

Traffic Impact Assessment

Proposed 106 Lot Residential Subdivision Lakeside Estate Boorga Road, Griffith NSW Report February 2016

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1. Executive Summary

This report provides an assessment of the traffic impacts of a proposed seven stage 106 Lot expansion of an existing residential subdivision known as Lakeside Estate. The subdivision is located between Boorga Road (west side) and Lake Wyangan approximately 6.4km north of Griffith, NSW.

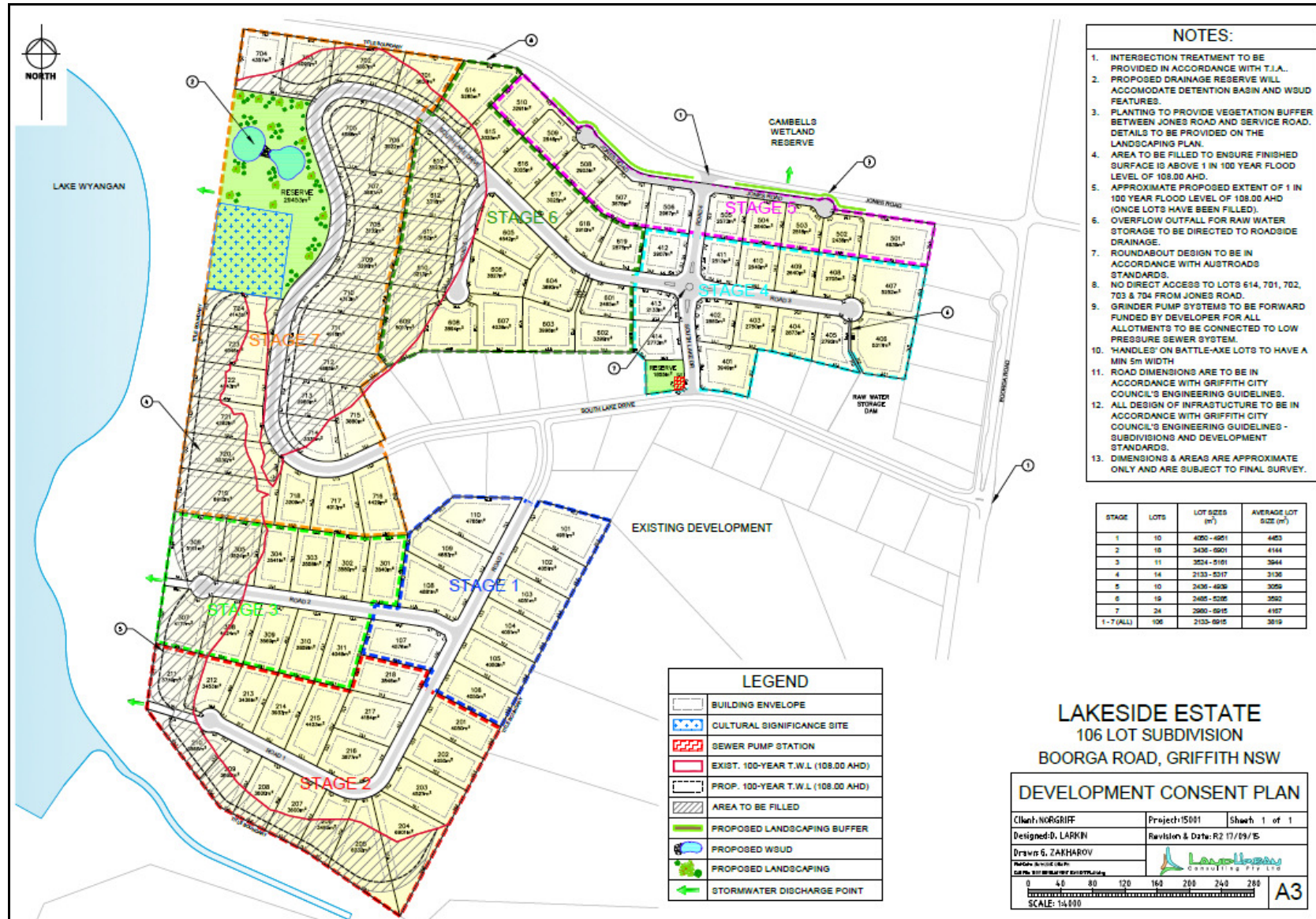
The seven stage development proposes a major access from the existing T-junction intersection of Boorga Road and South Lake Drive and a secondary access junction at the intersection of South Lake Drive (Road 4) and Jones Road. The 106 lot subdivision purports circulation roadways that connect to the existing end sections of South Lake Drive that were constructed as part of the original subdivision. The proposed subdivision consists of a circuit type major circulation roadway connecting to six cul-de-sacs. A small roundabout is proposed at the cross road intersection of South Lake Drive, Road 3 and Road 4. *Refer Section 1.2 to Subdivision Development Consent Plan.*

It is concluded that the existing T-junction intersection at Boorga Road and South Lake Drive with minor improvements to the existing BAR and BAL turning treatments will minimise traffic impacts on the local road network and satisfactorily cater for the anticipated traffic generated by the proposed subdivision and any future developments. In addition the proposed lower-order T-junction treatment with larger turning radii at the intersection of Jones Road and Road 4 will provide adequate facilities for the low volumes of turning traffic.

