

*Traffic Report*

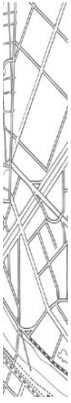
**Wahroonga Estate  
Traffic Report  
18 February 2009**

Prepared for

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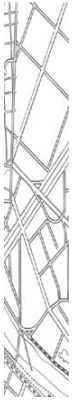
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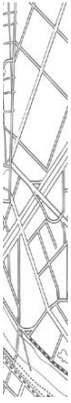


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## Executive Summary

The Wahroonga Estate has been planned to build on the close relationship between the Adventist Hospital and Church with the community that lives around it, many of whom are church members and work at the Hospital.

The proposal involves expansion of the hospital and a unique opportunity to provide housing in close proximity to it along with other facilities to support the hospital and local community. This close relationship provides the advantage that many residents will work locally and will not need to drive to and from work. This is already the case to a large extent.

Proposed non hospital development within the precinct would provide additional services and facilities for both existing and new residents of the area. These proposals include a new school, multi-purpose community facility, an increased number of professional consulting rooms and small retail shops.

The study has found that the precinct's access road system would be able to satisfactorily accommodate traffic arising from the proposed development subject to some traffic management improvements.

Of note roundabouts which accommodate two lanes southbound are needed at the intersections of Fox Valley Road / Lucinda Avenue and Fox Valley Road / Ada Avenue. These will afford satisfactory traffic capacity at these locations. A major expansion of the intersection of Fox Valley Road and the Comenarra Parkway is also proposed.

Access to the expanded hospital would be improved, through the provision of improved site access intersections.

The proposed development does not rely on proposed major road infrastructure proposals in the area such as the F3 to M2 link. However it is noted that this link would provide traffic relief to Pennant Hills Road. This would particularly benefit estate traffic passing through the intersection of Pennant Hills Road and Comenarra Parkway.

The development proposes an innovative car sharing initiative for residents within the estate. This initiative would be funded through a levy on *all* dwellings and would result in the availability of approximately one car share vehicle per six dwellings.

This car share scheme will reduce private vehicle ownership by residents and allow an overall reduction in the amount of residential parking that will need to be provided.

Parking for commercial and retail uses are proposed to be reduced having regard to the close proximity of many employee homes and the extent of business that will be derived by local residents, employees and visitors to the hospital.

Future parking needs of the hospital expansion are the subject to a separate report. That study is provided under separate cover.

Overall the study finds that subject to some road improvements, traffic aspects of the proposal will be satisfactory.

A draft Transport Management and Accessibility Plan accompanies this traffic report and this identifies measures that would enhance use of other transport access modes.



# 1. Introduction

A Preliminary Assessment Report for the development of the “Wahrenonga Estate” precinct was reviewed by the Department of Planning in April 2008. At the time, the precinct was known as the “Sydney Adventist Hospital Redevelopment”. That application included a traffic and parking impact assessment report<sup>1</sup> which reviewed existing traffic conditions, future traffic conditions at ultimate development of the precinct and included recommendations for road infrastructure improvements in and around the precinct to accommodate the future growth in traffic flows.

Following a preliminary assessment of the proposal, Director General’s requirements were issued for the preparation of an environmental assessment report to support the ultimate concept plan. The Director General’s requirements included submissions on traffic, transport and parking matters associated with the redevelopment of the estate from key stakeholders, including the NSW Roads and Traffic Authority, Ministry of Transport and Ku-ring-gai Council. Copies of the submissions from the RTA, MoT and Ku-ring-gai Council are provided in **Appendix A** of this report.

The Director General’s requirements relating to Traffic, Transport and Car Parking are summarised below:

*“Traffic Study in accordance with the Roads and Traffic Authority’s Guide to Traffic Generating Developments, with particular regard to:*

- *Existing road capacity, expected impacts on local and regional roads and any upgrade requirements;*
- *Internal road layout and access arrangements;*
- *Pedestrian and bicycle linkages; and*
- *Access for emergency vehicles.*

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<sup>1</sup> Sydney Adventist Hospital Redevelopment – Preliminary Traffic and Transport Paper, Masson Wilson Twiney Pty Limited May 2008

*Transport Management and Accessibility Plan (TMAP) for the entire site, in accordance with the Ministry of Transport Interim TMAP Guidelines, also including:*

- *Staging / Sequencing Plan;*
- *Construction Traffic Management Plan; and*
- *Voluntary Planning Agreement addressing MoT's requirements.*

*Car parking plans showing location and number of existing and proposed car parks, allocation to proposed uses and evidence confirming adequacy."*

Since the Director General's requirements were issued, the site configuration, access arrangements and potential yield of the development as a whole have been modified. In addition, the Department of Planning established a Community Reference Group to provide information and input to facilitate the planning assessment process for the site. The group consists of representatives of Hornsby and Ku-ring-gai Councils, Sydney Adventist Hospital, ACA, STEP Community Group, Bushland Catchments and Natural Reserve Reference Group, and local area residents. The CRG has met twice, receiving project briefings and providing feedback to the consultant team.

The purpose of this report is to review the proposed development as currently proposed and provide comments and additional information to respond to traffic and parking and access matters raised in the Director General's Requirements or individual submissions by key stakeholders. A separate Transport Management and Accessibility Plan (TMAP) report<sup>2</sup> has been prepared and should be read in conjunction with this report.

This traffic report has been prepared on behalf of Johnson Property Group and examines traffic implications in accordance with the methodology set out in the NSW Roads and Traffic Authority's "Guide to Traffic Generating Developments".

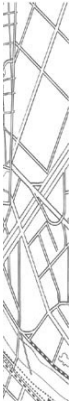
The remainder of this report is set out below:

- Chapter 2 describes the background development, road network conditions and public transport services, and discusses future road network proposals which may impact on traffic conditions in and around the site;
- Chapter 3 describes the development proposal;
- Chapter 4 presents an analysis of potential increased traffic loads and their associated impacts;
- Chapter 5 discusses off-street car parking requirements; and
- Chapter 6 presents the conclusions of the study.

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<sup>2</sup> Wahroonga Estate / Sydney Adventist Hospital TMAP Report – Halcrow MWT November 2008





## 2. Background Situation

### 2.1 Site Location and Land Use

The Wahroonga Estate, which includes the Sydney Adventist Hospital, is divided into two precincts by Coups Creek. West of Coups Creek, known as the Mt Pleasant Precinct, includes a small number of low density dwellings and residential aged care facilities.

On the eastern side of Coups Creek, the Sydney Adventist Hospital is located on the western side of Fox Valley Road, to the North of The Comenarra Parkway. The main vehicular access to and from the hospital is via a signalised intersection on Fox Valley Road. A secondary unsignalised access is located farther to the south, and is used by ambulances to access the emergency department and by a small number of staff.

Development fronting each side of Fox Valley Road includes hospital administration offices and professional consulting rooms, the SDA administration offices, school, hostel and residential accommodation, many of which have individual vehicular accesses to and from Fox Valley Road. There are also several dwellings fronting Comenarra Parkway east of the intersection with Fox Valley Road. This precinct is known as the Coups Creek East Precinct.

The area that is the subject of the concept plan is shown in **Figure 1**.

### 2.2 Road Network

The existing network serving the site is described below, noting that the RTA has set down the following guidelines for the functional classification of roads:

- Arterial roads are typically main roads carrying over 15,000 vehicles per day (1,500 vehicles per hour) and fulfilling a role as a major inter-regional link.
- Sub-arterial roads are defined as secondary inter-regional links, typically carrying volumes between 5,000 and 20,000 vehicles per day (500 to 2,000 vehicles per hour).
- Collector roads provide links between local roads and regional roads and typically carry between 2,000 and 10,000 vehicles per day (250 to 1,000 vehicles per hour).

- Local roads provide access to individual allotments, carrying low volumes typically less than 2,000 vehicles per day (350 vehicles per hour).

**Pacific Highway** is the main east to west arterial road through the area running parallel to the north shore rail line. It generally consists of three travel lanes in each direction. All major intersections, including the intersection with Fox Valley Road, are controlled by traffic signals.

**Pennant Hills Road** is the main north-south arterial road through the area connecting the F3 Freeway and Hornsby to Parramatta and the M2 Motorway. It generally consists of a divided carriageway with three lanes in each direction. Major intersections are controlled by traffic signals, and additional turn bays are typically provided at these intersections. The road carries large volumes of traffic and is also the main freight route through the area.

**Comenarra Parkway** is a sub-arterial road providing a parallel route to the M2 Motorway connecting Pennant Hills Road in the west with Ryde Road in the east. The alignment and topography of the road varies markedly along its length and in many locations these inhibit its use by buses. Whilst its purpose is to serve adjacent residential properties and surrounding residential areas, it carries a significant proportion of "through" traffic. It generally consists of a single traffic lane in each direction with unrestricted parallel parking permitted along much of its length. Its intersections with Pennant Hills Road, Wood Street, Fox Valley Road, Kissing Point Road, Wallalong Crescent and Ryde Road are signalised.

**Fox Valley Road** links the Comenarra Parkway (sub arterial) in the south to the Pacific Highway (arterial) in the north. It also provides direct access to the Sydney Adventist Hospital, a major employment centre in the area. Therefore it performs a sub arterial role in the area. It generally provides of a single traffic lane in each direction plus unrestricted parallel parking permitted along the majority of its length. Peak period parking restrictions are imposed across the hospital site frontage. It is noted that Ku Ring Gai Council classifies Fox Valley Road as a regional road<sup>3</sup>.

**Kissing Point Road**, as with Fox Valley Road, links the Comenarra Parkway with the Pacific Highway. It provides access to Turramurra Station for residents south of Pacific Highway. Therefore north of Comenarra Parkway its role through the area is also one of a sub arterial nature. South of Comenarra Parkway, Kissing Point Road functions as a local collector road for the surrounding residential area. This road forms part of the RTA's sub-regional bicycle network from Turramurra Station to Macquarie Park.

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<sup>3</sup> Ku Ring Gai Traffic Committee – KU Fox Valley Road Pre School Traffic Report, Ku Ring Gai Council 24 May 2007

**Mt Pleasant Avenue** is a local street providing access to and from Pennant Hills Road for adjacent residential properties. Right turn movements are permitted into and out of Mt Pleasant Avenue at Pennant Hills Road, however, this intersection is not signalised. Mt Pleasant Avenue provides access to land owned by the hospital on the north western side of Coups Creek.

**Osborne Road** is a cul de sac connected by traffic signals at Pennant Hills Road. Right turn movements into and out of this street are catered for in the traffic signal configuration. The street serves the Loreto School Normanhurst which accommodates the majority of the eastern frontage of the street.

**Ada Avenue** is a collector road which provides access between Fox Valley Road and the Pacific Highway. The road is well used during peak periods as right turn movements into and out of the street are permitted at the Pacific Highway. In addition, Ada Avenue provides a reasonably direct link to the railway vehicle overbridge on Redleaf Avenue to the east. It generally provides of a single travel lane in each direction with unrestricted parallel parking on both sides of the street.

**Lucinda Avenue** is a local street linking Fox Valley Road to the Pacific Highway just east of the F3 Freeway ramps. Only left in and left out movements are permitted at its intersection with the Pacific Highway. Consequently traffic flows are much greater in the evening peak as the street is used as a bypass route to gain access to the F3 Freeway. The street generally provides a single travel lane in each direction with unrestricted parallel parking on both sides of the street.

