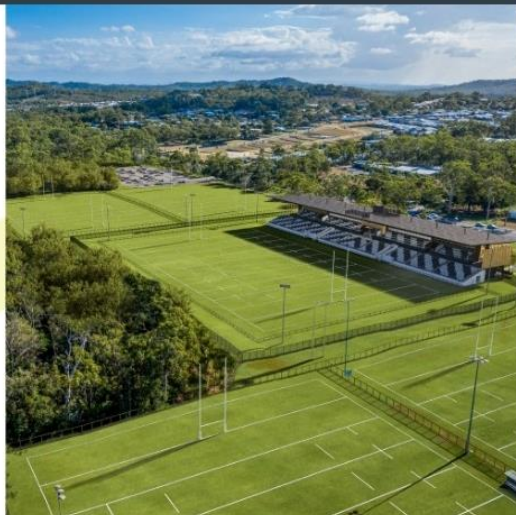




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**BESS Project, Carbean Road, Karara
Traffic Impact Assessment Report**

Client:
Project Number:
Document Number:

Acciona Energy
BE240125
BE240125-RP-TIA-06

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Appendices

- Appendix A – Site Layout
- Appendix B – Traffic Count
- Appendix C – SIDRA Output





1. Introduction

1.1 Project Overview

Burchills Engineering Solutions has been engaged by Acciona Energy to prepare a Traffic Impact Assessment report (TIA) for Acciona Energy's (AE) proposed Battery Energy Storage System (BESS) at Karara over 15 on Lot SP332758, within the Goondiwindi Regional Council's area.

This report has been prepared to summarise the traffic impacts associated with the construction stage of the BESS which is expected to be a peak scenario in terms of traffic impact by the subject development.

The site is identified by the GRPS v2 (GRC, 2018) as being located within the *Rural Zone – Traprock Precinct*. Figure 1-1 below illustrates the location of the subject site.

