



Traffic Impact Assessment

for the Proposed Concept Development Application on the
Existing Sisters of St Josephs Site at Barina Downs Road,
Baulkham Hills

prepared on behalf of The Sisters of St Josephs by **TRAFFIX** traffic & transport planners
ref: 11 073 report_v1 March 2011

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1. Introduction

TRAFFIX has been commissioned by UPDM Pty Limited, on behalf of The Sisters of St Joseph, to undertake a traffic impact assessment in support of a development application relating to the proposed Concept Master Plan and Staged Subdivision for the existing open land located on premises known as the Convent of St Joseph, Baulkham Hills. The proposed development will provide a low/medium residential density and lies within Baulkham Hills Shire Council precinct and is therefore subject to that Council's controls.

This report documents the findings of our investigations and should be read in the context of the Statement of Environmental Effects prepared separately by Worley Parsons, incorporating Planning Workshop Australia. This report relies on a density with the potential of 195 dwellings including the existing house on the northeast portion of the site which will be retained for adaptive reuse for community facility purposes. The development is considered of a size and nature that will require referral to the RTA under the provisions of SEPP (Infrastructure) 2007.

The report is structured as follows:

- Section 2: Describes the site and its location
- Section 3: Documents existing traffic conditions
- Section 4: Describes the proposed development
- Section 5: Assesses the traffic impacts
- Section 6: Discusses access and internal design aspects
- Section 7: Presents the overall study conclusions.

Following Concept Master Plan and Staged Subdivision approval, subsequent development application/s will be submitted for the development of the land for residential use, so that further assessment and design refinement will be possible.

This report refers to the Concept Master Plan (03 March 2011), which is expected to yield in the order of 195 dwellings and is assessed to present the worst case assessment.



2. Location and Site

The site is situated on the south-west corner of Barina Downs Road and Mackillop Drive in Baulkham Hills and is known as Lot 2 in DP 817696, Baulkham Hills. The site is located in the central part of the Baulkham Hills LGA and occupies an elevated ridge-top position with extensive district views, with the land sloping to the north and south from the central driveway.

The site is generally rectangular in configuration and has a total site area of approximately 18.5 ha, with an eastern site frontage to Mackillop Drive of approximately 260 metres and a northern site frontage to Barina Downs Road of approximately 650 metres. The site shares its southern boundary of 680 metres and western boundary of 350 metres with existing residential housing.

Vehicle access to the site is presently provided by a driveway onto Mackillop Drive. This a two way driveway of approximately 480 metres length and services the existing function/conference centre and related residential accommodation on the site's western boundary; as well as the existing original cottage that is located at the eastern end of the site.

A location and site plan are presented in **Figures 1 and 2** respectively. Reference should also be made to the Photographic Record, presented in **Appendix A**, which provides an appreciation of the general character of roads and other key attributes in proximity to the site.