1.1 Locality Plan



1.2 Development Consent Plan



1.3 Site Characteristics

| | |
|---|--|
| Address | Boorga Road, Lake Wyangan, City of Griffith. |
| Road Hierarchy | Boorga Road and Jones Road are classified as local roads and are under the management of Griffith City Council. |
| Proposed Use | 106 residential allotments developed in seven stages. |
| Existing Traffic and Speed Environment | Boorga Road North bound 42vph AM, 56 PM peak and 606vpd South bound 55vph AM, 50vph PM peak and 225vpd Speed limit posted at 100km/h with 85 th percentile 80-90km/h Jones Road West bound 20vph AM, 16 PM peak and 173vpd East bound 15vph AM, 22vph PM peak and 168vpd Speed limit posted at 100km/h with 85 th percentile 70.9km/h |
| Traffic Generation | Information obtained from RMS Guide to Traffic Generating Developments Technical Direction TDT 2013/04a Updated Traffic Surveys and suggests daily and peak vehicle movements generated by the 116 lots of existing and proposed development as 932vpd and 99vph respectively. |
| Sight Distance | Sight-distance criteria are adequately satisfied at the existing T-junction intersection on Boorga Road and the proposed T-junction of Jones Road/Road 4 |

1.4 Recommendations

- Griffith City Council concur with minor improvements to the BAR and BAL turning treatments at the existing T-junction intersection of at Boorga Road and South Lake Drive;
- Griffith City Council concur with a lower-order T-junction treatment with larger turning radii at the intersection of Jones Road and Road 4;
- Griffith City Council concur with the installation of street lighting T-junction sight-boards, give-way signs and holding lines at the intersections of Boorga Road/South Lake Drive and Jones Road/Road 4 and the Service Road/ South Lake Drive.

2. Introduction

Peter Meredith Consulting has been engaged to prepare a report assessing the traffic impacts of a proposed seven stage 106 Lot expansion of an existing residential subdivision known as Lakeside Estate. The subdivision is located between Boorga Road (west side) and Lake Wyangan approximately 6.4km north of Griffith, NSW.

The report will discuss the traffic impacts on the local road network from traffic generated by the proposed subdivision and providing major access from the existing T-junction intersection of Boorga Road and South Lake Drive and a secondary access junction at the intersection of South Lake Drive (Road 4) and Jones Road.

The Lakeside Estate assessment uses calculated traffic flow figures, on-site observations and peak hour traffic counts and traffic data obtained from Griffith City Council.

2.2 Documentation

The documentation and information provided for this assessment includes:

- Lakeside Estate Subdivision Development Consent Plan R2 17/09/2015 by LandUrban Consulting;
- Plan of Features and Levels by Walpole Surveying January 2016. *Refer to Appendix A.*

2.3 References

References used in the preparation of this traffic impact assessment include the following:

- (RMS) Guide to Traffic Generating Developments, Version 2.2 October 2002 for traffic generation predictions.
- Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections.
- Austroads Guide to Road Design – Part 6: Roadside Design, Safety and Barriers
- Signalised and Unsignalised Intersection Design and Research Aid (SIDRA). SIDRA Intersections 6.0 Plus software.

3. Existing Conditions

The proposed subdivision is located on the western side of Boorga Road bounded by Jones Road and Lake Wyangan. *Refer to Locality Plan in Section 1.1.*

3.1 Land Use

The proposed development comprises a large vacant allotment of land described as Lot 244 in DP1119328 South Lake Drive, Lake Wyangan, NSW 2680. The subject land is zoned R5 Large Lot Residential in the Griffith Local Environmental Plan 2014.

3.2 Road Hierarchy

Boorga Road

Boorga Road is classified as a local road and is under the management of Griffith City Council. At the development site Boorga Road is a local travel route for farming properties, industry and a residential estate that provides north-south links to facilities at Lake Wyangan and Griffith. Boorga Road is a designated B-double and school bus route. North of Jones Road, Boorga Road is a designated Road Train route. *For locations of designated Road Train and B-double routes in the development area refer to www.rms.nsw.gov.au for the RMS Restricted Vehicle Access Map.*

At the development site Boorga Road is an undivided two-way road and has a sealed carriageway width of 6.8m comprising two traffic lanes of 3.4m wide. The edges of Boorga Road consist of an open table drain within wide grassed and lightly timbered verges. Delineation consists of a marked centre line and guide posts. The intersection is a give-way T-junction but there is no give-way signage or line markings in place in South Lake Drive or at the Service Road connection.



Photo1: Looking north bound from intersection of South Lake Drive and Boorga Road



Photo 2: Looking south bound from intersection of South Lake Drive and Boorga Road



Photo 3: Looking east bound in South Lake Drive at intersection with Boorga Road

The existing intersection of Boorga Road and Lakeside Drive is constructed with right (BAR) and left (BAL) turn treatments. At the intersection the entrance to South Lake Drive is divided by a splitter island and a service road allowing access for 5 lots connects to the northern side of Lakeside Road. A shared bike path runs parallel along the western side of Boorga Road. *Refer to Photos 1 and 2) and Appendix A for details for the existing plan of the BAR and BAL treatments.*

Jones Road

Jones Road is classified as a local road and is under the management of Griffith City Council. At the development site Jones Road is a local travel route for farming properties and industry that provides east-west links to facilities at Lake Wyangan, Beelbangera and Griffith. At the development site Jones Road is a designated Road Train, B-double and school bus route.



Photo 4: Looking east bound along Jones Road at proposed intersection of Road 4



Photo 5: Looking west bound along Jones Road at proposed intersection of Road 4

At the development site Jones Road is an undivided two-way road and has a sealed carriageway width of 6.0m comprising two traffic lanes of 3.0m wide. The edges of Jones Road consist of an open table drain within wide grassed and lightly timbered verges. Delineation consists of guide posts. A shared bike path runs parallel along the northern side of Jones Road from the end of the service road cul-de-sac at Boorga Road.

3.3 Speed Environment

The speed limits of Boorga Road, Jones Road and South Lake Drive at the development site are as follows:

- Boorga Road has general rural area speed limit of 100km/h;
- South Lake Drive has a general urban speed limit of 50km/h;
- Jones Road has general rural area speed limit of 100km/h.

3.4 Existing Traffic

During September/October 2014 Griffith City Council carried traffic counts on Boorga Road between South Lake Drive and Jones Road. *The results of the traffic counts are shown in tables in Appendix B.*

A summary of the average daily traffic (vpd) and peak hour traffic (vph) volumes in both directions for Boorga Road is listed below:

Location: Boorga Road between South Lake Drive and Jones Road.

