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Wollondilly Shire Council

Report for Maldon Employment Lands Rezoning

Traffic and Transport Study

September 2011

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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- *did not include:*
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    - *Strategic traffic modeling;*
    - *Parking assessment;*
    - *Road safety auditing; and*
    - *Cost estimates*

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- *Background traffic growth;*
- *Proposed road network development;*
- *Site traffic generation ramp-up;*
- *Intersection arrangements*
- *Approval of proposed adjacent developments*

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1. Introduction

1.1 Background

GHD has been engaged to undertake a Traffic and Transport Assessment Study for the proposed rezoning of land in Maldon from agricultural to light industrial land use. Considerable work has already been undertaken in this area by Wollondilly Shire Council (WSC) and others, aimed at developing future land use plans and analysing potential traffic and transport options.

Future rezoning changes to Maldon within (and around) the area are likely to have impacts in the middle to long term due to a number of physical constraints on the further development of the road network. This is mainly due to access limitations to Picton Road and the physical barrier of the Main Southern railway line running through the middle of the rezoning site. Effective transport planning and management will therefore be required, including a range of measures to identify and protect key strategic routes as new areas for development are introduced and progressed.

As part of the planning exercise, it was necessary to identify strategic traffic and transport improvements, specifically access improvement options with an aim to ensure the transportation needs of the rezoned area are managed in a sustainable and integrated way over the next 25 years.

1.2 Study Purpose and Objectives

1.2.1 Study Purpose

Wollondilly Shire Council is investigating the potential impacts and environmental issues associated with the proposed zoning of rural land for industrial uses in Maldon. The Traffic and Transport Study will form part of the set of specialist studies involving environmental and form analysis at the local level that will inform the preparation of a draft Local Environmental Plan.

The background analysis of the traffic and transport investigation included an assessment of network options as part of the iterative planning process.

1.2.2 Objectives

This Traffic and Transport Study has been undertaken with the following key objectives for the proposed rezoning of land in Maldon:

- To inform future planning controls to ensure a coordinated and efficient approach to land use planning, environmental management and transport infrastructure for the rezoning of land in Maldon;
- To provide an integrated approach to determining the optimal mix of land uses and density concentrations as a means of minimising (where possible) trip generation and transport-related energy demand;

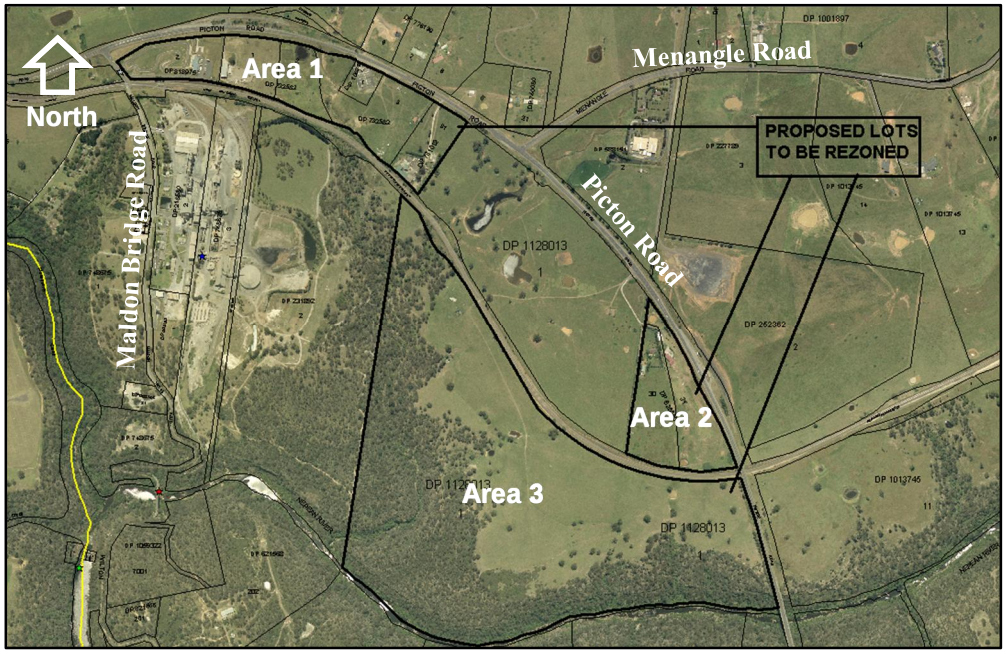
- To ascertain the cumulative and regional traffic and transport impacts associated with future land-based demands likely to imposed surrounding Maldon;
- Maximise efficiency and safety of the existing transport system in Maldon; and
- Develop a preferred road and transport network to serve Maldon in such a way that supports the aims of the public transport network and is sensitive to the environmental constraints and needs of the surrounding community.

1.3 Study Area

The study area is currently zoned RU2 - Rural under the Wollondilly LEP 2011 and is immediately adjacent to two parcels of land which are zoned IN3 – Heavy industrial. The study area consists of 9 parcels of land and is bounded by Picton Road and the Nepean River as shown in Figure 1.

- Area 1 consisting of Lot 2 D.P. 818975, Lots 1, 2 and 3 D.P. 732582, Lot 1 D.P. 105348 and Lot 31 D.P. 731012.
- Area 2 consisting of Lots 30 and 31 D.P. D.P. 826690; and,
- Area 3 owned by Allied Mills and is part of Lot 1 D.P. 1128013.

Figure 1 Maldon Rezoning Lands Aerial Photo and DP Numbers



1.4 Key Challenges

The key challenges which the development of the lands subject to the rezoning application faces are as follows:

- Ideally locate key access points to the rezoning land and minimise its impacts on the surrounding higher order roads;

- Ensure the safety and functionality of key access points to the rezoned land along Picton Road;
- Investigate options to access the rezoned lands other than via Picton Road;
- Evaluate the effects of increased rail traffic along the Main Southern Railway Line to the rezoned land traffic movements;
- Address future truck freight movements on the surrounding road network; and
- Review and recommend alternative transport modes to the rezoned lands,

1.5 Study Limitations

Given the strategic nature of the assessment, traffic modelling and traffic impact assessment has been undertaken at a high level, based on a set of assumptions relating to the current traffic conditions, the future traffic demand and the future transportation network.

All source data employed in the preparation of the transport assessment has been diligently collated and checked by GHD. However, given the level of detail of the assessment and the reliance on assumptions, the accuracy of modelling predictions will be influenced by unknowns or changes to what have been assumed to occur in the future.

1.6 Report Structure

This remainder of this report is structured as follows:

- Section 2: Context – presents a discussion of the land use planning, transport planning and policy context within which the precinct planning process was undertaken;
- Section 3: The Maldon Employment Lands – outlines the scope of the development and key planning considerations;
- Section 4: Development of Access Strategy – discusses the factors against which the transport and access features of the development area will be assessed;
- Section 5: Transport Assessment – presents the results of the strategic transport network and intersection assessment undertaken for the Site; and
- Section 6: Summary and Conclusions – summarises the key findings of this study.

The appendices to this report provide more details on the strategic network and intersection modelling.

2. Context

This section outlines the location of the site, its environmental context, connections to the local transport network and other development proposals that are under consideration in the area. These are presented in light of the relevant local planning documents that will guide the rezoning process.

2.1 Regional Context

Wollondilly Shire is located to the south west of Sydney and is part of the Macarthur Region of New South Wales along with Camden Council and the City of Campbelltown.

Maldon is one of the smallest suburbs within the Wollondilly Shire and is located within the eastern part of the shire, and to the west of the Hume Highway.

Picton Road and the Main southern Railway pass through Maldon.

2.2 Site Context

The rezoned land is intended to be developed for light industrial uses, although it is anticipated that the three areas are to be developed differently given the range in lot sizes and available access.

Area 1 has an area of 17.341 ha and has direct access to Picton Road via an existing access to the east of Maldon Bridge Road. Area 2 has an area of 8.943 ha and has access to Picton Road via a shared access with the Allied Flour Mill. Area 3 has an area of 87 ha and has no existing access by road. All of the areas covered in the Maldon Employment lands are constrained by having limited water and sewer access which impact on potential subdivision of the area.

2.3 Planning and Land Use Context

Planning for the rezoning of the Maldon Precinct is guided by a number of policy documents, the most relevant of which are:

- Macarthur Regional Environment Study (NSW department of Environment and Planning).
- The Sydney Metropolitan Strategy document Sydney into its Third Century (NSW Department of Environment and Planning, 1988).
- The Sydney Metropolitan Strategy document City of Cities: A Plan for Sydney's Future (NSW Government, 2005).
- Southwest Employment Lands Strategy Study (Liverpool City Council, Campbelltown City Council and Camden Council).
- Sydney to Canberra Corridor Strategy (NSW Department of Planning).
- Wollondilly Vision 2025 (Wollondilly Shire Council).

- Picton Road Corridor Strategy (NSW Roads and Traffic Authority, 2011).
- Wollondilly Shire Council LEP 2009.
- Sydney Regional Environmental Policy No. 20 – Hawkesbury – Nepean River.
- Sydney Regional Environmental Plan 27 – Wollondilly Regional Open Space.
- Wollondilly Shire DCP 20 – Industrial Development.

2.4 Transport Context

The following sections present a discussion on the travel characteristics, transport network and systems that provide a framework for transport and access considerations in the planning for the Maldon Employment lands.

2.4.1 Journey-to-Work Trips

Data from the Bureau of Transport Statistics (formerly Transport Data Centre) showed a significant private mode share for Journey-to-Work trips for residents and workers of Wollondilly Shire Council in 2006. Private vehicle modes used for work trips are more than 80% for journey-to-work trips originating from Wollondilly Shire Council LGA and more than 80% for journey-to-work trips to Wollondilly Shire Council LGA.

It is noted the car driver and car passenger modes are key contributors to traffic generation.

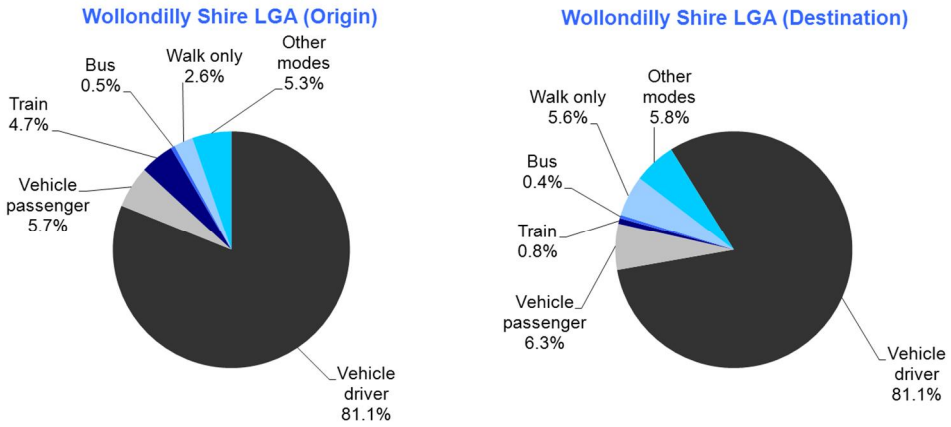
Table 1 and Figure 2 show how these mode shares for the LGA are distributed.

Table 1 2006 Journey to Work Travel Mode Shares in Wollondilly Shire

Mode	Wollondilly Shire (Origin)	Wollondilly Shire (Destination)
Vehicle driver	81.1%	81.1%
Vehicle passenger	5.7%	6.3%
Train	4.7%	0.8%
Bus	0.5%	0.4%
Walk only	2.6%	5.6%
Other modes	5.3%	5.8%
Total	81.1%	100%

Source: Transport Data Centre, via www.transport.nsw.gov.au [06JTW-Summary-Tables-Origin-LGA.xls and 06JTW-Summary-Tables-Destination-LGA.xls]

Figure 2 Mode Shares

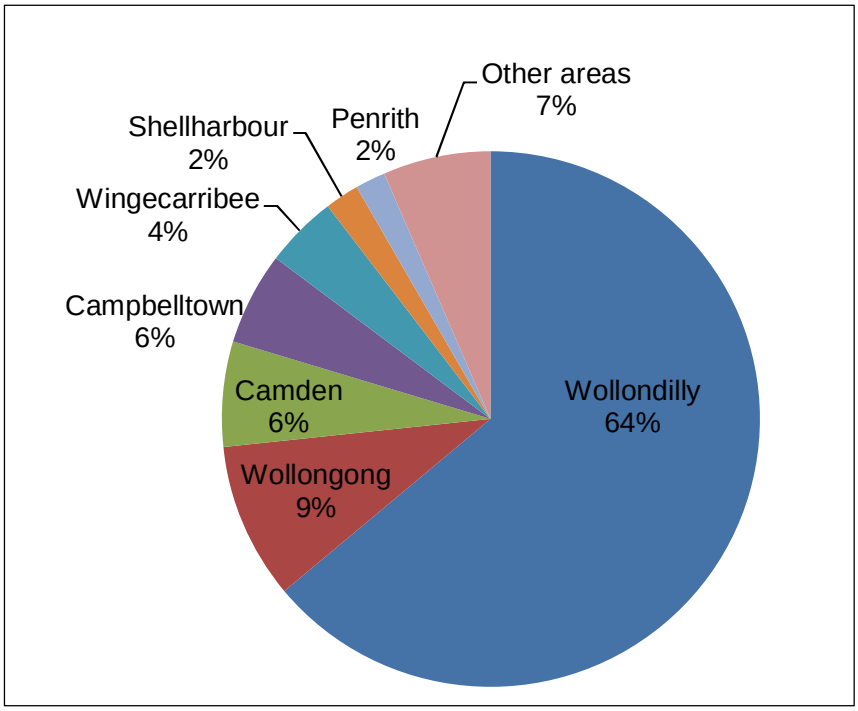


From the mode share composition, it is evident that there is a heavy reliance on private vehicle mode. New developments in the Picton area will generate travel demands and increase traffic loads on the network. However, with the dispersed nature of land use, locations of residents and infrequent bus services, it is unlikely that any reduction in car trips will be achieved through increased public transport usage.

2.4.2 Wollondilly Shire as a Workplace Destination

Analysis of the 2006 Census presents the likely origins or usual place of residence of the workers in Wollondilly Shire LGA.

Figure 3 Place of Usual Residence (LGA) of workers in Wollondilly Shire



Source: 2006 Census

From Figure 3, it can be seen that of the 8, 956 workers registered in 2006, 64% live within the Wollondilly Shire area. It is noted that the other likely areas of origin (with greater than 150 workers) are Wollongong (9%), Camden (6%), Campbelltown (6%), Wingecarribee (4%), Shellharbour (2%) and Penrith (2%). The remaining 7% are from other LGAs.

2.4.3 Existing Road Network

Figure 4 shows the existing road network in the vicinity of the Maldon employment Lands. A brief description of each of the major roads comprising the network follows Figure 4.

Figure 4 Existing Road Network

Source: Google Maps

Hume Highway

The Hume Highway is a major arterial road that runs between Sydney and continues to the border of New South Wales and Victoria. It is the main southern freight route to Goulburn and freight destinations further south to Melbourne. The Hume Highway has

a 4-lane divided carriageway with 3.5 metre lane widths and sealed shoulders of 2.5 metres on the west side and 2.0 metres on the east side. The Hume Highway has a posted speed limit of 110 km/hr.

The Hume Highway currently carries approximately 29,912 vehicles per day with 16 % heavy vehicle traffic.

Picton Road

Picton Road is the main east-west rural arterial road connecting the region of Picton with Wollongong, Goulbourn and Canberra. It has a 2-lane undivided carriageway with sealed shoulders and widens to 4 lanes at key intersections. Lane widths are 3.4 metres and the shoulder width is 2.5 metres. Some 300 m south of the Nepean River Bridge, an additional lane is provided in the eastbound direction towards the Hume Highway interchange. The speed limit along Picton Road varies between 100 km/hr (Nepean River Bridge), 80 km/hr (Maldon Bridge Road) and 60 km/hr (Remembrance Drive).

The Picton Corridor Strategy Report (April 2011) indicated Picton Road (between Remembrance Drive and Hume Highway) carries 8,000 vehicles per day with 11% heavy vehicle traffic.

Menangle Road

Menangle Road is a mainroad parallel to the Hume Highway that runs north-south providing an alternative route between Maldon and Campbelltown and further onwards to Sydney.

Menangle Road has a two (2) lane undivided road with lane widths of 3.1 metres and 2.0 metre wide shoulders. The sign posted speed limit varies between 100 km/hr, 80 km/hr and 60 km/h along its entire length.

The latest RTA Traffic Volume Data for MR167 at Maldon, at the Nepean River Bridge was recorded to be 5,943 vehicles per day in 2006.

Maldon Bridge Road

Maldon Bridge Road is a two-lane undivided rural road that was previously connected to Wilton via a suspension bridge over the Nepean River. The suspension bridge was then closed permanently to traffic due to safety reasons and Maldon Bridge Road is now only used as an access route to the Blue Circle Southern/Boral Maldon Cement site.

Maldon Bridge Road forms a priority T-intersection with Picton Road with a 150 metre left turn deceleration lane from the east approach of Picton Road, a 100 metre right turn deceleration lane from the west approach of Picton Road and a 60 metre westbound acceleration lane on Picton Road.

A signal controlled level crossing with the Main Southern Railway line exists approximately 100 metres south of the intersection of Maldon Bridge Road and Picton Road.

2.4.4 Rail

The Main Southern Railway line is part of the interstate rail network and travels through Maldon providing the national passenger and freight link between Sydney and Melbourne. The nearest major station is located at Picton township, approximately 5 kilometres from the site. The station provides CityRail and Countrylink services to Sydney to the north and Goulbourn, Canberra and Melbourne to the south.

There are currently 17 northbound Cityrail services per day and 17 southbound Cityrail services per day on the Southern Highlands Line which runs from Goulburn to Campbelltown. The volume of freight train services operating on the Southern Main Railway line varies per day. The ARTC Master Train schedule for January 2011 recorded an average of 37 northbound trains and 33 southbound trains during a typical weekday.

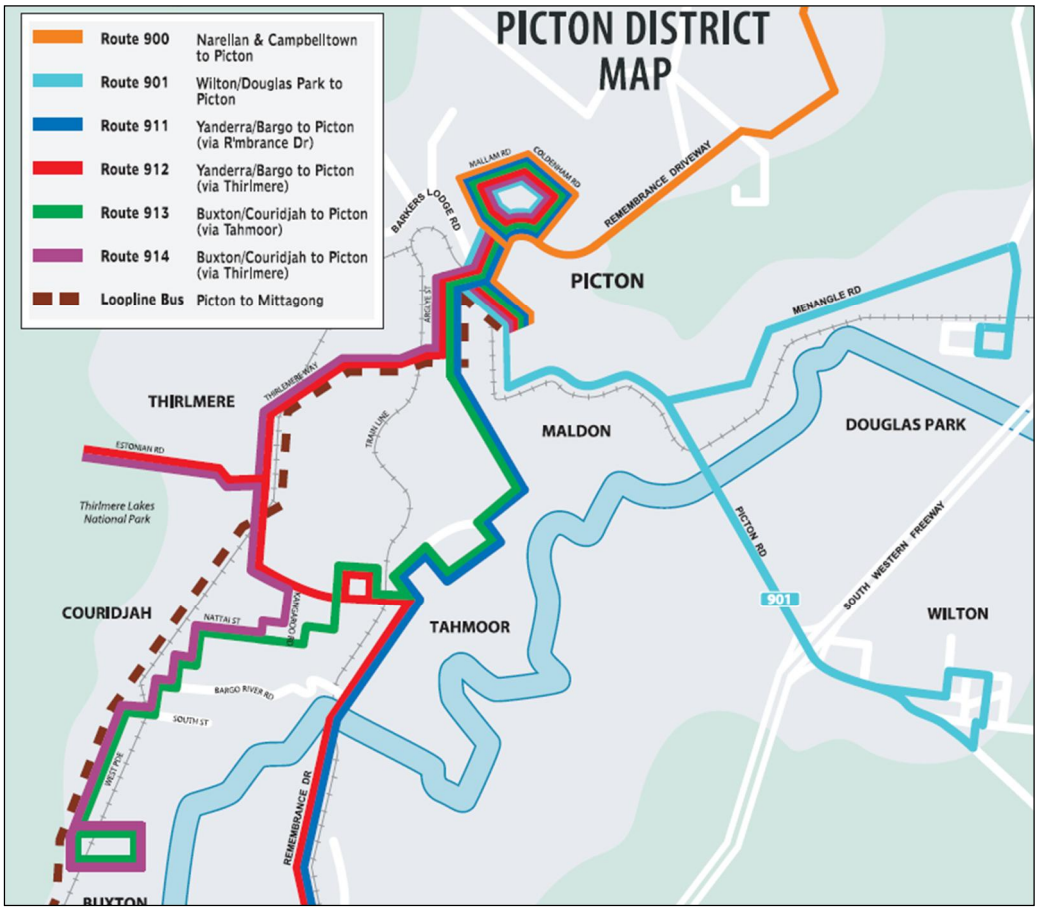
2.4.5 Bus Services

Public transport is available along the Picton Road corridor, operated by Picton Buslines, although this is generally restricted to the urban area of the Picton town centre with connections to other local centres.

Although Picton Buslines offer seven distinct route services, only one of these services, Route 901, travels along Picton Road in the vicinity of the proposed rezoning lands and provides a link between Picton and Wilton via Douglas Park. The Route 901 operates as a 'Hail and Ride' service along Picton Road with approximately 3 services per day running between 08:12 and 14:45.

