use strategies;

- A Plan for Growing Sydney
- NSW Long Term Transport Master Plan
- State Infrastructure Strategy.

The relationship between these documents is illustrated in the NSW transport planning framework (see Figure 3) below (note that the *Metropolitan Strategy for Sydney* has been replaced by *A Plan for Growing Sydney*, which was released in December 2014, as the key growth planning document for Sydney)

The key documents and their relevance to the GMLRI area are discussed in the sections following. The treatment of relevant planned transport infrastructure upgrades identified in these documents is discussed further in section 3.6.



Figure 3 NSW transport planning framework (Source: NSW Freight and Ports Strategy)

2.1 NSW 2021

NSW 2021 is built around five strategies:

- Rebuild the economy
- Return quality services
- Renovate infrastructure
- Strengthen our local environment and communities
- Restore accountability to government.

32 goals support each of these strategies. Under return quality services, NSW 2021 sets four transport goals for the state:

- Reduce travel times
- Grow patronage on public transport by making it a more attractive choice
- Improve customer experience with transport services
- Improve road safety.

The plan also sets the critical freight target of doubling the proportion of container freight movement by rail through NSW ports by 2020.

These goals have been used as key inputs to development of the key supporting land use and transport policy documents.

2.2 A Plan for Growing Sydney

A Plan for Growing Sydney is the NSW Government's guide for land use planning in the 16 years to 2031. The Plan's vision is for Sydney to be a strong global city and a great place to live. Four goals, 22 directions and 59 actions aim to make this vision a reality.

The Macarthur area is identified in two of the four goals:

- Goal 1: A competitive economy with world-class services and transport.
- Goal 2: Greater housing supply, choice and affordability to meet Sydney's changing needs and lifestyles.

2.2.1 Goal 1: A competitive economy with world-class services and transport

Goal 1 is supported by *Direction 1.7: Grow strategic centres - providing more jobs closer to home*. This direction recognises the need for Sydney to grow its regional centres, creating employment in areas outside of the CBD that are accessible to surrounding residential communities.

Direction 1.7 is further supported by *Action 1.7.4: Continue to grow Penrith, Liverpool and Campbelltown-Macarthur as regional city centres supporting their surrounding communities*. In this action, Government are recognising Campbelltown-Macarthur as an important strategic growth centre in both housing and employment. It is identified in the Plan that the Campbelltown-Macarthur centre would service communities in the North West Growth Centre (NWGC) and South West Growth Centre (SWGC).

2.2.2 Goal 2: Greater housing supply, choice and affordability to meet Sydney's changing needs and lifestyles

Goal 2 is supported by *Direction 2.4: Deliver timely and well planned greenfield precincts and housing*, and the associated *Action 2.4.2: Develop a framework for the identification of new growth centres*.

This direction recognises the need for Sydney to investigate and plan affordable development in new land release areas as a key component in meeting Sydney's required overall housing supply. More specifically, the Plan

stipulates the Government need to plan for future growth in areas beyond the NWGC and SWGC. This commitment has led directly to further investigation in the Greater Macarthur area as a potential growth region.

In this direction Government further recognise Campbelltown-Macarthur as an important strategic growth centre in both housing and employment, driving the need to further investigate greenfield areas to the south and south-west of Campbelltown-Macarthur (i.e. Macarthur South Investigation Area).

2.2.3 South West Subregion

Subregional planning of Sydney is described in the Plan as the link between the big picture and the formulation of detailed planning controls for local areas. The Plan subdivides Sydney into six subregions. The defined boundary for the South West Subregion, and planned priorities, are illustrated in Figure 4 and highlighted below.

- **Badgerys Creek Airport** will be a catalyst for investment in infrastructure and jobs in the subregion, enhancing connections to other cities across Australia and around the world.
- **Liverpool, Campbelltown-Macarthur, Leppington** and the **Western Sydney Employment Area** will also contribute to the growth and diversification of the subregion's economy.
- The **South West Growth Centre** will continue to play a key role in providing housing and jobs for future residents.
- The subregion will benefit from improved access including a potential extension of the **South West Rail Link** (see Section 2.4.2).

Macarthur South (referred to as Greater Macarthur for the purposes of this investigation) is further enforced in the subregional strategy as an Urban Investigation Area requiring assessment for suitability as a growth centre servicing Sydney's south west.

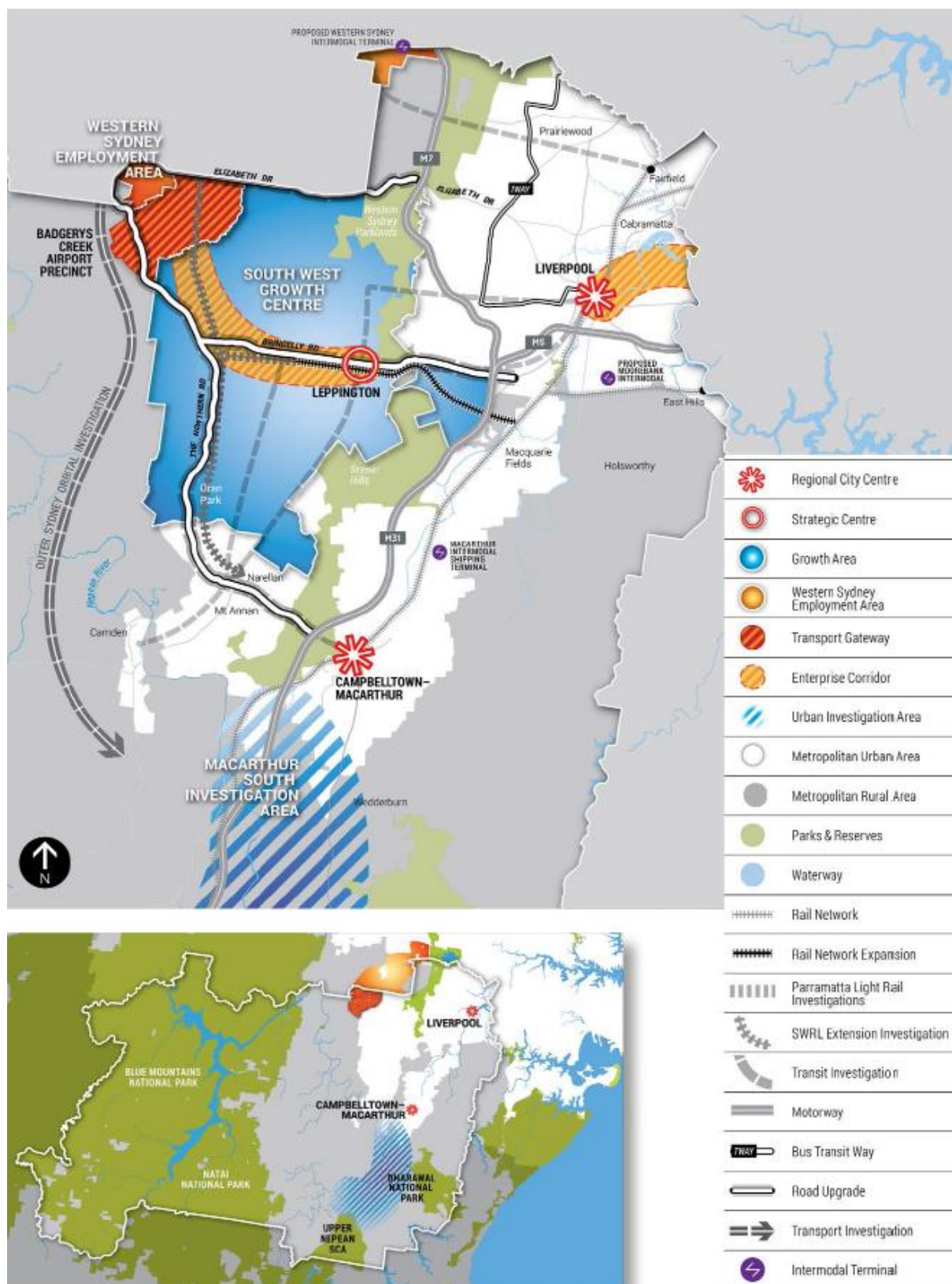


Figure 4 South West Subregion Plan (Source: A Plan for Growth Sydney, 2015)

2.3 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (LTTMP) sets the direction for transport planning for the next 20 years, providing a framework for transport policy and investment decisions that respond to key challenges. The LTTMP identifies solutions and actions that integrate, modernise, grow, and manage the transport system in the short term (0-5 years), medium term (5-10 years) and longer term (10-20 years). The LTTMP proposes a number of improvements to the transport network to deliver stronger connections to regional cities, towns and communities.

Through detailed analysis and customer engagement, six major challenges of the NSW transport system were identified:

- Integrating modes to meet customer needs
- Getting Sydney moving again
- Sustaining growth in Greater Sydney
- Providing essential access to regional NSW
- Supporting efficient and productive freight
- State-wide actions.

In response to these challenges, the LTTMP identifies a total of 220 short, medium and long term actions to transform the transport system to 2031.

Of relevance to the GMLRI area is the Plan's goal of protecting Greater Sydney's transport corridors. This goal is supported by *Action 19: Preserve 19 major transport corridors across Sydney for future transport requirements*. The corridors identified for preservation are illustrated in Figure 5.

A summary of information in the plan relevant to Sydney's south west and the GMLRI area is summarised in Table 1.

Table 1 Features of the LTTMP in Sydney's south west

Feature	Details
Outer Sydney Orbital	Identified as a medium to long term priority transport (road and rail freight) corridor to support freight and urban growth in Sydney's west. Identified as a key corridor for preservation (see Figure 5, item 10).
Georges River Parkway	Identified as a key future transport corridor that is already preserved (Figure 5, item 15).
High Speed Rail	Identified as a key corridor for protection. Current details of the project and its preferred alignment are discussed in Section 2.5 (National strategies and plans).
M31 Hume Motorway	Identified as the nation's busiest interstate freight route, along with the Pacific Highway.
Picton Road	Identified for safety upgrades to support freight operations and improve links to and within the Illawarra.
Camden Valley Way	Identified for upgrading to a four lane divided road between Narellan and Prestons by 2015. Stages 1 and 2 were completed in 2014, Stage 3 is expected to be complete late 2015.
Western Sydney Freight Line and Terminal	Identified as a key future transport corridor for preservation (Figure 5, item 18), to enhance capacity for movement of freight by rail.
Maldon to Dombarton Rail Link	Identified to allow a further shift of freight movement from road-based to rail-based. Corridor exists within the GMIA in the vicinity of Wilton Junction. Identified for project development in the medium term, and as a corridor for preservation.

Source: *NSW Long Term Transport Master Plan*, 2012

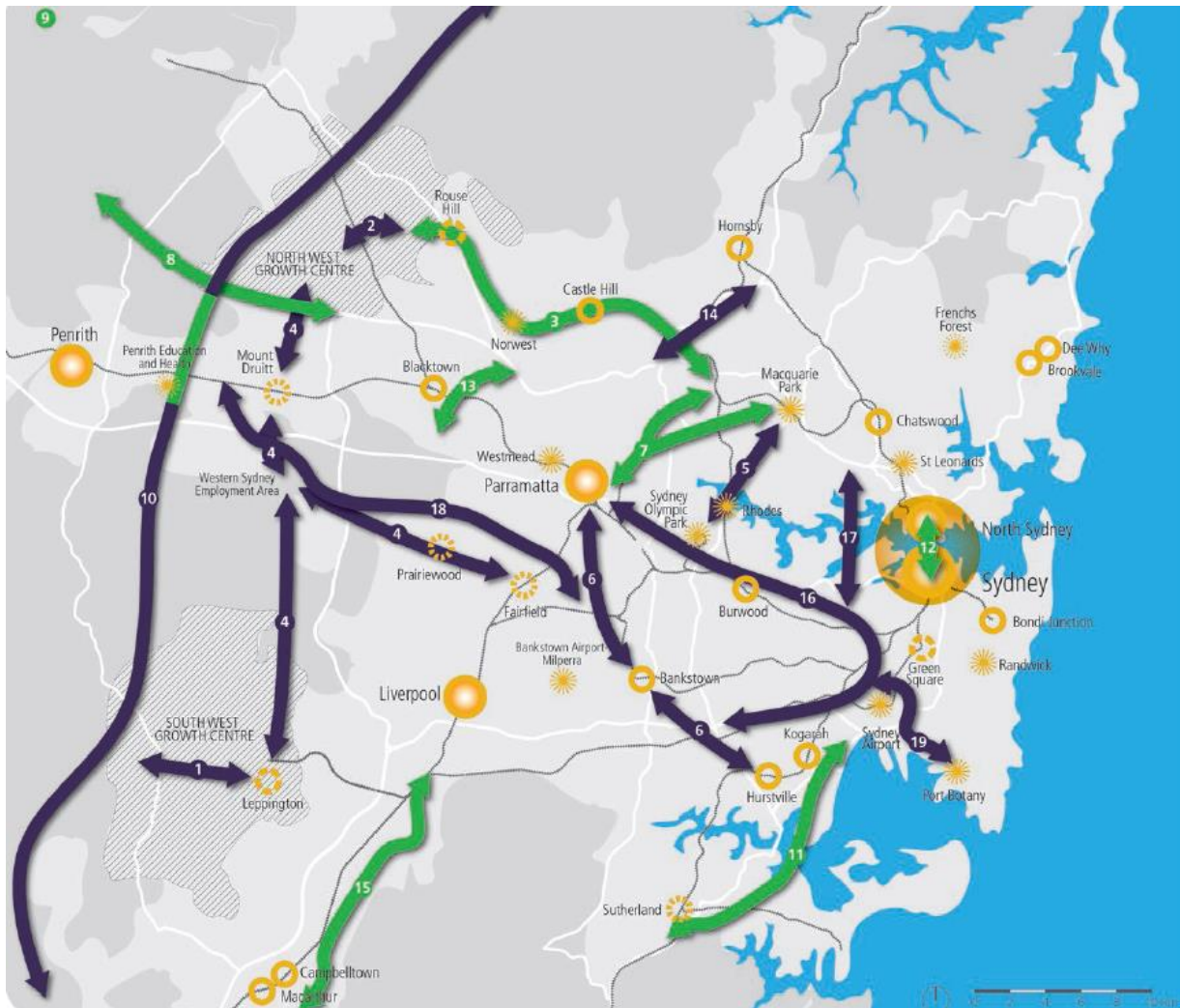


Figure 5 Sydney's preserved transport corridors (Source NSW Long Term Transport Master Plan)

2.3.1 Sydney's Walking Future

Sydney's Walking Future aims to encourage and enable more people to walk, reducing congestion on roads and easing pressure on public transport. *Sydney's Walking Future* (SWF) will provide for customers by:

- **Promoting** walking as a form of transport
- **Connecting** people with places by establishing safe walking networks around centres and public transport interchanges
- **Engaging** with partners to maximise effectiveness.

Research indicates 73 per cent of customers could be encouraged to walk more if the following issues are addressed:

- **Connectivity and reduced delays:** Establish more legible routes that provide stronger connections between public transport and centres, helping create more pleasant trips.
- **Pedestrian safety and personal security:** Initiatives such as reducing traffic speeds in high volume pedestrian areas and improving street lighting will improve safety and security.
- **Health and wellbeing benefits:** Using travel behaviour and planning initiatives in appropriate settings (such as schools, universities and workplaces) to promote the physical, emotional and social benefits of walking.
- **Supporting facilities:** Weather protection, effective signage and more facilities at transport interchanges will help support walking.

In terms of connecting people, emphasis is placed on linking walking with urban growth. A strong focus is placed on investing in areas within two kilometres of centres and public transport interchanges. The plan proposes a series of both infrastructure and non-infrastructure (i.e. policy, awareness etc.) initiatives sequenced over the short, medium and long term (7+ years).

2.3.2 Sydney's Cycling Future

Sydney's Cycling Future aims to support a shift towards cycling. About 70 per cent of NSW residents have indicated that they would like to cycle more for everyday transport. As such, *Sydney's Cycling Future* plans, prioritises and provides for cycling by:

- Investing in separated cycleways and providing connected cycle networks to major centres and transport interchanges.
- Promoting better use of the existing cycle network.
- Engaging with partners to maximise effectiveness.

Sydney's Cycling Future proposes a hierarchy of cycleways that help identify and prioritise key projects:

- **Regional bicycle corridors:** separate cycleways on high volume routes that connect major destinations.
- **Local bicycle network:** lower volume routes that connect to priority corridors and neighbourhood destinations within catchments.
- **Quiet local streets:** low traffic environment which connects residential destinations and local services.

Bicycle network plans are to be developed within five kilometre catchments of Major Centres, including Campbelltown / Macarthur. The Government will work with councils and developers to identify and co-fund these bicycle links.

2.3.3 Sydney's Rail Future

Sydney's Rail Future document sets out how Sydney's rail system challenges will be met through the delivery of a three-tiered rail network. The proposal includes the introduction of a new Rapid Transit service in addition to improvements to the existing Suburban and Intercity services. The new Rapid Transit Network is to provide 'turn up and go' type services with a high frequency single-deck train service at each station throughout the day.

The document identifies a five stage plan in which Sydney's Rail Future (see Figure 6) will be delivered as described below.

- 1) Operational efficiencies
- 2) Network efficiencies
- 3) New rapid transit system, including construction of North West Rail Link from the North West to Chatswood
- 4) Second Harbour Crossing, extending Rapid Transit from Chatswood to the CBD
- 5) Southern section conversion, including extension from the Rapid Transit network to Bankstown and Hurstville.

Under this plan, current suburban rail services on the T2 Airport Line will be doubled from eight to up to 16 services per hour to meet the needs of the growing south west, including Campbelltown. As indicated by Figure 6, the current plan does not include any extension of the suburban network beyond Macarthur.

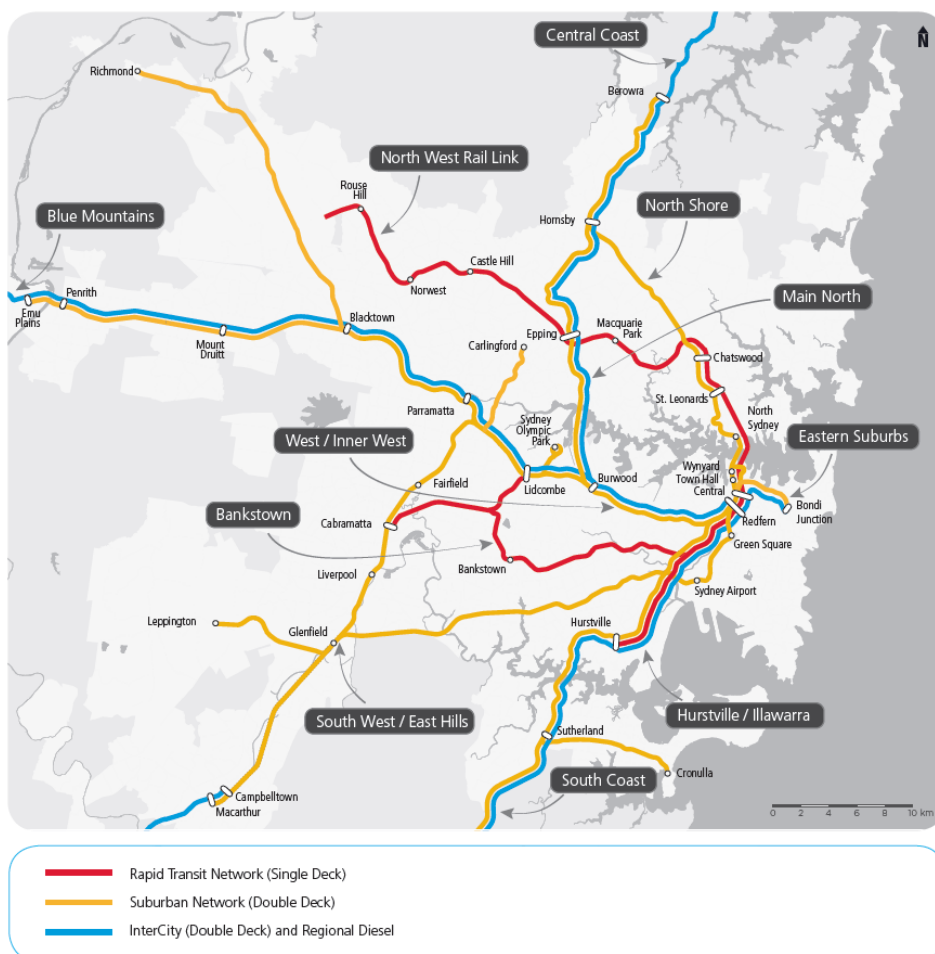


Figure 6 Sydney's Rail Future: Three tier railway (Source: *Sydney's Rail Future*)

2.3.4 Sydney's Bus Futures

Sydney's Bus Future document sets out actions to deliver faster and more reliable bus services for customers of Sydney's transport network. A three-tiered bus network is proposed comprising:

- Rapid bus services: Frequent 'turn up and go' services with stops every 800 metres to one kilometre. 13 routes will provide fast and reliable journeys.
- Suburban bus services: A mix of frequent 'turn up and go' and timetabled services with stops every 400 metres. 20 routes across Sydney.
- Local bus services: Timetabled services with stops every 400 metres. Services run on local streets and (where appropriate) bus lanes for peak express connections.

The proposed core bus network includes a total of 13 Rapid bus routes and 20 Suburban bus routes, as well as reconfiguration of Local bus services to supplement this core network. The proposed core bus network in the far south west is shown in Figure 7. As illustrated, no new Suburban or Rapid bus services are currently proposed within the GMLRI area. However a future Rapid route will be investigated between Liverpool and Campbelltown via Leppington using the existing Hoxton Park Road T-way, Fifteenth Avenue, Narellan Road and a new road alignment between Leppington and Oran Park. A Suburban route linking Camden to Liverpool via Oran Park, Leppington and Edmondson Park will also be investigated.

The combination of these two routes, should they be implemented, would improve public transport access to the SWGC from Camden and Campbelltown-Macarthur.



Figure 7 Sydney's Bus Future: Core bus network (Source: Adaptation from *Sydney's Bus Future*)

2.3.5 NSW Freight and Ports Strategy

In NSW, the freight movement task is predominantly undertaken on a shared transport network where the movement of freight and the movement of people compete for space. With the exception of some dedicated freight networks, such as railways in more regional NSW used to transport coal and grain, the interaction of the movement of freight with the movement of people generally happens across the transport network. This includes roadways, railways, airports and waterways.

The *NSW Freight and Ports Strategy* is the 20 year plan to ensure freight is at the forefront of the NSW economy. The strategy is the Governments response to the forecast doubling of freight volumes through NSW in the 20 year period to 2031. The key objectives of the strategy are the: delivery of a freight network that efficiently supports the projected growth of the NSW economy, and balancing freight needs with those of the broader community and the environment. An adaption of the plan is illustrated in Figure 8.