- North bound 606vpd weekly;
- North bound 42vph AM peak (8.00 to 9.00) and 56vph PM peak (5.00 to 6.00) weekdays;

- South bound 599vpd weekly;
- South bound 55vph AM peak (8.00 to 9.00) and 50vph PM peak (5.00 to 6.00) weekdays;
- 90.7% of vehicles travelling below 100km/h.

During September/October 2014 Griffith City Council carried traffic counts on Jones Road west of Boorga Road. *The results of the traffic counts are shown in tables in Appendix B.*

A summary of the average daily traffic (vpd) and peak hour traffic (vph) volumes in both directions for Jones Road is listed below:

Location: Jones Road west of Boorga Road.

- West bound 173vpd weekly;
- West bound 20vph AM peak (11.00 to 12.00) and 16vph PM peak (3.00 to 4.00) weekdays;
- East bound 168vpd weekly;
- East bound 15vph AM peak (11.00 to 12.00) and 22vph PM peak (3.00 to 4.00) weekdays;
- 85th percentile speed in both directions 70.9km/h.

The above existing traffic volumes will be used in traffic calculations in Section 5 of this report.

3.5 Pedestrians and Cyclists

There is an existing off-road shared pedestrian/cycling path running parallel to the western side of Boorga Road between the property boundary and the road formation. At the intersection of Boorga Road and South Lake Drive the shared path joins the low traffic volume service road. At the end of the service road the shared path restarts and continues along the northern side of Jones Road to Lake Wyangan. *Refer to Photos 3, 4 and 5.*

4. The Proposal

The development consists of a seven stage 106 lot low density residential subdivision and consists of the following main elements:

- The seven stage 106 lot residential subdivision consists of the following stages:
 - Stage 1: 10 lots
 - Stage 2: 18 lots
 - Stage 3: 11 lots
 - Stage 4: 14 lots
 - Stage 5: 10 lots
 - Stage 6: 19 lots
 - Stage 7: 24 lots

- Major access to the residential subdivision will be via the existing intersection of Boorga Road and South Lake Drive with a secondary access junction at the intersection of Road 4 (South Lake Drive) and Jones Road;
- Access to the subdivisions major circulation roadway will be via connections to and extensions of the existing section of South Lake Drive;
- The proposed extensions of South Lake Drive consist of a circuit type major circulation roadway connecting to six cul-de-sacs. A small roundabout is proposed at the cross road intersection of South Lake Drive, Road 3 and Road 4;
- South Lake Drive is designed for a future designated public bus route;

5. Future Traffic Growth

The proposed 106 lot extension to the existing Lakeside Estate subdivision represents the second last available land parcel for subdivision in the Lake Wyangan, Boorga Road area.

Another parcel of land located to the north west on Boorga Road bonded by West Road and Lake Wyangan is also zoned R5 for Large Lot Residential in the Griffith Local Environmental Plan 2014. It is estimate that this land could potentially produce 110 lots when subdivide.

Therefore it is assumed that the traffic generated by the extension of the Lakeside Estate subdivision and the future development of the land parcel to the north west will add to the existing traffic generated along Boorga Road at this location. A standard 2% per annum traffic growth will be applied to calculations.

5.1 Traffic Generation

Traffic generation levels for the proposed Lakeside Estate subdivision is established using the rates suggested in the *RMS Guide to Traffic Generating Developments 2002 version 2.2*. A supplement to the original guide is *Technical Direction TDT 2013/04a Updated Traffic Surveys*. TDT 2013/04a provides a summary of updated information relating to residential trip generation. The updated information was obtained from eleven surveys conducted in 2010, six within the Sydney urban area and five within regional NSW.

Suggested updated generation rates for low density dwelling houses in NSW regional areas are as follows:

- Daily vehicle trips = 7.4 per dwelling
- Weekday peak hour vehicle trips = 0.78 per dwelling

Existing Lakeside Estate

By applying the above rates, the fully-developed existing section of Lakeside Estate with 15 lots on South Lake Drive and 5 lots on the service road parallel to Boorga Road could potentially generate the following traffic flows:

- Total daily vehicle trips $7.4 \times (15 + 5) = 20 \text{ lots} = 148 \text{ vehicle trips per day (vpd)}$
- Weekday evening peak hour $0.78 \times 20 \text{ lots} = 16 \text{ vehicles per hour (vph)}$

Proposed Lakeside Estate

By applying the above rates, the future fully-developed proposed Lakeside Estate with 106 lots could potentially generate the following traffic flows:

- Total daily vehicle trips $7.4 \times 106 \text{ lots} = 784.4 \text{ vpd}$
- Weekday evening peak hour $0.78 \times 106 \text{ lots} = 83 \text{ vph}$

Total traffic generation for Lakeside Estate $(148 + 784.4) = 932.4 \text{ vpd}$ and $(16 + 83) = 99 \text{ vph}$

5.2 Traffic distribution and Analysis

It is difficult to determine an accurate future distribution of peak hour traffic because of differences in driver behaviour. The following determinations have been made for the distribution of AM and PM peak hour traffic entering and exiting Boorga Road and Jones Road from the future fully-developed (existing and proposed) Lakeside Estate subdivision:

Jones Road

It is estimated that there could potentially be traffic from 10 allotments (Stage 5) accessing the estate from Jones Road. It is estimated that $(10 \text{ lots} \times 0.78) = 8 \text{ vph}$ will turn-right onto Jones Road during the AM and 8 vph turning left from Jones Road into the estate during the PM.

Boorga Road

- The remaining 96 proposed lots plus the existing 20 lots will access the Lake Side Estate via the existing Boorga Road/ South Lake Drive intersection. It is estimated that 91 vph $(116 \text{ lots} \times 0.78)$ will exit onto Boorga Road during the AM peak. It is estimated 95% of vehicles (87 vph) could potentially turn-right at the existing T-junction intersection of Boorga Road and South Lake Drive and head south-bound for employment, to schools and shopping at Lake Wyangan or Griffith. There are very few facilities or attractors to the north along Boorga Road as the land in this area consists of farming properties and larger rural life style lots;
- It is estimated that 5% (4 vph) will turn left from South Lake Drive into Boorga Road in the AM peak. During the PM peak it is assumed that the reverse will occur with 91 vph will turning left and 4 vph turning right from Boorga Road into South Lake Drive.

