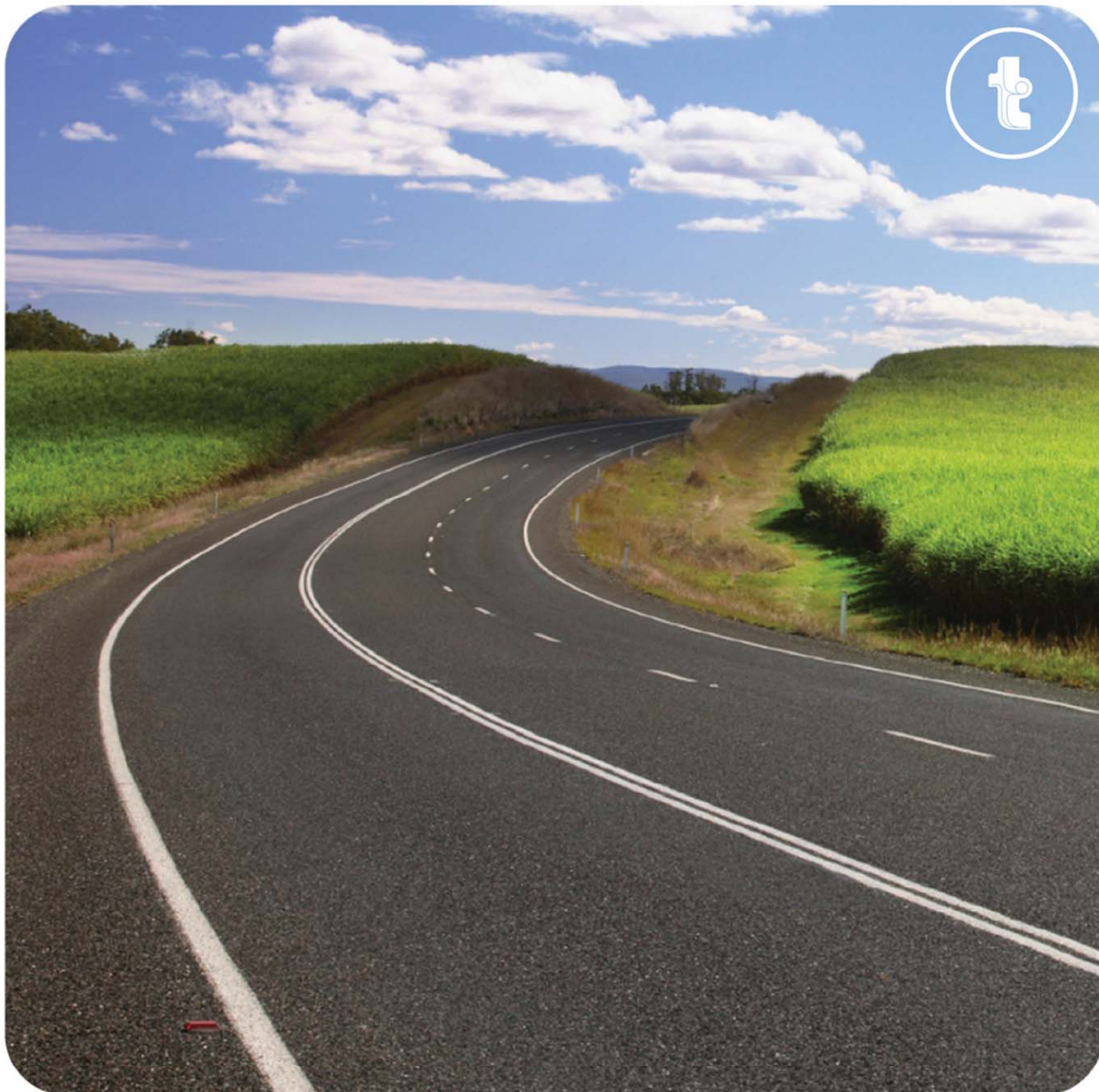




Traffic Impact Assessment

Lot 24 DP 714096 Warrah Road, North Nowra
Residential Subdivision – Planning Proposal

Ref: 13.358r01v3 TRAFFIX – June 2014

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Appendices

Appendix A:	Photographic Record
Appendix B:	SIDRA Intersection Outputs
Appendix C:	Indicative Layout Plan



1. Introduction

TRAFFIX has been commissioned by Huntingdale Developments and Southbank Land Pty Ltd to undertake a traffic impact assessment of a proposed rezoning of land located at the southern end of Warrah Road, North Nowra. The application seeks approval for the rezoning of the site from Rural (General Rural) Zone 1(d) to Residential 2(a) to permit the construction of approximately 397 residential lots and associated infrastructure.

The site is located within the Shoalhaven City Council LGA and is to be assessed under the relevant Council controls. The report documents the findings of our investigations and should be read in the context of the Planning Proposal prepared separately by Urbis.

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: Discusses the parking requirements
- Section 6: Assesses traffic impacts
- Section 7: Discusses access and internal design aspects
- Section 8: Presents the overall study conclusions.



2. Location and Site

The site is located approximately 55 kilometres south of Wollongong and approximately 5 kilometres northwest of the Nowra Town Centre, within the Shoalhaven LGA. The site is legally known as Lot 24 of DP714096 and is accessed via Illaroo Road (in a regional context) and Warrah Road and Moondara Drive locally.

The site is irregular in configuration and has a total area of approximately 73 hectares. The site generally has a northern and eastern boundary to residential developments with southern and western boundaries to riparian zones.

A Location Plan is presented in **Figure 1**, with a Site Plan presented in **Figure 2**. 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.