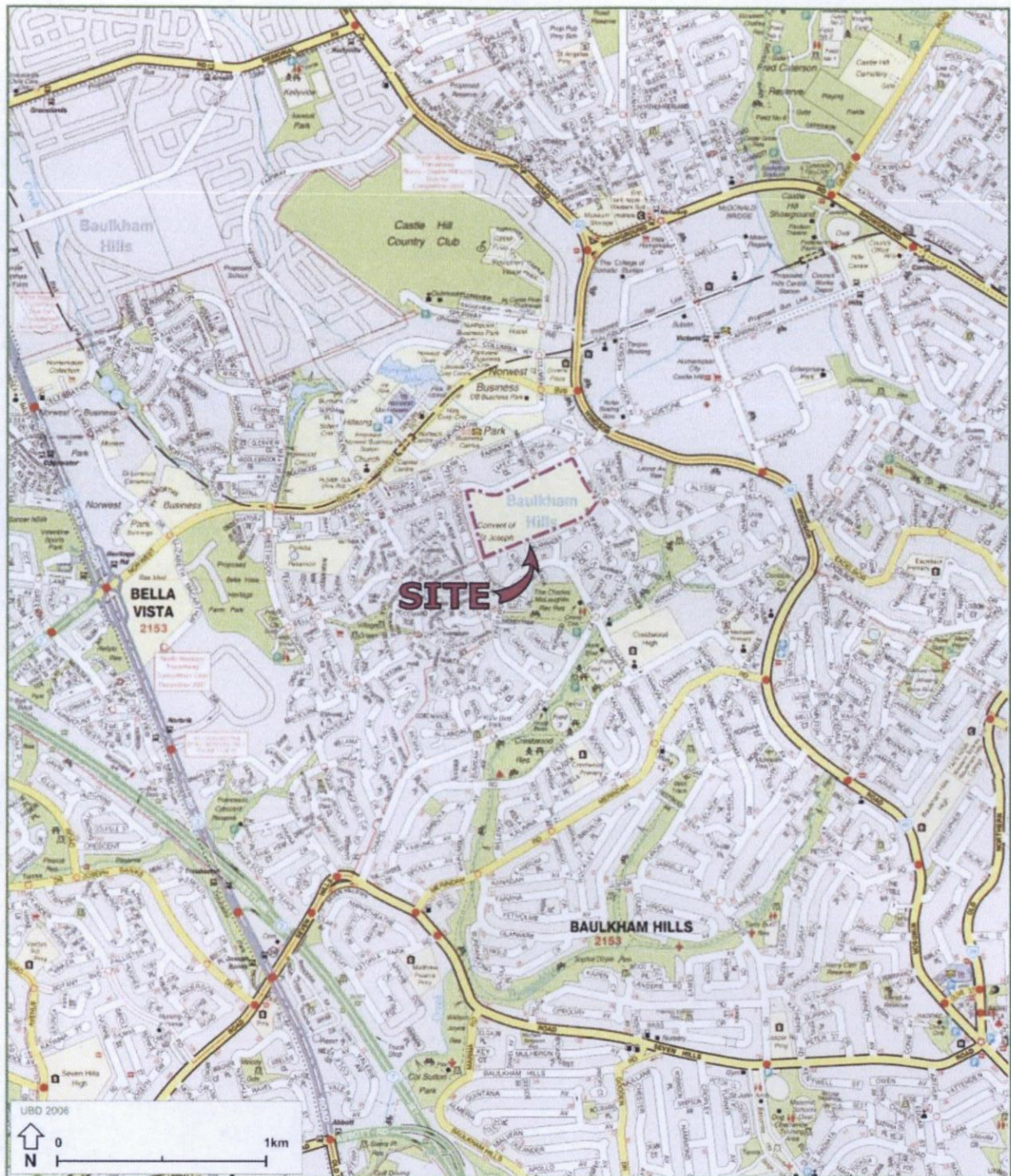


Figure 1: Location



Figure 2: Site



3. Existing Traffic Conditions

3.1 Road Hierarchy

The road hierarchy in the vicinity of the site is shown in **Figure 3** with the following roads of particular interest:

- Windsor Road: a State road (MR 184) to the north and east of the site that runs in a north-south direction connecting McGraths Hill and other roads in the north with North Parramatta and other roads in the south. It carries an estimated 32,000 vehicles per day in the vicinity of the site;
- Old Windsor Road: an arterial road (MR 635) to the west of the site that runs in a north south direction connecting Abbott Road to the south with Windsor Road in the North. It carries an estimated 31,000 vehicles per day in the vicinity of the site;
- Norwest Boulevard: a local collector road to the north of the site that runs in an east-west direction connecting Old Windsor Road in the west with Windsor Road in the east. It carries approximately 29,000 vehicles per day;
- Reston Grange: a local road to the west of the site that runs in a north-south direction connecting Norwest Boulevard in the north with Bella Vista Drive in the south;
- Barina Downs Road: a local road to the north of the site that forms the sites northern boundary and runs in an east-west direction connecting Reston Grange in the west with Windsor Road in the east;
- Mackillop Drive: a local road which forms the sites eastern boundary and provides the only access to the site. It runs in a north-south direction between Barina Downs Road in the north before turning into Chapel Lane which terminates at Seven Hills Road further south;
- Coorumbene Crescent: a local road located to the west of the site sites that runs in a north-south direction beginning at Barina Downs Road in the north and ending in a cul-de-sac to the south; and



② Hillsborough Way

a local road that extends northwards from Barina Downs Road opposite the site. It provides access to other minor streets serving residential dwellings.

It can be seen from **Figure 3** that the site is conveniently located with respect to the arterial and local road systems serving the region. It is therefore able to effectively distribute traffic onto the wider road network, minimising traffic impacts.



Figure 3: Road Hierarchy



3.2 General Description of Road Environment

Windsor Road is constructed with a divided carriageway, with generally two lanes of through traffic in each direction along the majority of its length. 'No Parking' restrictions are in place along both sides of Windsor Road in the vicinity of the site. Bus stops are situated on the eastern and western sides of Windsor Road immediately north of its signal controlled intersection with Norwest Boulevard, located approximately 420 metres walking distance to the northeast corner of the site. Windsor Road forms a four-way intersection with Barina Downs Road and Gladstone Road approximately 170 metres to the east of the site. However, general traffic access to Barina Downs Road is limited to left-in and left-out access to/from Windsor Road. Gladstone Road is a one-way road for eastbound traffic heading away from its intersection with Windsor Road (eastbound).

Old Windsor Road is constructed with a 26 metre divided carriageway that carries two lanes of traffic in each direction along the majority of its length. It forms a four-way signal controlled intersection with Norwest Boulevard approximately 2 km to the west of the site, with a diamond grade separation. Two left turn lanes are provided for northbound traffic along Old Windsor Road turning westbound onto Norwest Boulevard and four lanes are provided with the same configuration in place for southbound traffic on Old Windsor Road where two lanes are provided to accommodate vehicles turning eastbound onto Norwest Boulevard.

Norwest Boulevard is constructed with a 22 metre divided carriageway carrying two lanes of traffic in either direction and is located approximately 400 metres north of the site. It forms roundabout controlled intersections with local collector roads along its length and is part of the main access route connecting the M2 and Old Windsor Road in the west to the site. Norwest Boulevard also forms part of the local bus network with bus stops situated approximately 25 metres east of the intersections of Norwest Boulevard with Elizabeth Macarthur Drive and Norwest Boulevard with Westwood Way.

Reston Grange is constructed with a 10 metre undivided carriageway carrying one lane of traffic in either direction and is located approximately 365 metres west of the site. It forms one of the main local access routes to the site from the M2 and Old Windsor Road in the west and forms a roundabout controlled cross intersection with Norwest Boulevard. Closer to the site, it forms a four-way roundabout controlled intersection with Barina Downs Road. Bus stops are located along both sides of Reston Grange approximately 20 metres south of its intersection with Norwest Boulevard.

Barina Downs Road forms the site's northern boundary and is part of the local access route from the M2 and Old Windsor Road in the west; and Windsor Road in the east. It is constructed with a 10



metre undivided carriageway. Barina Downs Road forms a roundabout controlled intersection with Coorumbene Crescent which forms the site's western boundary. Barina Downs Road forms a roundabout controlled 'T-junction' with Hillsborough Way midway along the site's northern boundary, as well as with Mackillop Drive which forms the site's eastern boundary. At its intersection with Windsor Road only left turns are permitted to allow eastbound vehicles to turn north onto Windsor Road.

Mackillop Drive is constructed with a 7.5 metre carriageway and carries a single lane of traffic in either direction. It is subject to numerous local area traffic calming measure such as angled slow points at regular intervals along its length, creating a slow speed environment.

Reference should be made to the Photographic Record in **Appendix A** which provides a general appreciation of the character of the surrounding road network.

3.3 Existing Site Access Locations

Access to the site is currently achieved via a single driveway at the northern end of the Mackillop Drive frontage. This driveway extends through the site to the major building complex that is located on the western part of the site.