## **2.3 Existing Traffic Conditions**

### **2.3.1 Peak Period Traffic Volumes**

To examine prevailing traffic conditions, intersection traffic counts were undertaken during the morning and evening periods on Tuesday 8 May 2007 at the following locations:

1. Pennant Hills Road and The Comenarra Parkway
2. The Comenarra Parkway and Browns Road
3. The Comenarra Parkway and Fox Valley Road
4. The Comenarra Parkway and Kissing Point Road
5. Fox Valley Road and Hospital Main Entrance
6. Fox Valley Road and Hospital secondary entrance
7. Fox Valley Road and Ada Avenue
8. Fox Valley Road and Pacific Highway
9. Mt Pleasant Avenue and Pennant Hills Road

The morning peak period surveys were conducted from 7 to 9am, and the evening peak period from 2:30 to 6:30pm.

The peak hours were generally between 7:30-8:30am and 5-6pm for the morning and afternoon, respectively.

In addition to these intersection counts, automatic traffic counts on the two hospital access driveways were undertaken during the week of Monday 7 May 2007 to coincide with the intersection counts surrounding the site. These recorded hourly vehicle movements into and out of the hospital each day over a seven day period. As requested by the RTA in their submission to the Director General, further intersection counts were undertaken on Wednesday 11 June 2008 at the following intersections.

1. Fox Valley Road and Lucinda Avenue
2. Fox Valley Road and Ada Avenue
3. Pacific Highway and Lucinda Avenue

The surveyed peak hour vehicle turning movements are shown in **Figure 2**. Table 2.1 presents a summary of the existing two-way peak traffic flows on these roads.

**Table 2.1 – Existing Two Way Peak Traffic Flows (veh/hr)**

Road	Location	Classification	Morning Peak	Evening Peak
Ada Ave	West of Fox Valley Rd	Sub Arterial	565	469
Fox Valley Rd	South of The Comenarra Pwy	Sub Arterial	216	279
	North of The Comenarra Pwy	Sub Arterial	1,510	1,506
	South of Ada Ave	Sub Arterial	1,484	1,375
	North of Ada Ave	Sub Arterial	1,186	1,165
	South of Pacific Hwy	Sub Arterial	1,072	1,041
	North of Lucinda Avenue	Sub Arterial	1,560	1,331
	South of Lucinda Avenue	Sub Arterial	1,719	1,436
Lucinda Avenue	West of Fox Valley Road	Local	752	637
	East of Fox Valley Road	Local	137	138
Kissing Point Rd	North of The Comenarra Pwy	Sub Arterial	937	892
	South of The Comenarra Pwy	Collector	655	554
Mt Pleasant Ave	South of Pennant Hills Rd	Local	198	150
Osborn Rd	South of Pennant Hills Road	Local	357	303
Pacific Hwy	West of Fox Valley Rd	Arterial	4,309	4,480
	East of Fox Valley Rd	Arterial	4,971	5,123
	West of Ada Avenue	Arterial	4,155	4,158
	East of Ada Avenue	Arterial	4,008	3,904
Pennant Hills Rd	North of The Comenarra Pwy	Arterial	4,379	4,433
	South of The Comenarra Pwy	Arterial	4,872	5,150
The Comenarra Pwy	West of Fox Valley Rd	Sub Arterial	1,823	1,925
	East of Fox Valley Rd	Sub Arterial	1,395	1,356
	West of Kissing Point Rd	Sub Arterial	1,530	1,427
	East of Kissing Point Rd	Sub Arterial	1,604	1,473
The Comenarra Pwy	East of Pennant Hills Rd	Sub Arterial	1,347	1,435

The peak hourly flows indicate that the majority of roads surrounding the development are carrying traffic volumes which are consistent with their classifications. Lucinda Avenue exhibited higher than expected peak hour flows. This can be attributed to traffic using this road as a bypass route to gain access to the Pacific Highway / F3 Freeway interchange.

Ada Avenue, which links to the rail overpass north of the Pacific Highway, had recorded traffic flows in the upper range of those which would be expected for a collector road.

### 2.3.2 Intersection Operation

The intersections in the vicinity of the subject site were analysed using the SIDRA intersection analysis program. SIDRA Intersection analysis program determines the average delay that vehicles encounter and the level of service. The SIDRA outputs can be compared to the performance criteria set out in Table 2.2 to determine Levels of Service for the intersection being analysed. The Level of Service is a graded indicator of the ease with which a driver can pass through an intersection under the traffic loads being experienced at the time.

**Table 2.2 – Level of Service Criteria**

Level of Service	Average Delay per Vehicle (secs/veh)	Signals & Roundabouts	Give Way & Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & 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

Adapted from RTA Guide to Traffic Generating Developments, 2002.

For roundabouts and priority intersections, the reported average delay is for the individual movement with the highest average delay per vehicle. At signalised intersections, the reported average delay is over all movements. The results of the analysis are presented in Table 2.3, in which average delay is expressed in seconds per vehicle.

**Table 2.3 – Existing Intersection Operating Conditions**

Intersection	Control	Morning Peak		Evening Peak	
		Av Delay (sec/veh)	LOS	Av Delay (sec/veh)	LOS
Pennant Hills Road and The Comenarra Parkway	Signals	50	D	76	F
The Comenarra Parkway and Fox Valley Rd	Signals	74	F	58	E
The Comenarra Parkway and Kissing Point Rd	Signals	111	F	65	E
Fox Valley Road and Ada Avenue	Roundabout	20	B	18	B
Fox Valley Road and Pacific Highway	Signals	20	B	74	F
Mt Pleasant Avenue and Pennant Hills Road	Priority	>120	F	>120	F
Osborn Road and Pennant Hills Road	Signals	16	B	15	B
Fox Valley Road and Main Entrance	Signals	13	A	19	B
Fox Valley Road and Secondary Entrance	Priority	54	D	53	D
Pacific Highway and Ada Avenue	Signals	18	B	22	B
Pacific Highway and Lucinda Avenue	Priority	94	F	>120	F
Fox Valley Road and Lucinda Avenue	Roundabout	22	B	14	A

Av Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

From Table 2.3, it can be seen that a number of the key intersections serving the site currently operate at a poor level of service in peak periods. Recommendations to improve conditions at these intersections are discussed in Section D.1 of this report.

The secondary entrance to the hospital also operates near capacity during both peak periods with traffic having difficulty turning right out of the site. Observations indicate that the queue of traffic in Fox Valley Road from The Comenarra Parkway intersection extends past this driveway, and queued drivers tend to allow space for drivers to exit the driveway.

## 2.4 Traffic Speed

Recorded traffic speeds in Lucinda Avenue are discussed further in **Appendix F** of this report. These speed surveys found an average weekday 85<sup>th</sup> percentile speed of 48km/hr in each direction which is considered acceptable in a street with a designated speed limit of 50km/hr.

## 2.5 Existing Development

The land encompassed by the Wahroonga Estate is divided into a western and eastern precinct by Coups Creek. To the west, the Mt Pleasant Avenue precinct consists of a number of detached dwellings which are occupied by hospital staff. This precinct also includes a large aged care facility which provides independent living units and higher care hostel facilities.

East of Coups Creek on either side of Fax Valley Road, the land holdings consist of the following:

- The hospital;
- Professional consulting rooms;
- Seventh Day Adventist Church;
- Seventh Day Adventist Church Regional Administration Centre;
- Seventh Day Adventist Primary School (450 students);
- Detached and attached housing;
- Hostel for visiting doctors and church missionaries; and
- A 258 bed hostel room accommodation for staff accommodation.

The hospital and church administration operations currently employ between 2,500 and 3,000 staff. The Hospital / Church land on Mt Pleasant Avenue incorporates existing houses (private and retirement) and undeveloped land.

## 2.6 Existing Hospital Traffic Generation

### 2.6.1 Hospital Uses

Table 2.4 provides a summary of the weekday average morning and evening peak hour traffic generation recorded from the tube counters installed on the driveways of the hospital. The table presents the peak hourly volumes generated by the hospital during the morning, afternoon, and evening commuter peak periods on the surrounding road network.

**Table 2.4 – Existing Weekday Average Peak Hour Hospital Traffic Generation (veh/hr)**

Location	Hospital & Road Peak 8-9am		Hospital Peak 2-3pm		Road Network Peak 5-6pm	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Main Access	344	72	185	208	124	184
Second Access	178	37	104	37	47	56
Total	522	109	289	245	171	240
<b>Two Way Total</b>	<b>631</b>		<b>534</b>		<b>411</b>	

From Table 2.4 it is observed that whilst the morning peak for the hospital coincides with the road network peak, the afternoon peak generation of the hospital occurs during the changeover of morning and afternoon shift staff (2pm-3pm) before the evening commuter peak on the road system. The hospital generates some 630 and 410 vehicle trips per hour during the morning and evening road network peak hours respectively.

## 2.7 Existing Parking Provision

### 2.7.1 Mt Pleasant Precinct

As stated above development in this precinct consists of detached dwellings for staff accommodation and aged care facilities. Parking for detached dwellings is provided on site. The large aged care facility includes parking in common areas for staff and visitors along with garage / car port parking for self care units.

### **2.7.2 Coups Creek East Precinct**

The Hospital site includes a number of off street parking areas. Parking studies of these car parks estimated an existing hospital car park capacity of 1,270 spaces. This parking provision includes the two parking areas adjacent to the church. Developments fronting Fox Valley Road have their own individual car parks either at grade or in basements.

## **2.8 Public Transport Services**

A more detailed analysis of existing and potential future public transport services is discussed in the accompanying TMAP report. The existing public transport operations which operate past or in close proximity to the site are shown in **Figure 3** and summarised below.

### **2.8.1 Bus Services**

Shorelink operates bus services in the area, and has two routes in the vicinity of the hospital:

- Route 589 – Sydney Adventist Hospital Link – Hornsby to Sydney Adventist Hospital via Thornleigh Station and the Comenarra Parkway.
- Route 573 – Turrumurra Station to South Turrumurra via Fox Valley Road (Loop service).

Maps of these routes are provided in **Appendix B**.

### **2.8.2 Rail Services**

The nearest train stations are at Thornleigh, Wahroonga and Turrumurra. Thornleigh Station is located approximately 2km west of the hospital and Wahroonga and Turrumurra Stations are approximately 3km north east and east respectively of the hospital.

As discussed above, bus services connect the hospital to Thornleigh and Turrumurra Stations. Further discussions and analysis of existing rail services are discussed in the TMAP report.



## 2.9 Existing Commuter Travel Patterns

The Ministry of Transport's Transport Data Centre (TDC) collects and disseminates information on how and why people in Sydney travel. It does this by dividing Sydney into a number of travel zones within the resident population and number of jobs are known.

The Wahroonga Estate (excluding the Mt Pleasant Precinct) sits within Transport Data Centre (TDC) travel zone 2558. The boundaries of zone 2558 are shown in **Figure 4**. The travel zone essentially encompasses the hospital, the church and its administration facilities either side of Fox Valley Road and the small residential area between the Comenarra Parkway and the Lane Cove National park south of the hospital.

Table 2.5 summarises the volume and mode of commuters residing in this zone from the 2006 Journey to Work (JTW) data.

**Table 2.5 – Commuter Travel Originating in Zone 2558**

Mode	Train	Bus	Car Driver	Car Passenger	Other	Not Travelled on Census Day	Total
JTW Trips	117	0	328	15	31	100	591
Mode Share of Travel	24%	0%	67%	3%	6%	n/a	

Source: Table 07 JTW dataset, 2006

The transit mode share (train, ferry, light rail and bus combined) is above the Sydney-wide average of 22%, with the car mode share (car driver and car passenger), at 70%, below the Sydney-wide average of 72%.

