





# Selectability Rockhampton Mental Health Hub



## **TRAFFIC IMPACT ASSESSMENT**

Selectability Ltd.

#### **ROCKHAMPTON REGIONAL COUNCIL**

APPROVED PLANS
These plans are approved subject to the current

conditions of approval associated with Development Permit No.: D/106-2022 Dated: 23 November 2022

#### LANGTREE CONSULTING

Project No.:	0760
Reference No.:	R-NP0275
Date:	14/07/2022

## **Controlled Copy No.: 1**

### **Revisions: C**

## **Revision Record:**

Rev	Review Date	Description	Prepared	Checked	Approved
А	24/06/2022	Issued for Development Application	Natalie Pham	Geoffrey Smart	Geoffrey Smart
В	24/06/2022	GFA amended	Natalie Pham	Geoffrey Smart	Geoffrey Smart
С	14/07/2022	Minor grammar corrected	Natalie Pham	Geoffrey Smart	Geoffrey Smart

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#### 1.0 INTRODUCTION

Langtree Consulting has been engaged by MAL Engineers on behalf of Selectability Ltd. to undertake a Traffic Impact Assessment (TIA), to support of the Material Change of Use (MCU) application for the development of the Selectability Rockhampton Mental Health Hub located at 2-6 Musgrave Street, Berserker on land described as Lot 2 on RP906612, Lot 1 on RP600727, Lot 2 on RP600727 and Lot 62 on SP156097.

The Rockhampton Mental Health Hub will provide mental health support services, NDIS plan assistance and associated training programs to the Rockhampton region. It is understood that the proposed development MCU will be defined as "Community Use".

This TIA report outlines the following:

- Background information for the project and proposed development;
- Existing traffic conditions, proposed development traffic generation and distribution and postdevelopment traffic conditions;
- Intersection analysis including turn warrant assessment;
- Assessment of the development impacts on State-controlled and local roads postdevelopment; and
- Any recommendations and mitigation measures, if required.

#### 2.0 BACKGROUND

The proposed development is located approximately 1.5km from the Rockhampton CBD. The development site is proposed to be located on land described as:

- Lot 2 on RP906612;
- Lot 1 and 2 on RP600727; and
- Lot 62 on SP156097.

Hereon in, the above-described lands shall be referred to as the subject site.

The subject site is bound by Musgrave Road and neighbouring residential lots to the west, Evans Street to the north, Lakes Creek Road to the south and neighbouring residential land to the east.

Refer below in blue for development site locality.



Figure 1. Site Locality (Source: Google Earth)

#### 2.1 LAND USE AND ZONING

The subject site is currently vacant land and is currently within the Mixed Use Sub-precinct zone.



*Figure 2.* Current zoning (Source: Rockhampton Region Council Planning Scheme Maps)

#### 2.2 SITE ACCESS

Currently the subject site has four (4) accesses, two (2) on Lakes Creek Road, one (1) on Musgrave Street and one (1) on Evans Street.

#### 2.3 SURROUNDING ROAD NETWORK

The key surrounding roads in proximity of the subject site have been identified and summarised in **Table 3** below.

#### Table 1. Key Roads

Road Name	Jurisdiction	Hierarchy	Speed limit	AADT (Year)/
				AM PH / PM PH
Bridge Street/Lakes	TMR	Arterial	60km/h	
Creek Road				
Musgrave Street	RRC	Minor Urban	Not posted	1504 (2015)/
		Collector		127 / 160
		(Road Class 8)		
Evans Street	RRC	Urban Access	Not posted	Unavailable
		Place	(Local street)	
		(Road Class 9B)		
Goodsall Street	RRC	Urban Access	Not posted	Unavailable
		Street		
		(Road Class 9A)		

#### 2.4 KEY INTERSECTIONS / ACCESSES

The key intersections and accesses are summarised below in Table 2.

#### Table 2. Key Intersections / Accesses

ID	Roads	Control
Intersection 1	Bridge Street / Musgrave Street	Unsignalised
	/ Lakes Creek Road / Goodsall Street	
Intersection 2	Musgrave Street /	Unsignalised
	Evans Street	
Access 1	Lakes Creek Road / Site Access	Unsignalised
Access 2	Evans Street / Ste Access	Unsignalised

#### 2.5 CRASH HISTORY

Queensland Globe was used to investigate the crash history in the vicinity of the key roads and accesses/intersection. All reported road crash locations within the last 10 years and within 150m of the subject site have been reviewed and are shown in **Figure 3** and summarised in **Table 3**. Crash history for the site does not suggest any safety deficiencies.



Figure 3. Crash Report Locality

<b>Tuble 5.</b> Clush history Report Summary	Table 3.	Crash	History	Report	Summary
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Crash	Year	Severity	Crash Type	Crash	Crash Description
Location				Nature	
1	2018	Hospitalisation	Hit	Hit	Darkness – not lighted, Clear, sealed-dry, T-junction,
			Pedestrian	Pedestrian	giveway sign. Near side vehicle hit from right
2	2012	Hospitalisation	Multi-	Angle	Daylight, Clear, sealed-dry, intersection-cross,
			vehicle		Vehicle adjacent approach: Thru-Thru
3	2013	Medical	Multi-	Angle	Darkness-lighted, clear, seal-dry, intersection-cross,
		Treatment	vehicle		Adjacent approach: Right-Thru
4	2018	Hospitalisation	Hit	Hit	Darkness-lighted, clear, seal-dry, intersection-cross,
			Pedestrian	Pedestrian	Far side vehicle hit from left
5	2018	Hospitalised	Multi-	Angle	Daylight, clear, seal-dry, intersection-cross,
			Vehicle		Adjacent vehicle Approach: Thru-Thru
6	2012	Medical	Multi-	Angle	Darkness-lighted, clear, seal-dry, median opening,
		Treatment	vehicle		Manoeuvring: other

#### 3.0 PROPOSED DEVELOPMENT

The proposed development is a mental health support facility allowing community members to access a range of services. The centre will operate between 8.30am to 4.30pm on weekdays based on existing operations and other Selectability sites. The proposed site and internal layouts are shown in Figure 4 and **Figure 5** and included in **Appendix A**.



*Figure 4.* Site Plan (Source: GVD Building Designs)



*Figure 5.* Internal Layout Plan (Source: GVD Building Designs)

#### 4.0 BACKGROUND TRAFFIC (PRE-DEVELOPMENT TRAFFIC)

A summary of the traffic data obtained from TMR and Rockhampton Regional Council has been summarised in **Table 4**.

Road (ID)	Count Location	Count	AADT / Directional 1 AADT	AM Peak	PM Peak
		year	(Direction 1) / Directional 2		
			AADT (Direction 2)		
Bridge Street /	Count Site	2020	16453 /	1650	1650
Lakes Creek	60082 (opposite		7925 (Gazettal - Eastbound) /	(7-8am)	(4– 5pm)
Road	91 Lakes Creek		8528 (Against Gazettal -		
	Road)		Westbound)		
Musgrave Street	Opposite 40	2015	1504 /	127.4	160.2
	Musgrave Street		406 (Northbound) /	(8-9am)	(3-4pm)
			1182 (Southbound)		
Goodsall Street	15m South of	2020	1883 /	193.6	190.1
	Rail crossing		905 (Northbound) /	(8-9am)	(3-4pm)
			1000 (Southbound)		

Table 4.	Background	traffic data
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No growth rate was provided for Council Roads whilst Bridge Street/ Lakes Creek Road experienced negative growth. As such 1% growth has been adopted for all background traffic. Refer to **Appendix B** for traffic data provided by RRC and TMR.

For Evans Street, a peak rate of 0.8 per dwelling has been adopted.

#### 4.1 BACKGROUND TRIP DISTRIBUTION

The background traffic trip distribution for 2023 AM and PM is shown in **Figure 6** and **Figure 7**, whilst the 2033 AM and PM trip distribution is shown in **Figure 8** and **Figure 9**. Background trip distributions are also available in **Appendix C**.



Figure 6. 2023 Background Traffic AM Peak Hour Trip Distribution



Figure 7. 2023 Background Traffic PM Peak Hour Trip Distribution



Figure 8. 2033 Background Traffic AM Peak Hour Trip Distribution



Figure 9. 2033 Background Traffic PM Peak Hour Trip Distribution

#### 5.0 DEVELOPMENT TRAFFIC

#### 5.1 PROPOSED DEVELOPMENT

The development is proposed to contain the following features:

- Six (6) consultant offices;
- Four (4) clinical skills labs (CSL);
- Two (2) Activity areas; and
- Two (2) conference rooms.

#### 5.2 OPERATING REGIME

The proposed opening hours are between 8.30am and 4.30pm, 5 days per week (weekdays), with staff arriving and departing half an hr before and after opening hours.

#### 5.3 ACCESS

Two-way access is proposed to be from Lakes Creek Road Service Road (also refer to as Access 1) and Evans Street (also refer to as Access 2). Twenty-four (24) off-street parking spaces are proposed for patrons and staff.

#### 5.4 DEVELOPMENT TRAFFIC GENERATION

#### 5.4.1.1 Traffic Generation

In accordance with the TMR Guide to Traffic Impact Assessment (GTIA) the following resources were assessed to determine the development trip generation rate the following have been reviewed:

- Traffic generation data 2006–2017 (Queensland) Open Data;
- Guide to Traffic Generation Developments Updated traffic surveys, RMS (2013) (not available); and
- Guide to Traffic Generating Developments, RTA (2002).

In addition to those listed above the following was also reviewed:

- TMR RPDM 1<sup>st</sup> edition, Chapter 3;
- First principles traffic generation.

From Traffic generation data – 2006–2017 (Queensland) Open Data the average weekday peak volume rate for medical centre is 5.73 trips/100m<sup>2</sup> GFA. The building GFA is 558.2m<sup>2</sup>. Based on the average medical centre weekday rate the development peak hour volume would be 32 trips.

Selectability has indicated that operations are anticipated to consist of the following services and operate as follows:

- NDIS
  - Selectability provides mental health support services and NDIS plan assistance to regional Queensland.
  - Up to 10 of these employees will work from the Mental Health Hub in essentially office based tasks, providing
    - Local operational management staff
    - A local phone call hub for service rostering and,
    - NDIS support coordination and
    - Team leaders managing the staff providing services directly in the community.
- Mental Health Hub
  - Selectability's mental health hubs have an open-door policy, providing safe and welcoming spaces for self-help, advocacy, and socialisation. Services are open to all adults seeking support for their mental health and accept referrals from all sources, including self-referrals.
  - The Mental Health Hubs will grow to a staff of 4 or 5 staff and up to 10 community members at a time.
- Clinical Services
  - The Mental Health Hub will house a clinical services program with a full-time clinician on site, and telehealth services facilitating the provision of more individualised care to those requiring clinical intervention.
  - This is likely to be 2 staff and 2 consumers at any point in time, 5 days a week.
- Registered Training Organisation
  - Selectability Training is a not-for-profit Registered Training Organisation (RTO 0281) specialising in disability and community services training.
  - The RTO offers a flexible and tailored approach to suit the individual needs of students so that they can study at their own pace. All of classes are available online via our easyto-use learning management system.
  - While the bulk of the services are provided online, the local provision of classes will occur from time to time.
  - There will be a limited number of times where up to 10 community members and 1 staff member would be utilising the Mental Health Hub.

Notwithstanding the above, it is understood that an absolute maximum limit of thirty (30) concurrent users occupying the Mental Health Hub will be adopted at any point in time. This would equate to a maximum of sixty (60) trips assuming all users arriving and departing during the peak hours. It is assumed that staff shall arrive and depart outside the peak hour. It is acknowledged that there may be some overlap of community users at arriving and departing at the end/start of a scheduled service, however, the overlap would be minimal and the impact insignificant.

#### 5.4.2 Development Trip Distribution

For the purpose of trip generation by the proposed site the following has been assumed:

- Traffic arriving from the west will utilise Bridge Street/Lakes Creek Road to enter the site from the service Road.
- Traffic arriving from the east will turn right from Lakes Creek Road into Musgrave Road, before utilising Evans Road to access the site.
- Traffic arriving from the north will utilise Musgrave Street, before turning left into Evans Street to access the site.
- There is limited road network to the south of the site with development traffic extremely unlikely to be generated. It is assumed that no development traffic shall be generated from Goodsall Street.
- Traffic departing the site to go northbound shall exit the site via Evans Street, before turning right to utilise Musgrave Street and then left to utilise Bernard Street.
- Westbound traffic shall exit the site via Evans Street, before turning left on to Musgrave Street and right to enter Bridge Street. It is noted that Westbound traffic may also exit via Evans Street, before turning right on to Musgrave and left on Brown Street in order to turn right on Bridge Street.
- Eastbound traffic shall exit the site via Lakes Creek Road Service Road to re-join Lakes Creek Road.
- As per above, due to the limited road network south with few houses or services which are likely to be utilised by patrons following their visits, it is assumed that no development traffic is generated to the south.
- Trip distribution will be one third (1/3) utilising Lake Creek Service Road Access and two thirds (2/3) utilising Evans Street Access.
- Traffic numbers have been rounded to the nearest integer.

The adopted development traffic trip distribution is summarised in **Figure 10** and **Figure 11**. Development trip distributions are also available in **Appendix D**.



Figure 10. Development Traffic AM Peak Hour Trip Distribution



Figure 11. Development Traffic PM Peak Hour Trip Distribution

#### 5.5 POST-DEVELOPMENT TRAFFIC

The 2023 AM and PM traffic distribution post-development (i.e. Background + Development) is summarised in **Figure 12** and **Figure 13** respective and the 2033 AM and PM traffic distribution post-development is summarised in **Figure 14** and **Figure 15** respectively. Post development trip distributions are also available in **Appendix E**.



Figure 12. 2023 Background + Development Traffic AM Peak Hour Trip Distribution



Figure 13. 2023 Background + Development Traffic PM Peak Hour Trip Distribution



Figure 14. 2033 Background + Development Traffic AM Peak Hour Trip Distribution



Figure 15. 2033 Background + Development Traffic PM Peak Hour Trip Distribution

#### 6.0 TRAFFIC IMPACT ASSESSMENT

SIDRA Intersection Assessment has been conducted for Key Intersection 1 and 2. The level of service (LOS) at Key Intersection 1 (Bridge Street/ Musgrave Street / Lakes Creek Road / Goodsall Street) and Key Intersection 2 (Musgrave Street / Evans Street) for the 10 year horizon has been summarised in Table 5. Please note, the LOS for AM and PM peak hours resulted in the same LOS for both intersections in both 2023 and 2033. For all movement summary reports refer to **Appendix F**.

From the SIDRA analysis the following is noted:

- The AM and PM peak hour assessment for both 2023 and 2033 resulted in the same LOS.
- The level of service (LOS) for both intersections did not change between 2023 and 2033.
- At Key Intersection 1, Musgrave Street and Goodsall Street are both a LOS F in both the background (pre-development) and post-development scenarios.
- The level of service on all lanes at Intersection 2 are LOS A in all scenarios.

Whilst the LOS of Musgrave Street and Goodsall Street are below the LOS C/D threshold for consideration of intersection upgrade, the proposed development does not change the existing LOS at Key Intersection 1 during the base year or 10 year horizon. Thus, no significant impact is expected as a result of the proposed development. No mitigation to Key Intersection 1 is proposed.