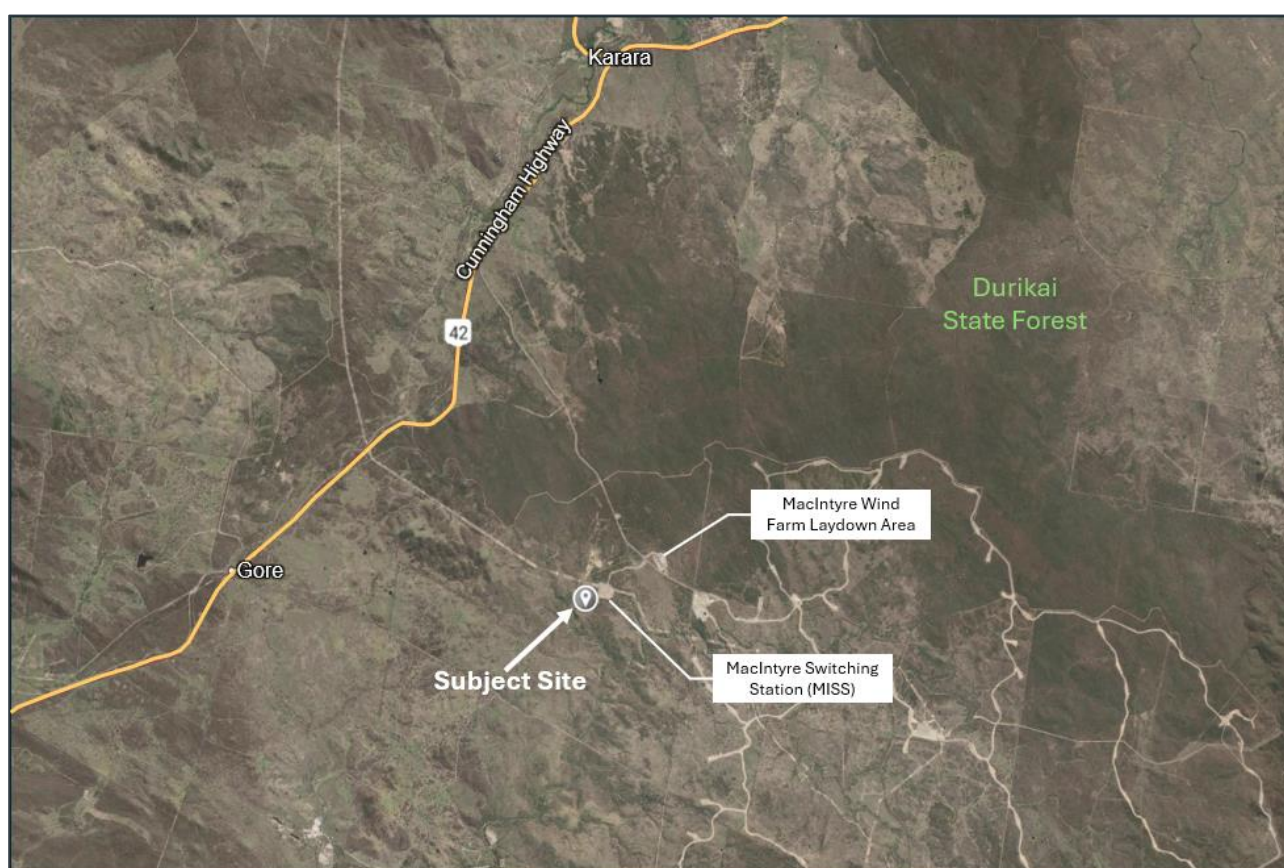


Figure 1-1 Subject Site





1.2 References

The following documents have been used in the preparation of this report.

- Transport Main Roads Guide to Traffic Impact Assessment, 2018 (GTIA);
- Austroads Guide to Road Design Part 4A, 2023;
- Road Planning and Design Manual, 2013 (RPDM);
- Local Government Heavy Vehicle Route Assessment Guidelines;
- Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management 2020; and
- MacIntyre Wind Farm Project TIA, prepared by GHD Consultants, dated July 2020.

1.3 Limitations

Burchills has completed this traffic report in accordance with the usual care and thoroughness of the consulting profession. To inform the Project construction conditions, workforce numbers and delivery stage durations, Burchills has largely utilised the information provided by AE with processes and methodologies that have been confirmed by AE.

This report has been prepared to summarise the traffic impacts associated with the construction stage of the BESS which is expected to be a worst-case scenario in terms of traffic impact by the BESS development.

During the Operational Stage, the anticipated traffic generation will be minimal due to the low maintenance and number of staff required to operate the site.

The assessment is based on accepted traffic engineering practises and standards applicable at the time of undertaking the assessment. The assessment was completed in December 2024 and is based on the conditions encountered and Project information available at the time. Burchills disclaims responsibility for any changes to project planning or road conditions that may occur after the completion of the assessment.





2. Project Assessment Methodology

2.1 Assessment Scope

The scope of this assessment is limited to the roads used by the proposed BESS Project on Carbean Road, Karara. The judgement of whether a road carries a significant amount of traffic is based on TMR Guidelines to Traffic Impact Assessments. These guidelines state that a road carries a significant proportion of project traffic when levels reach 5% of existing traffic volumes. The following roads and intersections have been assessed in this document to determine if the proposed road haulage exceeds the 5% trigger and be classed as a significant impact.

It is noted that this assessment has been completed to assess the traffic impacts associated with the construction stage of the BESS which is expected to be a worst-case scenario in terms of traffic generating impact by the BESS project.

During the Operational Stage, the anticipated traffic generation will be minimal due to the low maintenance and number of staff required to operate the site.

2.1.1 State-Controlled Road

- Cunningham Highway.

2.1.2 State-Controlled Intersection:

- Cunningham Highway / Carbean Road / Waraghai Road.

2.1.3 Southern Downs Regional Councils Road

- Carbean Road; and
- Waraghai Road.

2.1.4 Goondiwindi Regional Council Roads:

- Carbean Road.

2.1.5 Goondiwindi Regional Council Intersections:

- Carbean Road / Site Access Road.