Table 2.6 summarises the travel patterns of commuters who live and work in this zone.

**Table 2.6 – Commuter Travel Originating From and Travelling to Zone 2558**

Mode	Train	Bus	Car Driver	Car Passenger	Other	Not Travelled on Census Day	Total
JTW Trips	3	0	35	3	12	45	98
Mode Share of Travel	6%	0%	66%	6%	23%	n/a	

Source: Table 07 JTW dataset, 2006

Of the self contained commuters, the 'other' mode share of 23% (mainly walk, but also including bicycle) is more than double the Sydney wide average of 7.3%. This confirms the live / work nature of the surrounding residential area.

The level of zonal self-containment, at around 17% is relatively high compared with the Sydney wide average of 7.6% (2006 JTW data), especially given the predominantly residential land use and specialised use (SAH).

## 2.10 Bicycle Facilities

Both Hornsby Shire Council and Ku-ring-gai Municipal Council have published Cycleway maps. These indicate existing and proposed bicycle facilities. The closest to the Wahroonga Estate on the Hornsby Council side is along the alignment of the west side of the Main North Rail Line, running past Thornleigh Station on the Esplanade and past Normanhurst Station on Malsbury Road.

On the Ku-ring-gai Council side the closest facility is from Turramurra Station down Kissing Point Road to its terminal at South Turramurra. At this point an off-road facility continues through the bush along the alignment of the Great North Walk. This cycleway is a combination of a shared facility and an on-road cycleway.

## 2.11 Proposed F3-M2 Connection

The major road network improvement currently in planning that would have a bearing on traffic volumes in the immediate area is the proposed F3 – M2 link.

This is currently subject to a Federal Government planning study. A number of routes were analysed previously by Sinclair Knight Merz in a route study conducted jointly for the NSW and Federal Governments<sup>4</sup>.

Eight route options were tested in that report, with the preferred route option being a tunnel beneath Pennant Hills Road.

The route study report found that traffic volumes on the Pennant Hills Road corridor would reduce markedly with the construction of this link. However there would be limited benefits to east-west routes such as the Pacific Highway and The Comenarra Parkway.

Further planning studies on this development are continuing and timing for construction has not been fixed.

For the purpose of analysing future traffic conditions in the vicinity of the Wahroonga Estate with this link in place, a Sydney wide traffic model called EMME/2 was used to forecast future traffic flows on roads in the area.

This model included background traffic growth on roads surrounding the development site which have been forecast by the Transport Data Centre. These forecasts include expected increases in employment and population. A comparison of modelled peak hour flows in 2016 with and without the link in place are provided in Table 2.7.

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<sup>4</sup> F3-M2 Corridor Route Study – Sinclair Knight Merz 2004

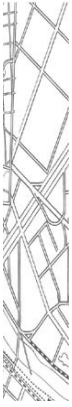
**Table 2.7 – Comparison of Modelled AM Peak Hour Flows With/Without F3-M2 Link**

Road	Location	2016 Without F3-M2 Link		2016 With F3-M2 Link	
		NB/EB	SB/WB	NB/EB	SB/WB
Fox Valley Rd	South of The Comenarra Pwy	176	179	164	180
	North of The Comenarra Pwy	858	809	881	873
	South of Pacific Hwy	1,019	1,072	1,090	1,184
Pacific Hwy	West of Fox Valley Rd	3,271	1,783	3,186	1,698
	East of Fox Valley Rd	3,776	2,341	3,679	2,285
Pennant Hills Rd	North of The Comenarra Pwy	2,459	2,523	1,939	1,831
	South of The Comenarra Pwy	3,505	3,221	3,049	2,593
The Comenarra Pwy	West of Fox Valley Rd	1,241	893	1,248	900
	East of Fox Valley Rd	479	181	502	178
	East of Pennant Hills Rd	1,241	893	1,248	900

Table 2.7 indicates that the F3-M2 link:

- would cause a slight increase in traffic flows on Fox Valley Road;
- would cause a slight drop in traffic flows on Pacific Highway;
- would have little impact on traffic flows on Comenarra Parkway; and
- would result in a significant drop in traffic flows on Pennant Hills Road.

It is noted that this traffic modelling was undertaken at a strategic level and purposely did not specifically include traffic growth related to this proposed development in order to give a better reflection of the effects of the proposed M2-F3 link on its own.



## 3. The Proposed Development

### 3.1 Development Proposal

The concept plan provides for the following development:

#### Mt Pleasant Precinct

- Increased aged care facilities including self care units and hostel expansion
- Medium density development for private and staff ownership

#### Coups Creek East Precinct

- Single lot and medium density housing
- Improved staff housing
- Expanded hospital services
- Increased number of professional consulting rooms
- Seniors' Living accommodation
- Kindergarten to Year 12 school
- Community centre
- Small retail shops to service the surrounding neighbourhood.

At this stage of planning the number of dwellings which would be occupied by staff of the Hospital and those which would not cannot be determined. Given a number of staff already live in close proximity to the Hospital and Church, it is likely this trend would continue into the future and they would occupy a reasonable proportion of the new housing.

The existing primary school would be relocated to the north of the estate and expanded to a K-Year 12 school. That is, an additional 570 students would be catered for equating to a total student population of 800 students.

Some of the existing 258 bed hostel which provides accommodation for staff and students would be demolished and replaced with apartments to meet these accommodation needs. Table 3.1 summarises a comparison of existing number of residential dwellings and the total number of dwellings proposed.

**Table 3.1 – Proposed Residential Dwellings**

Dwelling Type	Existing Number	Future Number	Difference
<b>Mt Pleasant Precinct</b>			
House / town house	30	34	+ 4
Studio / one bedroom units*	-	17	+ 17
Two / Three bedroom units	-	52	+ 52
Retirement / nursing home**	146	195	+ 49
<b>Coups Creek East Precinct</b>			
House / town house	48	42	- 6
Studio / one bedroom units*	258	446	+ 188
Two / Three bedroom units	-	386	+ 386
Retirement / nursing home**	30	30	0
<b>Total</b>	<b>512</b>	<b>1,202</b>	<b>690</b>

\*Assumes hostel room is comparable with a studio unit

\*\*Includes self care units and hostel rooms

## 3.2 Vehicular Access

### Mt Pleasant Precinct

A road connection is proposed from Mt Pleasant Avenue to Osborne Road to provide access to the traffic signals at Pennant Hills Road. Access to these traffic lights will enable safe right turn movements to and from Pennant Hills Road.

The existing break in the centre island of Pennant Hills Road at Mt Pleasant Avenue which allows right turn movements to and from Pennant Hills Road could be closed once the Osborne Road connection was made if deemed necessary by the RTA. However the intersection would still operate as a left in / left out arrangement so all Mt Pleasant Avenue traffic was not transferred to Osborne Road.

### Coups Creek East Precinct

Development of lands on either side of Fox Valley Road would include a new internal road system. This would loop around the hospital and Church on the western side with connections to Fox Valley Road at each end. On the eastern side a new spine road would connect to Fox Valley Road at its northern end and to Comenarra Parkway at its southern end. This new internal road network would spread the increased traffic loads, alleviating pressure on site access points and at the intersection of Fox Valley Road with Comenarra Parkway and provide an improved asset protection zone for existing and proposed development.

A new dual lane roundabout would be provided on Fox Valley Road-Coups Creek Way intersection, providing access to the new access road at the northern end of the estate.

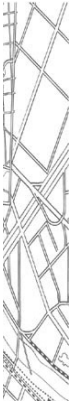
A new priority controlled intersection would be also provided on Comenarra Parkway-Ku-Ring-Gai Way intersection at the southern end of the spine road.

Fox Valley Road, between the Comenarra Parkway and the northern boundary of the site would be widened to accommodate two travel lanes in each direction. North of the estate, Fox Valley Road would include two lanes southbound up to the Pacific Highway.

On-street parking in Fox Valley Road along the frontage of the estate would be removed to provide two travel lanes in each direction. The removal may take the form of either peak hour parking restrictions or permanent restrictions and would be subject to negotiations with the RTA and Ku-ring-gai Council.

The existing secondary Hospital entrance would be converted to left in and left out only, given its close proximity to the intersection of Fox Valley Road and The Comenarra Parkway.

A plan showing the potential development by type and location is shown in **Appendix C** of this report.



## 4. Future Traffic Conditions

### 4.1 Assumed Intersection Upgrades

In recognition of existing capacity limitations at intersections on approach roads to the estate, a series of potential intersection improvements were investigated. These are shown in **Appendix D** of this report.

These intersection improvements would provide additional capacity to accommodate background traffic growth plus that generated by the proposal. The scope and nature of these improvements was determined through site inspections and trial and error testing of possible changes. The intersections identified for upgrades include:

- Pennant Hills Road and The Comenarra Parkway
- The Comenarra Parkway and Fox Valley Road
- Fox Valley Road and Pacific Highway
- The Comenarra Parkway and Kissing Point Road

The modelling of future conditions undertaken in this report assumes that these intersection improvements would be in place.

In general the existing poor operating conditions during peak periods at these intersections plus future background traffic growth justify some improvements even without further development on the Wahroonga Estate. It is however, noted that existing road reservation limitations and the private ownership of adjacent properties constrain improvement opportunities and thus in some cases it would not be possible to improve on present operating conditions.

The intersection upgrade proposals in this report will require formal assessment and scrutiny by relevant authorities.

During this process, it would be appropriate to identify those works that would be needed to cater for background traffic growth and those that would be needed to provide extra capacity to cater for the extra traffic arising from development of the Wahroonga Estate.

## 4.2 Traffic Generation

The estimated additional peak period traffic generated by each development type was assessed using existing traffic counts, consideration of expected demand for private vehicle usage and the review of existing journey to work data.

### 4.2.1 Residential Component

In total the following is provided for accommodation within lands under consideration for redevelopment:

- 258 bed hostel
- 78 houses
- 176 dwelling aged care facility

Traffic generated by these existing dwellings was captured in the intersection counts undertaken as part of this report. Therefore this traffic generation has been discounted from the calculations of future Estate traffic generation growth.

It is proposed that existing hostel beds be converted into studio / one bedroom units. The proposed car sharing initiative combined with the rotating shifts for staff living in the studio / one bedroom units will result in a low peak hour traffic generation for this component of the development.

For residential units, the RTA recommends the following peak hour traffic generation rates:

- smaller units (up to two bedrooms) – 0.4 to 0.5 trips per unit; and
- larger units (three or more bedrooms) – 0.5 to 0.65 trips per unit.

The lower end of the range would be applicable for medium density development located close to frequent public transport services.

To take into account the high proportion of hospital related persons that do and will live in the new dwellings and send their children to the local school, it is appropriate to discount the RTA normal traffic generation rate. Transport Data Centre research indicates that 31% of travel in peak periods in Sydney relates to travel to and from work. This percentage was adopted as an indicative discount and is applied in Table 4.1 to estimate increased traffic generation arising from proposed residential development.

Similarly for privately owned residential units, the RTA trip generation rates were discounted by 10% to account for the units' close vicinity to the hospital and school and the high likelihood of a hospital employee living in them.

Table 4.1 shows the adopted trip generation rates for different types of residential dwellings.