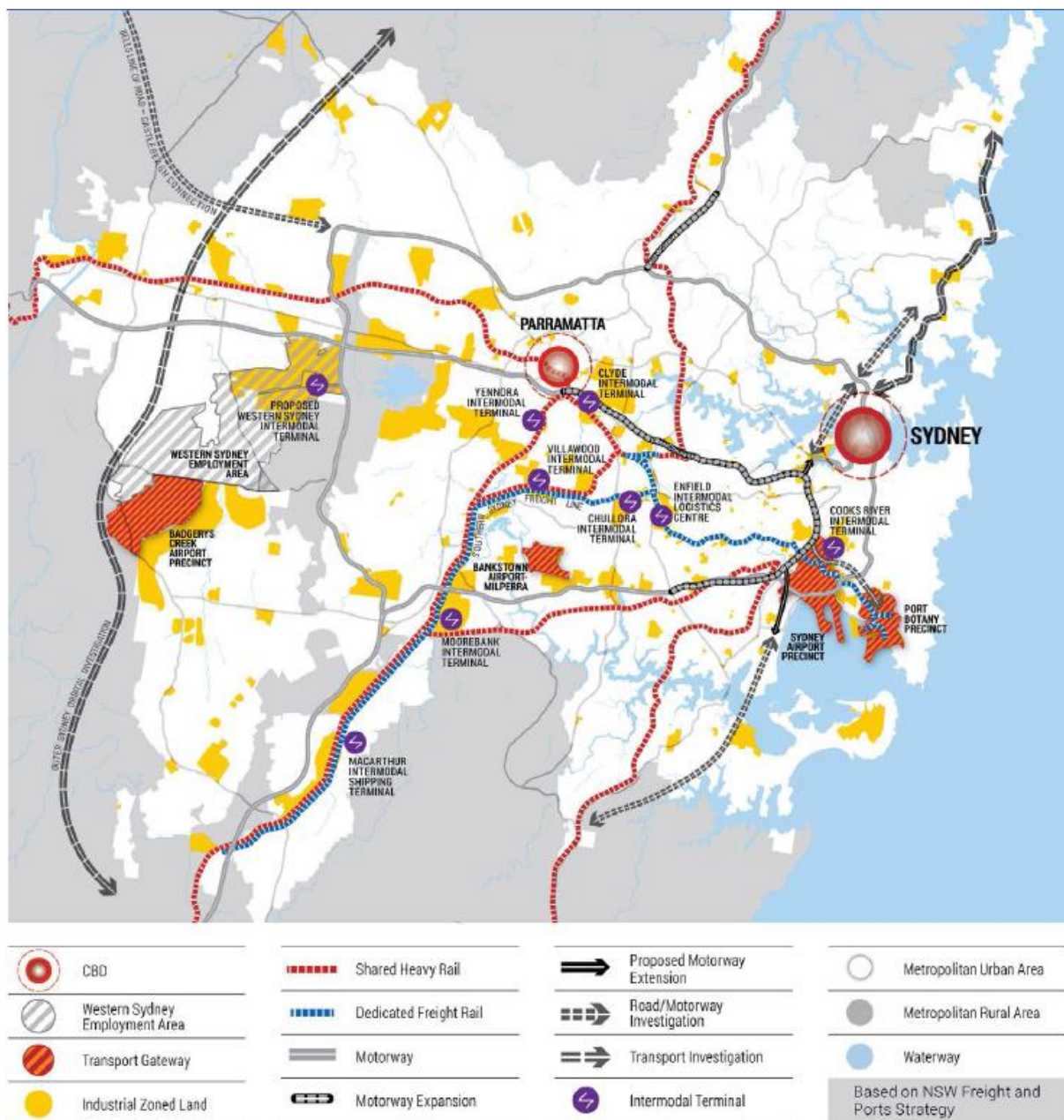


Figure 8 NSW Freight and Ports Strategy (Source: A Plan for Growing Sydney, based on NSW Freight and Ports Strategy)

The strategy defines a three stage action program as identified below.

- 1) Network efficiency – aimed at identifying and utilising latent capacity in the existing network and assets.
- 2) Network capacity – aimed at setting out to establish and maintain a whole-of-network approach to identify actions that increase network capacity, and achieve the desirable balance of capacity and performance.
- 3) Network sustainability – aimed at achieving a sustainable freight network that balances efficient freight movements with community expectations of safety, good neighbourhood amenity and positive environmental outcomes through the integration of land use and freight logistics planning.

Of the 71 projects identified in the NSW Freight and Ports Strategy infrastructure program, some projects have secured funding and work has commenced. The infrastructure program also incorporates additional projects identified as a result of the Actions in the Strategy. Information relevant to the GMLRI area has been extracted and provided in Table 2.

Table 2 NSW Freight and Ports Infrastructure Program

Sponsor	Project	Description	Mode	Status
TfNSW	Outer Sydney Orbital	Detailed Alignment Study for an Outer-Sydney Orbital Multi-Modal Transport Corridor that includes dedicated rail for freight movements.	Multi	Funding sources to be determined
TfNSW	Maldon-Dombarton Rail Line	Approximately 70 per cent of the earthworks, track formation, drainage and bottom ballast was constructed when the project initially began works in the 1980's, including the approaches to the mid span of the Nepean River Bridge. To enable the connection of Port Kembla directly to the Main South via Dombarton at Maldon requires the laying of 35 kilometres of rail track and track related infrastructure, with construction of the Avon Tunnel and the Cordeaux River Bridge. The Australian Government provided TfNSW with \$25.5M to undertake planning and preconstruction development in 2011. This planning encompassed assessment of design, engineering, safety, operations, environmental, economic, cost and stakeholder issues.	Rail	Planning complete
TfNSW	M31 Hume Motorway – Picton Road Interchange	RMS has undertaken modelling to assess alternative interchange layouts that could resolve the long term capacity and road safety concerns associated with the existing layout. The preferred option for upgrading the interchange involves constructing an additional bridge to provide a six lane configuration of Picton Road over the M31 Hume Motorway and two continuous off-ramp trumpets from the M31 Hume Motorway, reducing conflicting traffic movements and maintaining traffic flow. Private development proposals in the Wilton Junction area are major drivers for the project.	Road	Funding source to be determined
TfNSW	Picton Road – Road Safety Treatments	This project provides essential improvements to upgrade the Picton Road between the M31 Hume Motorway intersection at Wilton and the Mt Ousley Road intersection at Mt Keira.	Road	Complete
TfNSW	Moorebank Intermodal Terminal supporting transport system upgrades	Provide the supporting road infrastructure upgrades at the Moorebank IMT precinct to meet forecast transport demand driven by Moorebank IMT operations and passenger traffic growth on the surrounding network.	Road	Funding sources to be determined

Sponsor	Project	Description	Mode	Status
ARTC	Southern Sydney Freight Line (SSFL)	The SSFL is a 36 kilometre dedicated single, bi-directional and non-electrified freight line between Macarthur and Sefton Park Junction, where it joins the existing Metropolitan Freight Network. The SSFL also incorporates six kilometres of existing track between Ingleburn and Glenfield and provides for a connection to the proposed intermodal terminals at Moorebank. It was also identified in the SIS to amplify the SSFL to meet future growth in freight. ARTC will lead a planning project to investigate capacity enhancements to the SSFL and Metropolitan Freight Network, which will support the Moorebank terminal precinct. ¹	Rail	Complete. Amplification Scoping phase also funded.
TfNSW	Western Sydney Freight Line and Intermodal Terminal	Corridor protection and design works for potential Western Sydney Freight Line (WSFL) alignments are required to ensure successful construction and on time delivery of the WSFL if the project were to proceed. The project includes assessment of suitable sites, land acquisition and planning to "ready-to-proceed" status for a Western Intermodal Terminal that connects to interstate mainline rail networks, Port Botany and Sydney Metropolitan arterial roads	Rail	Planning is partially funded

Source: Adapted from NSW Freight and Ports Strategy

In terms of the impacts of the above on the GMLRI area, it is considered that:

- Proposed upgrades at the M31 Hume Motorway / Picton Road interchange would increase capacity locally, and potentially facilitate increased development in the Wilton area.
- Completion of the Maldon-Dombarton Rail Line would attract significant increase in rail freight movements. Consideration of freight rail noise impacts on the amenity of land development is especially important. Infrastructure within and near the corridor will need to be adequately designed to address rail noise.

2.4 State Infrastructure Strategy

The State Infrastructure Strategy is produced by Infrastructure NSW in its function of delivering independent advice to the NSW Government on the highest priority infrastructure projects for the State. The strategy was initially developed in 2012 following the establishment of Infrastructure NSW in mid-2011. It was subsequently updated in 2014 following the transition of many important projects from concept to business case. As part of the *Rebuilding NSW Plan*, the NSW Government has reviewed and accepted the investment recommendations put forward by Infrastructure NSW, with larger scale transport commitments including:

- \$7 billion for Sydney Rapid Transit.
- \$1 billion of funding for Sydney's Rail Future Phase 2.
- An additional \$600 million for Parramatta Light Rail.
- \$300 million for Bus Rapid Transit and Bus Priority Infrastructure.
- Invest in the Western Harbour Tunnel and WestConnex northern/southern extensions.
- \$300 million to unblock critical constraints, creating a Gateway to the South.
- Complete investigations for larger-scale investment in the F6 and A6 corridors.
- \$300 million for the Urban Roads Pinch Points program.
- \$2 billion for a Regional Road Freight Corridor program.
- \$1 billion for a Regional Growth Roads program.
- \$100 million for Corridor Identification and Reservation

¹ http://investment.infrastructure.gov.au/projects/ProjectDetails.aspx?Project_id=051132-13SA-NP

Key relevant recommendations from the Strategy are summarised below. The design and delivery of the identified projects for which funding is reserved will be subject to thorough examination and scrutiny.

2.4.1 Improving connections to Port Kembla and the Port of Newcastle

The strategy makes reference and recommendations regarding projects that improve connectivity to Port Kembla, predominantly surrounding the need for freight access to the port. Sydney's existing Metropolitan Passenger Network is shared infrastructure used predominantly for passenger services, causing efficiency issues for freight services to Port Kembla. These are forecast to exacerbate with proposed passenger service frequency increases. The strategy makes the following recommendations:

- Work commence to assess and prioritise the following projects: Moss Vale – Unanderra capacity enhancements, Dapto to Unanderra duplication and Macarthur to Moss Vale capacity enhancements.
- ARTC be encouraged to amplify the South Sydney Freight Line between Moorebank and Macarthur to enable regional exporters to secure freight paths to Port Kembla.
- Work commence to gauge private sector interest in the potential to construct, operate and maintain the Maldon-Dombarton Rail Line (see Figure 9).
-

Delivery of these projects would provide dedicated freight railway for almost the full journey from metropolitan Sydney almost all the way to Port Kembla as well as improved access further south west. Within the Government-endorsed version of the Strategy (*Rebuilding NSW*), it is stated that both road and rail projects that improve connectivity into the port will be developed and assessed on an economic needs basis.

It should be noted that as a future overflow to Port Botany, Port Kembla is designated as the second NSW container port.



Figure 9 Road and Rail Network Supporting Port Kembla (Source: State Infrastructure Strategy Update, 2014)

2.4.2 Future extensions to the rail network

In order to improve connectivity to Sydney's global centres, Infrastructure NSW have identified that following the delivery of SRT (the current focus of passenger service capacity enhancements in Sydney), there will be potential to expand the existing rail network further into the western growth centres. Furthermore, the earlier that preferred connections and alignments are identified, the earlier the corridors can be preserved.

The **South West Rail Link (SWRL) extension** to St Marys via Second Sydney Airport and Bringelly to Macarthur via Narellan is identified in the strategy as a corridor to be prioritised for corridor protection. The strategy further recommends that TfNSW commence feasibility studies into the long-term rail network (including greenfield areas) and report back to the Government by the end of 2015.

In response, TfNSW in 2014 commenced the process of consulting with the community to assist in identifying a public transport corridor that extends the South West Rail Link into the areas where residential and employment are planned to grow. Just recently in June 2015, following consultation and more detailed technical analysis, TfNSW has identified a recommended corridor for the southern section from Leppington to Bringelly and Narellan. Furthermore, and of particular relevant to the GMIA, an investigation area has been opened for consultation, which extends the corridor further south from Narellan to the existing T2 South Line near Macarthur. The investigation area includes the areas of Menangle and Menangle Park as illustrated in Figure 10.

Extension of the South West Rail Link to Macarthur would provide residents of the Macarthur / Campbelltown area with enhanced connectivity to the planned western Sydney centres including the Western Sydney Employment Area and the Western Sydney Airport. By extension, it also provides an opportunity to enhance public transport access to these employment areas for Greater Macarthur residents, through integration with the GMIA transport network.

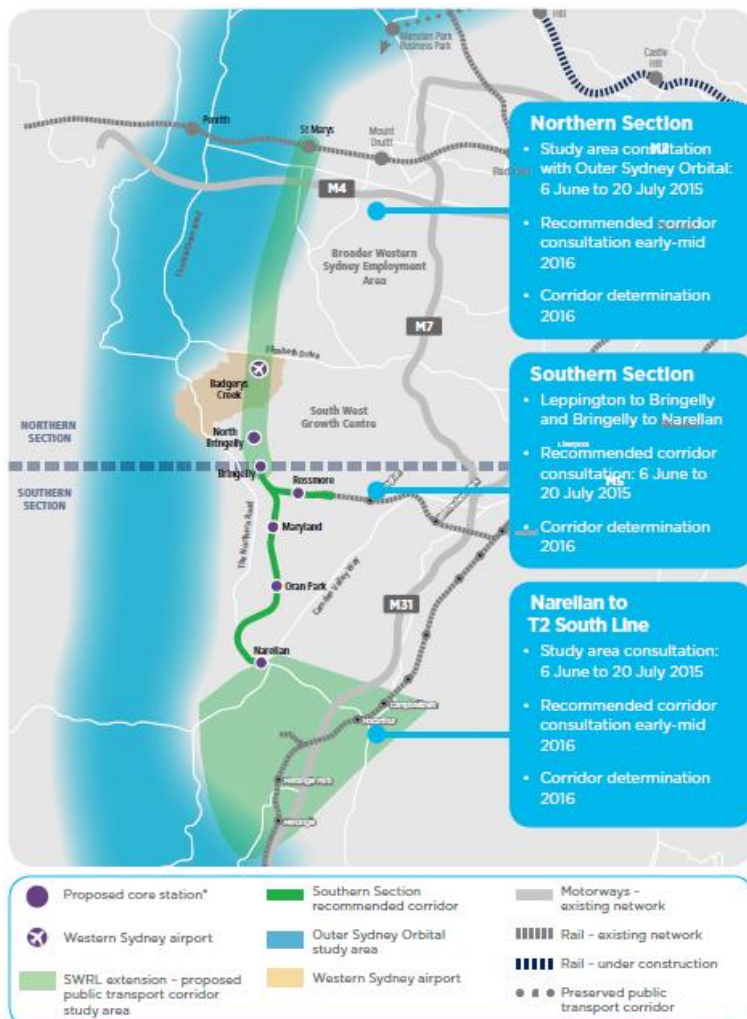


Figure 10 SWRL extension (Source: TfNSW, 2015)

2.4.3 Future corridor definition and protection

In regards to the **Outer Sydney Orbital (OSO)**, Infrastructure for NSW assessed construction of the road and freight rail project as falling outside the 20-year horizon for the strategy, recommending TfNSW should instead complete corridor identification and preservation.

In response, TfNSW announced in June 2015 that an investigation is being undertaken to determine a suitable OSO corridor to provide a north – south connection for a future motorway, freight rail with supporting Intermodal Terminal and where practical a passenger rail line. The study is currently in a consultation and information gathering period, due to end in July 2015, which will be followed by the identification of a 'long list' of corridor route options. Corridor preservation is currently programmed to be complete by the end of 2016.

2.5 National strategies and plans

2.5.1 High speed rail

A high speed rail (HSR) passenger network connecting Melbourne, Sydney, Canberra, Brisbane and other regional centres is under investigation by the Australian Government. The *High Speed Rail Study Phase 2 Report* was published in April 2013, which identified the following key findings²:

- The preferred definition of the HSR includes approximately 1,748 kilometres of dedicated rail corridor with four city centre stations, four peripheral city stations and 12 regional stations.
- Stations in Sydney would include Central, Hornsby (Sydney North) and Holsworthy (Sydney South) – approximately 15 kilometres north east of Macarthur.
- The preferred project would cost approximately \$114 billion to deliver and has an estimated economic BCR of 2.3.
- The optimal staging for the HSR program would involve building the Sydney-Melbourne line first, starting with the Sydney-Canberra section. Construction of the Sydney to Canberra section of the HSR could begin as early as 2022 under an accelerated program, or 2027 under optimal program.

The preferred alignment for the project in the Macarthur area is illustrated in Figure 11. The alignment traverses the south eastern extent of the existing urban footprint of Macarthur (adjacent to the Georges River Parkway Reserve), crossing Appin Road near Mount Gilead, then running on a north-south alignment adjacent to the Nepean River between Appin Road and the M31 Hume Motorway before crossing Picton Road immediately to the east of Wilton.

This alignment was preferred over an alignment to the west of the M31 Hume Motorway due to lower anticipated impacts on planned urban release at Menangle Park and lower anticipated adverse impacts on endangered species and areas of cultural heritage.

Preservation and protection of a preferred HSR corridor was identified in the Phase 2 report as the next important step in the project. The Australian Government is currently consulting with the governments of New South Wales, Victoria, Queensland and the ACT on the best approaches to protecting a corridor for a future HSR network and other considerations for HSR³. It is understood that the process of land resumption or corridor preservation has not commenced. Progression of the project has also slowed since the change of Federal Government in 2013.

² AECOM et al, High Speed Rail Study Phase 2 Report, April 2013

³ https://www.infrastructure.gov.au/rail/trains/high_speed/ (accessed 17 April 2014)

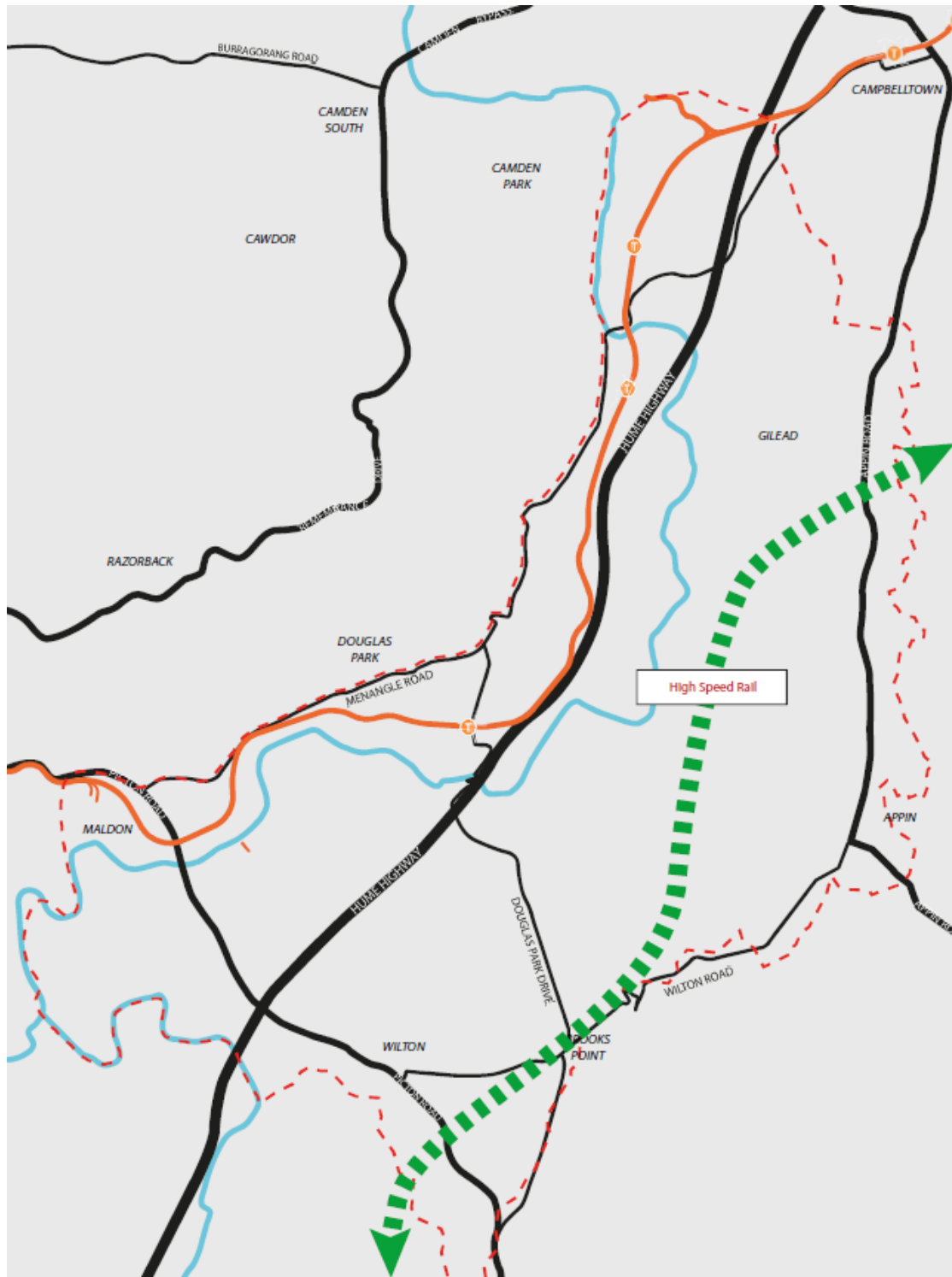


Figure 11 Preferred high speed rail alignment (Source: Adaptation from High Speed Rail Study: Phase 2, 2013)

2.5.2 Western Sydney Infrastructure Plan

In response to increasing levels of congestion on roads in Sydney's west, and the planned increase in economic activity induced by the Western Sydney Airport (WSA) and Western Sydney Employment Area (WSEA), the Australian Government has committed to investing over \$3 billion over 10 years in major infrastructure upgrades that will facilitate the region's economic activity.

This programme includes:

- Upgrade of The Northern Road to a minimum of four lanes from Narellan to the M4 Western Motorway.
- Construction of a new east-west motorway to the airport between M7 WestLink Motorway and The Northern Road.
- Upgrade of Bringelly Road to a minimum of four lanes between The Northern Road and Camden Valley Way.
- A \$200 million package for local roads upgrades.

This plan is described further in the context of the broader plan for Western Sydney in Section 4.1.