3.4 Existing Traffic Generation

The existing site incorporates conference centre activities as part of the Sisters of St Joseph Convent. Information provided by the Sisters indicates that the existing site generates average flows of 100 vehicles per day. The majority of these arrive during the morning and depart during the afternoon. This is predominantly comprised of standard car sized vehicles with the exception of a single 20 seat bus and large delivery van that attend the site daily. These volumes are included in the traffic surveys reported upon below.

3.5 Existing Intersection Performances

For the purposes of the assessment of traffic impacts of this development, surveys were undertaken to establish the performance of the existing road system. In this regard, the key intersections in the locality of interest lie on key access routes and are the intersections of Barina Downs Road with



Windsor Road, Mackillop Drive and Reston Grange; and the intersection of Reston Grange with Norwest Boulevard. The extent of this analysis is also sufficient having regard for the predicted traffic volume increases as discussed in Section 5. In this regard, it is also noteworthy that the purpose of this report is to support the preferred concept plan, with subsequent development application/s to follow.

Surveys were undertaken at the above intersections on Friday 30th November 2007 during the AM (7.00-9.00am) peak period on a typical weekday. This represents the worst case for assessment due to the fact that the proposed use will generate peak flows that will overlap with the existing on-street peak as discussed further in Section 5.

A further survey was undertaken on Friday 21st July 2010 in order to 'calibrate' and update the aforementioned surveys. It was evident that the current total traffic volumes at the intersection of Norwest Boulevard with Reston Grange remain relatively unchanged and therefore the previous surveys are considered to remain an accurate representation of existing traffic conditions.

The results of these turning count surveys are shown in **Figure 4** which relates to the times of maximum traffic volumes over the period surveyed.

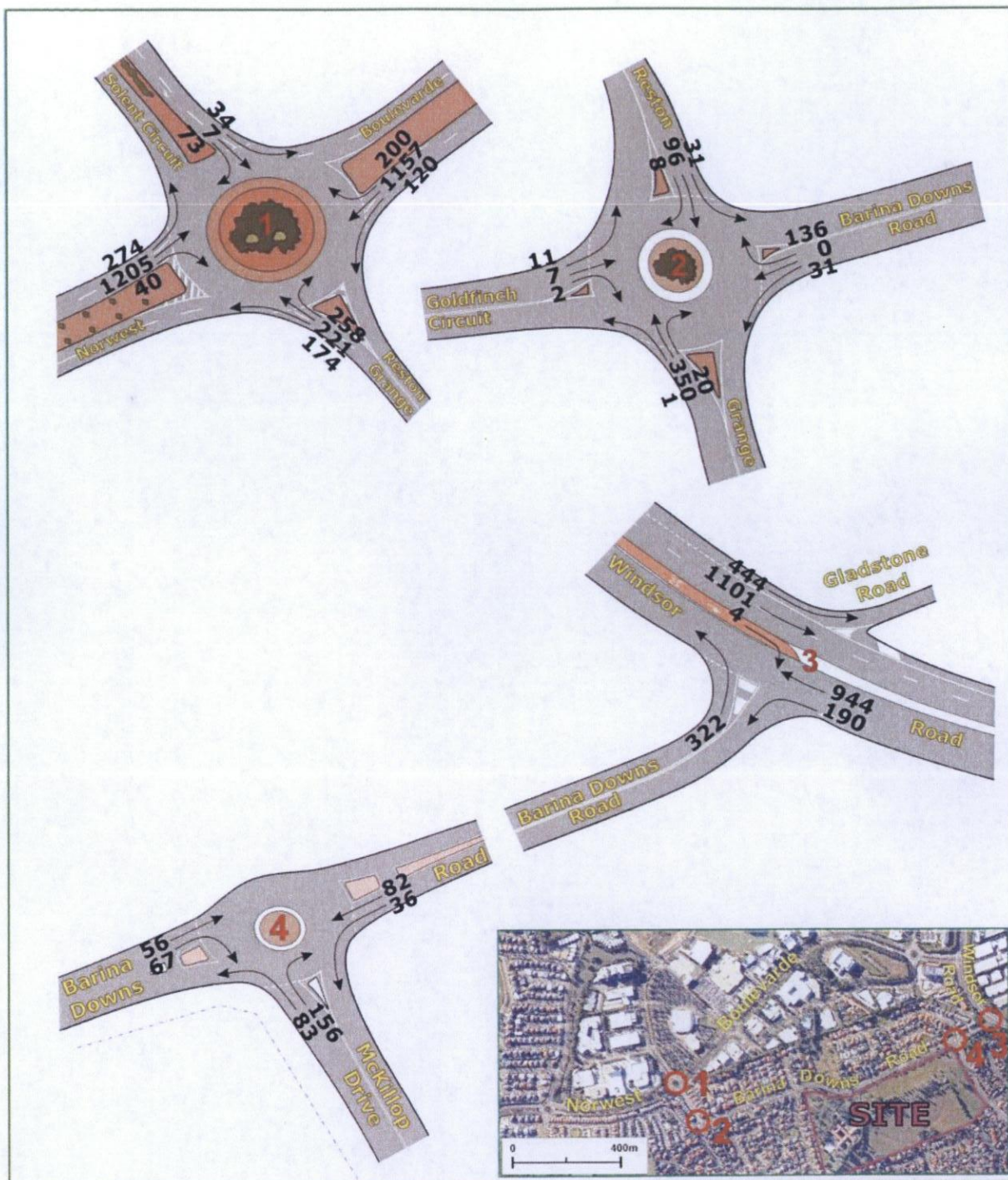


Figure 4: Survey Results

The results of these surveys were analysed using the SIDRA computer program to determine their performance characteristics under existing traffic conditions. The SIDRA model produces a range of outputs, the most useful of which are the Degree of Saturation (DOS) and Average Vehicle Delay per



vehicle (AVD). The AVD is in turn related to a level of service (LOS) criteria. These performance measures can be interpreted using the following explanations:

DOS - the DOS is a measure of the operational performance of individual intersections. As both queue length and delay increase rapidly as DOS approaches 1, it is usual to attempt to keep DOS to less than 0.9. When DOS exceeds 0.9 residual queues can be anticipated, as occurs at many major intersections throughout the metropolitan area during peak periods. In this regard, a practical limit at 1.1 can be assumed. For intersections controlled by roundabout or give way/stop control, satisfactory intersection operation is generally indicated by a DOS of 0.8 or less.