Figure 5 shows the bus routes that currently serve the Maldon and Picton areas in the vicinity of the proposed rezoning.

Figure 5 Picton Buslines Service Map



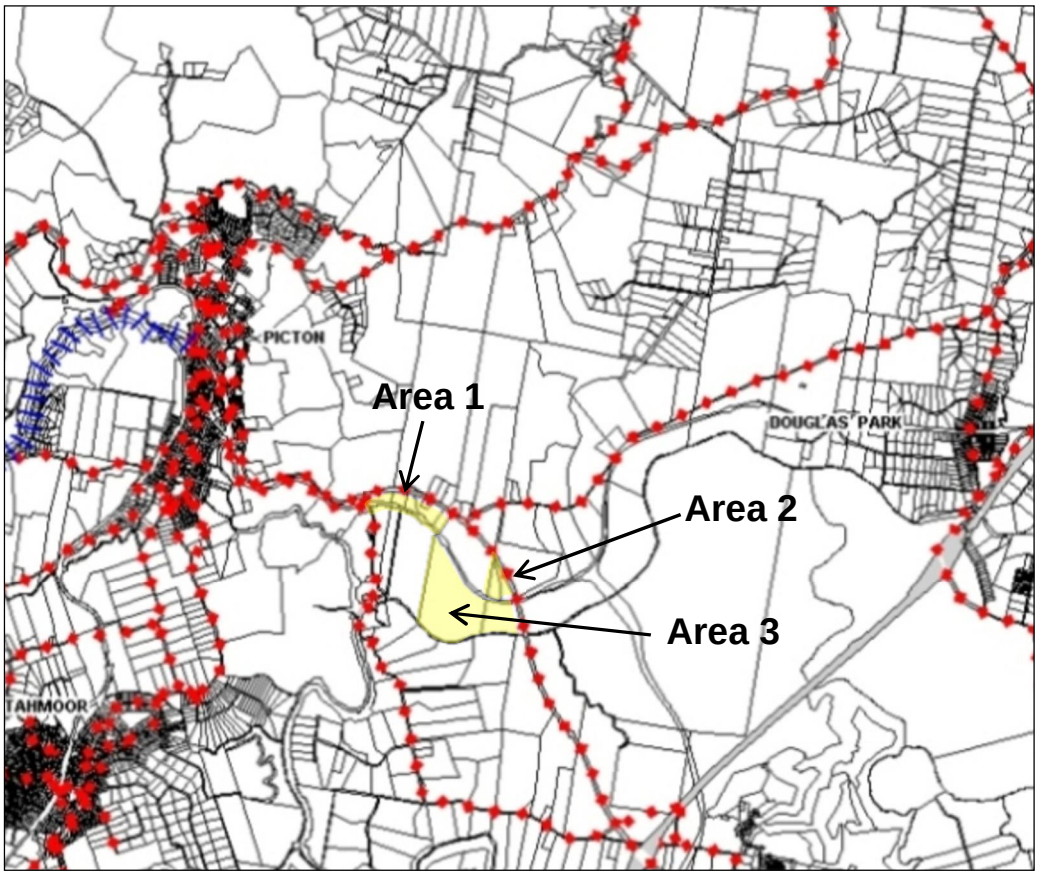
Source: Picton Buslines

2.4.6 Pedestrian and Cycle

In addition to the limited bus services available between Picton and Wilton, walking and cycling opportunities via dedicated infrastructure are limited. The WSC's Shared Cycleway Plan indicate that Picton Road is proposed to form part of the Council's cycleway/shared pathway route. At this stage there is no dedicated infrastructure separating cyclists and pedestrians from through traffic travelling along Picton Road.

Figure 6 shows the proposed cycleways in the vicinity of the site.

Figure 6 Current Cycleway Network



Source: Wollondilly Shire Council

2.5 Status of Current Transport Proposals

2.5.1 Maldon Rail Terminal

Boral Resources Pty Ltd is proposing to establish the Maldon Rail Terminal adjacent to Boral's existing cement works operated by its subsidiary Blue Circle Southern cement (BCSC). The Terminal will receive up to 1.75 million tonnes per annum (mtpa) of quarry materials from Peppertree Quarry by rail for unloading and stockpiling. Peppertree Quarry is a new hardrock quarry being developed by Boral at Marulan South. The aggregates will be loaded on road trucks and dispatched to the Sydney Market at via the Hume Highway.

The proposed Maldon Rail Terminal will include an upgrade to the Maldon Bridge Road-Picton Road intersection and improvements to the existing safety measures at the Maldon Bridge Road level crossing.

The intersection upgrade of the Maldon Bridge Road / Picton Road intersection was initially proposed to be seagull intersection treatment. Recent developments and discussions with the RTA have led to the proposed upgrade of the intersection as a roundabout. This is detailed in correspondence between AECOM and Wollondilly Shire

Council, attached in Appendix A. The concept design for the roundabout intersection provides a circulating island with a 16 metre radius and a circulating width of 8 metres. It concept design incorporates one through lane in both the eastbound and westbound direction along Picton Road and a 100m left turn slip lane from Picton Road into Maldon Bridge Road. The concept design is intended to accommodate the design vehicle of a B-Double truck (25 metres).

The Maldon Rail Terminal and the associated roundabout proposed at the intersection of Maldon Bridge Road and Picton Road has been approved.

2.5.2 Macarthur Intermodal Shipping Terminal (MIST)

The Macarthur Intermodal Shipping Terminal (MIST) is a proposed development on the west side of Maldon Bridge Road, south of the Main Southern Railway line. The MIST will provide an interchange facility for rail and road freight, providing a dedicated daily freight rail shuttle between Macarthur and Port Botany. The MIST will provide primarily container storage and handling services for freight traffic into and out of Sydney and will operate 24 hours a day and seven days a week.

The development is proposed to employ 80-90 staff and will provide car parking for up to 85 cars. It is also expected to generate approximately 20 truck movements per week.

2.5.3 Maldon to Dombarton (Port Kembla) rail link

The Maldon to Dombarton Rail Link was first considered during the construction of the Port Kembla coal loader in 1979.

Following a feasibility investigation and assessment of options, the Premier announced that in October 1982 the Maldon-Dombarton rail line had concept approval.

Construction commenced in 1983 and proceeded until it was cancelled in June 1988 citing a reduction in the anticipated coal load which would be transported along the corridor.

A pre-feasibility investigation of the completion of the project was commissioned by the Commonwealth Government in 2008.

The pre-feasibility report found that the completion of the rail corridor would provide alleviation to road and rail congestion in Sydney and south west Sydney, create jobs and provide benefits to Port Kembla and the south western Sydney coal industry.

2.5.4 Picton Bypass and Picton Road Improvements

A Picton Bypass to divert the non-essential traffic flow from the township of Picton has been discussed by WSC but no firm route or commitment to its provision has been resolved.

An original funding commitment of $15 million was made for safety improvements on Picton Road as a part of the Black Spot program to reduce crashes on Australian Roads, with a further commitment of $25 Million to the scheme made by State

Government. In February 2009, the NSW State Government announced a $12 million program of safety improvements for Picton Road. The program will be for two and a half years and is intended to address the most common types of crashes along the Picton Road corridor.

2.5.5 Wollondilly Bike Plan

The "Wollondilly Bike Plan Final Draft Report, GHD, May 2011" identified a number of proposed cycle improvements within the Wollondilly Local Government Area (LGA). None of the proposed improvements are located in the Maldon area. However Picton Road within Maldon, is shown on the WSC's Shared Cycleway Plan as a cycleway within the Shire.

2.5.6 Picton Road Upgrade

In 2010, the Federal Government committed $3.7 million to help upgrade Picton Road east of the Hume Highway interchange. These would include junction improvements, median treatments and clearing of zones such as vegetation removal and shoulder widening.

In addition, the RTA's strategy for Picton Road, as outlined in the "Picton Road Strategy, NSW RTA, April 2011", envisages the following key traffic management strategies for Picton Road:

- A two lane road with an adequate number of overtaking opportunities in both directions along its length, with potential for additional lanes if required in the longer term;
- Central medians to enhance separation between vehicles;
- Sealed shoulders of adequate width along its length;
- Improved clear zones along the corridor;
- Treatments at intersections to ensure traffic efficiency and safety for all road users;
- Intelligent communication strategies to assist road users; and
- Ongoing asset maintenance to support a safe and reliable road environment.

3. Maldon Employment Lands

This section provides an overview of the rezoning proposal of Maldon Employment Lands, including the site location, adjacent land uses and proposed developments, as well as the proposed trip generation and transportation network integration.

3.1 Site Context

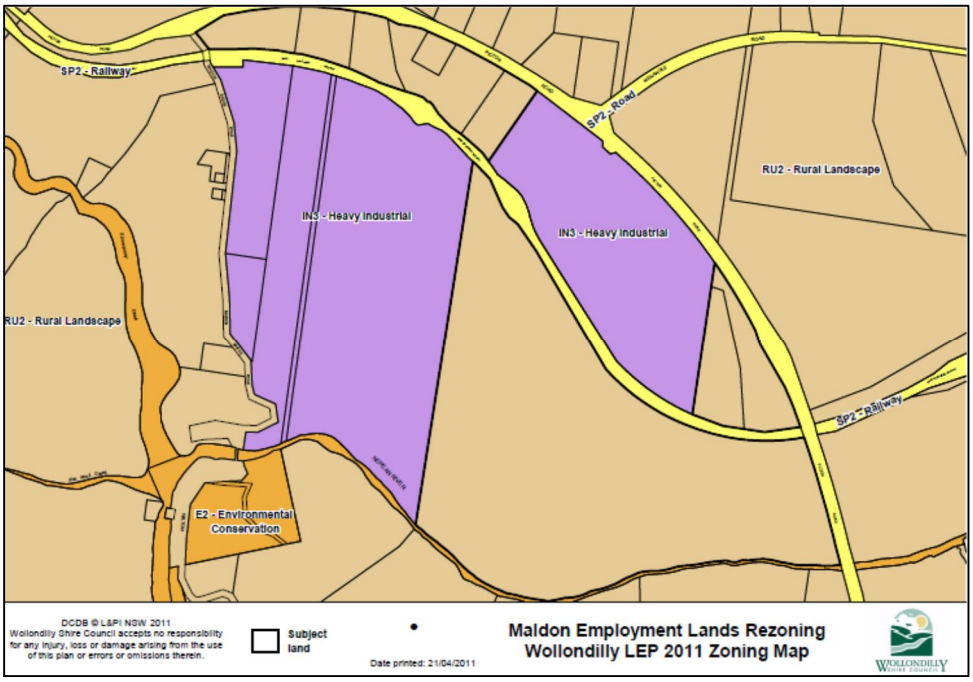
The planning area covers Maldon industrial precinct within the Wollondilly.

Maldon Employment Lands lies within a semi-rural area within the Wollondilly Local Government Area near the Nepean River. The area consists of relatively undeveloped land in the Wollondilly Shire Council local government area and generally undulating terrain with mainly cleared land used for grazing, smaller rural residential properties and small semi-industrial and recreational uses.

Maldon has been identified as an area that is potentially suitable to accommodate additional industrial development, due to its proximity to major transport infrastructure including the Hume Highway, Picton Road and the Main Southern Rail line. The combined areas are generally serviced by major roads in the Picton area: namely Picton Road to the north and northeast, Maldon Bridge Road on the western side, and the Hume Highway on the south east.

Figure 4 shows the area boundaries for the lands to be rezoned in Maldon.

Figure 7 Maldon Rezoning Lands Lot Boundaries



Source: Wollondilly Shire Council

3.2 Existing Uses

The current land use of the site is primarily greenfield, with other properties used for various rural-residential, recreation and semi-industrial purposes. The main properties that are within the land being proposed for rezoning include:

- Picton Karting Facility – a commercial go-carting facility at the corner of Picton Road and Maldon Bridge Road;
- Roadworx Profiling Pty Ltd – a commercial facility specialising in road maintenance, water and sewer maintenance, civil engineering, asphalt paving, decorative paving and traffic management. It is located along Picton Road within Area 1;
- Maldon Zone 330kV Substation – a single story structure within Area 1 to the east of Carriage Creek, comprising a brick control room and exposed transformers and switchgear;
- Semi-Industrial Property – operates as a commercial vehicle and plant maintenance and repair facility;

3.3 Adjacent Uses

3.3.1 Allied Mills

Allied Mills is a flour milling complex located southeast of Picton, north of the existing Main Southern Railway line. The flour and maize mill has an annual capacity of 300,000 tonnes per annum and includes a rail spur and site access off Picton road.

3.3.2 Blue Circle Southern/Boral Maldon Cement Works

The Blue Circle Southern Maldon Works cement plant, adjacent to Maldon Bridge Road, has a capacity to produce 0.6 million tonnes per annum (mtpa) and manufactures bulk and bagged cement products for the Sydney metropolitan market. Currently all raw materials are delivered to the site via rail and trucks and the majority of the products are transported from the site by road with a proportion by rail.

Boral, the owner of the Blue Circle Southern cement plant are have submitted applications to develop a hard rock stockpile within the Blue Circle Southern Maldon Works site. This development has been approved by the Joint Regional Planning Panel (JRPP) in July 2011.

3.4 Transport Planning Considerations

3.4.1 Development Potential

The site has a total area of 113.284 hectares. The net developable area as provided by Wollondilly Shire Council excludes the existing electricity substation, the riparian/significant area around Carriage Creek. The landscaped area/building setback along frontage of Picton Road and a 10m landscaped buffer along the railway

boundary and the 50m defendable space around the bushfire hazard and riparian buffers. The resulting net developable area is 43.498 hectares, distributed as follows:

- Area 1 has a net developable area of 11.495ha and has direct access to Picton Road via an existing access to the east of Maldon Bridge Road. Area 1 is likely to suit a wide variety of light industrial uses.
- Area 2 has a net developable area of 6.903ha and has access to Picton Road via a shared access with the Allied Flour mill. WSC anticipate that Area 2 will be developed for the purpose of waste recycling.
- Area 3 has a net developable area of 25.10ha and has no existing access by road except for emergency and maintenance purposes. Area 3 has potential for uses requiring large areas with low water needs.

Road access to Area 3 will be restricted to shared access with either Area 1 or Area 2. This is likely to require the construction of a new overbridge over the Main Southern Railway.

3.4.2 Potential Traffic Generation

Based on the Wollondilly Shire Council's vision for the development intensity of the Maldon Employment lands, a traffic generation rate has been determined that is appropriate to the proposed land use. Typically, traffic generation rates for industrial land in Sydney are derived from the RTA Guide to Traffic Generating Developments, 2002 (the *Guide*). Traffic generation for industrial lands is based on the amount of Gross Leasable Floor Area (GLFA) of the development. The *Guide* specifies two traffic generation rates for generating employee-based vehicle trips for industrial land use:

- 1 vehicle trips/100 m^2 of GLFA based on factories; and
- 0.5 vehicle trips/100 m^2 of GLFA based on warehouses.

Both these rates are considered to be reflective of a land use intensity that is much higher than that expected for the Maldon Employment Lands as discussed with Wollondilly Shire Council officers. Due to site constraints relating to sewer and water reticulation, the expected land use intensity is expected to be significantly lower than that of warehousing or factory developments typically expected in the Sydney Metropolitan Area.

Traffic generation for the Maldon Employment Lands was also calculated based on trip generation rates observed for large-scale manufacturing land in Penrith and Blacktown. These rates were derived from surveys undertaken by the RTA for the Western Sydney Employment Area (at Eastern Creek) and correspond to a similar land use and development intensity to that proposed for the Maldon Employment lands, ranging from 5 to 10.5 trips per hour per hectare of developable land. Assuming upper and lower trip generation rates of 5 and 10.5 trips per hectare, trip generation for the Maldon Employment Lands based on surveyed rates from Penrith and Blacktown is shown in Table 2.

Table 2 Peak Hour Traffic Generation Potential based on Penrith/Blacktown Surveys

	Total Area	GLFA	Low	Medium	High
	Hectares	100 m^2	5 trips/hectare	7.25 trips/hectare	10.5 trips/hectare
Area 1	11.495	4.023	57	83	121
Area 2	6.903	2.416	35	50	72
Area 3	25.100	8.785	126	182	263
Total	43.498		218	315	456

To better reflect the proposed land use intensity, and based upon traffic generation observed for similar land use in Blacktown and Penrith, the following trip rates were proposed, reflecting low, medium and high scenarios for the Maldon Employment Lands:

- 0.1 vehicle trips/100 m^2 of GLFA;
- 0.2 vehicle trips/100 m^2 of GLFA; and
- 0.3 vehicle trips/100 m^2 of GLFA.

The GLFA was assumed to be 35% of the total site area (accounting for parking, internal roads, on-site wastewater management, bio-retention areas etc). The trip generation resulting from these rates is shown in Table 3

Table 3 Peak Hour Traffic Generation Potential based on GLFA

	Total Area	GLFA	Low	Medium	High
	Hectares	100 m^2	0.1 vehicle trips /100 m^2	0.2 vehicle trips/100 m^2	0.3 vehicle trips/100 m^2
Area 1	11.495	4.02	40	80	121
Area 2	6.903	2.41	24	48	72
Area 3	25.100	8.78	88	176	264
Total	43.498		152	304	457

Comparison of the trip generation based on adopted trip generation rates and GLFA assumptions with those based on rates surveyed in Blacktown and Penrith shows good agreement in trip generation calculated by both methods. This indicates that the adopted trip generation rates are comparable to those observed in Penrith and Blacktown. Based on this comparison, the assumed GLFA's and trip generation rates detailed in Table 3, based on 35% of total area were adopted for the traffic assessment

Non-employee based heavy vehicle trip generation was developed according to the method outline in the RTA Guide to Traffic Generating Developments. A total of 10

heavy vehicle trips in the morning peak and 15 heavy vehicle trips in the evening peak were assumed to be generated by the Maldon Employment.

3.4.3 Transport Characteristics

Transport to the lands subject to the current rezoning application is available by road, via Picton Road; the Main Southern Railway runs east-west through the site, however, there is no railway station at Maldon. Use of the rail line by developments in the Maldon Employment Lands is dependent on sidings and other rail infrastructure being developed.

The primary traffic generation of existing developments in the Maldon area and proposed developments on the rezoning lands are expected to take the form of road and rail freight and car traffic generated by staff at the various sites.

3.4.4 Road Transport Network Integration

The site is bounded by Picton Road to the northeast and Maldon Bridge Road to the West. Picton Road provides a direct connection to major centres via the Hume Highway located some 4 km to the southeast. Menangle Road to the north east provides a connection to Campbelltown via Macarthur. Maldon Bridge Road currently only serves the Blue Circle Southern Works but borders Area 1 of the proposed rezoning. Although limited, opportunities exist for local direct access connections from the site to Picton Road mainly via extension of existing internal roads. The use of existing accesses to connect the Maldon Employment Lands to Picton Road is desirable for the integration with the existing transport network.

3.4.5 Public Transport Network Integration

Due to the limited service available from the Picton Buslines Route 901 and other local bus services, integration of public transport within any new development is considered unlikely. Although there may be potential for improved services between Picton, Douglas Park and Wilton should sufficient demand be generated through development in the LGA.

Picton Rail Station is located 5km from the site in the Picton township. This distance is considered prohibitive for commuters wishing to commute to and from Maldon via Picton station, without access to bus services to complete their journey.

However, it may be feasible for employers to operate shuttle services between any new developments and the nearby centres of Picton, Tahmoor, Douglas Park and Wilton.

3.4.6 Active Transport Network Integration

The site is located 5km from Picton township and its rail station. This distance is considered too far to generate many walking journeys. The lack of infrastructure to support walking as a feasible mode of transport is also considered prohibitive.

Cycling is considered a feasible transport mode for commuters living in Picton or Douglas Park. However, the lack of dedicated infrastructure and street lighting, coupled with the high numbers of heavy vehicles using Picton Road, may act as a deterrent.

3.4.7 Freight

Rail Freight

Use of the Main Southern Railway corridor is considered a possible means to access the proposed site; however, the following limitations are considered barriers to rail access for the purpose of freight transport via rail:

- The construction of a new station to service the development is not possible as the site is not identified for use as a future intermodal terminal development;
- Connection of a new siding onto the Main Southern Railway would be at the cost of the proponent so would be dependent on the type and size of development;
- Connection of a new siding would be dependent on approval by Australian Rail Track Corporation Ltd (ARTC) and train operators; and
- Should the construction of the Maldon to Dombarton Rail Line progress, the addition of a new junction in close proximity to the Maldon to Dombarton junction may not be feasible and advice/approval should be sought from ARTC.

From the consultation with the ARTC it was noted that the ARTC's main concerns in relation to the connection of a new siding are:

- The siding should be designed to ensure minimal impact on other rail movements;
- The siding needs to enable departing and entering the main line in a safe and efficient manner; and
- The final design of the new siding would need to limit the requirement for shunting on the main line.

Road Freight

The RTA's strategy for Picton Road as described in the "Picton Road Corridor Strategy, NSW RTA, April 2011" acknowledges its use of Picton Road as a freight transport corridor. The RTA's short and long term priorities for the corridor in terms of freight include monitoring and responding to the impact of freight movement along Picton Road the in future.

