Proposed Residential Development, Boondah Rd, Warriewood

Traffic Impact Assessment and Transport Management and Accessibility Plan

16 August 2010

Prepared for

Meriton Apartments Pty Ltd

Halcrow

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1 Introduction

This report has been prepared on behalf of Meriton Apartments Pty Ltd to present the results of an assessment of the traffic implications of a proposed residential development at 14-18 Boondah Road, Warriewood. A Development Application has recently been approved for the site, for a residential development comprising some 140 detached and semi-detached dwellings, with vehicular access to and from both Boondah Road and Macpherson Street. This development proposes similar access arrangements, with 559 high density residential apartments in three and five storey buildings, and a childcare centre.

The study examines the existing road transport situation in the vicinity of the site, and updates previous land use and traffic generation planning work previously undertaken as part of the development of the Roads Master Plan for Warriewood Valley. It examines likely future traffic conditions with all approved and planned development in the Valley, and then assesses the implications of the additional traffic generated by the subject development.

The report also identifies appropriate transport measures for the proposed development to help manage the demand for travel to and from the site, and to reduce the demand for travel by private cars and commercial vehicles.

The remainder of the report is set out as below:

- Section 2 describes the background traffic conditions, including the planning context of the site, the existing road network and traffic volumes, planned potential development in the Warriewood Valley, planned road network changes/upgrades in Warriewood Valley and likely traffic conditions with the potential development.
- Section 3 describes the proposed development, assesses its peak period traffic generation, and compares this with the approved development on the site.
- Section 4 examines the future traffic conditions resulting from the subject development proposal, and identifies transport management measures appropriate for the area.
- Section 5 presents a summary and the conclusions of the investigation.

2 Background Situation

An appreciation of the background traffic conditions in the vicinity of the site can be gained by examining the road network, traffic volumes, public transport availability, and the potential for other development in the local area. These aspects are discussed in this section.

2.1 Site Location

The site location is shown in **Figure 1**, and lies on the south western corner of the intersection of Boondah Road and Macpherson Street at Warriewood. It is bounded by Macpherson Street, Boondah Road and Warriewood Wetlands Reserve. It is undeveloped with the exception of two homesteads.

2.2 Road Network

The roads serving the subject site are briefly described below.

Macpherson Street is identified as a subarterial street in Pittwater Council's Roads Master Plan. Together with Ponderosa Parade and Warriewood Road, it provides a link between Mona Vale Road and Pittwater Road. It has a single travel lane in each direction, with some kerbside parking and a speed limit of 60kph.

Boondah Road is also identified as a subarterial street in Council's Roads Master Plan, and has a single travel lane in each direction, and a speed limit of 50kph along its northern part, and 40kph along its southern part. It provides a link between Macpherson Street and Jacksons Road. It intersects with Jacksons Road to the east of Warriewood Square shopping centre.

Ponderosa Parade – Macpherson Street – Warriewood Road (east) form a route through Warriewood Valley between Mona Vale Road to the north and Pittwater Road to the south-east. Along most of its length, the route typically has a single travel lane in each direction, and major intersections within the Valley are controlled with roundabouts (or are planned to be), while the access intersections with Mona Vale Road and Pittwater Road are signal controlled.

2.3 Regional Transport Planning and Strategic Context

The development of a residential subdivision on the subject site and development of surrounding sites has been proposed by Pittwater Council for some time. Accordingly, the traffic generation potential of the site was incorporated into the regional transport planning investigations undertaken for the area. Those investigations have resulted in the preparation of Development Control Plan No.29 – Warriewood Valley Urban Release Area (WV DCP, adopted July 2001) and a Roads Master Plan for the Warriewood area.

The Warriewood Valley Roads Master Plan was prepared in 1999, reviewed and updated by Masson Wilson Twiney in 2004, and updated again by Pittwater Council in 2006. It documents road cross sections, traffic calming and management measures for implementation in the Warriewood Valley Urban Land Release Area. It also documents pedestrian and cycle routes for the area.

The Roads Master Plan (2006 Review) references other documents which also guide development in the Warriewood Valley area:

- Pittwater 21
- The Roads Master Plan Drawing (Dwg No.99-029)
- Development Control Plan 29 – Warriewood Valley Urban Land Release
- AUS-SPEC 2 – Pittwater Council Edition
- Warriewood Valley water Specifications
- Australian Model Code for Residential Development (AMCORD)
- Austroads guidelines.

Mona Vale is designated as a Town Centre in the Metropolitan Strategy, *City of Cities – A Plan for Sydney's Future* (2005) and a focal point for regional transport connections and jobs growth. The NSW State Plan and North East Subregional Strategy share the aims of increasing the use of walking, cycling and public transport; appropriately co-locating new urban development with existing and improved transport services; and improving the efficiency of the road network.

The North East Subregional Strategy sets a target of 17,300 new dwellings including a small amount of greenfields development and 16,000 new jobs in the subregion (which includes Pittwater, Warringah and Manly LGAs) by 2031. The Strategy aims to increase capacity and use of public transport, noting that 72 percent of all trips by residents of the subregion are made by car (as driver or passenger), and 9.5 percent of trips are made by public transport. It has one of the highest proportion of car use of any subregion. Almost 80 per cent of jobs in the North East Subregion are taken by residents of the subregion, and half of all workers in the North East Subregion live and work within the subregion.

The Strategy seeks to strengthen the role of buses, encouraging use of public transport, accommodating growth and relieving road congestion. Integrated land use and transport planning are proposed to ensure that new and improved infrastructure and services lead to an increased share of peak hour journeys by public transport, which is a key State Plan Priority (S6). The Strategy identifies a number of measures to increase the capacity of the bus network in the North East, including improved physical and electronic bus priority measures, operational strategies such as increased use of articulated buses, increased frequency and off-board ticket sales.

2.4 Surveyed Traffic Volumes

Surveys of vehicle movements were undertaken at key intersections throughout Warriewood Valley as a means of quantifying existing traffic conditions. The surveys were conducted on Tuesday 8 September 2009, at the following intersections:

- Warriewood Road and Pittwater Road
- Boondah Road and Macpherson Street
- Macpherson Street and Warriewood Road
- Boundary Road and Ponderosa Parade
- Garden Street and Macpherson Street
- Boondah Road and Jacksons Road
- Jacksons Road and Pittwater Road
- Jubilee Avenue and Ponderosa Parade
- Ponderosa Parade and Mona Vale Road.

The morning peak hour occurred between 8.00am and 9.00am, and the evening peak hour between 4.30pm and 5.30pm. The peak hour turning movements at the surveyed intersections are presented in **Figure 2** and the two way volumes are summarised in Table 2.1.

Table 2.1 – Surveyed Peak Hour Traffic Volumes September 2009 (veh/hr)

Road	Location	Morning Peak Hour	Evening Peak Hour
Boondah Road	South of Macpherson Street	117	114
	North of Jacksons Road	121	158
Casuarina Drive	South of Macpherson Street	86	74
Forest Road	West of Macpherson Street	537	113
Garden Street	South of Macpherson Street	784	697
Jacksons Road	West of Boondah Road	762	1,060
	West of Pittwater Road	670	987
Jubilee Avenue	West of Ponderosa Parade	517	568
	East of Ponderosa Parade	537	435
Macpherson Street	South of Forest Road	905	792
	West of Garden Street	987	820
	East of Garden Street	335	297
	West of Boondah Road	260	267
	West of Warriewood Road	310	291
Mona Vale Road	West of Ponderosa Parade	1,484	1,581
	East of Ponderosa Parade	1,521	1,581
Pittwater Road	North of Warriewood Road	3,170	3,415
	North of Jacksons Road	3,568	3,884
Ponderosa Parade	South of Mona Vale Road	983	1,005
	South of Jubilee Avenue	1,045	858
Samuel Street	North of Mona Vale Road	396	393
Warriewood Road	North of Macpherson Street	516	529
	South of Macpherson Street	606	618
	West of Pittwater Road	786	881

The results demonstrate the dominance of Pittwater Road, Mona Vale and Jacksons Road in carrying traffic in the Warriewood area. Within the Warriewood Valley itself, Ponderosa Parade – Macpherson Street – Garden Street provides a significant north-south link through the Valley, as well as providing direct access to properties, carrying around 700 to 1,050 vehicles per hour during the peak hours. Warriewood Road also carries significant volumes during the peak hours, with around 520 to 880 vehicles per hour during the peak hours.

