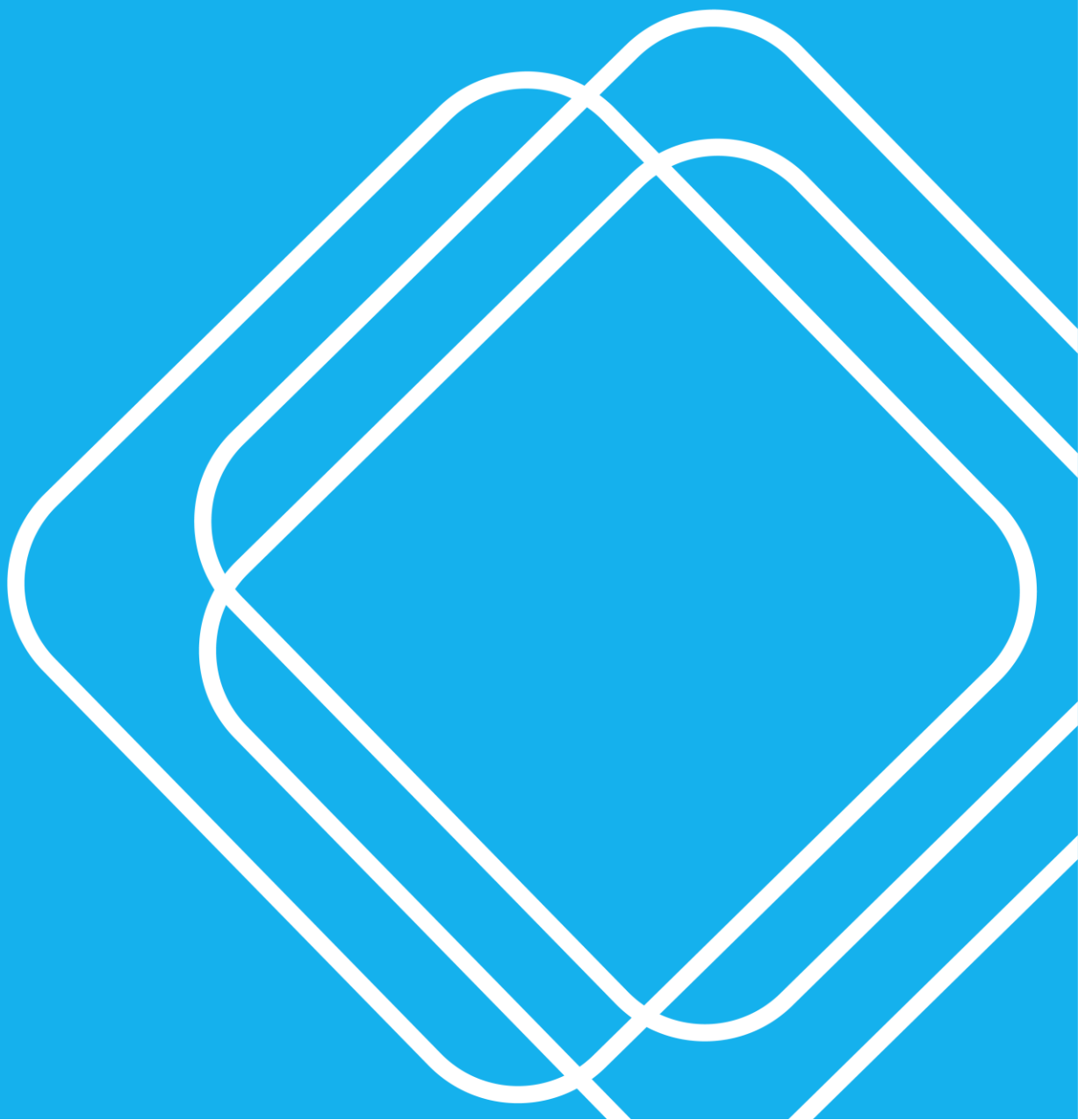
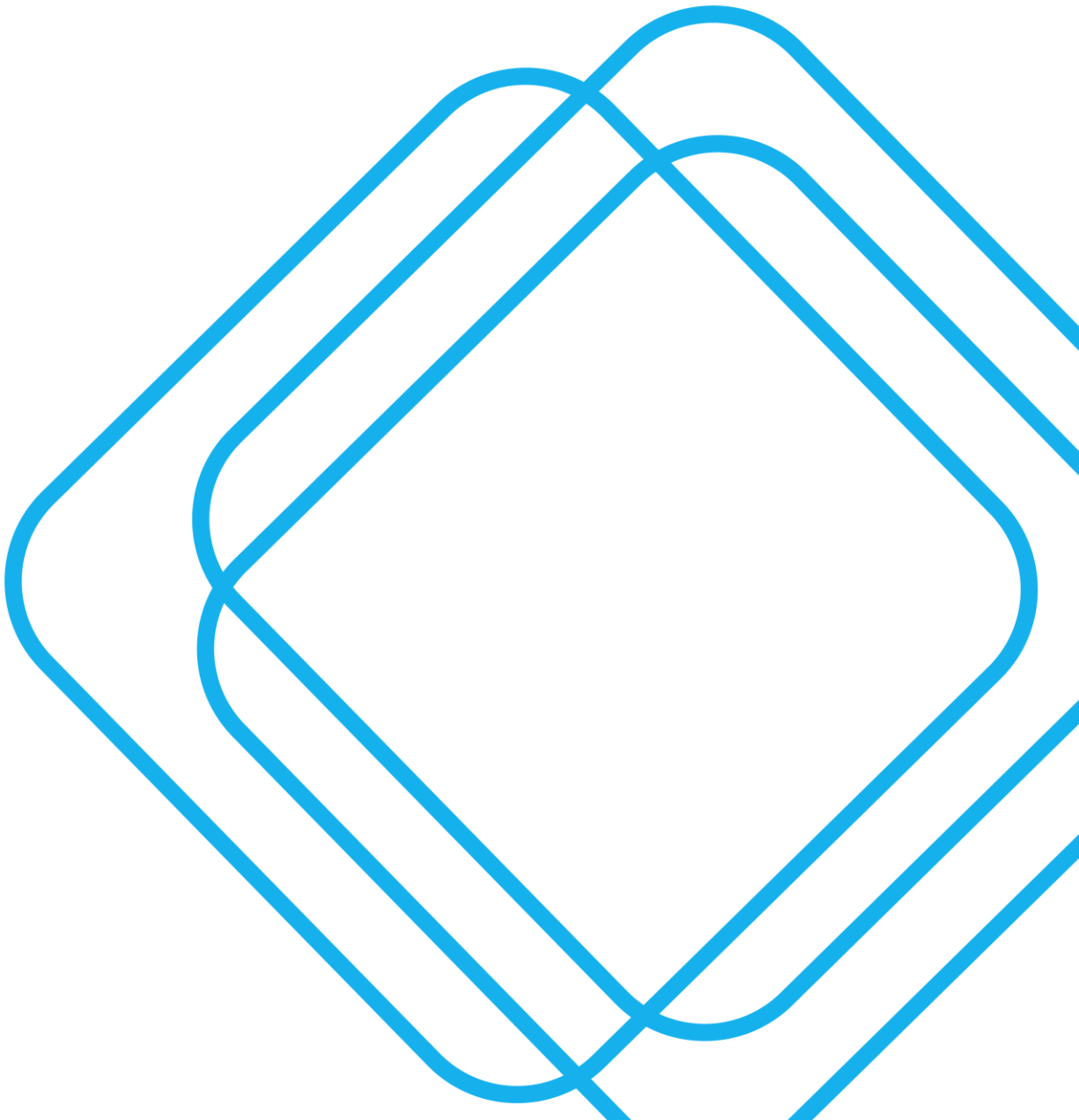
SCT Consulting

GOOGONG SUNSET ESTATE STAGE 2

Traffic Impact Statement

28 OCTOBER 2024





Quality Assurance

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1.0	17 September 2024	Draft report
2.0	28 October 2024	Final report

Contents

Appendices

Executive summary

SCT Consulting was engaged by Binowee Developments PTY. LTD. to undertake a Traffic Impact Study to support the subdivision and Planning Proposal for Lot 4401817 at 141 Googong Road (the site), as part of Stage 2 of the subdivision and development of the Sunset Estate, located in the Queanbeyan–Palerang Local Government Area (LGA).

The proposed concept subdivision plan provides for 86 residential lots of varying sizes. As the plan is preliminary and designed for Planning Proposal purposes, the specific lot breakup has not yet been finalised.

Access to and from the site would be via Gorge Creek Drive (completed) which intersects with Googong Road. This is shared with the approved Stage 1 development. Road cross sections were examined to determine compliance with the road hierarchy outlined in *QPRC Geometric Road Design (Urban Rural).* Gorge Creek Drive in its current configuration, as well as the proposed roads as part of the subdivision, conform to the cross-sectional requirements within this guideline for their intended use.

Googong Road is planned to have a bus route as part of NH1 stage 1-6 construction, which could provide public transport access to residents of the proposed development. Given the relatively low public transport demand generated by the development, there is no major public transport capacity issue expected to be incurred by the development.

SIDRA traffic modelling has been undertaken to assess the intersection performance associated with the additional vehicle trips at Old Cooma Road / Googong Road and Gorge Creek Drive / Googong Road. It confirms that there is no significant impact associated with 86 dwellings (assuming one dwelling per lot). The LOS remains the same for the intersections of Old Cooma Road / Googong Road and Gorge Creek Road / Googong Road. The variations of delay are less than one second and therefore there is no need to propose any change to the infrastructure. The LoS of A and low DoS at the intersection of Gorge Creek Road / Googong Road indicate significant remaining capacity to accommodate additional dwellings from the subdivision plan.