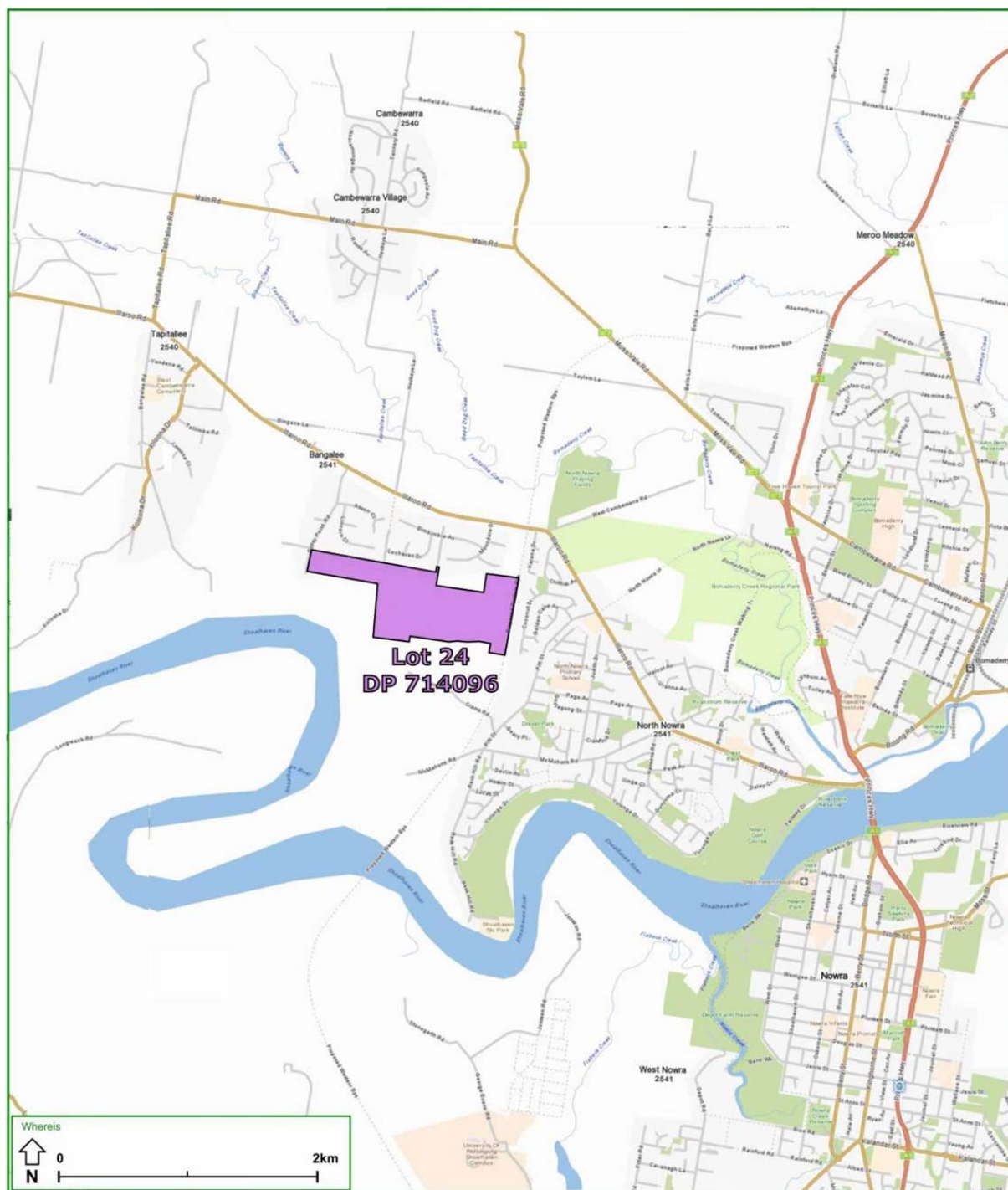


Figure 1: Location Plan



Figure 2 : Site Plan



3. Existing Traffic Conditions

3.1 Road Hierarchy

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

- ➡ **Princes Highway:** an RMS State Road (SH 1) that generally runs in a north-south direction and forms part of an interstate link between Sydney and Melbourne. The Princes Highway carries 50,881 vpd measured at the Shoalhaven River Bridge. The Princes Highway is subject to a 70km/h speed zoning within the locality and generally carries two lanes of traffic in either direction within a divided carriageway of width 22 metres.
- ➡ **Illaroo Road:** a collector road that generally runs in an east-west direction from the Princes Highway in the east and joins Bugong Road in the west. It generally carries a single lane of traffic in either direction and is subject to variable speed limits with a maximum limit of 80km/h. Illaroo Road is a generally constructed with a 6.5m wide trafficable carriageway in the vicinity of the site with unformed gravel or grass verges. No pedestrian footpaths or kerbs are constructed along Illaroo Road west of its intersection with West Cambewarra Street.
- ➡ **Moondara Drive:** a local road that generally runs in a north-south direction between Illaroo Road in the north to its cul-de-sac to the south-east of its intersection Burrandool Avenue. Moondara Drive is subject to a 50km/h speed zoning and carries a single lane of traffic in either direction along an undivided carriageway 7.5m carriageway. No line marking, kerbs or pedestrian footpaths are provided along its length.
- ➡ **Bimbimbie Avenue:** a local road that generally runs in an east-west direction from Moondara Drive in the east to its cul-de-sac to the west of its intersection with Lochaven Drive. Bimbimbie Avenue is constructed with a 7.5m wide carriageway and forms the stem of a priority controlled intersection with Moondara Drive, however no line marking or signage is provided at this intersection. A 50km/h speed zoning applies along its length.



- ➡ Warrah Road: a local rural road that generally runs in a north-south direction from Bimbimbie Avenue in the north and providing direct access to the site in the south. Warrah Road is subject to a 50km/h speed zoning and carries a single lane of traffic in either direction along an undivided carriageway with a width varying from 4.5-5.0m. Warrah Road is proposed as the primary access to the subject site.
- ➡ Gypsy Point Road: a local road that runs in a north-south direction from Illaroo Road in the north to its termination in the south. Gypsy Point Road carries a single lane of traffic in either direction and is subject to a 50km/h speed zoning in the vicinity of the site.

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 however access to this road network is limited to a single ingress and egress route via Moondara Drive. The key intersections in the locality are discussed in more detail in the following sections.

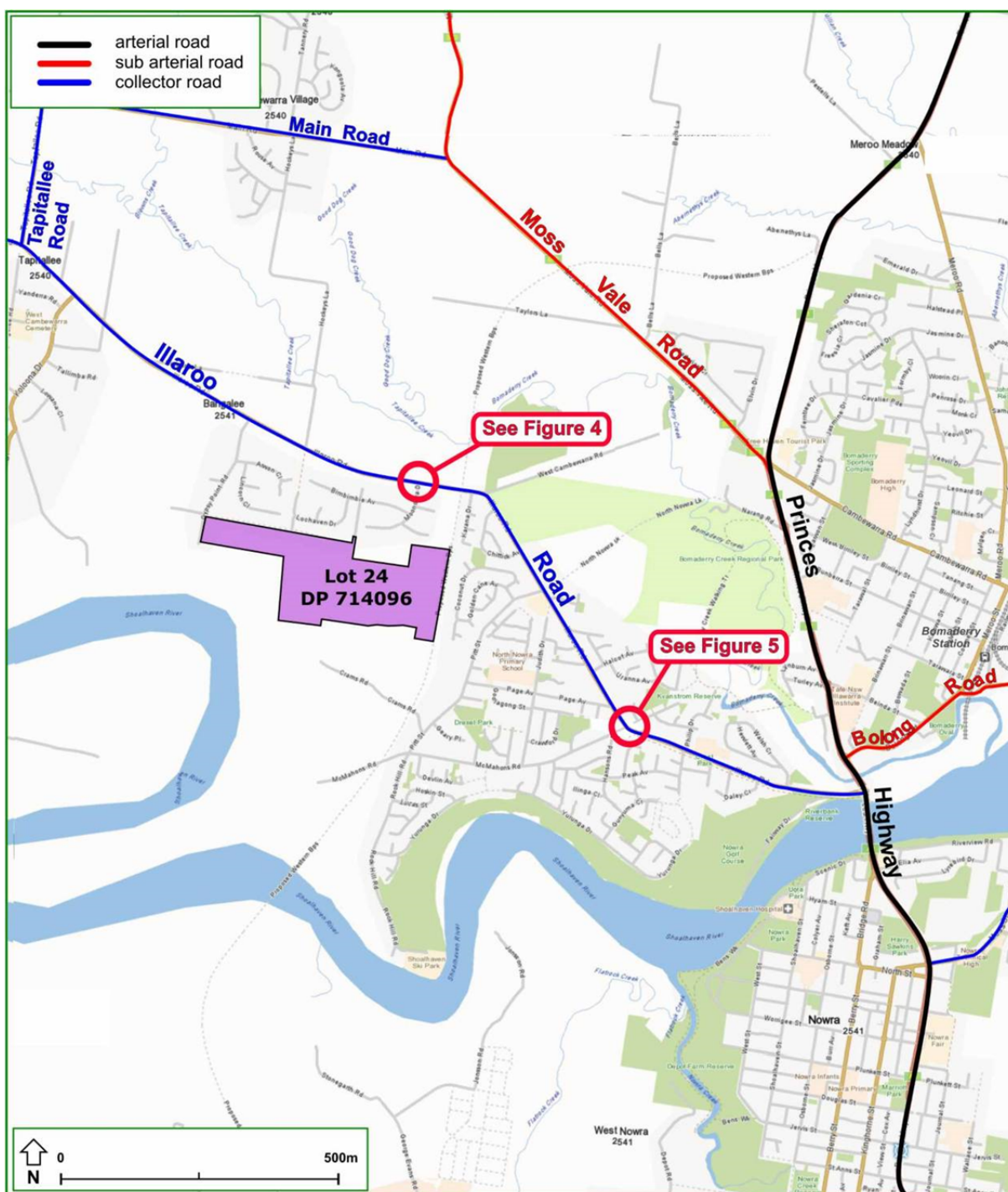


Figure 3: Surrounding Road Hierarchy



3.2 Key Intersections

The key intersections in the vicinity of the site are shown below and provide an understanding of the existing road geometry and alignment:



Figure 4 : Intersection of Moondara Drive & Illaroo Road

It can be seen from **Figure 4** that Illaroo Road generally carries one lane of traffic in either direction in the vicinity of the site. Illaroo Road forms the through movement of a priority controlled 'T' junction with Moondara Drive and provides adequate sightlines in both directions. This intersection will accommodate all vehicles associated with the proposed subdivision and as such will require remediation works to ensure adequate safety and operation is achieved.



Figure 5: Intersection of McMahon's Road & Illaroo Road

Figure 5 shows the intersection of McMahon's Road and Illaroo Road located to the south east of the site (approximately 3km). This roundabout intersection is located approximately 1.6km to the west of the Princes Highway and will accommodate a large proportion of trips associated with the site.

3.3 Public Transport

The existing bus services that operate in the locality are shown in **Figure 6**. The Bomaderry (Nowra) Railway Station is located approximately 3.7km east of the site and is located between Meroo Street and Railway Street. The railway station is served by CityRail's South Coast Line and provides services to Kiama, where further railway linkages provide services to Central Station which provides services throughout the Sydney metropolitan network.