3.5 Current Development Proposals

Current development proposals in the vicinity of the site include (Refer to Figure 8):

3.5.1 Blue Circle Southern/Boral Maldon Cement Works

As mentioned in Section 3.3.2, Boral are proposing to expand their existing operations on the site of the Blue Circle Southern Maldon Works. The expansion involves developing a hard rock stockpile on the site for distribution to the Sydney market and

the upgrade of the intersection of Maldon Bridge Road and Picton Road to a roundabout configuration. This development has been approved and the roundabout design has been accepted.

3.5.2 Macarthur Intermodal Shipping Terminal

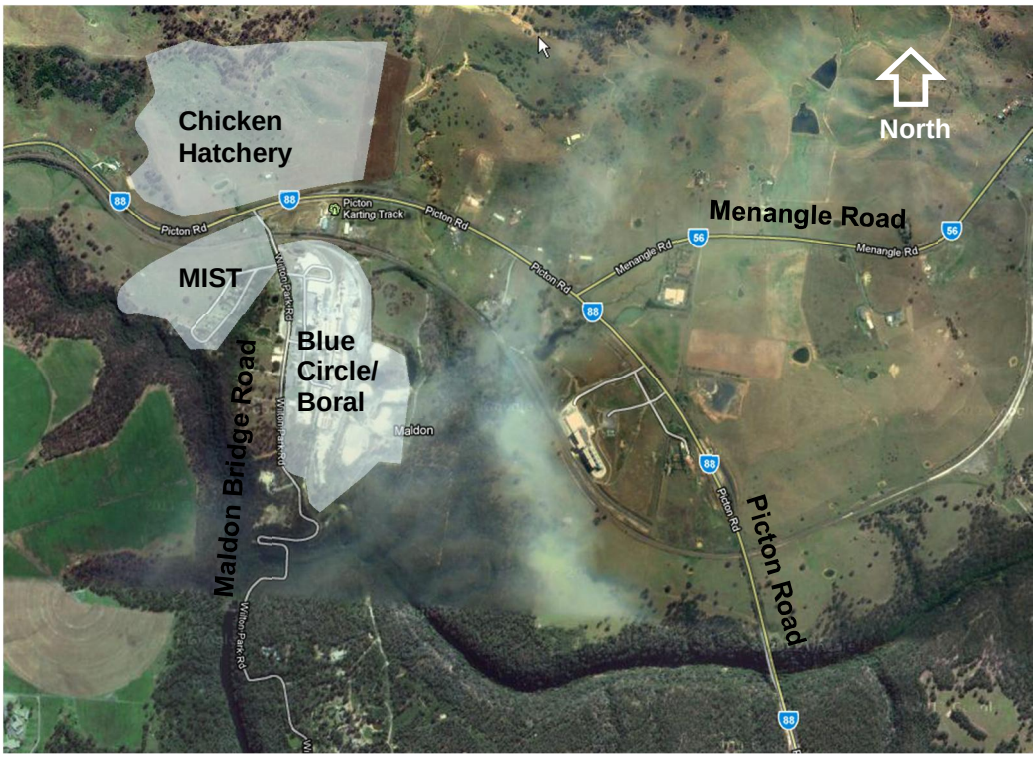
The Macarthur Intermodal Shipping Terminal (MIST) is a proposed development on the west side of Maldon Bridge Road, south of the Main Southern Railway line. The development is proposed to employ 80-90 staff and will provide car parking for up to 85 cars. It is also expected to generate approximately 20 truck movements per week.

The MIST will operate 24 hours a day and seven days a week.

3.5.3 Proposed Chicken Hatchery – 205 Picton Road, Maldon

A chicken hatchery is proposed to be established along Picton Road in the vicinity of Maldon Bridge Road. The proposed chicken hatchery will consist of chicken hatchery building and two dwelling houses for the live-in managers and staff. The proposed hatchery will operate Monday to Friday between 7:00 am and 6:00 pm and will have 14 full-time staff, two of which will be living on-site in the propose dwelling houses. The report for the proposed chicken hatchery development was reviewed and it determined that the traffic impact of the development, particularly during peak hours, would be negligible.

Figure 8 Current Development Proposals in the Vicinity of the Site



Source: Google Maps

3.6 Other Development Potential

In addition to the proposed and pending developments in Maldon, there are also undeveloped, zoned lands in the area that may potentially generate traffic if developed in the future. The Allied Mills Site currently has 12ha of undeveloped, industrially zoned land. Although no development applications for this site are publicly available at the time of this report, this land has the potential to generate traffic in the future. As there are no details of such development available at the time of preparing this report, the traffic generation of the undeveloped land on the Allied Mills Site has been omitted for the future traffic analysis of the Maldon Employment Lands.

A metal recycling plant has been proposed for Area 2. This land use is consistent with the assumed land use considered as part of this rezoning study; it has been assumed that the traffic generation calculations in Section 3.4.2 reflect the impact of such a proposal.

4. Access Considerations

This section examines the options for providing access to and from the Maldon Employment lands and considers internal and external connectivity between the sites and the local transportation network, identifying potential constraints and opportunities for access.

4.1 Issues, Constraints and Limitation

A summary of the transport and access issues that would impact on the planning and rezoning of the Maldon Employment lands:

- There are limited opportunities for access along Picton Road as the RTA submission indicated that they are not in favour of new access connections along Picton Road.
- There are no direct access points from Picton Road to Area 3 (except for emergency and maintenance vehicles) located south of the railway line. Due to safety considerations, a level crossing would not be feasible. Future access arrangements would require grade separation and access via Area 2.
- Picton Road speed zone environment. The site lies along the 100 km/hr speed zone and any proposal for a reduction in speed would require concurrence and approval by the RTA.
- Previous assessments have noted capacity limitations of the Picton Road-Hume Highway interchange. The RTA is currently undertaking concept design studies for the upgrade of the interchange to accommodate future traffic.
- Maldon Bridge Road level crossing may pose some limitations on the use of Maldon Bridge Road as a primary access to the site.
- Sight distance requirements at the access intersections would limit the number of potential access locations
- The existing intersections are priority controlled and would need to be assessed for capacity potential.
- Development of the three areas proposed for rezoning would be limited to sharing access through the Allied Mills Access and Maldon Bridge Road.

4.2 Access Options

The lots subject to the rezoning application are divided into three land parcels referred to as Area 1, Area 2 and Area 3.

4.2.1 Area 1

All properties in Area 1 currently have access to Picton Road. The RTA has requested that access points from Picton Road where possible should be consolidated. Area 1 currently incorporates the Picton Karting Track and is comprised of the following lots:

- Lot 2 DP818975
- Lot 1 DP732582
- Lot 2 DP732582
- Lot 3 DP732582
- Lot 1 DP105348
- Lot 31 DP731012

Area 1 has access to Picton Road via the existing entrance in use by Picton Karting Facility, which connects to Maldon Bridge Road between the level crossing and Picton Road. Area 1 is also bisected by Carriage Creek; access to the eastern side of Area 1 is currently provided by an informal access on Picton Road.

4.2.2 Area 2

Area 2 currently is located adjacent to the Allied Mills development and is comprised of the following lots:

- Lot 30 DP826690
- Lot 31 DP826690

Area 1 has access to Picton Road via the shared access with Allied Mills.

4.2.3 Area 3

Area 3 is bounded by the Main Southern Railway and the Nepean River in the north and south, and the Boral/ Blue Circle Southern cement works in the west. Area 3 is comprised of Part of Lot 1 of DP1128013.

Area 3 has no direct access to Picton Road or Maldon Bridge Road and would need to access Picton Road via a new overbridge over the Main Southern Railway and through the existing entrances of Area 2. For accessibility reasons, it is desirable for trips coming to and from Area 3, the majority of which will come from the Hume Highway and Picton Road East, to enter the site as directly as possible. For this reason, access to Area 3 should be via an internal connection along the western boundary of Area 2 that connects to the Allied Mills Access on the northern side and bridge over the railway line to the south.

Any connection between Area 2 and Area 3 would need to cross the railway line to the west of Picton Road. This would require a level crossing immediately to the west of Picton Road or a bridge crossing further to the west at the existing railway cutting. A bridge crossing is preferred for the connection between Area 2 and Area 3, primarily because the provision of a level crossing will be subject to a lengthy review and approval process by ARTC. This approval process is unlikely to recommend a level crossing option given the proximity to the existing level crossing at Maldon Bridge Road and the availability of a grade-separated crossing at the existing cutting.

An alternative to this access arrangement has also been considered, which would involve the addition of a fourth leg to the intersection of Picton Road and Menangle

Road. The addition of a new leg at this intersection would encroach upon an existing aboriginal heritage site that runs along the southern side of Picton Road opposite Menangle Road.

Figure 9 shows the options for access to Areas 1, 2 and 3.

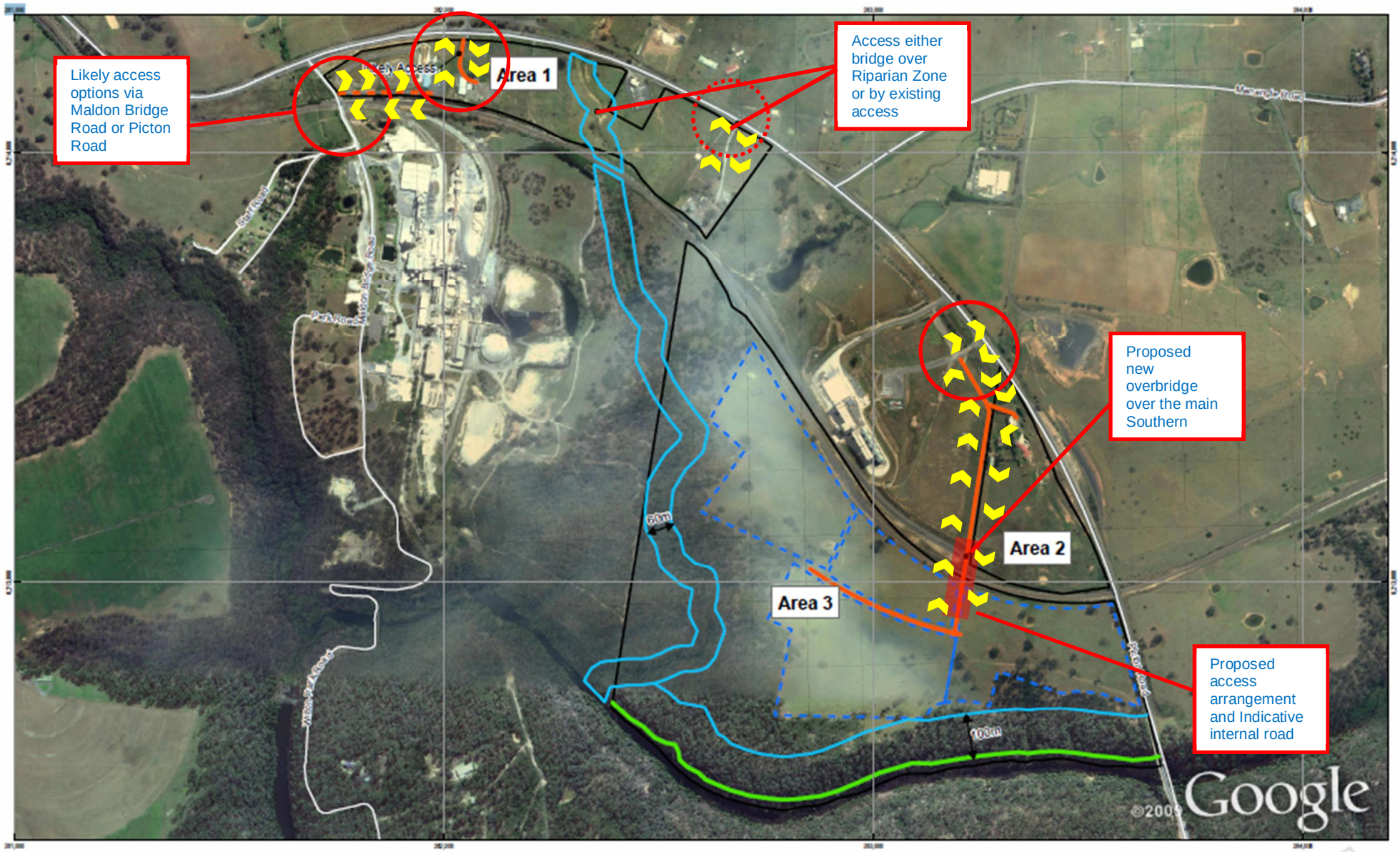

Likely access options via Maldon Bridge Road or Picton Road
Area 1
Access either bridge over Riparian Zone or by existing access
Proposed new overbridge over the main Southern
Area 2
Area 3
Proposed access arrangement and Indicative internal road
60m
100m
©2009 Google
0 50 100 200 300 400
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56
N
LEGEND
Access Route
Potential Alternate Access Arrangement
Approximate Riparian Zone
Top of Bank
Possible Subdivisions
Lots
GHD
CLIENTS | PEOPLE | PERFORMANCE
Wollondilly Shire Council
Maldon Employment Lands Rezoning
Traffic Study
Access options and planned subdivison
Job Number 21-20248
Revision A
Date 05 Sep 2011
DRAFT
Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Figure 9

4.3 Internal Access and Transport Planning Principles

This section provides a brief outline of key elements of the transportation network that should be considered during the detailed planning stages of the proposed rezoning lands in Maldon. The transportation and access planning for the proposed lands will need to be undertaken on the basis of full accessibility to be incorporated as part of the detailed development planning stages.

4.3.1 Overview

The "Wollondilly Development Control Plan (DCP) 2010 Volume 5 – Industrial and Infrastructure Uses, Wollondilly Shire Council, 2010" lists a number of access and amenity requirements for new industrial developments within the Wollondilly LGA.

According to the DCP, the design of the development should:

- Provide accessible, functional and safe open space for employees;
- Ensure good vehicular access, circulation and loading facilities and that these do not impact on the pedestrian and vehicular mobility in the locality;
- Ensure that parking areas and access ways are constructed with a smooth trafficable surface and to avoid conflict between pedestrians and vehicles; and
- Encourage the integration of land use and transport, and provide for environments that are highly accessible and conducive to walking, cycling and the use of public transport.

4.3.2 Internal Roads and Intersections

The internal road network comprises three major elements:

- The road hierarchy and street pattern
- Road widths
- Intersections

The above elements will need to be integrated into the overall planning of the rezoning sites, with a firm view of the broader aims during the detailed planning stages to ensure the following outcomes:

- An interconnected, legible, street pattern that will provide a pedestrian-friendly environment and optimal opportunities for future bus servicing and access.
- The employment lands be developed on the basis of promoting local access rather than through/regional traffic.
- The road hierarchy is compatible with the land use and range of roles that each street services. This should incorporate a collector road network to distribute traffic within these sites and provide access to parking areas etc.
- The alignment of internal roads and intersections support the urban structure and form.

4.3.3 Local Bus Services

Ensure that future public transport conditions can be provided for bus services running between the proposed rezoning lands and the Picton railway station. By providing an appropriately dimensioned street layout, reliable and appropriate access local bus services can play an integral part of the transportation strategy for the subject land sites.

Both the interim and long term public transport planning would need to be located in such a way that:

- Promotes integration of local bus services with rail services
- Provides a hub that has the flexibility to serve range of future local bus routes

4.3.4 Pedestrian and Cycle Facilities

Sound planning and the provision of adequate facilities for pedestrians and cyclists should also be considered during the detailed planning stages. It will be necessary to build the transportation and access network from the 'bottom-up' (i.e. pedestrian and cyclist) as well as the 'top-down' (road network, public transport).

The future detailed planning of the sites will need to be developed on the basis that there will be a safe, amenable and attractive pedestrian environment in all streets. Similarly, cycling should be promoted through a network comprising dedicated bicycle facilities and streets that are made safe for cycling through traffic planning, carriageway design and streetscape treatments.

The Wollondilly Bike Plan, recently prepared by GHD also identifies that to encourage cycling in the Wollondilly LGA, employers should provide end trip facilities for cyclists. This should generally include parking and shower and changing facilities.

5. Transport Assessment

This section presents an assessment and discussion of the adequacy of the proposed transport network around Maldon to meet the forecast traffic demand. It also presents an evaluation of the key intersections along sub-arterial and collector roads within the network.

5.1 Strategic Network Modelling (Tracks Model)

Wollondilly Shire Council currently maintains a strategic traffic model (i.e. TRACKS model) of Wollondilly Shire, developed by Gabites Porter. The strategic model has been calibrated to a base year of 2006. Traffic forecasts for the model are available for horizon years of 2016, 2021, 2026, 2031 and 2036 and can provide forecast traffic volumes, traffic congestion and road network performance for the Shire.

The land use assumptions used in the Wollondilly Shire Strategic Traffic Model are based on the Wollondilly Shire Council Draft Growth Management Strategy 2010 and traffic growth forecasts from the model have been used in this study to determine traffic flows along Picton Road. The Strategic Model has been used as a reference for determining the background traffic growth in the study area, this is documented in further detail in section 5.2.2.

It should be noted that the TRACKS modelling does not incorporate the proposed Maldon Employment Lands or any of the adjacent developments considered in this report.

5.2 Development of Traffic Forecasts

Forecast traffic for the Maldon Employment Lands has been generated from a synthesis of four primary data sources:

- Various traffic counts from 2009-2011 on Picton Road through Maldon;
- Historic growth patterns identified in the RTA's Picton Road Corridor Strategy;
- Strategic TRACKS Model traffic growth forecasts derived from the Wollondilly Shire strategic traffic model supplied by Gabites Porters; and
- Traffic generation from current development applications and the Maldon Employment Lands as presented in Section 3.4.2.

Traffic flows derived from these three sources have been combined to generate future traffic flows along Picton Road in the study area. Each of these sources is discussed in further detail below.

Traffic forecasts have been developed for two horizon years, 2016 and 2036. Background traffic growth forecasts were available from the strategic model for these horizon years. For the purposes of determining traffic growth associated with developments in Maldon, the following assumptions have been made:

- All current development applications are assumed to realise their forecast traffic generation by 2016. This represents a conservative estimate of traffic flows from these developments; and
- Developments in the Maldon Employment Lands from Areas 1, 2 and 3 are assumed to reach their full forecast generation by 2036. 2016 traffic generation from the Maldon Employments lands in 2016 has been interpolated on a pro-rata basis from 2036.

5.2.1 Base Traffic Count Data

Various traffic counts taken along Picton Road have been used to develop the base 2011 traffic flows for the study area. The following sources of traffic count data were used to develop the base traffic flows:

- Intersection turning movement counts at the intersection of Picton Road and the Hume Highway and Picton Road and Wilton Road (sourced from Hume Highway Modelling - RTA, 2011); and
- Intersection turning movement counts at the intersection of Picton Road and Maldon Bridge Road (sourced from Maldon Rail Terminal Traffic Impact Assessment – AECOM, 2009).

No recent traffic volume data was available for Menangle Road, indicative volumes for Menangle Road have been synthesised for the purposes of this study based on adjacent intersection flows and the Wollondilly Shire Strategic Traffic Model (2006).

Using these data, 2011 Base traffic flows for the weekday morning and evening peak hours were generated. Plots of the base 2011 traffic volumes are shown in Figure 10.

Figure 10 Base Year (2011) Traffic Volumes

Source: Google Maps

5.2.2 Future Background Traffic Growth

An initial estimate of future traffic growth along Picton and Menangle Roads for the forecast 2016 and 2036 years has been derived from the Wollondilly Shire Strategic Traffic Model, developed by Gabites Porter. Forecast traffic flows from the model were available for the following locations:

- Picton Road west of Maldon Bridge Road;
- Menangle Road north of Picton Road; and
- Picton Road east of Wilton Park Road.

Peak hour traffic flows (total vehicles) from the strategic model provided by Wollondilly Shire Council for the forecast 2016 and 2036 are shown in Figure 11 and Figure 12. When compared with the observed 2011 traffic flows, the TRACKS model traffic forecasts for the study area represent a linear growth rate of approximately 7% per annum in the peak direction. This represents an exceptionally high traffic growth rate that is not reflected by other growth areas in Sydney.

By contrast, RTA's Corridor Strategy for Picton Road notes a linear growth pattern of approximately 2.8% per annum to the west of Hume Highway. This growth pattern is based on historical annual average daily traffic and cannot be directly applied to peak hour traffic which is highly directional. In light of these estimates, rather than use the traffic growth from the TRACKS model, a more realistic estimate of background traffic growth has been made based on the linear growth rate identified in the RTA's Picton Road Corridor Strategy. Further traffic assessment has been undertaken using this growth rate assumption.