A turning warrant assessment based on *Guide to Road Design Part 4: Intersections and Crossings: General* (Austroads, 2017) for the intersection of Gorge Creek Road / Googong Road found that the additional traffic as a result of 86 dwellings does not require further upgrades to safely facilitate turning movements from development traffic. The dwelling yields that would trigger further upgrades are:

– A yield of 175 dwellings (for Stage 2) would trigger an additional right turn bay on Googong Road (east approach) at Gorge Creek Road intersection.

– A yield of 260 dwellings (for Stage 2) would further trigger an additional left turn bay on Googong Road (west approach) at Gorge Creek Road intersection.

These development scales would not be feasible for Stage 2 given the site area and density restrictions, so no additional turn bays are warranted. At present, both intersections have been constructed. The results suggest that there is no need to propose any changes to the approved road network in the structure plan associated with the development.

The proposed road cross-sections will satisfy up to 222 dwellings for Stage 2 and Gorge Creek Road will satisfy up to 293 dwellings from Stage 2 (considering the 40 approved dwellings in Stage 1). **These development scales would not be feasible for Stage 2 given the site area and density restrictions. Hence, the road network is at an appropriate scale.**

The Planning Proposal includes the provision of an active transport entrance to and from the site. The design minimises the development's impact on walking and cycling traffic while facilitating residents to make short-distance trips to the surrounding destinations via active transport modes. The number of walking and cycling trips generated by the development during the peak hours could expectedly be accommodated by the existing and planned active transport infrastructure.

The Traffic Impact Study concluded that the scale of the Planning Proposal represents a small increase in traffic and is at a level able to be accommodated by the existing and planned infrastructure.

1.0 Introduction

1.1 Purpose of report

SCT Consulting was engaged by Binowee Developments PTY. LTD. to undertake a Traffic Impact Study to support the Planning Proposal (PP) of 141 Googong Road as part of Stage 2 of the development of the former Sunset Estate, north of Googong Neighbourhood 1 (NH1), located in Queanbeyan–Palerang Local Government Area (LGA).

This document has considered the following scope of works:

– Key relevant planning documents, especially the Googong Development Control Plan (DCP) and the Queanbeyan–Palerang Regional Council (QPRC) DCP

– Historical traffic studies for Stage 1 development of the Sunset Estate

– Existing transport conditions, including road network conditions, public transport accessibility and connectivity to walking and cycling routes (based on publicly available data)

– Austroads turning warrants at the intersection of Gorge Creek Road / Googong Road to assess whether its current configuration is consistent with Austroads documentation.

– Traffic impact of the proposed development.

Intersection modelling was conducted to assess traffic impacts, building on a traffic study for the structure plan subdivision application[1]. The assumed yield for this proposal is 86 lots for the purpose of this report.

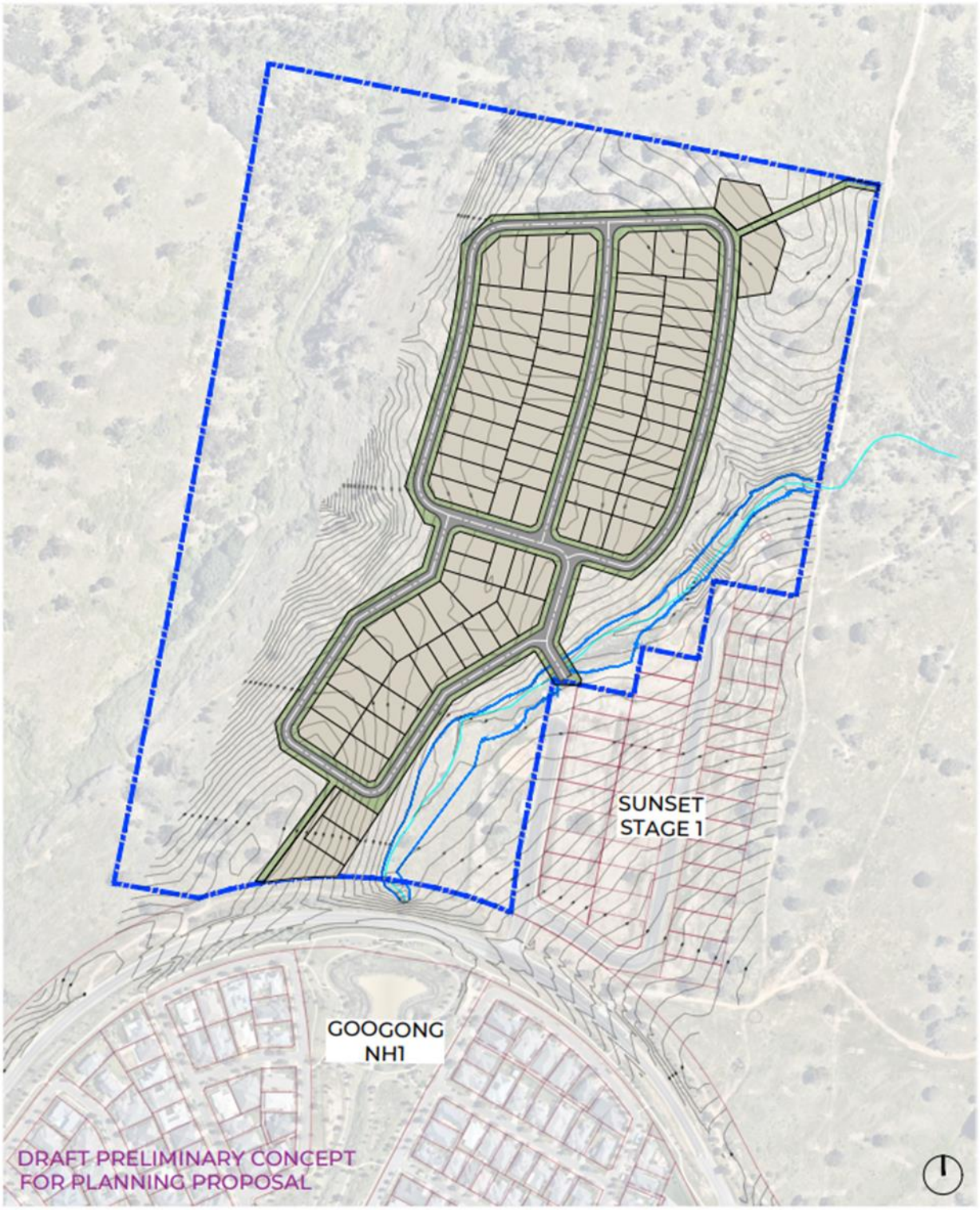
1.2 Development context

The Googong township is located approximately 17 km to the south of Canberra and 8 km to the south of Queanbeyan town centre. The Googong township development is divided into five neighbourhoods, and two ‘East’ and ‘West’ Hamlets. The subject site is situated within ‘Hamlet East’, formerly part of the ‘Sunset Estate’.

[1] Calibre (2017) Googong Neighbourhood 2 Traffic Report

The site plan of the proposed development is shown in **Figure 1-1**.

Figure 1-1 Proposed site plan and subdivision



Source: Urbane, 2024

1.3 Report structure

This report has been structured into the following sections:

– **Section 2.0** provides an overview of the historical traffic studies associated with the development.

– **Section 3.0** describes the existing transport conditions.

– **Section 4.0** provides an overview of the proposed sub-division and access requirements.

– **Section 5.0** outlines the traffic appraisal which describes the likely trip generation and indicative impact as a result of the proposed development.

– **Section 6.0** summarises the study findings and presents the conclusions.

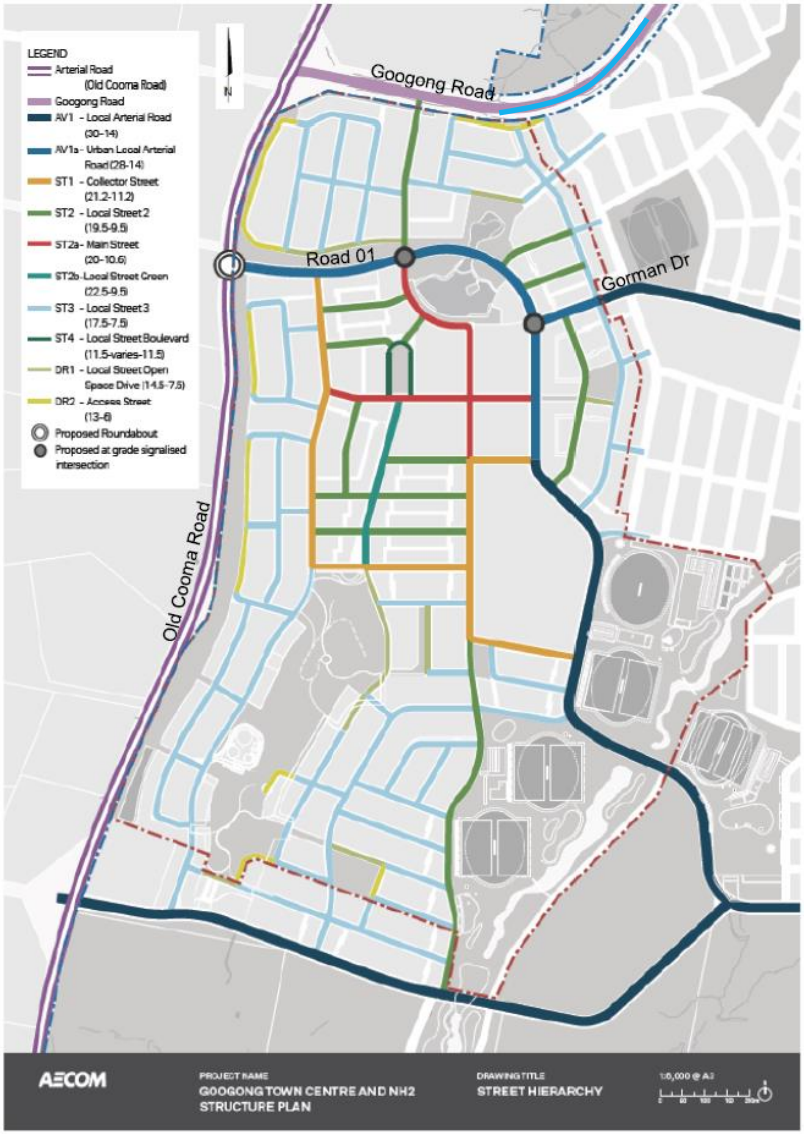
2.0 Previous studies

Several traffic studies have been carried out to understand the impact of Googong NH2 on the surrounding road network.