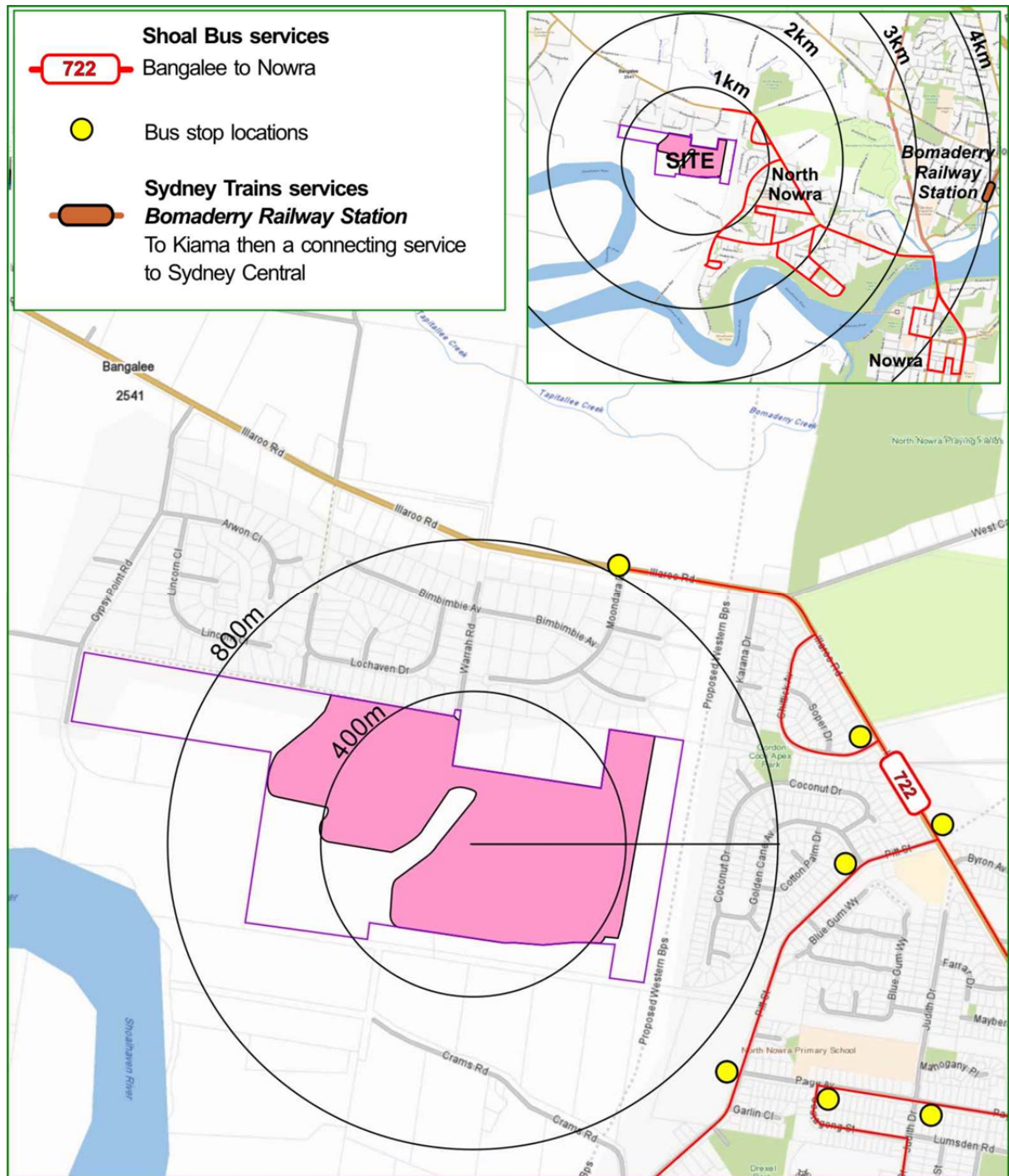


Figure 6: Public Transport

Shoalbus provides services between Nowra and North Nowra which traverse Illaroo Road via the Princes Highway, typically providing services on an hourly basis. A bus stop is located within the



vicinity of the site at the intersection of Moondara Drive and Illaroo Road, however this stop is on-request only and arrangements must be made with Shoalbus to arrange pick-up from this stop.

It is evident that the public transport facilities in the vicinity of the site are limited. It is expected that the increased residential densities on the subject site would not warrant the diversion of existing routes. This would however be reviewed over time and will ultimately be a commercial decision by operators in response to a demonstrated demand.

3.4 Walking and Cycling

The road network within the vicinity of the site is designed with a rural road verge which doesn't provide roadside kerbing or pedestrian footpaths, as such a limited level of pedestrian amenity is currently provided. The increased residential density would likely result in sufficient population to justify a change in the existing bus routes in the locality to service the development and surrounding area. This however will be subject to approval from the relevant operators having regard for commercial impacts of any new or deviated route. It would be proposed that these discussions would be held after the rezoning of the site was approved.

There are a limited number of cycle paths within the vicinity of the site, however the Shoalhaven City Council identifies Illaroo Road as part of a prominent cycle route (Ride A8) that travels within the vicinity of the site. Ride A8 is a recreational on-street cycle route that travels 19.6 kilometres from Apex Park to Coolendel Lookout utilising Illaroo Road to the north of the site, a map of ride A8 is shown below in Figure 7.

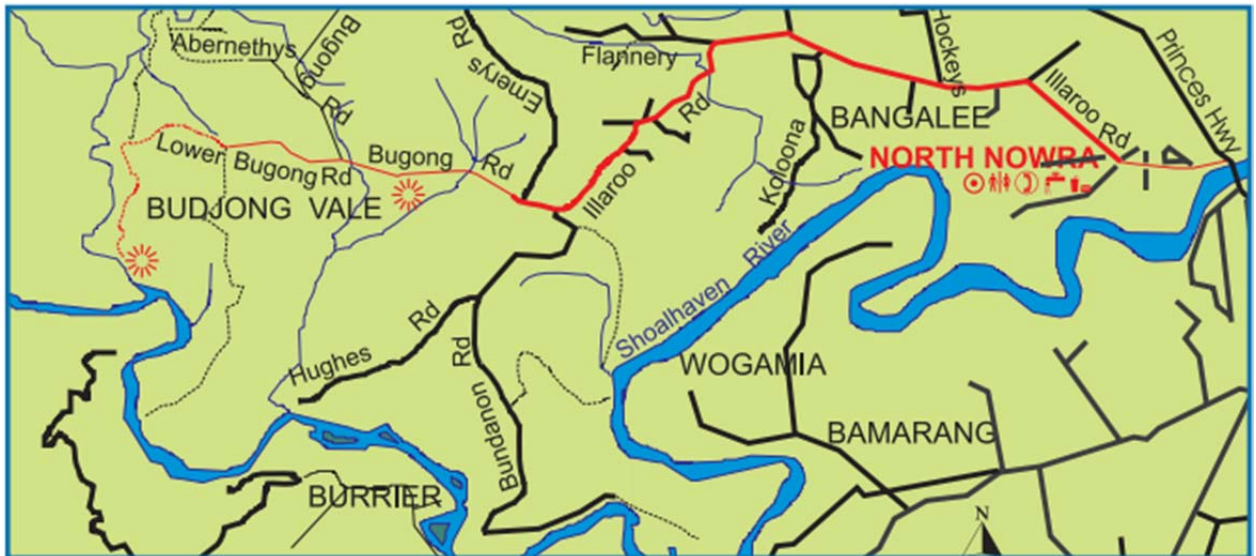


Figure 7: Council Identified Cycle Route (Ride A8)

3.5 Existing Travel Mode

It is evident from the above discussion of the limited public transport that there is a high reliance upon private vehicle usage in the locality of the site. It is therefore clear that the low frequency of bus/train services within the locality is not expected to achieve high levels of patronage (in relative terms) as they are not a viable alternative to private passenger vehicles for the majority of trip purposes, certainly in the short to medium term. Thus, the traffic assessment discussed below takes a conservative (car dependent) approach in order to assess a worst case scenario, whereby traffic impacts are overstated.

3.6 Existing Site Generation

The site currently accommodates undeveloped rural land which is largely vegetated by native eucalypt woodland and therefore generates no significant traffic volumes. Accordingly, the traffic generation for the indicative future development has been assessed as a net increase over and above existing conditions, to assess a worst case scenario.



3.7 Existing Road Network Performance

3.7.1 Existing Average Annual Daily Traffic Flows (AADT)

Tube counts were undertaken at key locations in the vicinity of the site to establish the current road performance of the road network. The results of the survey are summarised in Table 1.

Table 1: Tube Count Results

Count Location	Direction	AADT (veh/day)	Heavy Vehicle %	85% Speed (km/hr)
Moondara Drive (south of its Illaroo Road)	Northbound	379	2.6	45.2
	Southbound	364	1.9	41.6
Illaroo Road (east Moondara Drive)	Eastbound	1,653	3.6	64.3
	Westbound	1,627	3.3	64.2

It is evident, that Moondara Drive carries a combined AADT (northbound and southbound vehicles) of 734 veh/day with a heavy vehicle usage of approximately 2.3%. This is considered relatively low and reflects the low number of dwellings accessed via Moondara Drive. The measured 85th percentile speeds are also considered low and are below the signposted 50km/hr speed limit.