Figure 11 2016 Strategic Model Forecast Flows

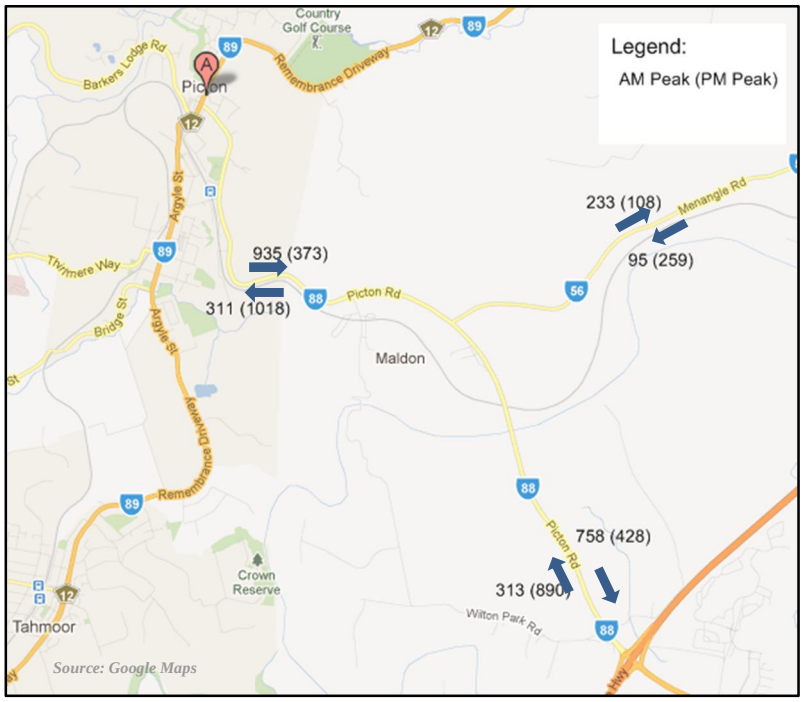
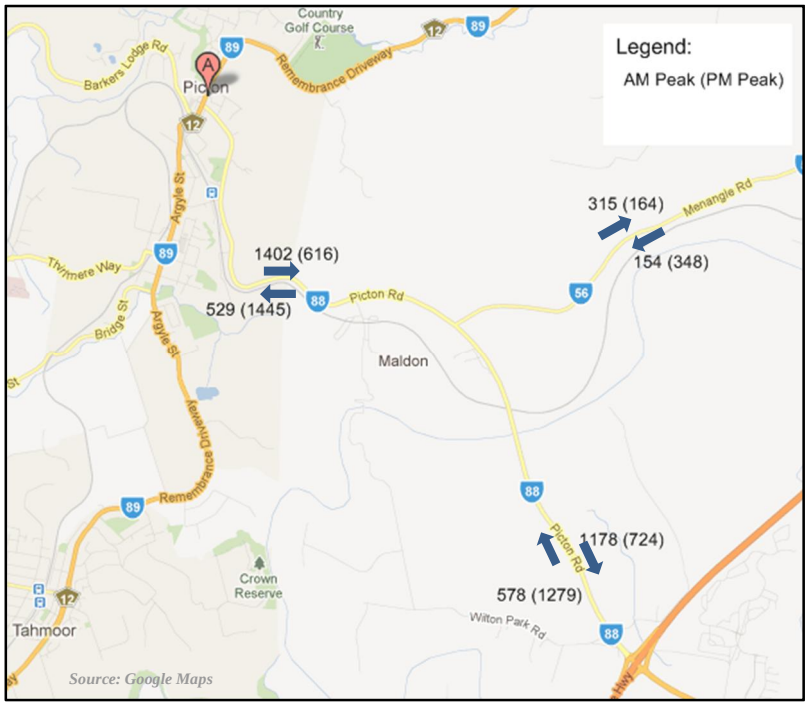


Figure 12 2036 Strategic Model Forecast Flows



5.3 Site Traffic Generation and Assignment

The traffic generation expected from the proposed rezoning has been calculated based on the assumed Gross Leasable Floor Areas (GLFAs) and trip generation rates

adopted for this assessment as described in Section 3.4.2. This rate is 0.3 vehicles per 100 m² of GLFA for light vehicles, based on a 35% of the total developable area being leasable. These rates have been agreed by Wollondilly Shire Council as representative of the land use activity that has been planned for the three sites based on infrastructure constraints such as water supply and sewage treatment.

In order to assess site traffic generation based on the worst-case scenario, the high traffic generation scenario has been adopted for road and intersection assessment. Total trip generation for each site has been split according to an assumption of:

- 85% of traffic in and 15% out in the morning peak; and
- 15% in and 85% out in the evening peak.

A summary of forecast morning and evening peak trips into and out of the site in 2036 is presented below in Table 4. This includes the employee based car trip generation derived in section

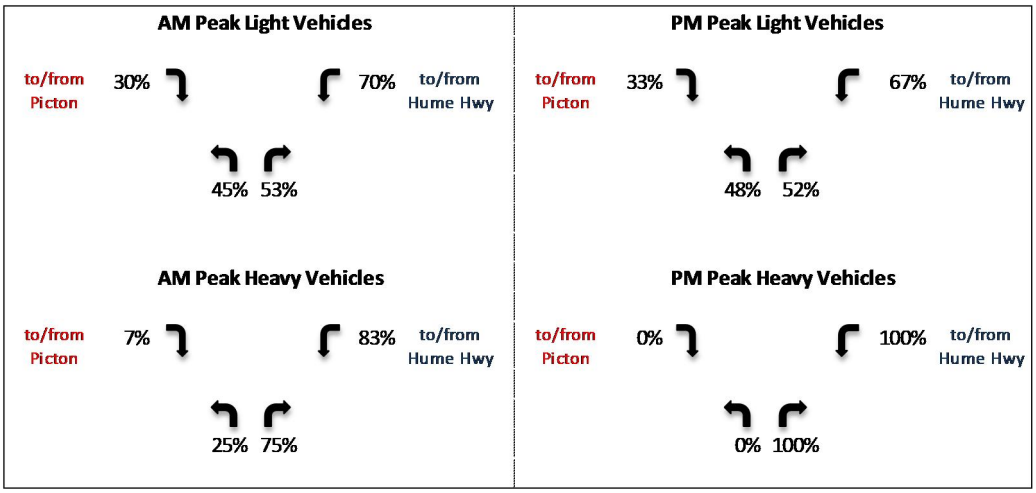
Table 4 Potential Peak Hour Traffic Generation (Light + Heavy Vehicles)

	Morning Peak		Evening Peak	
	Trips In	Trips Out	Trips In	Trips Out
Area 1	104	19	20	104
Area 2	62	12	12	63
Area 3	227	42	43	228
Directional Total	**393**	**74**	**75**	**395**
Site Total	**467**		**470**	

The traffic generation from the site has been distributed across the network based on the existing pattern of traffic demand observed for heavy and light vehicles at Maldon Bridge Road. The land use served by Maldon Bridge Road is generally representative of the proposed land use for the three sites with respect to the distribution of traffic, the majority of which will come to and from the Hume Highway and Picton Road east.

A plot of the assumed distribution of light and heavy vehicles to and from the proposed sites is shown in Figure 13. These have been assumed for 2016 and 2036 horizon years.

Figure 13 Distribution of Traffic To and From Maldon Employment Lands



The distributed site traffic was then combined with the 2011 traffic flows and the forecast background traffic growth to produce future traffic volumes along Picton Road for the morning and evening peak periods for the following horizon years:

- 2011 (Base);
- 2016; and
- 2036.

5.4 Desired Standards of Service

The desired standards of service for the transport network around Maldon relate to both the process of transport planning and to the objectives of the RTA, as stated in the Picton Road Corridor Strategy (2011).

5.4.1 Transport Planning

The Standards of Service for strategic network planning for Maldon relate to:

- Connectivity between the sites and to the main arterial road network;
- Provision of an orderly and legible road network; and
- Provision of adequate capacity to meet reasonable community expectations on the higher-order traffic carrying roads.

The first two issues are addressed by developing an orderly road hierarchy with specific design standards and target maximum traffic loads related to each road type within the network.

The issues of adequate capacity on the major road network (specifically, Picton Road) is addressed by defining acceptable Levels of Service, generally defined by a measure of volume against capacity, as discussed in Section 5.5.

5.4.2 RTA Picton Road Corridor Strategy

The RTA's Picton Road Corridor Strategy identifies objectives Picton Road corridor. Key objectives relating to desired Standards of Service include:

- Enhance road safety outcomes for all road users over the length of the corridor;
- Improve traffic efficiency for freight , commuter and recreational road users; and
- Improve access between existing and developing residential and commercial developments, especially at the western end at Maldon, Picton and Tahmoor.

Meeting these objectives for the corridor is supported by the standards of service discussed in Section 5.4.

5.5 Assessment Criteria

5.5.1 Road Capacity

The AUSTROADS *Guide to Traffic Management – Part 3: Traffic Studies and Analysis* defines "capacity" in accordance with the *Highway Capacity Manual 2000 (Transport Research Board)* as follows:

> *"Capacity is the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point of uniform section of a lane or roadway during a given time period under the prevailing roadway, traffic and control conditions. The concept equally applies to motorised vehicular traffic and to bicycle and pedestrian traffic."*

The typical roadway capacity for single lane flow is given in section 4.1 of the AUSTROADS *Guide to Traffic Management*. The capacity of a significant length of a single traffic lane for the prevailing roadway and traffic conditions can be calculated based on the following equation:

$$C=1800\ f_W\ f_{HV}$$

Where

C = capacity in vehicles per hour under prevailing roadway and traffic conditions

f_W = adjustment factor for narrow lanes and lateral clearances

f_{HV} = adjustment factor for heavy vehicles

5.5.2 Levels of Service

The AUSTROADS *Guide to Traffic Management – Part 3: Traffic Studies and Analysis* defines "Level of Service" or "LoS" as follows:

> "Level of Service is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A Level of Service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety.

In general, there are six Levels of Service, designated A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow)"

The Austroads *Guide to Traffic Management – Part 2: Traffic Theory (2008)* also states that :

"It has long been recognised that density is a fundamental measure of the Level of Service (LoS) being provided on a road at any particular time (e.g. HRB 1965) but, until relatively recently, the difficulties of field measurement of density led to the use of other LoS measures such as Volume/Capacity ratio"

Roadway Level of Service

Level of Service concepts and descriptions given in in the Austroads Guide to Traffic Management – Part 3: Traffic Studies and Analysis (2009) are shown in Table 5.

Table 5 Level of Service Descriptions for Roads

Level of Service	Uninterrupted Flow Facilities	Interrupted Flow Facilities	VCR Range
A	Free flow conditions in which individual drivers are unaffected by the presence of others in the traffic stream. Freedon to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.	Primarily free flow operations at average travel speeds, usually about 90% of the FFS (free flow speed) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is minimal.	0.00 to 0.34
B	Zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is less that with LoS A.	Reasonably unimpeded operations at average travel speeds, usually about 70% of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted and control delays at signalised intersections are not significant.	0.35 to 0.50
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	Stable operations ; however ability to manoeuver and change lanes in mid-block locations may be more restricted than at LoS B, and longer queues, adverse signal coordination or both may contribute to lower average travel speeds of about 50% of the FFS for the	0.51 to 0.74

Level of Service	Uninterrupted Flow Facilities	Interrupted Flow Facilities	VCR Range
		street class.	
D	Close to the limit of stable flow and is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.	A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LoS D may be due to adverse signal progression, inappropriate signal timing, high volumes or a combination of these factors. Average travel speeds are about 40% of FFS.	0.75 to 0.89
E	Occurs when traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.	Characterised by significant delays and average travel speeds of 33 of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections and inappropriate signal timing.	0.90 to 0.99
F	In the zone of forced flow. With LoS F, the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs and queuing and delays result.	Characterised by urban street flow at extremely low speeds, typically 25% to 33% of the FFS. Intersection congestion is likely at critical signalised locations, with high delays, high volumes and extensive queuing.	1.0 or greater.

Source: Austroads GFuide to Traffic Management – Part 3: Traffic Studies and Analysis

Intersection Level of Service

The Intersection "Level of Service" is the standard used to measure the performance of intersection operation. This is defined as the qualitative assessment of the quantitative effect of factors such as speed, traffic volume, geometric features, delays and freedom of movement. The Level of Service concept as applied to intersections through measures of effectiveness is summarised in Table 6.

Table 6 Level of Service Description for Intersections

Intersection Control	Measure of Effectiveness
Sign or merge control	Average Delay (sec/vehicle)
	Delay to critical movements
	Queue length for critical movements

Intersection Control	Measure of Effectiveness
Traffic Signals	Average Delay (sec/vehicle)
	Delay to critical movements
	Degree of Saturation
	Cycle Length
	Queue length for critical movements
Roundabout	Average Delay (sec/vehicle)
	Delay to critical movements
	Degree of Saturation
	Queue length for critical movements

The assessment of intersection operation is based on criteria outlined in Table 7 as defined in the *Guide to Traffic Generating Developments* published by the NSW Roads and Traffic Authority (RTA) in 2002.

Table 7 Intersection Levels of Service

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts will require other control mode	At capacity, requires other control mode
F	>70	Over capacity, unstable operation	Over capacity, unstable operation

Source: Guide to Traffic Generating Developments, NSW RTA (2002)

5.6 Future Traffic Conditions

Based on the forecast traffic flows detailed above, intersection modelling has been undertaken using the SIDRA intersection modelling package for the following intersections along Picton Road:

- Picton Road and Maldon Bridge Road;
- Picton Road and Access adjacent to Picton Karting Facility;
- Picton Road and Menangle Road;
- Picton Road and Allied Mills Access;
- Picton Road and Wilton Park Road; and
- Picton Road and Hume Highway Interchange

All of these intersections, including the Hume Highway and Picton Road intersection, currently operate under priority (give-way) sign control.

The primary intersections affected by the proposed rezoning are at the access adjacent to Picton Karting Facility, the Allied Mills Access and Maldon Bridge Road. These are the main focus of this study and concept designs based on SIDRA modelling have been developed for these intersections. It should be noted that previous studies have already determined proposed intersection arrangements for the following intersections:

- Picton Road and Maldon Bridge Road: A roundabout has been proposed by AECOM (April 2011) as a part of the proposed Maldon Rail Terminal Facility Study, which showed that a roundabout at the intersection of Maldon Bridge Road and Picton Road would increase the intersection lifespan, improve safety and help to slow vehicles on Picton Road to allow the entry and exit of heavy vehicles into and out of Maldon Bridge Road. The proposed design for this roundabout has been adopted as a part of the rezoning study for 2016 and 2036 horizon years.
- Picton Road and Menangle Road: Previous scoping work undertaken for the Allied Mills rezoning study (PB, 2007) recommended that this intersection be reconfigured as a signalised intersection. Further consultation by Wollondilly Shire Council with RTA in 2009 noted that the existing arterial road functionality of Picton Road must be preserved, and that it is unlikely to support a reduction in speed along the corridor. This would preclude the use of traffic signals at this intersection. For the purposes of this study, it has been assumed that this intersection will be upgraded to a seagull configuration in 2016 but will require upgrade to a roundabout by 2036.
- Picton Road and Hume Highway: For the purposes of this study, no additional works at the intersection of Hume Highway and Wilton Park Road and the interchange of the Hume Highway and Picton Road have been assumed. It should be noted, however, that the RTA is currently undertaking a study of the Picton Road and Hume Highway interchange and that an upgrade proposal for this interchange may be forthcoming.

For the purposes of this analysis, it has been assumed that it will be possible to bridge Carriage Creek and that all access to and from properties in Area 1 will be via a single access. This presents the worst-case scenario in terms of vehicle delays. In the event that bridging Carriage Creek is not feasible, developments to the east of Carriage Creek in Area 1 can access Picton Road via the existing access to the east of the electricity substation. Delays at this intersection are likely to be lower than those

modelled at the proposed access adjacent to the Picton Karting Facility, as the traffic from Area 1 will be split between these two accesses.

While this assessment makes every effort to accurately reflect the road network changes outlined in these proposals, it should be noted that this study is a high-level rezoning study, and reflects only the publicly available proposals and those made available by Council at the time of preparing this report.

5.6.1 Future Traffic Projections

Intersection flows for each of the modelled intersections for the two horizon years under the highest traffic demand scenario is shown in Appendix B.

These traffic growth forecasts include the following components of traffic growth:

- Background traffic growth of 2.8% linear growth per annum on Picton Road (derived from RTA's Picton Road Corridor Strategy);
- Traffic generated by the proposed Maldon Employment Lands;
- Traffic growth from the Boral Cement Factory Upgrade; and
- Traffic generated by the proposed Macarthur Intermodal Shipping Terminal.

The future traffic projections show that the majority of growth along the Picton Road corridor through Maldon is derived from background traffic growth between Picton and the Hume Highway. An assumed linear growth rate of 2.8% per annum has been adopted based on historic traffic growth on Picton Road identified in the RTA's Picton Road Corridor Strategy.

Traffic generation from the proposed rezoning sites is relatively low compared to the background traffic growth; however the high proportions of heavy vehicle traffic indicate that heavy vehicle movements will need to be taken into account in the intersection upgrades for the existing access adjacent to Picton Karting Facility and the Allied Mills Access. Background traffic growth on Picton Road is also likely to impact on vehicles turning at the intersection of Picton Road and Menangle Road.

5.7 Link Performance

Link performance is determined by assessing the roadway Level of Service, as noted in section 5.5.2. In the case of Picton Road, this assessment is made by calculating the ratio of traffic volume to roadway capacity (Volume to Capacity Ratio, or VCR).

Based on the forecast traffic volumes and heavy vehicles demands along Picton Road, the average capacity for Picton Road was computed as follows:

- 1,450 veh/hr eastbound; and
- 1,400 veh/hr westbound.

A summary of VCR and road Level of Service for Picton Road through Maldon for the 2016 and 2036 horizon years is provided in Table 8. These calculations are based on a single lane in each direction and the highest growth scenario.

Table 8 Road Level of Service at Picton Road east of Menangle Road

Year	Direction	Peak Period	Forecast Volume	VCR	LoS
2011	Eastbound	AM	533	0.36	B
2011	Westbound	AM	280	0.21	A
2011	Eastbound	PM	412	0.29	A
2011	Westbound	PM	504	0.35	B
2016	Eastbound	AM	668	0.47	B
2016	Westbound	AM	442	0.32	A
2016	Eastbound	PM	566	0.39	B
2016	Westbound	PM	646	0.45	B
2036	Eastbound	AM	1051	0.71	C
2036	Westbound	AM	677	0.48	B
2036	Eastbound	PM	854	0.59	C
2036	Westbound	PM	1048	0.74	D

Comparison of VCRs for Picton Road through Maldon shows that the current Level of Service for Picton Road is good, generally Level of Service A. By 2016, this is expected to degrade to Level of Service B, and by 2036, to a Level of Service D.

The link performance analysis suggests that forecast traffic volumes on Picton Road are likely to increase toward the upper limit of capacity for a two-lane, two-way rural road. This supports the RTA strategy to upgrade Picton road to provide two lanes of travel in each direction along its whole length by 2036.

5.8 Intersection Performance

The ease of access to and from the Maldon Employment Lands is largely dependent on the operating performance of the access intersections along Picton Road, as these are the critical control points on the road network. The SIDRA Intersection Analysis V5 software package was used to assess the existing and future peak hour operating performance of the key intersections along Picton Road.

The criteria used for evaluating the performance of intersections are provided in the RTA Guide to Traffic Generating Developments. The criteria are based on a qualitative measure (i.e. Level of Service) which is applied to each average vehicle delay band. This is defined as the qualitative assessment of the quantitative effect of factors such as speed, traffic volume, geometric features, delays and freedom of movement.

The Level of Service criteria set by the RTA (Guide to Traffic Generating developments, 2002) is outlined in Table 6. In analysing intersection performance, a Level of Service of “D” or better is generally acceptable to the RTA.

Intersection analysis was undertaken for the following horizon years:

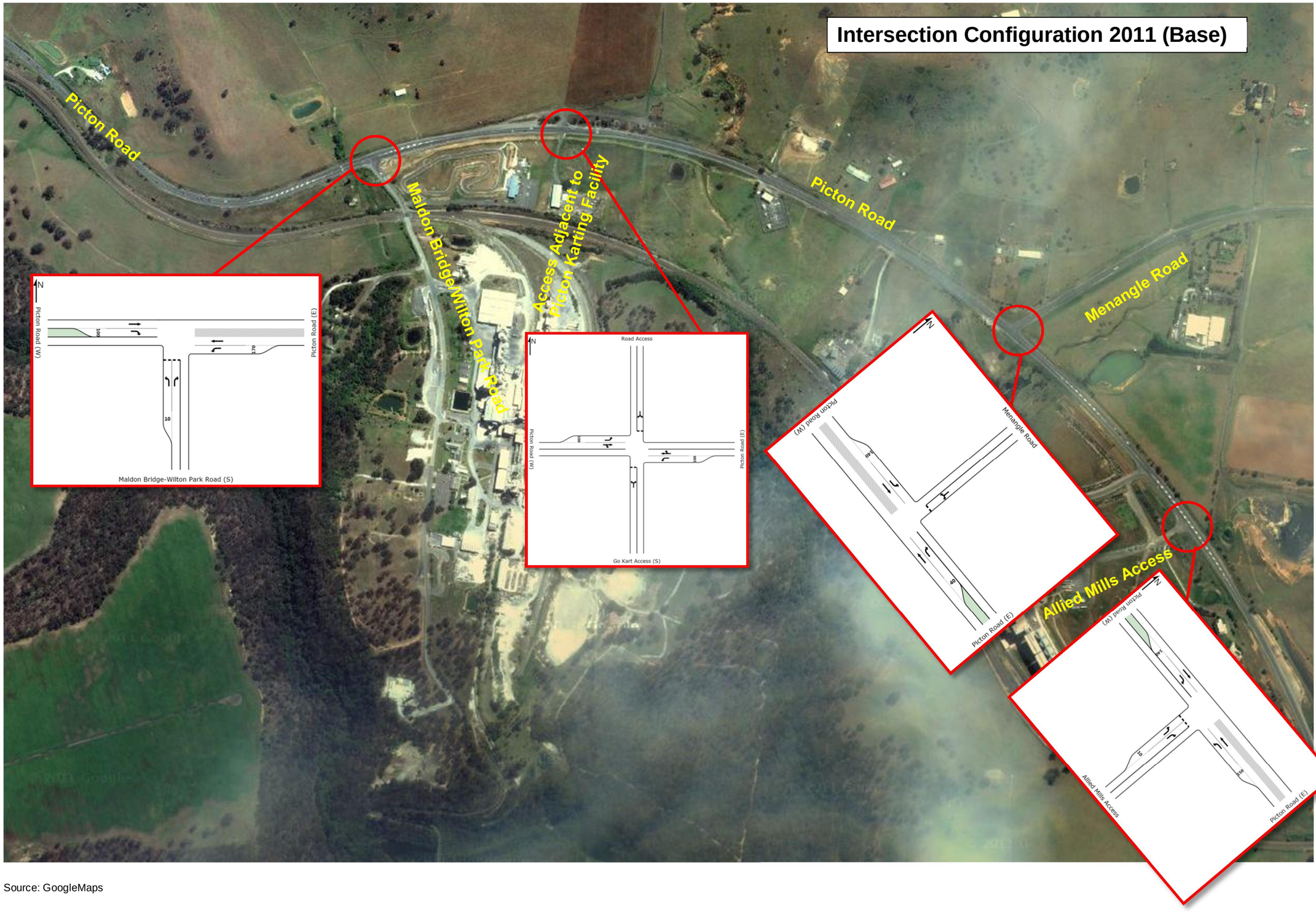
- 2011 (Base Year);
- 2016; and
- 2036.