ID	Description	2023 Pre-Development LOS	2023 Post-development LOS	2033 Pre-Development) LOS	2033 Background + Dev (Post- development) LOS				
	Goodsall Street (South)								
	Lane 1 (Left/ though/ right)	F/F	F/F	F/F	F/F				
	Approach	F/F	F/F	F/F	F/F				
	Lakes Creek Road (East)								
	Lane 1 (Through /Left)	A/A	A/A	A/A	A/A				
	Lane 2 (Through)	A/A	A/A	A/A	A/A				
11	Lane 3 (Right)	B/B	B/B	B/B	B/B				
ctior	Approach	NA	NA	NA	NA				
erse	Musgrave Street (North)								
Int	Lane 1 (Left/ though/ right)	F/F	F/F	F/F	F/F				
	Approach	F/F	F/F	F/F	F/F				
	Bridge Street (West)								
	Lane 1 (Through /Left)	A/A	A/A	A/A	A/A				
	Lane 2 (Through)	A/A	A/A	A/A	A/A				
	Lane 3 (Right)	C/C	C/C	C/C	C/C				
	Approach	NA		NA	NA				
	Musgrave Street (South)								
	Lane 1 (Left/ though/ right)	A/A	A/A	A/A	A/A				
	Approach	NA	NA	NA	NA				
on 2	Evans Street (East)								
secti	Lane 1 (Left/ though/ right)	A/A	A/A	A/A	A/A				
nter	Approach	A/A	A/A	A/A	A/A				
_	Musgrave Street (North)								
	Lane 1 (Left/ though/ right)	A/A	A/A	A/A	A/A				
	Approach	NA	NA	NA	NA				

#### Table 5. AM & PM Peak Hour Pre- and Post-Development LOS Summary

Note:

A/A – Indicates AM Peak LOS/PM Peak LOS



Figure 16. 2033 Background Traffic AM Peak Hour LOS Lane Summary at Intersection 1 (Site 1)

Note: LOS for AM and PM Peak are identical



Figure 17. 2033 Background + Development Traffic AM Peak Hour LOS Lane Summary at Intersection 2 (Site 2)

Note: LOS for AM and PM Peak are identical

#### 6.1 TURN WARRANT ASSESSMENT

#### 6.1.1 Intersection 1 (Bridge Street / Musgrave Street / Lakes Creek Road / Goodsall Street)

Current turn treatment at Intersection one is a short channelised right turn (CHR (S)) on both Bridge Street and Lakes Creek Road. No "urban" basic left turn treatment (BAL) is included in Austroads Guide to Road Design or TMR's supplement to the guide. Extended Design Domain (EDD) turn warrants for brownfield sites in accordance with TMR's supplementary to AGRD Part 4A, indicate that short channelised right turn treatments are still suitable for the intersection post-development. No upgrades are proposed. Refer to **Appendix G** for turn warrant assessment.

#### 6.1.2 Intersection 2 (Musgrave Street / Evans Street)

In accordance with turn warrants from the Austroads Guide to Road Design, Part 4A, the minimum turn treatment is a BAL/BAR arrangement. TMR's supplement to the guide does allow for existing intersections to maintain simple left (SL), simple right (SR) arrangements, however, the traffic volumes at Intersection 2 fall outside of this area and as such would be within the BAL/BAR area of the turn warrant.

Whilst a basic left turn treatment (BAL) is warranted by the turn warrant assessment it is not generally implemented on urban roads as indicated by the omission thereof an urban BAL treatment from the Austroads Guide to Roads Design. The cost to benefit ratio for the provision of a BAL at the intersection would likely indicate that the benefit would not outweigh the cost of construction and urban sites are generally restrained with space limitations especially at brownfield sites.

Musgrave Street currently has a 12m carriageway which is sufficient to accommodate a basic right turn treatment (BAR). Refer to **Figure 18** below for typical BAR turn treatment. However, due to the proximity of the intersection to Brown Street and possible confusion resulting from installation of linemarking, it is proposed that no parking signage and yellow linemarking be installed opposite the intersection to prevent parking in this area is adopted as opposed to line marking for BAR treatment.



Figure 18. Basic right-turn treatment for two lane urban road (Source: AGRD04A, Figure 7.6)

#### 6.2 ACCESS ASSESSMENT

#### 6.2.1 Access 1 (Lakes Creek Road Service Road Access)

In accordance with AS2890.1, Figure 3.2, the desirable 5s gap and minimum SSD for a 60km/h road is 83m and 65m respectively. Access 1 (Lakes Creek Road Service Road Access) has ample sight distance to the east, however, due to the service road being one-way sight distance is this direction is not of significance to the access. To the west the available sight distance is in the order of 75m, which is between the desired 5s gap sight distance and the minimum SSD required. Whilst it does not meet the desirable 5s gap sight distance, it does meet the minimum SSD requirement and thus the access location is deemed adequate.

In accordance with AS2890.1, Table 3.1 and 3.2, Access 1 is a Category 3 parking facility with an arterial frontage and is thus a Category 2 access category. The required width for a Category 2 access is 6m to 9m. The proposed width is 8m.

#### 6.2.2 Access 2 (Evans Road Access)

The proposed access location is along the western boundary of Lot 62 on SP156097. In accordance with AS2890.1, Figure 3.2, the desirable 5s gap and minimum SSD for a 40km/h road is 55m and 35m respectively. Evans Road is a dead-end road, thus traffic will all turn left to depart the site. There sufficient sight distance available for drivers departing the site to see to the end of the cul-de-sac (i.e.

45m). Whilst all drivers departing the site will turn left, it is noted there is in the order of 55m sight distance to the west. There are no issues with sight distance from Access 2.

In accordance with AS2890.1, Table 3.1 and 3.2, Access 2 is a Category 3 parking facility with a local road frontage and is thus a Category 1 access category. The required width is thus between 3m to 5.5m. The proposed access width is 5.5m and is thus adequate.

#### 6.2.3 Access Type

Accesses shall be constructed in accordance with Rockhampton Regional Council Standard Drawing CMDG-R\_042.

#### 6.3 PEDESTRIAN SAFETY

In accordance with AS2890.1, Parking facilities, off-street parking the minimum sight distance required for pedestrian safety is as shown in **Figure 19** below.



*Figure 19. Minimum sight lines for pedestrian safety (AS2890.1, 2004, Figure 3.3)* 

There are no obstructions proposed within the areas indicated in **Figure 19**, for Access 1 (Lakes Creek Road Services Road), however, due to the narrow nature of Lot 62 on SP156097, Access 2 (Evan Street), must be located against the western property boundary. As such, whilst there will be no obstructions on the eastern side of the access at the property boundary, visibility may be obstructed on the western side in the triangular area shown in **Figure 19** due to boundary fence and/or the neighbouring property.

From aerial imagery it is noted that the neighbouring lot (Lot 61 on SP156097) has an existing shed constructed on this corner. Refer to **Figure 20** below.



Figure 20. Existing structure on Lot 61 on SP156097

Evans Street is a cul-de-sac, thus, pedestrians walking pass Access 2 may be generated by a maximum of up to three dwellings. It is noted that no formal footpath has been constructed along Evans Street and in such cases, pedestrians have a preference to walk on the street for comfort. This would allow time for exiting vehicles to see and stop before a collision with a pedestrian. As such, whilst the access does not meet the minimum sight distance for pedestrian safety due to the neighbouring property, no mitigation measures are proposed as no improvements can be made by the development and the likelihood and risk is of an incident is low.

#### 7.0 PARKING ASSESSMENT

Based on the Rockhampton Regional Council Planning Scheme, Table 9.3.1.3.2 the following parking allowance are required for Community Use:

• One (1) space per twenty-five (20) square meters or part there of gross floor area:

The total floor area bound by the outside of the external walls of the building is 558.2m<sup>2</sup>. The floor area occupied by the public entrance and hallway areas are 98.59m<sup>2</sup>. These areas are non-traffic generating and as such the gross traffic generating floor area adopted is 459.61m<sup>2</sup>. Based on this area, it is proposed that twenty-three (23) parking spaces, one of which is an accessible (i.e. disabled) parking space.

#### 8.0 SAFETY ASSESSMENT

In accordance with the TMR Guide to Impact Assessment (GTIA), Table 9.3.3(a) and Table 9.3.3(b), (shown as **Table 6** and **Table 7** below) the Road environment safety rating matrix (level of risk) for Key Intersection 1 is Medium and the type of assessment required is a road safety assessment.

Table 6. Road environment safety rating matrix (level of risk) (Source: TMR GTIA, 2018, Table 9.3.3(a))

Traffic volume (AADT)	Speed (km/h)			
	Up to 50 km/h	60 km/h to 70 km/h	80 km/h+	
≤ 8000	Low	Medium	Medium	
> 8000	Medium	Medium	High	

**Table 7.** Type of road safety assessment based on road environment safety rating (Source: TMR GTIA, 2018, Table 9.3.3(b))

Development type	Road environment safety rating				
	Low Medium		High		
Major Development	road safety assessment	road safety audit	road safety audit		
Planning Act Development	road safety assessment	road safety assessment	road safety audit		

#### 8.1.1 Road Safety Assessment

A road safety risk assessment has been performed in accordance with the Safety Risk Score Matrix in accordance with **Table 8** below.

Table 8. Safety risk score matrix (Source: TMR GTIA, 2018, Table 9.3.2(a))

		Potential consequence									
		Property only (1)	Minor injury (2)	Medical treatment (3)	Hospitalisation (4)	Fatality <mark>(</mark> 5)					
Potential likelihood	Almost certain (5)	М	Μ	н	н	н					
	Likely (4)	М	М	М	н	н					
	Moderate (3)	L	М	М	М	н					
	Unlikely (2)	L	L	М	М	М					
	Rare (1)	L	L	L	М	М					

L: Low risk M: Medium risk H: High risk Safety risks identified for the development have been summarised in Table 9.

	Without Development		With Development				Dev and	With elopment mitigation		
Risk Item	Likelihood Consequence Risk Score		Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measure	Likelihood	Consequence	Risk Score
Traffic turning left into Access 1 queuing into Lakes Creek Service Road or Lakes Creek Road; rear end of queuing traffic	1	3	L	3	3	Μ	No Action			
Traffic turning out of Access 2 colliding with pedestrian	-	-	-	1	3	L	No Action			
Traffic departing service road at intersection with Edwards Street; Collision with vehicles turning left to Edwards Street from Lakes Creek Road due to poor viewing angle	2	3	Μ	2	3	L	Existing issue. No Action			
No give-way sign present on Evans Street; Collision between Musgrave Street traffic and Evans Street traffic	2	3	L	2	3	L	Install give-way sign	1	3	L

#### Table 9. Safety risk assessment

#### 8.1.2 Existing Road Issues

Other existing road issues noted are as follows:

- Noted that there is no give-way sign on left turn from Goodsall Street. It is recommended that Council should consider installation of give way sign.
- Noted that there is currently poor sight distance from Musgrave Street at Intersection 1. The available sight distance is in the order of 83m. In accordance with AGRD04A, Table 3.5 and 3.6 (refer to Figure 21 for extract of table), the critical gap acceptance time for a left turn requiring through traffic to slow down is five (5) seconds. For an 85th percentile speed of 60km/h a minimum sight distance of 83m is required. As such, the sight distance is sufficient as a bare minimum for a left turn movement. However, the critical gap acceptance time for a right turn movement from a minor road across a four lane/two way road is eight (8) seconds. The intersection does not currently have the required right turn minimum gap sight distance of 133m for an 85th percentile speed of 60km/h. This is an existing intersection and hence is an existing issue. It is recommended that the intersection is reviewed. The low traffic generated

by the development in comparison to the background volumes does not materially change the likelihood of an accident at the intersection due to visibility.

• As mentioned above, the geometry of the western leg of Lakes Creek Road Service Road at its intersection with Edwards Street is not ideal due to the high viewing angle. Driver must look behind them, to the left and in front of them to determine if it is safe to proceed.

Table 3.5: Critical acceptance gaps and follow-up headways									
Movement	Diagram	Description	t. <sup>(1)</sup> (sec)	t <sup>(2)</sup> (sec)					
Left turn		Not interfering with A Requiring A to slow	14 <u>4</u> 0 5	2–3 2–3					
Crossing		Two lane/one way Three lane/one way Four lane/one way Two lane/two way Four lane/two way Six lane/two way	4 6 8 5 8 8	2 3 4 3 5 5					
Right turn from major road		Across one lane Across two lanes Across three lanes	4 5 6	2 3 4					
Right turn from minor road		Not interfering with A One way Two lane/two way Four lane/two way Six lane/two way	14-40 3 5 8 8	3 3 5 5					
Merge		Acceleration lane	3	2					

1 ta = critical acceptance gap (sec).

2 t<sub>l</sub> = follow-up headway (sec).

Note: For a description of the follow-up headway and its uses, refer to Guide to Traffic Management Part 3: Traffic Studies and Analysis (Austroads 2013e).

Source: Department of Main Roads (2006)<sup>11</sup>.

Table 3.6: Table of minimum gap sight distances ('D' metres) for various speeds

Critical gap acceptance	85 <sup>th</sup> percentile speed of approaching vehicle (km/h)										
time (t <sub>a</sub> ) (secs)	10	20	30	40	50	60	70	80	90	100	110
4	11	22	33	44	55	67	78	89	100	111	122
5	14	28	42	55	69	83	97	111	125	139	153
6	17	33	50	67	83	100	117	133	150	167	183
7	19	39	58	78	97	117	136	155	175	194	214
8	22	44	67	89	111	133	155	178	200	222	244
9	25	50	75	100	125	150	175	200	225	250	275
10	28	56	83	111	139	167	194	222	250	278	305

Figure 21. Minimum gap sight distance extract from AGRD04

#### 9.0 CONCLUSION

This report has assessed the impact of the traffic generated by the proposed development on the existing road network including at key intersections and accesses. Consideration has been given to operational performance and road safety.

The impact of the proposed development on the road network has been analysed using procedures set out in Austroads, Australian Standard AS2890, Parking facilities and in TMR's Guide to Traffic Impact Assessment. Results from the SIDRA assessment has indicated that there is no significant worsening of the operational performance of the surrounding road network as a result of the proposed development.

It is noted that several existing safety issues have been identified in the existing road network, however, no worsening of the existing issues are expected as a result of the proposed development.

In conclusion, the proposed development accesses have been found to be adequate and no significant adverse impact on the operational performance or safety of the surrounding road network has been identified. No mitigation measures have been deemed necessary.

## **APPENDIX A**

**DEVELOPMENT PLANS** 

LANGTREE CONSULTING




# **APPENDIX B**

TRAFFIC DATA

LANGTREE CONSULTING

### Traffic Data provided by Rockhampton Regional Council

Street	Link Start	Link End	Location Description	Start Date	End Date	AADT	North Bound AADT	South Bound AADT	% of Heavy Vehicles	AM Peak 8-9am	PM Peak 3-4pm
Musgrave St	Painswick St	Lakes Creek Rd	Opp 40 Musgrave St	6/11/2015	20/11/2015	1504.0	406.0	1182.0	2.9	127.4	160.2
Goodsall St	Lakes Creek Rd	Reaney St	15m South of Rail Crossing	15/05/2020	29/05/2020	1883	905	1000	14.36	193.6	190.1







### Traffic Analysis and Reporting System Report Notes for AADT Segment Report



### 24-Jun-2021 15:18

### **AADT Segment Annual Volume Report**

Provides summary data for the selected AADT Segment of a Road Section. Summary data is presented as both directional information and a combined bi-directional figure. The data is then broken down by Traffic Class, when available. The report also includes maps displaying the location of both the AADT Segment and the traffic count site.

### Annual Average Daily Traffic (AADT)

Annual Average Daily Traffic (AADT) is the number of vehicles passing a point on a road in a 24 hour period, averaged over a calendar year.

### **AADT Segments**

The State declared road network is broken into Road Sections and then further broken down into AADT Segments. An AADT Segment is a sub-section of the declared road network where traffic volume is similar along the entire AADT Segment.