Illaroo Road carries a combined AADT (east and westbound vehicles) of 3,280 veh/day of which 3.5% were recorded as heavy vehicles. The 85th percentile speeds measured on Illaroo Road marginally exceed the sign posted speed limit of 60km/h. This is generally attributed to a change in speed zoning to 80km/hr that occurs approximately 150 metres west of Illaroo Road's intersection with Moondara Drive.

3.7.2 Existing Intersection Operation

For the purposes of the assessment of traffic impacts of the proposed rezoning, traffic surveys were undertaken during the critical morning and evening peak periods at the following key intersections of Moondara Drive with Illaroo Road; and McMahon's Road with Illaroo Road. The results of these surveys are summarised in Figure 9 and Figure 10 below for the morning and evening peak hours respectively. In addition to these intersections, the intersection of Gypsy Point Road and Illaroo Road



has also been assessed. Whilst this is not considered a critical intersection, the assessment of its existing and future operation has been undertaken to ensure a comprehensive assessment of the operation of the road network.

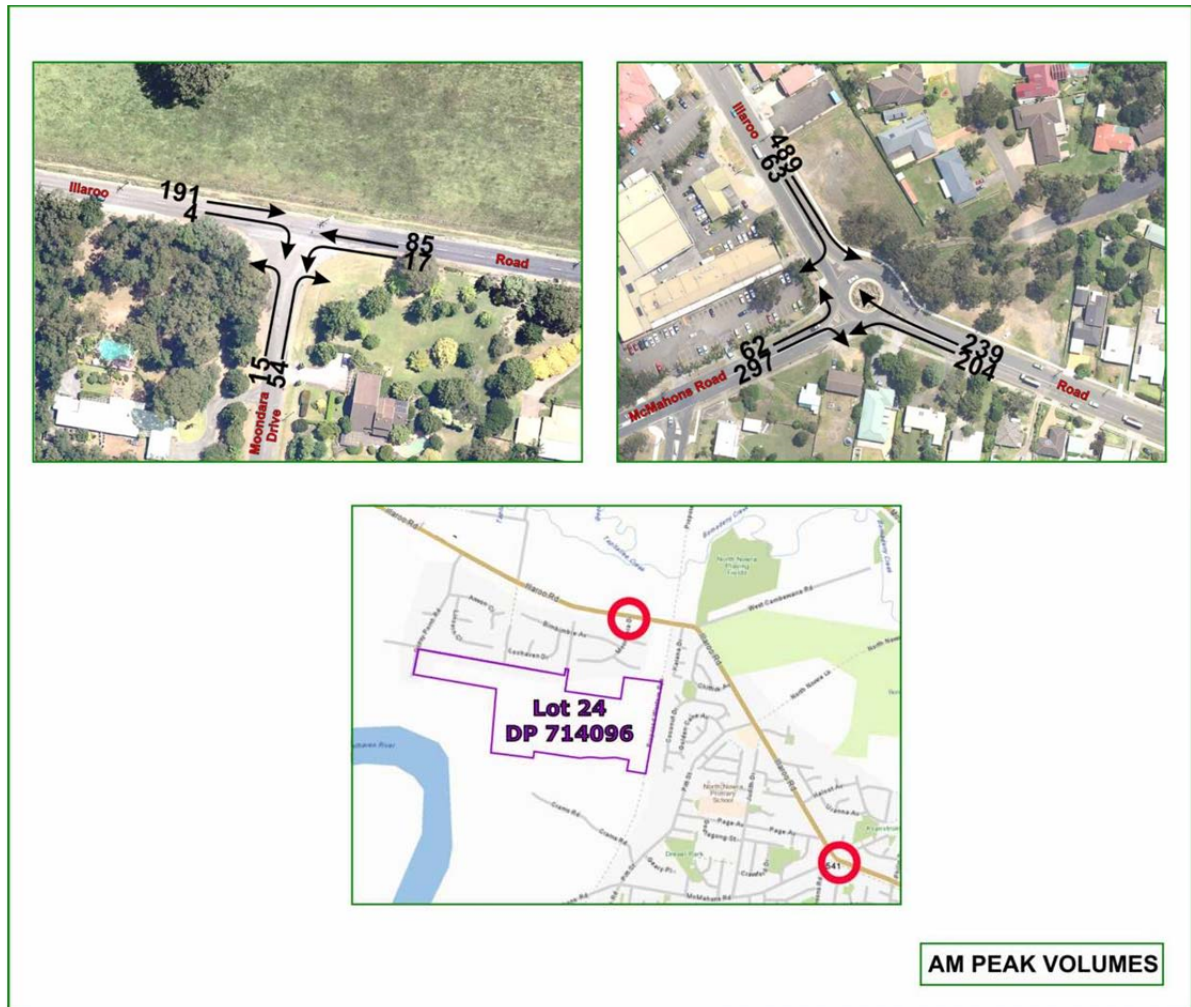


Figure 8: Existing AM Peak Turning Counts

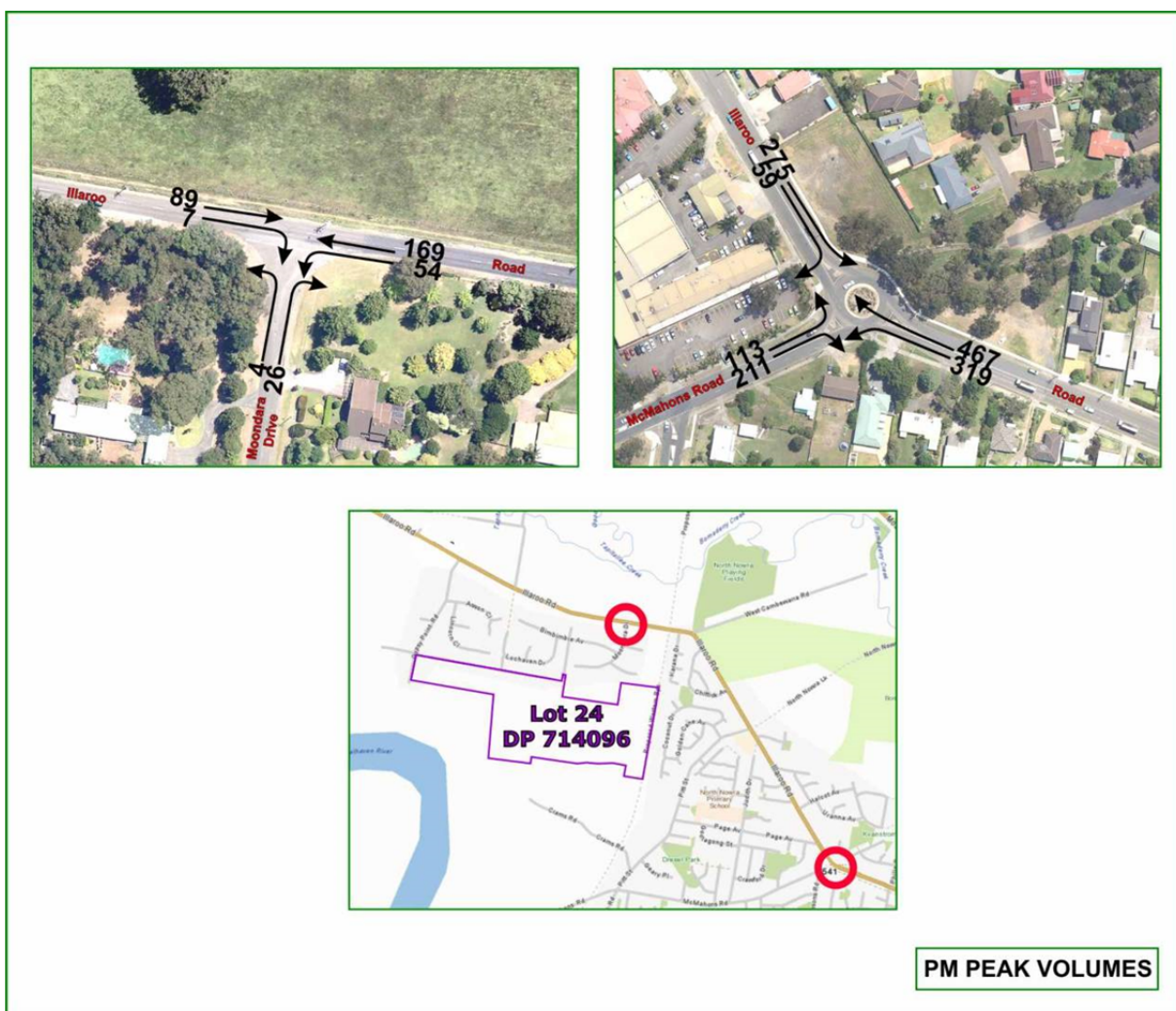


Figure 9: Existing PM Peak Turning Counts

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, Roundabout	Give Way and Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity 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 in **Table 2** below. Reference should also be made to the SIDRA outputs provided in **Appendix B** which provide detailed results for all approaches.