2.1 Googong Neighbourhood 2 Structure Plan, 2016

The structure plan for Googong NH2 was approved by QPRC in 2016. It guides the street hierarchy and possible intersection layouts throughout the NH2 area. **Figure 2-1** shows the road hierarchy of the network near to the site (■). The site is sits just off Googong Road accessed via Gorge Creek Drive which intersects with Googong Road:

Figure 2-1 Proposed road hierarchy in the structure plan



Source: AECOM (2016) Googong Neighbourhood 2 Structure Plan

2.2 Googong NH2 Structure Plan Network Assessment, 2016

TDG carried out a high-level road network assessment of the proposed Googong NH2 structure plan and the performance of the intersections. The traffic modelling was undertaken based on 6,690 households at a full delivery of Googong Neighbourhood in 2031.

The modelled intersections are shown in **Figure 2-2**, which include:

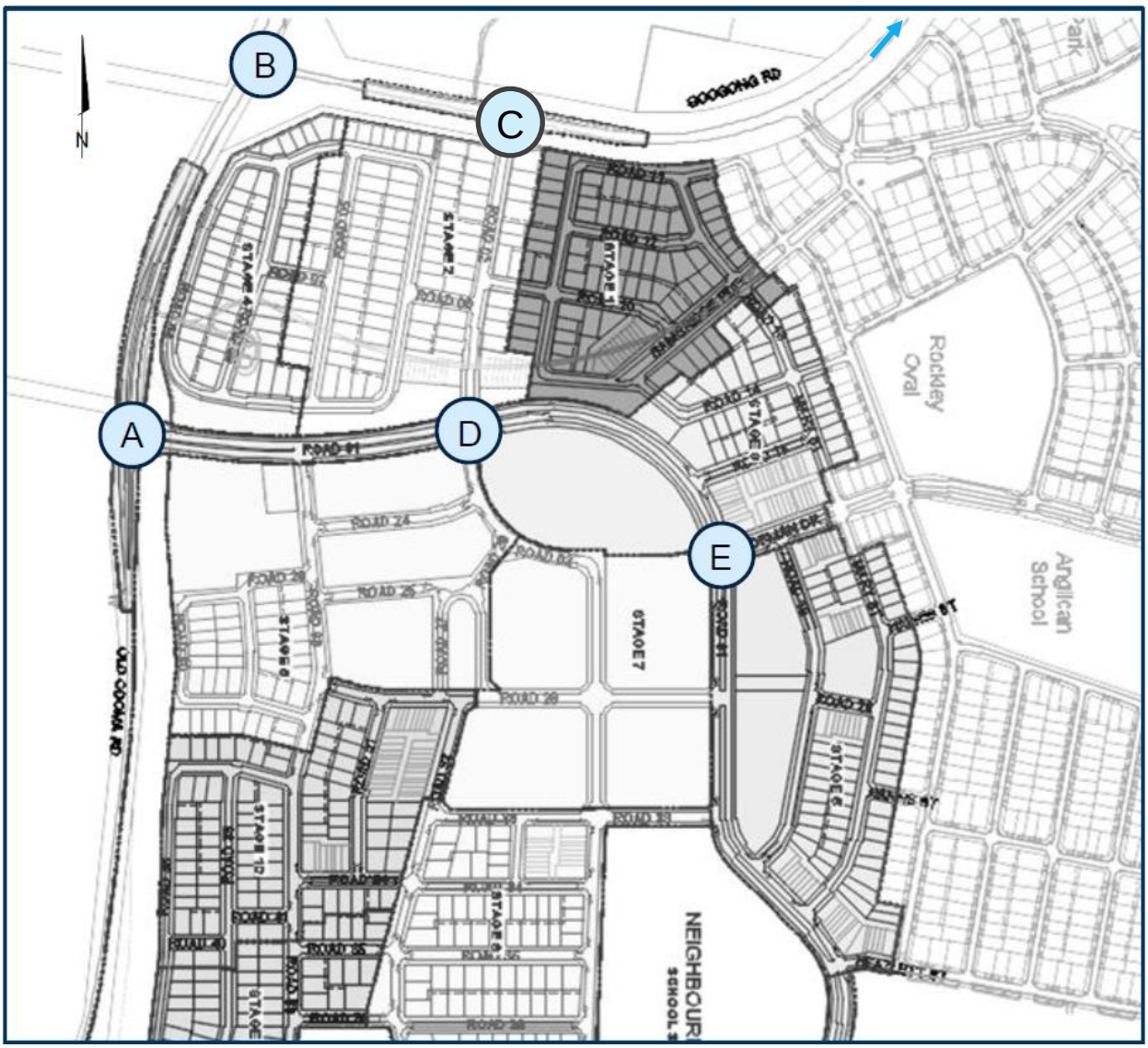
A. Old Cooma Road / Wellsvale Drive – Traffic signals

B. Old Cooma Road / Googong Road – Traffic signals

D. Wellsvale Drive / Courtney Street – Traffic signals

E. Wellsvale Drive / Gorman Drive –Give way.

Figure 2-2 Intersections modelled based on AECOM Structure Plan layouts



Source: TDG (2016) Googong NH2 Structure Plan Network Assessment

The assessment provided AM and PM peak hour volumes for most approaches of the major intersections within Googong NH2 for 2031 and some guidance as to the expected level of service.

2.3 Googong Neighbourhood 2 Traffic Report, 2017

Calibre Consulting was engaged by Googong Township Proprietary Limited (GTPL) in 2017 to undertake the Development Application (DA) and detail design of Googong Township – Neighbourhood 2. The analysis for Calibre's traffic report was based on the traffic volumes provided by TDG's network assessment, which was accepted and approved by QPRC.

The DA for Googong NH2 proposed an overall residential yield of 1,737 dwellings in various housing types and a town centre with a Gross Floor Area (GFA) of 17,500 m^2.

It is determined that the below intersections will be signalised (**Figure 2-2**):

A. Old Cooma Road / Wellsvale Drive

B. Old Cooma Road / Googong Road

D. Wellsvale Drive / Courtney Street

The other two intersections will be priority intersections:

E. Wellsvale Drive / Gorman Drive

C. Googong Road / Courtney Street (newly analysed in the DA).

The timing for these upgrades and construction was identified. Based on the proposed intersection layout, all the intersections could perform satisfactorily during peak hours with the staging of the development of NH2.

2.4 Sunset Googong – Stage 1 Traffic Impact Statement, 2018

Genium Civil Engineering prepared a Traffic Impact Statement (TIS) as part of Stage 1 development of the Sunset Estate, with a proposed yield of 40 dwellings (**Figure 2-3**). The TIS conducted a qualitative assessment into the impacts with regards to delay and road network capacity, as well as an Austroads Warrant assessment for the intersection of Gorge Creek Road / Googong Road, the access road to the development. The TIS concluded that:

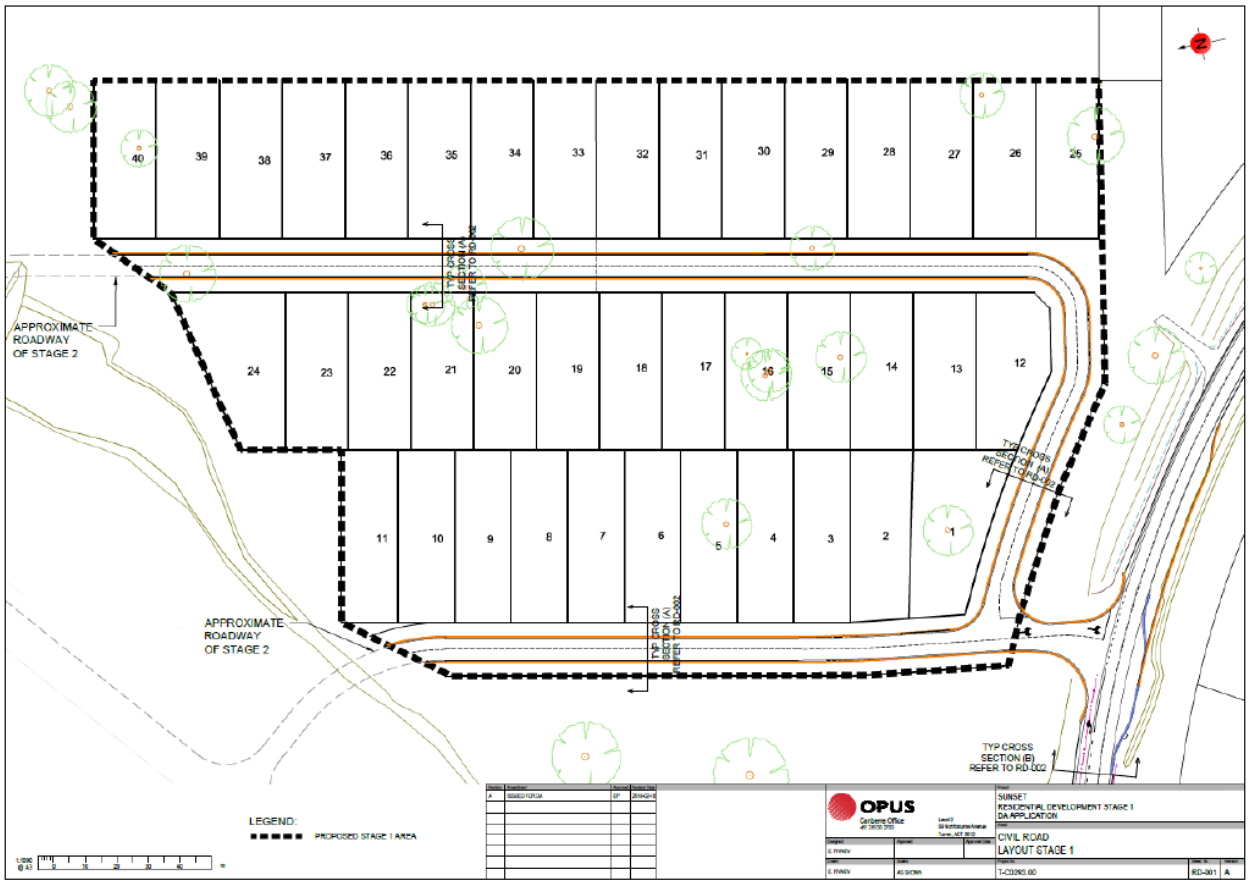
– Stage 1 development would generate 34 vehicle trips during peak hour periods in accordance with the Guide To Traffic Generating Developments (2002) rate of 0.85 per dwelling house.