For each of the horizon years the high traffic generation scenario, as detailed in Section 5.3, was modelled. This represents the worst case scenario for traffic demand in the corridor and sets the upper limit for capacity requirements at each of the intersections. For the purposes of this study, it has been assumed that Picton Road will remain one lane in each direction in 2016, but will be upgraded to two lanes in each direction by 2036.

5.8.1 Intersection Level of Service – 2011 Base Case

The key intersections along Picton Road through Maldon were analysed for operational performance under existing conditions. The base case intersection configurations that were modelled are depicted in Figure 14.

Figure 14 **Base 2011 Existing Intersection Layouts**



Source: GoogleMaps

The results of the base case analysis are summarised in Table 9.

Table 9 2011 Base Intersection Operational Performance

		2011 AM Peak			2011 PM Peak		
Intersection	Intersection Control	Level of Service	Degree of Saturation	Average Delay (s)	Level of Service	Degree of Saturation	Average Delay (s)
Picton Road/Maldon Bridge Road	Priority	E	0.14	58	C	0.16	42
Picton Road/Access Adjacent to Picton Karting Facility	Priority	B	0.03	17	B	0.14	25
Picton Road/Menangle Road	Priority	B	0.30	19	B	0.60	28
Picton Road/Allied Mills Access	Priority	E	0.07	69	C	0.09	29
Picton Road/Wilton Park Road	Priority	B	0.10	21	B	0.08	21
Picton Road/Hume Highway East	Priority "seagull"	B	0.50	28	C	0.53	29
Picton Road/Hume Highway West	Priority "seagull"	B	0.26	18	B	0.36	19

The operational performance output (Table 9) from the SIDRA analysis indicates that the majority of intersections along Picton Road operate satisfactorily under existing conditions, with the exception of the intersections of Picton Road and Maldon Bridge Road and Picton Road and the Allied Mills Access, which perform at a Level of Service E. These intersections are close to or at capacity and are likely to require alternative treatment to serve future traffic growth.

It should be noted that for priority intersections, the average delay of the worst intersection is always reported, and that high delays on one approach are sufficient to indicate that an intersection is performing poorly, even if overall Degree of Saturation is acceptable.

5.8.2 Intersection Level of Service – 2016 Case

As discussed in Section 5.2, future turning movement volumes have been developed for three traffic generation scenarios corresponding to low, medium and high land use intensity. These volumes were combined with the forecast background traffic growth

from the Wollondilly Shire Strategic Model and used as inputs for intersection modelling. These forecast traffic volumes are shown in Appendix B.

A preliminary assessment of intersection performance was undertaken using the high generation scenario to determine the performance levels of various intersection configurations arrangements, i.e. unsignalised (Give-Way or Stop Sign), roundabout or signalised compared with a baseline of a Give-Way controlled intersection treatment. Based on the delays and performance of these various options, the preferred intersection control was then selected and modelled with the low and medium generation scenarios.

Review of the access arrangements for Area 1 to Picton Road has shown that while the preferred access for Area 1 is to be via Maldon Bridge Road, it is possible that due to the alignment of the proposed road through the existing Picton Karting Facility, Area 1 cannot be connected via Maldon Bridge Road and will be required to use the existing access adjacent to the Picton Karting Facility. Access of Area 1 to Maldon Bridge Road may also be restricted by the difficulty of crossing Carriage Creek at the southern boundary. To account for this possibility, two options have been considered for the access arrangements for Area 1, assuming access via Maldon Bridge Road or directly on Picton Road. The worst-case scenario traffic volumes for Maldon Bridge Road and for the access adjacent to Picton Karting Facility have been adopted for the purposes of determining future intersection operation at these locations.

Based on the preliminary assessment, the following controls will be required for the key intersections along Picton Road under the forecast 2016 traffic flows:

- Picton Road and Maldon Bridge Road: Roundabout operation (assumed as part of the MIST and Boral Site redevelopment);
- Picton Road and Access adjacent to Picton Karting Facility: Existing give-way operation;
- Picton Road and Menangle Road: Give-way “seagull” operation; and
- Picton Road and Allied Mills Access: Give-way “seagull” operation.

Preliminary modelling of the intersections along Picton Road in the study area showed that the growth in traffic flow along Picton Road will be sufficiently high that vehicles will have difficulty exiting accesses from the Maldon Employment Lands if they are required to give way to both directions of traffic. For this reason, “seagull” give-way operation will be required at each of the key intersections along Picton Road. A “seagull” intersection is a staged give-way arrangement that allows traffic turning right into and out of the minor leg to cross opposing traffic in two stages rather than wait for a gap in traffic from both directions.

The results of the 2016 intersection analysis are presented in Table 10.

Table 10 2016 Intersection Analysis – High Generation

Intersection	Intersection Control	2016 AM Peak			2016 PM Peak		
		Level of Service	Degree of Saturation	Average Delay (s)	Level of Service	Degree of Saturation	Average Delay (s)
Picton Road/Maldon Bridge Road	Roundabout	B	0.09	18.3	B	0.20	18.4
Picton Road/Access Adjacent to Picton Karting Facility*	Priority "seagull"	C	0.04	32.8	D	0.27	44.8
Picton Road/Menangle Road	Priority	B	0.34	20.8	B	0.53	22.9
Picton Road/Allied Mills Access	Priority "seagull"	B	0.04	23.8	B	0.12	16.5
Picton Road/Wilton Park Road†	Priority	C	0.22	39.0	C	0.13	30.1
Picton Road/Hume Highway East†	Priority "seagull"	C	0.59	35.2	C	0.58	31.7
Picton Road/Hume Highway West†	Priority "seagull"	B	0.58	27.4	C	0.73	35.4

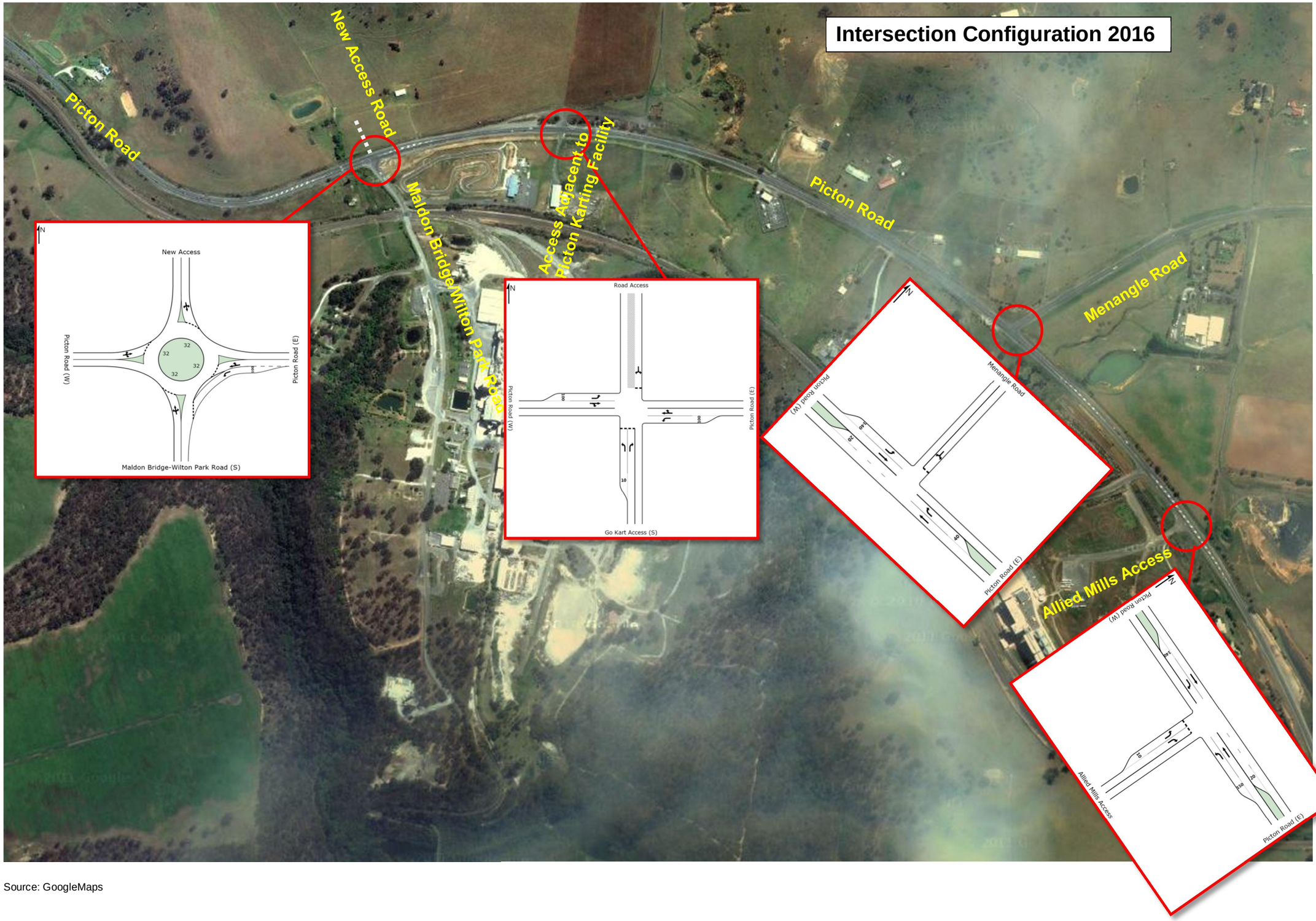
*Intersection has been analysed in the event that access to Area 1 is not granted through Picton Karting Facility

†These intersections are currently being investigated by RTA and have been modelled in their existing configurations

Note: Refer to Appendix C for the Sidra Summary Outputs

Plots of the proposed 2016 intersection layouts for each of the key intersections along Picton Road are shown in Figure 15. Turning bay lengths given in these layouts are for storage purposes only and it is likely that further lane length will be required for deceleration. Preliminary inspection of deceleration and taper lengths shows that there should be sufficient space between intersections to allow for vehicle storage.

Figure 15 **2016 Future Intersection Layouts**



Source: GoogleMaps

2016 Intersection Operation Summary

SIDRA analysis of the key intersections along Picton Road shows that all of the intersections, with the exception of Wilton Park Road and Hume Highway, perform acceptably under the high generation scenario. High average delays for the side streets at Wilton Park Road and the Highway off-ramp at the Hume Highway shows that these intersections will require some form of alternative control. This is likely to be addressed by the current study of these intersections being undertaken by the RTA.

5.8.3 Intersection Level of Service – 2036 Case

A similar approach to determining intersection control requirements was taken for the 2036 horizon year, with a preliminary assessment of the 2016 designs using the high generation scenario 2036 traffic flows. Based on the delays and performance of these various options, the preferred intersection control was then selected and modelled with the low and medium generation scenarios.

Based on the preliminary assessment, the following changes to traffic controls will be required for the key intersections along Picton Road under the forecast 2036 traffic flows:

- Picton Road and Menangle Road: Give-way “seagull” operation upgraded to roundabout operation; and
- Picton Road and Access Adjacent to Picton Karting Facility: Existing priority operation upgraded to give-way “seagull” operation.

The forecast increase in flows along Picton Road, particularly in the evening peak hour, present significant opposing flows for traffic turning onto or off Picton Road, such that the intersection of Picton Road and Menangle Road would operate under unacceptable levels of delay under give-way sign control assumed for 2016. In order to serve the flows into and out of the Maldon Employment Lands, some form of upgraded control will be required. The following traffic controls were considered:

- Traffic Signals;
- Grade Separation; and
- Roundabouts.

Traffic signal operation, while efficient, would typically not be appropriate for a rural road such as Picton Road (at Maldon) unless existing intersections have a poor safety record. Grade separation is another option but the relatively low turning flows to and from minor local roads is unlikely to warrant the need for grade separation of all movements.

Based on this assessment, roundabout operation is the preferred treatment alternative for the intersection of Picton Road and Menangle Road, with other intersections remaining in the same configuration as in 2016. In the event that access is not granted through the Picton Karting Facility, it is expected that Area 1 can connect to Picton Road through the existing access adjacent to Picton Karting Facility. This access performs satisfactorily under give-way “seagull” priority operation, and would reduce demand at the intersection of Maldon Bridge Road and Picton Road.

The results of the 2036 intersection analysis are presented in to Table 11.

Table 11 2036 Intersection Analysis – High Generation

Intersection	Intersection Control	2036 AM Peak			2036 PM Peak		
		Level of Service	Degree of Saturation	Average Delay (s)	Level of Service	Degree of Saturation	Average Delay (s)
Picton Road/Maldon Bridge Road	Roundabout	B	0.14	18.0	B	0.36	18.1
Picton Road/Access Adjacent to Picton Karting Facility*	Priority "seagull"	B	0.04	18.0	C	0.39	38.8
Picton Road/Menangle Road	Roundabout	B	0.30	17.7	B	0.45	19.0
Picton Road/Allied Mills Access	Priority "seagull"	C	0.20	31.4	C	0.73	40.4
Picton Road/Wilton Park Road†	Priority	F	1.00	385	F	1.00	480
Picton Road/Hume Highway East†	Priority "seagull"	E	0.79	56.6	D	0.72	42.8
Picton Road/Hume Highway West†	Priority "seagull"	F	1.38	382	F	1.89	854

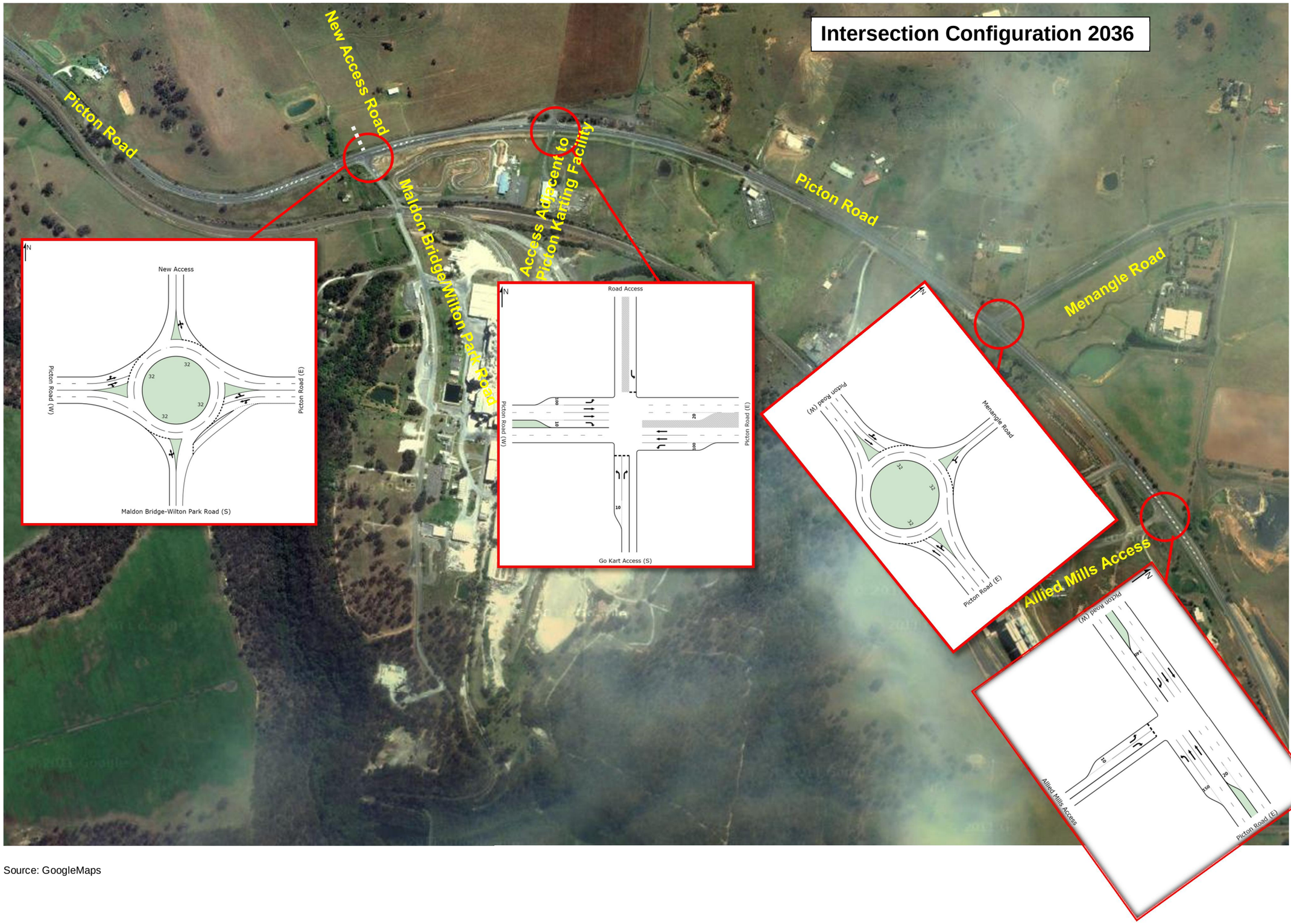
*Intersection has been analysed in the event that access to Area 1 is not granted through Picton Karting Facility

†These intersections are currently being investigated by RTA and have been modelled in their existing configurations

Note: Refer to Appendix D for the Sidra Summary Outputs

Plots of the proposed 2036 intersection layouts for each of the key intersections on Picton Road are shown in Figure 16. Turning bay lengths given in these layouts are for storage purposes only and it is likely that further lane length will be required for deceleration and appropriate tapers. A preliminary review of deceleration and taper lengths shows that there should be sufficient space between intersections to allow for vehicle storage.

Figure 16 **2036 Future Intersection Layouts**



Source: GoogleMaps

2036 Intersection Operation Summary

Inspection of the 2036 intersection analysis shows that all of the intersections of Picton Road perform satisfactorily, with the exception of Wilton Park Road and Hume Highway.

Modelled delays at Wilton Park Road and the Hume Highway are consistent with those modelled under the 2016 case, and are not sensitive to changes to the traffic generation assumptions for the Maldon Employment Lands. This suggests that future background traffic at these two intersections is likely to exceed capacity in the future, independent of the Maldon Employment Lands. As the RTA is currently investigating options for the upgrade of these intersections, when new concepts have been developed for these intersections, an assessment should be undertaken to determine if the proposed concepts have sufficient capacity to serve the additional traffic generated by the Maldon Employment Lands.