2.2 Access and Egress to Sites

Roads impacted by the construction stage of the development will be assessed according to Austroads Guide to Road Design Part 4A, Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management 2020 and TMRs Road Planning and Design Manual, which includes:

- Safe Intersection Sight Distance (SISD) assessment
- Acceleration assessment, and
- Turn Warrant Assessment.





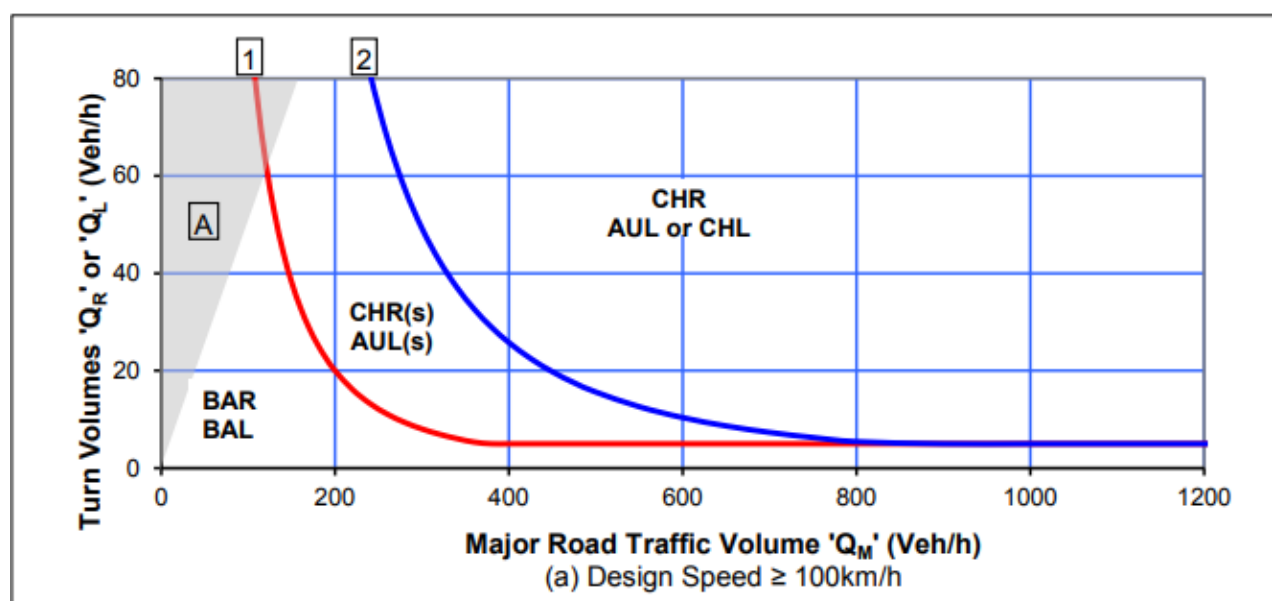
2.3 Intersection Safety Criteria

2.3.1 Turn Treatments

While the Degree of Saturation (DOS) and critical delay statistics provide an indication of the operational performance of an intersection, turn warrant assessments provide an indication of the turn treatment requirements to ensure an appropriate level of safety is provided for vehicles entering and exiting the site.

A turn warrant assessment provides guidance on where deceleration lanes and turning lanes should be used based on traffic volumes. The warrants were developed by Arndt and Troutbeck (2006) referenced in Austroads Guide to Traffic Management Part 6: *Intersections, Interchanges and Crossings Management*. These warrants were produced by identifying the location at which the benefits of providing a higher-level treatment (the reduction in estimated crash costs) are equal to additional construction costs associated with the treatment.

Figure 2-1 reproduces the warrants for turn treatments for rural roads with speeds greater than or equal to 100 kilometres per hour (km/h).



Source: Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management

Figure 2-1 Warrants for Turn Treatments for Design Speed Greater Than or Equal to 100km/h

2.4 Link Capacity Criteria

The road link capacity of the roads impacted by the BESS Project traffic has been assessed according to the Guide to Traffic Impact Assessments (GTIA). The GTIA defines the impact assessment area as:

- All road links where the development traffic exceeds 5% of the base in either direction on the links annual average daily traffic (AADT) in the year of opening of each stage.