**Table 4.1 – Adopted Trip Generation Rates for Residential Units**

Dwellings	Used by	RTA Trip Rates (trips/unit)	Discount Applied	Adopted Trip Rates (trips/unit)
Houses/ Town houses	Staff Accommodation	0.85	-	0.85
Studio/ 1 bedroom units	Staff Accommodation	0.40	31%	0.28
	Student Accommodation	0.30*	31%	0.21
	Private Residential	0.40	10%	0.36
2/3 bedroom units	Staff Accommodation	0.5 – 0.65	31%	0.40
	Private Residential	0.5 – 0.65	10%	0.52
Retirement units		0.20	-	0.20

NOTE: \* - trip generation rate of 0.3 trips/unit was assumed for student accommodation

At this stage of planning the final number of dwellings which would be in private ownership cannot be determined. For the purpose of analysing the impacts of the traffic generated by the residential component, it was assumed that *all* proposed dwellings would be in private ownership. This approach is considered conservative.

The adopted traffic generation rates for the residential component have been assumed as described in Table 4.2.

**Table 4.2 – Additional Staff Accommodation / Residential Peak Hour Traffic Generation**

Dwellings	Used by	Quantity	Rate (trips/dwelling)	Trips per Hour (veh/hr)
Houses/ Town houses	Staff Accommodation	-2	0.85	-2
Studio/ 1 bedroom units	Staff Accommodation	-18	0.28	-5
	Student Accommodation	60	0.21	13
	Private Residential	164	0.36	59
2/3 bedroom units	Staff Accommodation	0	0.40	0
	Private Residential	437	0.52	227
Retirement units		49	0.20	10
<b>Total New Residential dwellings</b>		<b>690</b>		<b>302</b>

#### 4.2.2 *Hospital Expansion*

The Sydney Adventist Hospital Master Plan Review (2008) estimates that hospital activities across all services will grow about 4% per year for the period up to 2020. This would result in the net increase in traffic of about 60%. This increase accounts for the potential traffic generated by increased services and professional consulting rooms in the immediate area. This existing and future traffic generation of the hospital is shown in Table 4.3. It is noted that to afford a conservatively high assessment the analysis has not taken into account the expected 9% reduction in employee travel by car expected as a result of the travel demand management measures discussed in the TMAP report.

**Table 4.3 – Existing and Future Hospital Traffic Generation**

	Morning Peak		Evening Peak	
	Inbound	Outbound	Inbound	Outbound
<b>Existing</b>				
Main Entrance	307	64	106	157
Secondary Entrance	178	37	47	56
Total	485	101	153	213
<b>Future</b>				
Main Entrance	491	103	170	252
Secondary Entrance	295	59	75	90
Total	776	162	245	342
<b>Net Increase</b>	<b>291</b>	<b>61</b>	<b>92</b>	<b>129</b>

Note: The existing hospital traffic generation at the main entrance was reduced by 45 trips/hour to account for 60% of hostel trips using this access.

#### 4.2.3 School Component

The existing primary school would be expanded to accommodate Kinder to Year 12 students. An additional 573 students would be catered for equating to a total of 800 students.

An estimate of the additional traffic generation of the high school component was developed having regard to the travel behaviour at other schools. In this regard, Table 4.4 presents results of surveys at other non public schools.

**Table 4.4 – Other Schools Survey Results – Student Travel Modes**

School	Car Drop Off/Pick Up	Car Driver	Bus	Bicycle/Walk
St. Josephs Regional	45%	-	47%	8%
Mary MacKillop Senior School	30%	35%	30%	5%

Applying the travel mode share proportions in Table 4.5, the following travel mode proportions were estimated for the proposed high school component.

**Table 4.5 – Estimated Mode Share of the Proposed High School Component**

School Years	No. of Students	Car Drop Off/Pick Up	Car Driver	Bus	Bicycle/Walk
Years 7 to 10	382	171 (45%)	-	180 (47%)	31 (8%)
Years 11 to 12	191	58 (30%)	66 (35%)	57 (30%)	10 (5%)
<b>Total</b>	<b>573</b>	<b>229</b>	<b>66</b>	<b>237</b>	<b>41</b>

It is expected that out of 573 new students attending the proposed school, about 10% of students would be absent from school or not travel during normal before or after school periods on any one day. Therefore, it is estimated that about 516 students would travel to school in the morning arrival peak and from school during the afternoon departure peak.

The surveyed peak hours on the surrounding road network for the morning and afternoon peak periods are between 7:30 and 8:30am and 5:00 and 6:00pm. The existing Wahroonga Adventist Primary School operates between the hours of 8:40am and 2:55 pm. Hence, it is unlikely that 100% of the traffic generated by the school would be captured in the morning and afternoon peak hour.

Therefore it is assumed that about 60% of the school traffic generation would occur in the morning peak hour of 7:30-8:30am. It is expected that the impact of the school traffic on the surrounding road network would be negligible in the evening commuter peak period between 5:00pm and 6:00pm.

Table 4.6 summarises the resultant net increase in traffic generation during the morning peak hour of 7:30 – 8:30 AM.

**Table 4.6 – Proposed High School Traffic Generation (veh)**

School Years	Car (driver & drop off) <sup>2</sup>		Bus <sup>1</sup>		Total
	Inbound	Outbound	Inbound	Outbound	
Years 7 to 10	71	71	2	2	146
Years 11 to 12	56	26	1	1	84
Additional Trips	127	97	3	3	230

NB: 1 - Assumed 50 students per bus.

2 – Vehicle occupancy rate of 1.3 and 1.2 students per car was adopted for Years 7 to 10 and Years 11 to 12, respectively.

#### 4.2.4 *Faculty of Nursing*

The existing faculty of nursing is currently accommodated within the hospital. It is proposed that this facility be relocated to the south of the hospital in order for the hospital to expand. The new facility would cater for approximately 450 students (a 150 student increase over and above existing enrolment numbers) with accommodation provided for about 300 students. It is expected that the only minor amount of additional traffic would be generated by the relocation of the existing facility. The traffic growth is accounted for within the growth estimate for overall hospital activity.

#### 4.2.5 *Commercial*

An additional 7,000m<sup>2</sup> of commercial / business space is proposed. According to RTA traffic generation rates for commercial areas the peak hour traffic generation is 2 trips per 100m<sup>2</sup> assuming 21m<sup>2</sup> GFA per employee. However, in the medical industry the employee density is 29m<sup>2</sup> GFA per employee. This is equivalent to a traffic generation rate of 1.4 trips per 100m<sup>2</sup> in the peak hour. This rate results in an addition 101 trips in the peak hour.

#### 4.2.6 *Retail*

A small amount of retail (some 1,800m<sup>2</sup>) is proposed throughout the precinct. This retail would mainly consist of small shops and possibly a small supermarket / general store to service the surrounding residential area. It is not envisaged that the retail development would attract traffic into the area as it would serve only local residents or employee or passing traffic. Therefore no additional traffic generation has been for this.

#### 4.2.7 *Total Traffic Generation*

The precinct wide morning and evening peak hour additional traffic generation is shown in Table 4.7 below.

**Table 4.7 – Total Precinct Additional Traffic Generation**

Location / Use	AM Peak Hour	PM Peak Hour
<b>Mt Pleasant Precinct</b>		
Residential	41	41
<b>Coups Creek East Precinct</b>		
Residential	261	261
Hospital	352	220
School	230	-
Commercial	101	101
<b>Total Estimated Additional Traffic Generation</b>	<b>985</b>	<b>623</b>

Table 4.7 indicates that about 36% of the traffic growth is attributable to development of the hospital. This will take place over 20 years and therefore the effects of this would be felt only very gradually.

The school and commercial development are developments that are driven by population growth and therefore would be located somewhere in north eastern Sydney to serve forecast population growth irrespective of the proposed development of the Wahroonga Estate. However their location close to the rest of the Adventist Community that congregates around the church and hospital on the estate will mean that their traffic generation would be attenuated due to the high potential for walk in travel or travel accompanying another person coming to work in the area.

The effects of this is that there will be an increased concentration locally but less private vehicle travel in total on the wider road network compared to the location of these facilities elsewhere on the North Shore.

### 4.3 Trip Distribution

The distribution of vehicle trips on the surrounding road network was based on an analysis of regional Journey to Work data for residential trips and the estimate of the existing traffic pattern for all non-residential trips such as hospital, school, commercial and retail trips. A summary of the assumed trip distribution is provided in Table 4.8.

**Table 4.8 – Adopted Trip Distribution (%)**

Route	Residential Trips		Non-Residential Trips	
	To Site	From Site	To Site	From Site
Pacific Hwy (north)	20%	20%	30%	25%
Pacific Hwy (south)	10%	10%	20%	25%
Pennant Hills Road	15%	15%	35%	30%
The Comenarra Parkway (east)	55%	55%	15%	20%

Roads to be used would be as follows:

- o Pacific Hwy north provides a link to and from Hornsby and connects to north eastern suburbs
- o Pacific Hwy south provides a link to and from south and east
- o Pennant Hills Road provides a link to and from western and south western suburbs

- o The Comenarra Parkway provides a secondary link to and from south eastern suburbs.

#### 4.4 Background Traffic Growth

For the purpose of analysing future traffic conditions in the vicinity of the Wahroonga Estate, the Sydney wide EMME/2 was used to forecast future traffic flows on major roads surrounding the estate.

This model included background traffic growth on roads surrounding the estate which have been forecast by the Transport Data Centre. These forecasts include expected increases in employment and population.

The relative difference between the future (2016) forecast model and base year (2006) model was added to the surveyed peak hour intersection flows. Table 4.9 shows presents a summary of the existing and future (2016) two-way peak traffic flows on these roads without the development traffic.

**Table 4.9 – Existing and Future Two Way Traffic Flows (veh/hr) without the Development Traffic**

Road	Location	Existing		Future (2016) – No Development	
		Morning	Evening	Morning	Evening
Ada Ave	West of Fox Valley Rd	565	469	548	453
Fox Valley Rd	South of The Comenarra Pwy	216	279	217	303
	North of The Comenarra Pwy	1,510	1,506	1,420	1,463
Lucinda Avenue	South of Ada Ave	1,484	1,375	1,576	1,356
	North of Ada Ave	1,186	1,165	1,295	1,162
	South of Pacific Hwy	1,072	1,041	1,181	1,038
	North of Lucinda Avenue	1,560	1,331	1,652	1,312
	South of Lucinda Avenue	1,719	1,436	1,806	1,413
	West of Fox Valley Road	752	637	748	633
Kissing Point Rd	East of Fox Valley Road	137	138	137	138
	North of The Comenarra Pwy	937	892	1,088	1,032
Mt Pleasant Ave	South of The Comenarra Pwy	655	554	708	621
	South of Pennant Hills Rd	198	150	198	150
Pacific Hwy	West of Fox Valley Rd	4,309	4,480	4,698	4,990
	East of Fox Valley Rd	4,971	5,123	5,464	5,609
Pennant Hills Rd	North of The Comenarra Pwy	4,379	4,433	4,896	4,888
	South of The Comenarra Pwy	4,872	5,150	5,406	5,648
The Comenarra Pwy	East of Pennant Hills Rd	1,347	1,435	1,377	1,566
	West of Fox Valley Rd	1,823	1,925	1,903	1,959
	East of Fox Valley Rd	1,395	1,356	1,393	1,317
	West of Kissing Point Rd	1,530	1,427	1,618	1,533
	East of Kissing Point Rd	1,604	1,473	1,734	1,591

#### 4.5 Background Growth within Travel Zone 2558

The TDC travel zone which encompasses the Wahroonga Estate (Travel Zone 2558) includes all lands either side of Fox Valley Road between Comenarra Parkway and the Pacific Highway bounded by Coups Creek in the west and the national park in the east.