– The intersection of Gorge Creek Road / Googong Road should be constructed to a minimum Basic Left Turn (BAL) and Basic Right Turn Treatment standard.

– Appropriate pedestrian facilities should be provided to link those within the Googong Neighbourhood

– Internal roads and traffic facilities should be designed in accordance with QPRC *Geometric Road Design.*

Figure 2-3 Stage 1 site plan



Source: Genium Civil Engineering Traffic Impact Statement (TIS), 2018

3.0 Existing conditions

The purpose of this chapter is to provide an understanding of the current traffic and transport conditions in the vicinity of the site.

3.1 Road network

The site is connected to the Googong township road network through two access points on Calthorpe Street and Perrin Street. The key road network around the site is shown in **Figure 3-1**.

Figure 3-1 Road network around the site

Source: Nearmap, 2024

The key features of the roads around the site are:

1. **Old Cooma Road** connects Edwin Land Parkway to the north and Monaro Highway to the south. It has a signposted speed limit of 80 km/h adjacent to the site. The duplication of this arterial road was completed in 2020 between Edwin Land Parkway and Googong Road. A footpath is provided on the east side of Old Cooma Road. On-road bicycle lanes in the form of a road shoulder, are available in both directions.
2. **Googong Road** is a local sub-arterial road that runs east to west from Old Cooma Road to the Queanbeyan River. It has a single lane in each direction of travel and posted speed limit of 60km/h. At the intersection with Old Cooma Road there is a dedicated right turn lane from Googong Road that is approximately 150m in length. There is a slip lane from Old Cooma Road for vehicles travelling southbound that is controlled by signals and a give way signal just past the signalised crossing. There are two right turn bays from Googong Road to Courtney Street and Beltana Avenue, two local collector streets that service the bulk of the NH1 dwellings and connect to the Googong town centre. There is pedestrian and cycling infrastructure on the south side of Googong Road, as the road forms the northern border of the urban dwellings in Googong. A footpath is also available on the northern side of Googong Road within the vicinity of Stage 1.
3. **Gorge Creek Drive** is a local collector road, that intersects with Googong Road. It was constructed in 2021 with the intention to service the dwellings constructed as part of Stage 1 of the Sunset Development. Being a cul-de-sac currently, it is also planned to be extended in order to serve the dwellings as part of Stage 2. The portion of Gorge Creek Road that is completed has a carriageway width of 11.2m and is two-way. A footpath is provided on the east side of the road that connects with the pedestrian network along Googong Road.

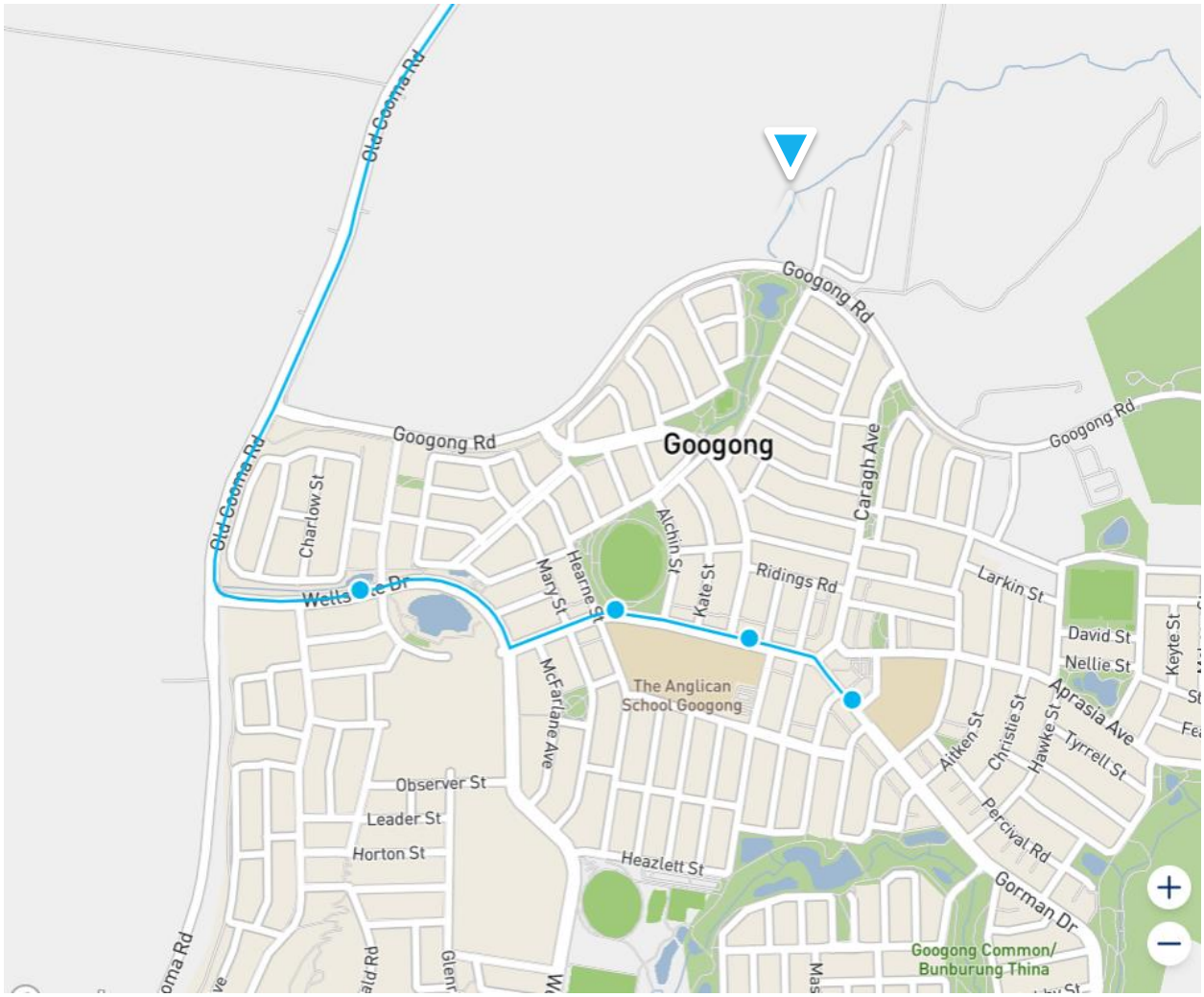
3.2 Bus network

The public transport network within Googong in relation to the site is shown in **Figure 3-2**. The nearest bus stop is located about 1km from the site on Gorman Drive. Bus routes 830 and 840X are available at this bus stop, which operates between Googong, Queanbeyan and Canberra.

There are five inbound bus services towards Queanbeyan and Canberra for a typical weekday peak hour between 7am and 8am.

There are three outbound bus services towards Queanbeyan and Canberra during a typical weekday peak hour between 7am and 8am.

Figure 3-2 Bus network around the site



Source: Transport for NSW (TfNSW), 2023

3.3 Active transport

There are extensive walking and cycling facilities in the existing Googong NH1 development. Active transport facilities on the northern border of the NH1 development are generally well connected, with a footpath running from Cavan to Old Cooma Road connectivity within the NH1 area. Residents of the proposed development site could use this existing infrastructure to access the Googong Town Centre and Old Cooma Road. The grid-like footpath network within the Googong Neighbourhood developments enables pedestrians to have high-quality facilities for short-distance trips east towards Googong township and west towards Old Cooma Road. A footpath is provided on the east side of the road that connects with the pedestrian network along Googong Road.

On-road bicycle lanes are available on Wellsvale Drive, Gorman Drive and Old Cooma Road.

4.0 Proposed proposal

4.1 The planning proposal

The site is located at 141 Googong Road. A potential concept subdivision plan indicates that the zoning could accommodate some 86 residential lots of varying sizes. As the plan is preliminary and designed for Planning Proposal purposes, the specific lot breakdown has not yet been finalised.