### Area

For administration purposes the Department of Transport and Main Roads has divided Queensland into 12 Districts. The Area field in TSDM reports displays the District Name and Number.

District Name District	
Central West District	401
Darling Downs District	401
Far North District	402
Fitzrov District	404
Mackay/Whitsunday District	405
Metropolitian District	406
North Coast District	407
North West District	409
Northern District	408
South Coast District	410
South West District	411
Wide Bay/Burnett District	412

### **AADT Values**

AADT values are displayed by direction of travel as:

- G Traffic flow in gazettal direction
- Traffic flow against gazettal direction Traffic flow in both directions
- В

### **Data Collection Year**

Is the most recent year that data was collected at the data collection site.

### **Please Note:**

- Due to location and/or departmental policy, some sites are not counted every year.

### **Gazettal Direction**

Is the direction of the traffic flow. It can be easily recognised by referring to the name of the road eg. Road Section: 10A Brisbane -Gympie denotes that the gazettal direction is from Brisbane to Gympie.

### Maps

Display the selected location from a range of viewing levels, the start and end position details for the AADT Segment and the location of the traffic count site.

### **Road Section**

Is the Gazetted road from which the traffic data is collected. Each Road Section is given a code, allocated sequentially in Gazettal Direction. Larger roads are broken down into sections and identified by an ID code with a suffix for easier data collection and reporting (eg. 10A, 10B, 10C). Road Sections are then broken into AADT Segments which are determined by traffic volume.

### Segment Site

Is the unique identifier for the traffic count site representing the traffic flow within the AADT Segment.

### Site

The physical location of a traffic counting device. Sites are located at a specified Through Distance along a Road Section.

### Site Description

The description of the physical location of the traffic counting device.

### Start and End Point

The unique identifier for the Through Distance along a Road Section.

#### Vehicle Class

Traffic is categorised as per the Austroads Vehicle Classification scheme. Traffic classes are in the following hierarchical format:

### **Volume or All Vehicles**

00 = 0A + 0B

- **Light Vehicles**
- $0A^{-} = 1A$  $1A^{-} = 2A + 2B$

### **Heavy Vehicles**

- $\begin{array}{l} 0B &= 1B + 1C + 1D \\ 1B &= 2C + 2D + 2E \\ 1C &= 2F + 2G + 2H + 2I \\ \end{array}$
- = 2J + 2K + 2L 1D

The following classes are the categories

- for which data can be captured:
  - Volume

00 All vehicles

#### 2-Bin nΔ

- Light vehicles Heavy vehicles 0B
- 4-Bin

#### 1A

- Short vehicles Truck or bus 1B
- Articulated vehicles 1D Road train
- 12-Bin
- Short 2 axle vehicles
- 2BShort vehicles towing
- 2C 2 axle truck or bus
- 2D 3 axle truck or bus
- 2E 2F 4 axle truck 3 axle articulated vehicle
- 4 axle articulated vehicle 2G
- 5 axle articulated vehicle
- 2H 2H 2I 6 axle articulated vehicle
- B double
- 2K 2L Double road train
- Triple road train

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### Traffic Analysis and Reporting System **Annual Volume Report**

### TARS

Page 2 of 3 (5 of 7)

Area	404 - Fitzroy District	N N	0040
Road Section	194 - ROCKHAMPTON - EMU PARK ROAD	Year	2018
Site	60082 - 200m E of Edward St, Berserker	AADT	16,453
Thru Dist	0.685	Avg Week Day	17,933
Туре	C - Coverage	Avg Weekend Day	13,326
Stream	TB - Bi-directional traffic flow		



Year	AADT	1-Year Growth	5-Year Growth	10-Year Growth	Year	AADT	1-Year Growth	5-Year Growth	10-Year Growth
2018	16,453	7.21%	-0.96%	-0.70%	2003	14,685	-2.41%	1.81%	
2017	15,346	-0.64%	-3.31%	-1.55%	2002	15,048	-0.78%		
2016	15,445	-9.70%	-3.07%	-1.36%	2001	15,167	12.77%		
2015	17,104	-4.36%	-0.61%	0.46%	2000	13,449	4.77%		
2014	17,883	2.87%	0.81%	1.46%	1999	12,837	-7.71%		
2013	17,384	-0.90%	0.02%	1.38%	1998	13,909			
2012	17,541	3.70%	0.97%	1.72%	1997				
2011	16,915	-5.48%	0.32%	1.35%	1996				
2010	17,895	4.36%	3.09%	2.62%	1995				
2009	17,148	-1.37%	2.87%	2.49%	1994				
2008	17,387	7.99%	4.00%	2.90%	1993				
2007	16,100	-2.02%	2.03%		1992				
2006	16,432	10.22%	2.58%		1991				
2005	14,909	1.11%	0.84%		1990				
2004	14,745	0.41%	1.72%		1989				





Days of the Week





	January									
т	W	т	F	s	S					
2	3	4	5	6	7					
9	10	11	12	13	14					
16	17	18	19	20	21					
~~	~ 1	~ -	~~	~ -	~ ~					

...

м 1

	way									
М	Т	W	т	F	s	S				
	1	2	3	4	5	6				
7	8	9	10	11	12	13				
14	15	16	17	18	19	20				
21	22	23	24	25	26	27				
28	29	30	31							

September										
М	т	W	т	F	S	S				
					1	2				
3	4	5	6	7	8	9				
10	11	12	13	14	15	16				
17	18	19	20	21	22	23				
24	25	26	27	28	29	30				

### 2018 Calendar

February										
М	т	W	т	F	S	s				
			1	2	3	4				
5	6	7	8	9	10	11				
12	13	14	15	16	17	18				
19	20	21	22	23	24	25				
26	27	28								

	June									
М	т	W	т	F	s	S				
				1	2	3				
4	5	6	7	8	9	10				
11	12	13	14	15	16	17				
18	19	20	21	22	23	24				
25	26	27	28	29	30					

October											
М	т	W	т	F	S	S					
1	2	3	4	5	6	7					
8	9	10	11	12	13	14					
15	16	17	18	19	20	21					
22	23	24	25	26	27	28					
29	30	31									

March									
М	т	W	т	F	S	S			
			1	2	3	4			
5	6	7	8	9	10	11			
12	13	14	15	16	17	18			
19	20	21	22	23	24	25			
26	27	28	29	30	31				

	July									
М	т	W	т	F	s	S				
30	31					1				
2	3	4	5	6	7	8				
9	10	11	12	13	14	15				
16	17	18	19	20	21	22				
23	24	25	26	27	28	29				

November							
М	т	W	т	F	S	S	
			1	2	3	4	
5	6	7	8	9	10	11	
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	
26	27	28	29	30			

			April			
м 30	Т	W	Т	F	S	s 1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

August								
М	т	W	т	F	s	s		
		1	2	3	4	5		
6	7	8	9	10	11	12		
13	14	15	16	17	18	19		
20	21	22	23	24	25	26		
27	28	29	30	31				

December									
м 31	т	W	т	F	s 1	s 2			
3	4	5	6	7	8	9			
10	11	12	13	14	15	16			
17	18	19	20	21	22	23			
24	25	26	27	28	29	30			

Days on which traffic data was collected.



### Traffic Analysis and Reporting System **Report Notes for Annual Volume Report**



### 24-Jun-2021 15:18

### **Annual Volume Report**

Displays AADT history with hourly, daily and weekly patterns by Stream in addition to annual data for AADT figures with 1 year, 5 year and 10 year growth rates.

### Annual Average Daily Traffic (AADT)

Annual Average Daily Traffic (AADT) is the number of vehicles passing a point on a road in a 24 hour period, averaged over a calendar year.

### AADT History

Displays the years when traffic data was collected at this count site.

### Area

For administration purposes the Department of Transport and Main Roads has divided Queensland into 12 Districts. The Area field in TSDM reports displays the District Name and Number.

District Name District	
Central West District	401
Darling Downs District	402
Far North District	403
Fitzroy District	404
Mackay/Whitsunday District	405
Metropolitian District	406
North Coast District	407
North West District	409
Northern District	408
South Coast District	410
South West District	411
Wide Bay/Burnett District	412

### Avg Week Day

Average daily traffic volume during the week days, Monday to Friday.

### Avg Weekend Day

Average daily traffic volume during the weekend, Saturday and Sunday.

### Calendar

Days on which traffic data was collected are highlighted in green.

### **Gazettal Direction**

The Gazettal Direction is the direction of the traffic flow. It can be easily recognised by referring to the name of the road eg. Road Section: 10A Brisbane - Gympie denotes that the gazettal direction is from Brisbane to Gympie.

- G Traffic flowing in Gazettal Direction
- Traffic flowing against Gazettal Direction The combined traffic flow in both Directions A B

### **Growth Percentage**

Represents the increase or decrease in AADT, using a exponential fit over the previous 1, 5 or 10 year period.

### Hour, Day & Week Averages

The amount of traffic on the road network will vary depending on the time of day, the day of the week and the week of the year. The ebb and flow of traffic travelling through a site over a period of time forms a pattern. The Hour, Day and Week Averages are then used in the calculation of AADT.

### **Road Section**

Is the Gazetted road from which the traffic data is collected. Each Road Section is given a code, allocated sequentially in Gazettal Direction. Larger roads are broken down into sections and identified by an ID code with a suffix for easier data collection and reporting (eg. 10A, 10B, 10C). Road Sections are then broken into AADT Segments which are determined by traffic volume.

### Site

The unique identifier and description of the physical location of a traffic counting device. Sites are located at a Through Distance along a Road Section.

### Stream

The lane in which the traffic is travelling in. This report provides data for the combined flow of traffic in both directions.

### Thru Dist or TDist

The distance from the beginning of the Road Section, in kilometres.

### Туре

There are two types of traffic counting sites, Permanent and Coverage. Permanent means the traffic counting device is in place 24/7. Coverage means the traffic counting device is in place for a specified period of time.

### Year

Is the current year for the report. Where an AADT Year record is missing a traffic count has not been conducted, for that year.

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### WEEKLY VOLUME REPORT



## **APPENDIX C**

BACKGROUND TRIP GENERATION AND DISTRIBUTION

LANGTREE CONSULTING



### **Background Traffic Trip Generation**

Local Roads													Growth	1%	Growth	1%
Rockhampton Regi	on Council												Base Year	2023	Horizon Year	2033
			Location									Count	AM PH Base	PM PH Base		
Street	Link Start	Link End	Description	Start Date	End Date	AADT	North Bound AADT	South Bound AADT	% of Heavy Vehicles	AM Peak 8-9am	PM Peak 3-4pm	Year	Year	Year	AM PH 2033	PM PH 2033
			Opp 40													
Musgrave St	Painswick St	Lakes Creek Rd	Musgrave St	6/11/2015	20/11/2015	1504.0	406.0	1182.0	2.9	127.4	160.2	2015	138	173	150	189
			15m South of													
Goodsall St	Lakes Creek Rd	Reaney St	Rail Crossing	15/05/2020	29/05/2020	1883	905	1000	14.36	193.6	190.1	2020	209	205	228	224

First principles	
------------------	--

Thist principles			
Street	No. Houses	AADT	PH
Evans Street	5	50	4

#### State-Controlled Roads (DTMR)

	Count year	2020		
Bridge Street/ Lakes		Average		
Creet Road	Average	Weekday	AM PH	PM PH
G	7925	8638	767	784
A	8528	9295	826	844
В	16453	17933	1593	1628

Growth

10 Year's Adopt -0.70% (Negative growth) 1.00%

	Base Year	2023	]		Projected	2033		
Bridge Street/ Lakes		Average				Average		
Creet Road	Average	Weekday	AM PH	PM PH	Average	Weekday	AM PH	PM PH
G	8163	8897	790	808	8955	9761	867	886
A	8784	9574	851	869	9637	10503	933	954
В	16947	18471	1641	1677	18592	20264	1800	1840

### First principles (Service Road)

Lakes Creek Road						
Service Road	Units	No. Units	Peak rate/unit	AADT	Daily rate	PH
Dwellings	Dwellings	7	10	70	0.8	6
Commercial						
(Light Industrial)	100m <sup>2</sup>	3.29	3	10	0.9	3
				80		9



### Background AM Peak Hour Trip Distribution (2023)

Bridge Street (W)



Goodsall Street (S)



Evans Street (E)

### Background PM Peak Hour Trip Distribution (2023)



Bridge Street (W)



### Background AM Peak Hour Trip Distribution (2033)

Bridge Street (W)



Goodsall Street (S)



Evans Street (E)

### **Background PM Peak Hour Trip Distribution (2033)**



## **APPENDIX D**

DEVELOPMENT TRIP GENERATION AND DISTRIBUTION

LANGTREE CONSULTING



### **Development Traffic Trip Generation**

### First Principles Check (Adopted)

			Peak H	our Volume
	No. Staff	Patrons (No./hr)	Staff (Trips/hr)	Patrons (Trips/hr)
NDIS	10		10	
Medical Practitioner Offices	4	10	4	20
CSL	2	2	2	4
RTO	1	10	1	20
Sub total			17	44
Total				61

Worst-case assume all arrive and depart during peak hour

### Source: Traffic generation data – 2006–2017 (Queensland) Open Data (Not Adopted)

									Average	Average	Weekday	Weekday	Weekday	Weekend	Weekend	Weekend	Vol /	
Vear	Land use	SITE	Suburb	Local Government	Variable	Variable	Start Date	End Date	Volume	Volume	Peak Hour Start	Peak Hour End	Peak Volume	Peak Hour Start	Peak Hour End	Peak Volume	100m2 GLFA	PH/ 100m2 GLFA
2006	Medical Centre	2006MD1	TARINGA	Brisbane City	GLFA	2188	19/05/2006	16/06/2006	Volume	Volume	15:00:00	16:00:00	63	Start	Liiu	Volume	0	2.88
2006	Medical Centre	2006MD2	INDOOROOPI	Brisbane City	GLFA	1695	19/05/2006	16/06/2006			15:30:00	16:30:00	86				0	5.07
2006	Medical Centre	2006MD3	CAMP HILL	Brisbane City	GLFA	469	19/05/2006	16/06/2006			15:00:00	16:00:00	21				0	4.48
2006	Medical Centre	2006MD4	NEWMARKET	Brisbane City	GLFA	1147	19/05/2006	16/06/2006			16:15:00	17:15:00	52				0	4.53
2006	Medical Centre	2006MD5	ASPLEY	Brisbane City	GLFA	910	19/05/2006	16/06/2006			17:30:00	18:30:00	57				0	6.26
2006	Medical Centre	2006MD6	KEDRON	Brisbane City	GLFA	936	19/05/2006	16/06/2006			16:00:00	17:00:00	50				0	5.34
2007	Medical Centre	2007MD7	ROBINA	Gold Coast City	GLFA	640	23/05/2007	13/06/2007			15:15:00	16:15:00	53				0	8.28
2007	Medical Centre	2007MD8	BEENLEIGH	Logan City	GLFA	840	23/05/2007	13/06/2007			16:15:00	17:15:00	41				0	4.88
2009	Medical Centre	2009MD1	TARINGA	Brisbane City	GLFA	2188	12/05/2009	18/05/2009	1013	790	15:00:00	16:00:00	88	18:15:00	19:15:00	73	46.297989	4.02
2009	Medical Centre	2009MD2	INDOOROOPI	Brisbane City	GLFA	1695	5/05/2009	11/05/2009	814	188	8:45:00	9:45:00	88	9:00:00	10:00:00	30	48.023599	5.19
2009	Medical Centre	2009MD4	NEWMARKET	Brisbane City	GLFA	1147	5/05/2009	11/05/2009	552	92	14:00:00	15:00:00	61	11:00:00	12:00:00	14	48.125545	5.32
2009	Medical Centre	2009MD6	KEDRON	Brisbane City	GLFA	937	5/05/2009	11/05/2009	1005	543	11:15:00	12:15:00	100	9:30:00	10:30:00	70	107.2572	10.67
2011	Medical Centre	2011MD1	MUNDINGBU	Townsville City	GLFA	351	24/05/2011	30/05/2011	155	30	9:30:00	10:30:00	24	11:00:00	12:00:00	8	44.159544	6.84
2011	Medical Centre	2011MD2	CAIRNS NORT	Cairns Regional	GLFA	300	5/05/2011	11/05/2011	86	5	10:30:00	11:30:00	13	14:00:00	15:00:00	2	28.666667	4.33
2011	Medical Centre	2011MD3	PARRAMATTA	Cairns Regional	GLFA	638	5/05/2011	11/05/2011	200	50	14:30:00	15:30:00	24	10:00:00	11:00:00	14	31.347962	3.76
2011	Medical Centre	2011MD4	WOREE	Cairns Regional	GLFA	294	14/05/2011	20/05/2011	203	23	9:15:00	10:15:00	28	9:15:00	10:15:00	8	69.047619	9.52
2011	Medical Centre	2011MD5	BURLEIGH HE	Gold Coast City	GLFA	298	14/06/2011	20/06/2011	141	56	7:45:00	8:45:00	18	9:30:00	10:30:00	11	47.315436	6.04
																A	F2 2400C2	F 73