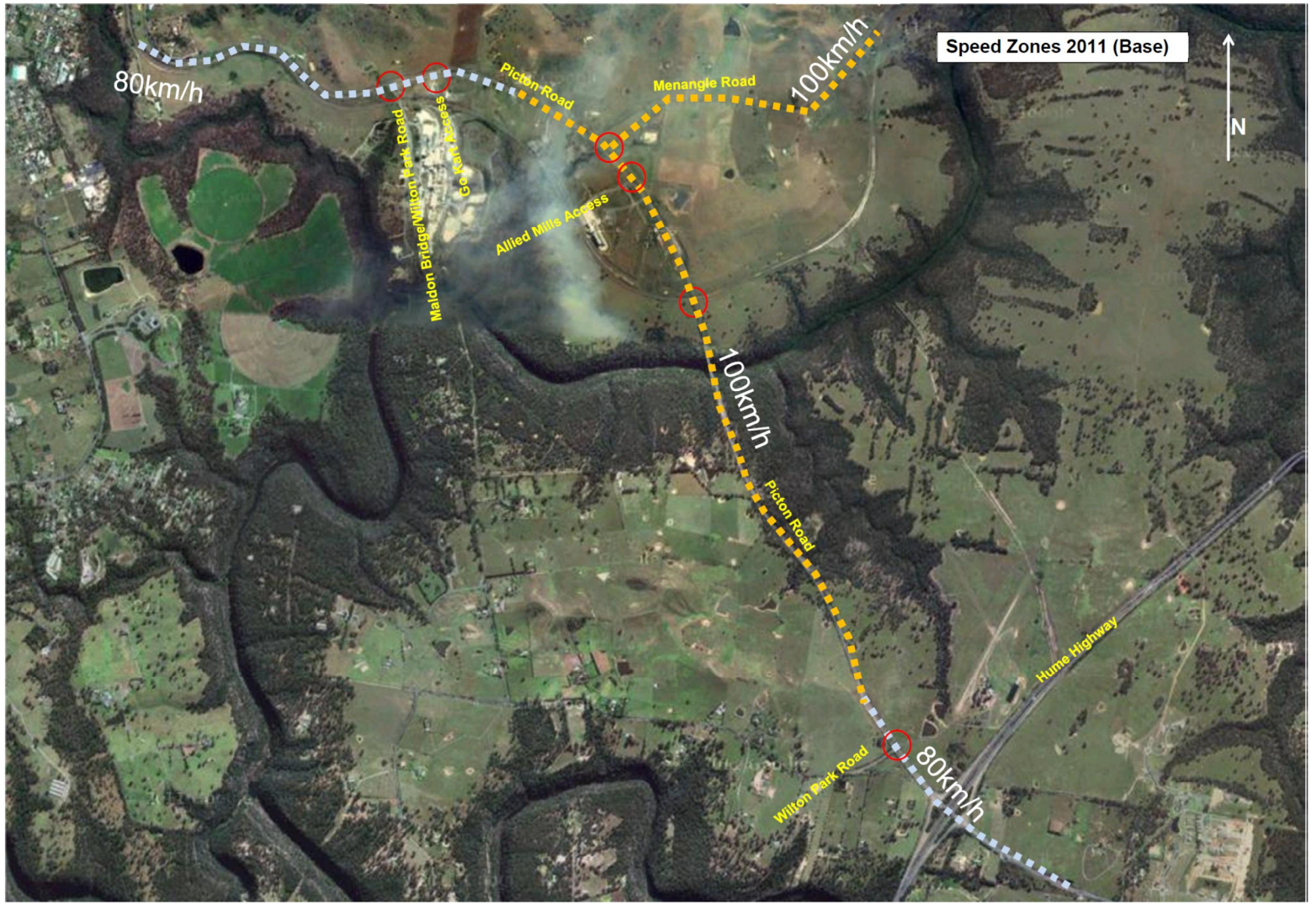
5.9 Summary

Based on the forecast traffic growth from the Wollondilly Shire Council Strategic Traffic model and the traffic generation assumed under the high traffic generation scenarios for the Maldon Employment Lands, Picton Road will need to be upgraded to two lanes in each direction by 2036. This is in line with the objectives of the RTA stated in the Picton Road Corridor Strategy.

As there is limited scope for freight rail access to Maldon Employment lands, the assessment of traffic access to and from Maldon Employment Lands has been undertaken under the assumption that all fright traffic to and from it will take place via road. The construction of any additional rail sidings at Maldon Employment Lands would be subject to an approval by ARTC and is likely to reduce the number of heavy vehicles accessing the site. The freight assumptions used in this report represent the worst-case scenario for road-based freight.

While it is possible to restrict access to the Maldon Employment Lands to the use of existing access points on Picton Road, it is unlikely that the projected future volumes on Picton Road and the traffic generated by the Maldon Employment Lands, even at low generation intensities, can be achieved without the conversion of existing give-way intersections to roundabouts, which will necessitate a reduction of the 100 km/hr speed zone. If the Maldon Employment Lands are to be developed according to the proposed land use, the function and form of Picton Road through Maldon will need to be re-evaluated. On the basis of this assessment, it is recommended that the existing 80 km/hr zone on Picton Road to the west of Menangle Road also be extended to cover the section of Picton Road between Menangle Road and Wilton Park Road. This reduction is speed should coincide with the upgrade of the intersection of Picton Road and Menangle Road. A diagram of the existing and proposed speed zones is shown in Figure 17 and Figure 18.

Figure 17 2011 Base Speed Zones



Source: Google Maps

Figure 18 2036 Proposed Speed Zones

Source: Google Maps

Recommendations for intersection arrangements are:

- *Picton Road and Menangle Road*: This intersection will require upgrading to give-way "seagull" operation by 2016 and to a roundabout by 2036. This is to accommodate the existing right and left turn movements, which are likely to experience excessive delays as flows on Picton Road increase.
- *Picton Road and Allied Mills Access*: This intersection will provide access to Areas 2 and 3, taking advantage of the existing rail cutting on the western border of Area 2. To accommodate forecast traffic generation from Areas 2 and 3, this access will intersection will require upgrading to a give-way "seagull" operation by 2016.
- *Picton Road and Maldon Bridge Road*: This intersection will provide access to Area 1 via the existing access on Maldon Bridge Road, currently used by the Picton Karting Facility. Modelling of this intersection showed that maximum queues on Maldon Bridge Road under roundabout operation were likely to be less than 30m and thus would not extend to the existing level crossing south of Picton Road.
- *Picton Road and Access adjacent to Picton Karting Facility*: This intersection may be retained as an alternative to allowing access to Area 1 via Maldon Bridge Road. The existing configuration will be sufficient to serve the forecast 2016 flows, while a give-way "seagull" will be required by 2036.

It is the RTA's preference that the access to Area 1 be limited to an single existing access and the modelling indicates that that this should be via Maldon Bridge. This can be accomplished by bridging Carriage Creek to allow the eastern properties to access Maldon Bridge Road via the existing Picton Karting Facility. If a bridge is not workable, properties to the east of Carriage Creek could access Picton Road via a combined access to the west of Menangle Road. This intersection would perform comparably to the intersection of Picton Road and the Access adjacent to Picton Karting Facility, albeit with less traffic.

6. Summary and Conclusions

6.1 Overview

GHD have undertaken a review of the proposed rezoning of the Maldon Employment Lands for Wollondilly Shire Council. This review focuses on the traffic impacts of the redevelopment of three sites along Picton Road in Maldon from greenfield to a proposed general industrial land use, consistent with the existing land use at adjacent industrial sites including the Allied Mills site and Blue Circle Southern site.

An assessment of the current and proposed transportation network in the area showed that the dominant mode of travel for the proposed developments is likely to be private vehicles and trucks.

The transport assessment has therefore focussed on traffic access to the site. A proposed accessibility plan has determined that the ideal internal transport network should connect Areas 2 and 3 for access via the existing Allied Mills Access on Picton Road, and Area 1 should connect via Maldon Bride Road, north of the existing level crossing. These arrangements are contingent on the feasibility of road crossings over the rail corridor between Areas 1 and 2 and Carriage Creek in Area 1.

Traffic forecasts were developed for Picton Road through Maldon, taking into account the following components of traffic generation:

- Current traffic flows;
- Forecast traffic growth (sourced from RTA's Picton Road Corridor Strategy);
- Traffic generation of existing and proposed nearby developments (sourced from Development Applications); and
- Traffic generation of the proposed Maldon Employment Lands under three possible intensity scenarios (based on land use assumptions provided by Council).

An analysis of road and intersection Levels of Service was undertaken for Picton Road and its accesses through Maldon; based on forecast 2016 and 2036 traffic flows, corresponding to high, medium and low development intensity for the Maldon Employment Lands.

Intersection modelling was undertaken using the SIDRA intersection modelling package, to determine the required intersection controls and their operating conditions under the 2016 and 2036 forecast flows. Intersection configurations were developed based on the high intensity generation scenarios and checked under lower intensity scenarios.

6.2 Key Findings

The Main Southern Railway that runs through Maldon Employment Lands presents the opportunity for rail access for freight to the site, however there a number of limitations to freight rail access to the site. In particular, the construction of a new rail siding on the site would be at the cost of the proponent and would be subject to approval by the

Australian Rail Track Corporation. Such a review would take into account the proximity to the existing siding, level crossing and proposed Maldon to Dombarton Junction.

These traffic forecasts showed that significant growth is expected along Picton Road in the study area. Analysis of the forecast Level of Service showed that Picton Road is expected to reach Level of Service B by 2016 and D by 2036; indicating that Picton Road will benefit from widening to two lanes in each direction by 2036. This is consistent with RTA's vision stated in the Picton Road Corridor Study.

RTA has also proposed that access to the Maldon Employment Lands be through existing intersections along Picton Road preferably consolidated rather than any new access points. As a part of this study, an indicative internal access strategy has been developed that allows all three sites to be connected through existing accesses. A preliminary analysis of accessibility has shown that this internal access plan is feasible.

Analysis of the key intersections on Picton Road showed that the following works would be required for each intersection in the study area:

- *Picton Road and Maldon Bridge Road*: This intersection has previously been proposed as a roundabout, to coincide with the development of the Macarthur Intermodal Shipping Terminal (MIST) and the proposed upgrade of the Blue Circle Southern Concrete Plant. Intersection analysis shows that the proposed layout for this intersection will be sufficient to serve forecast traffic and without resulting in queues on Maldon Bridge Road that extend to the level crossing.
- *Picton Road and Access adjacent to Picton Karting Facility*: Intersection analysis shows that it is undesirable to connect Area 1 to Picton Road via this access, as it will require upgrading to a give-way "seagull" operation in 2036.
- *Picton Road and Menangle Road*: Based on forecasts of background traffic growth on Picton Road, this intersection will need to be upgraded to a give-way "seagull" operation by 2016 and a roundabout by 2036. This analysis is based on estimates of traffic flow at this location as recent traffic counts were not available. Further investigation should be undertaken to more accurately determine future flows through this intersection.
- *Picton Road and Allied Mills Access*: This intersection will be the access for developments in Areas 2 and 3 and will need to be upgraded to give-way "seagull operation by 2016.
- *Picton Road and Wilton Park Road*: This intersection is currently under investigation by the RTA, and is far-removed from the study area. It is likely that traffic generation from the Maldon Employment Lands will impact on this intersection; however intersection modelling shows that this intersection performs unsatisfactorily under 2016 and 2036 flows in its current configuration under all land-use intensity scenarios. This intersection should be investigated further following the outcomes of the RTA study.
- *Picton Road and Hume Highway*: This intersection is currently also under investigation by the RTA, and is far-removed from the study area. It is likely that traffic generation from the Maldon Employment Lands will impact on this

intersection; however intersection modelling shows that this intersection performs unsatisfactorily under 2016 and 2036 flows in its current configuration under all land-use intensity scenarios. This intersection should be investigated further following the outcomes of the RTA study.

Given the expected increase in land use intensity along Picton Road and the increased volumes on key accesses through Maldon, it is unlikely that the corridor can continue to operate at the current sign posted speed limit of 100 km/hr in the future. To accommodate the increased flows on side streets and the introduction of traffic controls such as roundabouts, it is likely that Picton Road will need to be reclassified as 80 km/hr through Maldon, west of the Nepean crossing. This should coincide with the upgrade of the intersection of Menangle Road and Picton Road to a roundabout, prior to 2036.

Examination of the public and active transportation network around the Maldon Employment Lands indicates that there is an opportunity to increase public transport usage in the region. While Picton Railway Station is too far from Maldon for walking journeys, dedicated cycling infrastructure could be provided on Picton Road to increase the likelihood of employees cycling from Picton Station. This dedicated cycling infrastructure could be incorporated into a Development Control Plan for the site. Picton Buslines offer bus services along Picton Road, and it may be possible for employers to offer shuttle buses between the new developments in Maldon and the nearby centres of Picton, Tahmoor, Douglas Park and Wilton.

6.3 Key Conclusions

Investigation of the proposed rezoning of the Maldon Employment Lands to light industrial land use shows that the majority of travel associated with the Maldon Employment Lands is likely to be vehicular. The proposed development and the traffic generation associated with it can be accommodated on the network, albeit with some modifications to the form and function of Picton Road. Consideration should be given to improving cycle facilities between Maldon and Picton Railway Station as well as to the operation of a shuttle bus connecting the Maldon Employment Lands with nearby population centres.

Based on the RTA's vision of Picton Road through Maldon, it is possible to accommodate the proposed traffic generated by the development of the Maldon Employment Lands through existing accesses on Picton Road subject to the following road improvements:

- Widening of Picton Road to two lanes in each direction by 2036;
- Reduction in speed on Picton Road between the Nepean crossing and Maldon Bridge Road;
- The construction of an overbridge crossing the railway line joining Areas 2 and 3;
- The upgrade of intersections along Picton Road to give-way "seagull" operation by 2016 and upgrade of the intersection of Picton Road and Menangle Road to roundabout operation by 2036;

A shuttle bus between Maldon Employment Lands, Picton Station and the nearby centres of Picton, Tahmoor, Douglas Park and Wilton could increase mode to public transport and reduce the impact of private vehicle trips. Similarly, cycling is also a feasible mode of transport mode for commuters living in Picton or Douglas Park and dedicated cycling infrastructure on Picton Road could be incorporated into a Development Control Plan for the site.

Furthermore, analysis of proposed background traffic growth on Picton Road is likely to require upgrade of the intersection of Picton Road and Wilton Park Road and the Hume Highway/Picton Road interchange. Both these intersections are under investigation by the RTA at the time of this study, and will need to be examined further to ensure that they are also able to accommodate additional traffic from the Maldon.

Appendix A

Maldon Bridge Road Roundabout

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15 April 2011

Michael Kelly
Development Services
Wollondilly Shire Council
PO Box 21
Picton
NSW
2571

Dear Michael

Proposed Maldon Rail Terminal Facility and Maldon Bridge Road Intersection Upgrade - Response to Submission from the RTA

1.0 Background

The Roads and Traffic Authority (RTA) and the Regional Development Committee have requested in a letter dated 11 February 2011 (received from Grant Rokobauer of the Wollondilly Shire Council), to undertake further concept design and analysis to upgrade the intersection of Maldon Bridge Road and Picton Road as a roundabout. This information is required to support the subject development application submitted on 21 January 2011.

The RTA and RDC believe there was merit in investigating a roundabout intersection which would have a greater lifespan, improved safety and act to slow approaching vehicles which would assist heavy vehicles in exiting Maldon Bridge Road.

The RTA requires that the roundabout incorporate a separate slip lane for left turning vehicles into Maldon Bridge Road in order to provide increased queuing capacity at times when the railway level crossing is closed. The concept design shall inform the parameters for the revised SIDRA modelling.

This technical note is an addendum to AECOM's Traffic Impact Assessment (dated 31 August 2010), which documents the design criteria and performance of the intersection at Picton Road / Maldon Bridge Road as a roundabout.

2.0 Design Criteria

Based on the requirements set out in the RTA letter, a concept design of the roundabout has been prepared in accordance to the following design reference documents:

- AUSTROADS Guide to Road Design, 2009.
- AUSTROADS Guide to Traffic Management, 2009.
- Road Design Guide (RDG), 1998.
- Guide to Traffic Engineering Practice Parts 1 – 14 AUSTROADS, 1999.
- Guide to the Geometric Design of Urban Roads – AUSTROADS, 2003.
- Relevant RTA Technical Directions and Supplements.

The design will provide one through lane in both the eastbound and westbound direction along Picton Road through this intersection with Maldon Bridge Road. The current design has assumed a design speed of 90km/h on Picton Road. All proposed turning radii and diameters in the upgrade will accommodate the design vehicle of a B-Double truck (25 metres).

Please refer to the preliminary concept design of the roundabout at Picton Road / Maldon Bridge Road as attached to this note. The concept design of the roundabout intersection provides a circulating island with a radius of 16 meters and a circulating width of 8 meters to allow for a turning path for B-double trucks. The separate left turn slip lane from Picton Road (east) into Maldon Bridge Road has a length of 100m; this considers a design speed approach of 90 km/h with an exit curve design speed of 40km/h.

3.0 Intersection Performance – Roundabout

The proposed single lane roundabout with a separate left turn slip lane into Maldon Bridge Road has been tested with the peak hour forecast traffic volumes in 2012 and 2022 to confirm the roundabout will cater for the traffic growth on Picton Road and the proposed development traffic generated by the rail terminal.

Table 1 highlights the performance of the roundabout with respect to degree of saturation and queue length. The overall performance of the roundabout operates at LoS A for all scenario years for 2012 and 2022 in both AM and PM peaks.

Table 1: The overall performance of Maldon Bridge Road and Picton Road (with Roundabout Treatment)

	AM Peak				PM Peak			
Year	LoS	DoS	Ave Delay (s)	Longest Queue (m)	LoS	DoS	Ave Delay (s)	Longest Queue (m)
2012	A	0.373	9.1	29 (Picton Road EB)	A	0.308	8.9	21 (Picton Road WB)
2022	A	0.538	9.3	50 (Picton Road EB)	A	0.422	9.2	34 (Picton Road WB)

In the AM Peak, the worst approach is the southern approach at Maldon Bridge Road which operates at LoS B. Other approaches on Picton Road operate at LoS A. The analysis showed for queue lengths on Maldon Bridge Road to extend 5 metres and 8 metres in 2012 and 2022 respectively.

In the PM peak, the worst approach is the southern approach at Maldon Bridge Road which operates at LoS B. Other approaches on Picton Road operate at LoS A. The analysis showed for queue lengths on Maldon Bridge Road to extend 6 metres and 11 metres in 2012 and 2022 respectively.

4.0 Summary

AECOM has prepared a concept design of a roundabout (with a separate westbound left-turn slip lane into Maldon Bridge Road) based on the RTA requirements. The proposed roundabout will operate satisfactorily during the peak hours in 2012 (opening year) and 2022 with acceptable level of service, degree of saturation and minimal queuing on all approaches to the intersection. The queuing on Maldon Bridge Road will not interfere with the operation of the rail crossing.

Kind regards

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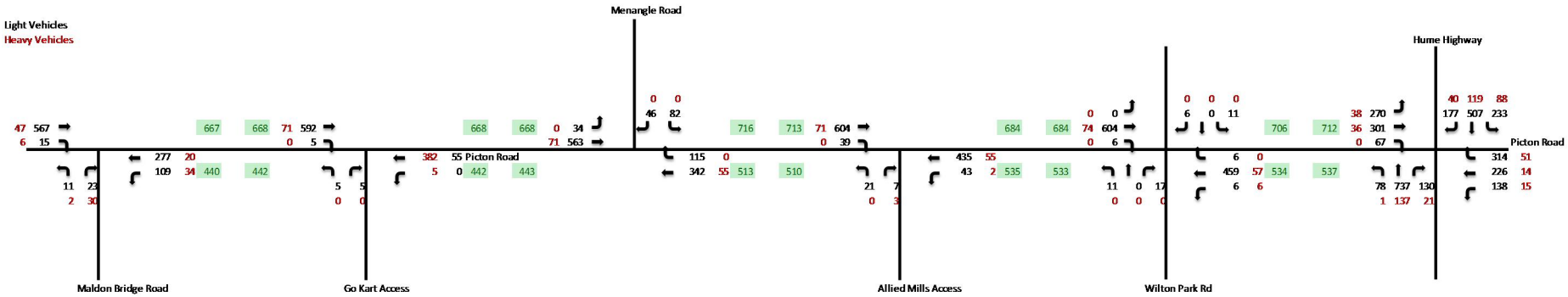
cc: Grant Rokobauer - Wollondilly Shire Council
Rod Wallace - Boral