4.2 Proposed transport access

The transport access for the proposed sub-division will need to align with QPRC *Geometric Road Design* specifications as well as integrate appropriately with the surrounding road network. The subject site sits north of the Googong Neighbourhoods (NH1-5) and is proposed to link via Gorge Creek Road to dwellings as part of Stage 1 of the Sunset Estate Development and the wider Googong road network. The existing configuration of Googong Road / Gorge Creek as a priority give-way intersection is proposed to be maintained as part of the proposed Stage 2 Subdivision.

4.2.1 QPRC Road design specifications

The QPRC *Geometric Road Design* sets out the specifications developed specifically for the design of subdivision roadworks using principles of street design to ensure safety and improved amenity and to reduce pedestrian / vehicular conflicts. A hierarchical road network is essential to maximise road safety, residential amenity and legibility. Each class of road in the network serves a distinct set of functions and is designed accordingly. The design should convey to motorists the predominant function of the road. The hierarchy is determined by the number of vehicles using a road each day (vehicles/day). For a development, one lot is expected to generate nine vehicle trips per day. Four distinct levels of roads are identified for residential neighbourhoods:

- **Access Street:** The lowest order road having as its primary function, residential space - amenity features which facilitate pedestrian and cycle movements, and where vehicular traffic is subservient in terms of speed and volume, to those elements of space, amenity, pedestrians and cyclists.
- **Local Street:** The next level road as a local residential street should provide a balance between the status of that street in terms of its access and residential amenity functions. Resident safety and amenity are dominant but to a lesser degree than access streets.
- **Collector Street:** The second highest-order road has a residential function but also carries higher volumes of traffic collected from lower-order streets. A reasonable level of residential amenity and safety is maintained by restricting traffic volumes and speeds, however, amenity and resident safety do not have the same priority as access or local streets.
- **Local Sub-Arterial Road:** The highest-order road within a residential development should have as its main function the convenient and safe distribution of traffic generated by the development. Direct access should not be provided for single-dwelling allotments, but access can be provided to multi-unit developments and non-residential land uses. The local sub-arterial should serve only the development and should not attract through traffic.

The cross-section of the road reserve must provide for all functions that the road is expected to fulfil, including the safe and efficient movement of all users, provision for parked vehicles, acting as a buffer from traffic nuisance for residents, the provision of public utilities and streetscaping.

4.2.2 Vehicular access design

This specification sets out requirements to be used in the design of vehicular access for application in all types of development, including residential, commercial, industrial and subdivision development.

This specification aims to set standards related to the provision of vehicular access to proposed allotments, which are to be safe and convenient and shall maintain a satisfactory level of service for the user. It also aims to set the minimum design standards required for the provision of vehicular footpath crossings and driveways, located within allotments and the Council's road reserve.

The number of vehicular kerb crossings required to be provided to each allotment in a subdivision is usually one crossing. In urban areas, the number of vehicular kerb crossings may be extended to two provided that the combined

width of the vehicular kerb crossings does not exceed seven metres and there is an adequate driveway and turning areas within the lot to justify the need for two vehicular crossings.

Vehicular access is prohibited from being constructed in the locations within six metres from the kerb returns of the intersection.

4.2.3 Proposed cross section

The geometric requirements for roads are set out under the QPRC *Geometric Road Design* (**Table 4-1**). Number of lots are calculated based on the assumed nine vehicles per day per dwelling specified within the design guideline.

Table 4-1 QPRC *Geometric Road Design* specifications

Road type under hierarchy	Vehicles per day	No. of dwellings it serves in equivalent	Maximum speed	Required traffic lane width (minimum)	Required verge width (minimum)
Access street	200 vehicles	c. 22 dwellings	25km/h	8.0m	5.0m
Local street	2,000 vehicles	c. 222 dwellings	40km/h	8.0m	5.0m
Collector street	3,000 vehicles	c. 333 dwellings	50km/h	11.2m	5.0m

The roads of the subdivision are proposed to have a width of 18m (inclusive of traffic lane and verge widths) which is sufficient for being categorised as local streets under the QPRC *Geometric Road Design*. The permissible number of dwellings is 222 dwellings under this road class category, which is more than twice the proposed lot yield for the site (assuming one dwelling per lot).

The completed Gorge Creek Road (21.2m wide road reserve) is anticipated to act as a collector road for Stage 1 and 2 Development which would accommodate up to 333 dwellings. Considering the approved 40 dwellings in Stage 1 Development, the permissible number of dwellings is 293 dwellings under this road class category, which is more than three times the proposed lot yield for the site (assuming one dwelling per lot).

These development yields would not be feasible for Stage 2 given the site area and density restrictions.

It is noted that the main difference between a local street and a collector is the provision of on-street parking on both sides. The proposed extension of Gorge Creek Road is 18m wide whereas the existing width is 21.2m with an 11.2m carriageway. This is less of an issue since there will be no residential dwellings along the Gorge Creek Road extension, hence, no parking demand. The different carriageway widths will be addressed by geometric design in the future phase.

4.3 Public transport

As discussed in **Section 3.2**, there is only one bus stop nearby 141 Googong Road. From **Figure 4-1**, a bus route is planned as part of stage 1-6 of NH1 construction. bus stops could be proposed near the intersection of Googong Road and west of the site.

Figure 4-1 Proposed bus routes within NH2

Source: Googong Development Control Plan, 2010

5.0 Traffic impact assessment

5.1 Trip generation

Calibre's (2017) Googong Neighbourhood 2 Traffic Report undertook intersection analysis for the surrounding five intersections for 2031 (as discussed in **Section 2.3**), upon full completion and occupation of Googong. The trip rates considered in traffic modelling are summarised in **Table 5-1**.

Table 5-1 Trip generation rates

Stage		Discount factor	Trip rate (vehicle / hour / dwelling)	
			AM peak hour	PM peak hour
NH1		**0%**	**0.67**	**0.82**
NH2	Stage 1-6	0%	0.67	0.82
	Stage 7-15	10%	0.60	0.73
NH5		35%	0.43	0.53

Source: Calibre (2017) Googong Neighbourhood 2 Traffic Report

Trips from the site are anticipated to have the same travel patterns as NH2 and the site forms part of the Googong Township. It is noted that in **Section 2.4**, a trip generation rate of 0.85 per dwellings taken from the Guide To Traffic Generating Developments as part of Stage 1. The trip generation rates developed by Calibre are considered to be more specific and localised to the Googong Township. Furthermore, these rates have been used in the planning and development of Googong NH1 developments and accepted by the QPRC. Thus, for consistency across the township, these trip generation rates were adopted.

Using the proposed development yield and the trip generation rates shown in **Table 5-1**, the following inbound and outbound trips are generated from the proposed development, i.e. one dwelling per lot:

Table 5-2 Inbound and outbound vehicle trip generation

	Time	Trip rates	Directional split		Trips
86 dwellings	AM Peak	0.67 trips/dwelling	Inbound	10%	6 veh/h
			Outbound	90%	51 veh/h
	PM Peak	0.82 trips/dwelling	Inbound	90%	62 veh/h
			Outbound	10%	8 veh/h

Based on the proposed 86 dwellings associated with the development proposal, the site would generate 57 and 70 vehicle trips during the AM and PM peak hours, respectively.

5.2 Road network impact

The intersection analysis in Calibre's (2017) report confirms that the intersection of Old Cooma Road / Googong Road will perform at a Level of Service B or better at the completion of Googong Neighbourhood 2.

The intersection of Googong Road / Gorge Creek Road was not assessed as part of Calibre's (2017) report and will be assessed as part of this report.

5.2.1 Traffic modelling assumptions

SIDRA 9.1 was used for this Traffic and Parking Impact Study to test the operational performance of Old Cooma Road / Googong Road tested as part of Calibre's (2017) report and Googong Road / Gorge Creek Road.

SIDRA 9.1 was the most recent version of the software at the time of writing. The software models the delays experienced by different road users, e.g., cars, trucks, buses, pedestrians, and cyclists, based on the demand and geometry of intersections. It is a typical software used for a development application of this scale.

Traffic volumes in 2031 at the completion of NH2 were extracted from Calibre's (2017) report to inform the traffic volumes at the intersection of Old Cooma Road / Googong Road. The future year base case comprised also traffic generated by the proposed new expansion of nearby lots in the vicinity of the site, totalling These include:

– Sunset Development Stage 1: +40 dwellings
– Lot 566: +72 dwellings
– Lot 601: +30 dwellings
– Lot 642: +112 dwellings
– Lot 667: +39 dwellings
– 191 Googong Road: +49 dwellings

The 34 vehicle trips during peak hour periods proposed as part of Stage 1 redevelopment (**Section 2.4)**, as well as their distribution and directional split**,** were kept consistent with those outlined in *Sunset Googong – Stage 1 Traffic Impact Statement* (2018). Traffic counts captured at the intersection of Googong Road / Gorge Creek Road as part of this previous report, from traffic data collected in 2017. For consistency in the traffic analysis between Stage 1 & 2, these higher traffic volumes were utilised in the SIDRA model.

Calibre's 2017 report does not provide traffic volumes at the location of the proposed site, only the accumulated traffic volumes at the intersection of Old Cooma Road / Googong Road from the various local roads that are collected by Googong Road. In lieu of this, traffic volumes from the TRACKS model completed by SCT Consulting in 2022 were used to inform movements along Googong Road.

Based on previous studies, 80 per cent of the traffic generated was allocated to travel to and from the north via Old Cooma Road / Googong Road, whilst the remaining 20 per cent were allocated to travel east towards / from the Googong township via Googong Road and Caragh Avenue.

5.2.2 Intersection performance

5.2.2.1 Intersection performance measures

Intersection Level of Service (LOS) is a tool to measure the level of congestion at an intersection as well as to identify locations requiring further investigations. The LOS as defined in the Roads and Maritime Services' (2002) *NSW Traffic Modelling Guidelines* is summarised in **Table 5-3**.