The Council's Roads Masterplan identifies Ponderosa Road, Macpherson Street, Warriewood Road east of Macpherson Street, Garden Street and Boondah Road as subarterial roads which would be expected to carry up to 10,000 vehicles per day. This is equivalent to approximately 1,000 vehicles per hour during the peak hours. The results in Table 2.1 show that the existing volumes are typically below this limit, although it is currently slightly exceeded on Ponderosa Parade.

Jubilee Avenue is identified as a collector street in Council's Roads Master Plan. Collector streets would be expected to carry up to approximately 5,000 vehicles per day, which is equivalent to approximately 500 vehicles per hour during the peak hours. The surveys indicate that the existing peak hour volumes on Jubilee Avenue exceed this typical maximum. Existing volumes on Warriewood Road north of Macpherson Street also slightly exceed the expected upper limit of 500 vehicles per hour, although it is not specifically identified as a collector road.

2.5 Existing Intersection Operating Conditions

The operation of the surveyed intersections was analysed using Sidra Intersection, an analysis program which determines characteristics of intersections operating conditions including the degree of saturation, average delays, and levels of service. The degree of saturation, or x-value, is the ratio of the arrival rate of vehicles to the capacity. The operating characteristics can be compared with the performance criteria set out in Table 2.2 below. It is noted that average delay per vehicle is expressed in seconds per vehicle and is measured over all movements at signalised intersections, and for the movement with the highest average delay at roundabout and priority intersections.

Table 2.2 – Level of Service Criteria

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

The results of the analysis are presented in Table 2.3.

Table 2.3 – Existing Intersection Operating Conditions (Sept 2009)

Intersection	Morning Peak Hour			Evening Peak Hour		
	X-value	AD	LOS	X-value	AD	LOS
Warriewood/Pittwater	0.78	23.3	B	0.90	31.2	C
Boondah/Macpherson	0.09	10.8	A	0.10	11.1	A
Macpherson/Warriewood	0.22	10.7	A	0.21	10.6	A
Macpherson/Ponderosa	0.38	13.7	A	0.36	11.2	A
Garden/Macpherson	0.47	9.8	A	0.40	8.9	A
Boondah/Jacksons	0.21	11.7	A	0.36	17.0	B
Jacksons/Pittwater	0.95	14.3	A	0.93	24.5	B
Jubilee/Ponderosa	0.51	14.9	B	0.52	14.1	A
Ponderosa/Mona Vale	0.60	19.2	B	0.83	30.5	C

The results indicate that the surveyed intersections currently operate at satisfactory levels of service, with spare capacity and short to moderate delays to vehicles. Delays at the roundabout at the intersection of Ponderosa Parade and Mona Vale Road lead to queuing on Mona Vale Road, typically westbound in the morning and eastbound in the evening.

It is noted that Sidra Intersection does not fully model the effects of co-ordination of signals along a route, as occurs on Pittwater Road. The analysis above assumes the

current cycle length and phase splits, and includes some co-ordination benefits. The results indicate that both the Pittwater Road intersections operate at satisfactory levels of service, however some movements are close to capacity, with the right turn bays into Jacksons Road and Warriewood Road currently overflowing into the adjoining lane on occasions during the peak hours.

2.6 Existing Public Transport

Warriewood is served by Sydney Buses and Forest Coach Lines bus services. Only Sydney Buses routes operate within the Warriewood Valley itself, with Forest Coach Lines operating the following two services along Mona Vale Road.

- Route 196 between Gordon and Mona Vale
- Route 197 between Macquarie University and Mona Vale, via Gordon.

Sydney Buses operates three routes within the Warriewood Valley:

- Route 185 which operates along Pittwater Road, Jacksons Road, Garden Street Macpherson Street (east), Warriewood Road, Foley Street, Mona Vale Road, Samuel Street, Parkland Road, and Waratah Street to Mona Vale. This operates between Wynyard in the CBD and Mona Vale, and on weekdays provides only morning and evening services, with no services operating during the middle of the day.
- Route L85 which operates along Pittwater Road, Jacksons Road, Garden Street Macpherson Street (east), Warriewood Road, Foley Street, Mona Vale Road, Samuel Street, Parkland Road, and Waratah Street to Mona Vale. This operates with limited stops between the Wynyard in the CBD and Mona Vale. On weekdays, this service operates throughout the day, with a bus every half an hour in each direction, and more frequently during peaks.
- Route 182 which operates along Pittwater Road, Jacksons Road, Garden Street, Macpherson Street (west), Mona Vale Road, Pittwater Road and Park Street to Mona Vale. Route 182 operates between Narrabeen and Mona Vale, via Elanora Heights and North Narrabeen. This route operates with an hourly service in each direction throughout weekdays.

In addition, numerous Sydney Buses routes operate through Mona Vale along Pittwater Road and Barrenjoey Road, including:

- Route 187/L87/E87 Sydney CBD – Newport
- Route 188/L88/E89 Sydney CBD – Avalon
- E88 Sydney CBD – Careel Head Road
- Route 190/L90 Sydney CD – Palm Beach
- Route L60 Dee Why – Mona Vale
- Route 155 and 156 and E86 Manly – McCarrs Creek
- Route 184/L84/E84 Sydney CBD – Mona Vale.

The frequency of buses operating the routes within Warriewood Valley in each direction is presented in **Appendix A** for both weekdays and weekends. The tables indicate that on weekdays, there is typically three buses each way each hour except during the early morning and late evening. On weekend days, frequencies reduce to one or two buses each way each hour.

Sydney Buses has indicated that service levels can be reviewed once the subject development has been completed, noting that the development offers the opportunity to provide a higher level of service in Warriewood. In order for service levels to be increase, infrastructure changes would be needed in Garden Street and Macpherson Street, as currently buses have trouble pulling into the short bus stops and bus bays.

2.7 Potential Development in Warriewood Valley

Potential development of land within Warriewood Valley was examined as part of the development of DCP 29 and the Roads Master Plan update. As that was last updated several years ago, Halcrow has liaised with Pittwater Council and collated available information regarding land in the Valley which was previously identified for development, to determine how much of that potential has been taken up and how much remains undeveloped or incomplete.

The data is presented in **Appendix B** of this report, and was used to develop forecasts of potential future traffic flows on roads within Warriewood Valley, updated from the forecasts used in the Roads Master Plan review in 2004. On 1 February 2010, Pittwater Council resolved to publicly exhibit a report which suggests increasing residential densities above those in the 1997 Planning Framework. This relates to Sector 9 and Buffer Areas 1 to 3, increasing the permitted number of dwellings on those sites

combined by 126 dwellings. The implications of this possible increase in densities were not included in this assessment, as its status remains unknown. However it is noted that 126 dwellings would be expected to generate about 100 vehicle trips per peak hour. Once spread onto the local network, this would produce only a marginal traffic increase except possibly locally near the location of the additional dwellings.

It is noted that the subject site currently has approval to create 140 lots on the site, with the following mix of dwelling types:

- 19 detached dwellings
- 22 semi attached dwellings
- 99 terrace houses

The approved development would be expected to generate some 95 vehicle trips per hour during the morning and evening peak hours, which is consistent with the traffic generation allowance made for the site as part of the Roads Master Plan update.