2.6 Summary

In recent years, the State and Federal Governments have prepared a number of plans and strategies that highlight the needs of additional infrastructure to address existing pinch-points of the road and rail networks as well as to cater for future population and employment growth targets in Western Sydney through multi-modal transport strategies including:

- Road network upgrade planning and corridor preservation such as:
 - Outer Sydney Orbital (corridor preservation for road and freight)
 - Georges River Parkway
 - M31 Hume Motorway (road and freight)
 - Picton Road (road and freight)
 - Camden Valley Way and Narellan Road upgrades
 - Western Sydney Infrastructure Plan that includes:
 - Upgrade of The Northern Road to a minimum of four lanes from Narellan to the M4 Western Motorway.
 - Construction of a new east-west motorway between the M7 WestLink Motorway and Northern Road, serving Western Sydney Airport.
 - Upgrade of Bringelly Road between The Northern Road and Camden Valley Way.
- Rail network and service upgrade planning such as:
 - High Speed Rail (corridor preservation)
 - Improvements to the existing Suburban and Intercity services as proposed in Sydney's Rail Future
 - South West Rail Link extension to St Marys via Second Sydney Airport and Bringelly to Macarthur via Narellan is identified in the strategy as a corridor to be prioritised for corridor protection.
 - Maldon-Dombarton Rail Line (freight)
 - Southern Sydney Freight Line (completed).
- Bus network and service upgrade planning to deliver rapid bus and suburban bus routes in South Western Sydney to connect major centres including Liverpool, Campbelltown-Macarthur, Leppington and Camden.
- Walking and cycling strategies to deliver supporting infrastructure that aim to encourage and enable more people to walk and cycle to centres, reducing congestion on roads and easing pressure on public transport.

The development of a transport infrastructure plan for the GMIA should be considered in the context of all these existing plans and policies such that they can be applied or extended to provide a multi-modal transport strategy for the GMIA serving future population and employment growth in the area and connecting to surrounding major centres and transport hubs.

3.0 Existing conditions

3.1 Travel pattern and behaviour

The Bureau of Transport Statistics (BTS) provides a range of data pertaining to observed trends in travel pattern and behaviour of NSW residents. These include the Household Travel Survey (HTS) and Journey to Work (JTW) data.

The HTS provides detailed data on the travel patterns of residents of the Greater Metropolitan Area of Sydney collected through face-to-face interviews.

The JTW data is extracted from the Australian Bureau of Statistics (ABS) census. The data set provides details of the origin and destination zones of trips, as well as characteristics of the journey such as mode of travel.

3.1.1 Purpose of travel

A review of the 2012/13 Household Travel Survey (HTS) for surrounding local government areas was undertaken to gain an understanding of current travel behaviour in the area.

In 2012/13 residents within Wollondilly LGA made 3.6 trips on a weekday, which is lower when compared to the Sydney Greater Metropolitan Area (GMA) which made 3.7 trips on a weekday. Vehicle ownership per household within Wollondilly LGA was 2.2, the highest of any LGA within the Sydney GMA. The average for Sydney GMA was 1.6 vehicles per household and the average for the South West subregion was 1.8 vehicles per household.

Table 3 presents the trip purpose of residents within surrounding LGAs of the study area. Social/recreation trips were higher for LGAs outside of the Sydney Train's suburban network, whereas serve passenger trips were higher for those within the suburban network.

Table 3 Purpose of travel

Trip purpose	Wollondilly LGA	Camden LGA	Campbelltown LGA	South West subregion
Commute	15.2%	18.4%	15.2%	15.9%
Work related business	11.5%	9.0%	8.8%	9.4%
Education/child care	12.7%	9.4%	10.7%	11.2%
Shopping	12.7%	13.0%	15.4%	15.1%
Personal business	5.5%	4.3%	5.3%	5.2%
Social/recreation	22.4%	23.1%	19.2%	20.2%
Serve passenger	16.4%	19.5%	22.9%	20.6%
Other	3.6%	3.2%	2.5%	2.5%

Source: 2012/13 Household Travel Survey

3.1.2 Trip origin and destination

In order to gain an understanding of where trips in the area are travelling to and coming from, the 2011 JTW data for BTS travel zones that approximately comprise the study area was analysed. The GMIA traverses eight travel zones as defined by the NSW Bureau of Transport Statistics (BTS) as shown in Figure 12. Travel zones within the GMLRI study area includes 3005 (Menangle), 3007 (Douglas Park), 3008 and 3010 (Wilton), 3009 (Appin) and 3300, 3305 and 3307 (Menangle Park).

The 2011 BTS data for the highlighted zones indicate that approximately 3,000 work, and 7,000 people reside, within the GMLRI area. The JTW data for the above zones is summarised in Table 4 and illustrated in Figure 13 and Figure 14.

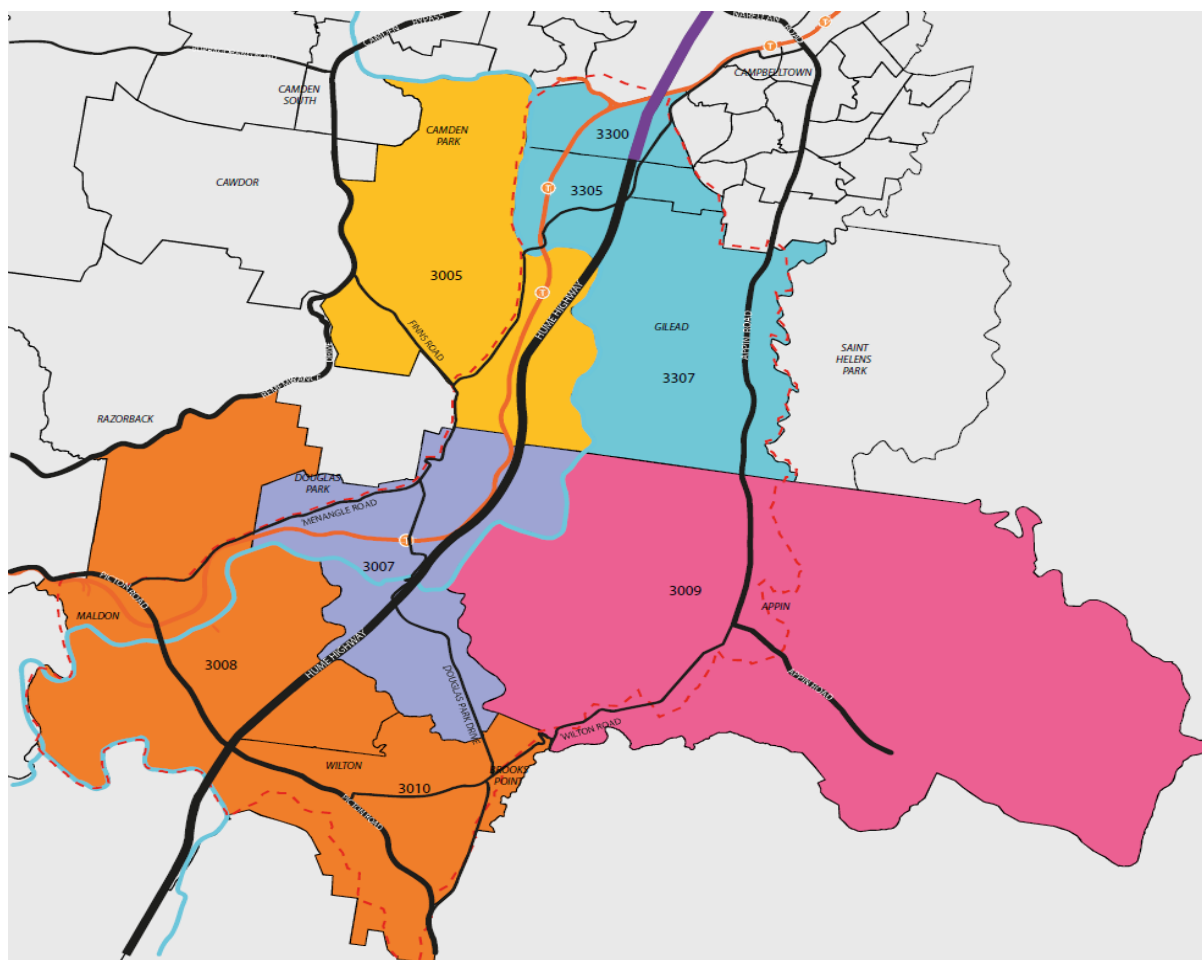


Figure 12 Travel zones within GMIA (Source: BTS, 2015)

Table 4 GMIA JTW origins and destinations

GMIA residents' place of work		GMIA workers' place of residence	
Destination	Proportion (%)	Origin	Proportion (%)
Wollondilly (self-containment)	25%	Wollondilly (self-containment)	34%
Campbelltown	22%	Wollongong	19%
Camden	12%	Kiama - Shellharbour	10%
Liverpool	6%	Campbelltown	9%
Sydney CBD	4%	Dapto - Port Kembla	8%
Other	31%	Other	20%

Source: 2011 Journey to Work, Bureau of Transport Statistics

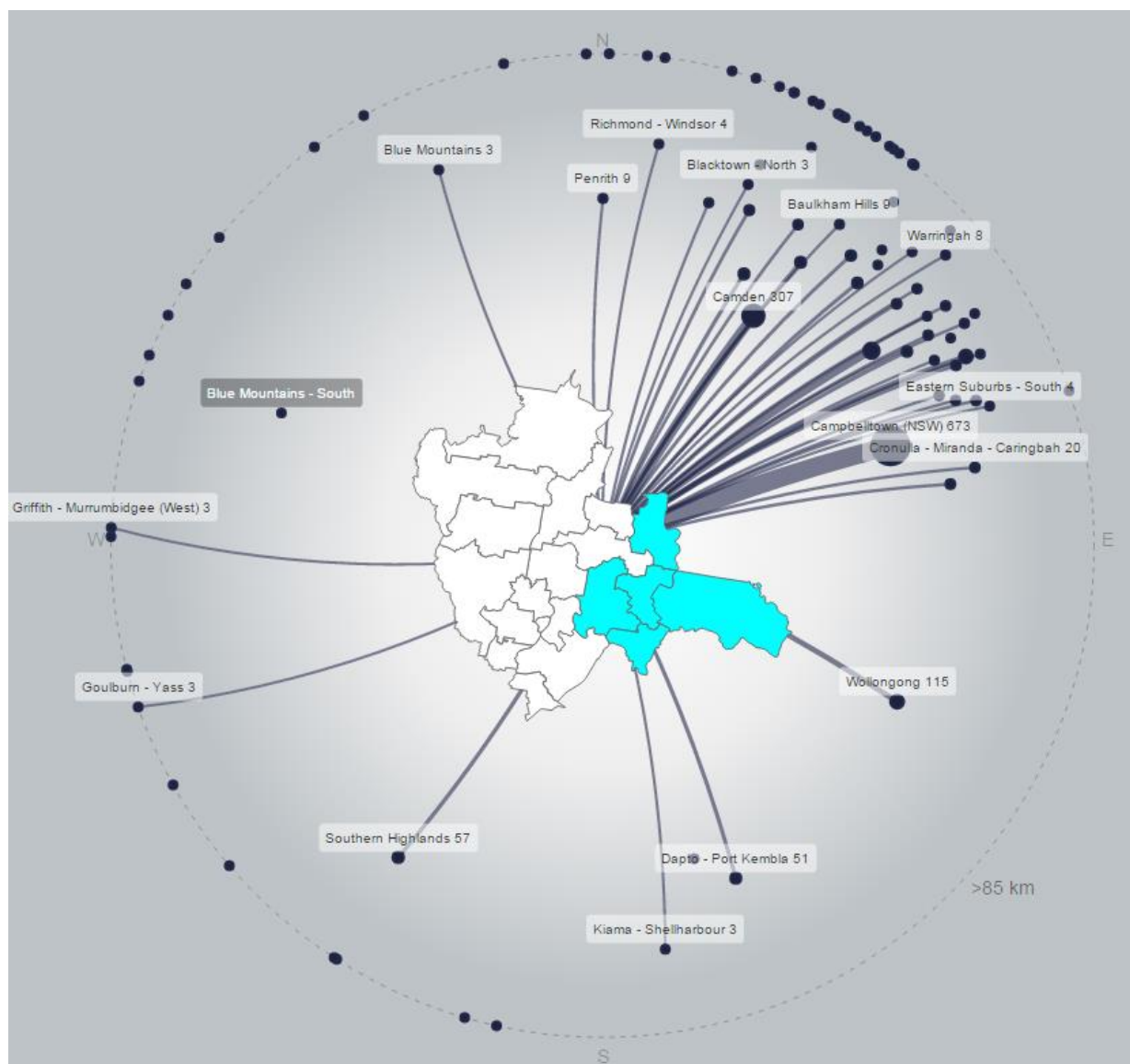


Figure 13 JTW 2011 data - GMIA residents' place of work (Source: BTS JTW Visualiser)

Based on the 2011 JTW data, the majority of employed residents within the study area worked in LGAs within the South West subregion. Approximately 25 per cent of residents both worked and lived within the area (i.e. were self-contained). The predominant source of employment outside of the study area was Campbelltown, followed by Camden and Liverpool. Overall the data suggests the predominant movements for local residents accessing work is to the north and north east. Note the relatively low proportion of residents accessing Wollongong for employment.

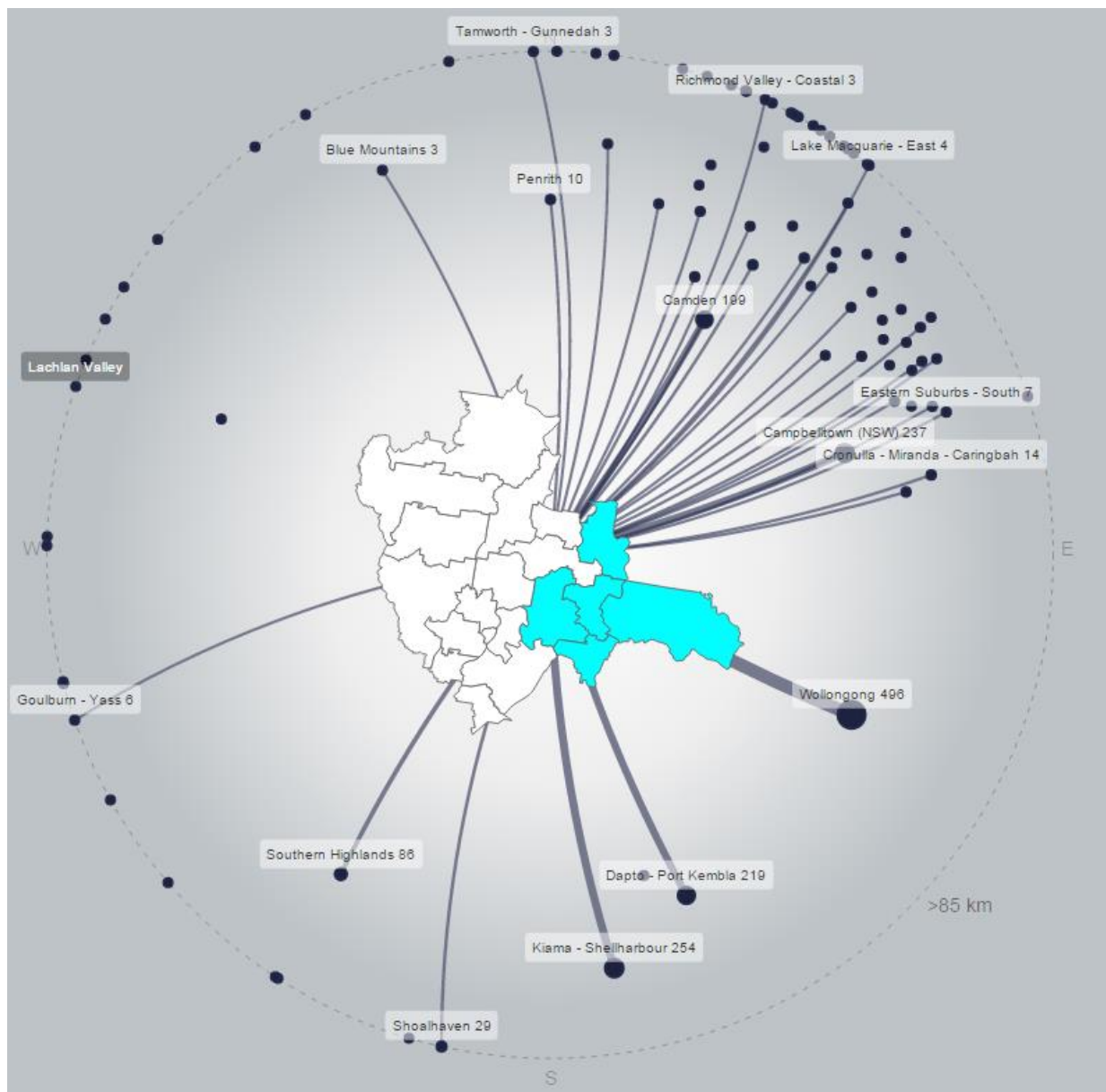


Figure 14 JTW 2011 data - GMIA workers' place of residence (Source: BTS JTW Visualiser)

In terms of people who worked within the GMIA, the 2011 JTW data suggests approximately 30 per cent live and work in the area (i.e. were self-contained), with significant other portions of local workers coming from Wollongong (and surrounds), Campbelltown and Camden. Overall the data suggests the predominant movements for people accessing employment outside of the GMIA are from the southeast and northeast.

High level analysis of JTW data for the surround LGA's of Camden and Campbelltown has also been undertaken and is summarised in the tables following.

Table 5 Campbelltown trip origin and destination

Campbelltown residents' place of work		Campbelltown workers' place of residence	
Destination	Proportion (%)	Origin	Proportion (%)
Campbelltown (self-containment)	36%	Campbelltown (self-containment)	53%
Sydney CBD	11%	Camden	11%
Liverpool	9%	Wollondilly	6%
Camden	5%	Liverpool	4%
Other	40%	Other	26%
Total employed residents	62,582	Total workers	44,610

Source: 2011 Journey to Work, Bureau of Transport Statistics

Table 6 Camden trip origin and destination

Camden residents' place of work		Camden workers' place of residence	
Destination	Proportion (%)	Origin	Proportion (%)
Camden (self-containment)	29%	Camden (self-containment)	47%
Campbelltown	20%	Campbelltown	19%
Liverpool	8%	Wollondilly	14%
Sydney CBD	7%	Bringelly – Green Valley	4%
Other	36%	Other	16%
Total employed residents	25,625	Total workers	15,928

Source: 2011 Journey to Work, Bureau of Transport Statistics

Table 7 Wollondilly trip origin and destination

Wollondilly residents' place of work		Wollondilly workers' place of residence	
Destination	Proportion (%)	Origin	Proportion (%)
Wollondilly (self-containment)	35%	Wollondilly (self-containment)	61%
Campbelltown	15%	Camden	8%
Camden	14%	Wollongong	7%
Southern Highlands	6%	Campbelltown	7%
Other	31%	Other	18%
Total employed residents	16,556	Total workers	9,504

Source: 2011 Journey to Work, Bureau of Transport Statistics

In terms of quantum, the largest origin-destination pairs are those of self-containment within each respective LGA. This is intuitive given the relatively large areas of each respective LGA, combined with the high relative numbers of jobs available. In addition to this, the data further suggests a high level of containment within the three subject LGA's of Wollondilly, Camden and Campbelltown. The next largest origin-destination pairs relate to local residents accessing work in the Sydney CBD and Liverpool.

3.1.3 Mode share

A summary of the mode of transport that employed residents within the study area use to travel to work is shown in Figure 15. The data suggests that residents have a high reliance on private vehicles, accounting for over 90% of trips. This is a reflection on the limited public transport serving the area. Public transport accounted for approximately seven per cent of trips, a majority of which were train trips.

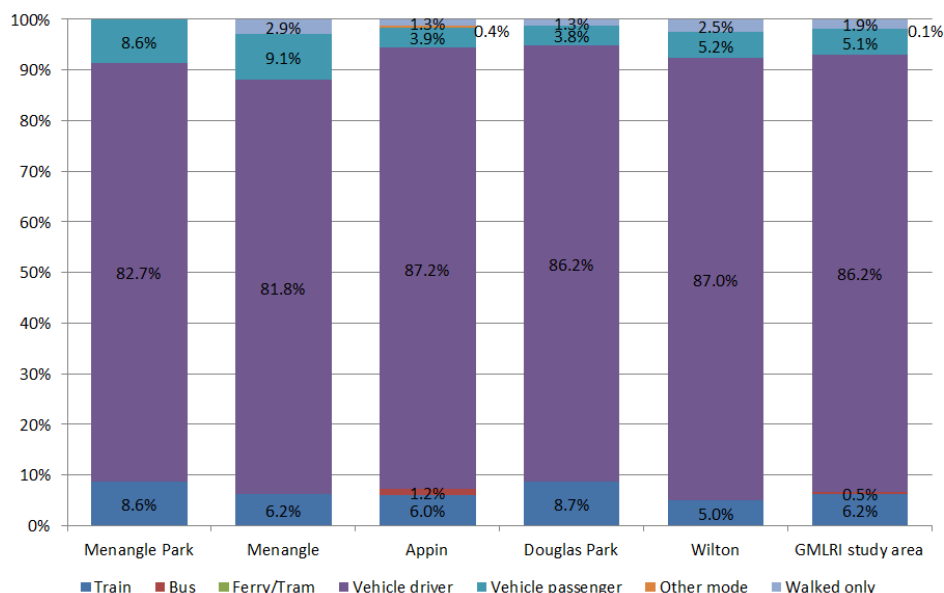


Figure 15 Origin – mode split (Source: 2011 Journey to Work, Bureau of Transport Statistics)

A summary of the mode of transport workers within the study area use to travel to work is shown in Figure 16. The mode split also reflects the lack of public transport serving the area with private vehicle trips accounting for approximately 97 per cent of trips within the study area.

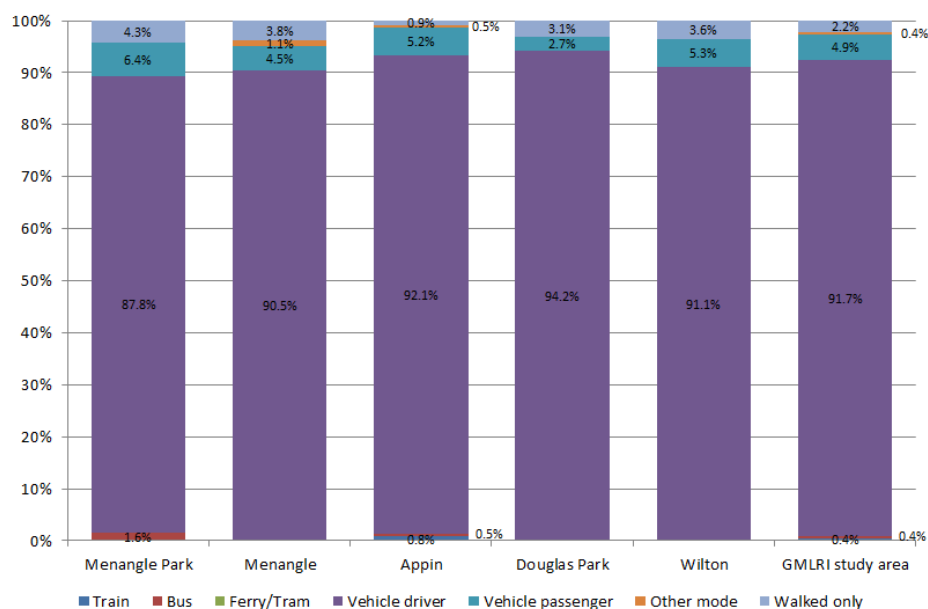


Figure 16 Destination – mode split (Source: 2011 Journey to Work data)

3.1.4 Change in travel behaviour

Based on the existing transport network, there is a high likelihood the use of private vehicle would be the dominant mode of travel for JTW trips from the study area. The choice of travel mode depends on a number of factors including the range of transport services available and car availability. An expansion or improvement on the public transport network may change the travel behaviour of residents and result in a shift to public transport.