Table 5-3 Level of Service definitions

Level of Service (LOS)	Average Delay per Vehicle (sec/h)	Performance explanation
A	Less than 14.5	Good operation
B	14.5 to 28.4	Good with acceptable delays and spare capacity
C	28.5 to 42.4	Satisfactory
D	42.5 to 56.4	Operating near capacity
E	56.5 to 70.4	At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method.
F	70.5 or greater	At capacity, at signals incidents will cause excessive delays. Roundabouts require other control method.

Source: Roads and Maritime Services, 2002

Intersection Degree of Saturation (DOS) is another metric to measure the performance of isolated intersections and approaches. DOS is a ratio of traffic demand to capacity. For intersections controlled by traffic signals, both queue length and delays typically increase rapidly as DOS approaches 1.0. The *NSW Traffic Modelling Guidelines* identified an upper limit of 0.9 for signalised intersections.

5.2.2.2 Modelling results

The analysis confirms that the difference in the intersection performance between the two future year scenarios is insignificant. The LOS remains the same for the two intersections and the variations of delay are generally within one second. The results for the 2031 base case and 2031 with additional yield are compared in **Table 5-4**.

Table 5-4 Comparison of intersection performance in 2031

Intersection	Weekday AM peak			Weekday PM peak		
	Delay (sec)	LOS	DOS	Delay (sec)	LOS	DOS
Future year base case						
Googong Road / Gorge Creek Drive	5.7	A	0.10	6.5	A	0.12
Old Cooma Road / Googong Road	25.0	B	0.87	18.2	B	0.90
Future year with 86 dwellings from Sunset Stage 2						
Googong Road / Gorge Creek Drive	6.5	A	0.10	6.7	A	0.15
Old Cooma Road / Googong Road	25.6	B	0.87	18.4	B	0.90

At present, both these intersections have been constructed. The results suggest that there is no need to propose any changes to the approved road network in the structure plan associated with the proposed Stage 2 development.

The detailed SIDRA results are shown in **Appendix A.**

5.3 Bus impact

Given the relatively low public transport trip generation of the site and the distance to the nearest bus stop, there is no major capacity issue with the potential site in terms of public transport impacts. TfNSW regularly reviews bus services as part of managing the network. Additional frequency can be provided if required.

5.4 Walking and cycling impact

The distance between the lots along the proposed road network within the site is sufficient for footpaths and active transport infrastructure.

The subdivision proposes active transport entrances around the site. The design minimises the development's impact on walking and cycling traffic while facilitating residents to make short-distance trips to the surrounding destinations, such as the town centre and open space to the east and the school to the south, via active transport modes. The development also integrates with the safe, well-connected, high-quality shared path network around the site.

The number of walking and cycling trips generated by the development during the peak hours could expectedly be accommodated by the existing and planned active transport infrastructure.

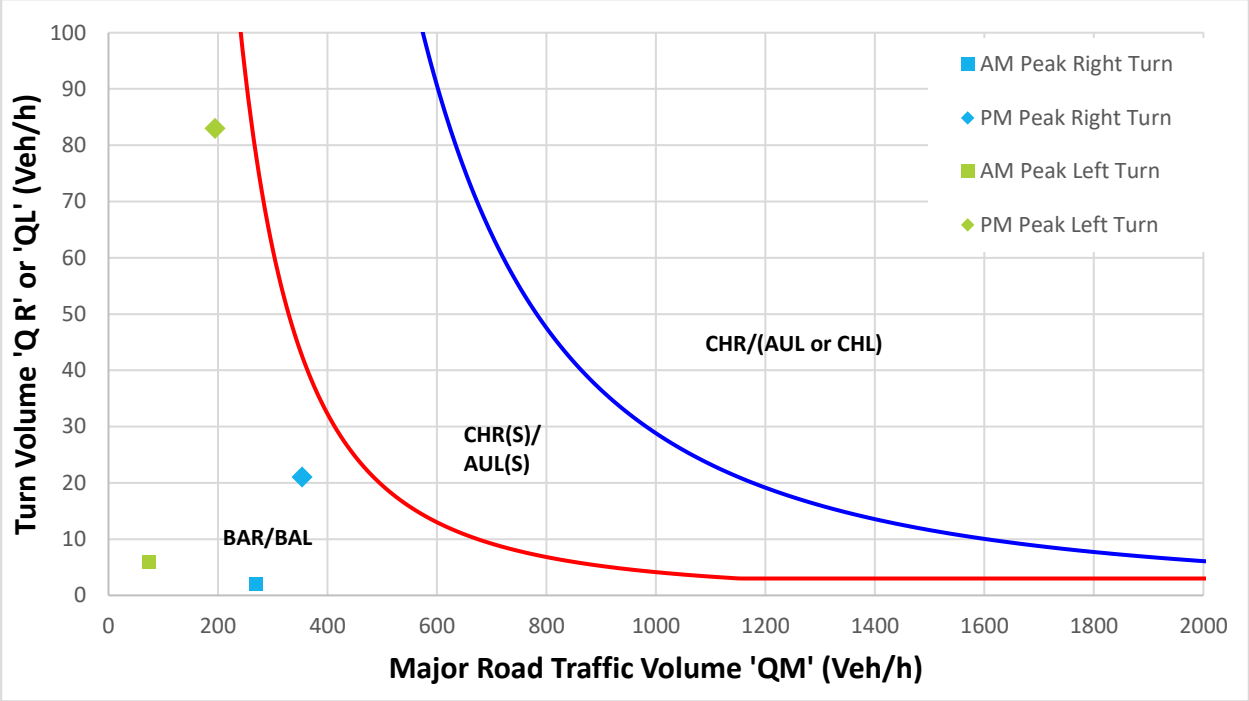
5.5 Intersection turning warrants

5.5.1 Sunset Stage 2 development warrants

The configuration of Googong Road and Gorge Creek Drive was approved under Stage 1 of the Sunset Development, to accommodate turning vehicles from the main road via a Basic Right Turn (BAR) and basic left turn (BAL) arrangement. The need for upgrades to the turn arrangement at the intersection as a result of Stage 2 of the development were assessed in accordance with the *Guide to Road Design Part 4: Intersections and Crossings: General* (Austroads, 2017). The assessment considers, among other things, major road traffic volume, turn volume, and design speed. Googong Road as outlined in **Section 3.1**, has a posted speed limit of 60km/h and therefore, a design speed of up to 66km/h was considered appropriate (10% above the signposted speed limit).

Traffic volumes from **Section 5.2** were used to determine treatments and are presented in the turn warrant design charts in **Figure 5-1**.

Figure 5-1 Turn warrant design chart for the Googong Road / Gorge Creek Drive intersection – Stage 2 traffic case



The turn warrant assessment for Stage 2 development indicate that a BAR and BAL treatment is sufficient. Therefore, the intersection of Googong Road / Gorge Creek Drive in its current configuration is considered appropriate to cater for traffic as a result of Stage 2 development, i.e. 86 dwellings.

5.5.2 Upper limit development dwelling yield warrants

A sensitivity test was conducted to determine the dwelling yield that would trigger the need for upgrades at the intersection of Googong Road / Gorge Creek Drive. As the plan is preliminary and designed for Planning Proposal purposes, the specific lot breakup has not yet been finalised. Since some of the proposed lots might be capable of accommodation secondary dwellings, a sensitivity analysis was conducted to identify key trigger points. The analysis yielded the following conclusions:

– A yield of 175 dwellings (from Stage 2) would trigger an additional right turn bay on Googong Road (east approach) at Gorge Creek Road intersection.

– A yield of 260 (from Stage 2) dwellings would further trigger an additional left turn bay on Googong Road (west approach) at Gorge Creek Road intersection.

The turn warrant design charts that analyse the 175 dwellings and 260 dwellings yield cases are shown in **Figure 5-2** and **Figure 5-3** where PM peak is a worse case that determines the triggering point. However, these development scales would not be feasible for Stage 2 given the site area and density restrictions.

Figure 5-2 Turn warrant design chart for the Googong Road / Gorge Creek Drive intersection – 175 dwelling yield traffic scenario