2.8 Planned Infrastructure Upgrades

The Roads Master Plan identifies planned upgrades to infrastructure in the Warriewood Valley area in response to the planned development. These include the following of relevance to this project and/or the surveyed intersections:

- Roundabout at Boondah Road and Macpherson Street
- Roundabout at Garden Street and Macpherson Street
- Roundabout at Warriewood Road and Macpherson Street
- Roundabout at Macpherson Street and Brands Lane (access to Sector 11)
- Roundabout at Boondah Road and Jacksons Road
- Realignment of intersection of Warriewood Road and Macpherson Street
- New signals at Mona Vale Road and Ponderosa Parade
- Upgrade intersection of Warriewood Road and Pittwater Road
- Upgrade intersection of Jacksons Road and Pittwater Road
- Warriewood Road pavement correction and strengthening
- Macpherson Street widening Boondah Road to Warriewood Road
- Boondah Road upgrade, widen and raise above flood level

- Macpherson Street bridge at Narrabeen Creek – two lane bridge plus approaches plus shared pedestrian/cycle path on both sides
- Boondah Road bridge at Narrabeen Creek – two lane bridge plus shared pedestrian/cycle path on both sides
- Pedestrian refuge in Boondah Road
- Pedestrian refuge in Macpherson Street between Brands Lane and Boondah Road
- Two bus bays in Macpherson Street near Boondah Road.

2.9 Traffic Conditions with Potential Development

This section outlines the likely traffic conditions in Warriewood Valley assuming that all previously identified potential and approved development of land occurs, as presented in **Appendix B**. The total additional traffic assumed to be generated by the potential and approved developments is 1,166 vehicle trips per hour during the morning peak hour, and 1,590 vehicle trips per hour during the evening peak hour.

2.9.1 Traffic Volumes with Potential Development

Table 2.4 summarises the estimated future two way traffic volumes at key locations in Warriewood Valley assuming that all potential and approved development occurs. The forecast vehicle turning movements at intersections are presented in **Figure 3**.

Table 2.4 – Estimated Peak Hour Traffic with Potential Development (veh/hr)

Road	Location	Morning Peak Hour		Evening Peak Hour	
		Existing	Potential	Existing	Potential
Boondah Road	South of Macpherson Street	117	201	114	235
	North of Jacksons Road	121	182	158	230
Casuarina Drive	South of Macpherson Street	86	86	74	74
Forest Road	West of Macpherson Street	537	551	113	155
Garden Street	South of Macpherson Street	784	1,043	697	1,177
Jacksons Road	West of Boondah Road	762	966	1,060	1,319
	West of Pittwater Road	670	871	987	1,229
Jubilee Avenue	West of Ponderosa Parade	517	587	568	666
	East of Ponderosa Parade	537	565	435	520
Macpherson Street	South of Forest Road	905	1,209	792	1,220
	West of Garden Street	987	1,291	820	1,248
	East of Garden Street	335	535	297	587
	West of Boondah Road	260	531	267	640
	West of Warriewood Road	310	584	291	637
Mona Vale Road	West of Ponderosa Parade	1,484	1,799	1,581	1,902
	East of Ponderosa Parade	1,521	1,798	1,581	1,888
Pittwater Road	North of Warriewood Road	3,170	3,474	3,415	3,753
	North of Jacksons Road	3,568	3,862	3,884	4,202
Ponderosa Parade	South of Mona Vale Road	983	1,210	1,005	1,264
	South of Jubilee Avenue	1,045	1,335	858	1,243
Samuel Street	North of Mona Vale Road	396	441	393	439
Warriewood Road	North of Macpherson Street	516	664	529	748
	South of Macpherson Street	606	894	618	904
	West of Pittwater Road	786	1,074	881	1,167

The results indicate that the greatest increases in traffic would be expected to occur during the evening peak hour in the immediate vicinity of the proposed neighbourhood shopping centre on Garden Street at Macpherson Street. As noted in Appendix B, the traffic impact report lodged with that DA did not present an estimate of peak hour traffic generation, and the assumptions used in this assessment are considered to be somewhat high as a "worst case" assessment.

The forecast traffic volumes with all potential developments in Warriewood Valley would exceed the nominal expected upper limits for a number of roads according to their classification in the Roads Master Plan. This includes:

- Garden Street south of Macpherson Street – up to 1,180 vehicles per hour
- Macpherson Street and Ponderosa Parade between Mona Vale Road and Garden Street – up to 1,340 vehicles per hour
- Warriewood Road west of Pittwater Road – up to 1,170 vehicles per hour
- Jubilee Avenue – up to 670 vehicles per hour
- Warriewood Road north of Macpherson Street – up to 750 vehicles per hour.

In relation to this, it is noted that the maximum traffic levels targeted for collector and subarterial roads in residential areas are desirable limits and the specifics of a particular road network may mean that traffic levels may exceed the desirable levels. The desirable upper limits are not consistent with the potential development yield for the area. In such circumstances, particular care needs to be taken in the design of intersections, in the location of site driveways and in the adequacy of provisions for pedestrians. Design aspects such as these would be taken into consideration with the upgrade works already planned for the area.

2.9.2 Intersection Operating Conditions with Potential Development

The key intersections were reanalysed using Sidra Intersection to determine what their likely operating conditions would be with all potential development in Warriewood Valley taken up. Table 2.5 presents the results of the analysis, which assumes that intersection upgrades identified in the Roads Master Plan occur.

Table 2.5 – Intersection Operating Conditions with Potential Developments

Intersection	Morning Peak Hour			Evening Peak Hour		
	X-value	AD	LOS	X-value	AD	LOS
Warriewood/Pittwater*	0.72	18.3	B	0.87	26.5	B
Boondah/Macpherson*	0.26	10.1	A	0.24	11.1	A
Macpherson/Warriewood*	0.47	11.8	A	0.34	10.4	A
Macpherson/Ponderosa	0.51	16.0	B	0.57	12.4	A
Garden/Macpherson*	0.56	11.0	A	0.63	11.8	A
Boondah/Jacksons*	0.38	10.1	A	0.57	12.3	A
Jacksons/Pittwater*	0.59	14.7	B	0.79	14.2	A
Jubilee/Ponderosa	0.75	18.4	B	0.64	13.9	A
Ponderosa/Mona Vale*	0.78	41.5	C	0.80	34.2	C
Site Access/Macpherson	0.22	10.3	A	0.25	11.0	A
Site Access/Boondah	0.03	7.1	A	0.04	7.4	A

* Intersection upgraded from existing, as identified in Roads Master Plan (see Section 2.8)

It is noted that the detailed design of the upgrading of the intersection of Mona Vale Road and Ponderosa Avenue to traffic signals has not yet been undertaken, thus the analysis is based on assumptions about the possible future layout. It allows for two through lanes on Mona Vale Road with additional right turn lanes, and two approach lanes on both Ponderosa Parade and Samuel Street. This is consistent with the concept sketch in the Roads Master Plan.

The upgrading of the Pittwater Road signalised intersections are presented in the Roads Master Plan as concept plans only, thus assumptions were made in this analysis. The analyses assume that the cycle length remains the same as existing, with phase times determined by the Sidra Intersection programme. In reality, RTA would be responsible for determining the details of the signal timing. The right turn bays into Jacksons Road and Warriewood Road were assumed to be lengthened to overcome the existing problem with queues overflowing into the through lanes.

The analysis of the proposed roundabout at the intersection of the site access and Macpherson Street assumed a three way intersection only, as the details of the access arrangements for the fourth leg are unknown. The results indicate a good level of service, and thus it is expected that with a fourth leg, the roundabout would also function at a good level of service.

Overall, the results demonstrate that with the potential future developments in Warriewood Valley and the planned upgrades to key intersections, the intersections would operate at satisfactory levels of service.

3 The Proposal and its Traffic Generation

3.1 The Proposed Development

It is proposed to develop the site with 559 high density residential apartments in three to five storey buildings, constructed in two stages. Stage 1 is proposed to contain 295 apartments with the following mix:

- 4 studio apartments
- 41 one bedroom apartments
- 233 two bedroom apartments and
- 17 three bedroom apartments.

The mix of apartment sizes for Stage 2 is as follows:

- 30 one bedroom apartments
- 192 two bedroom apartments and
- 42 three bedroom apartments.

The proposed development would also include a 40 place childcare centre. The childcare centre is expected to operate as a long day centre.