PROJECT No.: 0760 CALCULATED BY: NP DATE: 24/06/2022 CHECKED BY: BL DATE: 24/06/2022 SHEET: 1 of 3

Average 52.249063 5.73



PROJECT No.: <u>0760</u> CALCULATED BY: <u>NP</u> DATE: <u>24/06/2022</u> CHECKED BY: <u>BL</u> DATE: <u>24/06/2022</u> SHEET: <u>2</u> of <u>3</u>

### Development AM Peak Hour Trip Distribution

Bridge Street (W)



Goodsall Street (S)



PROJECT No.: 0760 CALCULATED BY: NP DATE: 24/06/2022 CHECKED BY: BL DATE: 24/06/2022 SHEET: <u>3</u> of <u>3</u>

### Development PM Peak Hour Trip Distribution



Goodsall Street (S)

Bridge Street (W)

## **APPENDIX E**

POST-DEVELOPMENT TRIP DISTRIBUTION

LANGTREE CONSULTING



Bridge Street (W)

### Background + Development AM Peak Hour Trip Distribution (2023)



Goodsall Street (S)



### Background + Development PM Peak Hour Trip Distribution (2023)



Bridge Street (W)



Bridge Street (W)

### Background + Development AM Peak Hour Trip Distribution (2033)



Goodsall Street (S)



### Background + Development PM Peak Hour Trip Distribution (2033)



Bridge Street (W)

## **APPENDIX F**

SIDRA ANALYSIS

LANGTREE CONSULTING

## 5 Site: 101 [Site 1 - Back AM PH (2023)]

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	Movement Performance - Vehicles Mov OD Demand Flows Deg. Average Level of 95% Back of Queue Prop. Effective Average														
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h				
South:	Goods	all Street													
1	L2	47	14.4	6.603	5174.7	LOS F	76.5	601.3	1.00	1.82	0.7				
2	T1	11	14.4	6.603	5222.6	LOS F	76.5	601.3	1.00	1.82	0.4				
3	R2	47	14.4	6.603	5250.4	LOS F	76.5	601.3	1.00	1.82	0.7				
Approa	ach	105	14.4	6.603	5213.5	LOS F	76.5	601.3	1.00	1.82	0.6				
East: L	_akes C	reek Road													
4	L2	53	9.0	0.047	5.7	LOS A	0.0	0.0	0.00	0.37	54.8				
5	T1	824	9.1	0.234	0.4	LOS A	0.5	4.0	0.06	0.03	59.2				
6	R2	20	9.0	0.234	12.2	LOS B	0.5	4.0	0.13	0.03	53.6				
Approa	ach	897	9.1	0.234	1.0	NA	0.5	4.0	0.06	0.05	58.9				
North:	Musgra	ave Road													
7	L2	48	2.9	4.194	2953.7	LOS F	62.3	447.1	1.00	2.67	0.6				
8	T1	11	2.9	4.194	3002.9	LOS F	62.3	447.1	1.00	2.67	0.6				
9	R2	48	2.9	4.194	3013.1	LOS F	62.3	447.1	1.00	2.67	0.6				
Approa	ach	107	2.9	4.194	2985.3	LOS F	62.3	447.1	1.00	2.67	0.6				
West:	Bridge	Street													
10	L2	20	5.2	0.201	5.6	LOS A	0.0	0.0	0.00	0.03	30.3				
11	T1	736	5.2	0.201	0.0	LOS A	0.0	0.0	0.00	0.02	59.8				
12	R2	53	5.2	0.183	16.7	LOS C	0.6	4.3	0.75	0.90	45.7				
Approa	ach	808	5.2	0.201	1.2	NA	0.6	4.3	0.05	0.07	57.9				
All Veh	nicles	1918	7.4	6.603	454.2	NA	76.5	601.3	0.16	0.30	6.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## 1223) www.site: 101 [Site 1 - Back+Dev AM PH (2023)]

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	Movement Performance - Vehicles Mov OD Demand Flows Deg. Average Level of 95% Back of Queue Prop. Effective Average														
Mov	OD Mov	Demand	I Flows	Deg.	Average	Level of	95% Back	of Queue	Prop.	Effective Stop Boto	Average				
	IVIOV	veh/h	пv %	V/C	Sec	Service	venicies veh	m	Queueu	per veh	km/h				
South	: Goods	all Street													
1	L2	47	14.4	7.238	5754.2	LOS F	78.3	615.4	1.00	1.79	0.6				
2	T1	11	14.4	7.238	5799.7	LOS F	78.3	615.4	1.00	1.79	0.3				
3	R2	47	14.4	7.238	5826.6	LOS F	78.3	615.4	1.00	1.79	0.6				
Appro	ach	105	14.4	7.238	5791.3	LOS F	78.3	615.4	1.00	1.79	0.6				
East:	Lakes C	reek Road													
4	L2	53	9.0	0.049	5.7	LOS A	0.0	0.0	0.00	0.36	55.0				
5	T1	824	9.1	0.243	0.6	LOS A	0.8	6.1	0.08	0.04	58.9				
6	R2	31	9.0	0.243	12.4	LOS B	0.8	6.1	0.20	0.06	52.5				
Appro	ach	907	9.0	0.243	1.3	NA	0.8	6.1	0.08	0.06	58.5				
North:	Musgra	ive Road													
7	L2	48	2.9	5.389	4027.7	LOS F	73.9	530.5	1.00	2.50	0.5				
8	T1	11	2.9	5.389	4068.6	LOS F	73.9	530.5	1.00	2.50	0.5				
9	R2	59	2.9	5.389	4077.2	LOS F	73.9	530.5	1.00	2.50	0.5				
Appro	ach	118	2.9	5.389	4056.1	LOS F	73.9	530.5	1.00	2.50	0.5				
West:	Bridge \$	Street													
10	L2	20	5.2	0.203	5.6	LOS A	0.0	0.0	0.00	0.03	30.3				
11	T1	746	5.2	0.203	0.0	LOS A	0.0	0.0	0.00	0.02	59.8				
12	R2	53	5.2	0.184	16.8	LOS C	0.6	4.4	0.75	0.90	45.7				
Appro	ach	819	5.2	0.203	1.2	NA	0.6	4.4	0.05	0.07	57.9				
All Vel	hicles	1949	7.4	7.238	559.1	NA	78.3	615.4	0.17	0.31	5.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## 9 Site: 101 [Site 1 - Back PM PH (2023)]

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	Movement Performance - Vehicles Mov OD Demand Flows Deg. Average Level of 95% Back of Queue Prop. Effective Average														
Mov	OD	Demand	Flows	Deg.	Average	Level of	95% Back	of Queue	Prop.	Effective	Average				
ID	Mov	lotal veh/h	HV %	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed km/h				
South	: Goods	all Street	/0	V/C	300		VCII			per ven	N111/11				
1	L2	46	14.4	8.921	7290.4	LOS F	81.9	643.7	1.00	1.67	0.5				
2	T1	11	14.4	8.921	7337.8	LOS F	81.9	643.7	1.00	1.67	0.3				
3	R2	46	14.4	8.921	7358.1	LOS F	81.9	643.7	1.00	1.67	0.5				
Appro	ach	103	14.4	8.921	7325.6	LOS F	81.9	643.7	1.00	1.67	0.5				
East:	Lakes C	reek Road													
4	L2	52	9.0	0.049	5.7	LOS A	0.0	0.0	0.00	0.35	55.0				
5	T1	839	9.1	0.244	0.7	LOS A	0.8	6.2	0.08	0.03	58.9				
6	R2	24	9.0	0.244	14.2	LOS B	0.8	6.2	0.19	0.04	52.4				
Appro	ach	915	9.0	0.244	1.3	NA	0.8	6.2	0.08	0.05	58.5				
North:	Musgra	ave Road													
7	L2	60	2.9	7.834	6238.9	LOS F	92.3	662.0	1.00	2.27	0.3				
8	T1	14	2.9	7.834	6275.8	LOS F	92.3	662.0	1.00	2.27	0.3				
9	R2	60	2.9	7.834	6284.5	LOS F	92.3	662.0	1.00	2.27	0.3				
Appro	ach	134	2.9	7.834	6263.1	LOS F	92.3	662.0	1.00	2.27	0.3				
West:	Bridge	Street													
10	L2	24	5.2	0.232	5.6	LOS A	0.0	0.0	0.00	0.03	30.3				
11	T1	851	5.2	0.232	0.0	LOS A	0.0	0.0	0.00	0.02	59.8				
12	R2	52	5.2	0.185	17.2	LOS C	0.6	4.4	0.76	0.91	45.5				
Appro	ach	926	5.2	0.232	1.1	NA	0.6	4.4	0.04	0.07	58.0				
All Ve	hicles	2078	7.2	8.921	767.7	NA	92.3	662.0	0.17	0.28	4.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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### 1233 [Site: 101 [Site 1 - Back+Dev PM PH (2023)]

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	Movement Performance - Vehicles Mov OD Demand Flows Deg. Average Level of 95% Back of Queue Prop. Effective Average														
Mov	OD	Demand	Flows	Deg.	Average	Level of	95% Back	of Queue	Prop.	Effective	Average				
<u></u> כו	Nov	Iotai veh/h	HV %	Sath v/c	Delay sec	Service	venicies veh	Distance	Queued	ber veh	Speed km/h				
South	Goods	all Street													
1	L2	46	14.4	9.027	7384.5	LOS F	81.7	642.1	1.00	1.69	0.5				
2	T1	11	14.4	9.027	7434.6	LOS F	81.7	642.1	1.00	1.69	0.3				
3	R2	46	14.4	9.027	7449.9	LOS F	81.7	642.1	1.00	1.69	0.5				
Appro	ach	103	14.4	9.027	7419.0	LOS F	81.7	642.1	1.00	1.69	0.5				
East:	_akes C	reek Road													
4	L2	52	9.0	0.051	5.7	LOS A	0.0	0.0	0.00	0.33	55.2				
5	T1	839	9.1	0.255	0.9	LOS A	1.2	8.8	0.11	0.04	58.5				
6	R2	35	9.1	0.255	14.4	LOS B	1.2	8.8	0.27	0.07	50.9				
Appro	ach	925	9.1	0.255	1.7	NA	1.2	8.8	0.11	0.06	58.1				
North:	Musgra	ive Road													
7	L2	65	2.9	9.172	7444.6	LOS F	102.7	737.0	1.00	2.21	0.3				
8	T1	14	2.9	9.172	7478.6	LOS F	102.7	737.0	1.00	2.21	0.3				
9	R2	65	2.9	9.172	7486.8	LOS F	102.7	737.0	1.00	2.21	0.3				
Appro	ach	144	2.9	9.172	7466.9	LOS F	102.7	737.0	1.00	2.21	0.3				
West:	Bridge \$	Street													
10	L2	24	5.2	0.235	5.6	LOS A	0.0	0.0	0.00	0.03	30.3				
11	T1	861	5.2	0.235	0.0	LOS A	0.0	0.0	0.00	0.02	59.8				
12	R2	52	5.2	0.186	17.3	LOS C	0.6	4.4	0.76	0.91	45.4				
Appro	ach	937	5.2	0.235	1.1	NA	0.6	4.4	0.04	0.07	58.0				
All Vel	nicles	2109	7.2	9.172	874.5	NA	102.7	737.0	0.18	0.29	3.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## ▽ Site: 102 [Site 2 - Back AM PH (2023)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	OD Mov	Demand F Total	Flows HV	Deg. Satn	Average Delay	Level of Service	95% Back Vehicles	of Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed			
South:	Musgrave	Street	70	v/C	300		VCII				KI1/11			
2	T1	39	2.9	0.021	0.0	LOS A	0.0	0.0	0.01	0.02	58.1			
3	R2	1	0.0	0.021	3.8	LOS A	0.0	0.0	0.01	0.02	41.4			
Approa	ich	40	2.8	0.021	0.1	NA	0.0	0.0	0.01	0.02	57.3			
East: E	vans Stree	et												
4	L2	2	0.0	0.003	3.4	LOS A	0.0	0.1	0.20	0.45	25.5			
6	R2	2	0.0	0.003	3.7	LOS A	0.0	0.1	0.20	0.45	22.0			
Approa	ich	4	0.0	0.003	3.6	LOS A	0.0	0.1	0.20	0.45	23.9			
North:	Musgrave	Street												
7	L2	1	0.0	0.056	2.4	LOS A	0.0	0.0	0.00	0.01	26.2			
8	T1	106	2.9	0.056	0.0	LOS A	0.0	0.0	0.00	0.01	59.6			
Approa	ich	107	2.9	0.056	0.0	NA	0.0	0.0	0.00	0.01	58.9			
All Veh	icles	152	2.8	0.056	0.1	NA	0.0	0.1	0.01	0.02	55.8			

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## ▽ Site: 102 [Site 2 - Back+Dev AM PH (2023)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	OD Mov	Demand F Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay se <u>c</u>	Level of Service	95% Back Vehicles veh	of Queue Distance <u>m</u>	Prop. Queued	Effective Stop Rate per v <u>eh</u>	Average Speed km/ <u>h</u>			
South:	Musgrave	e Street												
2	T1	39	2.9	0.027	0.1	LOS A	0.1	0.4	0.10	0.12	47.8			
3	R2	11	0.0	0.027	3.9	LOS A	0.1	0.4	0.10	0.12	37.3			
Approa	ich	49	2.3	0.027	0.9	NA	0.1	0.4	0.10	0.12	44.3			
East: E	vans Stre	eet												
4	L2	13	0.0	0.020	3.5	LOS A	0.1	0.5	0.20	0.46	25.4			
6	R2	13	0.0	0.020	3.8	LOS A	0.1	0.5	0.20	0.46	21.9			
Approa	ich	25	0.0	0.020	3.6	LOS A	0.1	0.5	0.20	0.46	23.9			
North:	Musgrave	e Street												
7	L2	11	0.0	0.061	2.4	LOS A	0.0	0.0	0.00	0.05	25.7			
8	T1	106	2.9	0.061	0.0	LOS A	0.0	0.0	0.00	0.05	56.9			
Approa	ich	117	2.6	0.061	0.2	NA	0.0	0.0	0.00	0.05	51.6			
All Veh	icles	192	2.2	0.061	0.8	NA	0.1	0.5	0.05	0.12	42.2			