Analysis

Details of movement summary's, traffic growth and design life are shown below:

- A standard 2% per annum traffic growth has been applied to the existing volumes on Boorga Road and Jones Road to forecast traffic volumes over 7 years to year 2022 (allowing for the development of one stage per year starting in 2016);
- Details of the SIDRA Movement Summary for the existing T-junction intersection at Boorga Road and Lakeside Drive for a fully developed subdivision at year end 2022 for AM and PM distributed peak hour traffic volumes of 91vph (approx 116 lots) is shown in Appendix C. *Refer to Figure 1 below for the forecast traffic movements and the SIDRA Movement Summary results in Appendix C.*
- No SIDRA analysis of the operation of the proposed Jones Road/Road 4 T-Junction intersection is necessary as the existing traffic and anticipated very low right (1vph) and left-turning (8vph) peak traffic generated by the subdivision will have a negligible effect on the safety and existing operations of the Jones Road and Road 4 intersection. *Refer to Figure 2.*
- A 5% value of the peak hour movement volume has been applied to the reverse peak movement.
- Design life of intersection is 15 years.

Figures 1 and 2 below show the existing and forecast traffic movements at the existing T-junction intersection of Boorga Road/South Lake Side Drive and the proposed secondary junction of Jones Road and Road 4.

Figure1: Existing and forecast traffic movements at the existing T-junction intersection of Boorga Road and South Lake Drive

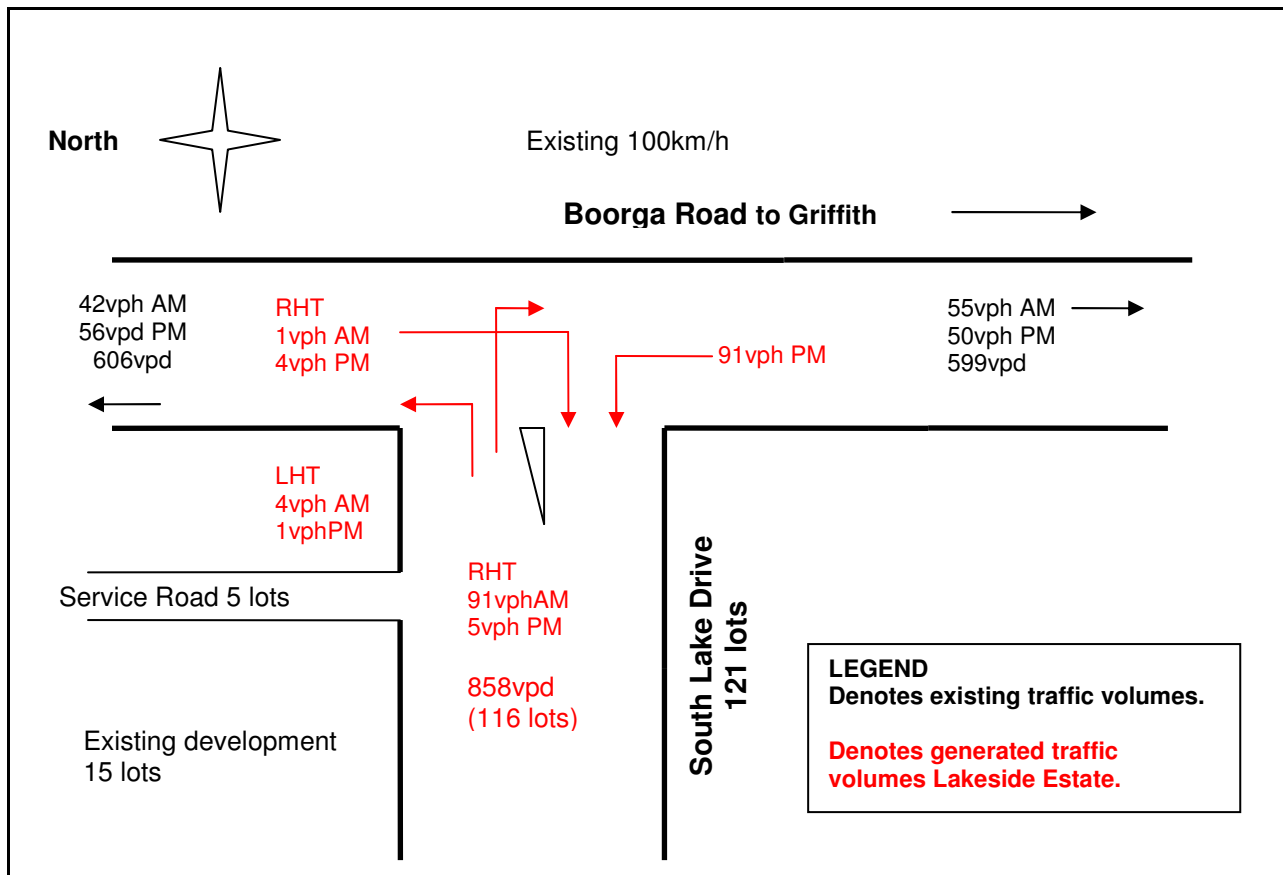
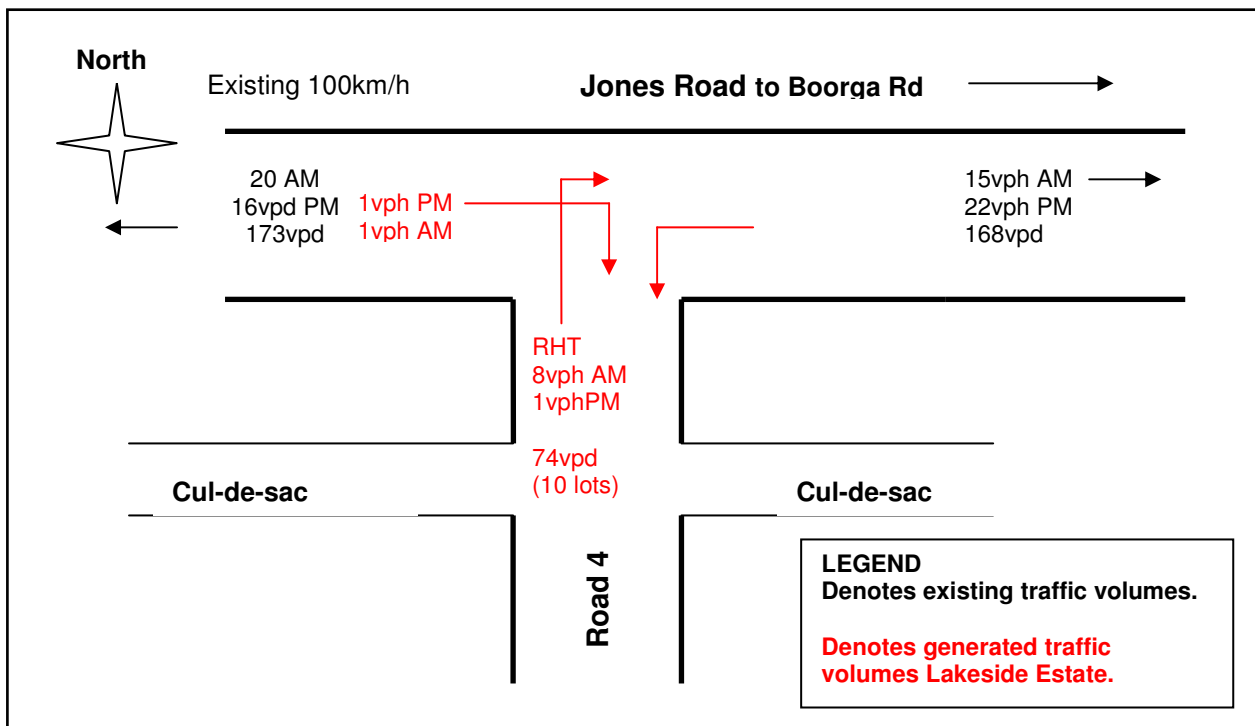