2.5 Road Safety Criteria

The road safety criteria of the roads and intersections impacted by the BESS Project traffic have been assessed according to the Guide to Traffic Impact Assessments (GTIA). The GTIA defines the impact assessment area as:

- All intersections where the development traffic exceeds 5% of the base traffic for any movement in the design peak periods in the year of opening of each stage; and
- All road links where the development traffic exceeds 5% of the base traffic in either direction on the link in the design peak periods in the year of opening of each stage.

2.6 Transport Infrastructure

The transport infrastructure criteria of road links impacted by the BESS Project traffic have been assessed according to the Guide to Traffic Impact Assessments (GTIA). The GTIA defines the impact assessment area as:

- All road links where the development traffic exceeds 5% of the base traffic in either direction on the link's AADT in the year of opening of each stage, or where Transport and Main Roads identifies prevailing structural integrity issues of transport infrastructure (for example, bridges or culverts).

2.7 Pavement Impact Assessment (PIA)

It is anticipated that a financial contribution may be required to mitigate the impact of the construction stage on the Cunningham Highway (State-Controlled). This contribution should be determined once more details about the sources of the primary construction materials are known. A detailed PIA can be stipulated as a part of approval conditions prior to the commencement of the construction stage.





3.3 Staff Estimates

Burchills has been advised that in the order of 80 staff members are anticipated to be on-site during the construction stage of the development, with maximum estimates in the order of 200 construction staff to be on-site during peak periods.

It is understood that the shift will be 12 hours in duration (6am to 6pm) and will operate six (6) days per week (Monday to Saturday).

3.4 Vehicle Access

Vehicle access to the BESS site is proposed via an existing access track located on Carbean Road and the Cunningham Highway / Carbean Road intersection. The suitability of the proposed access arrangement is discussed in Section 4 of this report.

3.5 Project Staging

The estimated timing of the construction stage is the year 2026. A construction period of 18 months is anticipated.





4. Existing Conditions

4.1 Subject Site

The subject site is located on Lot 15 SP332758 within the Goondiwindi Regional Council area. The subject lot is currently zoned as a rural area.

The subject site is shown in Figure 4-1.