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## ▽ Site: 102 [Site 2 - Back PM PH (2023)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Movement Performance - Vehicles														
Mov ID	OD Mov	Demand F Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h			
South:	Musgrave	e Street												
2	T1	49	2.9	0.027	0.0	LOS A	0.0	0.1	0.02	0.02	57.1			
3	R2	2	0.0	0.027	3.9	LOS A	0.0	0.1	0.02	0.02	41.0			
Approa	ich	52	2.8	0.027	0.2	NA	0.0	0.1	0.02	0.02	55.8			
East: E	vans Stre	eet												
4	L2	1	0.0	0.002	3.5	LOS A	0.0	0.0	0.23	0.44	25.3			
6	R2	1	0.0	0.002	3.9	LOS A	0.0	0.0	0.23	0.44	21.8			
Approa	ich	2	0.0	0.002	3.7	LOS A	0.0	0.0	0.23	0.44	23.7			
North:	Musgrave	e Street												
7	L2	2	0.0	0.070	2.4	LOS A	0.0	0.0	0.00	0.01	26.2			
8	T1	133	2.9	0.070	0.0	LOS A	0.0	0.0	0.00	0.01	59.4			
Approa	ich	135	2.9	0.070	0.0	NA	0.0	0.0	0.00	0.01	58.3			
All Veh	icles	188	2.8	0.070	0.1	NA	0.0	0.1	0.01	0.02	56.5			

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## ▽ Site: 102 [Site 2 - Back+Dev PM PH (2023)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand F Total veh/h	lows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h		
South:	Musgrav	ve Street											
2	T1	49	2.9	0.034	0.1	LOS A	0.1	0.6	0.11	0.11	47.8		
3	R2	13	0.0	0.034	4.0	LOS A	0.1	0.6	0.11	0.11	37.3		
Approa	ach	62	2.3	0.034	0.9	NA	0.1	0.6	0.11	0.11	44.5		
East: E	vans Str	eet											
4	L2	11	0.0	0.017	3.5	LOS A	0.1	0.4	0.23	0.47	25.2		
6	R2	11	0.0	0.017	4.0	LOS A	0.1	0.4	0.23	0.47	21.7		
Approa	ach	21	0.0	0.017	3.8	LOS A	0.1	0.4	0.23	0.47	23.7		
North:	Musgrav	e Street											
7	L2	13	0.0	0.075	2.4	LOS A	0.0	0.0	0.00	0.05	25.7		
8	T1	133	2.9	0.075	0.0	LOS A	0.0	0.0	0.00	0.05	57.0		
Approa	ach	145	2.6	0.075	0.2	NA	0.0	0.0	0.00	0.05	51.8		
All Veh	icles	228	2.3	0.075	0.7	NA	0.1	0.6	0.05	0.10	44.1		

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## 12033) www.site: 101 [Site 1 - Back AM PH

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	Movement Performance - Vehicles Mov OD Demand Flows Deg. Average Level of 95% Back of Queue Prop. Effective Average UD Mov. Total HV. Sata Delay Service Vehicles Distance Queued Stop Pate Speed														
Mov	OD Mov	Demand Total	Flows	Deg.	Average	Level of	95% Back	of Queue	Prop.	Effective Stop Boto	Average				
	IVIOV	veh/h	%	V/C	Sec	Service	venicies	m	Queueu	per veh	km/h				
South	Goods	all Street													
1	L2	52	14.4	10.113	8355.5	LOS F	92.3	725.9	1.00	1.67	0.4				
2	T1	12	14.4	10.113	8403.4	LOS F	92.3	725.9	1.00	1.67	0.2				
3	R2	52	14.4	10.113	8414.9	LOS F	92.3	725.9	1.00	1.67	0.4				
Appro	ach	115	14.4	10.113	8387.1	LOS F	92.3	725.9	1.00	1.67	0.4				
East:	Lakes C	reek Road													
4	L2	57	9.1	0.051	5.7	LOS A	0.0	0.0	0.00	0.36	54.9				
5	T1	904	9.1	0.257	0.5	LOS A	0.7	5.2	0.06	0.03	59.1				
6	R2	21	9.1	0.257	13.7	LOS B	0.7	5.2	0.14	0.03	53.2				
Appro	ach	982	9.1	0.257	1.1	NA	0.7	5.2	0.06	0.05	58.8				
North:	Musgra	ive Road													
7	L2	53	2.9	7.758	6185.9	LOS F	82.6	592.7	1.00	2.15	0.3				
8	T1	12	2.9	7.758	6228.1	LOS F	82.6	592.7	1.00	2.15	0.3				
9	R2	53	2.9	7.758	6237.7	LOS F	82.6	592.7	1.00	2.15	0.3				
Appro	ach	117	2.9	7.758	6213.4	LOS F	82.6	592.7	1.00	2.15	0.3				
West:	Bridge S	Street													
10	L2	21	5.2	0.220	5.6	LOS A	0.0	0.0	0.00	0.03	30.3				
11	T1	808	5.2	0.220	0.0	LOS A	0.0	0.0	0.00	0.01	59.8				
12	R2	57	5.2	0.231	19.8	LOS C	0.8	5.6	0.80	0.94	44.0				
Appro	ach	886	5.2	0.231	1.4	NA	0.8	5.6	0.05	0.07	57.7				
All Vel	hicles	2100	7.4	10.113	805.1	NA	92.3	725.9	0.16	0.26	3.9				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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## 1233) www.site: 101 [Site 1 - Back+Dev AM PH (2033)]

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	Movement Performance - Vehicles Mov OD Demand Flows Deg. Average Level of 95% Back of Queue Prop. Effective Average														
Mov	OD	Demand	Flows	Deg.	Average	Level of	95% Back	of Queue	Prop.	Effective	Average				
ID	Mov	Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Speed				
South	: Goods	all Street	70	V/C	Sec	_	ven	111	_	per ven	K111/11				
1	L2	52	14.4	10.240	8468.5	LOS F	91.8	721.5	1.00	1.71	0.4				
2	T1	12	14.4	10.240	8518.2	LOS F	91.8	721.5	1.00	1.71	0.2				
3	R2	52	14.4	10.240	8525.1	LOS F	91.8	721.5	1.00	1.71	0.4				
Appro	ach	115	14.4	10.240	8499.0	LOS F	91.8	721.5	1.00	1.71	0.4				
East:	Lakes C	reek Road													
4	L2	53	9.1	0.053	5.7	LOS A	0.0	0.0	0.00	0.32	55.2				
5	T1	904	9.0	0.266	0.7	LOS A	1.0	7.7	0.09	0.04	58.8				
6	R2	32	9.1	0.266	13.8	LOS B	1.0	7.7	0.22	0.05	51.9				
Appro	ach	988	9.1	0.266	1.4	NA	1.0	7.7	0.09	0.05	58.4				
North	Musgra	ive Road													
7	L2	53	2.9	9.996	8202.5	LOS F	95.7	686.2	1.00	1.99	0.2				
8	T1	12	2.9	9.996	8237.7	LOS F	95.7	686.2	1.00	1.99	0.2				
9	R2	63	2.9	9.996	8246.3	LOS F	95.7	686.2	1.00	1.99	0.2				
Appro	ach	127	2.9	9.996	8227.4	LOS F	95.7	686.2	1.00	1.99	0.2				
West:	Bridge \$	Street													
10	L2	21	5.2	0.223	5.6	LOS A	0.0	0.0	0.00	0.03	30.3				
11	T1	819	5.2	0.223	0.0	LOS A	0.0	0.0	0.00	0.01	59.8				
12	R2	57	5.2	0.230	19.8	LOS C	0.8	5.6	0.80	0.94	44.0				
Appro	ach	897	5.2	0.230	1.4	NA	0.8	5.6	0.05	0.07	57.8				
All Ve	hicles	2127	7.3	10.240	952.2	NA	95.7	721.5	0.18	0.27	3.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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### 9 Site: 101 [Site 1 - Back PM PH (2033)]

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	ment F	Performance	- Vehio	cles							
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South:	Goods	all Street									
1	L2	51	14.4	10.393	8603.1	LOS F	90.5	711.3	1.00	1.69	0.4
2	T1	12	14.4	10.393	8660.9	LOS F	90.5	711.3	1.00	1.69	0.2
3	R2	51	14.4	10.393	8657.5	LOS F	90.5	711.3	1.00	1.69	0.4
Appro	ach	113	14.4	10.393	8633.5	LOS F	90.5	711.3	1.00	1.69	0.4
East: I	_akes C	reek Road									
4	L2	57	9.1	0.055	5.7	LOS A	0.0	0.0	0.00	0.34	55.1
5	T1	920	9.1	0.273	0.9	LOS A	1.2	8.8	0.09	0.03	58.6
6	R2	27	9.0	0.273	16.3	LOS C	1.2	8.8	0.23	0.05	51.3
Appro	ach	1004	9.0	0.273	1.6	NA	1.2	8.8	0.09	0.05	58.3
North:	Musgra	ave Road									
7	L2	65	2.9	13.279	11163.6	LOS F	114.9	824.1	1.00	1.88	0.2
8	T1	15	2.9	13.279	11201.4	LOS F	114.9	824.1	1.00	1.88	0.2
9	R2	65	2.9	13.279	11202.4	LOS F	114.9	824.1	1.00	1.88	0.2
Appro	ach	145	2.9	13.279	11184.9	LOS F	114.9	824.1	1.00	1.88	0.2
West:	Bridge \$	Street									
10	L2	27	5.2	0.255	5.6	LOS A	0.0	0.0	0.00	0.03	30.3
11	T1	933	5.2	0.255	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
12	R2	57	5.2	0.239	20.6	LOS C	0.8	5.8	0.81	0.94	43.6
Approa	ach	1017	5.2	0.255	1.3	NA	0.8	5.8	0.05	0.07	57.7
All Vel	nicles	2279	7.2	13.279	1140.9	NA	114.9	824.1	0.17	0.26	2.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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### 1233) www.site: 101 [Site 1 - Back+Dev PM PH (2033)]

Bridge Street / Musgrave Road / Lakes Creek Road / Goodsall Street Stop (Two-Way)

Move	ment P	Performance	e - Vehio	cles							
Mov	OD	Demand	Flows	Deg.	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
<u> </u> עו	Mov	lotal veh/h	HV %	Sath v/c	Delay	Service	Venicles	Distance	Queued	Stop Rate	Speed km/h
South	: Goods	all Street	,0				Von				N11/11
1	L2	51	14.4	10.393	8600.5	LOS F	89.9	707.0	1.00	1.72	0.4
2	T1	12	14.4	10.393	8657.0	LOS F	89.9	707.0	1.00	1.72	0.2
3	R2	51	14.4	10.393	8653.7	LOS F	89.9	707.0	1.00	1.72	0.4
Appro	ach	113	14.4	10.393	8630.2	LOS F	89.9	707.0	1.00	1.72	0.4
East:	Lakes C	reek Road									
4	L2	57	9.1	0.057	5.7	LOS A	0.0	0.0	0.00	0.33	55.2
5	T1	920	9.1	0.286	1.3	LOS A	1.6	12.1	0.12	0.04	58.2
6	R2	38	9.1	0.286	16.6	LOS C	1.6	12.1	0.32	0.07	49.5
Appro	ach	1015	9.1	0.286	2.1	NA	1.6	12.1	0.12	0.06	57.8
North:	Musgra	ive Road									
7	L2	71	2.9	14.315	12091.5	LOS F	123.6	887.0	1.00	1.89	0.2
8	T1	15	2.9	14.315	12128.6	LOS F	123.6	887.0	1.00	1.89	0.2
9	R2	71	2.9	14.315	12127.2	LOS F	123.6	887.0	1.00	1.89	0.2
Appro	ach	156	2.9	14.315	12111.2	LOS F	123.6	887.0	1.00	1.89	0.2
West:	Bridge S	Street									
10	L2	34	5.2	0.259	5.6	LOS A	0.0	0.0	0.00	0.04	30.2
11	T1	943	5.2	0.259	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
12	R2	57	5.2	0.242	20.8	LOS C	0.8	5.9	0.81	0.94	43.5
Appro	ach	1034	5.2	0.259	1.4	NA	0.8	5.9	0.04	0.07	57.5
All Vel	hicles	2317	7.2	14.315	1235.4	NA	123.6	887.0	0.19	0.27	2.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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# ▽ Site: 102 [Site 2 - Back AM PH (2033)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Move	Movement Performance - Vehicles										
Mov ID	OD Mov	Demand F Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South:	Musgrave	e Street									
2	T1	42	2.9	0.022	0.0	LOS A	0.0	0.0	0.01	0.01	58.2
3	R2	1	0.0	0.022	3.9	LOS A	0.0	0.0	0.01	0.01	41.4
Approa	ach	43	2.8	0.022	0.1	NA	0.0	0.0	0.01	0.01	57.4
East: E	Evans Stre	et									
4	L2	2	0.0	0.003	3.5	LOS A	0.0	0.1	0.21	0.45	25.4
6	R2	2	0.0	0.003	3.8	LOS A	0.0	0.1	0.21	0.45	21.9
Approa	ach	4	0.0	0.003	3.6	LOS A	0.0	0.1	0.21	0.45	23.9
North:	Musgrave	Street									
7	L2	1	0.0	0.060	2.4	LOS A	0.0	0.0	0.00	0.00	26.2
8	T1	116	2.9	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	59.7
Approa	ach	117	2.9	0.060	0.0	NA	0.0	0.0	0.00	0.00	59.0
All Veh	icles	164	2.8	0.060	0.1	NA	0.0	0.1	0.01	0.02	56.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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# ▽ Site: 102 [Site 2 - Back+Dev AM PH (2033)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Mover	Novement Performance - Vehicles										
Mov	OD	Demand F	lows	Deg.	Average	Level of	95% Back	of Queue	Prop.	Effective	Average
שר		veh/h	-⊓v %	v/c	sec	Service	venicies veh	m	Queued	per veh	speed km/h
South:	Musgrave	e Street									
2	T1	42	2.9	0.028	0.1	LOS A	0.1	0.5	0.10	0.11	48.2
3	R2	11	0.0	0.028	3.9	LOS A	0.1	0.5	0.10	0.11	37.5
Approa	ich	53	2.3	0.028	0.9	NA	0.1	0.5	0.10	0.11	44.9
East: E	vans Stre	eet									
4	L2	13	0.0	0.020	3.5	LOS A	0.1	0.5	0.21	0.46	25.4
6	R2	13	0.0	0.020	3.9	LOS A	0.1	0.5	0.21	0.46	21.9
Approa	ich	25	0.0	0.020	3.7	LOS A	0.1	0.5	0.21	0.46	23.8
North:	Musgrave	e Street									
7	L2	11	0.0	0.065	2.4	LOS A	0.0	0.0	0.00	0.05	25.8
8	T1	116	2.9	0.065	0.0	LOS A	0.0	0.0	0.00	0.05	57.1
Approa	ich	126	2.7	0.065	0.2	NA	0.0	0.0	0.00	0.05	52.1
All Veh	icles	204	2.2	0.065	0.8	NA	0.1	0.5	0.05	0.11	42.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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# ▽ Site: 102 [Site 2 - Back PM PH (2033)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Move	Novement Performance - Vehicles										
Mov ID	OD Mov	Demand F Total veh/h	lows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Average Speed km/h
South:	Musgrav	e Street					Von				N110/11
2	T1	54	2.9	0.029	0.0	LOS A	0.0	0.1	0.02	0.02	57.2
3	R2	2	0.0	0.029	4.0	LOS A	0.0	0.1	0.02	0.02	41.0
Approa	ich	56	2.8	0.029	0.2	NA	0.0	0.1	0.02	0.02	56.1
East: E	vans Stre	eet									
4	L2	1	0.0	0.002	3.6	LOS A	0.0	0.0	0.24	0.45	25.2
6	R2	1	0.0	0.002	3.9	LOS A	0.0	0.0	0.24	0.45	21.7
Approa	ich	2	0.0	0.002	3.7	LOS A	0.0	0.0	0.24	0.45	23.7
North:	Musgrave	e Street									
7	L2	2	0.0	0.076	2.4	LOS A	0.0	0.0	0.00	0.01	26.2
8	T1	145	2.9	0.076	0.0	LOS A	0.0	0.0	0.00	0.01	59.5
Approa	ich	147	2.9	0.076	0.0	NA	0.0	0.0	0.00	0.01	58.5
All Veh	icles	205	2.8	0.076	0.1	NA	0.0	0.1	0.01	0.02	56.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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# ▽ Site: 102 [Site 2 - Back+Dev PM PH (2033)]

Musgrave Street / Evans Street Giveway / Yield (Two-Way)

Move	nent Pe	rformance -	Vehic	les							
Mov ID	OD Mov	Demand F Total veh/h	lows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South:	Musgrave	e Street									
2	T1	54	2.9	0.036	0.1	LOS A	0.1	0.6	0.11	0.11	48.3
3	R2	13	0.0	0.036	4.0	LOS A	0.1	0.6	0.11	0.11	37.5
Approa	ich	66	2.3	0.036	0.9	NA	0.1	0.6	0.11	0.11	45.1
East: E	vans Stre	eet									
4	L2	11	0.0	0.017	3.6	LOS A	0.1	0.4	0.24	0.47	25.2
6	R2	11	0.0	0.017	4.0	LOS A	0.1	0.4	0.24	0.47	21.6
Approa	ich	21	0.0	0.017	3.8	LOS A	0.1	0.4	0.24	0.47	23.6
North:	Musgrave	e Street									
7	L2	13	0.0	0.082	2.4	LOS A	0.0	0.0	0.00	0.04	25.8
8	T1	145	2.9	0.082	0.0	LOS A	0.0	0.0	0.00	0.04	57.2
Approa	ich	158	2.7	0.082	0.2	NA	0.0	0.0	0.00	0.04	52.4
All Veh	icles	245	2.4	0.082	0.7	NA	0.1	0.6	0.05	0.10	44.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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: 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 is used. Control Delay includes Geometric Delay.