Figure 2: Existing and forecast traffic movements at the proposed junction intersection of Jones Road and Road 4



6. Impacts & Mitigating Works

The impacts of the fully-developed 106 lot subdivision on through-traffic on Boorga Road and Jones Road are primarily related to providing adequate sight lines at the access points and the low speed turning manoeuvres at the existing T-junction intersection of Boorga Road/South Lake Drive and the proposed secondary access junction at Jones Road.

The impacts are quantified below and appropriate mitigating works are recommended, if required.

6.1 Sight Distance

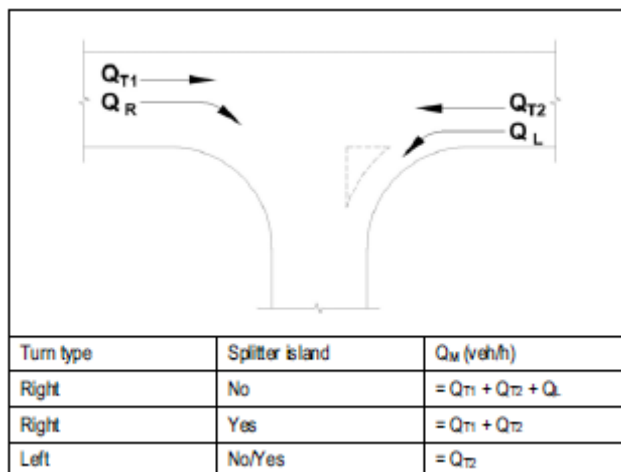
The existing speed limit for Boorga Road and Jones Road along the frontage of the subdivision development is 100km/h. The minimum safe intersection sight distance (SISD) as set out in the *Austroads Guide to Road Design Part 4A: Section 3 Sight Distance, Table 3.2* for a design speed of 100km/h is 248m for a reaction time of 2.0 seconds. This criteria is satisfied at both intersections in both directions with measured sight distances as of over 300m in both directions.

6.2 Intersection Turning Treatments

To ensure the safe operation of vehicles turning at the existing T-junction intersection of Boorga Road/Lake Side Drive and the proposed secondary access junction at Jones Road appropriate provisions for turning vehicles should be provided.

The PM Peak has been used in the analysis as it represents the highest volume (worst-case-scenario) of turn movements into the estate. Applying the existing and forecast PM traffic distribution volumes as shown in Figures 3 and 4 indicate that warrants are met for the minimum turning treatments in accordance with *Austroads Guide to Road Design Part 4A, Section 4.8 Warrants for BA, AU and CH Turn Treatments*. *Figure 4.9 (for speeds greater than 100km/h)* indicates that a BAR right-turn (violet line) and BAL left-turn (green line) treatment are required. Refer to calculations for Q_M of major road traffic and Figures 5 and 6 below.

Figure 3: Calculation of the major road traffic volume parameter Q_M



6.2.1 Calculations for QM

Boorga Road right-turn into Lake Side Drive (south bound)

$$Q_R = 4\text{vph}$$

$$Q_M = Q_{T1} + Q_{T2} + Q_L$$

$$Q_M = 56 + 50 + 91 = 197\text{vph}$$

Boorga Road left-turn into Lake Side Drive (north bound)