Travel behaviour over the past decade (2001 to 2011) for Wollondilly have been compared to the growing areas of North West Sydney (Blacktown – North West) and south west Sydney (Camden), as shown in the tables below.

JTW trips in Wollondilly Shire have increased by 26 per cent in the past decade. There has been a minimal shift to public transport, with the majority of new trips opting to drive.

North West Sydney trips have increased by 74 per cent, with a significant mode shift to public transport in the past decade. Growth in bus trips have grown significantly with an increase by over 800 per cent. It is anticipated that a significant contributor to this shift is the completion of projects such as the North-West T-way, and will continue to change in the future with completion of the North West Rail Link.

Table 8 Wollondilly mode split

Mode	2001		2011	
	Number	Percentage	Number	Percentage
Train	744	5%	776	4%
Bus	78	1%	90	1%
Car – driver	10,831	78%	14,385	83%
Car – passenger	809	6%	880	5%
Bicycle	30	0%	24	0%
Walked	370	3%	320	2%
Other	1,003	7%	944	5%

Source: Australian Bureau of Statistics, Census of Population and Housing, 2001 and 2011

Table 9 Blacktown – North West mode split

Mode	2001		2011	
	Number	Percentage	Number	Percentage
Train	2,825	15%	4,262	13%
Bus	212	1%	2,042	6%
Car – driver	13,480	71%	23,713	72%
Car – passenger	1,276	7%	1,730	5%
Bicycle	44	0%	46	0%
Walked	284	1%	273	1%
Other	858	5%	998	3%

Source: Australian Bureau of Statistics, Census of Population and Housing, 2001 and 2011

Table 10 Camden Council mode split

Mode	2001		2011	
	Number	Percentage	Number	Percentage
Train	1,327	7%	1,750	7%
Bus	173	1%	190	1%
Car – driver	13,953	78%	19,741	81%
Car – passenger	1,081	6%	1,297	5%
Bicycle	59	0%	52	0%
Walked	314	2%	324	1%
Other	1,046	6%	909	4%

Source: Australian Bureau of Statistics, Census of Population and Housing, 2001 and 2011

3.2 Constraints

The natural and built environment within the GMLRI area is considered to present several constraints to increased development, and the provision of a well-connected transport network. These are briefly highlighted in the following.

River crossings

The natural watercourse network within the GMLRI area is formed predominantly by the Nepean River, Cataract River and Allens Creek. Limited connectivity is currently provided across these waterbodies, each with significant embankments lining them. The crossings within the study area are listed below.

- Nepean River crossings
 - M31 Hume Motorway (near both Menangle and Douglas Park)
 - Menangle Road (to the south of Menangle Park)
 - Douglas Park Drive (low level weir crossing, to the south of Douglas Park)
 - Picton Road (to the east of Maldon).
- Cataract River crossings
 - Wilton Road, at Broughton Pass – this forms a particularly significant constraint with tight horizontal curves and reasonable grades on approach to a two-way one-lane bridge crossing operation, at which only one vehicle can cross at a time. Heavy vehicle access is restricted.

Rail crossings

The Southern Highlands Line traverses the western boundary of the study area, and is described further in Section 3.4.2. Crossings of the rail line are currently provided at:

- M31 Hume Motorway (grade separated, to the west of Glen Alpine)
- Menangle Road (grade separated, to the south of Menangle Park)
- Station Street (grade separated, near Menangle)
- Camden Road (at grade, Douglas Park station)
- Picton Road (grade separated, to the east of Maldon).

M31 Hume Motorway

The M31 Hume Motorway is described in Section 3.3.1.1, and presents an additional barrier to road connectivity with only a singular access point (Picton Road interchange) within the study area. For the rest of its length within the GMLRI area, it provides a barrier to east-west connectivity. Existing grade separated crossings of the Motorway are listed as follows:

- Menangle Road (to the east of Menangle Park).
- Moreton Park Road (to the south of Menangle, and again to the east of Douglas Park).
- Douglas Park Drive (to the south of Douglas Park and the Nepean River crossing).

3.3 Roads

3.3.1 Road hierarchy

Road access to / from the Greater Macarthur area is supported by a hierarchy of roads as defined by the LTTMP and Roads and Maritime's (RMS) *Network and Corridor Planning Practice Notes*. The relationship between the NSW road hierarchy and the RMS sub-network ranking for urban roads is as follows:

- Motorway: Class 6U
- Principal Arterial: Classes 6U, 5U and 4U
- Arterial: Classes 4U, 3U, 2U, 1U

The NSW road hierarchy also includes categories of Sub-arterial and Local / Collector, however these road types do not overlay the RMS sub-network.

The GMIA road network as defined by the RMS sub-network ranking is below, with further discussion on each in the sections following (see Figure 17).

- Class 6U road: M31 Hume Motorway.
- Class 5U roads: Picton Road (south of the M31 Hume Motorway).
- Class 4U roads: Narellan Road, Appin Road and Appin-Bulli Road.
- Class 3U roads: Menangle Road (north of the Nepean River) and Picton Road (north of the M31 Hume Motorway).

3.3.1.1 Class 6U roads

Class 6U roads are principal State Roads typified by the highest traffic volumes and include freight, public transport and cars. Class 6U roads provide the highest standard of travel and serve interstate and strategic inter-regional and regional functions with strictly limited direct access. These roads are typically high-speed, grade-separated, divided carriageways with two or more lanes in each direction.

The **M31 Hume Motorway** is identified as a Class 6U road. It is a grade separated motorway connecting Sydney to Melbourne (inclusive of the sections known as Hume Highway and Hume Freeway). It is part of the Auslink National Network performing an integral role in road-based freight movement. Access to the motorway is limited within the study area with only a singular connection along the approximately 18km section. The connection is provided in the south of the study area at Picton Road. The next interchange along the M31 Hume Motorway is approximately 3km north of the study area at Narellan Road which provides access to the wider Campbelltown / Macarthur area. Other general features of the motorway include:

- 110km/h posted speed limit.
- Designated B-double route with a 4.6m height restriction.
- Two lanes in each direction through the study area with a wide median, three lanes in each direction between Narellan Road and Raby Road, widening again to four lanes north of Raby Road.



Figure 17 Road network management hierarchy (Source: RMS)

3.3.1.2 Class 5U roads

Class 5U roads are significant State Roads typified by high traffic volumes and include freight, public transport and cars. Direct access to these roads is usually controlled as they serve interstate, strategic inter-regional and regional functions. Class 5U roads are usually undivided carriageways with four or more lanes and kerbside parking restrictions during peak periods.

Picton Road is identified as a Class 5U road to the south of the M31 Hume Motorway, and Class 3U (described below) to the north. Picton Road forms a majority of the B88 route that links Wollongong to Wilton, the M31 Hume Motorway and Picton. General features of the road include:

- Posted speed limits of 80km/h to 100km/h.
- Four lanes between its interchange with the Hume Motorway and Pembroke Parade otherwise generally one lane in each direction with overtaking lanes provided in sections and localised widening at intersections.
- B-double route with a 4.6m height restriction.

3.3.1.3 Class 4U roads

Class 4U roads are important State Roads typified by moderately high traffic volumes and include freight, public transport and cars. They serve inter and intra-regional functions and have controlled access abutting land. Class 4U roads are usually undivided carriageways with four or more lanes, and kerbside parking restrictions as required during peak periods.

Narellan Road, Appin Road and **Appin-Bulli Road** are identified as Class 4U roads. Together these roads form the B69 route connecting the M31 Hume Motorway and Campbelltown-Macarthur area with northern Wollongong via Appin. General features of the route include:

- Posted speed limits of 60km/h (through built-up areas) to 100km/h.
- Four lanes and signalised intersections along Narellan Road to the extent of the existing urban footprint at Rosemeadow. Otherwise, generally one lane in each direction along the route with overtaking lanes provided in sections and localised widening at intersections.
- B-double route with a 4.6m height restriction.

3.3.1.4 Class 3U roads

Class 3U roads are typified by moderate traffic volumes including freight, public transport and cars. An acceptable standard of travel can be expected as they serve inter/intra-regional functions. Class 3U roads typically have undivided carriageways with at least two lanes. Kerbside parking restrictions apply as required.

Menangle Road (north of the Nepean River) and **Picton Road** (north of the M31 Hume Motorway) are identified as Class 3U roads. The role of Picton Road is described in section 3.3.1.2 above. Menangle Road provides connectivity between the Campbelltown-Macarthur area and residential communities in Menangle Park and generally has one lane in each direction with localised widening at intersections.

3.3.1.5 Local roads

Other local roads that perform some role in connecting local communities to the trunk road network include those described below. These are each generally two-lane two-way roads with posted speeds of 60km/h to 100km/h.

- Wilton Road that connects Appin and Wilton including crossing of the Cataract River at Broughton Pass.
- Douglas Park Drive / Camden Road provide connection all the way from Menangle Road to Wilton Road, including a crossing of the Southern Highlands Rail Line (at grade), the Nepean River and the Hume Motorway.
- Moreton Park Road provides an alternate connection between Menangle Park and Douglas Park to Menangle Road on the eastern side of the M31 Hume Motorway, including two crossings of the motorway.

3.3.2 Traffic volumes

Traffic data has been extracted from several sources in order to gain a level of understanding of traffic flows on various parts of the road network. The traffic data collected is summarised in Figure 18.

The traffic volumes generally reflect the hierarchy of the roads in the vicinity of the study area, with the busiest roads including the M31 Hume Motorway (M31), Narellan Road, Appin Road and Picton Road. The data shows relatively minor flows (i.e. less than 300 veh/hr) during peak periods on the remainder of the surveyed local roads.

3.3.3 Traffic operating conditions

Data and observations of traffic operating conditions have been extracted from several sources in order to gain a level of understanding of how various parts of the road network are performing during peak periods. These are summarised as follows.

- Mid-block Level of Service (LoS) calculations undertaken indicated that during peak periods:
 - Traffic volumes on the M31 Hume Motorway are operating at LoS C or better through the study area⁴.
 - Traffic volumes on sections of Narellan Road corridor both east⁵ and west of the M31 Hume Motorway are at capacity, operating at a LoS E.
 - The crossing of the Cataract River at Broughton Pass is currently operating at a LoS E, due to the operational constraints of the crossing.
- Delays can be experienced at the M31 Hume Motorway/Picton Road Interchange, with traffic currently queuing back to the M31 Hume Motorway during busy periods⁶.
- Intersection analysis of existing intersections through the Appin centre, indicated that Appin Road's intersections with Macquariedale Road, King Street and Church Street (Bulli-Appin Road) all operated at LOS B or better⁷.

⁴ West Appin Strategic Infrastructure Investigation - Preliminary traffic and transport assessment, 2015

⁵ Narellan Road Upgrade: Camden Valley Way to Blaxland Road / Gilchrist Drive REF, 2013

⁶ http://www.rms.nsw.gov.au/projects/illawarra/M31_Hume-highway-and-picton-road/index.html, 2015

⁷ Endeavour Appin Planning Proposal, Transport Impact Assessment, 2013

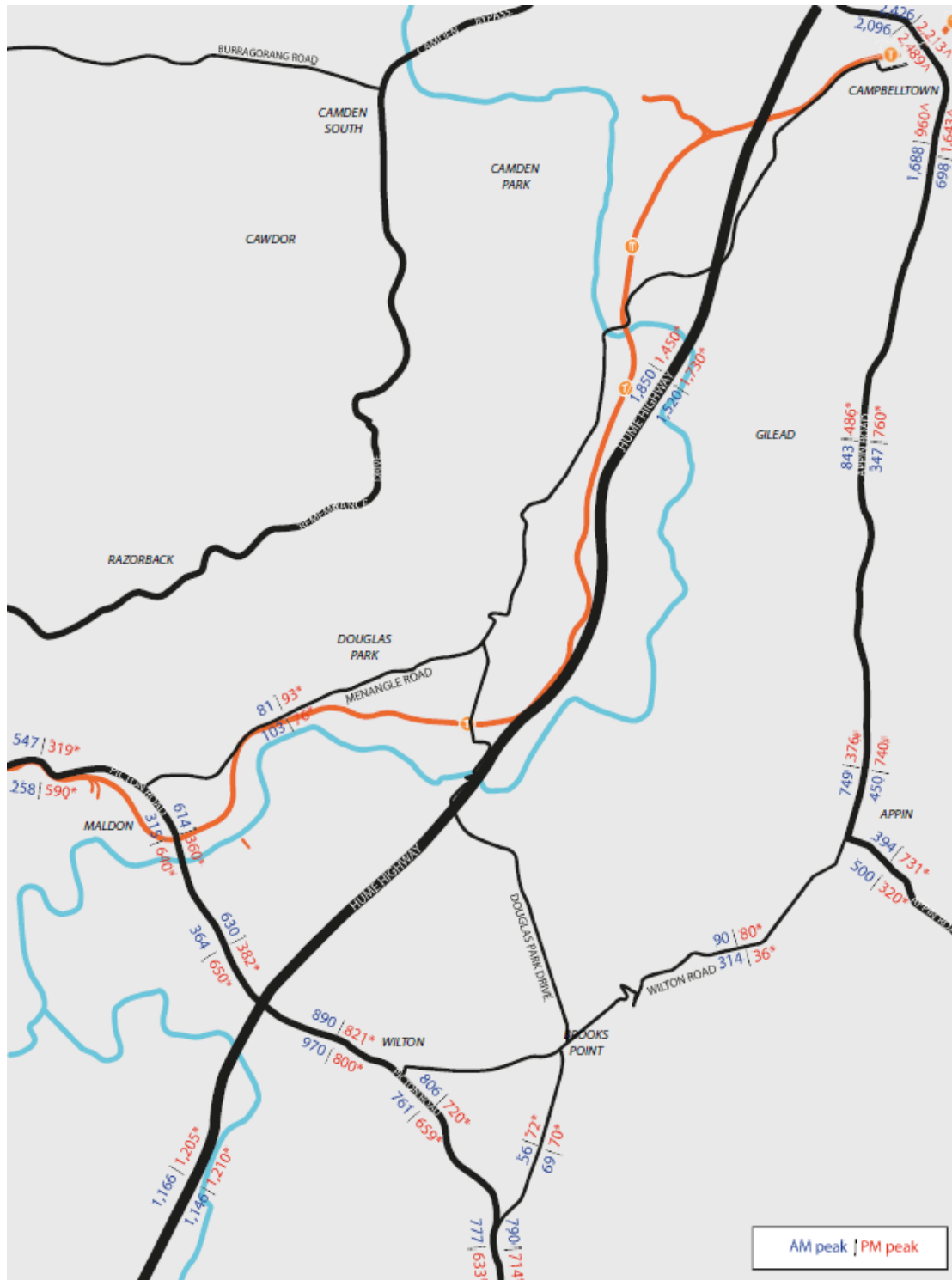


Figure 18 Existing traffic data summary (2013 PCU's)

* Source: Wilton Junction Development, Transport Management and Accessibility Plan, 2014

Source: Endeavour Appin Planning Proposal, Transport Impact Assessment, 2013

^ Source: Data collected for the Narellan Road Upgrade: Camden Valley Way to Blaxland Road / Gilchrist Drive REF, 2013

Note: PCUs have been estimated assuming a heavy vehicle is equivalent to 2 PCU's. Where heavy vehicle volumes have not been specified, a nominal 10% proportion of total traffic flow has been assumed. Where two hour volumes have been specified, a one hour conversion factor of 1.9 (divisor) has been applied.

3.4 Public transport

3.4.1 Bus services

Bus services operating in the study area are limited in light of the relatively low residential and employment density of the communities that comprise it. Existing public bus services that operate in the area include:

- Route 47: Camden to Menangle via Remembrance Drive (Busabout).
- Route 887: Campbelltown to Wollongong via Appin (Busabout).
- Route 889: Campbelltown to Menangle via Menangle Park (Busabout).
- Route 901: Picton to Wilton and Douglas Park (Picton Buses).

These routes are illustrated in Figure 19. Note that no map is currently available for Route 901. Approximate frequencies and operating hours are summarised in Table 11.

Table 11 Existing bus services

Route	Direction	Operating hours	Average AM peak headway	Average off peak headway	Average PM peak headway
47	To Camden	0630 to 1630	1 hour	Does not operate	1 hour
	To Menangle	0600 to 1800	1 hour	Does not operate	1 hour
887	To Wollongong	0730 to 1730	1 hour	2 hours	1 hour
	To Campbelltown	0630 to 1915	1 hour	2 hours	1 hour
889	To Menangle	0700 to 1900	1 hour	1 service	1 hour
	To Campbelltown	0600 to 1800	1 hour	1 service	1 hour
901	To Wilton	0800 to 1600	1 service	2 services	1 service
	To Picton	0830 to 1600	1 service	1 service	1 service

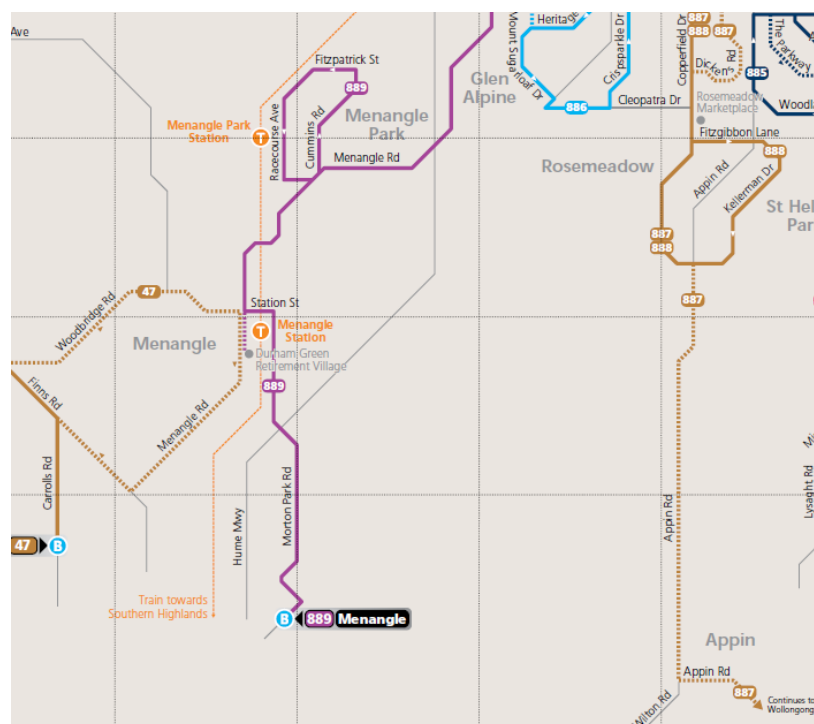


Figure 19 Existing bus routes (Source: Campbelltown and Camden bus network map, Busabout)

3.4.2 Passenger rail services

The Southern Highlands Line traverses the western boundary of the study area. Stations contained within the study area include Menangle Park, Menangle and Douglas Park with Picton Station immediately to the south and Macarthur Station immediately to the north. The line forms part of the NSW Intercity Trains Network servicing the Southern Highlands, Southern Tablelands and the Wollondilly section of the Macarthur Region. The line is the only intercity line connecting to the Sydney suburban network (see Figure 20) that is not electrified, currently being serviced by diesel trains as far north as the Campbelltown Station.

It should be noted that the line south of Macarthur is leased and operated by ARTC and is shared between passenger and freight trains.

Commuters bound for the metropolitan area can switch from the diesel line to the T2 Line at Macarthur or Campbelltown, as well as the T5 Line at Campbelltown only. These suburban lines provide direct access to the major centres of Liverpool, Parramatta, Sydney Airport and Sydney CBD without further interchange.

In terms of the level of facilities, train stations within the GMLRI area generally (i.e. all except Picton Station):

- Have limited formal parking, kiss and ride or cycle facilities within proximity to the station.
- Have limited general facilities such as toilets and ticket vending machines.
- Not wheelchair accessible.

In contrast to the above, the suburban trains stations at Macarthur and Campbelltown:

- Have dedicated pedestrian facilities providing access to the stations.
- Provide bike racks or bike lockers.
- Accommodate for bus interchange immediately adjacent the station.
- Have nearby taxi ranks.
- Are wheelchair accessible.
- Have large formal commuter car parks, and kiss and ride facilities within close proximity to the stations.



Figure 20 Intercity Train Network (Source: Sydney Trains, 2015)



Figure 21 Suburban Train Network (Source: Sydney Trains, 2015)

Approximate headways between services for both the Southern Highlands Lines and nearby Suburban Network Lines are summarised in Table 12. Train services along the Southern Highlands Line are low in frequency, in both peak and off peak periods. Frequency of services on the Suburban Network at Macarthur and Campbelltown are higher, generally with 15 minute headways in peak periods.

Table 12 Existing rail services

Line	Direction	Operating hours	Average AM peak headway	Average off peak headway	Average PM peak headway
Southern Highlands	To Campbelltown	0430 to 2200	1 hour	1 hour	1 hour
	From Campbelltown	0530 to 2300	1 hour	1 hour	30 minutes
T2 Airport Line	To City via Airport	0400 to 2400	10 minutes	30 minutes	15 minutes
	To Macarthur via Airport	0400 to 2300	15 minutes	30 minutes	15 minutes
T2 Inner West & South Line	To City via Granville	0330 to 2300	15 minutes	30 minutes	30 minutes
	To Campbelltown via Granville	0400 to 2400	30 minutes	30 minutes	15 minutes
T5 Cumberland Line	To Schofields	0630 to 1800	30 minutes	30 minutes	30 minutes
	To Campbelltown	0630 to 1800	30 minutes	30 minutes	30 minutes

Source: Sydney Trains

Passenger entries and exits at stations in the vicinity of the study area are summarised in Table 13. The low patronage currently observed at stations in the study area is reflective of the low density of land uses currently in proximity to the stations and the low frequency of train services on the Southern Highlands Line. The higher barrier counts observed at the Macarthur and Campbelltown stations are reflective of the higher density of both employment and residential land uses in this centre, and higher frequency of services provided.

Data made available by BTS further suggests that line loads on the Southern Highlands Line on a typical weekday AM peak hour in 2014 were in the order of 300 passengers per hour in the inbound direction on approach to Macarthur.