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

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

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# **APPENDIX G**

TURN WARRANT ASSESSMENT

LANGTREE CONSULTING



			Q <sub>T2</sub> Q <sub>L</sub>
Road Type	Turn Type	Splitter Island	Q <sub>M</sub> (veh/h)
Road Type	Turn Type	Splitter Island	<b>Q</b> <sub>M</sub> (veh/h) = Q <sub>T1</sub> + Q <sub>T2</sub> + Q <sub>L</sub>
Road Type	Turn Type Right	Splitter Island No Yes	$Q_{M} (veh/h) = Q_{T1} + Q_{T2} + Q_{L} = Q_{T1} + Q_{T2}$
<b>Road Type</b> 2 Lane 2 Way	Turn Type Right Left	Splitter Island No Yes Yes/No	$     \begin{array}{l} Q_{M} (veh/h) \\ = Q_{T1} + Q_{T2} + Q_{L} \\ = Q_{T1} + Q_{T2} \\ = Q_{T2} \end{array} $
Road Type 2 Lane 2 Way	Turn Type Right Left	Splitter Island No Yes Yes/No No	$\begin{array}{l} \textbf{Q}_{M} \mbox{ (veh/h)} \\ = Q_{T1} + Q_{T2} + Q_{L} \\ = Q_{T1} + Q_{T2} \\ = Q_{T2} \\ = 50\% \ x \ Q_{T1} + Q_{T2} + Q_{L} \end{array}$
Road Type 2 Lane 2 Way 4 Lane	Turn Type Right Left Right	Splitter Island No Yes Yes/No No Yes	$\begin{array}{l} \textbf{Q}_{M} \ (\textbf{veh/h}) \\ = Q_{T1} + Q_{T2} + Q_{L} \\ = Q_{T1} + Q_{T2} \\ = Q_{T2} \\ = 50\% \ x \ Q_{T1} + Q_{T2} + Q_{L} \\ = 50\% \ x \ Q_{T1} + Q_{T2} \end{array}$

Figure 4A-A 5 - Calculation of the major road traffic volume parameter 'Q<sub>M</sub>'

			Q <sub>R</sub> or Q <sub>L</sub>	Q <sub>M</sub>	Warrant
	AM	Right Turn	29	1,119	CHR (S)
2022		Left Turn	19	355	BAL
2025	PM	Right Turn	33	1,240	BAR
		Left Turn	23	409	BAL



\* - the minimum right-turn treatment for multi-lane roads is a CHR(s)



# Figure 4A-A 5 - Calculation of the major road traffic volume parameter ' $Q_M$ '

			Q <sub>T2</sub> Q <sub>L</sub>
Road Type	Turn Type	Splitter Island	Q <sub>M</sub> (veh/h)
		No	$= Q_{T1} + Q_{T2} + Q_L$
2 Lane	Right	Yes	$= Q_{T1} + Q_{T2}$
2 Way	Left	Yes/No	= QT2
225	202281211	No	= 50% x Q <sub>T1</sub> + Q <sub>T2</sub> + Q <sub>L</sub>
4 Lane	Right	Yes	= 50% x Q <sub>T1</sub> + Q <sub>T2</sub>
2 Way	Left	Yes/No	= 50% x QT2

			$Q_R \text{ or } Q_L$	Q <sub>M</sub>	Warrant
	AM	Right Turn	30	1,228	BAR
2022		Left Turn	20	409	BAL
2033	PM	Right Turn	36	1,359	BAR
		Left Turn	26	448	BAL



\* - the minimum right-turn treatment for multi-lane roads is a CHR(s)



Turn Warrant Assessment - Key Intersection 2 (2023)

		$\langle \rangle$	
Road Type	Turn Type	Splitter Island	Q <sub>M</sub> (veh/h)
01	Dista	No	$= Q_{T1} + Q_{T2} + Q_L$
2 Lane	Right	Yes	$= Q_{T1} + Q_{T2}$
2 way	left	Ves/No	- Om

E				
Figure 4A-A 5 - Cal	culation of the n	najor road traffic	volume parameter 'G	ХM´

			Q <sub>R</sub> or Q <sub>L</sub>	Q <sub>M</sub>	Warrant
	AM	Right Turn	10	148	BAR
2023		Left Turn	10	101	BAL
	DM	Right Turn	12	185	BAR
	FIVI	Left Turn	12	126	BAL





Figure 4A-A 5 - Calculation of the major road traffic volume parameter 'Q<sub>M</sub>'



			Q <sub>R</sub> or Q <sub>L</sub>	Q <sub>M</sub>	Warrant
	444	Right Turn	10	160	BAR
2033		Left Turn	10	110	BAL
	РМ	Right Turn	12	201	BAR
		Left Turn	12	138	BAL





# Selectability Rockhampton Mental Health Hub



# **ENGINEERING SERVICES REPORT**

#### Selectability Ltd.

#### ROCKHAMPTON REGIONAL COUNCIL APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with Development Permit No.: D/106-2022 Dated: 23 November 2022

#### LANGTREE CONSULTING

Project No.:	0760
Reference No.:	R-NP0276
Date:	14/07/2022

# Controlled Copy No.: 1

## **Revisions: B**

# **Revision Record:**

Rev	Review Date	Description	Prepared	Checked	Approved
А	24/06/2022	Issued for Comment	Natalie Pham	Geoffrey Smart	Geoffrey Smart
А	14/07/2022	Issued for Development Application	Natalie Pham	Geoffrey Smart	Geoffrey Smart

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### **APPENDIX A – Development Plans**

**APPENDIX B – Detailed Survey** 

**APPENDIX C – Hydrological Assessment** 

**APPENDIX D – Flood Modelling Report** 

#### **1.0 INTRODUCTION**

Langtree Consulting has been engaged by MAL Engineers on behalf of Selectability Ltd. to undertake this Engineering Services Report. This report has been prepared in support of the Material Change of Use (MCU) application for the development of the Selectability Rockhampton Mental Health Hub located at 2-6 Musgrave Street, Berserker on land described as Lot 2 on RP906612, Lot 1 on RP600727, Lot 2 on RP600727 and Lot 62 on SP156097.

The Rockhampton Mental Health Hub will provide mental health support services, NDIS plan assistance and associated training programs to the Rockhampton region. The proposed development MCU will be defined as "Community Use".

As part of the development the lots will be amalgamated from four (4) lots into one (1) lot.

This report outlines the following processes undertaken to identify suitable engineering solutions for the proposed development:

- Assessment of the external civil infrastructure services and proposed connection points for the development (potable water main, sewer, stormwater, drainage infrastructure);
- Assessment of stormwater related overlays affected by the site including flood hazard overly, storm surge potential overly and coastal hazard overlay; and
- Assessment of stormwater quality and quantity impacts of the development.

#### 2.0 EXISTING CONDTIONS

The proposed development is located approximately 1.5km from the Rockhampton CBD. The development site is located at 2-6 Musgrave Street, Berserker proposed to be located on land described as:

- Lot 2 on RP906612;
- Lot 1 and 2 on RP600727; and
- Lot 62 on SP156097.

Hereon in, the above-described lands shall be referred to as the subject site.

The subject site has a total area of 1,701m<sup>2</sup> and is bound by Musgrave Road and neighbouring residential lots to the west, Evans Street to the north, Lakes Creek Road to the south and neighbouring residential land to the east. The subject site is current vacant with no structures.



Refer below in blue for development site locality.

Figure 1. Site Locality (Source: Google Earth)

#### 2.1 EXISTING SERVICES

From the Rockhampton Regional Council (RRC) Interactive Mapping, services surrounding the are shown in **Figure 2**.



Figure 2. Existing infrastructure services (Source: Rockhampton Regional Council Interactive Mapping)

#### 2.1.1 Existing Water

From **Figure 2**, there is an existing 150 diameter water main adjacent to the western boundary and 100 diameter MPVC water mains adjacent to the southern boundary and northern boundary of the subject site. From detailed survey an existing meter was located on Evans Street adjacent to the north-eastern corner of the subject site. This has been verified with RRC. Fire hydrants are located on Musgrave Street and Lakes Creek Road near the proposed building.

#### 2.1.2 Existing Sewer

As shown in **Figure 2**, the subject site is currently serviced by a 150 diameter Earthenware sewer reticulation main. It is noted that an existing 100 diameter property connection is also located on the subject site.

#### 2.1.3 Existing Stormwater

Existing stormwater drainage pipe systems are located along the western and northern boundary as shown in **Figure 2**. The 1200mm diameter pipe on Musgrave Street is Brick "egg" construction and the 600mm diameter pipe on Evans Street is a reinforced concrete pipe. It is noted that an existing manhole is located in the southwestern corner of the subject site.

#### 3.0 PROPOSED DEVELOPMENT

The proposed development is a mental health service facility. The Selectability Rockhampton Mental Health Hub will provide mental health support services, NDIS plan assistance and associated training programs to the Rockhampton region.

It is proposed that the facility will operate between 8.30am to 4.30pm on weekdays.

The proposed site layout and internal layout is shown in Figure 3 and **Figure 4** respectively and included in **Appendix A**.



Figure 3. Site Plan (Source: GVD Building Designs)



Figure 4. Internal Layout Plan (Source: GVD Building Designs)

The floor area encompassed by the outside perimeter of the building is 558.2m<sup>2</sup>, however, for the purpose of demand/loading calculations the GFA for the building has been assumed to be the outer perimeter of the building minus entry area and hallways. The GFA adopted is 459.6m<sup>2</sup>.

#### 4.0 WATER RETICULATION

#### 4.1 PROPOSED SERVICING STRATEGY

It is proposed that a new 25mm diameter water connection is provided for the 'domestic use' of the proposed development from the 150mm uPVC main on Lakes Creek Road. An assessment of the firefighting requirements of this building proposal is outside the scope of this report but if a fire sprinkler system is required the connection should be taken off the Lake Creek Road 150mm diameter main. The existing meter and connection on Evans Street will be decommissioned. Refer to **Figure 5** and **Figure 6** for locality.

The service connection shall be constructed in accordance with Capricorn Municipal development Guidelines (CMDG) standard drawing CMDG-W-090.



Figure 5. Proposed new water connection and meter locality on existing aerial



Figure 6. Proposed new water connection and meter locality on proposed development layout

No flow and pressure testing has been done on the hydrants near the building site and it is recommended this be don prior to completion of the hydraulics design.

#### 4.1.1 Existing Design Demand

From Annexure D11C, of the CMDG, Water Supply Network Design Guideline, D11, Table D11.32.01 (shown as **Table 1** below), the design demand for residential areas is 3 EP per lot residential lot. The existing demand is thus 12 EP.

Table 1. Design EP's Per Development Type (Source: CMDG)	, Water Supply Network Design Guideline,	. D11, Ta	ible
D11.32.01)			

Planning Areas	Unit	EP per Unit
Residential Areas	Lot	3
Accommodation Building, Multi-unit dwelling, Aged care accommodation, duplex	Dwelling Unit	2.5
Group Housing	Gross hectare	120
Local Commercial (Garden Centre, Shop, Take away food store, Vet)	Gross hectare	75
Educational Institutions	Student	0.2
Hospitals / Nursing homes	Bed	2.5
Public Open Space	Gross hectare	10
Other High Density Commercial (Cinema, Major Shopping Outlet, Nightclub, Service Station)	Gross let-able floor space, 10,000 square meters	500-800
Industrial Areas	Gross hectare	56
Environmental Protection Areas	N/A	Nil
Community/Recreation Uses	Gross hectare	56

#### 4.1.2 Development Demand

The water demand based on Community/Recreation Use development type is 56 EP per Gross hectare. Based on the subject site area (1,701m<sup>2</sup>), the development would thus have a demand of 9.53EP. Alternatively, based on a rate of 1 EP/ 90m2 GFA for shops/offices (Refer to **Figure 7**), the proposed development would have a demand of 5.11 EP. Regardless of which demand assumption is adopted, the proposed demand of the development is less than that of the existing demand. As such, there existing network should be able to accommodate the proposed development and no mitigation measures to the existing network are required as a result of expected demand by the development.

Dev	elopment Type/class	Equivalent Persons / Connection
Sir Lo Lo L	ngle Family Dwelling Lot > 1500m <sup>2</sup> ot 1101m <sup>2</sup> to 1500m <sup>2</sup> ot 901 m <sup>2</sup> to 1100m <sup>2</sup> Lot 401m <sup>2</sup> to 900m <sup>2</sup> Lot < 400m <sup>2</sup>	4.0 3.7 3.4 3.1 2.5
Mult U U U	ti Unit Accommodation Units > 3 Bedrooms Units = 3 Bedrooms Units = 2 Bedrooms Units = 2 Bedrooms Units < 2 Bedrooms	0.4 + 0.6 / Bedroom 2.2 1.6 1.0
Var	Caravan Parks In Site / Camping Site	1.2
	Shops/Offices Per 90 m <sup>2</sup> GFA	1.0

*Figure 7. EP/connection based on Development Type/class (Source: CMDG, Water Supply Network Design Guideline, D11, pg. D11-35)* 

#### 5.0 SEWERAGE RETICULATION

#### 5.1 PROPOSED SERVICING STRATEGY

It is proposed that the existing development will be serviced by the existing maintenance hole (ID: 16626). The MH is serviced by a 150mm diameter Earthenware main. It is understood that the site has been vacant for a long period of time as such it is assumed that the existing 100mm diameter connection has been capped off. This connection will remain capped and unutilised. The condition of the VC pipe downstream of the development has not been assess as part of the report but is assumed to be fully functioning.