AVD - the AVD for individual intersections provides a measure of the operational performance of an intersection. In general, levels of acceptability of AVD for individual intersections depend on the time of day (motorists generally accept higher delays during peak commuter periods) and the road system being modelled (motorists are more likely to accept longer delays on side streets than on the main road system).

LOS - this is a comparative measure which provides an indication of the operating performance of an intersection as shown below:

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabouts	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 and requires other control mode
F	More than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode or major treatment.



A summary of the modelled results are provided below. Reference should also be made to the SIDRA outputs provided in **Appendix C** which provide detailed results for individual lanes and approaches.

Table 1: Existing Intersection Performances - AM Peak Hour

Intersection Description	Control Type	Degree of Saturation	Intersection Delay	Level of Service
Barina Downs Road & Windsor Road	Priority	0.803	27.9	B
Barina Downs Road & Mackillop Drive	Roundabout	0.199	7.5	A
Barina Downs Road & Reston Grange	Roundabout	0.330	8.3	A
Norwest Boulevard & Reston Grange	Roundabout	0.690	9.4	A

It can be seen from Table 1 that these intersections generally operate at a good level of service with minimal delays. The values relating to the designated bus lane at the intersection of Barina Downs Road and Windsor Road are excluded from the table above as they tend to misrepresent the overall performance of the intersection, particularly as the intersection provides only left-in, left-out access to private vehicle users. Furthermore, Council officers have advised that there are generally no significant issues regarding the performance of this intersection with only one minor accident recorded in a recent period of 5 years.

In this regard, it is stressed that the most relevant use of this analysis is to compare the relative change in the performance parameters as a result of the proposed development. This is discussed further in Section 5.

3.6 Existing Public Transport Services

The availability of public transport is shown in **Figure 5**. Numerous bus services operate along Norwest Boulevard and Windsor Road which provide the site with reasonable access to the public transport network.



It should be noted that any future (if realised) rail station at Norwest, located approximately 400 metres northwest of the site, will further significantly benefit the sites access to public transport, so that the traffic assessment undertaken as discussed in Section 5 based on RTA trip rates represents a worst case scenario.



4. Description of Proposed Development

A detailed description of the proposed concept plan is provided in the Statement of Environmental Effects prepared separately. In summary, the Concept Master Plan and Staged Subdivision for which approval is now sought outlines the density zones for the site which includes the following components:

- Retention of the existing building at the eastern side of the site which will be used as community facility;
- Provision of a total of 4 density zones:
- Construction of 7 vehicle accesses; four along Barina Downs Road and another 3 along the Mackillop Drive frontage, which are intended to achieve a more efficient dispersal of traffic onto the road system and to avoid unnecessary local traffic concentrations; and
- Development of a internal road system;

The parking requirements of the proposed development and its resulting traffic impacts are discussed in the following sections. A copy of the plans prepared by AAUD is provided at reduced scale in **Appendix B**.

It should be noted that the above refers to the proposed Concept Master Plan and Staged Subdivision development. The Indicative Lot Sizes plan, also included in Appendix B, demonstrates that the site can potentially achieve a development yield of up to 195 dwellings.



5. Impacts of the Proposed Development

5.1 Proposed Traffic Generation

The proposed Concept Application involves indicative subdivision densities or zones with the potential for 195 dwellings ranging in size from two bedroom apartments through to four bedroom individual dwellings. The RTA's Guide to Traffic Generating Developments specifies the following peak hour generation rates for the various dwelling size and type provided by the development:

- 0.85 trips per individual dwelling;
- 0.50 trips per two bedroom unit;
- 0.65 trips per three bedroom unit;

In practice, the proposed Small Lot and Courtyard Homes would be likely to result in reduced traffic generation when compared to the larger Standard Detached and Traditional Homes and could potentially be classified as medium density development under application of the RTA's rates. However, the dwelling house rates have been adopted for all lots (excluding apartment buildings) in order to provide a 'worst case' scenario.

The table below contains a summary of the peak hour and daily trips for the various 'blocks' (zones) as specified within the preferred Indicative Housing Type plan.

Table 2: Trips Generation by Block

Type	Block No.							Total
	1A	1B	2A	2B	3A	3B	3C	
2 Bed Unit					12	6		18
3 Bed Unit					12	12		24
Dwelling House	16	61	34	35			7	153
Total Dwellings	16	61	34	35	24	18	7	195
Peak Hour Trips	14	52	29	30	14	11	6	157

It can be seen from Table 2, above, that the development will generate a total of 157 veh/hr during peak periods. This will equate to 126 out and 31 in trips in the AM peak, with these flows reversed during the PM peak.



5.2 Traffic Impacts of Proposed Concept Plan

A review of the 2006 Journey-to-Work data indicates the following distribution of commuter trips for residents residing in the vicinity of the site (Travel Zone 2730):

North	11% (includes 7% of trips which are localised within the Statistical Local Area – Baulkham Hills Central, generally to the east of Windsor Road via Showground Road)
East	25%
Southeast	33%
South	7%
West	24% (8% of these are localised within the Statistical Local Area – Baulkham Hills Central, generally within the Norwest Business Park)

It is expected that traffic heading east and southeast would generally be split between using Windsor Road (via Mackillop Drive and Merindah Road) and Old Windsor Road (via Norwest Boulevard) to access the M7 Motorway. Westbound traffic will generally use Norwest Boulevard to access the westbound lanes of the M7, with a high proportion of southbound vehicles using Norwest Boulevard to access Old Windsor Road and/or the westbound lanes of the M7. Northbound vehicles are expected to use Windsor Road, via Barina Downs Road.