Appendix B

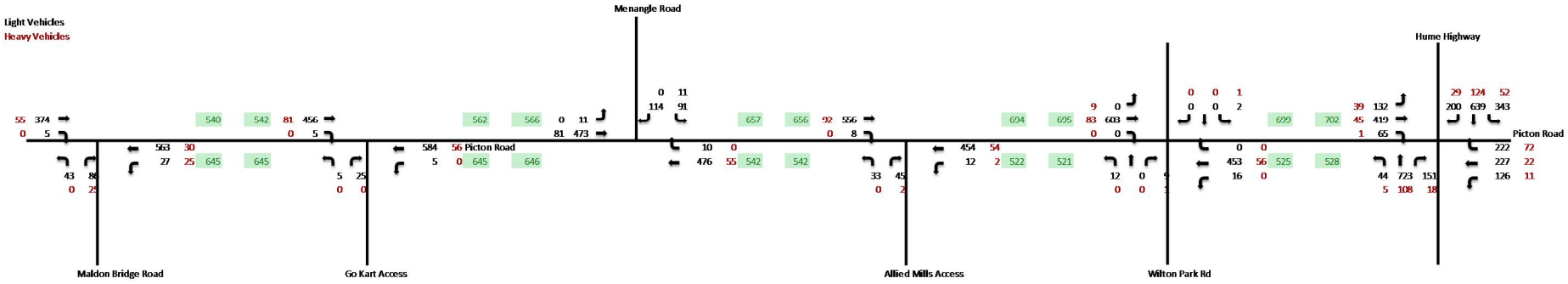
Future Traffic Projections

Appendix B.1 2016 Future Flows

2016 Morning Peak High Generation Scenario Traffic Flows

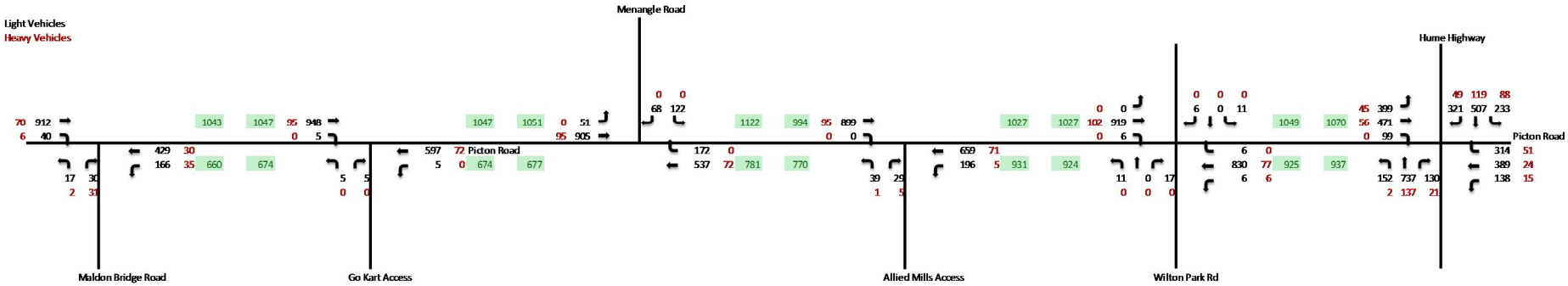


2016 Evening Peak High Generation Scenario Traffic Flows

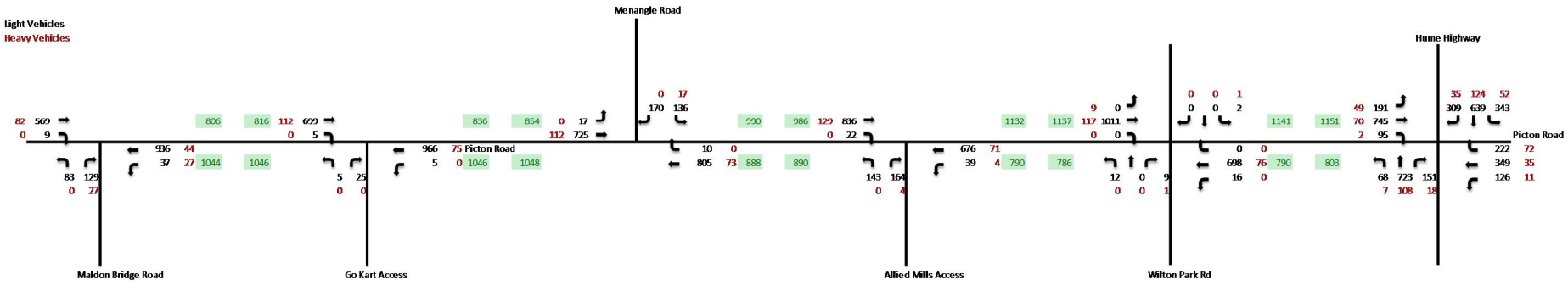


Appendix B.2 2036 Future Flows

2036 Morning Peak High Generation Scenario Traffic Flows



2036 Evening Peak High Generation Scenario Traffic Flows



Appendix C

2016 SIDRA Summary Outputs

MOVEMENT SUMMARY

Site: Picton Road and Maldon Bridge-Wilton Park Road_AM 2016 High

Picton Road and Maldon Bridge-Wilton Park Road Intersection
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maldon Bridge-Wilton Park Road (S)											
1	L	13	15.4	0.094	10.2	LOS A	0.5	4.8	0.54	0.58	45.5
2	T	1	0.0	0.094	7.1	LOS A	0.5	4.8	0.54	0.49	42.6
3	R	53	56.6	0.094	18.3	LOS B	0.5	4.8	0.54	0.74	41.0
Approach		67	47.8	0.094	16.6	LOS B	0.5	4.8	0.54	0.71	41.8
East: Picton Road (E)											
4	L	143	23.8	0.118	8.1	LOS A	0.6	5.1	0.14	0.49	55.7
5	T	297	6.7	0.179	8.2	LOS A	1.1	8.4	0.14	0.50	58.6
6	R	10	0.0	0.179	13.5	LOS A	1.1	8.4	0.14	0.91	48.3
Approach		450	12.0	0.179	8.3	LOS A	1.1	8.4	0.14	0.51	57.5
North: New Access											
7	L	5	0.0	0.013	10.2	LOS A	0.1	0.6	0.69	0.60	49.2
8	T	1	0.0	0.013	7.7	LOS A	0.1	0.6	0.69	0.55	47.3
9	R	5	0.0	0.013	16.9	LOS B	0.1	0.6	0.69	0.70	45.8
Approach		11	0.0	0.013	13.0	LOS A	0.1	0.6	0.69	0.64	47.4
West: Picton Road (W)											
10	L	5	0.0	0.450	8.2	LOS A	3.9	29.1	0.38	0.56	58.0
11	T	614	7.7	0.450	8.8	LOS A	3.9	29.1	0.38	0.52	59.8
12	R	21	28.6	0.450	15.0	LOS B	3.9	29.1	0.38	0.82	53.2
Approach		640	8.3	0.450	9.0	LOS A	3.9	29.1	0.38	0.53	59.6
All Vehicles		1168	11.9	0.450	9.2	LOS A	3.9	29.1	0.30	0.53	57.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Maldon Bridge-Wilton Park Road_PM 2016 High

Picton Road and Maldon Bridge-Wilton Park Road Intersection
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maldon Bridge-Wilton Park Road (S)											
1	L	43	0.0	0.198	10.9	LOS A	1.2	9.3	0.68	0.71	43.9
2	T	1	0.0	0.198	8.4	LOS A	1.2	9.3	0.68	0.66	40.9
3	R	111	22.5	0.198	18.4	LOS B	1.2	9.3	0.68	0.83	39.8
Approach		155	16.1	0.198	16.3	LOS B	1.2	9.3	0.68	0.80	40.8
East: Picton Road (E)											
4	L	52	48.1	0.053	8.8	LOS A	0.2	2.4	0.06	0.50	56.7
5	T	593	5.1	0.326	8.1	LOS A	2.4	17.9	0.09	0.51	59.3
6	R	5	0.0	0.326	13.4	LOS A	2.4	17.9	0.09	0.95	48.3
Approach		650	8.5	0.326	8.2	LOS A	2.4	17.9	0.09	0.51	59.0
North: New Access											
7	L	10	0.0	0.017	9.2	LOS A	0.1	0.7	0.61	0.59	49.8
8	T	1	0.0	0.017	6.7	LOS A	0.1	0.7	0.61	0.52	48.1
9	R	5	0.0	0.017	15.9	LOS B	0.1	0.7	0.61	0.72	46.6
Approach		16	0.0	0.017	11.2	LOS A	0.1	0.7	0.61	0.62	48.6
West: Picton Road (W)											
10	L	5	0.0	0.351	8.5	LOS A	2.7	20.9	0.44	0.58	57.6
11	T	429	12.8	0.351	9.3	LOS A	2.7	20.9	0.44	0.55	59.3
12	R	5	0.0	0.351	14.3	LOS A	2.7	20.9	0.44	0.82	53.2
Approach		439	12.5	0.351	9.4	LOS A	2.7	20.9	0.44	0.55	59.2
All Vehicles		1260	10.7	0.351	9.6	LOS A	2.7	20.9	0.29	0.56	56.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Go Kart Access_AM 2016 High - Existing Layout

Picton Road and Go Kart Access Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Go Kart Access (S)											
1	L	6	0.0	0.011	10.8	LOS A	0.0	0.2	0.43	0.65	44.6
3	R	6	0.0	0.042	32.8	LOS C	0.1	0.9	0.85	0.95	27.3
Approach		12	0.0	0.042	21.8	LOS B	0.1	0.9	0.64	0.80	33.9
East: Picton Road (E)											
4	L	14	0.0	0.008	10.1	LOS A	0.0	0.0	0.00	0.71	52.2
5	T	383	8.1	0.208	4.4	LOS A	2.4	17.6	0.71	0.00	56.1
6	R	1	0.0	0.208	12.8	LOS A	2.4	17.6	0.71	1.40	50.4
Approach		398	7.8	0.208	4.6	NA	2.4	17.6	0.69	0.03	56.0
North: Road Access											
7	L	1	0.0	0.009	21.7	LOS B	0.0	0.2	0.75	0.74	37.5
9	R	1	0.0	0.009	21.7	LOS B	0.0	0.2	0.75	0.88	37.5
Approach		2	0.0	0.009	21.7	LOS B	0.0	0.2	0.75	0.81	37.5
West: Picton Road (W)											
10	L	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
11	T	633	7.4	0.350	3.0	LOS A	3.8	28.4	0.66	0.00	61.0
12	R	9	0.0	0.350	13.1	LOS A	3.8	28.4	0.66	1.19	60.6
Approach		643	7.3	0.350	3.1	NA	3.8	28.4	0.66	0.02	61.0
All Vehicles		1055	7.4	0.350	3.9	NA	3.8	28.4	0.67	0.03	58.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Go Kart Access_PM 2016 High - Existing Layout

Picton Road and Go Kart Access Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Go Kart Access (S)											
1	L	11	0.0	0.023	12.6	LOS A	0.1	0.4	0.54	0.74	42.6
3	R	31	0.0	0.270	44.8	LOS D	0.9	6.3	0.90	1.00	22.5
Approach		42	0.0	0.270	36.4	LOS C	0.9	6.3	0.81	0.93	25.6
East: Picton Road (E)											
4	L	7	0.0	0.004	10.1	LOS A	0.0	0.0	0.00	0.71	52.2
5	T	613	5.7	0.327	4.2	LOS A	4.2	30.9	0.74	0.00	55.4
6	R	1	0.0	0.327	12.6	LOS A	4.2	30.9	0.74	1.37	51.0
Approach		621	5.6	0.327	4.3	NA	4.2	30.9	0.74	0.01	55.3
North: Road Access											
7	L	1	0.0	0.010	24.6	LOS B	0.0	0.2	0.76	0.71	35.7
9	R	1	0.0	0.010	24.7	LOS B	0.0	0.2	0.76	0.91	35.7
Approach		2	0.0	0.010	24.6	LOS B	0.0	0.2	0.76	0.81	35.7
West: Picton Road (W)											
10	L	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	49.0
11	T	503	12.1	0.286	4.8	LOS A	3.5	27.2	0.75	0.00	59.1
12	R	6	0.0	0.286	14.9	LOS B	3.5	27.2	0.75	1.21	58.8
Approach		510	12.0	0.286	4.9	NA	3.5	27.2	0.75	0.02	59.1
All Vehicles		1175	8.2	0.327	5.8	NA	4.2	30.9	0.74	0.05	55.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Menangle Road_AM 2016 High - Seagull Int

Picton Road and Menangle Road
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
5	T	397	13.9	0.222	0.0	X	X	X	X	0.00	79.9
6	R	115	0.0	0.172	14.6	LOS B	0.7	4.6	0.60	0.90	52.1
Approach		512	10.7	0.222	3.3	NA	0.7	4.6	0.13	0.20	71.9
North: Menangle Road											
7	L	82	0.0	0.344	20.8	LOS B	1.5	10.4	0.73	0.97	44.6
9	R	46	0.0	0.344	20.3	LOS B	1.5	10.4	0.73	0.97	44.9
Approach		128	0.0	0.344	20.6	LOS B	1.5	10.4	0.73	0.97	44.7
West: Picton Road (W)											
10	L	34	0.0	0.018	10.4	LOS A	0.0	0.0	0.00	0.72	57.6
11	T	634	11.2	0.349	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		668	10.6	0.349	0.5	NA	0.0	0.0	0.00	0.04	78.6
All Vehicles		1308	9.6	0.349	3.6	NA	1.5	10.4	0.12	0.19	70.8

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Menangle Road_PM 2016 High - Seagull Int

Picton Road and Menangle Road
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
5	T	531	10.4	0.291	0.0	X	X	X	X	0.00	79.9
6	R	10	0.0	0.013	13.4	LOS A	0.0	0.3	0.53	0.74	53.6
Approach		541	10.2	0.291	0.3	NA	0.0	0.3	0.01	0.01	79.2
North: Menangle Road											
7	L	102	10.8	0.530	22.9	LOS B	3.1	22.6	0.75	1.06	43.4
9	R	114	0.0	0.530	21.8	LOS B	3.1	22.6	0.75	1.05	43.7
Approach		216	5.1	0.530	22.3	LOS B	3.1	22.6	0.75	1.05	43.6
West: Picton Road (W)											
10	L	11	0.0	0.006	10.4	LOS A	0.0	0.0	0.00	0.72	57.6
11	T	554	14.6	0.311	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		565	14.3	0.311	0.2	NA	0.0	0.0	0.00	0.01	79.4
All Vehicles		1322	11.1	0.530	3.9	NA	3.1	22.6	0.13	0.18	70.1

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Allied Mills Access_AM 2016 High - Seagull int

Picton Road and Alllied Mills Access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Allied Mills Access											
1	L	21	0.0	0.048	12.4	LOS A	0.1	0.8	0.50	0.75	41.2
3	R	10	30.0	0.044	23.8	LOS B	0.2	1.3	0.69	0.90	31.6
Approach		31	9.7	0.048	16.1	LOS B	0.2	1.3	0.56	0.80	37.6
East: Picton Road (E)											
4	L	45	4.4	0.025	10.3	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	490	11.2	0.270	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		535	10.7	0.270	0.9	NA	0.0	0.0	0.00	0.06	77.7
West: Picton Road (W)											
11	T	675	10.5	0.370	0.1	X	X	X	X	0.00	79.8
12	R	39	0.0	0.049	12.9	LOS A	0.2	1.3	0.51	0.77	53.2
Approach		714	9.9	0.370	0.8	NA	0.2	1.3	0.03	0.04	77.9
All Vehicles		1280	10.2	0.370	1.2	NA	0.2	1.3	0.03	0.07	76.7

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Allied Mills Access_PM 2016 High - Seagull int

Picton Road and Alllied Mills Access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Allied Mills Access											
1	L	33	0.0	0.076	12.5	LOS A	0.2	1.2	0.51	0.77	41.1
3	R	47	4.3	0.124	16.5	LOS B	0.5	3.3	0.61	0.88	36.7
Approach		80	2.5	0.124	14.9	LOS B	0.5	3.3	0.57	0.84	38.4
East: Picton Road (E)											
4	L	14	14.3	0.008	10.7	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	508	10.6	0.279	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		522	10.7	0.279	0.3	NA	0.0	0.0	0.00	0.02	79.3
West: Picton Road (W)											
11	T	648	14.2	0.363	0.1	X	X	X	X	0.00	79.8
12	R	8	0.0	0.010	12.6	LOS A	0.0	0.3	0.50	0.70	53.5
Approach		656	14.0	0.363	0.2	NA	0.0	0.3	0.01	0.01	79.4
All Vehicles		1258	11.9	0.363	1.2	NA	0.5	3.3	0.04	0.07	76.4

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Wilton Park Road_AM 2016 High

Picton Road and Wilton Park Road Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wilton Park Road (S)											
1	L	11	0.0	0.219	39.0	LOS C	0.7	4.9	0.87	0.95	33.4
2	T	1	0.0	0.219	36.6	LOS C	0.7	4.9	0.87	0.95	31.4
3	R	17	0.0	0.219	38.9	LOS C	0.7	4.9	0.87	0.98	33.6
Approach		29	0.0	0.219	38.8	LOS C	0.7	4.9	0.87	0.97	33.4
East: Picton Road (E)											
4	L	12	50.0	0.301	19.2	LOS B	4.4	34.1	0.82	0.31	56.6
5	T	516	11.0	0.301	6.3	LOS A	4.4	34.1	0.82	0.00	57.6
6	R	6	0.0	0.301	16.4	LOS B	4.4	34.1	0.82	1.16	57.1
Approach		534	11.8	0.301	6.7	NA	4.4	34.1	0.82	0.02	57.6
North: Access Road											
7	L	11	0.0	0.094	26.8	LOS B	0.3	2.0	0.80	0.90	37.3
8	T	1	0.0	0.094	25.4	LOS B	0.3	2.0	0.80	0.92	36.3
9	R	6	0.0	0.094	26.8	LOS B	0.3	2.0	0.80	0.94	37.3
Approach		18	0.0	0.094	26.8	LOS B	0.3	2.0	0.80	0.91	37.2
West: Picton Road (W)											
10	L	1	0.0	0.190	10.1	LOS A	0.0	0.0	0.00	1.74	57.1
11	T	678	10.9	0.190	1.9	LOS A	1.9	14.6	0.33	0.00	69.3
12	R	6	0.0	0.190	14.3	LOS A	1.9	14.6	0.67	1.18	59.0
Approach		685	10.8	0.190	2.0	NA	1.9	14.6	0.33	0.01	69.2
All Vehicles		1266	10.8	0.301	5.2	NA	4.4	34.1	0.55	0.05	61.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Wilton Park Road_PM 2016 High

Picton Road and Wilton Park Road Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wilton Park Road (S)											
1	L	12	0.0	0.127	30.1	LOS C	0.4	2.7	0.81	0.88	38.1
2	T	1	0.0	0.127	27.7	LOS B	0.4	2.7	0.81	0.92	36.1
3	R	9	0.0	0.127	30.0	LOS C	0.4	2.7	0.81	0.95	38.3
Approach		22	0.0	0.127	30.0	LOS C	0.4	2.7	0.81	0.91	38.1
East: Picton Road (E)											
4	L	16	0.0	0.290	17.0	LOS B	4.4	33.5	0.83	0.24	56.3
5	T	509	11.0	0.290	6.6	LOS A	4.4	33.5	0.83	0.00	57.3
6	R	1	0.0	0.290	16.6	LOS B	4.4	33.5	0.83	1.15	56.8
Approach		526	10.6	0.290	6.9	NA	4.4	33.5	0.83	0.01	57.3
North: Access Road											
7	L	3	33.3	0.028	29.4	LOS C	0.1	0.7	0.81	0.87	36.8
8	T	1	0.0	0.028	26.3	LOS B	0.1	0.7	0.81	0.92	35.8
9	R	1	0.0	0.028	27.8	LOS B	0.1	0.7	0.81	0.95	36.8
Approach		5	20.0	0.028	28.4	LOS B	0.1	0.7	0.81	0.90	36.6
West: Picton Road (W)											
10	L	9	100.0	0.195	14.5	LOS A	0.0	0.0	0.00	2.44	52.2
11	T	686	12.1	0.195	1.9	LOS A	2.0	15.2	0.34	0.00	69.0
12	R	1	0.0	0.195	14.2	LOS A	2.0	15.2	0.67	1.19	59.3
Approach		696	13.2	0.195	2.1	NA	2.0	15.2	0.34	0.03	68.7
All Vehicles		1249	11.9	0.290	4.7	NA	4.4	33.5	0.56	0.04	62.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy W_AM 2016 High

Picton Road and Hume Highway W (Northbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hume Highway (NB Off ramps)											
1	L	79	1.3	0.043	13.3	X	X	X	X	0.73	68.1
3	R	151	13.9	0.594	35.2	LOS C	3.4	26.2	0.85	1.08	40.8
Approach		230	9.6	0.594	27.7	LOS B	3.4	26.2	0.56	0.96	48.1
East: Picton Road (E)											
5	T	240	5.8	0.128	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R	365	14.0	0.216	11.7	LOS A	0.0	0.0	0.00	0.75	59.1
Approach		605	10.7	0.216	7.1	NA	0.0	0.0	0.00	0.45	66.0
West: Picton Road (W)											
10	L	308	12.3	0.180	11.7	X	X	X	X	0.69	58.8
11	T	337	10.7	0.185	0.0	X	X	X	X	0.00	79.9
Approach		645	11.5	0.185	5.6	NA	0.0	0.0	0.00	0.33	68.3
All Vehicles		1480	10.9	0.594	9.6	NA	3.4	26.2	0.09	0.48	63.2

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy W_PM 2016 High

Picton Road and Hume Highway W (Northbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hume Highway (NB Off ramps)											
1	L	49	10.2	0.028	13.9	X	X	X	X	0.73	68.1
3	R	169	10.7	0.583	31.7	LOS C	3.4	26.0	0.82	1.07	43.2
Approach		218	10.6	0.583	27.7	LOS B	3.4	26.0	0.64	1.00	47.6
East: Picton Road (E)											
5	T	249	8.8	0.135	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R	294	24.5	0.186	12.4	LOS A	0.0	0.0	0.00	0.75	59.1
Approach		543	17.3	0.186	6.7	NA	0.0	0.0	0.00	0.41	67.2
West: Picton Road (W)											
10	L	171	22.8	0.107	12.1	X	X	X	X	0.69	58.9
11	T	464	9.7	0.253	0.0	X	X	X	X	0.00	79.9
Approach		635	13.2	0.253	3.3	NA	0.0	0.0	0.00	0.18	72.9
All Vehicles		1396	14.4	0.583	8.4	NA	3.4	26.0	0.10	0.40	65.3

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy SB_AM 2016 High

Picton Road and Hume Highway E (Southbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
4	L	153	9.8	0.088	11.5	X	X	X	X	0.69	58.9
5	T	240	5.8	0.128	0.0	X	X	X	X	0.00	80.0
Approach		393	7.4	0.128	4.5	NA	0.0	0.0	0.00	0.27	70.2
North: Hume Highway (SB Off Ramps)											
7	L	321	27.4	0.207	15.2	X	X	X	X	0.73	68.1
9	R	217	18.4	0.582	27.4	LOS B	4.1	32.9	0.74	1.06	47.3
Approach		538	23.8	0.582	20.1	LOS B	4.1	32.9	0.30	0.86	58.6
West: Picton Road (W)											
11	T	337	10.7	0.185	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
12	R	67	0.0	0.036	11.2	LOS A	0.0	0.0	0.00	0.75	63.5
Approach		404	8.9	0.185	1.9	NA	0.0	0.0	0.00	0.12	76.4
All Vehicles		1335	14.5	0.582	10.0	NA	4.1	32.9	0.12	0.46	66.3