Figure 8. Existing sewerage connection to be maintained

#### 5.2 EXISTING DESIGN LOADING

The subject site is currently serviced by a 150mm dia. main. The subject site was previously four (4) individual residential lots. From CMDG, Sewerage System Design Guidelines, D12, Table D12.38.01 for residential detached dwelling the demand is 2.6 EP per lot equating to 10.4 EP for the four (4) lots occupied by the development.

**Table 2.** Typical Loading per Development Type (Source: CMDG, Sewerage System Design Guidelines, D12, Table

 D11.32.01)

	Unit	ET	EP
Accommodation			
Residential - detached dwelling	lot	1	2.6
Residential - Apartment/Unit/duplex			
1 Bedroom	unit	0.5	1.3
2 Bedroom	unit	0.8	2.08
3+ Bedroom	unit	1	2.6
Caravan Park - Van Site	site	0.8	2.08
Caravan Park - Tent Site	site	0.3	0.78
Hostel Accommodation	bed	0.5	1.3
Motel	room	0.6	1.56
Aged Care Accommodation (full service nursing home)	bed	1.1	2.86
Retirement Village			
1 Bedroom	unit	0.6	1.56
2 Bedroom	unit	0.9	2.34
3 Bedroom	unit	1.3	3.38
Education			
Child Care Centre	staff & pupils	0.1	0.26
Education – Primary School	staff & pupils	0.1	0.26
Education – Secondary School	staff & pupils	0.2	0.52
Education – Tertiary Institution	staff & pupils	0.2	0.52
Commercial			
Central Business	ha	21.3	55.38
Commercial Premises	100 sqm GFA	0.8	2.08
Shop	100 sqm GFA	0.9	2.34
Fast Food Services	100 sqm GFA	3.5	9.1
Food Services	100 sqm GFA	2	5.2
Hotel	100 sqm GFA	1.2	3.12
Major Shopping Development	100 sqm GFA	0.7	1.82
Medical Centre	100 sqm GFA	0.7	1.82
Restaurant	100 sqm GFA	1.6	4.16
Service Station	100 sqm GFA	0.8	2.08
Industrial			
Heavy Industry	ha	28.1	73.06
Light Industry	ha	28.1	73.06
Other			
Crematorium	100 sqm GFA	0.8	2.08
Hospital	bed	1.4	3.64
Place of Worship	100 sqm GFA	0.4	1.04
Public Building	100 sqm GFA	0.7	1.82

#### 5.3 DEVELOPMENT LOADING

From the same table above, for Commercial Premises the demand is 2.08EP/ 100m<sup>2</sup> GFA. Based on a GFA of 462.6m<sup>2</sup>, the demand of the proposed development is 9.56 EP.

The existing network infrastructure network should have sufficient capacity to accommodate the demand of the proposed development as the development loading is less than the existing design loading. As such, no mitigation measures are deemed required for the subject site.

### 6.0 STORMWATER

#### 6.1 TOPOGRAPHY

Detailed survey of the subject site indicates that the existing topography falls south to north. Refer to **Figure 9** and **Appendix B** for detailed survey of the existing site.



Figure 9. Detailed Survey (Source: Vision Surveys)

#### 6.2 HYDRAULIC ASSESSMENT

Hydraulic assessment of the site has been undertaken in accordance with the Queensland Urban Drainage Manual (QUDM) 2017. The rational method per the following equation has been adopted:

$$Q_y = (C_y . {}^t I_y . A) / 360$$

Where:  $Q_y = \text{peak flow rate (m3/s) for average recurrence interval (ARI) of "y' years}$   $C_y = \text{coefficient of discharge (dimensionless) for ARI of 'y' years}$  A = area of catchment (Hectares)  ${}^{t}l_y = \text{average rainfall intensity (mm/h) for a design duration of 't' hours and an ARI of}$  ${}^{'}y' years$ 

t = the nominal design storm duration as defined by the time of concentration

The minor and major design rainfall event is 10% AEP (ARI 10) and 1% AEP (ARI100) respectively. A five (5) minute time of concentration,  $t_c$ , for the site has been adopted in accordance with QUDM Standard inlet time assumption.

#### 6.2.1 Pre-Development stormwater

Based on CMDG, Sewerage System Design Guidelines, D12, Table D12.38.01, Fraction Impervious for Development categories, Medium, Low-Medium, and low-density residential areas (infill subdivision excluding roads) is 0.75. Based on this fraction impervious and assumptions in Section 7.2, the predevelopment peak flow rate is 0.079m<sup>3</sup>/s during a 10% AEP (ARI 10) event and 0.149m<sup>3</sup>/s during a 1% AEP (ARI100) event.

#### 6.2.2 Post-Development Stormwater

Based on CMDG, Sewerage System Design Guidelines, D12, Table D12.38.01, Fraction Impervious for Development categories, Industrial uses, and other commercial uses (including in the District centre zone and Neighbourhood centre zone) is 0.9. Based on this fraction impervious and assumptions in Section 7.2, the post-development peak flow rate is 0.084m<sup>3</sup>/s during a 10% AEP (ARI 10) event and 0.151m<sup>3</sup>/s during a 1% AEP (ARI100) event.

Compared to the existing design conditions the proposed development will increase the peak flow rate by 0.005m<sup>3</sup>/s (i.e. 5L/s) during a 10% AEP (ARI 10) and 0.003m<sup>3</sup>/s (i.e. 3L/s) during a 1% AEP (ARI100) event. Whilst there is a small increase in the peak flow rate post-development, the increase is relatively small and insignificant. As such, no mitigations measures are proposed.

For all hydrological assessment scenarios pre- and post-development refer to Appendix C.

#### 6.3 STORMWATER QUALITY

From RRC Table 9.3.6.3.1, Acceptable Outcomes AO3.3, the following is prescribed *"Development provides a stormwater quality treatment system which is designed in accordance with State Planning Policy – Water Quality"*.

From State Planning Policy (SPP), 2017, Assessment benchmarks - Water Quality and Table B, Post construction phase – Stormwater management design objectives, performance outcomes apply only to development applications for a "material change of use for an **urban purpose** that involves premises **2,500m<sup>2</sup> or greater in size**".

The subject site is 1,701m<sup>2</sup> in area and thus, no does not trigger assessment against SPP Water Quality Objectives.

#### 7.0 STORMWATER OVERLAYS

#### 7.1 STORM SURGE POTENTIAL

From the RRC Interactive Mapping the northern portion of the site adjacent to Evans Street is affected by the medium hazard area of the Storm Surge Potential hazard overlay. Refer to **Figure 10** Overlay area. **Figure 10**. Storm Surge Potential Hazard Overlay (Source: RRC Interactive Mapping)



Figure 10. Storm Surge Potential Hazard Overlay (Source: RRC Interactive Mapping)

No buildings are proposed in this area and thus, does not result in increase in density within the hazard area.

A site access to Evans Street and parking is proposed within the storm surge potential area, however, access can still be gained from Lakes Creek Road providing adequate access and route of evacuation if required. The development is located to minimise susceptibility to and potential impacts of flooding through locating the building within the higher area of the subject site.

#### 7.2 COASTAL HAZARD OVERLAY

From RRC Interactive mapping of the Coastal Hazard Overlay, shown in **Figure 11**, the site is not affected by Coastal Hazard Overlay. As such, no migration measures are deemed necessary.



Figure 11. Coastal Hazard Overlay (Source: RRC Interactive Mapping)

#### 7.3 FLOOD HAZARD

From the flood hazard overlay shown in **Figure 12** the site is located within the North Rockhampton Flood Management Area (NRFMA).



Figure 12. Flood hazard overlay (Source: Rockhampton Regional Council Interactive Mapping)

RRC have undertaken mitigation measures to provide the NRFMA protection from Fitzroy River flooding up to and including the 1% Annual Exceedance Probability (AEP) event (9.54m on the Rockhampton Flood Gauge) which substantially reduces the risk of flooding to the protected area.

To reflect the reduced flood risk associated with the NRFMA Stage 1 works, Council have adopted updated Fitzroy River Flood Maps. The updated mapping excludes the NRFMA from Fitzroy River flood inundation extents up to and including the 1% AEP design flood event. However, from discussions with RRC, it is understood that to provide an added level of protection it has been requested that flood modelling be undertaken to ensure that the development has sufficient immunity against the 1% AEP flood event should the mitigation measures fail and ensure the development does not impact neighbouring properties and the development still has immunity against the 1% AEP flood event.

As such, flood modelling has been undertaken by Venant Solutions (Ref. RG: L.M00390.001.02.FloodReport.docx) and is available in **Appendix D**.

A summary of the reported flood levels and minimum floors levels is shown in Table 3.

Location	1 in 100 AEP Riverine Flood Level (m AHD)	Required Freeboard (mm)	Required Minimum Finished Level (m AHD)
Southern Entrance	N/A	N/A	N/A
Northeast Entrance	7.98	500 mm	8.48
Southeast Entrance	7.98	500 mm	8.48

Table 3. Summary of Flood levels and Minimum Floor Level Required

From the report it is noted the Riverine Flood level at the site is 7.98m AHD and as such the required minimum finished floor level is 8.48m AHD.

It is noted that a concrete island exists fronting the subject site on Lakes Creek Road. Refer to **Figure 13**. The island will constrict stormwater in the kerb and channel area. To provide immunity against ingress of stormwater into the building from the constricted area fronting the site it is recommended that the finished floor level is constructed at 8.52m AHD (i.e. 300mm above top of kerb). Whilst the acceptable outcome for non-residential development, is such that *"at least thirty (30) per cent of the gross floor area of all new buildings and structures is located a minimum of 500 millimetres above the defined flood level"*, it is recommended that the entire building is constructed at **8.52m AHD**.



Figure 13. Existing concrete island fronting subject site on Lakes Creek Road

#### 8.0 SUMMARY

This report has assessed the suitability of the proposed development and impacts associated with respect to water reticulation, sewerage reticulation and stormwater.

The report has found the following:

#### <u>Water</u>

- The subject site is currently serviced by a property connection to the 100mm diameter mPVC water main on Evans Street. This connection is likely to be a domestic connection (i.e. 20mm).
- It is proposed that a new 25mm diameter water connection is provided for the proposed development from the 150mm uPVC main on Lakes Creek Road. A new 25mm connection is proposed to service the proposed development to allow adequate capacity for 'domestic use', which are likely required for building hydraulics.
- The existing water connection and meter will be decommissioned.
- The existing water demand for the subject site is 12 EP (assuming four (4) residential lots).
- The proposed water demand for the subject site post-development is 9.53 EP based on CMDG, Water Supply Network Design Guideline, D11, Table D11.32.01. Alternatively adopting a rate of 1 EP/90 m<sup>2</sup>, the development demand is 5.14 EP.
- The proposed development water demand is less than the existing allowed demand. No mitigation measures are thus required to service the proposed development.
- This report excludes an assessment of the firefighting provisions.
- Flow and pressure testing should be undertaken for the hydraulics design of the facility.

#### Sewer

- The subject site is currently serviced by a 150 diameter Earthenware sewer reticulation main.
- From CMDG, Sewerage System Design Guidelines, D12, Table D12.38.01 for residential detached dwelling the demand is 2.6 EP per lot. Based on this the existing demand would be 10.4 EP.
- From the same table mentioned above, for Commercial Premises the demand is 2.08EP/ 100m<sup>2</sup> GFA. Based on a GFA of 462.6m<sup>2</sup>, the demand of the proposed development is 9.63 EP.
- The existing network infrastructure network should have sufficient capacity to accommodate the demand of the proposed development as the development loading is less than the existing design loading. As such, no mitigation measures are deemed required for the subject site.

#### Stormwater Assessment

• The pre and post development peak flow rates for the minor and major events are as follows:

Scenario	10% AEP (ARI 10)	1% AEP (ARI 100)
Pre-development	0.079m <sup>3</sup> /s	0.079m <sup>3</sup> /s
Post-development	0.149m³/s	0.151m <sup>3</sup> /s

- Compared to the pre-development design conditions the proposed development will increase the peak flow rate by 0.005m3/s (i.e. 5L/s) during a 10% AEP (ARI 10) and 0.003m3/s (i.e. 3L/s) during a 1% AEP (ARI100) event.
- Whilst there is a small increase in the peak flow rate post-development, the increase is relatively small. As such, no mitigations measures are proposed.
- In accordance with the State Planning Policy (2017), From State Planning Policy (SPP), 2017, Assessment benchmarks - Water Quality and Table B, Post construction phase – Stormwater management design objectives, performance outcomes apply only to development applications for a "material change of use for an urban purpose that involves premises 2,500m<sup>2</sup> or greater in size".
- The subject site is 1,701m<sup>2</sup> in area and thus, no does not trigger assessment against SPP Water Quality Objectives.

#### Stormwater Overlays

- The subject site is affected by the Flood Hazard and Storm Surge Potential Overlays.
- No buildings are proposed in the storm surge potential hazard area.
- The subject site is not affected by the coast hazard overlay.
- From the Flood hazard overlay it is noted that the subject site is within the North Rockhampton Flood Management Area (NRFMA).
- RRC have undertaken mitigation measures to provide the NRFMA protection from Fitzroy River flooding up to and including the 1% Annual Exceedance Probability (AEP) event (9.54m on the Rockhampton Flood Gauge) which substantially reduces the risk of flooding to the protected area.
- It is understood that to provide an added level of protection it has been requested that flood modelling be undertaken to ensure that the development has sufficient immunity against the 1% AEP flood event should the mitigation measures fail and ensure the development does that impact neighbouring properties and is should the mitigation measures fail, the development still has immunity against the 1% AEP flood event.

- Flood modelling has been undertaken by Venant Solutions. From the flood modelling report it is noted the Riverine Flood level at the site is 7.98m AHD.
- It is noted that a concrete island exists fronting the subject site on Lakes Creek Road. The island constricts stormwater in the kerb and channel area. To provide immunity against ingress of stormwater into the building from the constricted area fronting the site it is recommended that the finished floor level is constructed at 8.52m AHD (i.e. 300mm above top of kerb).
- Whilst the acceptable outcome for non-residential development, is such that "at least thirty (30) per cent of the gross floor area of all new buildings and structures is located a minimum of 500 millimetres above the defined flood level", it is recommended that the entire building is constructed at **8.52m AHD**.