Vehicular access is proposed to be available via both Macpherson Street and Boondah Road. These two accesses would be linked internally, so drivers would be able to choose whichever access was most convenient. The Macpherson Street access is proposed to be located near the western boundary of the site, and would form the fourth leg of a roundabout providing access to the retirement village on the northern side of Macpherson Street. The Boondah Road access is proposed to be about midway along the Boondah Road frontage, on the outside of the bend in Boondah Road. This is proposed to be a priority controlled tee intersection.

3.2 Traffic Generation

The volume of traffic expected to be generated by the proposed development was estimated using the rates for residential developments set out in the RTA's "Guide to Traffic Generating Developments". These guidelines define high density residential

apartment buildings as a multi-storey building containing 20 or more dwellings, usually more than five levels, with secure basement level car parking and located in close proximity to public transport services.

While the proposed development meets many aspects of that definition, the rates for medium density residential developments were adopted for this assessment, to reflect the fact that the site is not in a typical CBD or subregional centre, and thus public transport accessibility is less than for a typical high density residential development. Medium density residential buildings are defined in the Guide as a building containing at least two but less than 20 dwellings. They include villas, town houses, flats, semi-detached houses, terrace houses and other medium density developments.

The RTA guide indicates that during the weekday peak hours, medium density residential developments typically generate:

- Smaller units and flats (up to two bedrooms) 0.4 to 0.5 vehicle trips per dwelling
- Larger units and town houses (three or more bedrooms) 0.5 to 0.65 vehicle trips per dwelling.

On this basis, Table 3.1 presents the calculation of the weekday peak hour traffic generation of the proposed development.

Table 3.1 – Weekday Peak Hour Residential Traffic Generation

Apartment	Rate (veh/hr/apartment)	Vehicle Trips per Hour
Stage 1 – 296 apartments		
4 studio apartments	0.4	1.6
41 one bedroom apartments	0.4	16.4
233 two bedroom apartments	0.5	116.5
17 three bedroom apartments	0.65	11.1
Total Stage 1		145.6
Stage 2 – 264 apartments		
30 one bedroom apartments	0.4	12.0
192 two bedroom apartments	0.5	96.0
42 three bedroom apartments	0.65	27.3
Total Stage 2		135.3
Total (rounding)		**281**

The RTA guide indicates that long day care centres typically generate 0.8 vehicle trips per child during the morning peak, and 0.7 trips per child during the evening peak. For the 40 place centre proposed, this is equivalent to 32 and 28 vehicle trips during the morning and evening peak hours respectively. It is noted that this assessment was based on a somewhat larger centre, thus the analysis which follows assumes that the childcare centre would generate 34 and 30 vehicle trips during the morning and evening peak hours respectively.

The proposed development is thus expected to generate around 315 vehicle trips per hour during the weekday morning peak hour and 311 vehicle trips per hour during the evening weekday peak hour. It is noted that a trip is a one way movement, so a vehicle arriving and departing generates two vehicle trips.

4 Future Traffic Conditions

4.1 Additional Traffic Generation

As discussed in Section 3.2, the proposed development would generate some 280 vehicle trips per hour during weekday morning peak hours and 276 vehicle trips per hour during weekday evening peak hours, while the approved development and previous planning assumed this site would generate 95 vehicle trips per hour. The proposal thus increases the peak hour traffic generation of the site by some 220 and 216 vehicle trips per hour during the morning and evening peak hours respectively above that of the approved development and as used in previous planning for the Warriewood Valley road system.

This additional traffic has therefore been added to the road system to determine what impact it would be expected to have on traffic conditions. This is discussed in this section.

4.2 Future Traffic Volumes

The resulting future vehicle turning movements at intersections are presented in **Figure 4** and the two way volumes at key locations are summarised in Table 4.1.

These results indicate that the additional traffic would not significantly increase traffic on roads within the Warriewood Valley. The greatest increase of around 110 vehicles per hour (fewer than two additional vehicles per minute) would be expected to occur on Macpherson Street – Warriewood Road between the site and Pittwater Road.

As discussed in Section 2.9.1, the nominal upper traffic volumes on several roads would already be exceeded with the traffic generated by the anticipated and approved developments in the Valley. The additional traffic expected to be generated by the proposed development would increase the future volumes to further above the nominal limits, however would not be significant in the context of the overall volumes on the road system. As noted in Section 2.9.1, where nominal limits for traffic are expected to be exceeded, particular care needs to be taken in the detailed design aspects, and these would be taken into consideration with the upgrade works already planned for the area.

Table 4.1 – Future Peak Hour Traffic (veh/hr)

Road	Location	Morning Peak Hour		Evening Peak Hour	
		Potential	Future	Potential	Future
Boondah Road	South of Macpherson Street	201	257	235	291
	North of Jacksons Road	182	217	230	270
Casuarina Drive	South of Macpherson Street	86	86	74	74
Forest Road	West of Macpherson Street	551	551	155	155
Garden Street	South of Macpherson Street	1,043	1,057	1,177	1,188
Jacksons Road	West of Boondah Road	966	982	1,319	1,341
	West of Pittwater Road	871	890	1,229	1,247
Jubilee Avenue	West of Ponderosa Parade	587	587	666	666
	East of Ponderosa Parade	565	565	520	520
Macpherson Street	South of Forest Road	1,209	1,268	1,220	1,275
	West of Garden Street	1,291	1,350	1,248	1,303
	East of Garden Street	535	608	587	652
	West of Boondah Road	531	587	640	695
	West of Warriewood Road	584	695	637	747
Mona Vale Road	West of Ponderosa Parade	1,799	1,830	1,902	1,932
	East of Ponderosa Parade	1,798	1,827	1,888	1,912
Pittwater Road	North of Warriewood Road	3,474	3,529	3,753	3,810
	North of Jacksons Road	3,862	3,918	4,202	4,256
Ponderosa Parade	South of Mona Vale Road	1,210	1,269	1,264	1,318
	South of Jubilee Avenue	1,335	1,394	1,243	1,298
Samuel Street	North of Mona Vale Road	441	441	439	439
Warriewood Road	North of Macpherson Street	664	664	748	748
	South of Macpherson Street	894	1,005	904	1,014
	West of Pittwater Road	1,074	1,185	1,167	1,277

Potential = with all approved/anticipated development in Warriewood Valley
Future = as above with subject proposal.

4.3 Future Intersection Operating Conditions

The operation of the intersections was reanalysed using Sidra Intersection to determine what impact the additional traffic resulting from the proposed development would have on the operating conditions. The analysis results are presented in Table 4.2, which assumes that the intersection upgrades identified in the Roads Master Plan all occur.

Table 4.2 – Future Intersection Operating Conditions

Intersection	Morning Peak Hour			Evening Peak Hour		
	X-value	AD	LOS	X-value	AD	LOS
Existing Plus Potential Developments in Warriewood Valley						
Warriewood/Pittwater*	0.72	18.3	B	0.87	26.5	B
Boondah/Macpherson*	0.26	10.1	A	0.24	11.1	A
Macpherson/Warriewood*	0.47	11.8	A	0.34	10.4	A
Macpherson/Ponderosa	0.51	16.0	B	0.57	12.4	A
Garden/Macpherson*	0.56	11.0	A	0.63	11.8	A
Boondah/Jacksons*	0.38	10.1	A	0.57	12.3	A
Jacksons/Pittwater*	0.59	14.7	B	0.79	14.2	A
Jubilee/Ponderosa	0.75	18.4	B	0.64	17.9	B
Ponderosa/Mona Vale*	0.78	41.5	C	0.80	34.2	C
Site Access/Macpherson	0.22	10.3	A	0.25	11.0	A
Site Access/Boondah	0.03	7.1	A	0.04	7.4	A
Future with Subject Site Proposed Development						
Warriewood/Pittwater*	0.73	20.2	B	0.92	32.1	C
Boondah/Macpherson*	0.32	10.3	A	0.29	11.5	A
Macpherson/Warriewood*	0.53	13.5	A	0.36	10.6	A
Macpherson/Ponderosa	0.55	16.7	B	0.60	12.5	A
Garden/Macpherson*	0.60	11.7	A	0.67	11.9	A
Boondah/Jacksons*	0.39	10.2	A	0.60	12.3	A
Jacksons/Pittwater*	0.60	15.0	B	0.81	14.5	A
Jubilee/Ponderosa	0.80	18.9	B	0.65	18.3	B
Ponderosa/Mona Vale*	0.79	41.8	C	0.88	35.0	C
Site Access/Macpherson	0.26	10.5	A	0.31	11.1	A
Site Access/Boondah	0.11	7.2	A	0.07	7.7	A

* Intersection upgraded from existing, as identified in Roads Master Plan (see Section 2.8)

The results show that the additional traffic generated by the proposed development would have only a very minor impact on the operating conditions at the key intersections. The average delays experienced by drivers would increase only marginally at the surveyed key intersections, with most increasing by less than one second per vehicle. No additional upgrades to the intersections would be warranted by the additional traffic expected to be generated by the proposed development.