The development will generate in the order of 157 additional vehicle trips per hour during peak periods. The western access serving the small Blocks 3A will generate approximately 14 veh/hr. The remaining 143 veh/hr will be relatively evenly distributed between the main and secondary site accesses serving the main development area (Blocks 1, 2, 3B & 3C) which will result in a maximum of about (say) 50 vehicles per hour at any one site access, due to the site constraints which limit accessibility to a number of accesses from southern lots. This would be expected to be further refined as part of the assessment of subsequent development applications.

The performance of key intersections after full development is discussed in Section 5.3.



5.3 Future Intersection Performance

The future performance of key intersections in the vicinity of the site is shown in Table 3 below. Reference should also be made to the SIDRA outputs provided in **Appendix C**.

Table 3: Future Intersection Performances - AM Peak Hour

Intersection Description	Control Type	Degree of Saturation	Intersection Delay	Level of Service
Barina Downs Road & Windsor Road	Priority	0.841	30.5	C
Barina Downs Road & Mackillop Drive	Roundabout	0.221	7.6	A
Barina Downs Road & Reston Grange	Roundabout	0.365	9.0	A
Norwest Boulevard & Reston Grange	Roundabout	0.773	10.9	A

It can be seen from Table 3 above that the majority of these intersections continue to operate within acceptable limits and with minimal change to existing levels of service. Further refinement of the traffic assessment will be undertaken in support of subsequent development applications but it is concluded in the meantime that the proposed indicative subdivision is supportable.



6. Site Access and Internal Road System

6.1 Site Access Design

A total of 7 accesses are proposed, including 4 to Barina Downs Road with the remaining 3 to Mackillop Drive. The site is subject to a number of constraints and therefore, these accesses are required in order to provide sufficient accessibility to the overall site.

Available sight distances are a key aspect in future site access locations for safety reasons. In this regard, all accesses satisfy the required sight distance criteria in AS 2890.1, based on 50km/hr speed zoning. This will be dependent upon the maintenance of low level vegetation along the road verges as appropriate. Suitable on-street parking clearances from driveways will also need to be achieved and this can be further assessed with subsequent development application/s.

6.2 Internal Road System

The indicative internal road network is shown on the plans provided in Appendix B. The access road system is as shown, however, the localised layout within each 'Block' are subject to the requirements of individual developer/s and subject to future application/s. The following aspects of the internal road system are noteworthy:

- ➊ The future 'inter block' roads as indicated on the plans provides maximum separation from other intersections which is a key consideration in the development of the road network;
- ➋ Furthermore, the internal roads generally form intersections at right angles which provides the internal road system with an indicative priority system;
- ➌ Road carriageways should be in accordance with AMCORD principles, with minimum widths to ensure self-enforcing slow speeds;
- ➍ Further consideration will need to be given to the servicing of the individual dwelling lots by garbage vehicles and emergency services, particularly fire trucks;

In summary, the proposed internal road system is considered acceptable 'in principle'. There will be further detailed design during subsequent stages.



7. Conclusions

In summary, the following matters are considered noteworthy:

- The site enjoys good access to and from the arterial road network, using the surrounding local road network;
- The proposed low/medium density residential development under the Concept Master Plan and Staged Subdivision DA may be regarded as a low traffic generating use on the site and in this context, the proposal achieves the optimal traffic planning outcome for the site;
- The increased traffic associated with the development can be accommodated by the surrounding road network and will continue to operate within acceptable operating parameters;
- The proposed site access arrangements are satisfactory and form a suitable basis for future development applications on the individual development 'blocks' that are to be created by this Concept Development Application;

It is concluded that the proposed development is supportable on traffic planning grounds. The traffic impacts associated with the development are compatible with the strategic assessments as well as subsequent approvals.



appendix a

photographic record



View looking east along Norwest Boulevard at its roundabout controlled intersection with Reston Grange (right) and Solent Circuit (left).



View looking north from Mackillop Drive towards its intersection with Barina Downs Road at the northeast corner of the site.





View looking west along Barina Downs Road at its intersection with Reston Grange Road, to the west of the site.



View looking south-west along Norwest Boulevard at its intersection with Old Windsor Road.





View looking west east along the existing access driveway from adjacent the Priests House in the centre of the site.



View looking west along Barina Downs Road at its intersection with Hillsborough Way on the northern site boundary.





appendix b

reduced plans

Dwelling Types	Frontage (m)	Block		1A	1B	2A	2B	3A	3B	3C	Total
		Size (m ²)	2bed (110-120)								
Apartments	30 or more							12	6		18
								12	12		24
Small Lots: Attached/Zero Lot Homes	8-13				27	28					55
Medium Lots: Detached Homes	13.5-17.5			33	6	6					45
Large Lots: Detached Homes	18 or more			16	28	1				7	53
				16	61	34	35	24	18	7	195