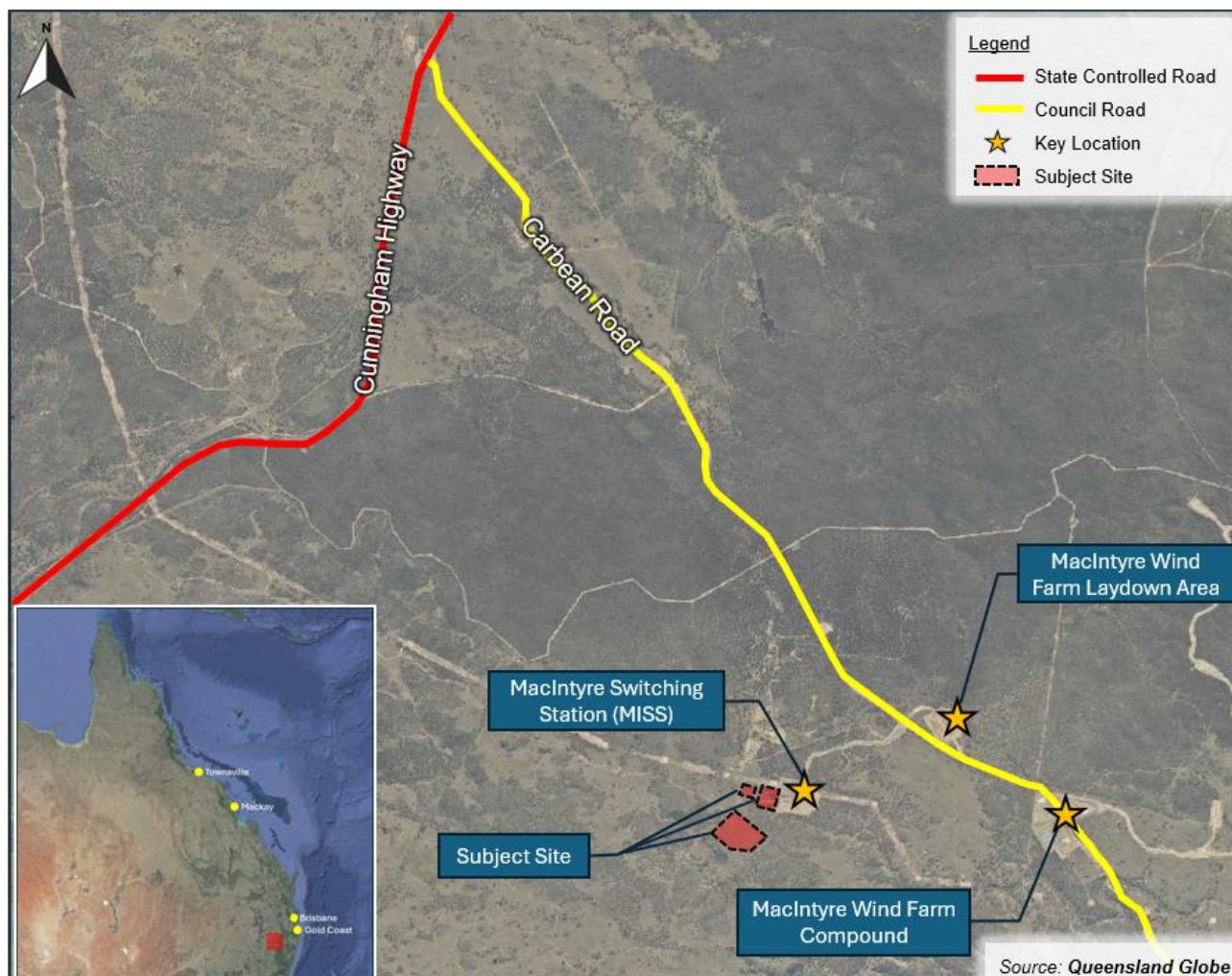


Figure 4-1 Subject Site and its Surrounds



4.2 Existing Roads Network

4.2.1 Road Links

Burchills undertook an inspection of the site and the surrounding road network on 16th May 2024. Tasks conducted on these inspections include the following:

- Visual review of general condition, including pavement type, sight distance and warning signage; and
- Visual review of intersection formation, including carriageway configuration.

For a robust traffic assessment, Burchills commissioned a traffic count at the intersection of Cunningham Highway / Carbean Road / Waraghai Road. Table 4-1 summarises the existing conditions for key roads along with the vehicles per day (vpd) and heavy vehicle (HV) percentage.

Table 4-1 Road Links

Road	Road Condition	Formation	Average Width	Speed Limit	AADT (2024) Based on Traffic Counts	HV%
Cunningham Highway	Sealed	2-lane 2-way	7.2m	100km/h	835	31%
Carbean Road	Unsealed	2-lane 2-way	8m	100km/h	670	15%
Waraghai Road	Unsealed	2-lane 2-way	6.5m	100km/h	35	10%

4.2.2 Cunningham Highway

The Cunningham Highway is a state-controlled road in Queensland under the Department of Transport and Main Roads (DTMR) jurisdiction. The Cunningham Highway is divided into four (4) main sections. The subject section of Cunningham Highway (17C) connects the townships of Warwick and Inglewood. The Cunningham Highway generally aligns east-west and is configured with a two-way, two-lane 10m carriageway.

Reference to the National Heavy Vehicle Regulator (NHVR) and TMR's heavy vehicle routes indicates that the subject section of Cunningham Highway is classified as a gazetted B-double and AB triple haulage route (RT1 route, Road Train Type 1 network).

4.2.3 Carbean Road

Carbean Road is a two-way, two-lane Council (Southern Downs Regional) managed Road. The subject road is classified as a Rural Access Road in the council's road hierarchy plan and provides a connection between Karara Town (via Cunningham Highway) and Durikai State Forest. The section of Carbean Road between Cunningham Highway and the MacIntyre Wind Farm has recently been upgraded and has a 10.5m wide sealed formation near the intersection with MacIntyre Wind Farm Laydown Area Access, the remaining section of Carbean Road is a mix of gravel and dirt.