Table 13 Station passenger entries and exits by period of day

Time Period	Picton		Douglas Park		Menangle		Menangle Park		Macarthur		Campbelltown	
	Entries	Exits	Entries	Exits	Entries	Exits	Entries	Exits	Entries	Exits	Entries	Exits
0200-0600	10	0	10	0	0	0	0	0	50	20	110	50
0600-0930	160	20	40	0	10	0	10	0	1,030	420	3,180	890
0930-1500	60	30	0	10	0	0	0	0	610	580	1,300	1,190
1500-1830	30	140	0	20	10	10	0	10	420	970	1,170	2,770
1830-0200	0	80	0	20	0	0	0	0	190	310	300	1,150
TOTAL	260	260	50	50	20	10	10	10	2,300	2,300	6,060	6,060

Source: Rail station barrier counts, BTS 2013

Historic passenger daily entry / exit totals at stations in the vicinity of the study area are summarised in Table 13 and illustrated in Table 14. The totals indicate negligible increase in local rail patronage over the last ten years.

Table 14 Station entry / exit totals 2004 to 2013 (daily totals)

Year	Picton	Douglas Park	Menangle	Menangle Park	Macarthur	Campbelltown	Total
2004	520	100	40	20	4,600	12,120	17,400
2005	540	100	40	20	4,540	12,740	17,980
2006	520	100	40	20	6,140	11,440	18,260
2007	540	100	40	20	5,240	11,260	17,200
2008	460	60	20	20	5,240	12,060	17,860
2009	440	60	20	20	4,600	12,520	17,660
2010	460	60	20	20	3,800	12,560	16,920
2011	460	60	20	20	2,400	13,700	16,660
2012	420	100	20	40	2,140	13,980	16,700
2013	440	100	20	40	3,420	13,940	17,960

Source: Rail station barrier counts, BTS 2013

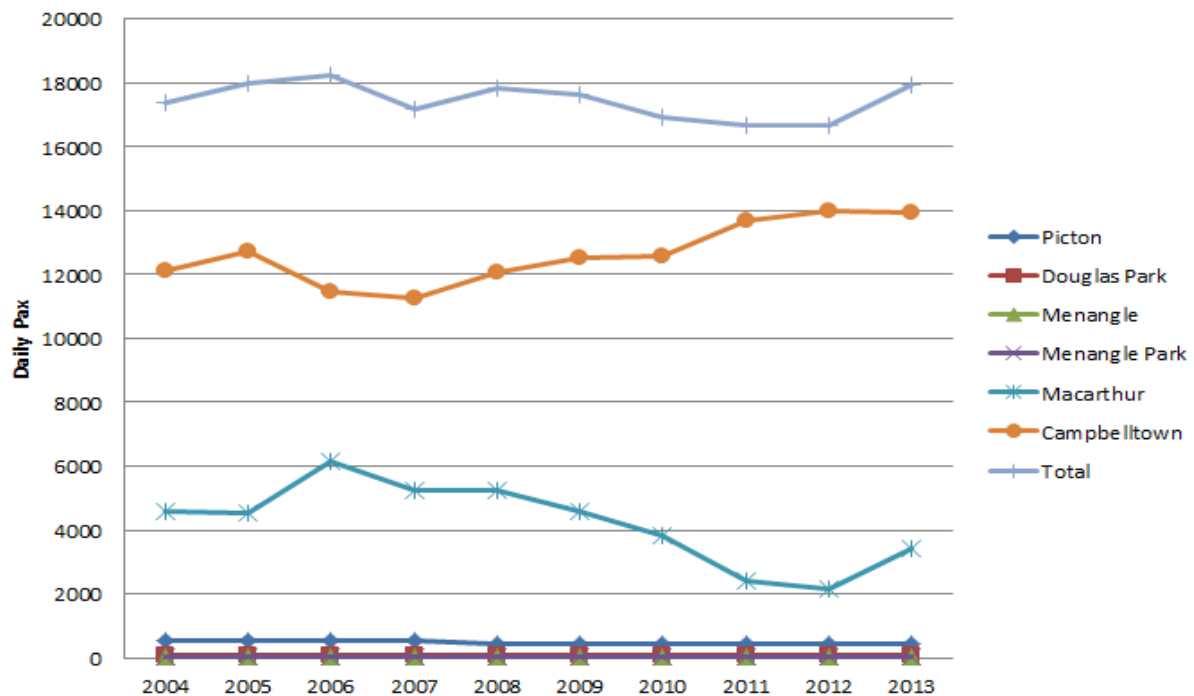


Figure 22 Station entry / exit totals 2004 to 2013 (Source: Rail station barrier counts, BTS 2013)

3.5 Active transport

The desirability of active transport within the study area is currently low due to the long distances between residential areas and surrounding employment, retail, education etc. The amount of dedicated active transport facilities provided is hence also low, with a significant portion of both local and trunk roads without paved footpaths.

Figure 23 shows the following cycle facilities within the study area:

- Off-road paths provided through the Bingara Gorge residential development to the north west of Wilton, with a link to the town centre via Hornby Street.
- An off-road path in Appin, linking the residential area around Winton Street to Appin Public School and adjacent bus stop.
- On-road shoulder along the M31 Hume Motorway.
- Other on-road facilities at:
 - Appin-Bulli Road between Appin Road and Burke Street
 - Menangle Road between Macarthur Train Station and the Nepean River crossing.

Other pedestrian facilities noted upon a desktop survey of the study area include:

- In Appin:
 - Paved footpaths along Appin Road and Wilton Road through the Appin town centre
 - Limited to no footpaths in the residential streets surrounding the centre.
- Limited to no footpaths through Wilton, with the exception of those constructed as part of the Bingara Gorge development.

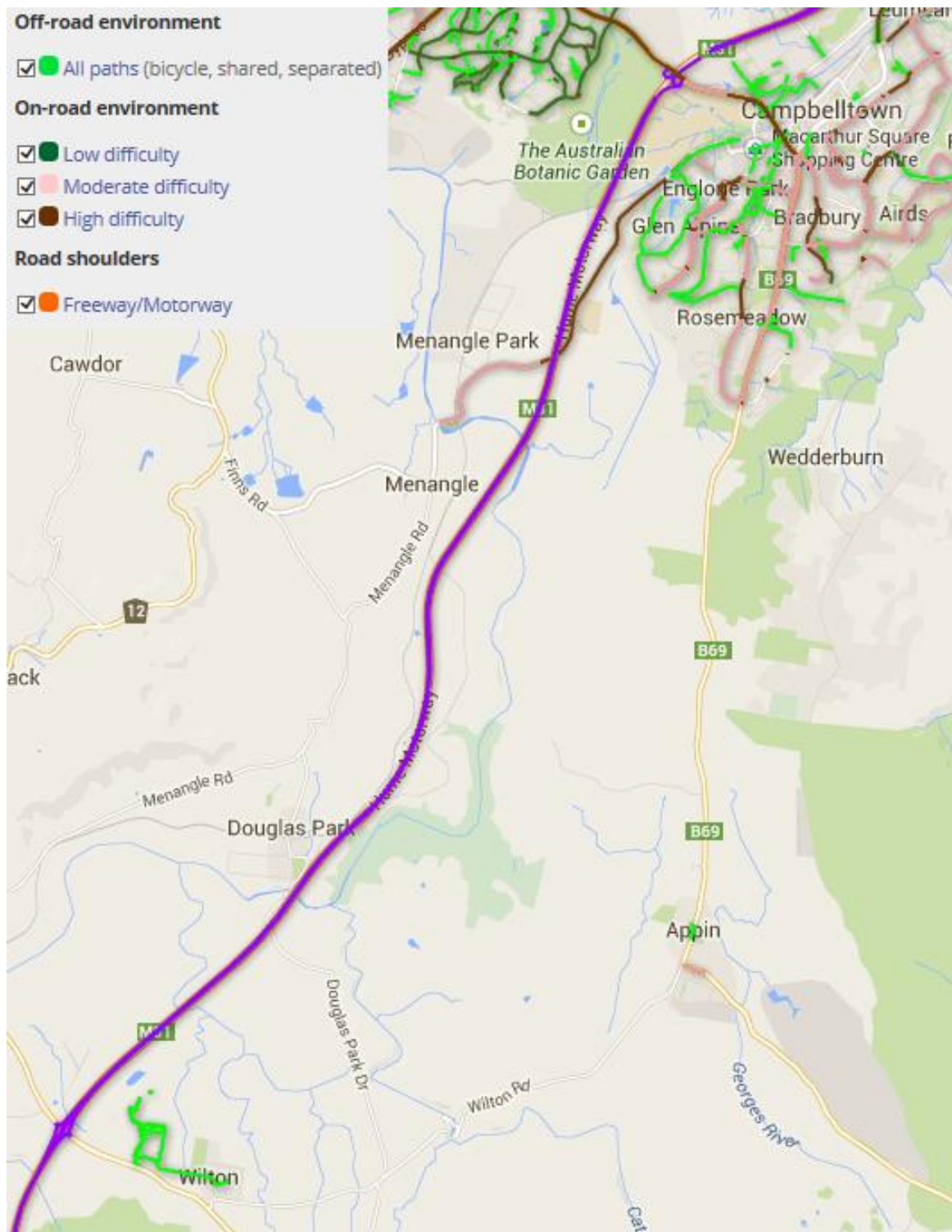


Figure 23 Existing cycle paths (Source: Adaptation from Cycleway Finder, TfNSW)

3.6 Freight

The NSW freight network is made up of a combination of trunk roads and railways, which service key nodes on the network such as ports, terminals, and industrial facilities where freight activity is generated. Figure 24 illustrates the top 10 NSW inter-regional freight flows. Several of these major flows pass through Sydney's southwest including: Illawarra to Port Kembla (9m tonnes per annum); Central West NSW to Port Kembla (7m tonnes per annum); and Illawarra to Sydney (7m tonnes per annum).

In general, NSW ports are the most significant origins and destinations for freight including:

- Port Botany, where the import/export container task was approximately 2 million containers in 2011.
- Port Kembla, which receives approximately 15 million tonnes of coal per annum and, depending on the season, approximately 2 to 4 million tonnes of grain per annum.

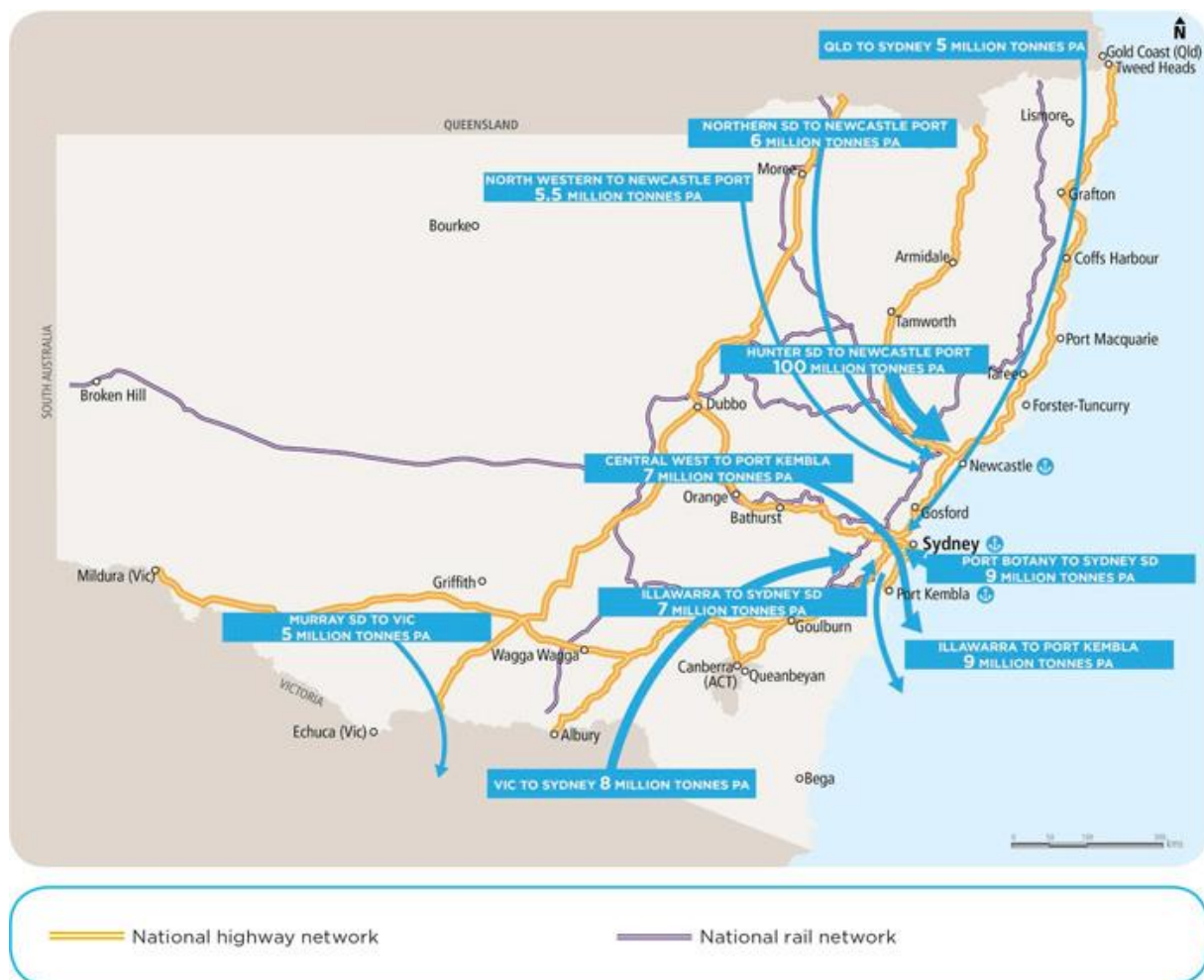


Figure 24 Top 10 NSW inter-regional freight flows (Source: TfNSW, 2013)

Road and rail corridors within the GMIA have an important role in facilitating the through movement of freight within NSW and interstate. Figure 25 illustrates local freight nodes and the current freight transport network in the vicinity of the GMIA. The map indicates that freight movement is driven by not just the nodes of Port Kembla and the intermodal terminal at Minto, but also several coal mine sites in the vicinity of the GMIA.

The Southern Highlands Line, owned and operated by ARTC, traverses the western boundary of the study area and accommodates movement of freight between Sydney and areas to the south. It is the secondary freight line to Port Kembla, with the Illawarra (or South Coast) Line being the primary. The line south of Macarthur is owned and operated by ARTC. The shared nature of the suburban rail network is creating significant disruption to the movement of freight via rail.

As defined by the *Metropolitan Road Freight Hierarchy on the State Road Network Practice Note* (TfNSW, 2011), three key B-Double road routes exist within GMIA including:

- Two primary routes: The M31 Hume Motorway (M31) and Picton Road (B88) from the M31 Hume Motorway (M31) to the Princes Motorway (M1).
- One secondary route: Route B69 from the M31 Hume Motorway (M31) to the Princes Motorway (M1), which includes Narellan Road, Appin Road and Bulli-Appin Road.

Road accommodates for 63 per cent of the freight movement task in NSW with the *NSW Freight and Ports Strategy* identifying the M31 Hume Motorway (north of the Illawarra) as the largest carrier of road freight in NSW (30kT in 2011).

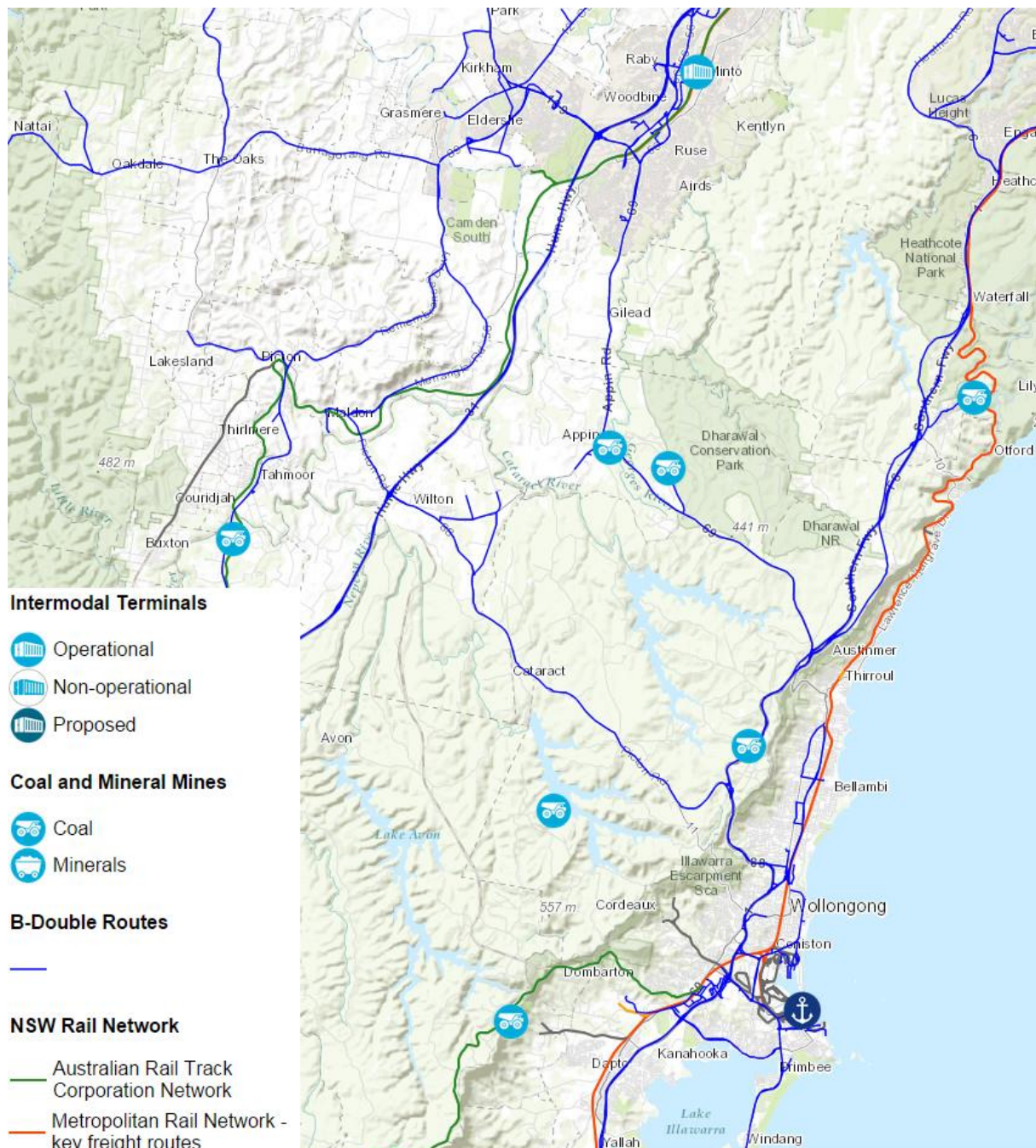


Figure 25 Local freight context (Source: TfNSW, 2015)

4.0 Future context

4.1 Future land use context of Western Sydney

There are four key areas of planned development growth in the broader Western Sydney area, including:

- North West Growth Centre (NWGC)
- Western Sydney Employment Area (WSEA)
- Western Sydney Airport (WSA)
- South West Growth Centre (SWGC).

WSA and WSEA are anticipated to be large employment generators servicing the surrounding residential communities, including the planned growth centres. Each of these planned precincts is briefly described as follows.

4.1.1 NWGC

The North West Growth Centre is approximately 10,000 hectares in size and traverses three Council LGAs including The Hills, Blacktown and Hawkesbury. The geographic centre of the area is approximately 55 kilometres north of Greater Macarthur. As set out in the North West Structure Plan, the area is divided into 16 precincts that are being progressively released and rezoned for sustainable urban development including a proposed Major Centre at Rouse Hill. To date, eleven precincts have been rezoned to allow urban development to commence. Collectively, these precincts have been planned to provide for approximately 40,000 homes. A further three Precincts are undergoing further planning to provide for approximately 12,000 additional homes. The total planned residential capacity of the growth centre is 70,000 new dwellings accommodating for around 200,000 residents.

Infrastructure proposed to support the centre includes:

- A package of road works, including a combination of new and upgraded roads, to be released as growth necessitates.
- A network of local and regional bus routes servicing neighbourhoods and town centres, and including bus priority measure along major roads.
- Rail services via duplication of the Richmond Line and the under-construction North West Rail Link project. Corridor planning is in place to enable extensions if NWRL in the future beyond the current extent (Cudgegong Road Station).

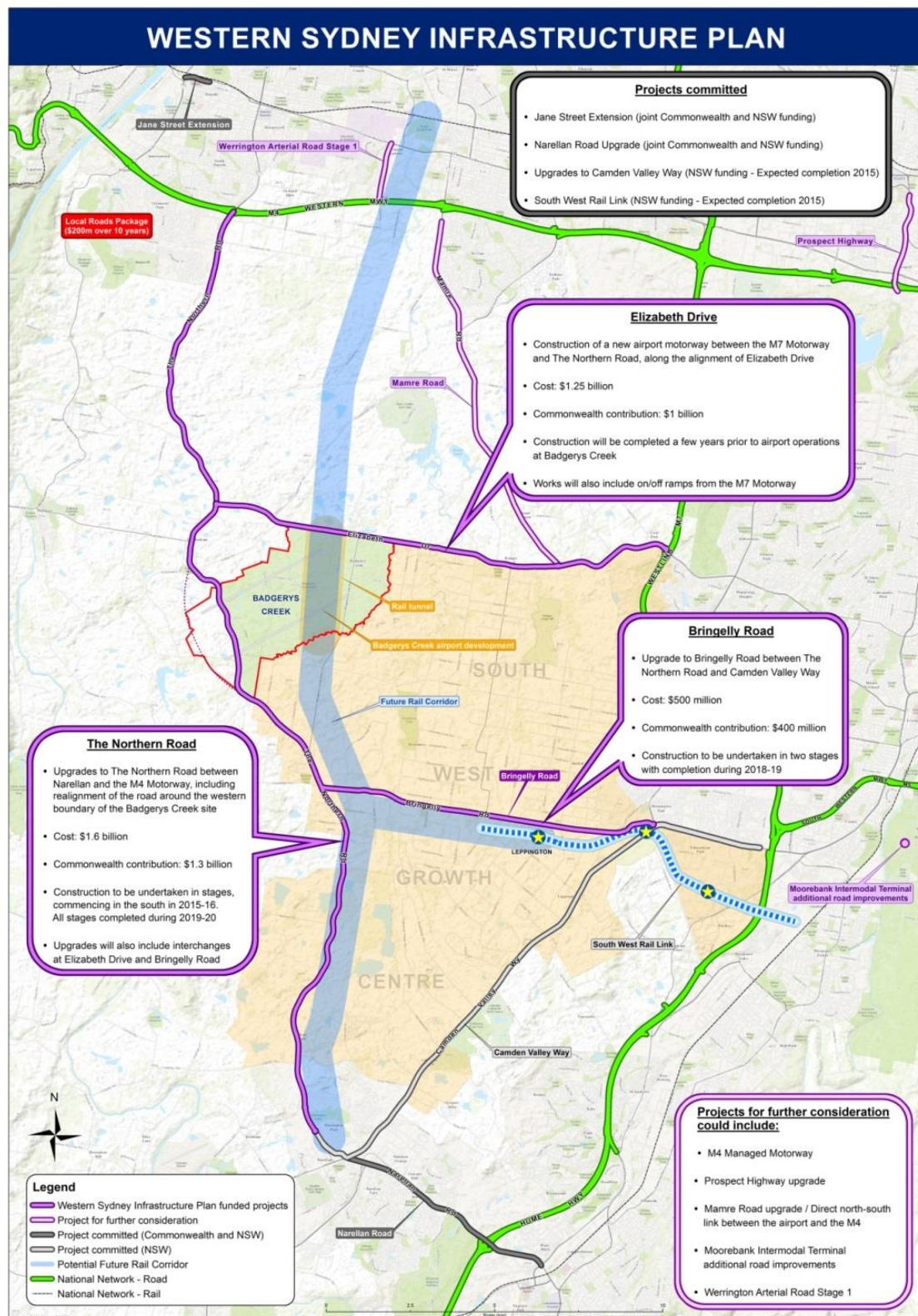
4.1.2 WSEA

Located approximately 35 kilometres north of Greater Macarthur, the Western Sydney Employment Lands form a large parcel of land established by the NSW Government for industry and employment, catering for transport and logistics, warehousing and office space. The area has been identified by the Government as one of nine key 'city shaping projects' critical to Sydney's employment growth. Early forecasts for the precinct were for the provision of approximately 57,000 new jobs over the next 30 years, with a total capacity of approximately 212,000 jobs.