The background growth from the TDC includes increases in both employment and population within each travel zone. Any increase in employment within the travel zone, which includes the Hospital, would only be generated by the Hospital. In addition, any increase in population would be attributed to lands in close proximity to the Hospital as the surrounding residential areas are mainly large lot single dwelling houses. To date there has been little subdivision of these large lots.

The TDC estimated employment, population and peak hour trips generated by the travel zone which includes the Wahroonga Estate are shown in Table 4.10.

**Table 4.10 – Travel Zone 2558 TDC Estimated Growth to 2016**

<b>Zone 2558 TDC Data</b>	<b>2006</b>	<b>2016</b>	<b>Difference</b>	<b>% Difference</b>
Population	5761	6110	<b>+349</b>	<b>+6.06%</b>
Employment	3164	3825	<b>+661</b>	<b>+20.89%</b>
<b>AM Traffic Generation</b>				
Inbound	768	849	<b>+81</b>	<b>+10.55%</b>
Outbound	658	748	<b>+90</b>	<b>+13.68%</b>
<b>PM Traffic Generation</b>				
Inbound	617	701	<b>+84</b>	<b>+13.61%</b>
Outbound	803	881	<b>+78</b>	<b>+9.71%</b>

The estimated increase in inbound and outbound trips in Table 4.10 has been excluded from the analysis of 2016 conditions following the completion of all development within the Wahroonga Estate as this background growth is separately captured in the traffic generation estimates for the proposal.

## 4.6 Future Traffic Flows

The additional traffic generation estimated in Section 4.2 was added to the surrounding road network using the trip distribution assumptions listed in Table 4.8. The resultant vehicle turning movements at the surveyed intersections are shown in **Figure 5**. **Figure 6** shows the traffic flows through new and existing intersections within the hospital precinct. Table 4.11 summarises the future traffic flows in 2016 with and without the traffic generated by the proposed development.

**Table 4.11 – Future Two Way Traffic Flows (veh/hr) with and without Development Traffic**

Road	Location	Future (2016) – No Development		Future (2016) – with Development	
		Morning	Evening	Morning	Evening
Ada Ave	West of Fox Valley Rd	548	453	642	511
Fox Valley Rd	South of The Comenarra Pwy	217	303	217	303
	North of The Comenarra Pwy	1,420	1,463	1,866	1,740
	South of Ada Ave	1,576	1,356	1,967	1,571
	North of Ada Ave	1,295	1,162	1,592	1,319
	South of Pacific Hwy	1,181	1,038	1,478	1,195
	North of Lucinda Avenue	1,652	1,312	2,043	1,527
Lucinda Avenue	South of Lucinda Avenue	1,806	1,413	2,226	1,652
	West of Fox Valley Road	748	633	776	657
Kissing Point Rd	East of Fox Valley Road	137	138	137	138
	North of The Comenarra Pwy	1,088	1,032	1,088	1,032
Mt Pleasant Ave	South of The Comenarra Pwy	708	621	708	621
	South of Pennant Hills Rd	198	150	242	192
Pacific Hwy	West of Fox Valley Rd	4,698	4,990	4,827	5,050
	East of Fox Valley Rd	5,464	5,609	5,640	5,714
Pennant Hills Rd	North of The Comenarra Pwy	4,896	4,888	5,004	4,960
	South of The Comenarra Pwy	5,406	5,648	5,598	5,748
The Comenarra Pwy	East of Pennant Hills Rd	1,377	1,566	1,668	1,730
	West of Fox Valley Rd	1,903	1,959	2,195	2,122
	East of Fox Valley Rd	1,393	1,317	1,607	1,490
	West of Kissing Point Rd	1,618	1,533	1,847	1,727
	East of Kissing Point Rd	1,734	1,591	1,963	1,785

From Table 4.11 it can be seen that future traffic flows on the majority of roads surrounding the development site would be marginally higher than 2016 flows generated by background traffic growth alone. Post development traffic flows on Fox Valley Road in the future would be somewhat higher.

Future morning peak one-way traffic flows on Fox Valley Road, north of the Estate are expected to range between about 950 and 1,400 vehicles per hour in the peak flow direction. Evening peak one-way flows would range between about 750 and 950 vehicles per hour.

Parking in this section is typically sporadic. The notional one-way midblock capacity of a four lane road with sporadic parking is 1,500 vehicles per hour. Thus in the morning peak, the road would operate a little under capacity while in the evening peak, it would operate well within capacity. Having regard to the morning operation, some peak period parking restrictions may be needed in the vicinity of intersections to ensure that turning vehicles did not impede through traffic.

In order to ensure that traffic flowed efficiently through the Estate, it is proposed that morning and evening peak period parking restrictions be imposed along Fox Valley Road in this section.

## 4.7 Future Intersection Performance

The effect of the additional traffic on the operation of key intersections was assessed using the SIDRA Intersection analysis program. The resulting intersection performance is presented in Table 4.12, noting that the post development case analysis assume that the intersection improvements discussed in **Appendix D** are implemented.



**Table 4.12 – Existing and Future Intersection Performance**

Intersection	Control	Morning Peak Hour						Evening Peak Hour					
		Existing		Future (2016) – No Development		Future (2016) – with Development		Existing		Future (2016) – No Development		Future (2016) – with Development	
		Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS
Pennant Hills Rd and The Comenarra Pwy	Existing Signals	50	D	69	E	-	-	76	F	132	F	-	-
	Modified Signals	-	-	-	-	63	E	-	-	-	-	82	F
The Comenarra Pwy and Fox Valley Rd	Existing Signals	74	F	91	F	-	-	58	E	69	E	-	-
	Modified Signals	-	-	-	-	39	C	-	-	-	-	35	C
The Comenarra Pwy and Ku-ring-gai Way	New Priority	-	-	-	-	30	C	-	-	-	-	27	B
The Comenarra Pwy and Kissing Point Rd	Existing Signals	111	F	>120	F	-	-	65	E	117	F	-	-
	Modified Signals	-	-	-	-	48	D	-	-	-	-	94	F
Fox Valley Rd and Ada Ave	Existing Roundabout	20	B	22	B	80	F	18	B	19	B	21	B
	Modified Roundabout	-	-	-	-	20	B	-	-	-	-	17	B
Fox Valley Rd and Pacific Hwy	Existing Signals	20	B	26	B	-	-	74	F	103	F	-	-
	Modified Signals	-	-	-	-	29	C	-	-	-	-	112	F
	Modified Signals <sup>#</sup>	-	-	-	-	28	C	-	-	-	-	82	F
Mt Pleasant Ave and Pennant Hills Rd	Existing Priority	>120	F	>120	F	>120	F	>120	F	>120	F	>120	F
Pennant Hills Rd and Osborn Road	Existing Signals	16	B	26	B	29	C	15	B	18	B	20	B
Fox Valley Rd and Main Hospital Entrance	Existing Signals	13	A	13	A	-	-	19	B	18	B	-	-
	Modified Signals	-	-	-	-	21	B	-	-	-	-	23	B
Fox Valley Road and Second Hospital Access	Existing Priority	54	D	58	E	-	-	53	D	64	E	-	-
	Modified Priority	-	-	-	-	17	B	-	-	-	-	18	B
Fox Valley Road and Coups Creek Way	New Roundabout	-	-	-	-	18	B	-	-	-	-	16	B
Pacific Hwy and Ada Ave	Existing Signals	18	B	20	B	25	B	22	B	31	C	34	C
Pacific Hwy and Lucinda Ave	Existing Priority	94	F	>120	F	>120	F	>120	F	>120	F	>120	F
Fox Valley Rd and Lucinda Ave	Existing Roundabout	22	B	70	E	>120	F	14	A	16	B	16	B
	Modified Roundabout	-	-	-	-	28	B	-	-	-	-	15	A

NOTE: # - option with pedestrian overbridge on Pacific Highway with surface pedestrian crossing removed.

From Table 4.12, it can be seen that at ultimate occupation of all the development proposed and with the intersection improvements implemented, intersection operation would be similar or improved at all intersections except:

- Lucinda Avenue / Pacific Highway (currently left in / left out intersection)
- Fox Valley Road / Lucinda Avenue (AM peak only)
- Fox Valley Road / Ada Avenue (AM peak only)
- Fox Valley Road / Pacific Highway (PM peak only)

#### Lucinda Avenue / Pacific Highway

The proposed development would not result in markedly higher future traffic flows in Lucinda Avenue (see Table 4.11). It is also noted that intersection of Pacific Highway / Lucinda Avenue which is left in / left out only currently operates at a poor level of service for the left turn into Pacific Highway. In this regard the SIDRA analysis tends to exaggerate delays as it does not take into account interruption to upstream traffic in Pacific Highway which makes it easier for the traffic turning left out of Lucinda Avenue.

There is no opportunity to increase the capacity of the intersection of Pacific Highway with Lucinda Avenue. The high usage of Lucinda Avenue occurs due to a combination of bypass traffic using the street and the school it serves.

#### Fox Valley Road / Lucinda Avenue

Ku Ring Gai Council has installed a number of raised thresholds in Ada Avenue to curtail the number of vehicles using the street. However no traffic facilities have been installed in Lucinda Avenue. Such would be a possible way of moderating traffic impacts on this road.

#### Fox Valley Road / Ada Avenue

As noted above, the intersection of Fox Valley Road and Ada Avenue would operate unsatisfactorily at level of service F during the morning peak period, and would operate with acceptable delays during the afternoon peak period. The intersection of Fox Valley Road and Lucinda Avenue would also operate at a poor level of service in the morning peak but at a satisfactory level of service in the PM peak.

The future operating conditions at these intersections were remodelled with Fox Valley Road widened locally to two lanes in the southbound direction and the roundabouts at both Ada Avenue and Lucinda Avenue widened to two lanes southbound also.

From Table 4.12, it can be seen that the provision of dual lane roundabouts for southbound movements at the Fox Valley Road / Ada Avenue and Fox Valley Road / Lucinda Avenue intersection would satisfactorily cater for future traffic volumes.

#### Fox Valley Road / Pacific Highway

The widening of Fox Valley Road to provide three lanes on its approach to Pacific Highway would result in satisfactory performance in the morning peak period.

In the evening peak period, the effects of traffic growth would be more pronounced. This is because there are only two lanes northbound and evening peak flows are heaviest in this direction.

With the addition of background traffic growth, the operation of the intersection would deteriorate significantly in the evening peak period with average delays increasing from 74 seconds per vehicle at present to 103 seconds per vehicle in future. With widening of the Fox Valley Road approach added along with additional Wahroonga Estate traffic, there would only be a small deterioration to 112 seconds per vehicle.

To achieve further reduction in delay, it would be possible to remove the pedestrian crossing of Pacific Highway and replace it with a pedestrian overbridge. This would allow traffic signal green time to be more efficiently allocated such that average delays per vehicle would reduce to 82 seconds per vehicle in the evening peak period.

The secondary entrance to the hospital as left in and left out control would operate at a good level of service. The new dual lane roundabout near the northern boundary of the estate would satisfactorily serve the school and residential development in this part of the Estate.

#### **4.8 Effects of the F3-M2 Link**

To examine effects of aggregate traffic changes in the area, the 2016 increase in traffic flows forecast using the EMME/2 model with and without the F3-M2 link were added to the future traffic flows estimated above for the ultimate development of the Wahroonga estate. As with modelling 2016 conditions post development in Section 4.6, the background traffic growth from zone 2558 has been removed to avoid double counting of the development traffic.

A comparison of intersection performance for existing and future conditions with and without the proposed F3-M2 link is provided in Table 4.13.