4.4 Vehicular Access

Vehicular access for the development is proposed to be via both Boondah Road and Macpherson Street. The Macpherson Street access is proposed to form a fourth leg of a roundabout providing access to the retirement village on the opposite side of Macpherson Street. The Boondah Road access would be a priority controlled tee intersection. The proposed location of the Boondah Road access would maximise sight distance for drivers exiting the site, and for passing drivers on Boondah Road to observe vehicles slowing to turn into the site or waiting to exit it.

Internally, the main access connecting Macpherson Street with Boondah Road is proposed via a future public road with all other internal access ways under private ownership. Collectively, these access routes would provide for direct access to car parking areas, internal circulation, emergency vehicle access, access for service vehicles (garbage and removalists) and on-street parking.

The future public road through the site is proposed to be designed as a local street in accordance with the Warriewood Roads Master Plan 2006 Review, which sets out road cross section guidelines as follows for local streets:

- *Minimum one traffic lane*
- *Parking allowed either side of carriageway, vehicle passing intermittent*
- *Minimum 1.0m to be maintained between carriageway and footpaths*

The Master Plan nominates that local streets carry an approximate upper limit of 2,000 vehicles per day, with a design speed of 40km/hr and speed limit of 50km/hr, and have a total carriageway width of 7.5m to cater for traffic, parking and cyclists. Cycles share the carriageway with vehicles, parking is adjacent to the kerb with no marked parking lane. A 1.5m wide footpath which may also be shared with cycles is required on at least one side of the carriageway. The total road reserve is required to be a minimum of 16.0m wide.

The proposed future public road is expected to carry up to 185 vehicles per hour (during the morning peak at the Macpherson Street access, refer **Figure 4**) which is equivalent to approximately 1,850 vehicles per day. Within the site, the volume at any point on the internal road would be less than this. This volume is consistent with the

Master Plan's guidelines for local streets, thus adoption of the street design guidelines is considered to be appropriate.

The manoeuvring of garbage trucks, removalist trucks and emergency vehicles would be checked as part of the detailed assessment of the internal layout of the site.

4.5 Car Parking

Car parking is proposed on site for 908 cars, allocated as follows:

Stage 1

- 429 resident spaces
- 42 visitor spaces
- 8 childcare centre spaces

Stage 2

- 402 resident spaces
- 27 visitor spaces.

The design and layout of car parking on the site would be reviewed as part of a detailed assessment, to ensure compliance with the relevant Australian Standards and the provisions of the Pittwater 21 DCP. Such checks are not part of this concept plan assessment.

4.5.1 Resident Parking

Resident parking is proposed on the basis of:

- 1 space per studio and 1 bedroom apartment
- 1.5 spaces per 2 bedroom apartment
- 2 spaces per 3 bedroom apartment.

Pittwater Council's DCP 21 sets out requirements for the provision of car parking for various types of development, and applies to multi-unit housing (three or more dwellings) and two and three storey residential flat buildings. The proposal comprises three and five storey buildings, and thus does not strictly satisfy the DCP definition for which the parking requirements apply. For other development types not specifically addressed in the DCP, Pittwater DCP 21 indicates that the minimum number of car

parking spaces should be determined using appropriate guidelines for parking generation and servicing facilities based on the RTA Guide to Traffic Generating Development or analysis drawn from surveyed data for similar development uses.

The proposed provision of resident parking has therefore been reviewed with regard to the rates set out in the RTA's Guide to Traffic Generating Developments, which distinguishes between medium and high density residential developments. In this case, the medium density residential flat building rates were used, as the site is not located in a subregional centre close to public transport. The proposed provision has also been reviewed with respect to the car ownership data collected as part of the 2006 Census for the Pittwater LGA. The comparison is set out below.

Table 4.3 – Comparison of Residential Parking Rates

Apartment	Proposed		Pittwater DCP 21 2-3 storey		RTA Medium Density		2006 Census Pittwater LGA	
	Rate	Spaces	Rate	Spaces	Rate	Spaces	Rate	Spaces
Stage 1								
4 x Studio	1.0	4.0	1.0	4.0	1.0	4.0	0.5	2.0
41 x 1 bed	1.0	41.0	1.0	41.0	1.0	41.0	0.91	37.3
233 x 2 bed	1.5	349.5	2.0	466.0	1.2	279.6	1.25	291.3
17 x 3 bed	2.0	34.0	2.0	34.0	2.0	34.0	1.52	25.8
Total Stage 1		429		545		359		357
Stage 2								
30 x 1 bed	1.0	30.0	1.0	30.0	1.0	30.0	0.91	27.3
192 x 2 bed	1.5	288.0	2.0	384.0	1.2	230.4	1.25	240.0
42 x 3 bed	2.0	84.0	2.0	84.0	2.0	84.0	1.52	63.9
Total Stage 2		402		498		345		301
Grand Total		**831**		**1,043**		**704**		**658**

Rate = spaces per apartment

The proposed residential parking provision thus exceeds both the RTA's requirements for medium density residential developments, and the surveyed demand for residential parking determined by the 2006 Census. The proposed provision of car parking is therefore considered to be satisfactory.

4.5.2 Visitor Parking

The plans indicate that visitor parking is proposed at a rate of one space per seven apartments. This is consistent with the aforementioned RTA Guide which recommends a visitor parking provision of between 1 visitor space per 5 – 7 dwellings.

4.5.3 Child Care Centre Parking

Pittwater DCP 21 does not specify a parking rate for child care centres. For development types not specifically addressed in the DCP, Pittwater DCP 21 indicates that the minimum number of car parking spaces should be determined using appropriate guidelines for parking generation and servicing facilities based on the RTA Guide to Traffic Generating Development or analysis drawn from surveyed data for similar development uses.

The RTA's Guide to Traffic Generating Development indicates that at child care centres, parking must be provided at the rate of one space for every four children in attendance. It is estimated that the childcare centre would cater for 40 children, which equates to a requirement for 10 car parking spaces.

It is noted that the RTA surveys found that on average, 93 percent of children travelled to/from long day care centres by car. The proposed childcare centre on this site would draw a significant proportion of its children from within the site itself, and also from within the Warriewood Valley as whole. Meriton's experience with similar centres suggests that around 40 percent of children at the centre would be residents of the development. This would reduce the proportion of children travelling by car from 93 percent to 60 percent or less, which would result in a significant reduction in the demand for parking.

Thus, given the likelihood that a significant proportion of children attending the centre would be drawn from the development itself, it is considered reasonable to reduce the number of parking spaces needed to be allocated to the child care centre below that of the RTA Guide. The reduction in the proportion of children travelling by car from 93 per cent to around 60 per cent would in turn reduce the parking demand from one space for every four children (0.25 spaces per child) to 0.16 spaces per child.

For the proposed 40 place child care centre, the reduced parking demand would therefore be for six to seven car parking spaces. The proposed provision of eight spaces would thus satisfy the likely demand, being equivalent to one space per five children. Such parking should be conveniently located to the centre to allow for the safe movement of children to and from the centre.