Apartments



Attached Homes



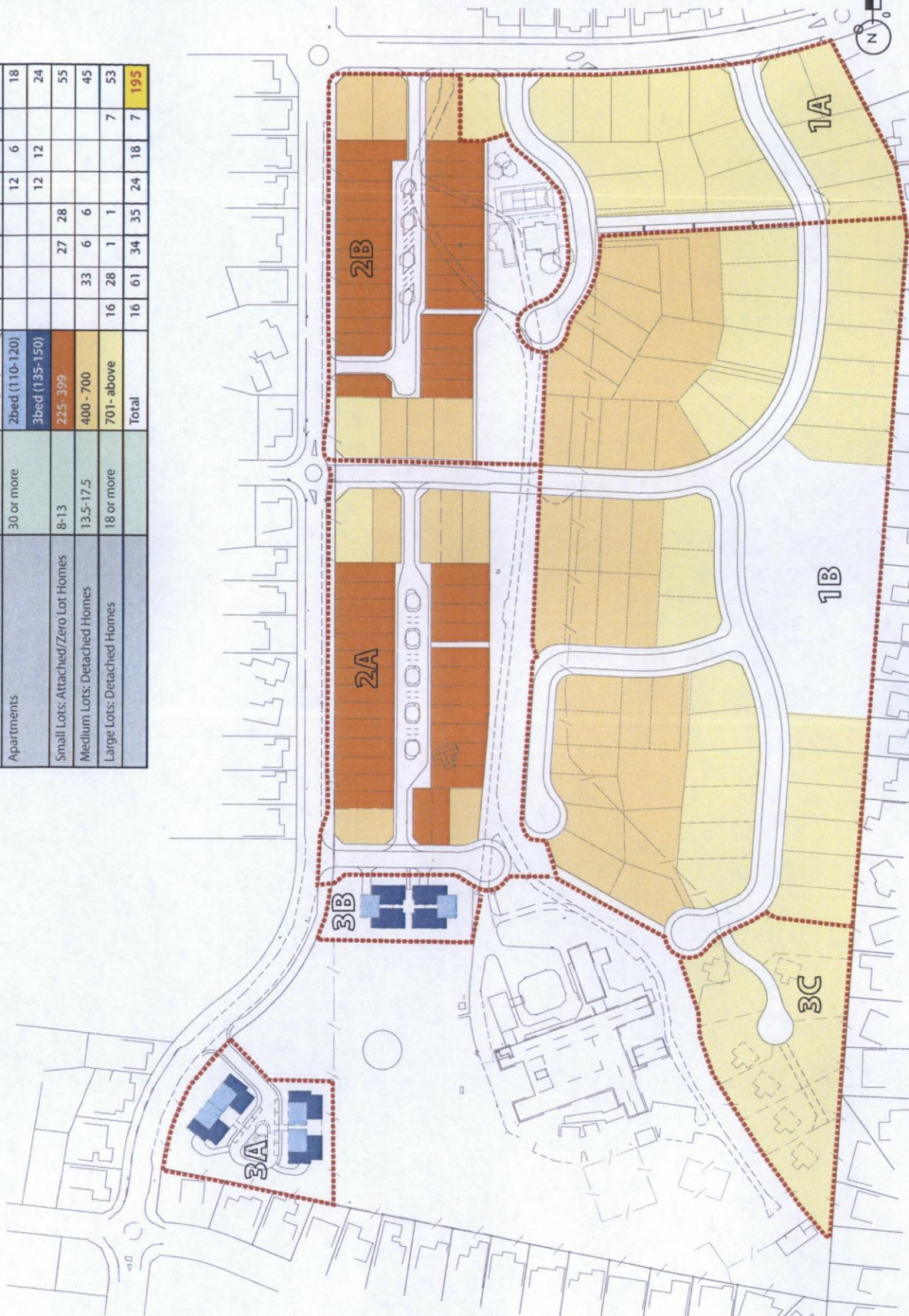
Zero Lot Homes



Medium Lots: Detached Homes



Large Lots: Detached Homes



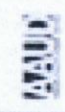
Indicative Lot Sizes

Project Name: Sisters of St. Joseph, Baulkham Hills
Address: Barina Downs Road
Issue: 03 March 2011



Development Principles Plan

Project Name: Subarea of St. Joseph's Healthcare
Address: 1000 St. Joseph's Road
Issue: 10 March 2011





appendix c

sidra outputs



appendix c-1

existing conditions

MOVEMENT SUMMARY

Site: WindsorRd-
BarinaDownsRd - EX - AM

Windsor Rd - Barina Downs Rd
Scenario: Existing
Period: AM
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV Deg. Satn %	Average Delay sec	Level of Service	95% Back of Queue Vehicles	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Windsor Rd (south)										
21	L	200	3.0	0.110	LOS A	0.0	0.0	0.00	0.67	49.0
22	T	994	5.0	0.263	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		1194	4.7	0.263	LOS A	0.0	0.0	0.00	0.11	57.8
North West: Windsor Rd (north)										
27	L	467	5.0	0.261	NA ⁹	NA ⁹	NA ⁹	0.00	0.60	49.7
28	T	1159	5.0	0.307	LOS A	0.0	0.0	0.00	0.00	60.0
29	R	4	50.0	0.081	LOS F	0.3	3.0	0.94	0.98	19.1
Approach		1631	5.1	0.307	LOS F	0.3	3.0	0.00	0.17	56.3
South West: Barina Downs Rd (west)										
30	L	339	3.0	0.803	LOS B	7.4	53.2	0.92	1.37	34.0
Approach		339	3.0	0.803	LOS B	7.4	53.2	0.92	1.37	34.0
All Vehicles		3163	4.7	0.803	NA	7.4	53.2	0.10	0.28	53.1

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

⁹ Continuous movement

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SIDRA
INTERSECTION

MOVEMENT SUMMARY

Site: BarinaDownsRd-
MackillopDr - EX - AM

Barina Downs Rd - Mackillop Dr

Scenario: Existing

Period: AM

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow	HV Deg.	Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: McKillop Dr (south)											
1	L	87	3.0	0.199	6.2	LOS A	1.4	9.9	0.26	0.52	42.8
3	R	164	3.0	0.199	9.5	LOS A	1.4	9.9	0.26	0.66	40.7
Approach		252	3.0	0.199	8.3	LOS A	1.4	9.9	0.26	0.61	41.4
East: Barina Downs Rd (east)											
4	L	38	3.0	0.099	6.0	LOS A	0.6	4.6	0.22	0.55	43.2
5	T	86	3.0	0.099	5.1	LOS A	0.6	4.6	0.22	0.45	43.8
Approach		124	3.0	0.099	5.4	LOS A	0.6	4.6	0.22	0.48	43.6
West: Barina Downs Rd (west)											
11	T	59	3.0	0.116	5.6	LOS A	0.7	5.4	0.35	0.48	43.0
12	R	71	3.0	0.116	9.9	LOS A	0.7	5.4	0.35	0.71	40.7
Approach		129	3.0	0.116	7.9	LOS A	0.7	5.4	0.35	0.61	41.7
All Vehicles		505	3.0	0.199	7.5	LOS A	1.4	9.9	0.27	0.58	42.0

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout Capacity Model: SIDRA Standard.