4.1.3 WSA

In 2014 the Federal Government announced that Badgerys Creek would be the site for a Western Sydney airport. This demonstrated a significant commitment from the Government to pursuing a second airport in the Western Sydney region, where a new airport would be a major catalyst for jobs growth and economic benefits. The site is located approximately 30 kilometres north of the Greater Macarthur area.

In order to support the anticipated large volumes of travel demand generated by the WSA, in addition to supporting the WSEA and SWGC, a Western Sydney Infrastructure Plan has been developed (see Figure 26). The plan involves an investment over the next 10 years of approximately \$3.6 billion in roads, as well as reserving potential rail corridors to enable extension of the South West Rail Link. As noted in Section 2.4, TfNSW has recently identified a recommended corridor for the southern section from Leppington to Bringelly and Narellan. Furthermore, an investigation area has been opened for consultation, which extends the corridor further south from Narellan to the existing T2 South Line near Macarthur.

Figure 26 WSA, WSEA, SWGC and supporting road infrastructure⁸⁸ http://www.infrastructure.gov.au/infrastructure/western_sydney/index.aspx

4.1.4 SWGC

The South West Growth Centre comprises 18 precincts, is approximately 17,000 hectares and has capacity for around 110,000 new dwellings for 300,000 people. The geographic centre of the area is approximately 25 kilometres north of Greater Macarthur. The SWGC would be serviced by employment contained within the centre as well as the WSEA, WSA and existing major centres to the east such as Liverpool. A considerable amount of urban development has been completed or is underway in the SWGC including East Leppington, Oran Park, Gregory Hills, Sekisui lands (The Hermitage) and Harrington Park. Indicative Layout Plans for Austral and Leppington North (ALN) precincts and Catherine Field (part) precinct have recently been on public exhibition and a major centre in Leppington will be serviced by the South West Rail Link (SWRL) opened in 2015. Leppington will form the Major Centre of the SWGC and will be a significant drawcard within and external to the SWGC, resulting in considerable access demands across all modes of transport.

4.2 Future transport context in Greater Macarthur

A number of road and rail projects that affect the Greater Macarthur area are currently either under investigation, proposed, planned or nearing construction phase. They range from major infrastructure projects driven by policy and long-term network planning, to small and medium size projects aimed at relieving existing constraints in the network. A summary of projects relevant to the Greater Macarthur area are as follows.

4.2.1 Policy documents

A number of relevant major transport infrastructure projects have been identified in Government policy documents, and are discussed in Section 2.0. A summary of these projects and their treatment within this study is given below.

Table 15 Treatment of policy-based transport projects

Item	Details	Treatment in GMLRI
Outer Sydney Orbital	Identified in the LTTMP as a medium to long term priority transport corridor and also recognised in the NSW Freight & Ports Strategy as a long term project. However, it was also identified in the SIS as falling outside the 20-year horizon for the strategy, recommending the focus should be placed on identifying a preferred corridor. TfNSW announced in June 2015 that an investigation is being undertaken to determine a suitable OSO corridor. The study is currently in a consultation and information gathering period, due to end in July 2015, which will be followed by the identification of a 'long list' of corridor route options. Corridor preservation is currently programmed to be complete by the end of 2016.	Not to be included in GMLRI base transport network. Corridor for preservation to be identified.
Georges River Parkway	Identified in the LTTMP as a key future transport corridor that is already preserved. However, the corridor is not included in the SIS, and there is no current program for construction.	To be tested as part of the investigation process, to determine potential relief impacts on the M31 Hume Motorway.
High Speed Rail	Identified in the LTTMP as a key corridor for protection. A preferred alignment has been identified that traverses through the GMLRI area, however corridor preservation has not commenced and the status of the corridor preservation process is not known. The HSR is anticipated to have limited impact on the transport assessment for the GMLRI area given that the HSR would: operate on an independent line, have limited interaction with the local road network (i.e. would have grade separated crossings), and would generate only small changes in trip generation and travel behaviour in the GMLRI area being 15km from the nearest station. The potential impacts for the GMLRI area are in the form of land requirements and community safety.	Not to be included in GMLRI base transport network. Further consultation is required between State and Federal Governments to confirm a preferred alignment for preservation, in light of updated urban growth planning.

Item	Details	Treatment in GMLRI
Camden Valley Way	Identified for upgrading to four lanes divided road between Narellan and Prestons by 2015. Stages 1 and 2 were completed in 2014, Stage 3 is expected to be complete late 2015.	Complete by 2016.
Proposed Maldon - Dombarton Rail Line	NSW Government has released a Registration of Interest process to gauge private sector interest in the potential to construct, operate and maintain the railway. TfNSW have requested that proponents rezone land along the alignment as SP2, with a nominated buffer to residential and other noise-sensitive land uses.	Identified corridor to be preserved.
South West Rail Link Extension	The South West Rail Link (SWRL) extension to St Marys via Second Sydney Airport and Bringelly to Macarthur via Narellan was identified as a corridor to be prioritised for corridor protection. TfNSW has identified a recommended corridor for the southern section from Leppington to Bringelly and Narellan. Furthermore, and of particular relevant to the GMLIA, an investigation area has been opened for consultation, which extends the corridor further south from Narellan to the existing T2 South Line near Macarthur.	Not to be included in GMLRI base transport network. Corridor for preservation to be identified.

4.2.2 Narellan Road Upgrade: Camden Valley Way to Blaxland Road / Gilchrist Drive

Roads and Maritime Services (RMS) is proposing to upgrade Narellan Road (MR178) between Camden Valley Way and Blaxland Road, a total of 6.8km in length. The solution proposed by RMS is aimed to improve road safety, ease congestion within the corridor, improve access to the M31 Hume Motorway as well as improve efficiency of freight movement. RMS is proposing to upgrade the corridor from generally four lanes to six lanes. The proposal is illustrated in Figure 27.



Figure 27 Narellan Road upgrade proposal (Source: <http://www.rms.nsw.gov.au>)

It should be noted that the Proposal is intended to relieve traffic congestion in the short term, but not to future-proof against long-term traffic growth within the corridor. Preliminary assessment of the corridor undertaken as part of the REF indicated that the proposal may provide sufficient intersection capacities during peak periods until approximately 2018, assuming 2011 traffic flows plus 20 per cent.

The contract to build Stage 1 has been awarded, whilst Stage 2 is currently in detailed design with works scheduled to begin in 2016. This project has been assumed to be complete for both the ultimate and interim scenarios in this study.

4.2.3 Spring Farm Link Road (Spring Farm Parkway)

The Spring Farm Link Road (SFLR) is a proposed east-west road link that would connect Camden Bypass in Spring Farm with the M31 Hume Motorway, Menangle Road and Appin Road. The alignment traverses both the Camden and Campbelltown LGA's. The approximate alignment of the SFLR is shown in Figure 28. The key drivers for the construction of this road link are to provide access to new communities in Spring Farm and Menangle, improve access between Camden and Campbelltown, as well as to reduce pressure along route B69 (Narellan Road and Appin Road) through Campbelltown. Current status of the link road is as follows:

- A majority of the corridor is preserved under land use zoning in each respective Camden and Campbelltown Council LEP's.
- Construction of the link road has begun at its western end, in the form of Liz Kernohan Drive in Spring Farm. In the short term, this section will provide access to local development only.
- Construction of the remainder of the western section of the link, to the M31 Hume Motorway and Menangle Road, has been proposed in order to support development. The proposed extension from Spring Farm is understood to include an above-ground interchange with the M31 Hume Motorway approximately 4.3 kilometres south of the existing Narellan Road interchange with north-facing ramps only, as well as an at-grade intersection with Menangle Road immediately to the east. Further consideration of this interchange is needed to ensure it will be adequate support industrial traffic.
- Timing of construction and form of the eastern section of the link road from Menangle Road to Appin Road is unknown. Current land use zoning indicates the potential for northern access into Rosemeadow via intersections at Englorie Park Drive and Glendower Street.
- As identified in the *Campbelltown Local Planning Strategy*, Council intend to continue to plan and lobby for funding assistance to design and construct the Spring Farm Link Road.

In the context of the GMLRI, it is considered that the Spring Farm Link Road would provide several key functions including supporting development in the Menangle Park and Mount Gilead Priority Precinct. It is also anticipated that a fully constructed SFLR across to Appin Road would be required in the short to medium term to alleviate forecast traffic congestion on Narellan Road and northern sections of Appin Road. As such, this road link has been assumed to be complete for both the ultimate and interim scenarios in this study.

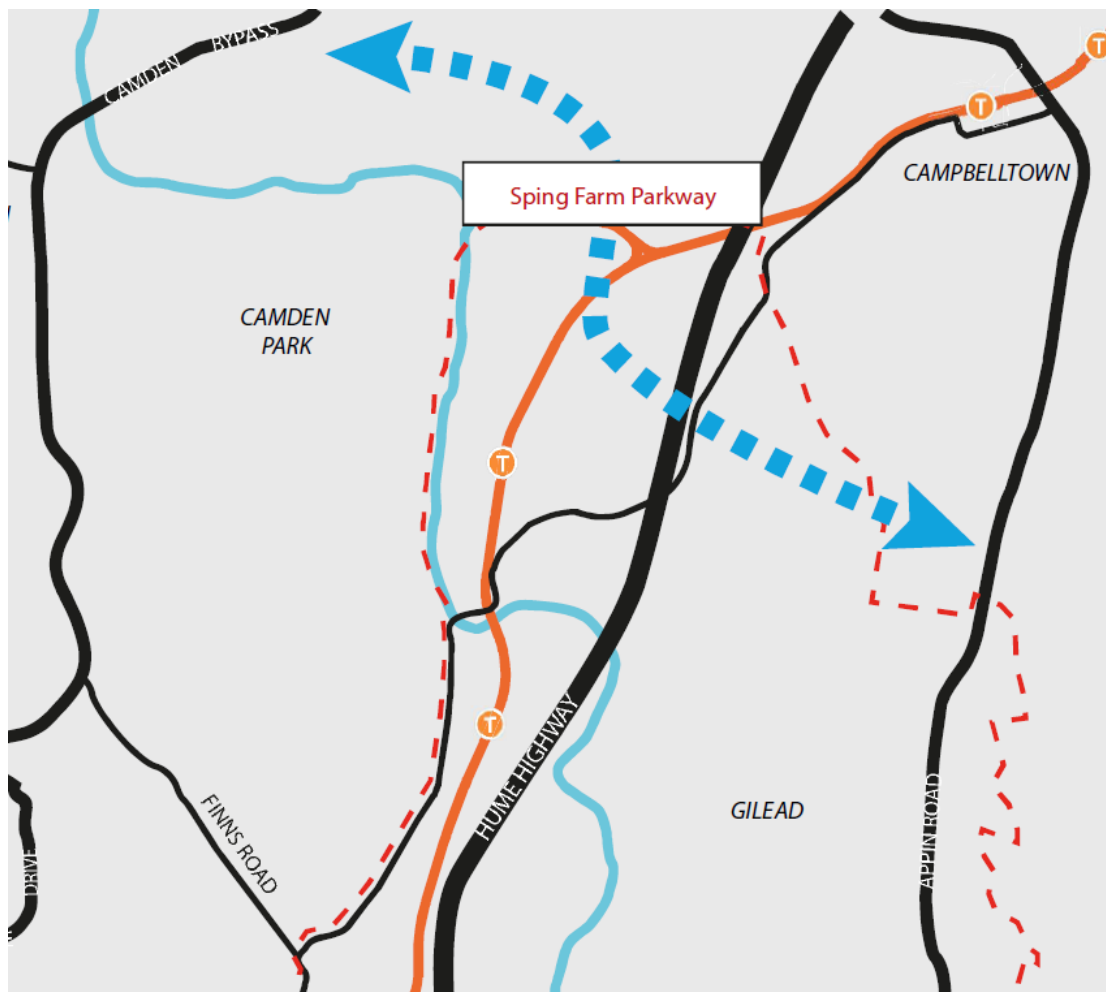


Figure 28 Spring Farm Link Road approximate alignment

4.2.4 Picton Road safety improvements

In 2013 Roads and Maritime completed a \$53 million dollar program of safety improvements on Picton Road is now finished. Treatments for the five remaining untreated sections of Picton Road are currently being developed and will be delivered as funding becomes available. The remaining sections include⁹:

- M31 Hume Motorway interchange - investigation is currently being undertaken for an upgrade of the interchange with the M31 Hume Motorway at Picton Road. The preferred option is to install traffic signals at each ramp intersection. Construction is expected to begin in mid-2015¹⁰. Note that it is understood these works are separate to those being investigated as part of the Wilton Junction development proposal.
- Mount Ousley Road to Mount Keira Road - design of a median barrier and curve improvements.
- Cordeaux Colliery to Cordeaux Dam - design of a median barrier and extending the existing overtaking lane is being finalised.
- Cordeaux Dam to Macarthur Drive - design for road widening, installing a median barrier and shoulder improvements is being finalised.
- Macarthur Drive to Janderra Lane - Roads and Maritime is investigating options to separate the east and westbound traffic to improve road safety.

⁹ <http://www.rms.nsw.gov.au/projects/illawarra/picton-road-safety-improvements/in-planning.html>

¹⁰ <http://www.rms.nsw.gov.au/projects/illawarra/M31-Hume-highway-and-picton-road/index.html>

In the context of the GMLRI study, the item of most relevance is the upgrade of the intersections at the M31 Hume Motorway / Picton Road interchange to traffic signals. In light of the progression of investigations associated with this upgrade, it has been assumed within this study that these improvements will be completed in the short term.

4.2.5 Appin Road safety improvements

In response to the outcomes of a safety review of the Appin Road corridor between Rosemeadow and Bulli Tops undertaken in 2012, a series of works have been proposed. The immediate works include¹¹:

- \$745,000 program of road resurfacing on the southern section of Appin Road
- Upgrading signage, line marking and delineation along the entire route
- Assessing the use of mobile food and beverage vendors in rest areas to encourage drivers to take a break
- The proposed removal of 24 high risk trees in the northern section of Appin Road in an effort to reduce the number of roadside hazards.

Future upgrades will be determined based on road safety issues identified in the review. They are likely to include:

- Assessing the safety of current overtaking opportunities
- Investigating further improvements to address wet weather crashes
- Developing safe enforcement sites for both NSW Police and mobile speed cameras
- Further investigation into clear zone improvements.

Note that the above measures do not increase capacity of Appin Road.

4.2.6 Outer Sydney Orbital

Transport for NSW is investigating a suitable corridor for the Outer Sydney Orbital to provide a north – south connection for a future motorway, freight rail and potential passenger rail line.

Given this is a corridor preservation study, this study will not automatically lead to planning for transport infrastructure. The corridor will be preserved now so it is available in the future while western Sydney grows and changes. A preserved corridor provides certainty for communities, businesses and land owners and reduces the cost of providing infrastructure in the long term.

Ultimately the corridor will provide increased capacity for the road network to improve accessibility to housing and employment opportunities in Western Sydney including Greater Macarthur. The corridor is also expected to provide for a future freight rail connection from Port Kembla to the T2 South Line, to the T1 Western Line and the Northern Line.

¹¹ <http://www.rms.nsw.gov.au/projects/illawarra/appin-road/index.html>

5.0 Transport objectives and principles

5.1 Objectives

The strategic objectives of GMIA have been based on those developed by TfNSW for the broader Western Sydney. Six key objectives have been identified for the Western Sydney transport network which are described as follows.

- 1) **Improve connectivity:** Identify new demand corridors to improve to provide links between where people live and future clusters of activity.
- 2) **Enhance productivity:** Enhance the efficiency of the transport network by improving network capacity, link speeds and the efficiency of interchange points.
- 3) **Meet customer needs:** Deliver transport outcomes that are attractive to customers while catering for growth and improving public transport patronage.
- 4) **Seamless integration:** Implement location, timing, scale and density of development that supports an efficient transport network and improves public transport and active transport take up.
- 5) **Provide value for money:** Ensure that investment in transport represents good value for money for both the customer and the government.
- 6) **Enhance liveability and sustainability:** By facilitating ease of movement, improving social access and optimising the use of the transport network.

5.2 Integrating land use and transport

The integration of land use and transport planning is a critical feature of the investigation process. The objective of this process is to complement particular land uses with bespoke transport infrastructure, with the ultimate goal of optimising the opportunity to create a sustainable transport outcome.

The following are some key principles to be integrated in the land use and transport planning process for the Greenfield area of GMIA.

- Establish higher **density** development where feasible: particularly at appropriate centres and along major transport corridors. Although there is anticipated to be a lower market demand for higher density residential development, higher densities can reduce the urban footprint of development and combined with appropriate traffic demand management measures, provide the opportunity to increase uptake of sustainable transport modes on a large scale.
- A **mix** of land uses should be encouraged: a higher number land use types provides more destinations in a given space. This can create higher trip containment and shorter travel distances for a variety of trip purposes.
- Ensure suitable access between residences and employment. Ensuring jobs are closer to homes can reduce the need for long commuter journeys and reduce pressure on the trunk transport network, including the operational reliability of freight and bus.
- As identified within *A Plan for Growing Sydney* (Action 1.5.2), ensure provision of suitable buffers around key nodes and corridors connecting the freight network. Noise from road and rail freight movement is a sensitive issue for communities living close to freight corridors. The freight network should be buffered from planned development, to help minimise community impacts. TfNSW have identified that a comprehensive acoustic analysis is needed at the next stage of investigation.

Transport nodes, corridors and services should be identified through recognition of the relationships illustrated in Figure 29. This describes the strategic method of developing a transport system based on a given land use, whereby:

- Land use represents the built form of the urban environment.
- Corridors represent the main 'lines' of travel demand and desire between centres.
- The transport network is how this demand along corridors is to be serviced based on the forecast quantum of demand, trip destination and also purpose.

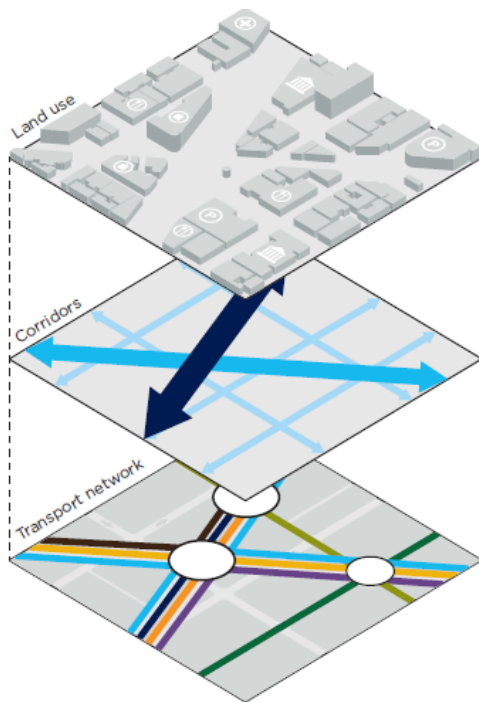


Figure 29 Relationship between land use, corridors and network planning (Source: TfNSW, 2012)

5.3 Public transport planning

Efficient public transport networks are influenced by four primary factors¹²:

- **Density** – the number of people within a given area. Density directly affects patronage potential. The more people in a service catchment, the more opportunity there is for a successful service.
- **Diversity** – the mix of land uses present. A mix of origins and destinations within a service area presents the opportunity for public transport services to collect passengers at different points in the network and at different times of the day.
- **Design** – the quality of the urban form. The urban form can be considered through the availability of footpaths to enable passengers to easily walk to bus stops and the connectivity of the street network (grid coverage, cul-de-sacs and/or curvilinear road forms). Footpaths should be provided on all roads to enable pedestrians to access public transport services.
- **Driving Deterrents** – reasons why people would choose public transport over driving. The major factors in travel choice are travel time and cost of parking. Networks should be designed to provide public transport priority wherever required and possible.

In Greenfield areas such as the GMIA, public transport services should be available to residents as early as possible after they move in. The early introduction of services provides residents with an alternative to car use and helps to establish public transport use in the area.

There are three key forms of land-based public transport in Sydney, namely Bus, Light Rail and Train. These are described in Table 16, as well as general considerations in terms of their characteristics.

¹² TCRP Report 116, TRB, 2006

Table 16 Key types of land-based public transport

Mode	Description	Indicative capacity	Considerations
Bus	A key component of the overall transport system expanding the train catchment area and providing an important intermediate mode for cross-regional connections. Provides limited mass transit.	Standard bus – varies from 50 to 60 people. High capacity bus – varies from 100 to 120 people.	Can be demand responsive, offer local services and tailored to provide mass transit along strategic corridors or low level service provision. Services can be changed quickly to service emerging issues, new operating conditions and link regions that cannot be connected by other modes.
Light Rail	An important interchangeable mode of transport, providing flexibility for cross-regional connections while also facilitating mass transit services.	Dependent on the vehicle, 206 – 300 people.	Supports corridors of higher demand levels with linkages to major centres and medium-density residential corridors. Linked with other public transport services to support a connected network.
Train	Mass transit mode, able to move many people quickly.	Up to 1,200 people.	The backbone of the public transport system. Provides a platform that supports all other transport modes. Typically actions implemented on the train network affect all other transport modes.

Source: TfNSW, 2013

It is important to take the above into consideration when making decisions around the appropriate form of the public transport network and the type of serviceability that should be provided. Whilst the above is predominantly in regard to service capacity, other key considerations need to be taken into account such as:

- Upfront capital and operating costs.
- Topography.
- Service flexibility and adaptability.
- Quality and reliability of service.
- Ability to integrate with other modes to maximise uptake (i.e. active transport, commuter parking etc).