Table 2: Existing Peak Hour Intersection Performance

Intersection Description	Control Type	Period	Degree of Saturation	Critical Movement Delay	Level of Service
Moondara Drive & Illaroo Road	'Give Way'	AM	0.12	11.5	A
		PM	0.05	11.7	A
McMahons Road & Illaroo Road	Roundabout	AM	0.56	9.4	A
		PM	0.57	8.7	A
Gypsy Point Road & Illaroo Road	Give Way'	AM	0.06	10.0	A
		PM	0.07	10.2	A

It can be seen from Table 1 that all intersections currently operate satisfactorily with moderate delays under the existing 'base case' scenario, with a level of service A during both peak periods. Nevertheless, it is emphasised 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 6.

3.8 Regional Road Upgrades

3.8.1 North Nowra Link Road (NNLR)

The Shoalhaven City Council has previously submitted applications to the Department of Planning and Infrastructure in relation to a link road that would traverse Bomaderry Creek Regional Park, connecting Illaroo Road with the Princes Highway. The most recent concept plan application was prepared by JBA Planning on behalf of Shoalhaven City Council and was submitted in October 2010 and subsequently determined on 20/12/2012.

Three concept route options were considered as part of this application these three options are shown below in **Figure 10**. All three options were considered for approval however the Planning Assessment Commission considered the 'northern' route to be the best option and therefore only approved the 'northern' West Cambewarra Road option for the North Nowra Link Road



Figure 10: Concept Route Options (JBA Planning Report, 2010)

The 'northern' West Cambewarra Road option, is proposed to form a link between the existing intersection of Moss Vale Road and Elvin Drive in the east and the existing Illaroo Road 'T'-junction intersection with West Cambewarra Road in the west (this road would run parallel to the south of the existing West Cambewarra Road).

The assessment undertaken by Aecom concluded that:

- Traffic volumes and flows along Illaroo Road and queuing and delays at the intersection with Princes Highway are significantly reduced as a result of the NNLR.



- Residential amenity would be significantly improved under the proposal with accident rates on Illaroo Road to be further improved with the inclusion of signals at key intersections
- Travel times on Illaroo Road for vehicles travelling south on the Princes Highway would improve

This project will therefore have a considerable impact on the operation of key intersections in the locality and will result in improved access from the subject site to the regional road network. The proposal will also result in improved safety at key intersections.

3.8.2 Princes Highway upgrade, South Nowra

The upgrade of the 6.3 kilometre section of Princes Highway between Kinghorne Street and Forest Road has been completed and was officially opened on Saturday 29 March 2014. The project involved upgrading this section from two to four lanes, thereby improving traffic flow through Nowra and improving road safety by reducing the conflict between through traffic and local traffic that previously occurred.

3.8.3 Berry to Bomaderry Princes Highway upgrade

This project proposes to upgrade approximately 11.5 kilometres of the Princes Highway from a two lane undivided carriageway to a divided four lane carriageway between Schofields Lane, Berry and Cambewarra Road, Bomaderry with the provision for future widening of up to six lanes between Schofields Lane and Pestells Lane.

This upgrade is planned in conjunction with the Foxground and Berry Bypass project and the Gerringong upgrade project and these projects will upgrade the Princes Highway from Kiama to Bomaderry (Nowra). The Berry to Bomaderry upgrade of the Princes Highway is of particular significance to the subject proposal as it is approximately 2.5 kilometres south west of the intersection of the Princes Highway and Cambewarra Road.



4. Description of Proposed Development

Approval from Shoalhaven City Council is sought for the rezoning of the 'Warrah Road, North Nowra' site to permit residential development. The application will require an amendment to Shoalhaven LEP 2013. A detailed description of the proposal is provided in the Planning Proposal prepared by Urbis and the key aspects are summarised below:

- ➊ To rezone the land from rural through to the establishment of an appropriate residential land-use zone.
- ➋ To allow a variety of lot sizes, ranging from 588m² to 2,277m² and a proposed lot yield of 397 lots, in order to facilitate the creation of a sustainable, integrated community.
- ➌ To establish a planning framework that sets a benchmark for high-quality residential development.

Although the final site layout has not been completed, an indicative subdivision layout plan is provided in **Figure 11** with a complete set of the Urban Design plans prepared by KFW Pty Ltd and provided in **Appendix C**. The indicative subdivision plan includes:

- ➊ Provision for the future development of approximately 397 residential dwellings.
- ➋ Construction of new internal road network in accordance with the Shoalhaven City Council's DCP. These roadways are generally proposed with road widths (including road related areas) of between 13m and 18.0m in width depending on their classification and function.
- ➌ Proposed widening of Warrah Road to a minimum carriageway width of 7.0m.
- ➍ Appropriate provisions for future pedestrian and cyclist networks in accordance with Council's DCP, and
- ➎ Upgrades to the intersection of Moondara Drive and Illaroo Road including new line marking and the regrading of the surface.

The traffic impacts of the proposal are discussed in the following sections.

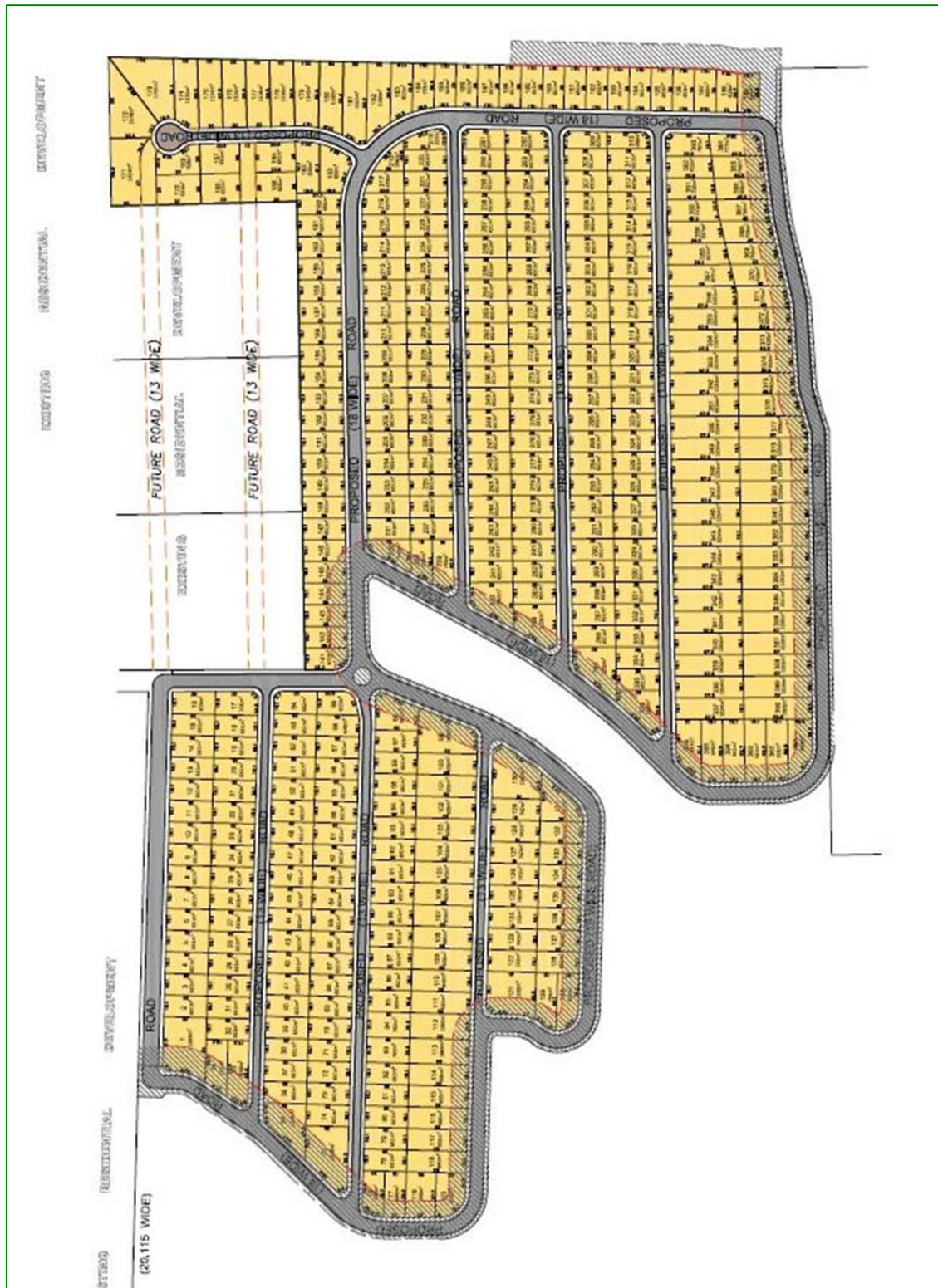


Figure 11: Indicative Future Layout Plan



5. Parking Requirements

All car parking is to be provided in accordance with Council's Development Control Plan No. 91 "Single Dwelling and Ancillary Structures". In this regard, Council's DCP requires that a minimum of two car/vehicle parking spaces be provided on-site for each dwelling. Based on the indicative yield of 397 dwellings, this results in a minimum future requirement of 794 parking spaces provided within each development lot.