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SIDRA
INTERSECTION

MOVEMENT SUMMARY

Site: BarinaDownsRd-
RestonGr - EX - AM

Barina Downs Rd - Reston Gra
Scenario: Existing
Period: AM
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV Deg. Satn %	Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Reston Gr (south)											
1	L	1	2.0	0.351	6.6	LOS A	2.6	18.3	0.40	0.60	42.7
2	T	368	2.0	0.330	7.6	LOS A	2.6	18.3	0.40	0.58	48.5
3	R	21	2.0	0.329	10.0	LOS A	2.6	18.3	0.40	0.78	41.0
Approach		391	2.0	0.330	7.7	LOS A	2.6	18.3	0.40	0.59	48.0
East: Barina Downs Rd (east)											
4	L	33	2.0	0.150	6.2	LOS A	1.0	6.9	0.28	0.52	42.8
5	T	6	2.0	0.150	5.3	LOS A	1.0	6.9	0.28	0.44	43.2
6	R	143	2.0	0.151	11.5	LOS A	1.0	6.9	0.28	0.69	45.5
Approach		182	2.0	0.151	10.4	LOS A	1.0	6.9	0.28	0.65	45.0
North: Reston Gr (north)											
7	L	33	2.0	0.103	7.6	LOS A	0.7	4.7	0.13	0.60	49.3
8	T	101	2.0	0.103	6.7	LOS A	0.7	4.7	0.13	0.51	50.0
9	R	8	2.0	0.103	11.1	LOS A	0.7	4.7	0.13	0.80	46.3
Approach		142	2.0	0.103	7.2	LOS A	0.7	4.7	0.13	0.55	49.6
West: Goldfinch Ct (west)											
10	L	12	2.0	0.026	10.3	LOS A	0.2	1.2	0.58	0.66	46.9
11	T	7	2.0	0.026	7.5	LOS A	0.2	1.2	0.58	0.58	41.9
12	R	2	2.0	0.026	11.7	LOS A	0.2	1.2	0.58	0.74	39.6
Approach		21	2.0	0.026	9.5	LOS A	0.2	1.2	0.58	0.64	44.3
All Vehicles		736	2.0	0.330	8.3	LOS A	2.6	18.3	0.33	0.60	47.4

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout Capacity Model: SIDRA Standard.

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INTERSECTION

MOVEMENT SUMMARY

Site: NorwestBlvde-RestonGr
- EX (2010)- AM

Norwest Boulevard - Reston Grange
Scenario: Existing (2010)
Period: AM
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Reston Gr (south)											
1	L	288	2.0	0.666	17.1	LOS B	5.5	39.5	0.89	1.11	36.7
2	T	160	2.0	0.675	12.5	LOS A	6.6	47.1	0.92	1.12	37.3
3	R	322	2.0	0.674	20.2	LOS B	6.6	47.1	0.92	1.17	36.4
Approach		771	2.0	0.674	17.4	LOS B	6.6	47.1	0.91	1.13	36.7
East: Norwest Blvde (east)											
4	L	3	3.0	0.632	5.6	LOS A	6.1	44.0	0.52	0.53	49.1
5	T	1579	3.0	0.607	5.2	LOS A	6.1	44.0	0.53	0.48	49.5
6	R	34	3.0	0.612	11.0	LOS A	6.0	43.0	0.55	0.83	46.6
Approach		1616	3.0	0.607	5.4	LOS A	6.1	44.0	0.53	0.48	49.5
North: Solent Ct (north)											
7	L	23	3.0	0.098	9.8	LOS A	0.6	4.4	0.78	0.85	42.1
8	T	24	3.0	0.098	7.6	LOS A	0.6	4.4	0.78	0.80	41.9
9	R	114	3.0	0.168	14.5	LOS A	1.2	8.9	0.82	0.89	39.5
Approach		161	3.0	0.168	12.8	LOS A	1.2	8.9	0.81	0.87	40.2
West: Norwest Blvde (west)											
10	L	379	3.0	0.690	9.1	LOS A	8.5	61.1	0.84	0.91	46.8
11	T	932	3.0	0.690	9.1	LOS A	8.5	61.1	0.84	0.91	47.0
12	R	46	3.0	0.691	15.0	LOS B	8.2	58.7	0.85	1.03	43.7
Approach		1357	3.0	0.690	9.3	LOS B	8.5	61.1	0.84	0.91	46.8
All Vehicles		3904	2.8	0.690	9.4	LOS A	8.5	61.1	0.73	0.78	45.0

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout Capacity Model: SIDRA Standard.

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appendix c-2

future scenario

MOVEMENT SUMMARY

Site: WindsorRd-
BarinaDownsRd - FU - AM

Windsor Rd - Barina Downs Rd
Scenario: Existing + Development
Period: AM
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV Deg. Satn %	v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Windsor Rd (south)											
21	L	221	3.0	0.122	8.3	LOS A	0.0	0.0	0.00	0.67	49.0
22	T	994	5.0	0.263	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		1215	4.6	0.263	1.5	LOS A	0.0	0.0	0.00	0.12	57.6
North West: Windsor Rd (north)											
27	L	467	5.0	0.261	7.7	NA ⁹	NA ⁹	NA ⁹	0.00	0.60	49.7
28	T	1159	5.0	0.307	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
29	R	4	50.0	0.086	83.7	LOS F	0.3	3.2	0.94	0.98	18.4
Approach		1631	5.1	0.307	2.4	LOS F	0.3	3.2	0.00	0.17	56.3
South West: Barina Downs Rd (west)											
30	L	355	3.0	0.841	30.5	LOS C	8.6	61.6	0.93	1.47	32.6
Approach		355	3.0	0.840	30.5	LOS C	8.6	61.6	0.93	1.47	32.6
All Vehicles		3200	4.7	0.840	5.2	NA	8.6	61.6	0.10	0.30	52.6