4.6 Impacts on Non-Car Transport Modes

As discussed in Section 2.8, planned infrastructure upgrades in Warriewood Valley include bus bays and pedestrian refuges in the vicinity of the subject site, as well as providing cycle lanes on the subarterial streets and shared pathways as per the cycle plan. These measures are expected to result in good linkages within Warriewood Valley for pedestrians and cyclists and good access to the bus services. Sydney Buses proposes to review bus service levels as a result of the proposed development and increased residential density and population.

4.7 Transport Management Measures

As demonstrated in this assessment, the already planned upgrades and improvements to the transport infrastructure of Warriewood Valley would satisfactorily accommodate the anticipated development in the area, and the additional traffic generated by the subject development. The measures identified in the Warriewood Valley Roads Master Plan (2006 Review) are therefore recommended, with the timing to be determined by Pittwater Council.

It is recommended that Sydney Buses review service levels and any infrastructure changes required to encourage public transport use on completion of the development.

5 Summary and Conclusions

5.1 Summary

Background Situation

- The site is located at the south western corner of the intersection of Boondah Road and Macpherson Street at Warriewood.
- Boondah Road and Macpherson Street are identified as subarterial routes in Pittwater Council's Roads Master Plan.
- Development on numerous sites in Warriewood Valley has been proposed by Pittwater Council for some time, which has resulted in the preparation of Development Control Plan No.29 and the Warriewood Valley Roads Master Plan.
- Surveys of vehicle movements were undertaken at key intersections in September 2009. The results show the dominance of the peripheral main roads such as Pittwater Road, Mona Vale Road and Jacksons Road in carrying significant traffic volumes. Within the Valley, Ponderosa Parade, Macpherson Street, Garden Street and Warriewood Road carry significant volumes, providing both direct access to properties and through functions.
- Analysis indicates that key intersections currently operate at satisfactory levels of service during the peak hours in accordance with prescribed RTA standards.
- Existing public transport in the Warriewood Valley is limited to buses, which link the area to Mona Vale, Gordon, Macquarie University, and to the Sydney CBD and intermediate locations.
- The subject site currently has approval for 140 lots with a mix of dwelling types.
- Assuming all the potential development in Warriewood Valley occurs, the nominal maximum traffic volumes based on their hierarchical classification would be exceeded on Garden Street, Macpherson Street, Ponderosa Parade, Jubilee Avenue and Warriewood Road. However, the already planned upgrades to intersections would satisfactorily accommodate the peak hour traffic, and the detailed design of upgrade works would take into consideration relevant issues relating to intersection design, pedestrian access and so on.

The Proposal and its Traffic Generation

- It is proposed to develop the site with 559 high density residential apartments in three to five storey buildings, and a 40 place long day care childcare centre.
- Vehicular access would be to and from both a priority tee intersection at Boondah Road and a roundabout at Macpherson Street.
- The proposed development is expected to generate around 315 and 311 vehicle trips per hour during the morning and evening peak hours respectively.

Future Traffic Conditions

- The proposed development would not significantly increase traffic on roads within Warriewood Valley.
- With the already planned infrastructure upgrades in Warriewood Valley, the key intersections are expected to operate at satisfactory levels of service with the additional traffic generated by the proposed development.
- The proposed vehicular access arrangements are considered to be satisfactory, and application of the Roads Master Plan's design for local streets is appropriate for the future public road through the site.
- Pittwater DCP 21 indicates that for development types not specifically addressed in the DCP, the minimum number of car parking spaces should be determined by reference to the RTA Guide to Traffic Generating Developments or analysis from data from similar developments.
- The proposed provision of resident and visitor car parking is in accordance with the minimum requirements of the RTA's Guide, and exceeds the surveyed demand from the 2006 Census, and is considered to be satisfactory.
- The proposed provision of car parking for the child care centre would cater for the likely demand for the centre, considering that is would draw a significant proportion of children from within the development itself.
- The transport infrastructure upgrades in the Roads Master Plan are recommended, with timing to be determined by Pittwater Council.
- It is recommended that Sydney Buses review service levels an infrastructure upgrades on completion of the development.

5.2 Conclusions

The proposed residential development at 14-18 Boondah Road Warriewood would not significantly increase traffic volumes or delays on the road system of Warriewood Valley above those previously expected and planned for as part of the Roads Master Plan. The proposed access arrangements are considered satisfactory, and are consistent with the approved development for the site. The provision of resident, visitor and child care centre car parking is satisfactory.