$$Q_L = 91\text{vph}$$

$$Q_M = Q_{T2}$$

$$Q_M = 56\text{vph}$$

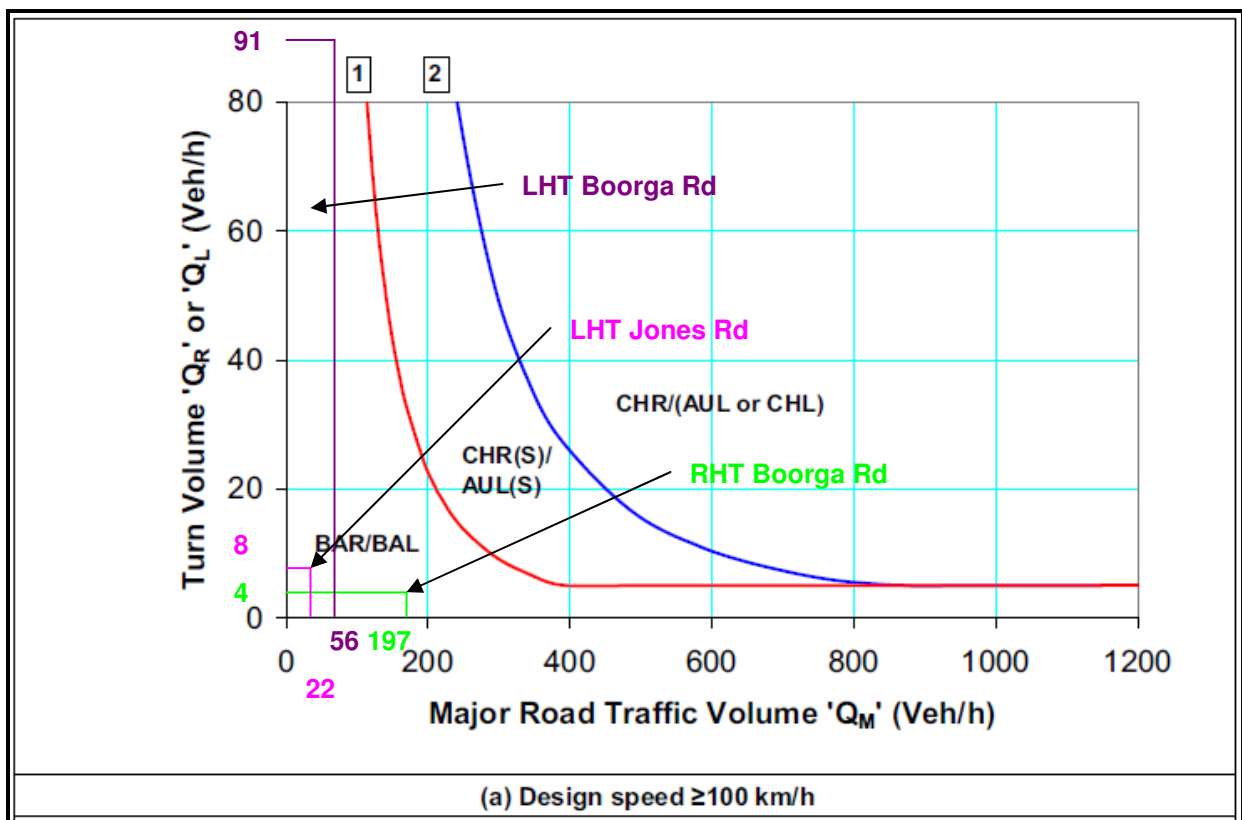
Jones Road left turn into Road 4

$$Q_L = 8\text{vph}$$

$$Q_M = Q_{T2}$$

$$Q_M = 22\text{vph}$$

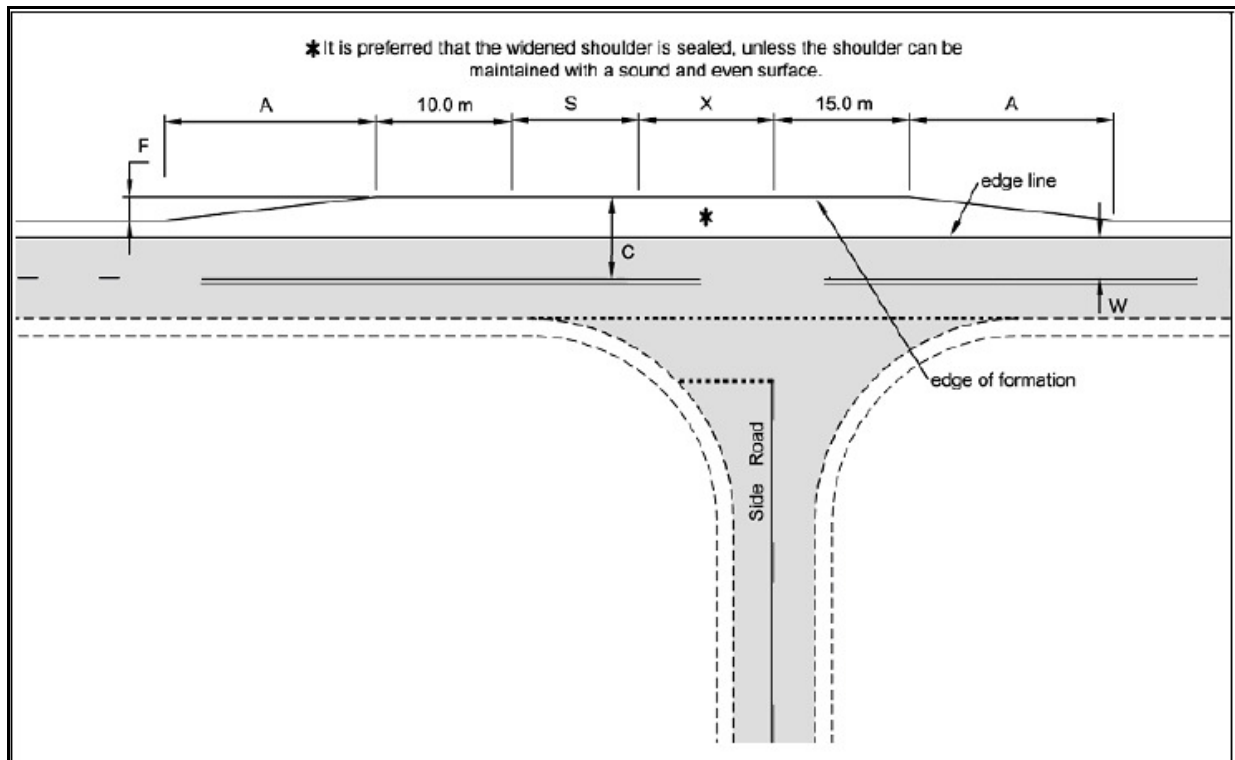
Figure 4: Warrants for turn treatments at intersections with design speeds of >100km/h



6.3 Boorga Road BAR right-turn treatment

The existing BAR right-turn treatment at the intersection of Boorga Road and Lakeside Drive should be in accordance with *Austroads Guide to Road Design Part 4A*. Refer to Figure 7.5: Basic right (BAR) turn treatment on a two-lane rural road. Diagrams and associated tables of the above treatments are shown below in Figure 5.