Whilst rail provides the largest capacity service, its implementation can often be restrained by high upfront costs and topographical constraints. Meanwhile bus services are lower in capacity, but are very adaptable in both their coverage and service characteristics and come with much lower upfront capital cost.

When considering the implementation of rail and bus services, reference will be made to the respective network design hierarchies as defined by TfNSW, and described in Table 17 and Table 18.

Table 17 Bus network design hierarchy

Rapid	Suburban	Local
<ul style="list-style-type: none"> - Frequent 'turn up and go' services without the need for consulting a timetable - Stops every 800 metres to 1km - Investment in bus priority infrastructure for fast and reliable journeys 	<ul style="list-style-type: none"> - A mix of frequent 'turn up and go' and timetabled services - Stops every 400 metres - Bus priority targeted at key pinch points to speed up services. 	<ul style="list-style-type: none"> - Timetabled services - Completes the network, providing services such as local shopping services, CBD shuttles, peak expresses - Stops every 400 metres - Peak express services with variable stop spacing - Services use local streets and roads, and bus priority for peak express connections.

Source: TfNSW, 2013

Table 18 Train network design hierarchy

Rapid Transit	Suburban	Intercity
<ul style="list-style-type: none"> - Frequent 'turn up and go' services without the need for consulting a timetable - Fast single deck trains, with plenty of seats, more doors, designed for easy boarding and alighting. 	<ul style="list-style-type: none"> - Timetabled services - Double deck trains with more seats per train. 	<ul style="list-style-type: none"> - Timetabled services - Double deck trains for Central Coast, Newcastle, Wollongong and Blue Mountains services - Comfortable services for long distance commute and leisure travel with on-board facilities for improved customer convenience.

Source: TfNSW, 2013

5.4 Road network planning

Guidelines for strategic road network design can be allocated into two main categories:

- Road classification (road hierarchy) – identification of how relevant transport modes will need to move through the precinct and how the road is will need to be designed to accommodate its intended function. This includes consideration to the movement of Higher Productivity Vehicles.
- Road capacity – identification of the adequate provision of lanes required to accommodate each relevant mode without significant congestion. There is a need to achieve balance between road connectivity / capacity and public transport provision / priority.

Note that the purpose of this investigation is to develop a strategic level transport plan, and as such intersection performance has not directly been taken into account. Emphasis in this study is determining an appropriate trunk road network structure and hierarchy that provides an appropriate level of connectivity and capacity, for which potential development could connect to. These trunk roads will be classified as either motorway, arterial or bus corridor type roads depending on their intended function. These are briefly described as follows.

Motorway: Predominantly serve and interregional and / or intercity function. They typically contain the features of high speed (typically 100km/hr or higher), high capacity, grade separated interchanges and limited accessibility. These are critical to the function of road based freight (i.e. primary freight routes) and efficient travel between districts and serve as the spine of trunk road networks. The need of motorway interchanges should be considered, whether this would induce car travel by making it too attractive to drive when compared to the use of public transport. Spacing of motorway interchange should be considered in the context such that the flow on the motorway should not be interrupted frequently when traffic is entering from the surrounding road network.

Arterial: Arterial roads typically serve a sub-regional role providing moderate to high speeds (typically 60 to 80 km/h) and capacities whilst also providing a higher level of connectivity and multimodal accessibility. In particular, arterial roads may include bus priority functions. They provide a role in connecting the State and Regional road networks, whilst also providing direct access to appropriate types of development. Freight roles for such roads can be primary, secondary or tertiary, depending the intended road function and design. These roads may be further defined by the categories of Principal Arterial, Arterial or Sub-Arterial, depending on the required function of the road.

Bus Corridor: A road facility conceived to provide a lower cost and more flexible transit alternative to commuter rail services. Through implementation of facilities such as Transit-Ways (T-Ways), bus corridors can provide a mass transit function. The T-Way has the flexibility of being able to be constructed both in-corridor with other roads, or realigned out-of-corridor to provide enhanced access to higher density residential pockets or key centres. The T-Way is tailored towards accommodating Rapid bus services, with greater (~800m) separation between bus stops, whilst also being able to accommodate selected other local and suburban routes in sections.

5.5 Active transport network

Walking and cycling are recognised as the highest priority access mode to public transport nodes. These modes are available to a broadest range of customers, require minimal spaces and facilities and are the most sustainable modes of travel. Successful active transport environments facilitate greater public transport use, contribute to healthy communities through the encouragement of physical activity, and can enhance both the economic and social aspects of an area.

In addition to the principles and objectives outlined in *Sydney's Cycling Future*, the NSW Bicycle Guidelines identify five key principles to adopt when designing a cycle network. These are:

- **Coherence:** The cycle network should link popular destinations in a continuous form, with consistent quality across the network. The correct path, especially at intersections, should be clear. There should be adequate density of routes to offer a choice to cyclists.
- **Directness:** Long detours should be avoided, but minor detours to avoid the steepest section of a hill are advisable so that the cyclist can maintain a constant speed throughout the journey. Barriers, such as a crossing at critical points can disrupt the momentum of the ride.
- **Safety:** Intersections should be designed with bicycles in mind and should include a path for cyclists. Roadway crossings should be safe and easy to negotiate.
- **Attractiveness:** Bicycle infrastructure should fit with the surrounding environment. Routes should be clearly signed, line marked and well-lit to offer a sense of security.
- **Comfort:** A smooth surface ensures a safe and comfortable ride. Space should be allocated to cyclists within the road reserve (in either a cycle lane or separated path) on all roads unless speed and traffic volumes are very low.

The plan outlined in *Sydney's Walking Future* proposes to support the integration of walking into the transport system through three 'pillars' of activity:

1. **Promote** the benefits of walking and provide quality information to customers
2. **Connect** communities by delivering safe walking infrastructure and completing networks
3. **Engage** with partners across the NSW Government, with local government, non-government organisations and the private sector to develop initiatives and policies.

Other principles / factors to be considered that are not specifically included in the above include:

- **Capacity:** There must be adequate space for waiting pedestrians, particularly at transit nodes and centres.
- **Integration:** Walking and cycling provisions should be bespoke of the strategic planning context of the area, as well as integrated with other transport modes (particularly mass transit services). This can be achieved through the provision of obvious, safe and convenient pedestrian/cycle access paths to interchange areas and centres. Active transport infrastructure needs to also be integrated with street function / facilities for vehicles, with provision of separated facilities where appropriate.
- **End of trip facilities:** Appropriate storage facilities should be provided at all key destinations (including train stations, major bus stops and large developments). Storage facilities should provide for both long and short term storage of cycles and related equipment. Design should be such that storage is not only secure and provides weather protection, but also conveys a sense of high priority for the treatment of cycles and cyclists.
- **User type:** Commuter cyclists typically prefer to use direct routes and are not as deterred by gradients and travel within the vehicle carriageway as recreational cyclists. Recreational cyclists are more likely to prefer a longer but flatter route and travel time is less of a consideration than a pleasant ride.

6.0 The Greater Macarthur Land Release Investigation

6.1 Introduction

DP&E has led investigations into the potential for urban development in Greater Macarthur. The process undertaken by the land use planning team has involved the following key steps:

- Defining an “urban capable” footprint, identifying the total developable land to be investigated as part of the GMLRI. This preliminary analysis took into account strategic constraints such as topography, waterways and biodiversity catchments.
- Defining “urban suitable” land, that takes into account more detailed analysis of the land including impacts of mining activities, agriculture, heritage & landscape character and vegetation management.
- Development of an indicative urban structure that quantifies the urban suitable footprint based on market demand / need for housing and employment centres, and defines the optimal sequencing of land release.

The indicative urban structure has been put forward in the form of a *Preliminary Strategy and Action Plan* (the “Strategy”) that identifies areas within Greater Macarthur that are proposed to become Priority Precincts that will accommodate housing demand in the short and medium term (i.e. to 2036). The Strategy also identifies the remaining urban suitable areas that will remain predominantly rural in nature until additional residential capacity is required in the long term.

The focus of this report is to identify the trunk transport infrastructure proposed to support the Priority Precincts identified in the Strategy (see Section 7.0 following). However, it is important to note that the transport network upgrades identified within the Strategy are based on a foundation planning-led transport framework that was identified to support the broader GMIA.

The planning-led transport framework was developed in response to a land use scenario that included development in all precincts of the GMIA, and was also subject to strategic-level assessment. The development of the broader transport framework is discussed in the following sections, and included:

- Acknowledgement of the constraints and opportunities in the existing transport network.
- Transport projects already under construction, or included within current Government planning documents.
- The “urban suitable” land for the GMIA, comprising of predominantly low-density residential dwellings and a hierarchy of proposed centres and employment lands.
- The transport planning objectives and principles discussed in Section 5.0.
- Stakeholder engagement, in the form of workshops attended by State and Local Government stakeholders.

6.2 Changes in land use

The 2011 census indicates that the GMIA has in the order of 1,811 dwellings comprising a population of 5,120 residents. The 2011 journey to work data further suggests approximately 2,800 people work within the study area.

An analysis of housing market needs has been undertaken to assist Government in understanding market demand / need, particularly in the context of the already released NWGC and SWGC. The analysis indicates that the GMIA could offer a potential solution to accommodate forecast overflow in the short term. Depending on the ultimate servicing capacity and staging strategy of the servicing agencies, the potential role of GMIA could conceivably be minor (circa 15,000 dwellings) or major (circa 75,000 dwellings) in the long term. It has been estimated that the total potential population of the GMIA could be as high as 190,000.

Approximately 70% to 80% of dwellings are anticipated to be in the form of medium to large lot detached housing, 15% to 20% semi-detached housing and the remainder flats/units.

An analysis of the potential for employment-generating and other community land uses has also been undertaken to identify suitable scale, type and spatial distribution of employment-generating land uses within the GMIA that could support forecast population increases. Based on analysis undertaken as part of the investigation, it is estimated that employment in a fully developed GMIA would be approximately 30,000.

6.3 Changes in travel demand

Such a level of development within the GMIA is anticipated to generate significant increases in travel demand in the area, particularly in the context of the existing transport network, and will generate the need for a large investment in supporting transport infrastructure. Based on preliminary analysis it is anticipated that:

- A low to moderate proportion of this demand will be self-contained within the GMIA, partially accounting for the trips generated by the 30,000 forecast GMIA workers.
- The remainder of inbound worker trips will likely come from the Wollongong area as well as the existing residential areas to the north / northeast.
- The largest type of generated travel demand will be home-based work trips. A significant portion of these trips will be destined for the external employment areas to the north and northeast, particularly Campbelltown-Macarthur as well as Camden and Liverpool.
- A relatively small portion of home-based work trips will be to the Illawarra area via Bulli-Appin Road or Picton Road.

6.4 Transport demand corridors

In the context of the GMIA, the key transport demand corridors are driven by the spatial distribution and location of centres. This is in light of the predominantly low density (residential) nature of the remainder of the development proposed. As shown in Figure 30, two key demand corridors have been defined and are described below. The corridors converge at the south around Maldon / Wilton Junction and at the north east around Glen Alpine (near Menangle Road), lending them both to a direct connection to the existing centre of Campbelltown-Macarthur.

- **Western demand corridor** - connecting centres to the west of the M31 Hume Motorway and along the existing Southern Highlands (Rail) Line. This is proposed to include the expanded existing centres of Menangle Park and Douglas Park as well as the proposed new centres of North Douglas Park and Maldon employment lands. This corridor would also have a function to service the freight tasks.
- **Eastern demand corridor** - the need to connect potential centres to the east of the M31 Hume Motorway between Gilead and Wilton Junction lends itself to a north-south demand corridor. This would connect the potential centres of Gilead, Appin, South Appin, Wilton and other centres in between.

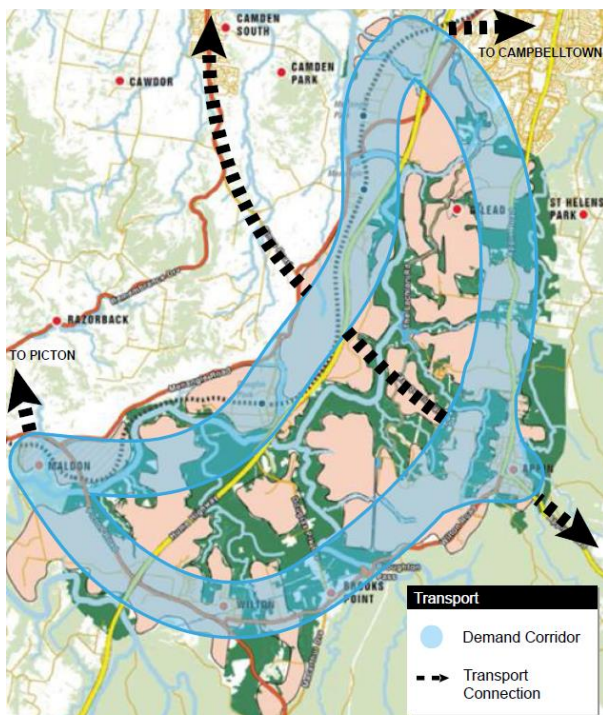


Figure 30 Transport demand corridors (Source: AECOM, 2015)

6.5 Potential ultimate transport network

The Western Sydney Strategic Model (WSSM) has been adopted as a tool to assess land use and transport network proposals for the GMIA. Preliminary outputs from the model have been used to inform the scale of infrastructure required. However the outputs have also identified the need to carry out further investigation, particularly in regards to the definition of the public transport network.

At this stage, costs for additional transport infrastructure and service upgrades required to support the Greater Macarthur Land Release are unfunded. The Greater Macarthur Land Release Preliminary Strategy and Action Plan notes that infrastructure requirements will need to be delivered through an appropriate mechanism. The preferred approach is a Special Infrastructure Contribution at no cost to Government, or alternatively by agreements between the NSW Government and relevant proponents. Funding for broader transport network impacts will also need to be considered as part of the land release.

6.5.1 Roads

Elements that comprise the potential package of road works are described as follows and conceptually illustrated in Figure 31.

Item	Description	Drivers
M31 Hume Motorway Upgrade	Widening of the motorway to eight lanes between Spring Farm Link Road and Raby Road interchanges. Upgrade of the motorway to six lanes between Picton Road and Spring Farm Link Road interchanges.	<ul style="list-style-type: none"> - Accommodate external impact of GMIA on trunk road network
M31 Hume Motorway - Wilton Junction Interchange	A new interchange at the M31 Hume Motorway to the north of Picton Road, including north-facing ramp access only	<ul style="list-style-type: none"> - Support development proposed in the Wilton Junction and Wilton areas - Provide relief to the Picton Road interchange to the south
Spring Farm Link Road	Completion of already-planned four lane arterial road from Spring Farm to Appin Road in southern Rosemeadow.	<ul style="list-style-type: none"> - Main access to the northern section of GMIA - Improved cross-regional access to Camden - Provide relief to the at-capacity B69 corridor in Campbelltown-Macarthur
Macquariedale Road Upgrade	New four lane arterial road in place of existing local road. Includes connection from Appin to Menangle Road, including full interchange with the M31 Hume Motorway and connection with Moreton Park Road.	<ul style="list-style-type: none"> - Serve as the main east-west connection through the GMIA for buses, traffic and cyclists - Provide improved access to the M31 Hume Motorway and relieve traffic loadings on parallel north-south corridors (Appin Road and Menangle Road) - Improve cross-regional connectivity between Appin and Camden
Appin Road Upgrade	Upgrade from two lane arterial to four lane arterial between Rosemeadow and Appin	<ul style="list-style-type: none"> - Provide sufficient capacity to accommodate development in northern GMIA
Appin Bypass	Construction of two lane free flow bypass in already-preserved corridor to west and south of Appin. Parallel section of Appin Road to perform "town centre" style road function only.	<ul style="list-style-type: none"> - Relocate through traffic out of the developing Appin centre - Allow the centre to grow as part of GMIA
Bulli-Appin Road	Allowance for improvements such as additional over-taking lanes	<ul style="list-style-type: none"> - Enable safe and efficient cross-regional movement between Greater Macarthur and the Illawarra

Item	Description	Drivers
Menangle Road Upgrade	Upgrade from two lane arterial to four lane arterial between Macarthur and Douglas Park.	- Support growth in Menangle Park, Menangle and Douglas Park
Picton Road Upgrade	Upgrade from two lane arterial to four lane arterial between Pembroke Parade and Almond Street, and from the M31 Hume Motorway to Picton. Allowance should also be made for improvements to Picton Road between Almond Street and the M1, such as additional over-taking lanes	- Support growth in Wilton Junction, Maldon, Picton, Wilton - Enable freight movement between the M31 Hume Motorway and Picton Road to the east - Enable safe and efficient cross-regional movement between Greater Macarthur and the Illawarra
Georges River Parkway	Already-reserved arterial corridor running parallel to the M31 Hume Motorway to the east.	- Provide relief to M31 Hume Motorway - Alternate access route for local trips between GMIA / Campbelltown and areas to the northeast
North – south arterial / sub-arterial	A new arterial / sub-arterial road bus priority features or separated transit way. Modelling to inform / confirm required role from a traffic perspective.	- To support development , and self-contained GMIA trips, from Gilead to south Appin - Relieve pressure from Appin Road - Provide opportunity as a trunk cycle route

Source: AECOM based on traffic modelling outputs by TMA / BTS, 2015

Note that Georges River Parkway has not been proposed as part of the required works to support development in Greater Macarthur. This is based on the outcomes of preliminary strategic transport modelling which yielded a low traffic assignment to the trunk road, along with the availability of capacity on parallel routes. The Georges River Parkway attracted less than 1000 vehicles per hour on the Appin Road – Rose Payten Drive section in 2036, and less than 500 vehicles per hour north of Rose Payten Drive. It is recommended that a targeted investigation be undertaken to confirm the requirement for, and form and timing of, Georges River Parkway that addresses the combined impacts of cumulative proposed development in southwest Sydney. This should include but not be limited to Greater Macarthur, the Glenfield to Macarthur Urban Activation Corridor and the Moorebank Intermodal Terminal.

6.5.2 Public transport

Potential improvements to the public transport network have been identified for the eastern and western demand corridors defined above. These include:

- In the western demand corridor: electrification of the existing line, and converting passenger service from low frequency diesel, to commuter frequency electrified services. This will require construction of new track to support freight movement (subject to further feasibility investigation and consultation with ARTC).
- In the eastern demand corridor: a new arterial / sub-arterial road with bus priority features or separated transit way, with a combination of tiered bus services connecting key centres not serviced by the proposed rail corridor – including South Appin, Appin and Gilead. The alignment of the corridor is proposed to the west of Appin Road, driven by the location of proposed centres and the presence of a two-sided walk-up catchment, compared to Appin Road which only has a western walk-up catchment.

Preliminary modelling of the electrification of the existing line indicates significant uptake of rail between Douglas Park and Campbelltown, but low-moderate take-up between Picton and Douglas Park. This indicates further tests may be warranted for a spur to Wilton Junction and Wilton (with associated changes to bus services) in order to potentially increase patronage. However, sensitivity testing a without-rail scenario yielded relatively modest increases on traffic volumes on the M31 Hume Motorway. Recent developments in the SWRL extension investigation may also warrant exploring additional integrative opportunities.

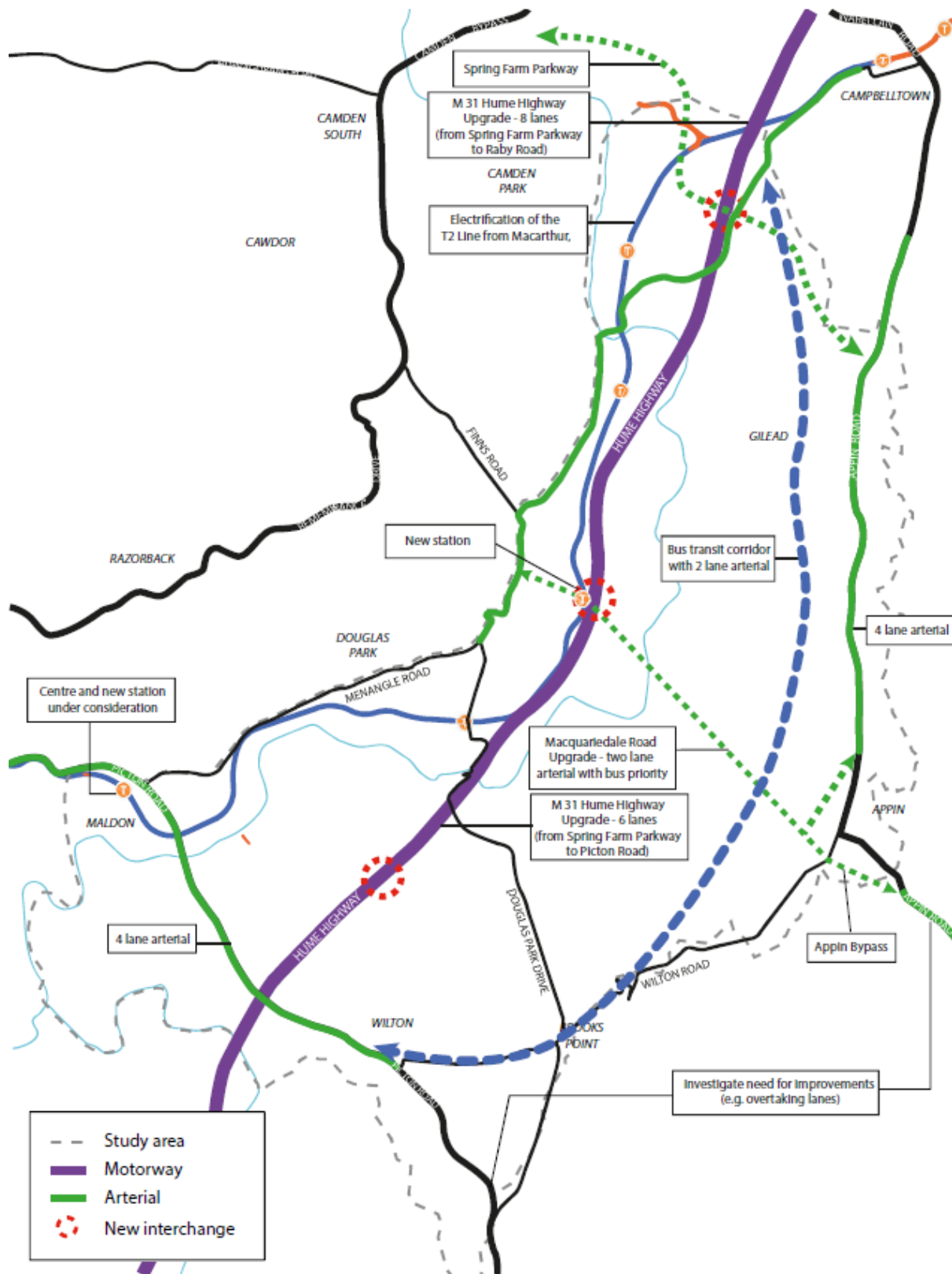


Figure 31 Concept transport network (Source: AECOM, 2015)

6.5.3 Active Transport

The development of a strategic active transport network will be developed once a more refined structure plan is determined. In the east, the spine of the cycling network could be formed within the Bus Corridor, with spurs connecting to open spaces, centres and education facilities etc. On the western side of the Nepean, Menangle Road may be pursued as the trunk cycle link. New east-west linkage will be required, which may be provided within the upgraded Macquariedale Road corridor. The Nepean River catchment also provides an attractive opportunity as a recreational / riparian route for both cyclists and pedestrians, however does not generally align with the proposed centres. The less spatially-constrained nature of the Greenfield development proposed should be utilised to ensure that dedicated facilities are provided at key links / routes - in the form of separated paths or dedicated cycle lanes for key cycle routes.