SITE LOCATION

RESIDENTIAL DEVELOPMENT, BOONDAH STREET, WARRIEWOOD

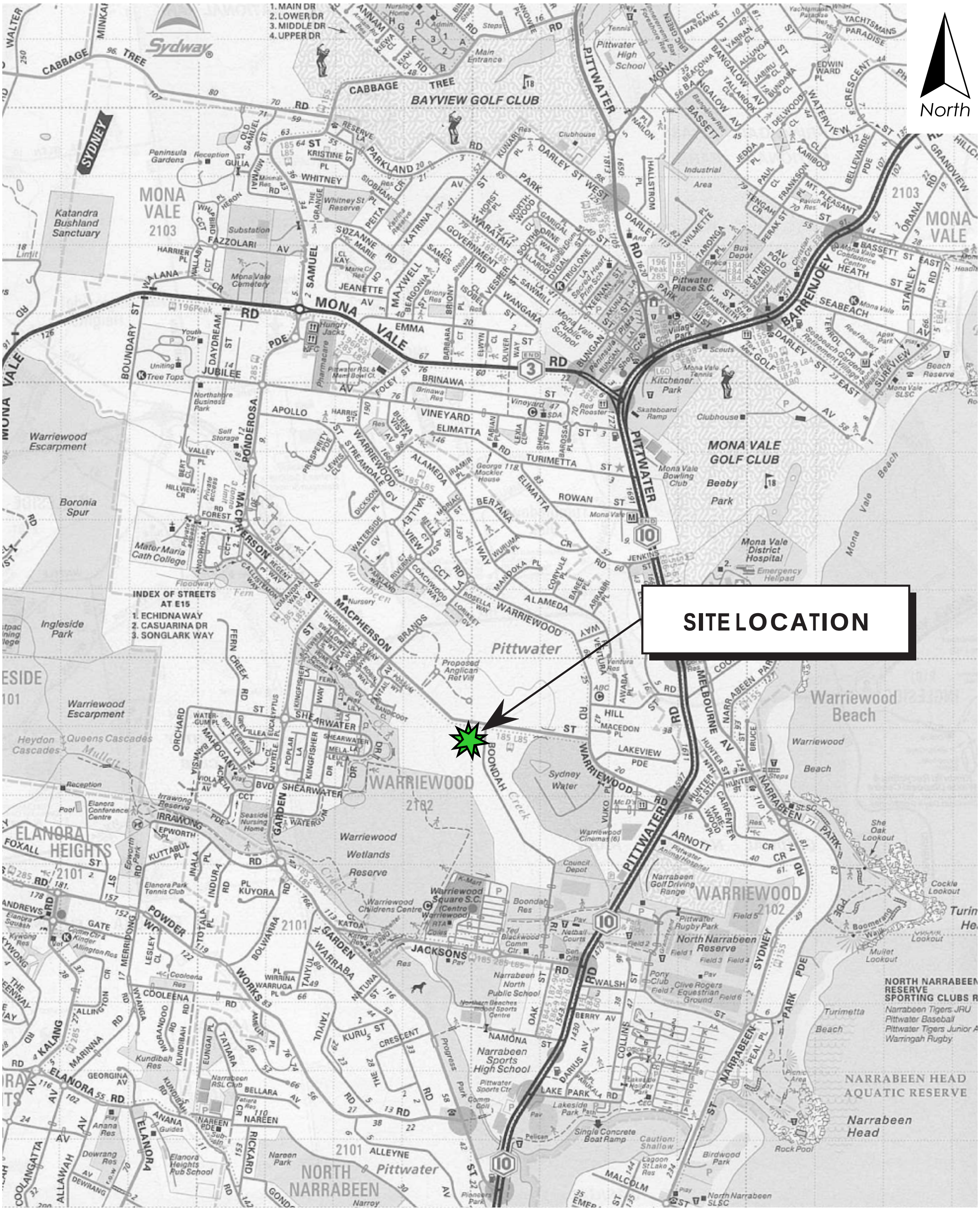

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Figure 1

Filename: CTLRCNdi01.ai

Date: 29 January 2010

EXISTING PEAK HOUR TRAFFIC

RESIDENTIAL DEVELOPMENT, BOONDAH ROAD, WARRIEWOOD

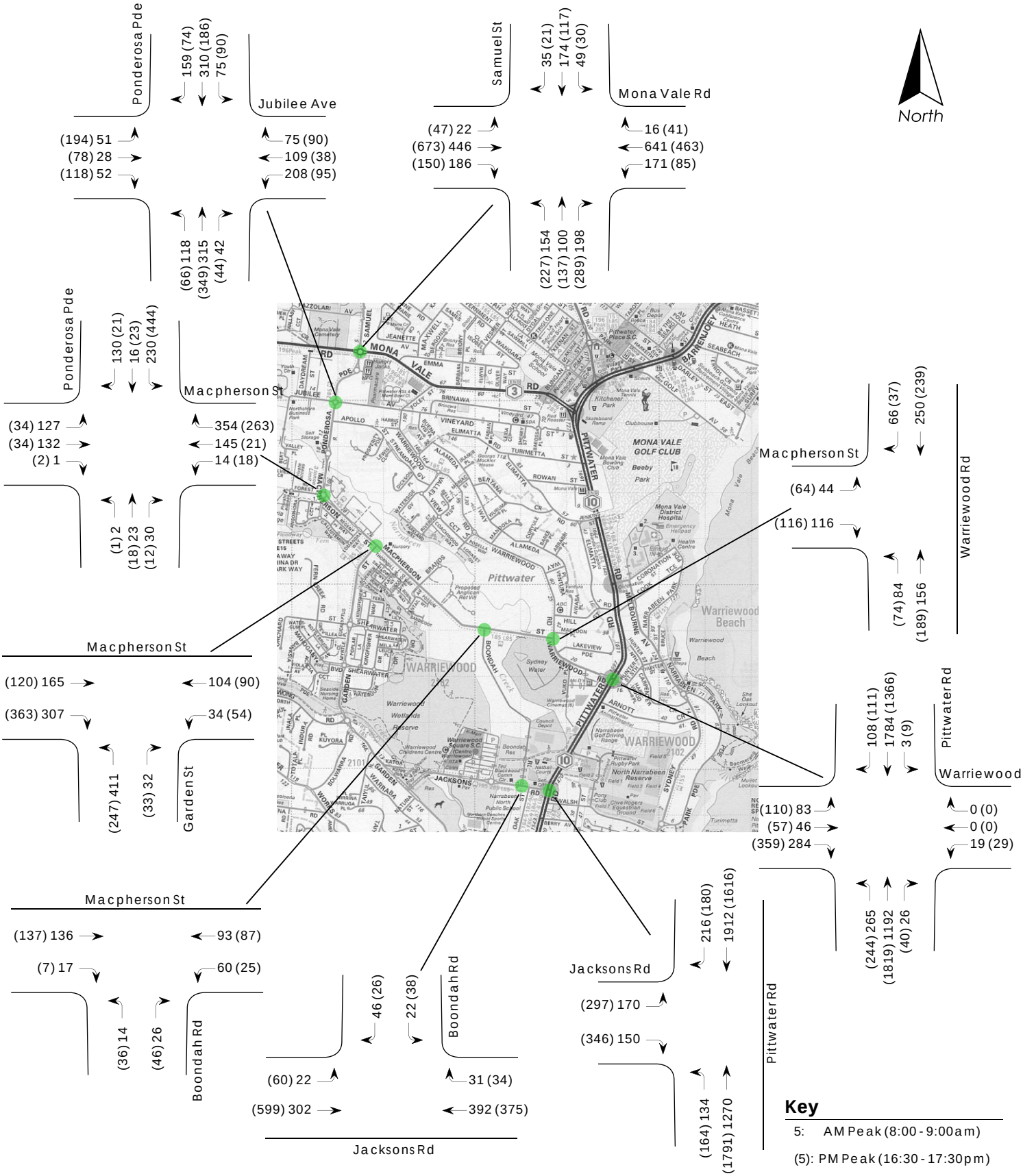

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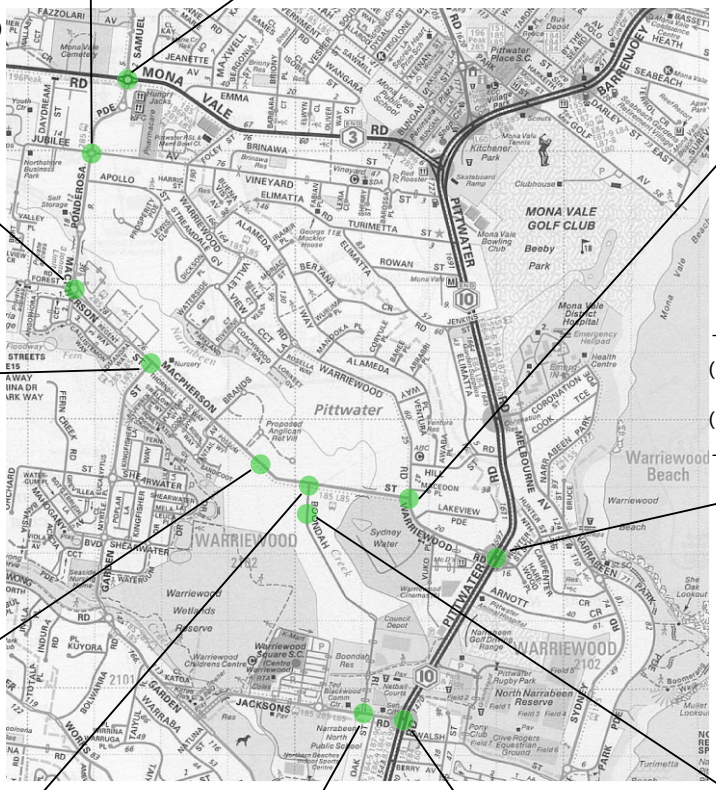
Figure 2

Filename: CTLRCNdi02.ai

Date: 29 January 2010

FUTURE PEAK HOUR TRAFFIC WITH POTENTIAL DEVELOPMENTS

RESIDENTIAL DEVELOPMENT, BOONDAH ROAD, WARRIEWOOD



Key

5: AM Peak (8:00 - 9:00am)

(5): PM Peak (16:30 - 17:30pm)