Figure 5: BAR right-turn treatment Boorga Road



Notes:

1. This treatment applies to the right turn from a major road to a minor road.

2. The dimensions of the treatment are defined thus:

W = Nominal through lane width (m) (including widening for curves). Width to be continuous through the intersection.

C = On straights – 6.5 m minimum
7.0 m minimum for Type 1 & Type 2 road trains

On curves – widths as above + curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle).

A = $\frac{0.5VF}{3.6}$

Increase length A on tighter curves (e.g. those with a side friction demand greater than the maximum desirable). Where the design through vehicle is larger than or equal to a 19 m semi-trailer the minimum speed used to calculate A is 80 km/h.

V = Design speed of major road approach (km/h).

F = Formation/carriageway widening (m).

S = Storage length to cater for one design turning vehicle (m) (minimum length 12.5 m).

X = Distance based on design vehicle turning path, typically 10–15 m.

Source: QDMR (2006).

Figure 7.5: Basic right (BAR) turn treatment on a two-lane rural road

Right Turn Facilities

The right turn design parameters have been established using Figure 5 and the associated notes and are compared to the existing BAR dimensions. The results are shown below:

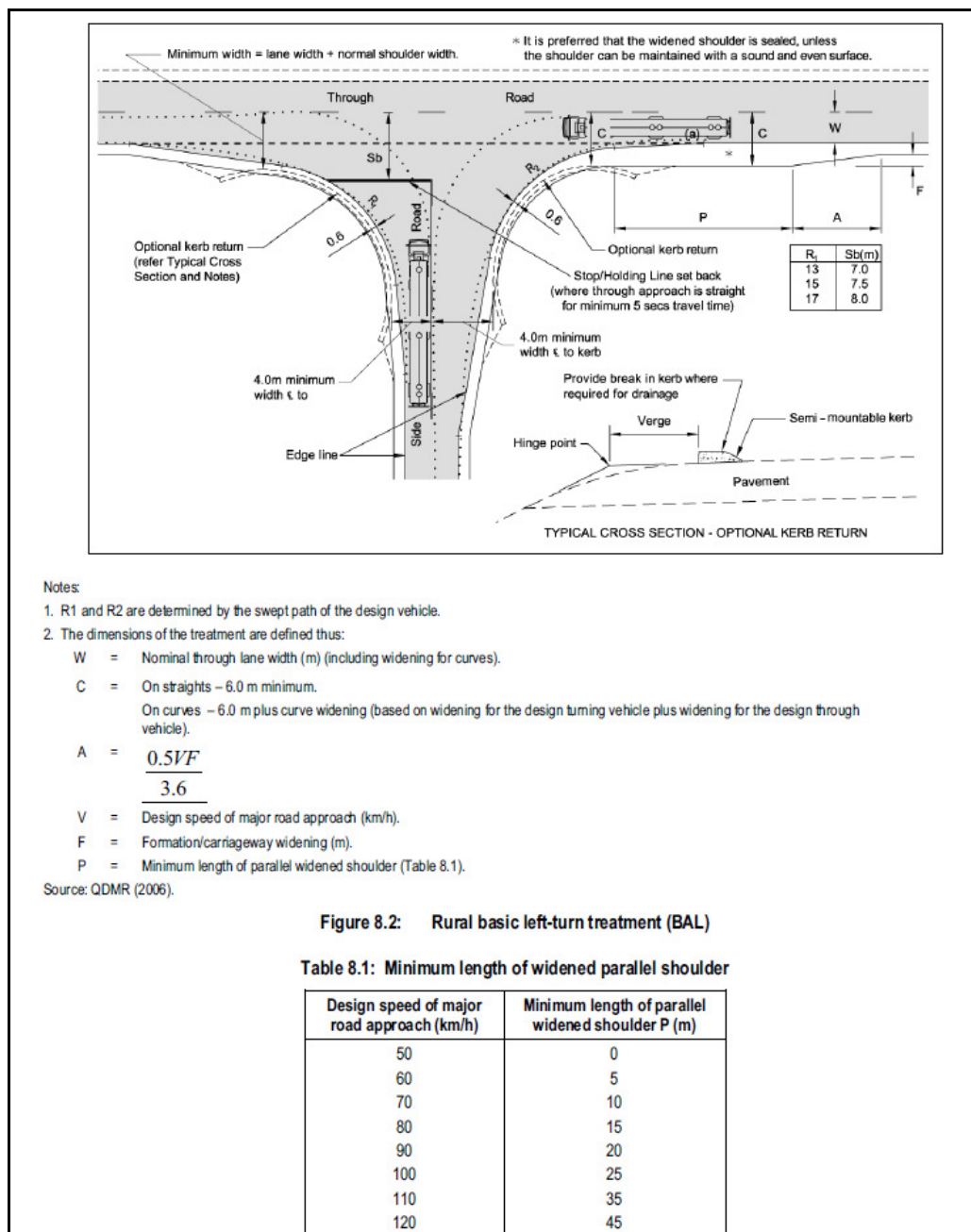
- Design traffic lane width W = 3.5m / Existing 3.57m
- Design C = 6.5m (for a straight section) / Existing 7.15m
- Design A= 41.7m (for 100km/h speed limit) / Existing approach 41.27m and departure 19.86m
- Storage length 10.0m S + X = 32.5m / Existing 32.38m
- Clearance to intersection X = 10m

The existing BAR is mostly consistent with the requirements of Figure 7.5: Basic right (BAR) turn treatment on a two-lane rural road. The departure side taper of the existing BAR is not in accordance with Figure 7.5 and may require extending to approximately 41.7m. Refer to Appendix A for details of possible BAR improvements.