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS F. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

⁹ Continuous movement

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MOVEMENT SUMMARY

Site: BarinaDownsRd-
MackillopDr - FU - AM

Barina Downs Rd - Mackillop Dr
Scenario: Existing + Development
Period: AM
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV Deg. Satn %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: McKillop Dr (south)										
1	L	98	3.0	0.220	LOS A	1.6	11.2	0.29	0.53	42.7
3	R	175	3.0	0.221	LOS A	1.6	11.2	0.29	0.66	40.6
Approach		273	3.0	0.221	LOS A	1.6	11.2	0.29	0.62	41.3
East: Barina Downs Rd (east)										
4	L	48	3.0	0.124	LOS A	0.8	5.9	0.26	0.56	43.1
5	T	102	3.0	0.123	LOS A	0.8	5.9	0.26	0.46	43.6
Approach		151	3.0	0.124	LOS A	0.8	5.9	0.26	0.49	43.4
West: Barina Downs Rd (west)										
11	T	69	3.0	0.146	LOS A	1.0	6.9	0.37	0.49	42.9
12	R	92	3.0	0.146	LOS A	1.0	6.9	0.37	0.71	40.6
Approach		161	3.0	0.146	LOS A	1.0	6.9	0.37	0.62	41.6
All Vehicles		584	3.0	0.221	LOS A	1.6	11.2	0.31	0.58	41.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout Capacity Model: SIDRA Standard.

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INTERSECTION

MOVEMENT SUMMARY

Site: BarinaDownsRd-
RestonGr - FU - AM

Barina Downs Rd - Reston Gra
Scenario: Existing + Development
Period: AM
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV Deg. Satn %	v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Reston Gr (south)											
1	L	1	2.0	0.351	7.3	LOS A	2.9	20.6	0.51	0.66	42.3
2	T	368	2.0	0.365	8.3	LOS A	2.9	20.6	0.51	0.63	47.9
3	R	21	2.0	0.363	10.6	LOS A	2.9	20.6	0.51	0.80	40.6
Approach		391	2.0	0.365	8.4	LOS A	2.9	20.6	0.51	0.64	47.4
East: Barina Downs Rd (east)											
4	L	33	2.0	0.215	6.2	LOS A	1.5	10.5	0.30	0.52	42.7
5	T	6	2.0	0.218	5.3	LOS A	1.5	10.5	0.30	0.44	43.1
6	R	227	2.0	0.215	11.6	LOS A	1.5	10.5	0.30	0.68	45.5
Approach		266	2.0	0.215	10.8	LOS A	1.5	10.5	0.30	0.66	45.1
North: Reston Gr (north)											
7	L	48	2.0	0.113	7.6	LOS A	0.8	5.4	0.14	0.60	49.2
8	T	101	2.0	0.113	6.7	LOS A	0.8	5.4	0.14	0.51	50.0
9	R	8	2.0	0.114	11.1	LOS A	0.8	5.4	0.14	0.79	46.2
Approach		158	2.0	0.113	7.2	LOS A	0.8	5.4	0.14	0.55	49.5
West: Goldfinch Ct (west)											
10	L	12	2.0	0.028	10.9	LOS A	0.2	1.3	0.63	0.68	46.3
11	T	7	2.0	0.028	8.1	LOS A	0.2	1.3	0.63	0.61	41.5
12	R	2	2.0	0.028	12.4	LOS A	0.2	1.3	0.63	0.75	39.2
Approach		21	2.0	0.028	10.1	LOS A	0.2	1.3	0.63	0.66	43.8
All Vehicles		836	2.0	0.365	9.0	LOS A	2.9	20.6	0.37	0.63	46.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout Capacity Model: SIDRA Standard.

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MOVEMENT SUMMARY

Site: NorwestBlvde-RestonGr
- FU- AM

Norwest Boulevard - Reston Grange
Scenario: Existing (2010) + Development
Period: AM
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV Deg. Satn %	Avg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Reston Gr (south)											
1	L	362	2.0	0.772	21.2	LOS B	7.4	52.8	0.92	1.22	34.3
2	T	171	2.0	0.745	14.2	LOS A	8.1	57.6	0.94	1.20	36.2
3	R	327	2.0	0.746	22.3	LOS B	8.1	57.6	0.94	1.23	35.4
Approach		860	2.0	0.773	20.2	LOS B	8.1	57.6	0.93	1.22	35.0
East: Norwest Blvde (east)											
4	L	8	3.0	0.602	5.7	LOS A	6.2	44.5	0.54	0.53	49.0
5	T	1579	3.0	0.617	5.3	LOS A	6.2	44.5	0.55	0.49	49.4
6	R	34	3.0	0.612	11.1	LOS A	6.1	43.4	0.57	0.84	46.6
Approach		1621	3.0	0.617	5.5	LOS A	6.2	44.5	0.55	0.49	49.3
North: Solent Ct (north)											
7	L	23	3.0	0.112	9.9	LOS A	0.7	5.3	0.80	0.87	42.1
8	T	29	3.0	0.112	7.7	LOS A	0.7	5.3	0.80	0.82	41.9
9	R	114	3.0	0.176	14.6	LOS B	1.3	9.6	0.84	0.90	39.4
Approach		166	3.0	0.176	12.7	LOS B	1.3	9.6	0.83	0.88	40.2
West: Norwest Blvde (west)											
10	L	379	3.0	0.737	11.0	LOS A	10.9	78.2	0.93	0.99	45.5
11	T	932	3.0	0.737	11.1	LOS A	10.9	78.2	0.94	1.01	45.7
12	R	57	3.0	0.738	17.1	LOS B	10.4	74.3	0.94	1.07	42.1
Approach		1367	3.0	0.737	11.4	LOS B	10.9	78.2	0.94	1.01	45.5
All Vehicles		4015	2.8	0.773	10.9	LOS A	10.9	78.2	0.78	0.84	43.8

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (RTA NSW).

Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (RTA NSW).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout Capacity Model: SIDRA Standard.

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