**Table 4.13 –Comparison of Intersection Performance with and without F3-M2 Link**

Intersection	Control	Morning Peak Hour						Evening Peak Hour					
		Existing		Future (2016) – with Development without F3-M2 Link		Future (2016) – with Development with F3-M2 Link		Existing		Future (2016) – with Development without F3-M2 Link		Future (2016) – with Development with F3-M2 Link	
		Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS	Avg Delay	LoS
Pennant Hills Rd and The Comenarra Pwy	Existing Signals	50	D	-	-	-	-	76	F	-	-	-	-
	Modified Signals	-	-	63	E	38	C	-	-	82	F	51	D
The Comenarra Pwy and Fox Valley Rd	Existing Signals	74	F	-	-	-	-	58	E	-	-	-	-
	Modified Signals	-	-	39	C	41	C	-	-	35	C	35	C
The Comenarra Pwy and Ku-ring-gai Way	New Priority	-	-	30	C	32	C	-	-	27	B	29	B
The Comenarra Pwy and Kissing Point Rd	Existing Signals	111	F	-	-	-	-	65	E	-	-	-	-
	Modified Signals	-	-	48	D	48	D	-	-	94	F	94	F
Fox Valley Rd and Ada Ave	Existing Roundabout	20	B	80	F	70	E	18	B	21	B	20	B
	Modified Roundabout	-	-	20	B	20	B	-	-	17	B	17	B
Fox Valley Rd and Pacific Hwy	Existing Signals	20	B	-	-	-	-	74	F	-	-	-	-
	Modified Signals	-	-	29	C	29	C	-	-	112	F	97	F
	Modified Signals <sup>#</sup>	-	-	28	B	29	C	-	-	82	F	82	F
Mt Pleasant Ave and Pennant Hills Rd	Existing Priority	>120	F	>120	F	>120	F	>120	F	>120	F	>120	F
Pennant Hills Rd and Osborn Road	Existing Signals	16	B	29	C	23	B	15	B	20	B	17	B
Fox Valley Rd and Main Hospital Entrance	Existing Signals	13	A	-	-	-	-	19	B	-	-	-	-
	Modified Signals	-	-	21	B	22	B	-	-	23	B	23	B
Fox Valley Road and Second Hospital Access	Existing Priority	54	D	-	-	-	-	53	D	-	-	-	-
	Modified Priority	-	-	17	B	17	B	-	-	18	B	19	B
Fox Valley Road and Coups Creek Way	New Roundabout	-	-	18	B	19	B	-	-	16	B	16	B
Pacific Hwy and Ada Ave	Existing Signals	18	B	25	B	24	B	22	B	34	C	31	C
Pacific Hwy and Lucinda Ave	Existing Priority	94	F	>120	F	>120	F	>120	F	>120	F	>120	F
Fox Valley Rd and Lucinda Ave	Existing Roundabout	22	B	>120	F	>120	F	14	A	16	B	18	B
	Modified Roundabout	-	-	28	B	47	D	-	-	15	A	21	B

NOTE: # - option with pedestrian overbridge on Pacific Highway with surface pedestrian crossing removed.

From Table 4.13, it can be seen that the proposed link would provide little relief for most intersections surrounding the site. The exception to this is the intersection of Pennant Hills Road and The Comenarra Parkway.

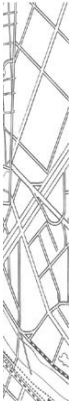
Nevertheless, as a result of the identified intersection improvements, most of intersections would operate at a level of service similar or better than the present.

#### **4.9 Sequencing of Road Improvements**

As discussed above, the traffic growth estimates for the Wahroonga Estate considered above covers development of the hospital up to 2020.

In addition the proposed F3-M2 link will lead to reductions in traffic on both Pacific Highway and Pennant Hills Road. In view of this, the following indicative road improvements program is suggested.

- Priority 1 Package of Works:  
Intersections of Fox Valley Road with:
  - site accesses
  - Ada Avenue
  - Lucinda Avenue
  - Comenarra ParkwayInvestigate possible Osborne Road connection for Mt Pleasant precinct.
  
- Priority 2 Package of Works:  
Intersection of Fox Valley Road with Pacific Highway  
Intersection of Kissing Point Road with Comenarra Parkway  
Review parking restrictions on Fox Valley Road
  
- Priority 3 Package of Works:  
Intersection of Comenarra Parkway with Pennant Hills Road (this would be reconsidered once timing of the F3-M2 link was known).



## 5. Parking Provision

### 5.1 Hospital Parking Provision

A detailed parking assessment of the hospital has been undertaken by Parking Consultants International Pty Ltd. That study forecasts the future parking demand of the hospital site and provides recommendations for expanded parking areas to cope with the additional demand. That study is provided under separate cover.

### 5.2 Residential Parking Provision

#### 5.2.1 *Car Sharing Proposal*

The church proposes to build on its already high car pooling practice and introduce an innovative car pooling system for staff, students and residents who will reside in the new residential community on the Estate. Cars would be booked in advance, in a similar manner to a number of schemes which currently operate within the Sydney metropolitan area (e.g. [www.charterdrive.com.au](http://www.charterdrive.com.au)).

A variety of car types will be provided to cater for different needs of new residents ranging from small cars, where only one person is using the car, up to people movers where residents can travel together in large groups, for example, for recreational trips.

The car pooling proposal would have the potential to reduce car usage by staff and hospital staff. As nurses and hospital staff work at different times throughout a 24 hour period depending on their shift, they have the opportunity to share vehicles, using them at different times of the day.

The proposal includes a condition of occupation / ownership that all residencies (excluding aged care) would pay a levy to support the car share scheme and provide capital for its operation<sup>5</sup>. Management fees and hire costs would be imposed on vehicle usage similar to existing schemes which operate in the Sydney metropolitan area.

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<sup>5</sup> *Car Sharing: An Overview* (The Department of Environment and Heritage, 2004) suggests that higher ratios may be sustainable and the number of car share vehicles may be reduced if it is demonstrated that a 1:4 ratio is too low. Any residual parking will revert to private parking associated with existing residential development.

The development proposes a car pooling provision of one vehicle per 6 dwellings with this subject to revision up or down once the scheme was operating and actual usage was established. This scheme will reduce the need for occupants to own individual cars and hence will allow reduced provision of parking spaces.

### 5.2.2 *Ku Ring Gai Council DCP 43*

The following subsections compare the proposed parking provision with the Ku Ring Gai Council requirements. The DCP recommends the following parking provision for normal residential situations:

#### Dwelling Houses

- 2 spaces for single occupancy.

#### Dual Occupancy

- minimum 1 space per dwelling under 125sqm.
- 2 spaces per dwelling (dwellings >125sqm)

#### Medium Density

- 1 bedroom unit:- 1 space per unit
- 2 bedroom unit:- minimum multiple of 1.25 spaces per unit.
- 3 bedroom unit:- minimum multiple 1.5 spaces per unit.
- Visitor parking: 1 space per 4 units.

### 5.2.3 *Proposed Residential Parking Provision*

To reduce the traffic impacts of the proposed and having regard to the existing low journey to work private vehicle usage by persons who currently live in close proximity to the Hospital, the Concept Plan proposes the following parking provision for residential (non aged care) dwellings within the estate.

- |                       |                       |                             |
|-----------------------|-----------------------|-----------------------------|
| • Studio:-            | 1 space per 4 units   | (not listed in DCP)         |
| • 1 bedroom:-         | 1 space per 2 units   | (50% reduction in DCP rate) |
| • 2 bedroom:-         | 1 space per unit      | (25% reduction in DCP rate) |
| • 3 bedroom:-         | 1 space per unit      | (50% reduction in DCP rate) |
| • Houses / Townhouses | 2 spaces per dwelling | (No reduction in DCP rate)  |

The on site parking provision would be complimented by access to the car sharing scheme.

A comparison the proposed on site parking provision for residential dwellings and the DCP requirements for this precinct is provided in Table 5.1.

**Table 5.1 – Comparison of Proposed Residential Parking Provision versus DCP Parking Requirements**

Dwelling Type	Future Number	DCP Rate	DCP Parking Required	Proposed Rate	Proposed Parking Provision
<b>Mt Pleasant Precinct</b>					
House / town house	34	2 spaces per dwelling	68	2 spaces per dwelling	68
Studio / one bedroom units <sup>1</sup>	17	1 space per dwelling <sup>2</sup>	17	1 space per 4 units or 1 space per 2 units <sup>3</sup>	6
Two / Three bedroom units	52	1.25 spaces per dwelling or 1.5 spaces per dwelling <sup>4</sup>	72	1 space per unit <sup>4</sup>	52
<b>Sub Total</b>	<b>103</b>		<b>Sub Total 157</b>		<b>126</b>
<b>Coups Creek East Precinct</b>					
House / town house	42	2 spaces per dwelling	84	2 spaces per dwelling	84
Studio / one bedroom units <sup>1</sup>	446	1 space per dwelling <sup>2</sup>	446	1 space per 4 units or 1 space per 2 units <sup>3</sup>	140
Two / Three bedroom units	386	1.25 spaces per dwelling or 1.5 spaces per dwelling <sup>4</sup>	531	1 space per unit <sup>4</sup>	386
Car Pool Parking		---	---	1 vehicle per 6 dwellings	146
<b>Sub Total</b>	<b>874</b>		<b>Sub Total 1,061</b>		<b>756</b>
			<b>Grand Total 1,218</b>		<b>882</b>

(1) Assumes hostel room is comparable with a studio unit

(2) 1 bedroom parking rate has been applied to studio apartments

(3) Assumed 75/25 split between studio and one bedroom dwellings

(4) Assumed 50/50 split between two bedroom and three bedroom dwellings

It is noted that the DCP rates are blanket rates applied throughout Ku-Ring-Gai and thus it would be reasonable to vary them when non standard situations were to apply.

In this case the proposed parking provision for private vehicles is considered appropriate as:

- student nurses and junior medical staff would be less likely than other residents of Ku-ring-gai to own cars;
- the fact that most persons living in the accommodation would also work in the area would reduce the need to own a car; and
- the availability of the car sharing scheme would reduce the need to own a car or have a second car.

#### 5.2.4 Visitor Parking

It is proposed that visitor parking would be provided in the form of on site parking provision within car parks complimented by the availability of on street parking on the estate's internal road network. The proposal is to provide an overall visitor parking provision of 1 space per four units in accordance with Council's DCP.



### 5.2.5 *Aged Care*

SEPP Seniors Living is the applicable control in relation to parking for aged care. In accordance with this, it is proposed to provide parking for this component as follows:

- independent living not subsidised – 1 space per two bedrooms in each dwelling.
- independent living subsidised – 1 space per five homes
- hostels and nursing homes – 1 space per ten homes plus one space per 2 staff.

### 5.2.6 *Commercial*

DCP43 requires 1 space per 33sqm gross floor area plus 1 space for a resident manager or caretaker.

In this case a large proportion of the commercial development will provide ancillary services to the hospital and church operations. Accordingly many visits to these will be made by persons living or working in the area who would either not require parking or would park elsewhere (e.g. in the hospital car park).

In general, a parking rate of 1 space per 100m<sup>2</sup> is proposed for new commercial floorspace. The parking provided for existing commercial buildings will be maintained. Parking needs for each future commercial building will be considered having regard to its particular needs.

### 5.2.7 *Retail*

Similar to commercial development, the retail development is proposed to provide a strictly local service function and therefore will have a high proportion of walk in trade. In view of this, a parking provision rate of 3 spaces per 100m<sup>2</sup> is proposed, this being about one half of the 1 space per 17m<sup>2</sup> required in the Ku-Ring-Gai DCP.