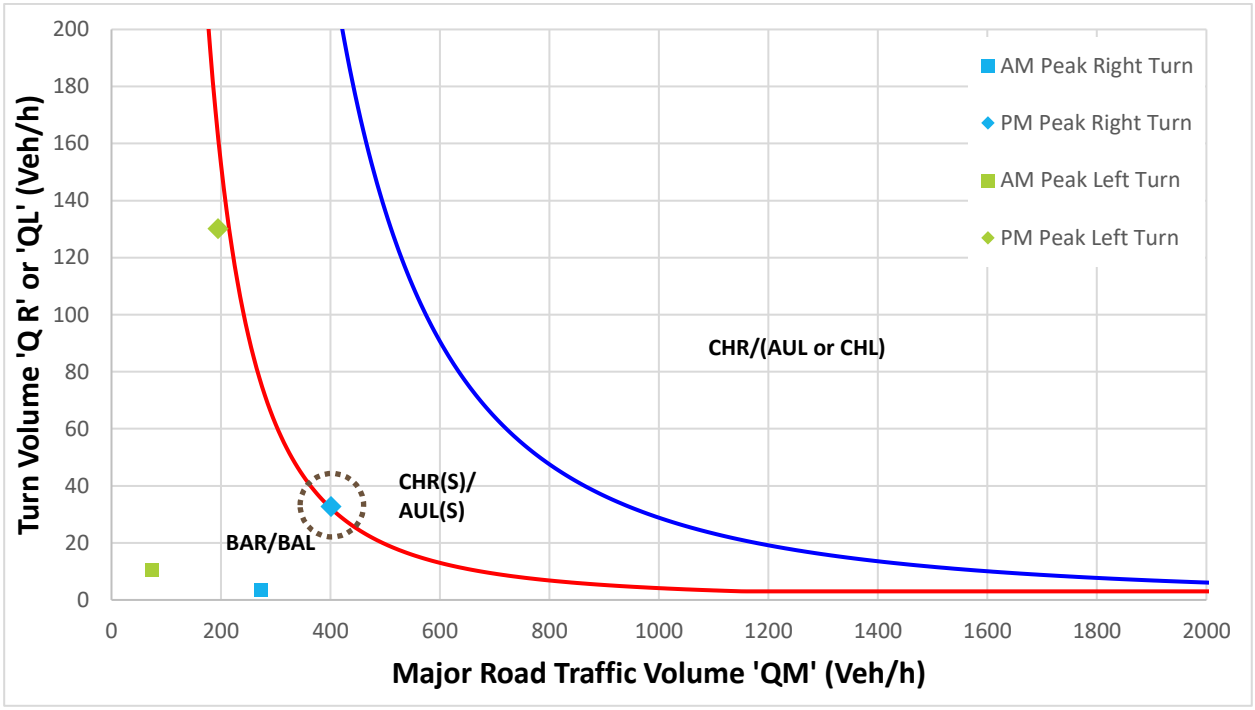
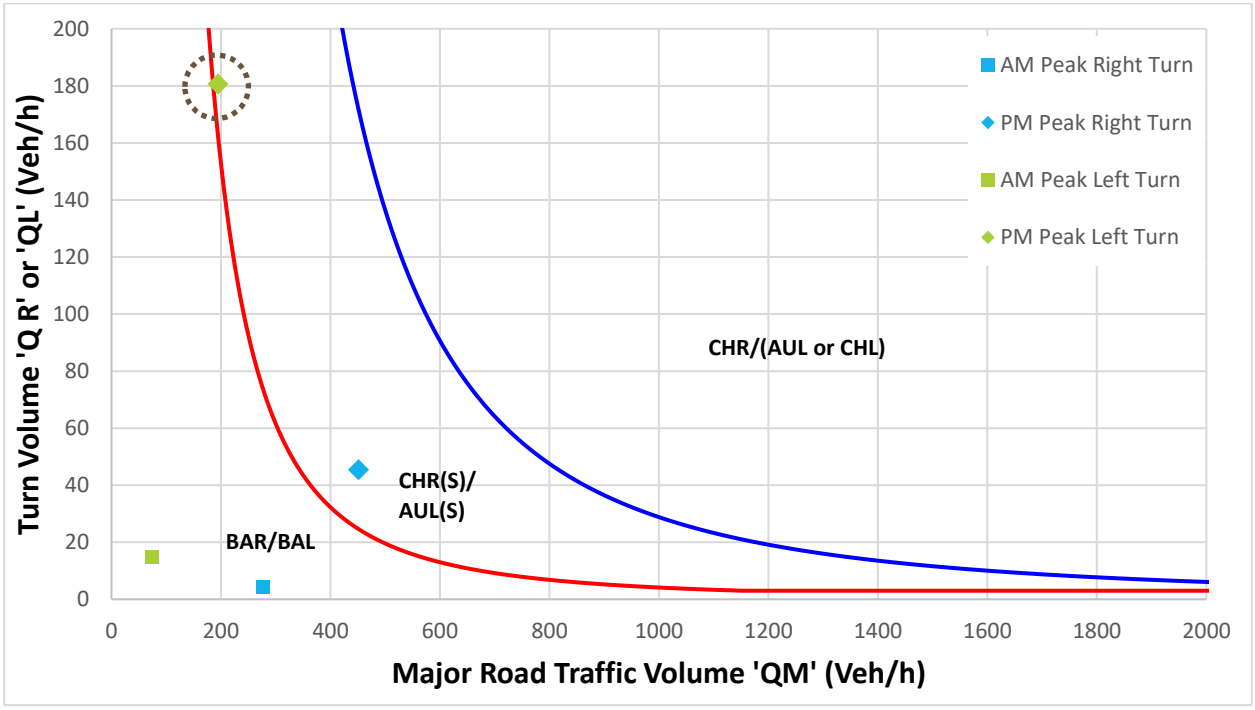


Figure 5-3 Turn warrant design chart for the Googong Road / Gorge Creek Drive intersection – 260 dwelling yield traffic scenario



6.0 Conclusion

The site is located at 141 Googong Road as part of the Sunset Estate in Googong. The proposed concept subdivision plan provides for 86 residential lots of varying sizes. As the plan is preliminary and designed for Planning Proposal purposes, the specific lot breakup has not yet been finalised.

– A development of 86 lots would generate a minimum of 57 and 70 vehicle trips during the AM and PM peak hours assuming one dwelling per lot.

– The traffic modelling confirms that there is no significant impact associated with 86 dwellings. The LOS remains the same for the intersections of Old Cooma Road / Googong Road and Gorge Creek Road / Googong Road. The variations of delay are less than one second and therefore there is no need to propose any change to the infrastructure. The LoS of A and low DoS at the intersection of Gorge Creek Road / Googong Road indicates significant remaining capacity if additional dwellings are to be incorporated into the subdivision plan.

– A turning warrant assessment *Guide to Road Design Part 4: Intersections and Crossings: General* (Austroads, 2017) for the intersection of Gorge Creek Road / Googong Road found that the additional traffic as a result of 86 dwellings, does not require further upgrades to safely facilitate turning movements from development traffic. The dwelling yields that would trigger further upgrades are:

  - A yield of 175 dwellings would trigger an additional right turn bay on Googong Road (east approach) at Gorge Creek Road intersection.
  - A yield of 260 dwellings would further trigger an additional left turn bay on Googong Road (west approach) at Gorge Creek Road intersection.

  These development scales would not be feasible for Stage 2 given the site area and density restrictions. **Hence, no additional turnbays are required on Googong Road.**The proposed road cross-sections are considered compliant and there would be no impact on Gorge Creek Road:

  - The proposed 18m road width for the roads within the subdivision results in a permissible number of dwellings of 222 dwellings, which is more than twice the proposed yield for the site (assuming one dwelling per lot).
  - Gorge Creek Road (21.2m wide road reserve) is anticipated to act as a collector road for Stage 1 and 2 Development which would accommodate 333 dwellings. Considering the approved 40 dwellings in Stage 1 Development, The permissible number of dwellings is 293 dwellings, which is more than three times the proposed lot yield for the site (assuming one dwelling per lot).

  These development scales would not be feasible for Stage 2 given the site area and density restrictions. Hence, the road network is at an appropriate scale.

The Traffic Impact Study concluded that the scale of the Planning Proposal represents a small increase in traffic and the impacts of the proposed development are at a level able to be accommodated by the existing and planned infrastructure.

APPENDIX A

SIDRA SUMMARY

MOVEMENT SUMMARY

Site: 1AM31B [1. GOO_GOR_31_AM_BASE (Site Folder: AM_BASE)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Googong Road															
5	T1	All MCs	198	0.0	198	0.0	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	All MCs	1	0.0	1	0.0	0.102	5.5	LOS A	0.0	0.0	0.00	0.00	0.00	56.3
Approach			199	0.0	199	0.0	0.102	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Gorge Creek															
7	L2	All MCs	8	0.0	8	0.0	0.005	5.7	LOS A	0.0	0.2	0.16	0.53	0.16	49.8
9	R2	All MCs	29	0.0	29	0.0	0.029	6.4	LOS A	0.1	0.7	0.31	0.61	0.31	49.0
Approach			38	0.0	38	0.0	0.029	6.3	LOS A	0.1	0.7	0.28	0.59	0.28	49.2
West: Googong Road															
10	L2	All MCs	1	0.0	1	0.0	0.041	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	56.4
11	T1	All MCs	79	0.0	79	0.0	0.041	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach			80	0.0	80	0.0	0.041	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.9
All Vehicles			317	0.0	317	0.0	0.102	0.8	NA	0.1	0.7	0.03	0.07	0.03	58.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 2AM31B [2.OCR_GOO_31_AM_BASE (Site Folder: AM_BASE)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