4.2.4 Waraghai Road

Waraghai Road is a two-way, two-lane Council (Southern Downs Regional) managed gravel road. The subject road is classified as a Rural Access Road in the council's road hierarchy plan and provides an alternative connection between Toowoomba Karara Road and Cunningham Highway. Waraghai Road is generally aligned north south and is configured with a 7m wide carriageway (approx.).





4.3 Key Intersections

4.3.1 Cunningham Highway / Carbean Road / Waraghai Road

Cunningham Highway / Carbean Road / Waraghai Road intersection is a four-way sealed priority-controlled intersection with a speed limit of 100km/h across the major road (Cunningham Highway). The subject intersection has an Auxiliary Left (AUL) of approximately 175m with a 0.5m sealed shoulder.

The intersection is shown in Figure 4-2.

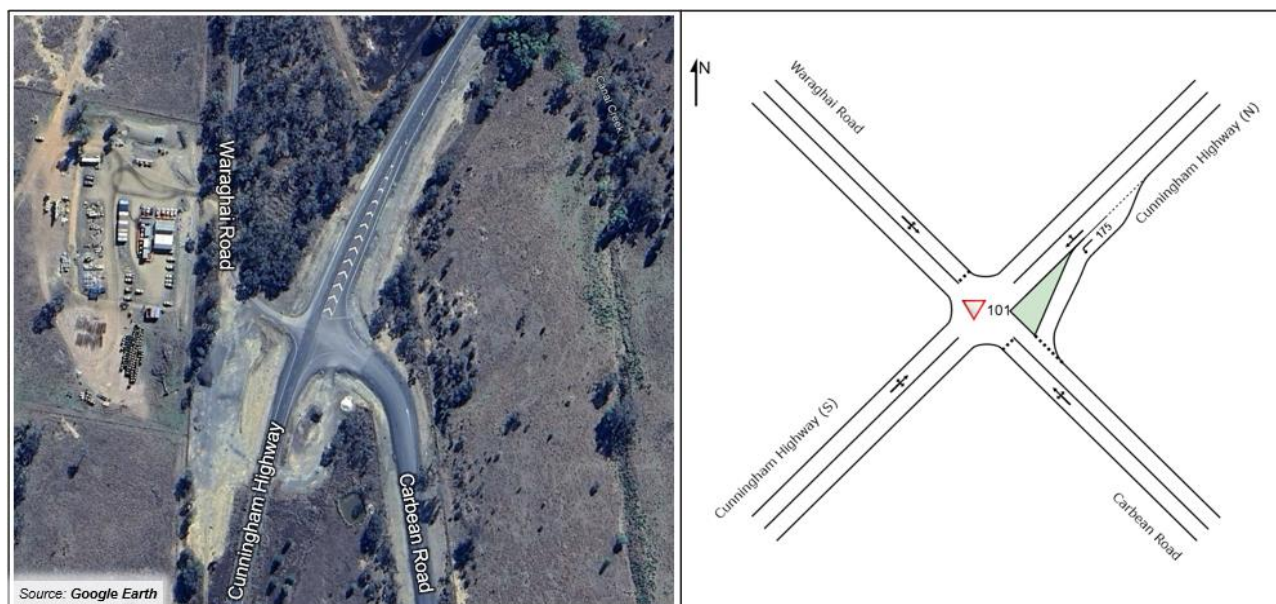


Figure 4-2 Cunningham Highway / Carbean Road / Waraghai Road Aerial and SIDRA Layout

Site visit investigations confirmed the lane widths illustrated in Table 4-2.

Table 4-2 Cunningham Highway / Carbean Road / Waraghai Road Lane Widths

Road	Lane Width (m)
Northbound Through-Lane (Cunningham Highway)	3.5m
Southbound Through-Lane (Cunningham Highway)	3.5m
Left Turn Lane onto Carbean Road	3.5m
Eastbound Through-Lane (Carbean Road)	3.5m
Westbound Through-Lane (Carbean Road)	3.5m
Eastbound Through-Lane (Waraghai Road)	3m
Westbound Through-Lane (Waraghai Road)	3m

The Safe Intersection Sight Distance (SISD) results for Cunningham Highway / Carbean Road / Waraghai Road are outlined in Table 4-3.