## 5.3 **Hospital Expansion**

As stated previously, the parking needs of the Hospital expansion are the subject of a separate report undertaken by Parking Consultants International.

It is proposed that the needs of each development element be determined and met once a concrete proposal for it was formulated.



## 6. Conclusions and Recommendations

This report analyses the potential traffic impacts of the revised concept plan for the development of land known as the “Wahroonga Estate”, located in the vicinity of and including the Sydney Adventist Hospital at Wahroonga. This report has also provides additional information and analysis requested in the Director General’s requirements. Detailed responses to issues raised by each key stakeholder are provided in **Appendix E** of this report.

The findings of the study are as follows:

- The Wahroonga Estate is a good example of a live-work community with a high proportion of employees who live in the area either walking or cycling to work.
- The expansion of the Hospital facilities and accommodation will increase employee numbers, however many of these employees travel out of peak periods as they work in shifts.
- This already does and will continue to attenuate the traffic generation of the estate.
- To expedite traffic flows on Fox Valley Road along the frontage of the site, clearway parking restrictions are proposed To provide an additional southbound lane from the Pacific Highway.
- The following suggested intersection upgrades would be sufficient to accommodate the demand generated by the proposed development of the estate including the expansion of the hospital with the overall level of service of the road system maintained at its current performance level.
  - A dual lane roundabout at the intersection of the northern access road and Fox Valley Road.
  - Dual lane (southbound) roundabouts in place of the single lane roundabouts at the intersections of Fox Valley Road-Ada Avenue and Fox Valley Road-Lucinda Avenue.
  - Capacity improvements at the following locations as detailed in this report:
    - Pennant Hills Road and Comenarra Parkway
    - Comenarra Parkway and Fox Valley Road
    - Comenarra Parkway and Kissing Point Road
    - Fox Valley Road and Pacific Highway

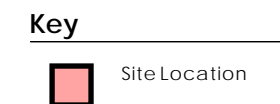
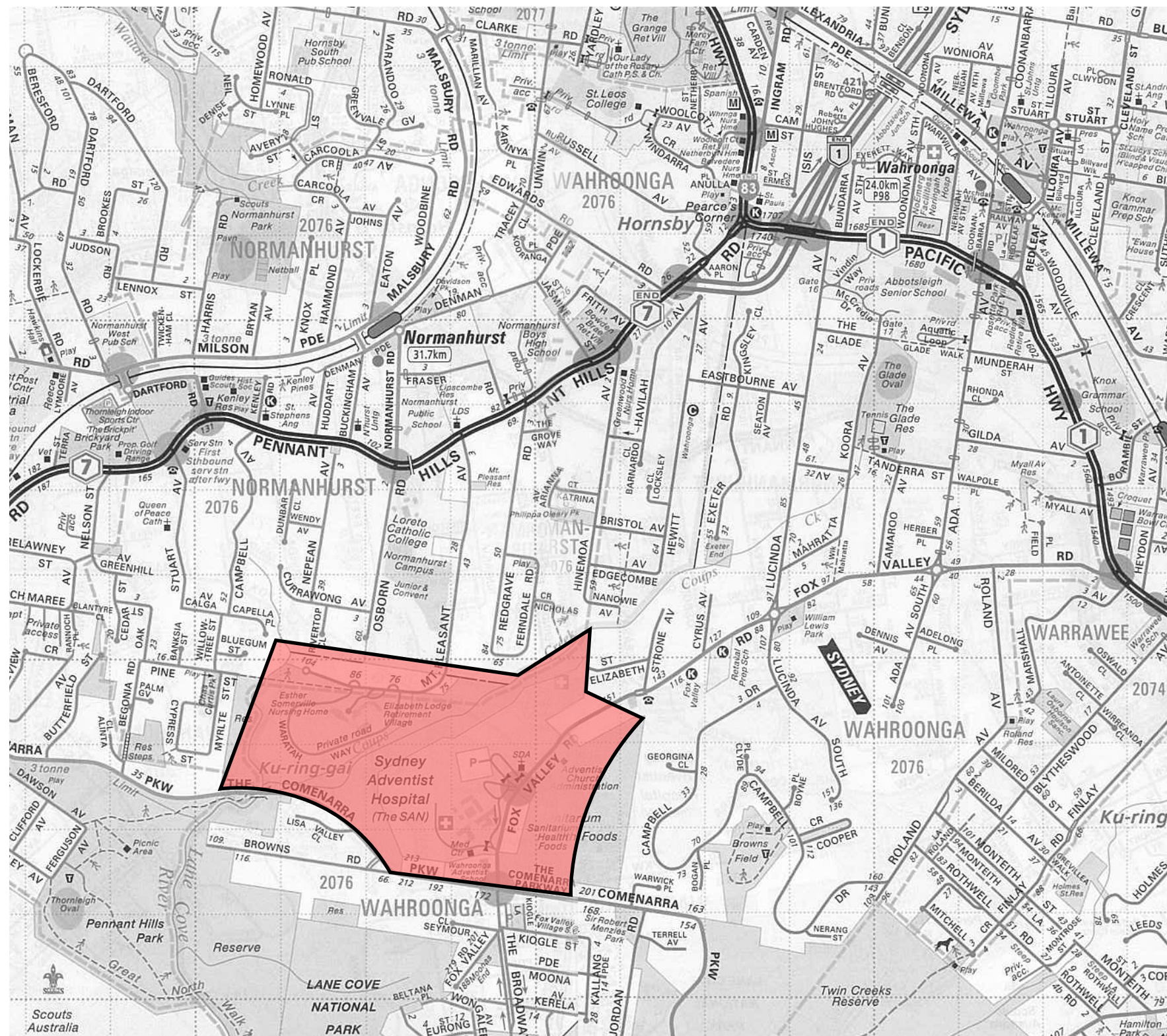
- The proposed parking provision rates for residential, commercial and retail uses are below those set in the Ku-ring-gai Council DCP for parking. However they are considered appropriate having regard to the high proportion of employees that will live on the site, a proposed car sharing scheme and the predominance of retail trade that will be derived from residents and employees of the site.
- The car sharing scheme for all residential accommodation would build on the hospital's existing successful car pooling scheme and result in lower traffic generation than for a typical residential development.
- The redevelopment of the precinct will provide a range of facilities and services in close proximity to existing and new residents, reducing the need to travel by private vehicle for certain trips such as education, retail, and employment.

Overall traffic and parking aspects of the proposal are considered to be satisfactory as:

- an appropriate amount of parking will be provided
- provision of an on site employee accommodation, fostering of car pooling and implementation of a car sharing scheme will minimize traffic generation; and
- proposed intersection improvements will more than offset the effects of the additional traffic that would be added to the traffic using them.