6.4 Boorga Road BAL left turn treatment

The existing BAR right-turn treatment at the intersection of Boorga Road and Lakeside Drive should be in accordance with *Austroads Guide to Road Design Part 4A with reference to Section 8.2 Urban Basic Left Turn Treatment (BAL)* and *Figure 8.2 Rural basic left-turn treatments (BAL)*. A diagram of the above treatment is shown below in Figure 6.

Figure 6: BAL left-turn treatment Boorga Road



Left Turn Facilities

The left turn design parameters have been established using Figure 6 and the associated notes and are compared to the existing BAL dimensions. The results are shown below:

- Design P minimum length of widened shoulder for 100km/h = 25m / *Existing 31.15m*
- Design taper A= 37.5m (for 100km/h speed limit) / *Existing taper 23.0m*

The existing BAL is consistent with the requirements of Figure 8.2 Rural basic left-turn treatment (BAL). The approach taper of the existing BAL is not in accordance with Figure 8.2 being shorter than required. However the widened shoulder storage is longer than required. Therefore the existing BAL treatment is determined to be satisfactory. *Refer to Appendix A for BAL details.*

6.5 Jones Road right and left turn treatments

It is anticipated that the very low right (1vph) and left-turning (8vph) peak traffic generated by the subdivision will have a negligible effect on the safety and existing operations of the Jones Road and Road 4 intersection. *Refer to Figures 2 and 4 above.* It is determined that BAR and BAL treatments at this intersection are not required because of the low traffic volumes and the traffic peaks occurring outside of normal residential AM and PM (*refer to Section 3.4 Existing Traffic for details*). It is proposed that a lower order T-junction treatment with turning radii at Road 4 in accordance with the table in Figure 8.2 Rural basic left-turn treatment (BAL) will provide adequate facilities for the very low volumes of turning traffic.

6.6 Capacity of existing T-Junction intersection of Boorga Road/ South Lake Drive

A SIDRA analysis of the operation of the existing T-Junction intersection for Boorga Road/ South Lake Drive with BAR and BAL treatments was undertaken for the existing, generated and future traffic flows. The analysis determines the future capacity and operational level-of-service (LOS) of the intersection movements. *Refer to Table 1 below for the Austroads definitions of level-of-service.*

The results of the SIDRA analysis for the T-junction intersection for AM 2022 and PM 202 distributed peak hour traffic indicate LOS A for all intersection movements. The south bound South Lake Drive AM right-turn movement (highlighted yellow) has a potential delay of an average delay of 6.5 seconds. These results indicate that the existing intersection at Boorga Road/ South Lake Drive will operate below capacity with good operating conditions and few delays. *Refer to Appendix C for the SIDRA Movement Summary results.*

Table 1: Level-of-service for capacity and operational analysis for all types of road facilities.

| | |
|---------------------------|--|
| Level of service A | A condition of free-flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent. |
| Level of service B | In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with level of service A. |
| Level of service C | Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level. |
| Level of service D | Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems. |
| Level of service E | Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown. |
| Level of service F | In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result. |

6.7 Intersection lighting and signage

To ensure safety appropriately designed street lighting should be installed at both the intersections of Boorga Road/ South Lake Drive and Jones Road/Road 4. In addition to alert motorists of the give-way requirements at the intersections T-junction sight-boards, give-way signs and holding lines should be installed.

6.8 Pedestrians / Cyclists

There is an existing off-road shared pedestrian/cycling path running parallel to the western side of Boorga Road and along the northern side of Jones Road to Lake Wyangan. *Refer to Photos 3, 4 and 5.*

The proposed roadways within the subdivision will provide connectivity to the existing off-road shared path at Boorga Road. To retain good off-road shared path connectivity a path link from Road 4 to the existing path on the northern side of Jones Road should be provided.

7. Conclusions and Recommendations

It is concluded that:

- Minor improvements to the BAR and BAL turning treatments at the existing T-junction intersection of at Boorga Road and South Lake Drive will cater for the peak hour traffic generated by the proposed subdivision and will have minimal impact on the operations of Boorga Road;
- The proposed lower-order T-junction treatment with larger turning radii at the intersection of Jones Road and Road 4 will provide adequate facilities for the low volumes of turning traffic and will have minimal impact on the operations of Jones Road;
- Sight-distance criteria are adequately satisfied for traffic at the T-junction intersections of Boorga Road and South Lake Drive and Jones Road and Road 4;
- Traffic safety will be improved with the installation of street lighting installed at both the intersections of Boorga Road/ South Lake Drive and Jones Road/Road 4.
- Traffic safety will be improved with the installation of T-junction sight-boards, give-way signs and holding lines at the intersections of Boorga Road/South Lake Drive and Jones Road/Road 4 and the Service Road/ South Lake Drive ;

It is recommended that:

- Griffith City Council concur with minor improvements to the BAR and BAL turning treatments at the existing T-junction intersection of at Boorga Road and South Lake Drive;
- Griffith City Council concur with a lower-order T-junction treatment with larger turning radii at the intersection of Jones Road and Road 4;
- Griffith City Council concur with the installation of street lighting T-junction sight-boards, give-way signs and holding lines at the intersections of Boorga Road/South Lake Drive and Jones Road/Road 4 and the Service Road/ South Lake Drive ;

APPENDIX A

Plan of Features and Levels by Walpole Surveying January 2016 showing possible improvements to the existing BAR and BAL turning treatments in Boorga Road.

APPENDIX B

Traffic Count Data:

Boorga Road

- B1: Boorga Road north bound weekly 24 hour count;
- B2: Boorga Road south bound weekly 24 hour count
- B3: Boorga Road class speed matrix.

Jones Road

- B4: Jones Road west bound weekly 24 hour count;
- B5: Jones Road east bound weekly 24 hour count;
- B6: Jones Road both directions speed statistics.

APPENDIX C

SIDRA Movement Summary's

- C1: Boorga Road T-Junction AM traffic year 2022
- C2: Boorga Road T-Junction PM traffic year 2022