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy SB_PM 2016 High

Picton Road and Hume Highway E (Southbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
4	L	137	8.0	0.078	11.4	X	X	X	X	0.69	58.9
5	T	249	8.8	0.135	0.0	X	X	X	X	0.00	80.0
Approach		386	8.5	0.135	4.1	NA	0.0	0.0	0.00	0.24	71.0
North: Hume Highway (SB Off Ramps)											
7	L	395	13.2	0.233	14.2	X	X	X	X	0.73	68.1
9	R	229	12.7	0.725	35.4	LOS C	5.7	44.2	0.86	1.18	40.7
Approach		624	13.0	0.725	22.0	LOS B	5.7	44.2	0.31	0.89	55.6
West: Picton Road (W)											
11	T	464	9.7	0.253	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
12	R	66	1.5	0.036	11.3	LOS A	0.0	0.0	0.00	0.75	63.5
Approach		530	8.7	0.253	1.4	NA	0.0	0.0	0.00	0.09	77.2
All Vehicles		1540	10.4	0.725	10.4	NA	5.7	44.2	0.13	0.45	65.2

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Appendix D

2036 SIDRA Summary Outputs

MOVEMENT SUMMARY

Site: Picton Road and Maldon Bridge-Wilton Park Road_AM 2036 High - 2lane

Picton Road and Maldon Bridge-Wilton Park Road Intersection
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maldon Bridge-Wilton Park Road (S)											
1	L	19	10.5	0.139	10.3	LOS A	0.6	5.5	0.56	0.66	42.8
2	T	1	0.0	0.139	8.0	LOS A	0.6	5.5	0.56	0.59	42.1
3	R	61	50.8	0.139	18.0	LOS B	0.6	5.5	0.56	0.84	38.6
Approach		81	40.7	0.139	16.1	LOS B	0.6	5.5	0.56	0.79	39.5
East: Picton Road (E)											
4	L	201	17.4	0.251	7.0	LOS A	1.4	11.0	0.21	0.49	52.1
5	T	459	6.5	0.251	6.5	LOS A	1.4	11.0	0.20	0.45	54.3
6	R	11	9.1	0.251	12.7	LOS A	1.4	10.5	0.20	0.89	46.4
Approach		671	9.8	0.251	6.8	LOS A	1.4	11.0	0.20	0.47	53.5
North: New Access											
7	L	6	16.7	0.025	10.7	LOS A	0.1	0.8	0.62	0.72	48.2
8	T	2	50.0	0.025	9.2	LOS A	0.1	0.8	0.62	0.70	47.9
9	R	6	16.7	0.025	17.1	LOS B	0.1	0.8	0.62	0.85	44.5
Approach		14	21.4	0.025	13.2	LOS A	0.1	0.8	0.62	0.77	46.4
West: Picton Road (W)											
10	L	6	16.7	0.379	7.5	LOS A	2.6	19.3	0.32	0.56	54.8
11	T	982	7.1	0.379	6.8	LOS A	2.6	19.3	0.33	0.48	56.1
12	R	46	13.0	0.379	13.2	LOS A	2.6	19.1	0.34	0.83	50.2
Approach		1034	7.4	0.379	7.1	LOS A	2.6	19.3	0.33	0.50	55.8
All Vehicles		1800	9.9	0.379	7.4	LOS A	2.6	19.3	0.29	0.50	54.2

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Maldon Bridge-Wilton Park Road_PM 2036 High - 2lane

Picton Road and Maldon Bridge-Wilton Park Road Intersection
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maldon Bridge-Wilton Park Road (S)											
1	L	83	0.0	0.364	11.2	LOS A	1.7	13.0	0.68	0.86	41.2
2	T	1	0.0	0.364	9.2	LOS A	1.7	13.0	0.68	0.81	40.3
3	R	156	17.3	0.364	18.1	LOS B	1.7	13.0	0.68	0.95	37.6
Approach		240	11.3	0.364	15.7	LOS B	1.7	13.0	0.68	0.92	38.7
East: Picton Road (E)											
4	L	64	42.2	0.339	7.5	LOS A	2.1	16.1	0.09	0.51	53.3
5	T	980	4.5	0.339	6.2	LOS A	2.1	16.1	0.10	0.45	55.5
6	R	5	0.0	0.339	12.3	LOS A	2.1	15.4	0.10	0.95	46.4
Approach		1049	6.8	0.339	6.3	LOS A	2.1	16.1	0.10	0.45	55.3
North: New Access											
7	L	10	0.0	0.021	8.6	LOS A	0.1	0.6	0.57	0.65	49.0
8	T	1	0.0	0.021	6.6	LOS A	0.1	0.6	0.57	0.58	48.5
9	R	5	0.0	0.021	15.0	LOS B	0.1	0.6	0.57	0.80	45.7
Approach		16	0.0	0.021	10.5	LOS A	0.1	0.6	0.57	0.69	47.8
West: Picton Road (W)											
10	L	5	0.0	0.286	7.4	LOS A	1.8	13.8	0.42	0.59	54.2
11	T	651	12.6	0.286	7.4	LOS A	1.8	13.8	0.42	0.53	55.3
12	R	9	0.0	0.286	13.2	LOS A	1.7	13.5	0.43	0.85	50.2
Approach		665	12.3	0.286	7.5	LOS A	1.8	13.8	0.42	0.54	55.2
All Vehicles		1970	9.1	0.364	7.9	LOS A	2.1	16.1	0.28	0.54	53.0

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Go Kart Access_AM 2036 High - Seagull-2lanes

Picton Road and Go Kart Access Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Go Kart Access (S)											
1	L	10	0.0	0.020	11.6	LOS A	0.0	0.3	0.51	0.70	41.1
3	R	12	8.3	0.038	18.0	LOS B	0.1	1.0	0.65	0.85	34.8
Approach		22	4.5	0.038	15.1	LOS B	0.1	1.0	0.59	0.78	37.4
East: Picton Road (E)											
4	L	48	0.0	0.026	9.1	LOS A	0.0	0.0	0.00	0.69	53.3
5	T	558	8.4	0.151	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		606	7.8	0.151	0.7	NA	0.0	0.0	0.00	0.05	68.4
North: Road Access											
7	L	2	50.0	0.001	11.1	LOS A	0.0	0.0	0.00	0.69	49.7
Approach		2	50.0	0.001	11.1	LOS A	0.0	0.0	0.00	0.69	49.7
West: Picton Road (W)											
10	L	2	50.0	0.001	11.1	LOS A	0.0	0.0	0.00	0.69	53.3
11	T	1015	6.9	0.272	0.0	X	X	X	X	0.00	69.9
12	R	23	0.0	0.047	12.0	LOS A	0.1	0.8	0.52	0.74	49.8
Approach		1040	6.8	0.272	0.3	NA	0.1	0.8	0.01	0.02	69.3
All Vehicles		1670	7.2	0.272	0.7	NA	0.1	1.0	0.01	0.04	68.5

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Go Kart Access_PM 2036 High - Seagull-2lanes

Picton Road and Go Kart Access Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Go Kart Access (S)											
1	L	35	0.0	0.102	16.4	LOS B	0.3	2.0	0.72	0.91	36.0
3	R	58	1.7	0.385	38.8	LOS C	1.5	10.3	0.89	1.02	22.7
Approach		93	1.1	0.385	30.4	LOS C	1.5	10.3	0.83	0.98	26.4
East: Picton Road (E)											
4	L	13	0.0	0.007	9.1	LOS A	0.0	0.0	0.00	0.69	53.3
5	T	1018	5.2	0.270	0.0	LOS A	0.0	0.0	0.00	0.00	72.2
Approach		1031	5.1	0.270	0.1	NA	0.0	0.0	0.00	0.01	71.9
North: Road Access											
7	L	2	50.0	0.001	11.1	LOS A	0.0	0.0	0.00	0.69	49.7
Approach		2	50.0	0.001	11.1	LOS A	0.0	0.0	0.00	0.69	49.7
West: Picton Road (W)											
10	L	2	50.0	0.001	11.1	LOS A	0.0	0.0	0.00	0.69	53.3
11	T	736	12.4	0.204	0.0	X	X	X	X	0.00	69.9
12	R	8	0.0	0.022	15.4	LOS B	0.1	0.4	0.68	0.82	46.1
Approach		746	12.3	0.204	0.2	NA	0.1	0.4	0.01	0.01	69.5
All Vehicles		1872	7.9	0.385	1.7	NA	1.5	10.3	0.04	0.06	67.6

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Menangle Road_AM 2036 High - Roundabout 2 lanes

Picton Road and Menangle Road
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
5	T	609	11.8	0.286	6.7	LOS A	1.9	14.4	0.25	0.45	56.7
6	R	172	0.0	0.286	13.7	LOS A	1.8	13.6	0.26	0.76	50.4
Approach		781	9.2	0.286	8.3	LOS A	1.9	14.4	0.26	0.52	55.1
North: Menangle Road											
7	L	122	0.0	0.296	11.3	LOS A	1.4	9.9	0.72	0.86	51.6
9	R	68	0.0	0.296	17.7	LOS B	1.4	9.9	0.72	0.95	47.3
Approach		190	0.0	0.296	13.6	LOS A	1.4	9.9	0.72	0.89	49.9
West: Picton Road (W)											
10	L	51	0.0	0.420	8.2	LOS A	2.8	21.0	0.42	0.60	54.6
11	T	1000	9.5	0.420	7.3	LOS A	2.8	21.0	0.43	0.54	55.2
Approach		1051	9.0	0.420	7.4	LOS A	2.8	21.0	0.43	0.54	55.2
All Vehicles		2022	8.3	0.420	8.3	LOS A	2.8	21.0	0.39	0.56	54.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Menangle Road_PM 2036 High - Roundabout 2 lanes

Picton Road and Menangle Road
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
5	T	878	8.3	0.359	7.2	LOS A	2.5	18.4	0.44	0.53	55.2
6	R	10	0.0	0.359	14.4	LOS A	2.4	18.0	0.44	0.83	50.9
Approach		888	8.2	0.359	7.3	LOS A	2.5	18.4	0.44	0.54	55.1
North: Menangle Road											
7	L	153	11.1	0.451	13.0	LOS A	2.5	18.2	0.71	0.90	50.1
9	R	170	0.0	0.451	19.0	LOS B	2.5	18.2	0.71	0.99	46.1
Approach		323	5.3	0.451	16.2	LOS B	2.5	18.2	0.71	0.95	47.8
West: Picton Road (W)											
10	L	17	0.0	0.286	7.3	LOS A	1.8	13.9	0.08	0.57	56.9
11	T	837	13.4	0.286	6.5	LOS A	1.8	13.9	0.08	0.45	58.5
Approach		854	13.1	0.286	6.5	LOS A	1.8	13.9	0.08	0.45	58.5
All Vehicles		2065	9.8	0.451	8.3	LOS A	2.5	18.4	0.33	0.56	55.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Allied Mills Access_AM 2036 High - Seagull int - 2lanes

Picton Road and Alllied Mills Access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Allied Mills Access											
1	L	40	2.5	0.118	15.7	LOS B	0.3	2.2	0.65	0.89	37.5
3	R	34	14.7	0.202	31.4	LOS C	0.7	5.5	0.83	0.96	26.3
Approach		74	8.1	0.202	22.9	LOS B	0.7	5.5	0.73	0.92	31.4
East: Picton Road (E)											
4	L	201	2.5	0.110	10.2	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	730	9.7	0.199	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		931	8.2	0.199	2.2	NA	0.0	0.0	0.00	0.15	74.2
West: Picton Road (W)											
11	T	994	9.6	0.271	0.0	X	X	X	X	0.00	79.9
12	R	1	0.0	0.002	15.4	LOS B	0.0	0.0	0.64	0.70	50.1
Approach		995	9.5	0.271	0.1	NA	0.0	0.0	0.00	0.00	79.8
All Vehicles		2000	8.9	0.271	1.9	NA	0.7	5.5	0.03	0.11	74.8

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Allied Mills Access_PM 2036 High - Seagull int - 2lanes

Picton Road and Alllied Mills Access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Allied Mills Access											
1	L	143	0.0	0.393	17.1	LOS B	1.3	9.2	0.68	0.96	36.0
3	R	168	2.4	0.727	40.4	LOS C	4.6	32.8	0.91	1.24	22.1
Approach		311	1.3	0.727	29.7	LOS C	4.6	32.8	0.81	1.11	26.9
East: Picton Road (E)											
4	L	43	9.3	0.025	10.5	LOS A	0.0	0.0	0.00	0.71	57.1
5	T	747	9.5	0.203	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
Approach		790	9.5	0.203	0.6	NA	0.0	0.0	0.00	0.04	78.5
West: Picton Road (W)											
11	T	965	13.4	0.269	0.0	X	X	X	X	0.00	79.9
12	R	22	0.0	0.036	14.5	LOS B	0.1	0.9	0.59	0.81	51.1
Approach		987	13.1	0.269	0.4	NA	0.1	0.9	0.01	0.02	79.0
All Vehicles		2088	10.0	0.727	4.8	NA	4.6	32.8	0.13	0.19	67.5

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Wilton Park Road_AM 2036 High - 2 Lanes

Picton Road and Wilton Park Road Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wilton Park Road (S)											
1	L	11	0.0	1.000[4]	384.5	LOS F	4.7	32.6	0.99	1.28	5.8
2	T	1	0.0	1.000[4]	382.1	LOS F	4.7	32.6	0.99	1.21	5.2
3	R	17	0.0	1.000[4]	384.4	LOS F	4.7	32.6	0.99	1.20	5.8
Approach		29	0.0	1.000	384.4	LOS F	4.7	32.6	0.99	1.23	5.8
East: Picton Road (E)											
4	L	12	50.0	0.257	12.3	LOS A	0.0	0.0	0.00	2.05	57.1
5	T	907	8.5	0.257	6.0	LOS A	5.4	40.9	0.48	0.00	63.2
6	R	6	0.0	0.257	22.2	LOS B	5.4	40.9	0.98	1.05	51.2
Approach		925	9.0	0.257	6.1	NA	5.4	40.9	0.48	0.03	63.0
North: Access Road											
7	L	11	0.0	0.546	183.9	LOS F	1.6	11.1	0.98	1.06	11.0
8	T	1	0.0	0.546	181.6	LOS F	1.6	11.1	0.98	1.04	9.9
9	R	6	0.0	0.546	183.9	LOS F	1.6	11.1	0.98	1.04	11.0
Approach		18	0.0	0.546	183.7	LOS F	1.6	11.1	0.98	1.05	10.9
West: Picton Road (W)											
10	L	1	0.0	0.285	10.1	LOS A	0.0	0.0	0.00	1.75	57.1
11	T	1021	10.0	0.285	4.9	LOS A	5.5	41.9	0.46	0.00	65.1
12	R	6	0.0	0.285	20.5	LOS B	5.5	41.9	0.94	1.08	53.0
Approach		1028	9.9	0.285	5.0	NA	5.5	41.9	0.46	0.01	65.0
All Vehicles		2000	9.3	1.000	12.6	NA	5.5	41.9	0.48	0.05	54.1

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

4 x = 1.00 due to minimum capacity

MOVEMENT SUMMARY

Site: Picton Road and Wilton Park Road_PM 2036 High - 2 Lanes

Picton Road and Wilton Park Road Intersection
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wilton Park Road (S)											
1	L	12	0.0	1.000[4]	479.5	LOS F	4.4	32.0	0.99	1.27	4.7
2	T	1	0.0	1.000[4]	477.2	LOS F	4.4	32.0	0.99	1.19	4.3
3	R	10	10.0	1.000[4]	480.1	LOS F	4.4	32.0	0.99	1.18	4.7
Approach		23	4.3	1.000	479.7	LOS F	4.4	32.0	0.99	1.23	4.7
East: Picton Road (E)											
4	L	16	0.0	0.217	10.1	LOS A	0.0	0.0	0.00	1.62	57.1
5	T	774	9.8	0.217	7.4	LOS A	5.2	39.4	0.50	0.00	60.9
6	R	1	0.0	0.217	24.7	LOS B	5.2	39.4	1.00	1.02	48.6
Approach		791	9.6	0.217	7.5	NA	5.2	39.4	0.49	0.03	60.8
North: Access Road											
7	L	3	33.3	0.144	105.7	LOS F	0.4	3.1	0.97	0.99	17.1
8	T	1	0.0	0.144	102.6	LOS F	0.4	3.1	0.97	0.99	16.3
9	R	1	0.0	0.144	104.1	LOS F	0.4	3.1	0.97	0.99	17.1
Approach		5	20.0	0.144	104.8	LOS F	0.4	3.1	0.97	0.99	16.9
West: Picton Road (W)											
10	L	10	90.0	0.314	14.1	LOS A	0.0	0.0	0.00	2.43	57.1
11	T	1128	10.4	0.314	4.1	LOS A	5.6	42.9	0.45	0.00	66.2
12	R	1	0.0	0.314	18.6	LOS B	5.6	42.9	0.88	1.12	55.0
Approach		1139	11.1	0.314	4.2	NA	5.6	42.9	0.44	0.02	66.1
All Vehicles		1958	10.4	1.000	11.4	NA	5.6	42.9	0.47	0.04	55.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

4 x = 1.00 due to minimum capacity

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy W_AM 2036 High - 2lanes

Picton Road and Hume Highway W (Northbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hume Highway (NB Off ramps)											
1	L	154	1.3	0.084	13.3	X	X	X	X	0.73	68.1
3	R	151	13.9	0.793	56.6	LOS E	5.4	42.0	0.94	1.27	31.7
Approach		305	7.5	0.793	34.7	LOS C	5.4	42.0	0.47	0.99	43.4
East: Picton Road (E)											
5	T	413	5.8	0.110	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R	365	14.0	0.216	11.7	LOS A	0.0	0.0	0.00	0.73	58.9
Approach		778	9.6	0.216	5.5	NA	0.0	0.0	0.00	0.34	68.6
West: Picton Road (W)											
10	L	444	10.1	0.256	11.6	X	X	X	X	0.69	58.8
11	T	527	10.6	0.144	0.0	X	X	X	X	0.00	79.9
Approach		971	10.4	0.256	5.3	NA	0.0	0.0	0.00	0.31	68.7
All Vehicles		2054	9.7	0.793	9.7	NA	5.4	42.0	0.07	0.43	62.7

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy
W_PM 2036 High - 2lanes

Picton Road and Hume Highway W (Northbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Hume Highway (NB Off ramps)											
1	L	75	9.3	0.043	13.9	X	X	X	X	0.73	68.1
3	R	169	10.7	0.724	42.8	LOS D	4.7	35.9	0.91	1.20	37.4
Approach		244	10.2	0.724	33.9	LOS C	4.7	35.9	0.63	1.06	43.4
East: Picton Road (E)											
5	T	384	9.1	0.104	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
6	R	294	24.5	0.186	12.4	LOS A	0.0	0.0	0.00	0.74	58.9
Approach		678	15.8	0.186	5.4	NA	0.0	0.0	0.00	0.32	69.4
West: Picton Road (W)											
10	L	240	20.4	0.148	12.0	X	X	X	X	0.69	58.8
11	T	815	8.6	0.221	0.0	X	X	X	X	0.00	79.9
Approach		1055	11.3	0.221	2.8	NA	0.0	0.0	0.00	0.16	72.8
All Vehicles		1977	12.7	0.724	7.5	NA	4.7	35.9	0.08	0.32	65.0

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy
SB_AM 2036 High - 2lanes

Picton Road and Hume Highway E (Southbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
4	L	153	9.8	0.088	11.5	X	X	X	X	0.69	58.9
5	T	413	5.8	0.110	0.0	X	X	X	X	0.00	80.0
Approach		566	6.9	0.110	3.1	NA	0.0	0.0	0.00	0.19	73.0
North: Hume Highway (SB Off Ramps)											
7	L	321	27.4	0.207	15.2	X	X	X	X	0.73	68.1
9	R	370	13.2	1.375	381.7	LOS F	73.5	572.5	1.00	3.42	6.0
Approach		691	19.8	1.375	211.5	LOS F	73.5	572.5	0.54	2.17	11.0
West: Picton Road (W)											
11	T	527	10.6	0.144	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
12	R	99	0.0	0.053	11.3	LOS A	0.0	0.0	0.00	0.73	63.3
Approach		626	8.9	0.144	1.8	NA	0.0	0.0	0.00	0.12	76.5
All Vehicles		1883	12.3	1.375	79.1	NA	73.5	572.5	0.20	0.89	23.6

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Picton Road and Hume Hwy
SB_PM 2036 High - 2lanes

Picton Road and Hume Highway E (Southbound On/Off Ramps)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Picton Road (E)											
4	L	137	8.0	0.078	11.4	X	X	X	X	0.69	58.9
5	T	384	9.1	0.104	0.0	X	X	X	X	0.00	80.0
Approach		521	8.8	0.104	3.0	NA	0.0	0.0	0.00	0.18	73.1
North: Hume Highway (SB Off Ramps)											
7	L	435	13.2	0.256	14.2	X	X	X	X	0.72	68.0
9	R	304	10.2	1.890	854.3	LOS F	98.0	745.6	1.00	3.67	2.8
Approach		739	11.8	1.890	359.6	LOS F	98.0	745.6	0.41	1.93	6.9
West: Picton Road (W)											
11	T	815	8.6	0.221	0.0	LOS A	0.0	0.0	0.00	0.00	80.0
12	R	97	2.1	0.053	11.5	LOS A	0.0	0.0	0.00	0.74	63.3
Approach		912	7.9	0.221	1.2	NA	0.0	0.0	0.00	0.08	77.6
All Vehicles		2172	9.4	1.890	123.6	NA	98.0	745.6	0.14	0.73	16.7

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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Document Status

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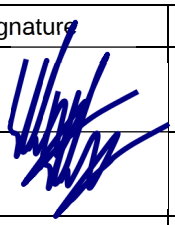
0	S Manahan	I Smith		S Konstas		9 Sept 2011
1		I Smith		S Konstas		21 Sept 2011