# **APPENDIX A**

**DEVELOPMENT PLANS**




# **APPENDIX B**

DETAILED SURVEY

LANGTREE CONSULTING



	РНОТО 1				LAKES	5 []								
B A Rev	SEWMH IL, SL LOCATED & PLOTTED Original Issue Description	JR JR Drawn	WE ME Check ed	8/06/2022 13/05/2022 Date	- - 5 -	<u>,  </u> 0	Scale	e <b>1:300</b>    0	– Leng 15	gths are	in Met	t <b>res.</b> 30	35	] 40
This surve desig not t bound of su meas bound been able from availa const	plan is prepared from a combination of field ey and existing records for the purpose of ning new constructions on the land and should be used for any other purpose. The title daries shown hereon were marked at the time urvey and have been determined by field surement. See attached plan IS309676 for title dary information. Services shown hereon have located where possible by field survey. If not to be located, services may have been plotted the records of relevant authorities where able. Prior to any demolition, excavation or truction on the site, the relevant authority should	CC PROJECT: LOCATION: REAL PROPERTY CLIENT: Aa	2234 2-6 M DESCRIP	DUR & 9 - Select lusgrave DTION: LOT 2 arrell	<b>DETA</b> ability Street, R ON SP3313	ockh	PLAN ampton, Q	LD	Airlie Beac	ch   Mackay   : admin@visio	Townsville	<b>Bockhampton</b> om.au P	<b>Brisbane</b>   0 2 : 13000VISIO	Gold Coast
be c under	contacted for possible location of further rground services and detailed locations of all	Horiz. Datum: MGA (GDA 1994) ZONE 56 VIDE PSM 14809					Scale:	1:300 (	D A3	Drawing No	22349-0	CD01		
servio	ces. This note is an integral part of this plan.	t of this plan. Vert. Datum: AHD VIDE PSM 14809 RL: 8.94			3.948	48 Drawn:			JR		Sheet:	1 of 1		
		Local Authority:	Rockha	mpton Reg	ional	Contou	r Interval: 0.10i	n	Surveyor:	ME		Revision:	В	

# **APPENDIX C**

HYDROLOGICAL ASSESSMENT

LANGTREE CONSULTING

# (RATIONAL METHOD - URBAN CATCHMENT)

Scenario: Pre-Development 10% AEP (ARI 10) Project: Selectability Rockhampton Mental Health Hub Date : 22/06/2022





# (RATIONAL METHOD - URBAN CATCHMENT)

Scenario: Post-Development 10% AEP (ARI 10) Project: Selectability Rockhampton Mental Health Hub Date : 22/06/2022



# (RATIONAL METHOD - URBAN CATCHMENT)

Scenario: Pre-Development 1% AEP (ARI 100) Project: Selectability Rockhampton Mental Health Hub Date : 22/06/2022



(1) Guidelines					
- Queensland Urban Drainage Manual (QUDM) 2017					
- Bureau of Meteorology (BOM)	Output				
(2) Time of Concentration (t <sub>a</sub> )					
Total t <sub>c</sub>					
$t_c$ (mins) = 5.0					
(3) Design Flow (Q)					
$Q_y = 0.00278 \times C_y \times I_y \times A$ - refer QODM 2017, Section 4.3					
where:					
Q <sub>y</sub> = peak flow rate (m <sup>3</sup> /s) for annual exceedence probability (AEP) of 1 in 'y' years					
$C_y$ = coefficient of discharge (dimensionless) for AEP of 1 in 'y' years					
A = area of catchment (ha)					
<sup>t</sup> l <sub>y</sub> = average rainfall intensity (mm/h) for a design duration of 't' hours and an AEP of 1 in 'y' years					
t = the nominal design storm duration as defined by the time of concentration (tc)					
Design ARL v = 100					
A (ha) = $0.170$ 1701 m <sup>2</sup>					
$t_c (mins) = 5.0$					
Rainfall intensity, I (mm/hr) = $318.6$					
$I_{10} (mm/hr) = 63.5$					
Fraction impervious f. = 0.75					
Frequency Factor, F = 1.20 - refer QUDM 2017, Table 4.5.2					
C <sub>10</sub> = 0.825 - refer QUDM 2017, Table 4.5.3 & 4.5.4					
$C_y = 0.99$					
Q(m/s) = 0.143					

# (RATIONAL METHOD - URBAN CATCHMENT)

Scenario: Post-Development 1% AEP (ARI 100) Project: Selectability Rockhampton Mental Health Hub Date : 22/06/2022





# **APPENDIX D**

FLOOD MODELLING REPORT

Our Ref: RG: L.M00390.001.02.FloodReport.docx

14 July 2022

Langtree Consulting L1, 14 Ingham Road West End QLD 4810

Attention:

Dear Brett

#### **RE: 2-6 MUSGRAVE STREET, BERSERKER – FLOOD HYDRAULIC REPORT**

Venant Solutions has completed a flood assessment of the proposed commercial development at 2-6 Musgrave Street, Berserker (the Site). The location of the Site is shown in Figure 1. Rockhampton Regional Council's (Council) flood mapping indicates that the Site would be subject to inundation in both a 1 in 100 AEP (annual exceedance probability) local catchment flood event and a 1 in 100 AEP riverine flood event. Council has requested that a flood mitigation report is prepared to address:

- Appropriate floor levels above the 1 in 100 AEP flood level;
- Obstruction to flow paths causing an adverse increase in flood level on neighbouring properties; and
- Site safety and safe access during flood events.

This letter presents the details of the assessment undertaken and summarises how the design complies with Council's and State Planning Policy requirements with regards to management of flood risk.

#### Background

The Site is currently unoccupied. It is proposed to construct a commercial building for Selectability Care on the Site. The Site covers an area of approximately 1707  $m^2$  and slopes generally from the south to the north with a total fall of approximately 1.2 m. Over the Site this represents approximately a 1.8% grade.

The Site is impacted by rainwater falling on the immediate area in the local catchment event. In the riverine flood event the Fitzroy River spills over Bridge Street approximately 170 m to the west of the Site and inundates an area to the north of Lakes Creek Road and to the east of Queen Elizabeth Drive including the Site.

Council requires that at least 30% of the gross floor area of non-residential floor levels be set a minimum of 500 mm above the 1 in 100 AEP flood level so as to minimise the risk of stormwater or flood damage.

#### Flood Assessment - Local

The Site is located within Council's Moores Creek catchment hydraulic TUFLOW model. A copy of this model was provided by Council to form the basis of the local assessment. The Moores Creek model is a local catchment model with a cell size of 3 m that uses both routed and rain-on-grid hydrology inflows. Figure 2 shows the schematisation of the Moores Creek hydraulic model in the vicinity of the Site.

Council required the local catchment 1 in 100 AEP event to be modelled as a coincident event with riverine flooding. It was established that a coincident event of an 18% AEP flood event in the Fitzroy River would be acceptable to Council. This was represented as a downstream water level of 5.64 m AHD.



Venant Solutions Pty Ltd

PO Box 877 Macleod VIC 3085, Australia P. 03 9457 7164 ABN. 15 166 193 219 www.venantsolutions.com.au The alterations to the Moores Creek model are as follows:

- The model was run on the latest version of TUFLOW at the time (2020-10-AD);
- To represent a coincident flooding event the downstream outflow boundary level was changed to 5.64 m AHD;
- To represent a coincident flooding event the 1D and 2D initial water levels were changed to 5.64 m AHD;
- Site ground levels were refined based on site feature survey (22349-CD01-REVA.dwg);
- For the developed case assessment the proposed building will be represented as an elevated solid blockage so that offsite impacts caused by the potential blockage to overland flow can be assessed. Therefore it was necessary to remove the application of rainfall over the building footprint, noting it is a rain-ongrid model, so that the modelling did not produce changes that are modelling artefacts rather than real changes.

#### Flood Assessment - Riverine

The Site is located within Council's Fitzroy River hydraulic TUFLOW model. A copy of this model was provided by Council to form the basis of the riverine assessment. The Fitzroy River model covers the greater Rockhampton area with a 15 m cell size and represents riverine flooding from the large Fitzroy River catchment. Figure 3 shows the schematisation of the Fitzroy River hydraulic model.

The Site is located within the North Rockhampton Flood Management Area (NRFMA). Stage 1 mitigation works of the NRFMA would prevent flooding at the Site. However, Council required the assessment be undertaken assuming the NRFMA Stage 1 flood mitigation works were not in place. The model as supplied did not have this as a scenario. Based on discussions with Council, several changes were made to the model to represent a scenario where the temporary measures taken as part of the Stage 1 works for the NRFMA have been disabled.

The alterations to the Fitzroy River model are as follows and some of these can be seen in Figure 4:

- The model was run on the latest version of TUFLOW at the time (2020-10-AD);
  - A 2020 version of TUFLOW was required to enable the use of TUFLOW's Quadtree feature.
  - The 2020 version of TUFLOW produced a different flow distribution and water surface gradient across the model that resulted in differences in water level to the 2018 version of TUFLOW of approximately 50 mm near the Site.
  - The following TUFLOW commands were used to ensure that the model produced results comparable to the TUFLOW version that the model was designed for (2018-03-AC):
    - Viscosity Formulation == Smagorinsky
    - Viscosity Approach == Method A
    - HPC Mannings Depth Approach == Method A
    - HPC Boundary Approach == Method A
- TUFLOW's Quadtree feature was used to represent the area around the Site with a cell size of 3.25 m as opposed to the 15 m used elsewhere in the model.
  - This allowed the changes in the proposed case model to be properly represented in TUFLOW.
- To model the catchment without the temporary elements of the Stage 1 NRFMA works in place the following changes to the model were made:
  - The Queen Elizabeth Drive and Bridge Street levee (2d\_zsh\_FR18\_LakesCk) was turned off;

- The Rodboro Street and Ellis Street levee (2d\_zlr\_FR18\_NRFMA\_Stg1) was turned off;
- The backflow prevention devices on the trunk drains along Lakes Creek Road were turned off. This was represented by turning the 1D network layer (1d\_nwk\_FR18\_Calibration\_LCR\_structures) on;
  - The 1D network layer did not contain the trunk drain that runs along Musgrave Street. After discussions with Council, the nodes and reaches of that drain in the Moores Creek model 1D network file were used in the Fitzroy River model.
- Site ground levels were refined based on site feature survey (22349-CD01-REVA.dwg).

To represent the proposed development of the Site the building footprint was represented as a full blockage. This is shown in Figure 5

Mapping is provided as follows:

- Figure 6 Local Catchment: Existing Peak 1 in 100 AEP Depth
- Figure 7 Riverine Catchment: Change in Peak 1 in 100 AEP Flood Level
- Figure 8 Riverine Catchment: Proposed Peak 1 in 100 AEP Depth
- Figure 9 Riverine Catchment: Proposed Peak 1 in 100 AEP Velocity
- Figure 10 Riverine Catchment: Proposed Peak 1 in 100 AEP Hazard

#### Flood Assessment – Critical Event

Figure 6 shows the existing flood depth on the Site in the local event. It is apparent that flooding on the Site is minimal, with only the inundation on the northern boundary of the Site connected to a significant area of flooding. The local flood level at the northern boundary of the Site is 7.01 m AHD and at the western edge of the Site it is 7.80 m AHD. The regional flood level at both of these locations is 7.98 m AHD. Therefore the riverine flood event is the critical event at the Site and no impact analysis was carried out for the local flood event.

#### Flood Assessment – Flood Offsite Impacts

Figure 7 colour maps the change in flood level in ranges in accordance with the figure legend, shows the areas that have undergone a change in flood height of more than 10 mm in the 1 in 100 AEP event. The oranges and reds denote areas of increased flood level and the greens marks areas where the flood level has fallen. Pink denotes areas where there was flooding and the land is now flood free, while blue denotes areas that were flood free and now have flooding. The mapping shows that there are no areas where flood levels have increased by more than 10 mm outside the Site. There is a small area of was dry now wet on the road at the southern end of the Site but it is less than 20 mm deep, is on public land and does not pose a threat to safe Site access or more generally the public.

#### Flood Assessment – Flood Height Levels

Minimum required floor levels are based on the peak 1 in 100 AEP flood level with an added allowance for appropriate freeboard. Council requires that at least 30% of the gross floor area of non-residential floor levels be set a minimum of 500 mm above the 1 in 100 AEP flood level. Table 1 provides the required minimum finished floor level assuming that the entire building is required to have floor levels of 500 mm above the 1 in 100 AEP flood level.

Location	1 in 100 AEP Riverine Flood Level (m AHD)	Required Freeboard (mm)	Required Minimum Finished Level (m AHD)
Southern Entrance	N/A	N/A	N/A
North-east Entrance	7.98	500 mm	8.48
Courtyard Entrance	7.98	500 mm	8.48

#### Table 1 Flood Level and Minimum Floor Level Requirements

### Flood Assessment – Safety and Egress

The Depth, Velocity and Hazard mapping is provided to assist in the assessment of site access/egress and site safety using the following Rockhampton Regional Council guideline maximums:

- Depth should be no more than 0.3 m; and
- Velocity should be no more than 2.0 m/s.

The colour ranges in the relevant mapping included as Figures 8, 9 and 10 are designed to allow easy assessment of achievement against the guideline maximums. Figure 8 shows that the northern portion of the Site (used as a driveway and carparking) has depths of more than 0.3 m in the riverine 1 in 100 AEP event. However, safe egress is possible to Lakes Creek Road. It is also noted that this is based on the assumption that the NRFMA Stage 1 mitigation works are not in place.

Figure 9 shows no velocities of greater than 0.5 m/s on the Site.

Figure 10 shows the ARR2019 H1 to H6 hazard classification categories. The categories are as follows:

- H1 generally safe for people, vehicles and buildings;
- H2 unsafe for small vehicles;
- H3 unsafe for vehicles, children and the elderly;
- H4 unsafe for people and vehicles;
- H5 unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure;
- H6 Unsafe for vehicles and people. All building types considered vulnerable to failure.

Figure 10 shows that in the riverine event the northern portion of the Site has hazard categories of up to H3 assuming that the NRFMA Stage 1 mitigation works are not in place. However, this does not impede Site egress to Lakes Creek Road and egress from the area east along Lakes Creek Road.

### Summary

The analysis reported on herein shows that the proposed development:

- Meets off-site and adjacent property flood impact requirements;
- Meets site safety and access/egress requirements;
- This report documents the required minimum floor levels.

Please do not hesitate to contact the undersigned should you require any further information.

Yours faithfully,

Ridowel 1.3. Lacke

Richard Gale Engineer

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Dr Mark Jempson Director (Reviewer) RPEQ (11111)













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## Our Ref: RG: L.M00390.001.02.FloodReport.docx

#### 14 July 2022

Langtree Consulting L1, 14 Ingham Road West End QLD 4810 ROCKHAMPTON REGIONAL COUNCIL APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with **Development Permit No.:** D/106-2022 **Dated: 23 November 2022** 

Attention:

Dear Brett

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Figure 7 colour maps the change in flood level in ranges in accordance with the figure legend, shows the areas that have undergone a change in flood height of more than 10 mm in the 1 in 100 AEP event. The oranges and reds denote areas of increased flood level and the greens marks areas where the flood level has fallen. Pink denotes areas where there was flooding and the land is now flood free, while blue denotes areas that were flood free and now have flooding. The mapping shows that there are no areas where flood levels have increased by more than 10 mm outside the Site. There is a small area of was dry now wet on the road at the southern end of the Site but it is less than 20 mm deep, is on public land and does not pose a threat to safe Site access or more generally the public.

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Location	1 in 100 AEP Riverine Flood Level (m AHD)	Required Freeboard (mm)	Required Minimum Finished Level (m AHD)
Southern Entrance	N/A	N/A	N/A
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Courtyard Entrance	7.98	500 mm	8.48

#### Table 1 Flood Level and Minimum Floor Level Requirements

### Flood Assessment – Safety and Egress

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- Depth should be no more than 0.3 m; and
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- H1 generally safe for people, vehicles and buildings;
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- H3 unsafe for vehicles, children and the elderly;
- H4 unsafe for people and vehicles;
- H5 unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure;
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### Summary

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- Meets off-site and adjacent property flood impact requirements;
- Meets site safety and access/egress requirements;
- This report documents the required minimum floor levels.

Please do not hesitate to contact the undersigned should you require any further information.

Yours faithfully,

Ridowel 1.3. Lacke

Richard Gale Engineer

mappen

Dr Mark Jempson Director (Reviewer) RPEQ (11111)












	Legend
	Site
	Proposed Building
· · · · · · · · · · · · · · · · · · ·	Underground Pipe Network
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Title: 2.6 Musarava Stroot Baroarkar Divaring Madal	
Change in Peak Flood Level - 1% AEP	VENANT solutions
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Title: 2-6 Musarave Street Berserker - Divoring Model	
Proposed Peak Flood Velocity - 1% AEP	VENANT solutions
Figure: 9 A A Approx. Scale	es es By: RG Date: Jun 2022 Level 1, Suite 101 26-30 Rokeby St Collingwood VIC 3066 T. (03) 9088 6700 www.VenantSolltions.com.au
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