7.0 Preliminary Strategy and Action Plan

7.1 Introduction

The outcome of the GMLRI process is a *Preliminary Strategy and Action Plan* to 2036 for Greater Macarthur. This 2036 vision is illustrated in Figure 32 and includes the following features:

- Immediate opportunities to deliver up to 18,100 homes in Menangle Park and Mount Gilead and 16,600 new homes in a new town at Wilton. Menangle Park, Mount Gilead and Wilton are proposed to become Priority Precincts, by including them in the *State Environmental Planning Policy 2006*.
- The above residences would be supported by employment in a proposed Major Centre in Wilton Junction, Town Centres in Menangle Park and Mount Gilead, Village Centres in Glenlee, Gilead, Wilton, Maldon and western Wilton Junction, as well as employment lands in Maldon.
- Areas outside Menangle Park, Mount Gilead and Wilton will provide opportunities for longer term housing supply beyond 2036. Up to 2036 these areas will remain rural in nature, with small scale development that can be supported by the existing infrastructure and transport network. Beyond 2036 there are opportunities to provide another 33,100 homes and strategic employment opportunities.
- The rural setting of Appin Village will be protected, with only small scale expansion taking place, in line with existing post-Gateway planning proposals.

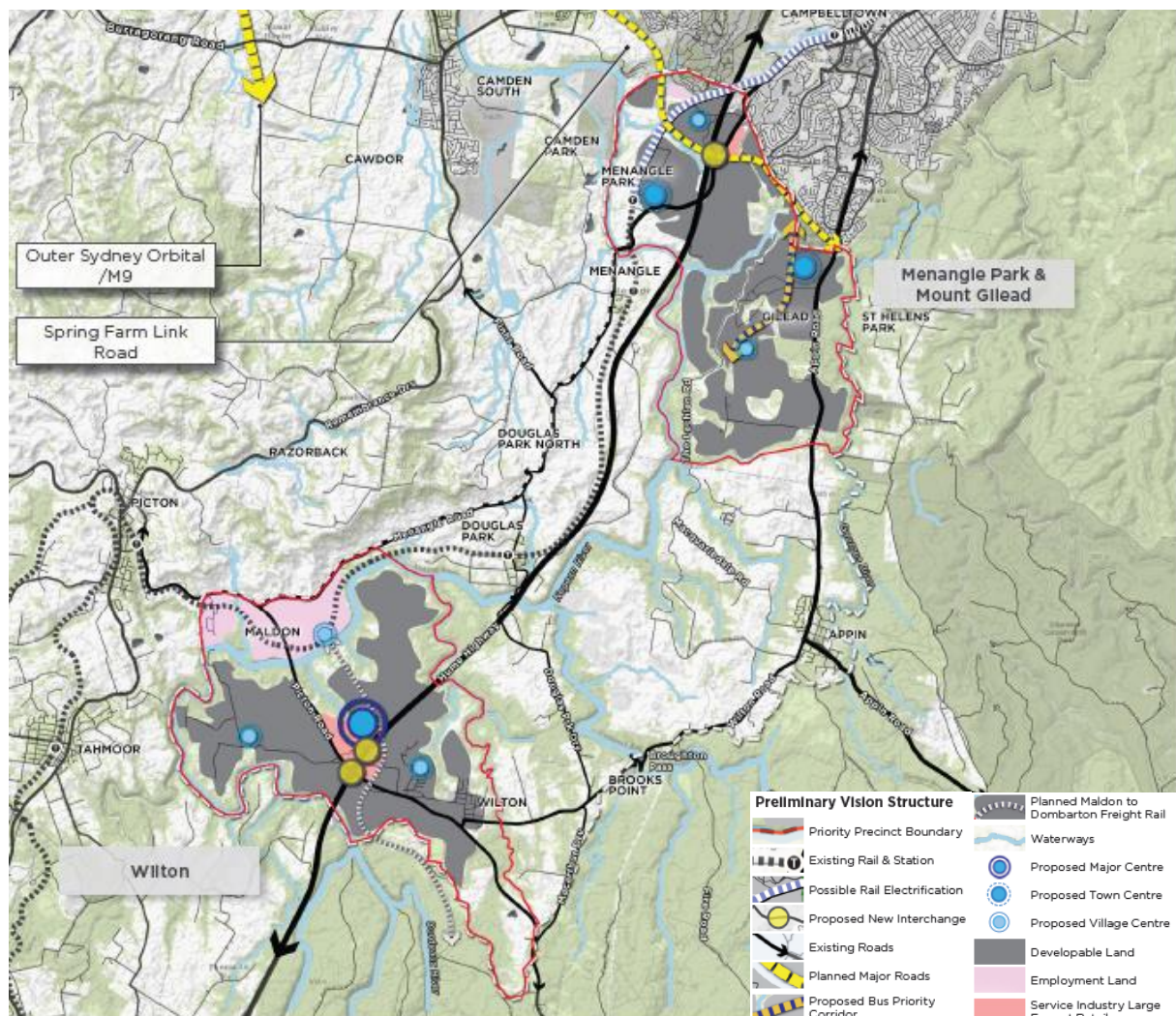


Figure 32 Vision to 2036 for Greater Macarthur (Source: DP&E, 2015)

Key infrastructure identified to support the 2036 vision for Greater Macarthur includes:

- Potential passenger rail electrification to Menangle Park (extension from Macarthur), subject to further investigation. This would require construction of additional tracks in order to allow separated freight / passenger rail operations.
- A new arterial / sub-arterial road through the Menangle Park and Mount Gilead Priority Precinct with bus priority features or separated transit way.
- Construction of the Spring Farm Link Road, including a new interchange with the M31 Hume Motorway.
- Improved accessibility to Wilton Junction and Wilton via an upgraded M31 Hume Motorway / Picton Road interchange, as well as new north-facing ramp connections at the M31 Hume Motorway to the north.
- Upgrades of existing roads such as Menangle Road, Appin Road and Picton Road.

At this stage, costs for additional transport infrastructure and service upgrades required to support the Greater Macarthur Land Release are unfunded. The Greater Macarthur Land Release Preliminary Strategy and Action Plan notes that infrastructure requirements will need to be delivered through an appropriate mechanism. The preferred approach is a Special Infrastructure Contribution at no cost to Government, or alternatively by agreements between the NSW Government and relevant proponents. Funding for broader transport network impacts will also need to be considered as part of the land release.

Details of the assumed transport network for assessment purposes are discussed in Section 7.4.1.2.

7.2 2036 land use changes

Based on the Strategy, a consolidated set of both population and employment forecasts have been developed by TfNSW. These have been developed for the purposes of informing the transport modelling undertaken to confirm the transport requirements to accommodate the immediate development opportunities to 2036. The projections developed are based on the proposed Priority Precincts being fully developed by the focal year of 2036, which is reasonable in light of the housing demand / market analysis undertaken. The population and employment forecasts utilised for transport network assessment purposes are summarized in Table 19.

Table 19 Population and employment forecasts by Priority Precinct

Priority Precinct	Population			Employment		
	2011	2036 Base ¹³	2036 GMLRI	2011	2036 Base	2036 GMLRI
Wilton Junction	2,167	4,426	49,316	623	799	10,199
Menangle Park and Mount Gilead	610	7,648	52,220	288	364	10,799
Total	2,777	12,074	101,536	911	1,163	20,998

Source: TfNSW, 2015

Note that the above employment forecasts are based on preliminary estimates provided by TfNSW. Subsequent analysis undertaken by the investigation team has indicated that employment in the GMIA would be in the order of 17,000 by 2036. This figure is slightly lower than the 21,000 estimated by TfNSW, but has been considered acceptable for the purposes of a preliminary transport assessment.

The above indicates that by 2036 approximately 50% of the total urban-suitable residential land within GMIA would be taken up, with a population of approximately 102,000.

¹³ Based on the BTS Population and Employment Travel Zone Forecasts - September 2014 Release

7.3 Changes in travel demand

In order to estimate approximate quantum of trips generated by GMIA residents, trip rate assumptions have been applied to the above forecasts. The assumptions made include:

- Average morning peak hour vehicle trips per dwelling of 0.8¹⁴.
- An assumed mode share to car of 90 per cent.

Note that the above are coarse assumptions, and actual trip generation and distribution will be undertaken as part of the strategic transport modelling task. The forecast estimates of GMIA travel demand based on the above are summarised in Table 20.

Table 20 GMIA forecast 2036 AM peak hour travel estimates (resident trips only)

Priority Precinct	Vehicle trips	Person trips
Wilton Junction	13,280	14,760
Menangle Park and Mount Gilead	14,480	16,090
Total	27,760	30,840

Source: TMA / BTS, 2015

Based on the estimates above it is forecast that in the focal year of 2036, the GMIA will generate in the order of 31,000 home based person trips in the morning peak hour. This is a significant increase in travel demand in the area in the context of the existing transport network, and will generate the need for a large investment in supporting transport infrastructure. Based on the land use and travel pattern analysis undertaken, it is anticipated that:

- A low to moderate proportion of this demand will be self-contained within the GMIA, partially accounting for the trips generated by the 17,000 forecast GMIA workers.
- The remainder of inbound worker trips will likely come from the Wollongong area as well as the existing residential areas to the north / northeast.
- A significant portion of the home-based work trips will be destined for the external employment areas to the north and northeast, particularly Campbelltown-Macarthur as well as Camden and Liverpool.
- A relatively small portion of home-based work trips will be to the Illawarra area via Bulli-Appin Road or Picton Road.

7.4 Strategic transport modelling

Preliminary transport modelling has been undertaken using the Western Sydney Strategic Model (WSSM). Strategic travel models are used to assess the impacts of various land use and transport network scenarios and inform decision-making at a strategic level. Although the WSSM covers the entire Sydney Greater Metropolitan Area (GMA), extending from Newcastle to Wollongong, the development of the model has been focussed on Western Sydney. For the purposes of assessing DP&E's Strategy, the WSSM has been used to:

- Estimate forecast travel demand on the transport network in 2036.
- Assess the proposed road and public transport infrastructure and services.

The inputs to the modelling process and the associated outputs are discussed in the sections following.

¹⁴ Based on *RMS Guide to Traffic Generating Developments: Updated traffic surveys*, using a balance of 80% low density residential, and 20% high density residential rates

7.4.1 Modelling inputs

7.4.1.1 Land use forecasts

Demographic forecasts for the proposed Priority Precincts within the GMIA have been assumed in accordance with Table 19.

In order to account for increases in population in a particular area such as those within the GMIA, it is typical practise to rationalise reductions in other parts of the Sydney area to attain a net zero difference on total demographic forecasts for the GMA. This is to reflect the notion that the introduction of a new growth centre will not induce additional population growth to the Sydney GMA, rather impact on the distribution of growth. The geographical redistribution of employment and population growth assumed for the modelling task was driven by land use analysis undertaken as part of the investigation. The projections indicate significant portions of both population and employment redistributed to the GMIA from other parts of Sydney's South West, in particular the SWGC. A notable level of shift in employment and population growth from the Illawarra region has also been assumed.

7.4.1.2 Transport network

The assumed **public transport network** includes the following:

- Extension of the electrified rail line from Macarthur Station to Menangle Park Station, along with extended suburban rail services to the proposed Menangle Park Town Centre.
- A bus network consistent with that assumed for the strategic-level assessment of the broader GMIA. The routes proposed include bus services to each of the Priority Precincts and have been adopted for the purposes of preliminary assessment. These include:
 - Rapid services operating between:
 - Campbelltown and Wilton Junction via Wilton, South Appin, Gilead.
 - Suburban / Local services operating between:
 - Campbelltown and Wilton Junction via Douglas Park, Menangle Park
 - Campbelltown and Wollongong via Appin (as per existing route 887)

The assumed **road network** includes the following upgrades:

- Full construction of SFLR (four lanes) east to Appin Road, including an all movement interchange with the M31 Hume Motorway,
- Widening of the M31 Hume Motorway to six lanes from Spring Farm Link Road and Narellan Road.
- Widening of Appin Road to four lane arterial from Kellerman Drive to the southern extent of the Menangle Park and Mount Gilead Priority Precinct.
- Widening of Menangle Road to four lane arterial from Tailby Street to the Nepean River crossing.
- A new arterial / sub-arterial road through the Menangle Park and Mount Gilead Priority Precinct with bus priority features or separated transit way.
- Widening of Picton Road to four lanes between Pembroke Parade and Almond Street, and from the M31 Hume Motorway to Picton.
- Improved accessibility to Wilton Junction and Wilton via an upgraded M31 Hume Motorway / Picton Road interchange, as well as new north-facing ramps to the north of Picton Road connecting the M31 Hume Motorway with a proposed internal road network for Wilton and Wilton Junction.

7.4.2 Model outputs

7.4.2.1 GMIA travel patterns

In order to establish approximate quantum, modal distribution and other travel characteristics of newly generated trips, trip information for all GMIA trips has been extracted from WSSM 2036 AM peak model. This information is summarised in Table 21, Table 22 and Table 23 below.

Table 21 WSSM 2036 AM peak two-hour trip generation: origin trips

Priority Precinct	Car trips	Rail trips	Bus trips	Total
Wilton Junction	15,200	300	1,700	17,200
Menangle Park and Mount Gilead	14,300	600	1,100	16,000
Total	29,500	900	2,800	33,200
Mode share	89%	3%	8%	100%

Source: TfNSW, 2015

Table 22 WSSM 2036 AM peak two-hour trip generation: destination trips

Priority Precinct	Car trips	Rail trips	Bus trips	Total
Wilton Junction	11,600	20	70	11,690
Menangle Park and Mount Gilead	11,000	700	2,700	14,400
Total	22,600	720	2,770	26,090
Mode share	89%	3%	8%	100%

Source: TfNSW, 2015

Table 23 WSSM 2036 AM peak self-containment matrix

Priority Precinct	Wilton Junction	Menangle Park and Mount Gilead	Total
Wilton Junction	7,100	1,700	8,800
Menangle Park and Mount Gilead	400	4,800	5,200
Total	7,500	6,500	14,000

Source: TfNSW, 2015

The above WSSM modelling outputs indicate that:

- The GMIA is anticipated to generate approximately 45,300 total trips in the 2036 two-hour AM peak period, including approximately 14,000 (31%) self-contained trips.
- A majority of the transport task will be undertaken using private vehicles, with approximately 88% of the mode share. Public transport utilisation for the GMIA will be relatively modest at around 12% of the mode share. These above mode shares suggest that there is a small shift of mode splits away from vehicular trips and are consistent with that currently observed in other Western Sydney LGA's such as Campbelltown.
- Utilisation of rail is particularly low, accommodating only approximately 3% of trips. This indicates little benefit to the provision of extending electrified suburban rail services to Menangle Park.
- Brief analysis of the origin-destination trip information also confirms that a significant portion of non-self-contained trips originating in the GMIA are bound for areas around the Macarthur-Campbelltown centre.

Travel distance and travel times for trips to and from the GMIA travel zones has also been extracted and is summarised in Table 24 below. As a guide to typical distances and travel times, Household Travel Statistics have been retrieved for the Campbelltown, Blacktown (fringe Western Sydney examples) and Sydney CBD LGA's:

- Average trip travel time (all purposes):
 - Sydney LGA: 20 minutes
 - Campbelltown LGA: 21 minutes
 - Blacktown LGA: 23 minutes
- Average trip length (all purposes):
 - Sydney LGA: 4.1 kilometres
 - Campbelltown LGA: 10.4 kilometres
 - Blacktown LGA: 10.5 kilometres

Table 24 WSSM 2036 AM peak two-hour trip times and distances

Priority Precinct	GMIA origin trips		GMIA destination trips	
	In-vehicle time (mins)	Travel distance (km)	In-vehicle time (mins)	Travel distance (km)
Wilton Junction	22	14	15	10
Menangle Park and Mount Gilead	16	9	14	8
All trips	19	11	14	9

Source: TfNSW, 2015

The WSSM model outputs indicate that:

- On the whole, GMIA AM peak trips have similar travel times and distances to those currently experienced in other Western Sydney LGA's.
- Trips to / from the Wilton Junction area have slightly higher travel times and distances when compared to the above benchmarks. This may be a result of the Wilton Junction area being significantly separated from the other major employment areas of Macarthur-Campbelltown centre (21 kilometres) and also Wollongong (29 kilometres).
- Trips destined for GMIA in the AM peak generally have lower trip travel times and distances when compared to those originating in GMIA. This is likely due to a high portion of self-contained trips driven by availability of local employment.

It should be noted that, based on analysis of previous model outputs, a significant majority of journey to work trips of GMIA were generally contained within other areas in Sydney's southwest. The previous analysis confirmed that residents were not travelling as far as the WSEA and WSA areas to access employment. This effect seems to have resulted in relatively normalised trip travel times and distances in the context of benchmark values currently recorded in other areas of Western Sydney.

7.4.2.2 Road network performance

Link flow plots and volume-to-capacity (VCR) plots have been extracted from WSSM, illustrating the anticipated traffic loads and traffic performance on key links in the GMIA area respectively. A strategic level assessment has been undertaken in which the appropriateness of assumed road infrastructure capacity (i.e. lane numbers) for trunk roads has been assessed based on preliminary model outputs. The network performance outputs from WSSM are summarised in Table 25.

It should be noted that strategic models make coarse assumptions regarding link capacity. As such, the VCR values reported below have been treated with caution in the assessment process, with first-principles checks undertaken at critical locations. Also note that the coarseness of the representation of the road network in some sections, and the large geographical area of the GMIA travel zones within WSSM make it difficult to assess some

areas of the network. A more disaggregated model in terms of zone and link structure would allow a more detailed assessment.

Table 25 WSSM 2036 AM peak road network performance

Road	Section	Required no. of lanes	Critical flow (veh / 2hr)	VCR range
Hume Motorway	Picton Road to SFLR	4 (6)*	5,900	0.4 – 0.6
	SFLR to Narellan Road	6 (8)*	8,500	0.4 – 0.6
SFLR	Glenlee to Appin Road	4	5,000	0.8 – 1.0
Appin Road	Rosemeadow to Gilead	4	3,600	0.6 – 0.8
	South of Gilead	2	2,500	0.6 – 0.8
Bulli-Appin Road	Appin to M1	2**	1,600	0.4 – 0.6
Menangle Road	Macarthur to SFLR	4	5,700	0.8 – 1.0
	SFLR to Nepean Crossing	4	3,900	0.4 – 0.6
	Nepean Crossing to Menangle	2	3,100	0.8 – 1.0
Picton Road***	Picton to Wilton Junction	4	3,600	0.6 – 0.8
	East of Almond Street	4	3,100	0.4 – 0.6

* the figure in brackets denotes the required number of lanes based on 100th HHV methodology (see comments below).

** overtaking opportunities provided throughout section.

*** Picton Road in proximity to the Hume Motorway, and the proposed arterial / sub-arterial road through Gilead, not assessed due to lack of modelling detail in WSSM.

Source: TfNSW, 2015

General comments on the performance of the road network are as follows:

- WSSM outputs indicate the proposed road network is generally within capacity.
- The outputs also indicate that the Hume Motorway is performing well within capacity based on a typical AM peak assessment.
- Spring Farm Link Road is anticipated to perform within capacity with four lanes. The volumes of traffic traversing through the SFLR / Menangle Road / Hume Motorway interchange area may require large-scale infrastructure / connections.
- WSSM outputs indicate all sections of Menangle Road will operate within capacity. However, the large link flows north of SFLR indicate that further widening may be required through certain sections.

Following the above strategic assessment exercise, the need has been identified to consider undertaking a 100th highest annual hour (100th HHV) assessment of the M31 Hume Motorway, and calculate lane provisions accordingly, in order to ensure the functionality of the highway is maintained during weekend and seasonal peak periods associated with inter-regional and inter-state traffic. Key outcomes of the 100th HHV analysis were:

- Based on 2012 data, the 100th HHV assessment infers a 50% higher traffic loading scenario for the northbound direction along the Hume Motorway when compared to a typical AM peak hour.
- Based on this additional loading, the lane requirements for the Hume Motorway in 2036 under a 100th HHV loading scenario would be:
 - 6 lanes between Picton Road and Spring Farm Link Road.
 - 8 lanes between Spring Farm Link Road and Raby Road (northern extent of assessment).

However, further consideration of the adoption of 100th HHV flows on the M31 Hume Motorway may be required as a result of recent advances in motorway management practice and potential changes in motorway design and management policy in NSW prior to this upgrade being required.

7.5 Further investigations

The outcomes of this preliminary assessment indicate that the proposed transport framework generally has sufficient capacity to support the travel demand generated by DP&E's proposed Strategy to 2036. Whilst the preliminary modelling has yielded some positive feedback on the transport framework, further modelling / investigations / analysis would be required to refine the network. This would help ensure an efficient network and help support further decision-making.

Based on the preliminary assessment of the transport network undertaken thus far, the following actions are recommended in order to further progress the network development and assist the decision-making process:

- A more disaggregated model in terms of zone and link structure be developed to allow a more detailed and accurate assessment.
- Further analysis of the public transport network be undertaken to consider:
 - The feasibility of electrification of the Southern Highlands Line to Menangle Park, and / or further south to Wilton Junction in the long term (beyond 2036).
 - Augmentation of the bus network to complement the 2036 Strategy, and outcomes of the rail electrification tests. Investigations into alternate service options that may increase overall public transport utilisation compared to that currently forecast.
- Further explore the impacts of the potential SWRL extension, and Outer Sydney Orbital investigation, on the GMLRI.
- More refined traffic modelling / investigations to confirm that the road infrastructure requirements developed from the strategic traffic assessment undertaken are suitable, as well as develop a more detailed road hierarchy including sub-arterial and local collector level roads.
- Further modelling to confirm the requirement for, and form of, Georges River Parkway. It is recommended that a targeted investigation be undertaken that addresses the combined impacts of cumulative proposed development in southwest Sydney, including but not limited to Greater Macarthur, the Glenfield to Macarthur Urban Activation Corridor and the Moorebank Intermodal Terminal.

Undertaking further investigations such as those identified above, would provide the opportunity to further refine the transport network to support the GMIA, allowing a more comprehensive evidence base from which to ensure an efficient transport network, inform decision making and incorporate the necessary infrastructure into planning.