Halcrow

Figure 3

Filename: CTLRCNdi03.ai

Date: 29 January 2010

FUTURE PEAK HOUR TRAFFIC WITH SUBJECT AND POTENTIAL DEVELOPMENTS

RESIDENTIAL DEVELOPMENT, BOONDAH ROAD, WARRIEWOOD

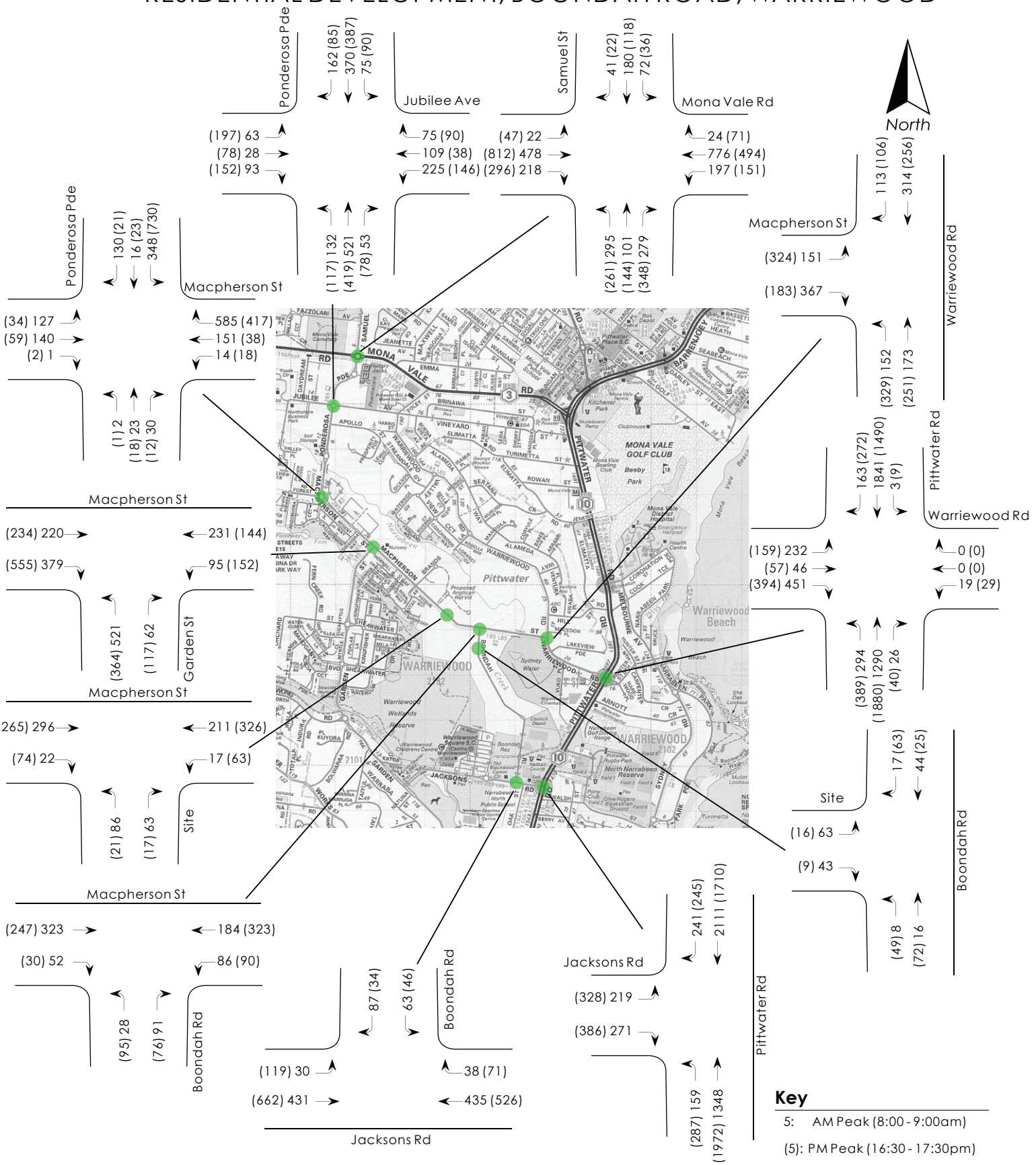


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Figure 4

Filename: CTLRCNdi05.ai

Date: 12 August 2010

Appendix A Sydney Buses Frequency Data

Sydney Buses Weekday Frequency (buses per hour)

Hour	To Mona Vale			From Mona Vale		
Starting	185	L85	182	185	L85	182
5.00am	-	-	-	1	-	-
6.00am	2	-	1	-	3	-
7.00am	1	-	2	-	3	-
8.00am	1	1	2	-	2	1
9.00am	-	2	1	-	2	1
10.00am	-	2	1	-	2	1
11.00am	-	2	1	-	2	1
12.00pm	-	2	1	-	2	1
1.00pm	-	2	1	-	2	1
2.00pm	-	2	1	-	2	1
3.00pm	-	2	1	-	2	1
4.00pm	-	2	1	-	2	1
5.00pm	-	2	1	-	2	2
6.00pm	-	2	1	-	1	2
7.00pm	-	2	1	1	-	-
8.00pm	-	1	-	1	-	-
9.00pm	1	-	-	1	-	-
10.00pm	1	-	-	1	-	-
11.00pm	1	-	-	1	-	-
12.00am	1	-	-	-	-	-

Source: www.131500.com.au, Feb 2010 using timetabled stop times at the closest bus stop to the site.

Sydney Buses Weekend Frequency (buses per hour)

Hour Starting	To Mona Vale					From Mona Vale				
	Saturday			Sunday		Saturday			Sunday	
	185	L85	182	185	L85	185	L85	182	185	L85
6.00am	-	-	-	-	-	-	1	-	-	-
7.00am	1	-	-	-	-	-	2	-	-	-
8.00am	1	1	-	1	-	-	2	-	-	1
9.00am	-	2	1	2	-	-	2	1	-	1
10.00am	-	2	-	-	1	-	2	-	-	1
11.00am	-	2	1	-	1	-	2	1	-	1
12.00pm	-	2	-	-	1	-	2	-	-	1
1.00pm	-	2	1	-	1	-	2	1	-	1
2.00pm	-	2	-	-	1	-	2	-	-	1
3.00pm	-	2	1	-	1	-	2	1	-	1
4.00pm	-	2	-	-	1	-	2	-	-	1
5.00pm	-	2	1	-	1	-	2	1	-	1
6.00pm	-	2	-	-	1	-	1	-	1	-
7.00pm	-	2	-	-	1	1	-	-	1	-
8.00pm	-	1	-	1	-	1	-	-	1	-
9.00pm	1	-	-	1	-	1	-	-	1	-
10.00pm	1	-	-	1	-	1	-	-	1	-
11.00pm	1	-	-	1	-	1	-	-	-	-
12.00am	1	-	-	1	-	-	-	-	-	-

Source: www.131500.com.au, Feb 2010 using timetabled stop times at the closest bus stop to the site.

Appendix B Land Use and Traffic Generation Data

Completed Developments – all complete at time of surveys, so no additional traffic generation allowance:
Sector 1
Sector 2
Sector 6
Sector 10
Sector 11

Not Yet Developed – these sectors have not yet been developed. Some have been formally rezoned, others have not, but none have commenced construction. Development potential thus generally remains similar to that allowed for in the Roads Master Plan update study, and assumptions used in that study have been applied here where insufficient detail is known.
Sector 3 (rezoned) to maximum 165 dwellings, assumed 50% detached, 50% medium density
Sector 5 (rezoning application) for maximum 75 dwellings, assumed 50% detached, 50% medium density
Sector 7 (rezoned) assumed FSR 0.7, 60% light industrial, 40% commercial
Sector 8 – two DAs have been lodged, the one with the higher likely generation has been used, 3,200m^2 supermarket and 750m^2 specialty shops, DA traffic report does not present traffic generation estimate, this analysis uses RTA rates for Thursday evening, assume morning one-third of evening, no discount for multi-purpose or linked trips (will result in over-estimate of future traffic conditions), assumes 80% of traffic generated from within Warriewood Valley. This internal traffic is likely to be drawn in part from the additional trips generated by the proposed developments, but no discount has been applied.
Sector 9 (rezoning application) assumed as per Master Plan – 205 detached dwellings
Sector 10A assumed as per Master Plan density – 14 detached dwellings
Sector 20 subdivision complete, DAs going to Council for dwellings

Buffer 1 (rezoned) – a Development Application has been lodged for a small part of this site, total development yield for the sector site is between 167 and 176 lots. Assumed all detached dwellings.
Buffer Area 3 (subject site) – a Development Application has been approved for 140 dwellings

DA Approved but Development Incomplete:
Sector 12 subdivision complete, dwellings under construction.
Buffer Area 2 – retirement village under construction. ARV advised that the first residents did not move in until late September 2009, after the traffic surveys were conducted. Approval is for 260 self-contained dwellings and a 119-bed residential aged care facility.

No predetermined land use under the Warriewood Valley Planning Framework:
No additional traffic generation has been allowed for these sectors.
Sector 15
Sector B

Total Traffic Generation
The total additional traffic assumed to be generated by the potential and approved developments is 1,166 vehicle trips per hour during the morning peak hour, and 1,590 vehicle trips per hour during the evening peak hour.