In addition, Council's DCP 100 "Subdivision Code" also requires the provision of on-street parking to be provided within the future road network. These spaces will be provided as parallel parking and will service the visitor needs of future residents.

The future parking requirements of the site are expected to be consistent with the above requirements. Notwithstanding, the parking requirements of the development will be assessed in detail during subsequent Development Application stages..



6. Traffic Impacts

6.1 Trip Generation

6.1.1 RMS Guideline

The Roads & Maritime Services Technical Direction 04a entitled the *Guide to Traffic Generating Developments Updated Traffic Surveys* recommends the following peak hourly traffic generation rates for low density residential dwellings in regional areas:

- ➡ 0.71 trips per morning peak hour for a standard residential dwelling.
- ➡ 0.78 trips per evening peak hour for a standard residential dwelling.
- ➡ 7.4 daily trips per dwelling

Application of the above rates to the indicative development yield of 397 residential dwellings would therefore result in a future generation of 282 vehicles per hour during the morning peak hour, 310 vehicles during the evening peak hour and 2,938 vehicle trips per day.

6.1.2 Surveyed Traffic Count Data

Traffic tube count surveys were undertaken on Moondara Drive immediately to the south of its intersection with Illaroo Road. Moondara Drive provides access to 114 existing residential dwellings and based on the traffic surveys, currently accommodates a daily traffic volume of 734 vehicles movements. This equates to a daily traffic volume of 6.5 trips per day and 0.65 trips per peak hour during peak periods.

Application of these surveyed rates to the indicative development yield of 397 dwellings results in peak hour traffic generation of generation of 258 veh/hr and a daily traffic volume of approximately 2,580 vehicles.

6.1.3 Adopted Traffic Generation

For the purpose of this assessment, the surveyed traffic generation rates have been adopted as it is more representative of local conditions. The surveyed rate of 0.65 trips/hour and 6.5 trips per day, are nevertheless very comparable to the rates published in the RMS Guideline.



Accordingly, a future peak hour generation of 258 veh/hr and a daily traffic volume of approximately 2,580 vehicles has been adopted for assessment. The distribution of this traffic onto the road network and the subsequent impact on the operation of key intersections is discussed further below.

6.2 Traffic Distribution

The following assumptions have been adopted for the purposes of this assessment in relation to the distribution of traffic onto the external road network:

- ➊ Directional splits of 20% in and 80% out during the morning peak and reversed for the evening peak period.
- ➋ 90% of total trips will arrive / depart to the east with 10% to arrive / depart to the west.

Having regard for the above distributions, the future traffic generation of the site has been superimposed onto the existing surveyed base case model. The resulting intersection operation during peak periods and mid-block traffic flows are discussed in Section 6.3 and 6.4.

6.3 Peak Period Intersection Performances (with Development)

The impacts of the proposed development on the external road network have been assessed having regard for the indicative yield (circa 397 dwellings). This assessment has been undertaken in accordance with the requirements of the RMS Guideline with the future traffic generation established through surveys of the existing developments in the locality. The results of this assessment are outlined in **Table 3** below.

It can be seen from the Table 3 that all intersections will continue to operate with acceptable Levels of Service and moderate delays. The intersections of Illaroo Road with Moondara Drive and Illaroo Road with McMahons Road accommodate a high proportion of trips associated with the development (between 100% and 90%). Nevertheless, they continue to operate at acceptable Levels of Service during peak periods and with minor increases in delay and queue as a result of the development.



Table 3: Intersection Performance – Existing plus Development

Intersection Description	Scenario	Period	Degree of Saturation	Critical Movement Delay	Level of Service
Moondara Drive & Illaroo Road	Existing	AM	0.12	11.5	A
		PM	0.05	11.7	A
	Future	AM	0.51	15.6	B
		PM	0.26	14.0	A
McMahons Road & Illaroo Road	Existing	AM	0.56	9.4	A
		PM	0.57	8.7	A
	Future	AM	0.74	16.5	B
		PM	0.70	17.4	B
Gypsy Point Road & Illaroo Road	Existing	AM	0.06	10.0	A
		PM	0.07	10.2	A
	Future	AM	0.06	10.0	A
		PM	0.07	10.2	A

It is noted that no assessment of Illaroo Road and Princes Highway has been undertaken as part of this assessment due to proposed regional road improvements being considered by Council and the State Government. In particular, the NNLR will result in considerable improvements in both accessibility and intersection operation along Illaroo Road and the Princes Highway beyond that which can be considered as part of this application. .

6.4 Midblock Capacity

Traffic tube counts were undertaken on Moondara Drive (south of Illaroo) and Illaroo Road (east of Moondara Drive) to establish the existing daily and peak hourly traffic flows in the locality. The maximum recorded traffic volumes during the survey period and the predicted future peak hourly volumes as a result of the development are outlined in Table 4 while the existing and future AADT volumes are summarised in Table 5.



Table 4: Existing and Future Peak Hour Traffic Volumes

Count Location	Direction	Existing Peak Hour Volumes (veh/hr)		Future Peak Hour Volumes (veh/hr)	
		AM	PM	AM	PM
Moondara Drive	Northbound	62	30	268	82
	Southbound	22	56	74	262
Illaroo Road	Eastbound	226	186	413	233
	Westbound	87	217	134	404

Table 5: Existing and Future Daily Traffic Volumes

Count Location	Direction	Existing AADT (veh/day)	Future AADT (veh/day)
Moondara Drive	Northbound	379	1,669
	Southbound	364	1,654
Illaroo Road	Eastbound	1,653	2,814
	Westbound	1,627	2,788

The future traffic volumes along Illaroo Road are considered supportable and fall within the AADT goal for Local Distributor Roads as outlined in Shoalhaven City Council's DCP 100 – Subdivision Code, which are 3,000 to 6,000 vehicles per day. Traffic volumes on Moondara Drive are however expected to slightly exceed the limits for Collector Streets (3,000 vpd) as defined in the DCP. This is considered to be a nominal exceedance of about 300 veh/day; or 50 veh/hr during peak periods. As this is less than one vehicle per minute above the DCP threshold, this is not expected to result in an observable impact.

Furthermore, AADT should not be considered the only determining factor with respect to the operation of the road network. Consideration to key factors such as intersection operation, noise and vehicular and pedestrian safety also need to be considered. These are detailed matters that are arguably more relevant than 'generic' daily threshold levels. It is also noted that the resultant traffic volumes only



marginally exceed the maximum RMS 'environmental capacity' threshold of 300 veh/hr. In this regard, the RMS Guideline also identifies techniques to increase this capacity, through traffic calming measures aimed at reducing speed. These are not however proposed due to the minor exceedance of the DCP threshold as discussed.

In particular, a number of infrastructure upgrades are proposed to ensure safe and efficient operation of the local road network is maintained in the future. The following upgrades are considered necessary to support the likely future increase in traffic volumes that would result from this application:

- ➊ Upgrades to the intersection of Moondara Drive and Illaroo Road. This is to include new line marking, and the re-grading of the roadway to improve road surface conditions. The installation of a pedestrian refuge should also be considered to ensure that pedestrian safety is maximised.
- ➋ New line marking and improved signage at the intersection of Moondara Drive and Bimbimbie Avenue.
- ➌ The widening of Warrah Road between Bimbimbie Avenue and the site access to a minimum width of 7.0m to accommodate two way traffic flow.

The implementation of the above infrastructure upgrades is considered necessary to off-set the increase in daily traffic follows along key local roads in the locality. Notwithstanding, with the exception of the increase in AADT movements along Moondara Drive the impacts of the proposal on the external road network is considered minor and has no impact on the operation of key intersections in the locality.

Accordingly, subject to the implementation of these upgrades, the development is considered supportable on traffic planning grounds

6.5 Local upgrades to Accommodate Development

A number of infrastructure upgrades are proposed within the local road network to ensure safe and adequate operation in the future. These upgrades are summarised in section 6 above and generally include:

- ➊ Upgrades to the intersection of Moondara Drive and Illaroo Road.