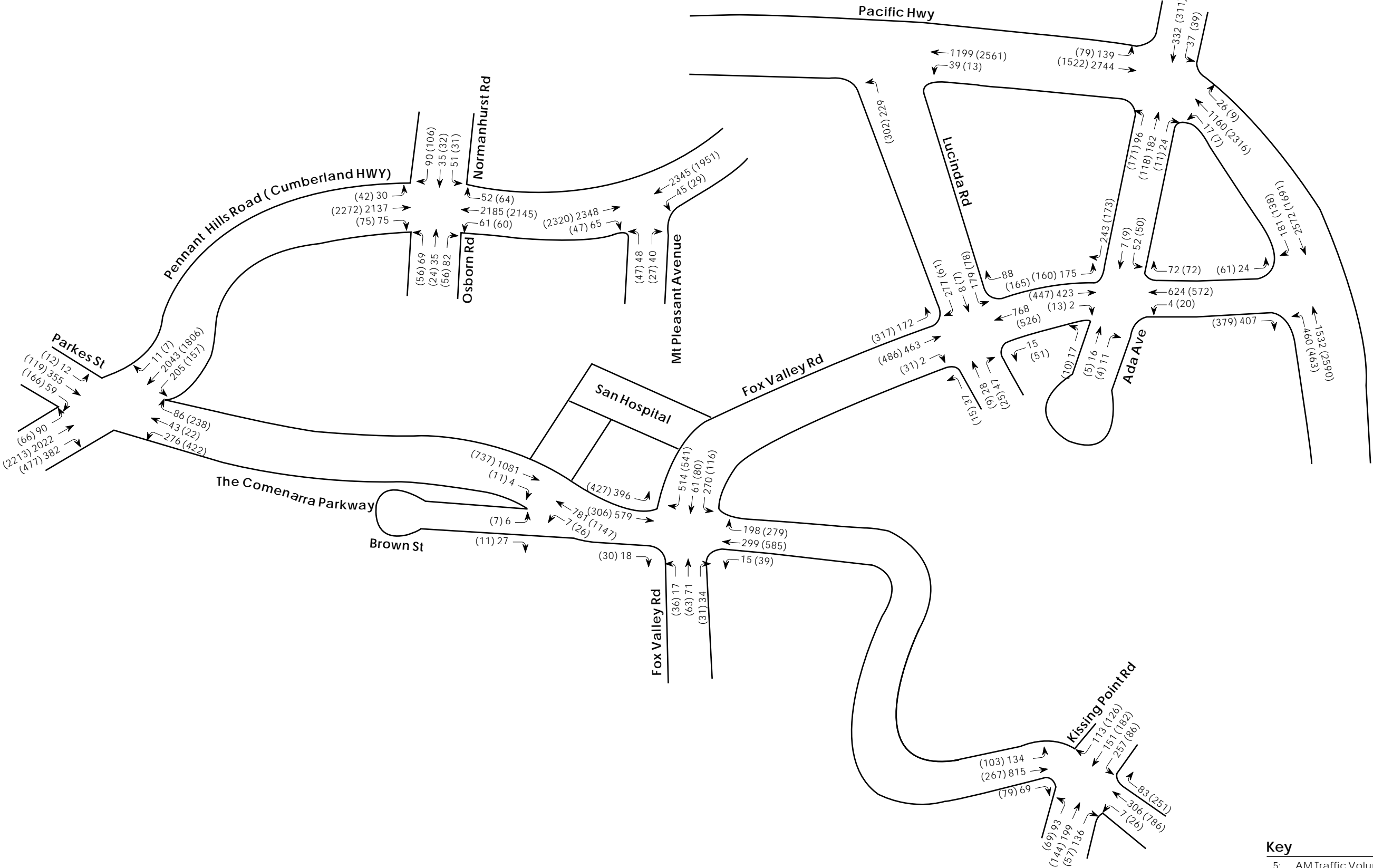
# SITELLOCATION

## WAHROONGA ESTATE MASTERPLAN



# EXISTING PEAK HOUR TRAFFIC FLOWS (VEH/HR)

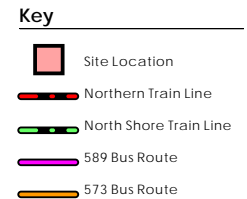
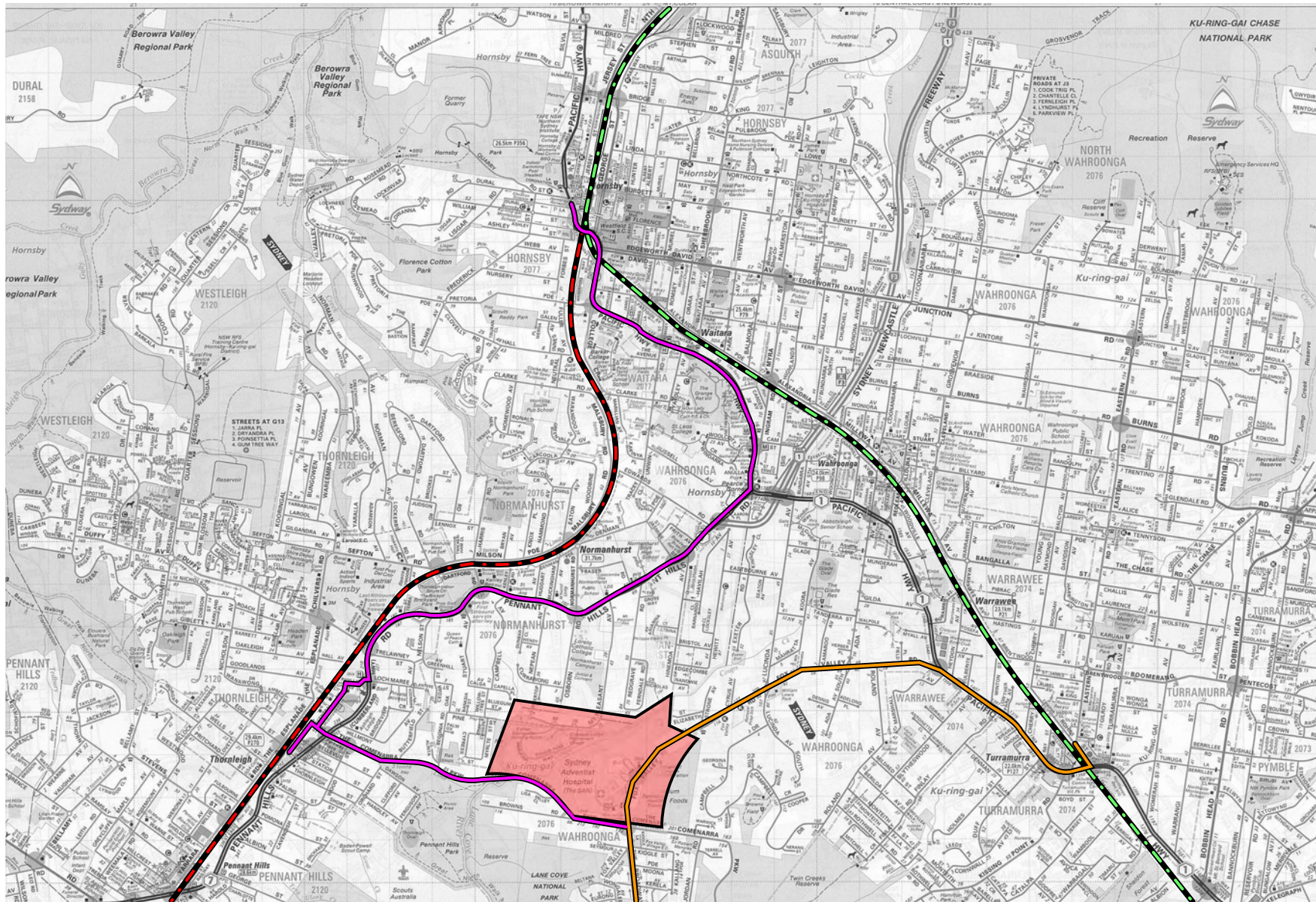
WAHROONGA ESTATE MASTERPLAN



**Key**  
 5: AM Traffic Volumes (veh/hr)  
 (5): PM Traffic Volumes (veh/hr)

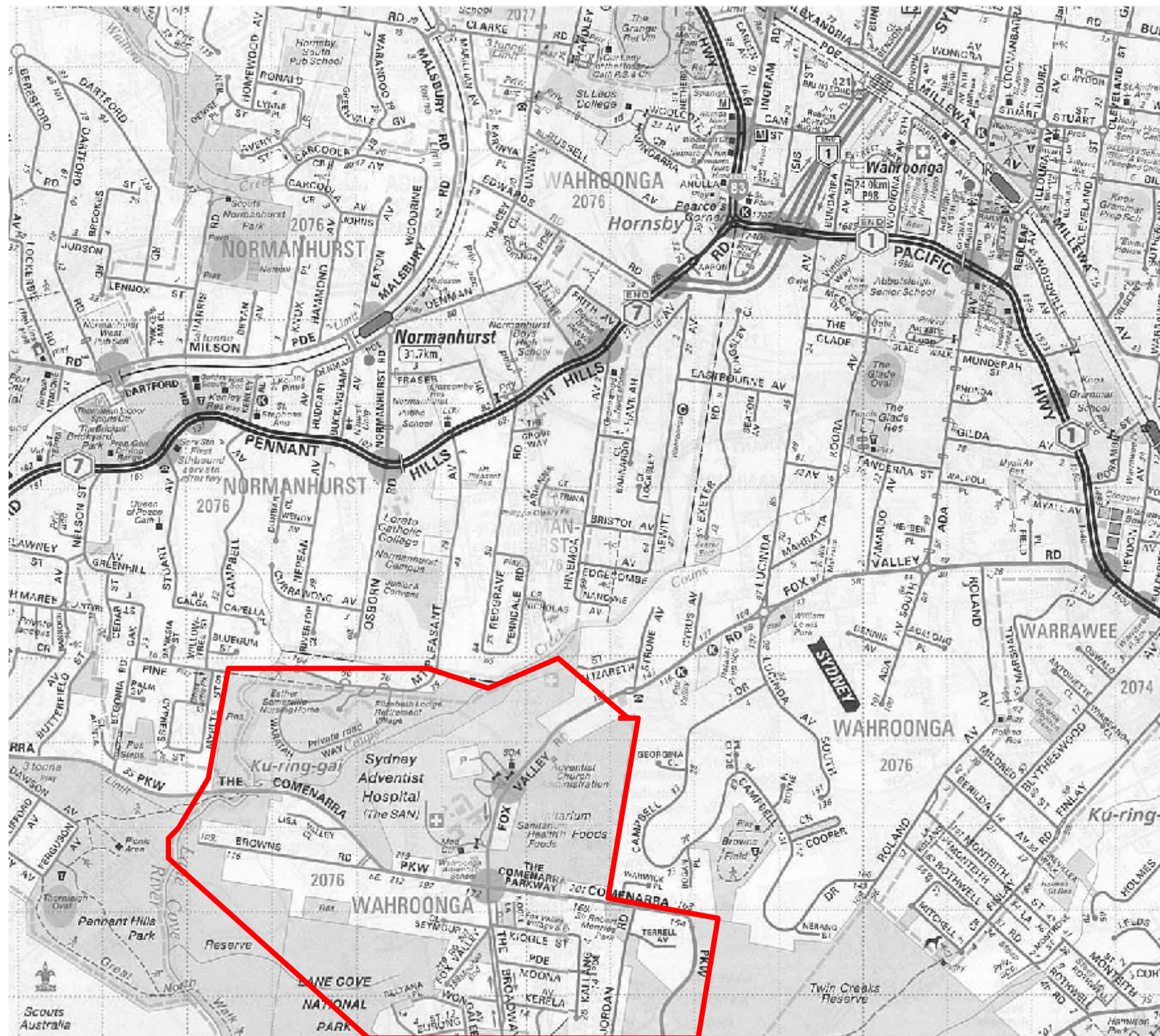
# EXISTING PUBLIC TRANSPORT OPERATIONS

## WAHROONGA ESTATE MASTERPLAN



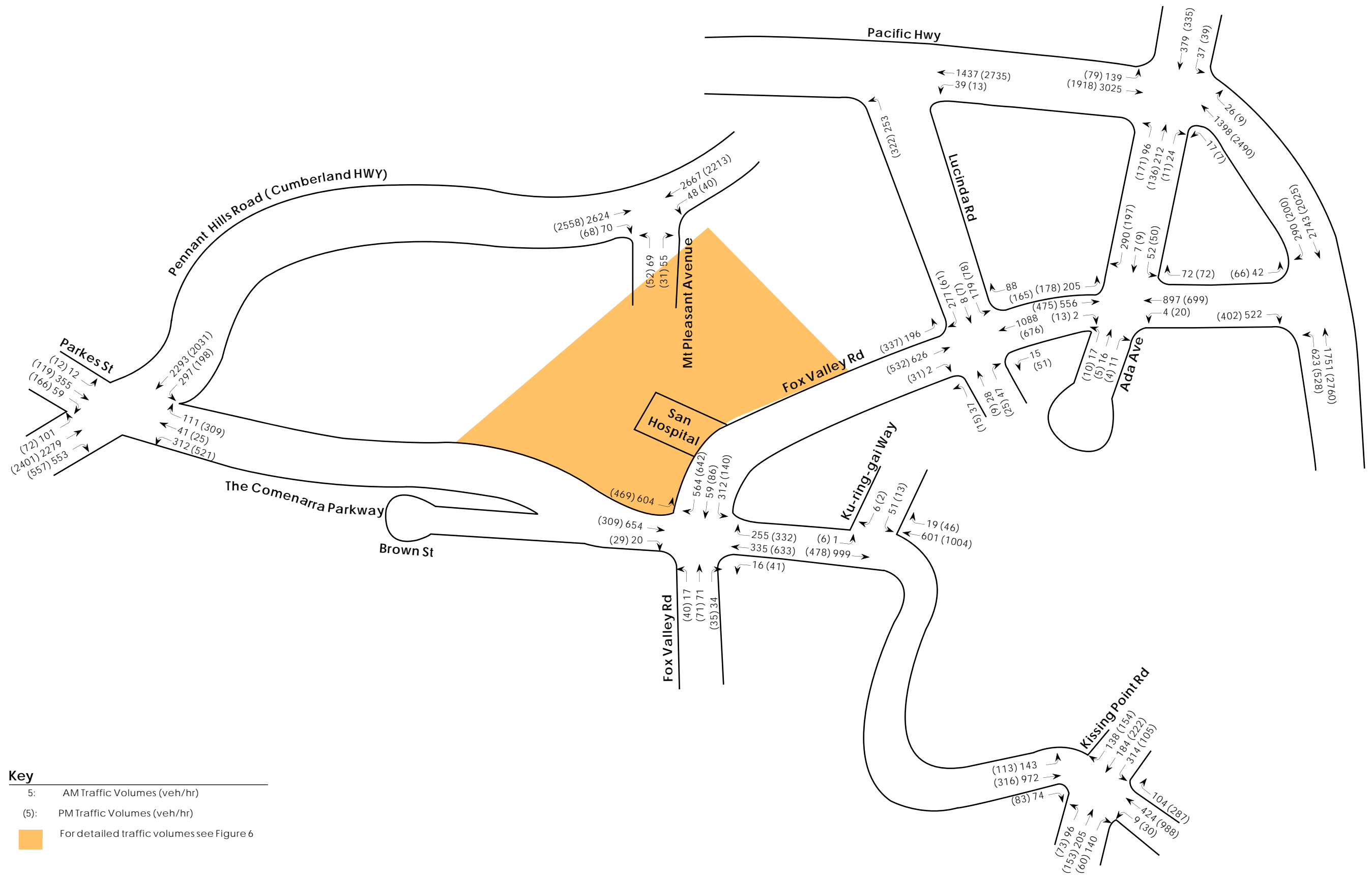
# TDC TRAVEL ZONE 2558 BOUNDARIES

## WAHROONGA ESTATE MASTERPLAN



# 2016 FUTURE PEAK HOUR TRAFFIC FLOWS WITH BACKGROUND TRAFFIC GROWTH (VEH/HR)

WAHROONGA ESTATE MASTERPLAN



**Key**

- 5: AM Traffic Volumes (veh/hr)
- (5): PM Traffic Volumes (veh/hr)
- For detailed traffic volumes see Figure 6