TCS 4947
Site Category: Future Conditions 2
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Old Cooma Road (s)															
2	T1	All MCs	1712	3.0	1712	3.0	* 0.870	24.5	LOS B	31.3	224.7	0.95	0.98	1.12	50.8
3	R2	All MCs	1	10.0	1	10.0	0.007	39.8	LOS C	0.0	0.2	0.93	0.59	0.93	32.5
Approach			1713	3.0	1713	3.0	0.870	24.5	LOS B	31.3	224.7	0.95	0.97	1.12	50.8
East: Googong Road															
4	L2	All MCs	1	10.0	1	10.0	0.844	26.3	LOS B	17.4	132.2	0.99	0.98	1.23	32.7
6	R2	All MCs	920	9.7	920	9.7	* 0.844	37.1	LOS C	17.4	132.2	0.99	0.97	1.23	34.3
Approach			921	9.7	921	9.7	0.844	37.1	LOS C	17.4	132.2	0.99	0.97	1.23	34.3
North: Old Cooma Road (n)															
7	L2	All MCs	509	7.0	509	7.0	0.378	8.2	LOS A	2.3	16.9	0.27	0.68	0.27	55.3
8	T1	All MCs	229	25.0	229	25.0	0.199	17.7	LOS B	2.8	23.8	0.74	0.60	0.74	56.5
Approach			738	12.6	738	12.6	0.378	11.2	LOS A	2.8	23.8	0.41	0.65	0.41	55.7
All Vehicles			3372	6.9	3372	6.9	0.870	25.0	LOS B	31.3	224.7	0.84	0.90	1.00	46.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Googong Road												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
All Pedestrians		0	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 1PM31B [1. GOO_GOR_31_PM_BASE (Site Folder: PM_BASE)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Googong Road															
5	T1	All MCs	80	0.0	80	0.0	0.046	0.1	LOS A	0.1	0.4	0.07	0.08	0.07	59.2
6	R2	All MCs	7	0.0	7	0.0	0.046	6.2	LOS A	0.1	0.4	0.07	0.08	0.07	55.4
Approach			87	0.0	87	0.0	0.046	0.6	NA	0.1	0.4	0.07	0.08	0.07	59.0
North: Gorge Creek															
7	L2	All MCs	1	0.0	1	0.0	0.001	6.1	LOS A	0.0	0.0	0.28	0.51	0.28	49.3
9	R2	All MCs	1	0.0	1	0.0	0.001	6.5	LOS A	0.0	0.0	0.32	0.56	0.32	49.0
Approach			2	0.0	2	0.0	0.001	6.3	LOS A	0.0	0.0	0.30	0.54	0.30	49.1
West: Googong Road															
10	L2	All MCs	28	0.0	28	0.0	0.121	5.6	LOS A	0.0	0.0	0.00	0.07	0.00	55.6
11	T1	All MCs	205	0.0	205	0.0	0.121	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	59.3
Approach			234	0.0	234	0.0	0.121	0.7	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles			323	0.0	323	0.0	0.121	0.7	NA	0.1	0.4	0.02	0.08	0.02	58.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 2PM31D [2.OCR_GOO_31_PM_BASE (Site Folder: PM_BASE)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

TCS 4947
Site Category: Future Conditions 2
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Old Cooma Road (s)															
2	T1	All MCs	979	20.0	979	20.0	0.382	3.5	LOS A	6.0	49.0	0.39	0.34	0.39	74.0
3	R2	All MCs	1	10.0	1	10.0	* 0.007	39.8	LOS C	0.0	0.2	0.93	0.59	0.93	32.5
Approach			980	20.0	980	20.0	0.382	3.5	LOS A	6.0	49.0	0.39	0.34	0.39	73.9
East: Googong Road															
4	L2	All MCs	1	10.0	1	10.0	0.769	32.3	LOS C	4.4	33.5	1.00	0.92	1.31	29.8
6	R2	All MCs	228	10.0	228	10.0	* 0.769	44.8	LOS D	4.4	33.5	1.00	0.92	1.31	31.5
Approach			229	10.0	229	10.0	0.769	44.8	LOS D	4.4	33.5	1.00	0.92	1.31	31.5
North: Old Cooma Road (n)															
7	L2	All MCs	1061	10.0	1061	10.0	0.754	9.0	LOS A	9.5	72.0	0.51	0.74	0.51	53.7
8	T1	All MCs	1781	20.0	1781	20.0	* 0.903	28.4	LOS B	36.0	295.2	0.96	1.05	1.21	48.0
Approach			2842	16.3	2842	16.3	0.903	21.2	LOS B	36.0	295.2	0.79	0.94	0.95	49.8
All Vehicles			4051	16.8	4051	16.8	0.903	18.2	LOS B	36.0	295.2	0.70	0.79	0.83	52.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Googong Road												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
All Pedestrians		0	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 1AM31B [1. GOO_GOR_31_AM_DEV (Site Folder: AM_DEV)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Googong Road															
5	T1	All MCs	198	0.0	198	0.0	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	All MCs	1	0.0	1	0.0	0.102	5.5	LOS A	0.0	0.0	0.00	0.00	0.00	56.3
Approach			199	0.0	199	0.0	0.102	0.0	NA	0.0	0.0	0.00	0.00	0.00	59.9
North: Gorge Creek															
7	L2	All MCs	20	0.0	20	0.0	0.013	5.8	LOS A	0.1	0.4	0.16	0.53	0.16	49.8
9	R2	All MCs	78	0.0	78	0.0	0.078	6.5	LOS A	0.3	1.8	0.32	0.63	0.32	49.0
Approach			98	0.0	98	0.0	0.078	6.4	LOS A	0.3	1.8	0.29	0.61	0.29	49.1
West: Googong Road															
10	L2	All MCs	6	0.0	6	0.0	0.044	5.6	LOS A	0.0	0.0	0.00	0.04	0.00	56.0
11	T1	All MCs	79	0.0	79	0.0	0.044	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.6
Approach			85	0.0	85	0.0	0.044	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.4
All Vehicles			382	0.0	382	0.0	0.102	1.7	NA	0.3	1.8	0.08	0.17	0.08	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 2AM31B [2.OCR_GOO_31_AM_DEV (Site Folder: AM_DEV)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

TCS 4947
Site Category: Future Conditions 2
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Old Cooma Road (s)															
2	T1	All MCs	1712	3.0	1712	3.0	* 0.870	24.5	LOS B	31.3	224.7	0.95	0.98	1.12	50.8
3	R2	All MCs	1	10.0	1	10.0	0.006	38.5	LOS C	0.0	0.2	0.92	0.59	0.92	33.0
Approach			1713	3.0	1713	3.0	0.870	24.5	LOS B	31.3	224.7	0.95	0.97	1.12	50.8
East: Googong Road															
4	L2	All MCs	1	10.0	1	10.0	0.861	27.1	LOS B	18.4	139.2	1.00	1.00	1.27	32.0
6	R2	All MCs	940	9.5	940	9.5	* 0.861	38.7	LOS C	18.4	139.2	1.00	1.00	1.27	33.6
Approach			941	9.5	941	9.5	0.861	38.7	LOS C	18.4	139.2	1.00	1.00	1.27	33.6
North: Old Cooma Road (n)															
7	L2	All MCs	514	6.9	514	6.9	0.383	8.2	LOS A	2.3	17.1	0.27	0.68	0.27	55.3
8	T1	All MCs	229	25.0	229	25.0	0.208	18.5	LOS B	2.9	24.3	0.76	0.61	0.76	55.7
Approach			743	12.5	743	12.5	0.383	11.4	LOS A	2.9	24.3	0.42	0.66	0.42	55.4
All Vehicles			3398	6.9	3398	6.9	0.870	25.6	LOS B	31.3	224.7	0.85	0.91	1.01	45.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Googong Road												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
All Pedestrians		0	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 1PM31B [1. GOO_GOR_31_PM_DEV (Site Folder: PM_DEV)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Googong Road															
5	T1	All MCs	80	0.0	80	0.0	0.058	0.3	LOS A	0.2	1.1	0.19	0.21	0.19	58.1
6	R2	All MCs	22	0.0	22	0.0	0.058	6.5	LOS A	0.2	1.1	0.19	0.21	0.19	53.9
Approach			102	0.0	102	0.0	0.058	1.7	NA	0.2	1.1	0.19	0.21	0.19	57.4
North: Gorge Creek															
7	L2	All MCs	2	0.0	2	0.0	0.002	6.1	LOS A	0.0	0.0	0.28	0.52	0.28	49.3
9	R2	All MCs	6	0.0	6	0.0	0.007	6.7	LOS A	0.0	0.1	0.35	0.60	0.35	48.9
Approach			8	0.0	8	0.0	0.007	6.6	LOS A	0.0	0.1	0.33	0.58	0.33	49.0
West: Googong Road															
10	L2	All MCs	87	0.0	87	0.0	0.152	5.6	LOS A	0.0	0.0	0.00	0.18	0.00	54.5
11	T1	All MCs	205	0.0	205	0.0	0.152	0.0	LOS A	0.0	0.0	0.00	0.18	0.00	58.3
Approach			293	0.0	293	0.0	0.152	1.7	NA	0.0	0.0	0.00	0.18	0.00	57.4
All Vehicles			403	0.0	403	0.0	0.152	1.8	NA	0.2	1.1	0.05	0.19	0.05	57.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

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 (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 2PM31D [2.OCR_GOO_31_PM_DEV (Site Folder: PM_DEV)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

TCS 4947
Site Category: Future Conditions 2
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Old Cooma Road (s)															
2	T1	All MCs	979	20.0	979	20.0	0.382	3.5	LOS A	6.0	49.0	0.39	0.34	0.39	74.0
3	R2	All MCs	1	10.0	1	10.0	* 0.007	39.8	LOS C	0.0	0.2	0.93	0.59	0.93	32.5
Approach			980	20.0	980	20.0	0.382	3.5	LOS A	6.0	49.0	0.39	0.34	0.39	73.9
East: Googong Road															
4	L2	All MCs	1	10.0	1	10.0	0.789	32.9	LOS C	4.6	34.6	1.00	0.94	1.35	29.6
6	R2	All MCs	234	9.7	234	9.7	* 0.789	45.4	LOS D	4.6	34.6	1.00	0.93	1.35	31.3
Approach			235	9.7	235	9.7	0.789	45.3	LOS D	4.6	34.6	1.00	0.93	1.35	31.2
North: Old Cooma Road (n)															
7	L2	All MCs	1120	9.5	1120	9.5	0.793	10.0	LOS A	12.0	90.9	0.56	0.79	0.57	53.2
8	T1	All MCs	1781	20.0	1781	20.0	* 0.903	28.4	LOS B	36.0	295.2	0.96	1.05	1.21	48.0
Approach			2901	15.9	2901	15.9	0.903	21.3	LOS B	36.0	295.2	0.80	0.95	0.97	49.7
All Vehicles			4116	16.5	4116	16.5	0.903	18.4	LOS B	36.0	295.2	0.72	0.80	0.85	52.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
East: Googong Road												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09
All Pedestrians		0	53	29.3	LOS C	0.1	0.1	0.92	0.92	183.2	200.0	1.09

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.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