- New line marking and improved signage at the intersection of Moondara Drive and Bimbimbie Avenue.
- The widening of Warrah Road between Bimbimbie Avenue and the site access to a minimum width of 7.0m to accommodate two way traffic flow.

These upgrades would be aimed at addressing the existing concerns of residents (if practicable) whilst creating a improved environment and amenity for the area more generally.



7. Access & Internal Design

The internal road network shown in **Appendix C** seeks to provide a high level of connectivity and limits the number of cul-de-sac roads provided. The internal design will aim to provide a road system within the subdivision in accordance with the aims and objectives of Shoalhaven City Council's DCP 100 - Subdivision Code (Amendment No 4) and will be assessed at the future DA stage should the planning proposal be approved through the gateway determination. The key objectives of the design include:

- ➊ To provide major street networks for vehicles, pedestrians and cyclists that are integrated, cost effective and minimise the impact of traffic on the residential environment;
- ➋ To create street networks in which the function of each street is clearly defined, providing acceptable levels of access, safety and convenience for all users;
- ➌ To contribute to the creation of an interesting and attractive streetscape
- ➍ To facilitate energy efficient lot and building orientation; and
- ➎ To encourage walking and cycling.

The proposed internal road network has been designed having regard for the requirements outlined in Table 1 and Table 3 of the Shoalhaven City Council DCP 100 which is summarised in **Table 6** below. In this regard Council's DCP requires consideration of both Table 1 and Table 3 of Council's DCP. Accordingly the following design elements have been adopted in the preparation of the Indicative Layout Plan:

- ➊ All major access streets have been designed with a minimum road reserve width of 18m including 4.5m wide verges and 9.0m wide carriageways
- ➋ Minor access roads proposed with a minimum road reserve of 13.0m with carriageway width of 6.0m which is sufficient to accommodate two lanes of through traffic plus 3.5m wide verges.
- ➌ The proposed cul-de-sac located in the north western corner of the site is designed with an 11.5m internal radius which exceeds the minimum requirements in Figure 6.1 of Council's DCP100.



Table 6: Council DCP Street Design Requirements

Road Type	Road Reserve (average)	Carriageway	Nature Strip	Design Speed Limit
Access Street	16m	6.0m	4.0min	30km/h
Local Street	18.0m	9.0m	4.5m	40km/h
Collector Road	20.0m	11.0m	4.5m	50km/h

Whilst the general intent of Council's controls is adhered to, it is noted that the Access Streets are proposed with a 13.0m wide road verge. Whilst council nominally requires a road reserve width of 16.0m for Access Streets, it is noted that the minimum carriageway of 6.0m is still achieved under the proposed design, with a reduced verge proposed to ensure that a low speed environment is achieved and is self-enforcing. The minor reduction is considered supportable and still provides suitable levels of accessibility, with uninterrupted two way flow conditions.

In summary, the proposed road hierarchy and cross sections will meet the objectives of Shoalhaven City Council and also meet the minimum design requirements of other relevant planning documents including AMCORD (the national resource document for residential development) and Austroads.

Accordingly, the proposed development is considered supportable on traffic planning grounds. Notwithstanding, any minor variations to optimise the design can be considered at the subsequent Development Application stage and would not hinder the ability for Council or the Department of Planning to approve this application.



8. Conclusions

The following conclusions are noteworthy:

- ➊ The application seeks approval for the rezoning of land to the south of Illaroo Road from Rural (General Rural) Zone 1(d) to Residential 2(a) to permit the construction of approximately 397 residential lots and associated infrastructure.
- ➋ The indicative future traffic generation of the application would result in a future peak hour generation in the order of 258 veh/hr and a daily traffic volume of approximately 2,580 vehicles.
- ➌ The impacts of the development on the road network have been assessed and all intersections will continue to operate with acceptable Levels of Service and moderate delays. The intersections analysed including Illaroo Road with Moondara Drive and Illaroo Road with McMahons Road have been assumed to accommodate a high proportion of trips associated with the development (between 100% and 90% of the total development traffic). Nevertheless, these intersections still continue to operate at acceptable Levels of Service during peak periods and with only minor increases in delays and queues with the development traffic.
- ➍ Future AADT volumes along Moondara Drive are expected to marginally exceed the limit for Collector Streets (3,000 vpd) outlined in Council's DCP100. It is however noted that this can be addressed through reduced speeds if necessary and in addition, AADT's are not the only determining factor in the assessment of network operation and other key considerations need to also be considered. In this regard a number of road improvements are proposed to offset these impacts and to ensure that acceptable levels of safety and amenity are achieved.
- ➎ The indicative road layout is considered supportable and is designed generally in accordance with the relevant requirements of Council's DCP.
- ➏ A number of significant regional road improvements are currently being considered by the Department of Planning and Infrastructure which will significantly improve the operation of key intersections in the locality and accessibility of the subject site to the regional road network.

The assessment satisfactorily demonstrates that the traffic generated by the assumed development yield under the rezoning is supportable subject to the adoption of network improvements identified above, with further refinement possible at development application stage/s.



Appendix A

Photographic Record



View looking north-west along Illaroo Road towards the future alignment of the North Nowra Link Road.



View looking west along Illaroo Road towards its intersection with Moondara Drive.





View looking south along Moondara Drive across Illaroo Road.



View looking south along Warrah Road towards the future site access





Appendix B

SIDRA Intersection Outputs

MOVEMENT SUMMARY

Site: Existing AM: Illaroo Road & Moondara Drive

Intersection: Illaroo Road & Moondara Drive
Period: AM
Scenario: Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Moondara Drive											
1	L	16	5.0	0.116	11.2	LOS A	0.4	3.3	0.38	0.59	45.9
3	R	57	5.0	0.116	11.5	LOS A	0.4	3.3	0.38	0.75	45.7
Approach		73	5.0	0.116	11.5	LOS A	0.4	3.3	0.38	0.72	45.7
East: Illaroo Road (East)											
4	L	18	5.0	0.057	8.4	LOS A	0.0	0.0	0.00	0.99	49.0
5	T	89	5.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		107	5.0	0.057	1.4	NA	0.0	0.0	0.00	0.16	57.8
West: Illaroo Road (West)											
11	T	201	5.0	0.110	0.4	LOS A	0.7	4.9	0.25	0.00	55.4
12	R	4	5.0	0.110	9.1	LOS A	0.7	4.9	0.25	1.02	49.0
Approach		205	5.0	0.110	0.6	NA	0.7	4.9	0.25	0.02	55.2
All Vehicles		385	5.0	0.116	2.9	NA	0.7	4.9	0.20	0.19	53.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

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INTERSECTION

MOVEMENT SUMMARY

Site: Existing AM: Illaroo Road & Moondara Drive

Intersection: Illaroo Road & Moondara Drive
Period: AM
Scenario: Existing
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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Moondara Drive											
1	L	16	5.0	0.116	11.2	LOS A	0.4	3.3	0.38	0.59	45.9
3	R	57	5.0	0.116	11.5	LOS A	0.4	3.3	0.38	0.75	45.7
Approach		73	5.0	0.116	11.5	LOS A	0.4	3.3	0.38	0.72	45.7
East: Illaroo Road (East)											
4	L	18	5.0	0.057	8.4	LOS A	0.0	0.0	0.00	0.99	49.0
5	T	89	5.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		107	5.0	0.057	1.4	NA	0.0	0.0	0.00	0.16	57.8
West: Illaroo Road (West)											
11	T	201	5.0	0.110	0.4	LOS A	0.7	4.9	0.25	0.00	55.4
12	R	4	5.0	0.110	9.1	LOS A	0.7	4.9	0.25	1.02	49.0
Approach		205	5.0	0.110	0.6	NA	0.7	4.9	0.25	0.02	55.2
All Vehicles		385	5.0	0.116	2.9	NA	0.7	4.9	0.20	0.19	53.8

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

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INTERSECTION

MOVEMENT SUMMARY

Site: Existing AM: Illaroo Road & McMahon's Rd

Intersection: Illaroo Road & McMahon's Road
Period: AM
Scenario: Existing
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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Illaroo Road											
1	L	215	2.5	0.340	7.5	LOS A	2.5	18.0	0.28	0.57	48.9
2	T	252	4.6	0.340	6.7	LOS A	2.5	18.0	0.28	0.49	49.4
3	R	4	25.0	0.340	14.0	LOS A	2.5	18.0	0.28	0.80	44.8
Approach		471	3.8	0.340	7.1	LOS A	2.5	18.0	0.28	0.53	49.1
North: Illaroo Road											
8	T	515	1.8	0.562	9.1	LOS A	4.7	33.6	0.70	0.72	46.9
9	R	67	1.6	0.562	13.9	LOS A	4.7	33.6	0.70	0.84	44.8
Approach		582	1.8	0.562	9.6	LOS A	4.7	33.6	0.70	0.74	46.6
West: McMahon's Road											
10	L	65	1.6	0.348	8.7	LOS A	2.2	15.6	0.51	0.64	47.3
12	R	314	1.3	0.348	12.7	LOS A	2.2	15.6	0.51	0.73	44.7
Approach		379	1.4	0.348	12.0	LOS A	2.2	15.6	0.51	0.71	45.1
All Vehicles		1432	2.4	0.562	9.4	LOS A	4.7	33.6	0.52	0.66	47.0

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

MOVEMENT SUMMARY

Site: Existing PM: Illaroo Road & McMahon Rd

Intersection: Illaroo Road & McMahon Road
Period: PM
Scenario: Existing
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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Illaroo Road											
1	L	336	0.6	0.574	7.5	LOS A	5.6	39.3	0.36	0.56	48.5
2	T	492	0.4	0.574	6.7	LOS A	5.6	39.3	0.36	0.49	48.9
3	R	1	0.0	0.574	13.4	LOS A	5.6	39.3	0.36	0.77	44.8
Approach		828	0.5	0.574	7.1	LOS A	5.6	39.3	0.36	0.52	48.7
North: Illaroo Road											
8	T	289	0.4	0.321	7.6	LOS A	2.1	15.2	0.51	0.60	48.0
9	R	64	3.3	0.321	12.5	LOS A	2.1	15.2	0.51	0.78	45.7
Approach		354	0.9	0.321	8.5	LOS A	2.1	15.2	0.51	0.63	47.6
West: McMahon Road											
10	L	119	0.9	0.389	10.4	LOS A	2.6	18.1	0.70	0.78	46.3
12	R	223	1.9	0.389	14.5	LOS A	2.6	18.1	0.70	0.83	43.6
Approach		342	1.5	0.389	13.0	LOS A	2.6	18.1	0.70	0.81	44.5
All Vehicles		1524	0.8	0.574	8.7	LOS A	5.6	39.3	0.47	0.61	47.4

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

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INTERSECTION

MOVEMENT SUMMARY

Site: Future AM: Illaroo Road & Moondara Drive

Intersection: Illaroo Road & Moondara Drive
Period: AM
Scenario: Existing + Development
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Moondara Drive											
1	L	38	5.0	0.510	15.3	LOS B	3.7	27.1	0.59	0.73	42.2
3	R	254	5.0	0.510	15.6	LOS B	3.7	27.1	0.59	0.97	42.1
Approach		292	5.0	0.510	15.5	LOS B	3.7	27.1	0.59	0.94	42.1
East: Illaroo Road (East)											
4	L	67	5.0	0.085	8.4	LOS A	0.0	0.0	0.00	0.85	49.0
5	T	89	5.0	0.085	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		157	5.0	0.085	3.6	NA	0.0	0.0	0.00	0.37	54.7
West: Illaroo Road (West)											
11	T	201	5.0	0.114	0.7	LOS A	0.7	5.3	0.31	0.00	54.3
12	R	9	5.0	0.114	9.3	LOS A	0.7	5.3	0.31	0.99	49.0
Approach		211	5.0	0.114	1.1	NA	0.7	5.3	0.31	0.04	54.0
All Vehicles		659	5.0	0.510	8.1	NA	3.7	27.1	0.36	0.52	48.2

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Future PM: Illaroo Road & Moondara Drive

Intersection: Illaroo Road & Moondara Drive
Period: PM
Scenario: Existing + Development
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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Moondara Drive											
1	L	9	5.0	0.180	13.7	LOS A	0.7	5.1	0.56	0.73	43.5
3	R	77	5.0	0.180	14.0	LOS A	0.7	5.1	0.56	0.86	43.4
Approach		86	5.0	0.180	14.0	LOS A	0.7	5.1	0.56	0.84	43.4
East: Illaroo Road (East)											
4	L	254	5.0	0.236	8.4	LOS A	0.0	0.0	0.00	0.79	49.0
5	T	178	5.0	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		432	5.0	0.236	4.9	NA	0.0	0.0	0.00	0.47	53.0
West: Illaroo Road (West)											
11	T	94	5.0	0.083	2.3	LOS A	0.5	3.9	0.49	0.00	50.8
12	R	29	5.0	0.083	10.9	LOS A	0.5	3.9	0.49	0.92	48.1
Approach		123	5.0	0.083	4.3	NA	0.5	3.9	0.49	0.22	50.1
All Vehicles		641	5.0	0.236	6.0	NA	0.7	5.1	0.17	0.47	50.9

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

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INTERSECTION

MOVEMENT SUMMARY

Site: Future AM: Illaroo Road & McMahon's Rd

Intersection: Illaroo Road & McMahon's Road
Period: PM
Scenario: Existing + Development
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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Illaroo Road											
1	L	215	2.5	0.375	7.5	LOS A	3.0	21.4	0.31	0.56	48.8
2	T	301	4.6	0.375	6.7	LOS A	3.0	21.4	0.31	0.49	49.2
3	R	4	25.0	0.375	14.0	LOS A	3.0	21.4	0.31	0.79	44.8
Approach		520	3.9	0.375	7.1	LOS A	3.0	21.4	0.31	0.52	49.0
North: Illaroo Road											
8	T	712	1.8	0.742	11.7	LOS A	9.8	69.8	0.87	0.86	45.3
9	R	67	1.6	0.742	16.5	LOS B	9.8	69.8	0.87	0.91	42.7
Approach		779	1.8	0.742	12.2	LOS A	9.8	69.8	0.87	0.86	45.1
West: McMahon's Road											
10	L	65	1.6	0.366	9.1	LOS A	2.4	16.6	0.56	0.67	47.0
12	R	314	1.3	0.366	13.1	LOS A	2.4	16.6	0.56	0.75	44.5
Approach		379	1.4	0.366	12.4	LOS A	2.4	16.6	0.56	0.74	44.9
All Vehicles		1678	2.4	0.742	10.6	LOS A	9.8	69.8	0.62	0.73	46.2

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Future PM: Illaroo Road & McMahon's Rd

Intersection: Illaroo Road & McMahon's Road
Period: PM
Scenario: Existing + Development
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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Illaroo Road											
1	L	336	0.6	0.702	7.7	LOS A	8.9	62.3	0.46	0.55	48.1
2	T	688	0.4	0.702	6.9	LOS A	8.9	62.3	0.46	0.49	48.3
3	R	1	0.0	0.702	13.5	LOS A	8.9	62.3	0.46	0.73	44.8
Approach		1025	0.5	0.702	7.2	LOS A	8.9	62.3	0.46	0.51	48.2
North: Illaroo Road											
8	T	339	0.4	0.366	7.6	LOS A	2.6	18.5	0.54	0.61	47.8
9	R	64	3.3	0.366	12.6	LOS A	2.6	18.5	0.54	0.78	45.8
Approach		403	0.8	0.366	8.4	LOS A	2.6	18.5	0.54	0.64	47.5
West: McMahon's Road											
10	L	119	0.9	0.475	13.3	LOS A	3.7	26.5	0.85	0.93	43.5
12	R	223	1.9	0.475	17.4	LOS B	3.7	26.5	0.85	0.96	41.3
Approach		342	1.5	0.475	16.0	LOS B	3.7	26.5	0.85	0.95	42.0
All Vehicles		1771	0.8	0.702	9.2	LOS A	8.9	62.3	0.55	0.62	46.7

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

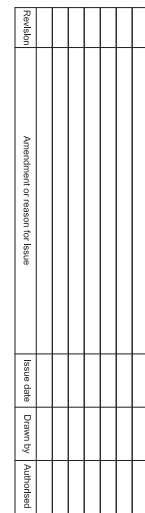
Roundabout Capacity Model: SIDRA Standard.

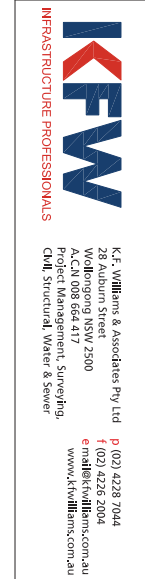
SIDRA Standard Delay Model used.



Appendix C

Indicative Layout Plan





Surveyor	Date
Date of Survey	SEPTEMBER 2013
Height Datum AHD	Drawn B. Purnell
Origin	Checked
Plotz. Datum	Approved

Drawing File
PROPOSED SUBDIVISION
 LOT 24 D.P. 714096
 WARRAH ROAD, NORTH NOWRA
 OVERALL LOT LAYOUT
 Scale 1:20000 A1
 14-00000 A3
 Drawing Status
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LOT1		
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