Table 4-3 Cunningham Highway / Carbean Road / Waraghai Road Intersection Sight Distance (SISD)

Direction	SISD	SISD Requirement (100km/h)	Site Photo
Left out of Carbean Road	290m+ (Along Cunningham Highway)	285m	
Right out of Carbean Road	300m+ (Along Cunningham Highway)	285m	

Table 4-4 illustrates a list of findings on site relevant to the Cunningham Highway / Carbean Road / Waraghai Road intersection.

Table 4-4 Cunningham Highway / Carbean Road / Waraghai Road Intersection Findings

Description	Existing Condition
Intersection clear zones	Good
Signage	Good
Line marking	Good
Pavement	Good





4.3.2 Carbean Road / Site Access Road / Storage Access

Carbean Road / Site Access Road intersection is a four-way gravel priority-controlled intersection with a default speed limit of 100km/h across the major road (Carbean Road). At present, the speed at the subject intersection is reduced to 60km/h under temporary traffic management.

The intersection is shown in Figure 4-3.

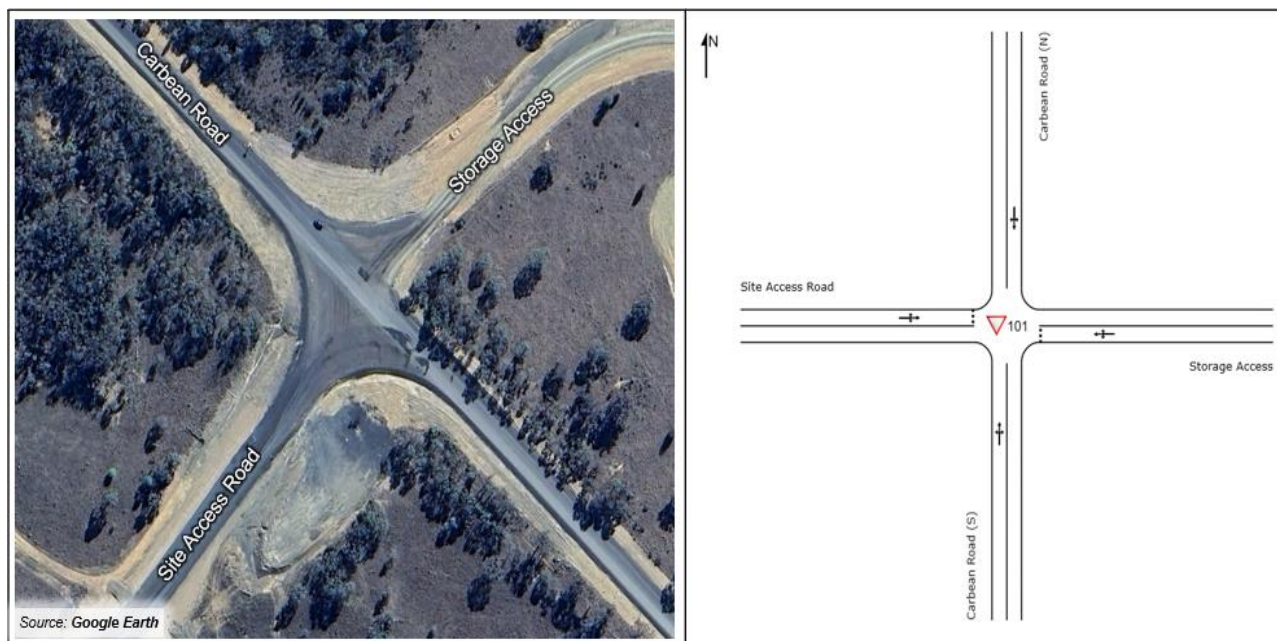


Figure 4-3 Carbean Road / Site Access / Storage Access Aerial and SIDRA Layout

Site visit investigations confirmed the lane widths illustrated in Table 4-5.

Table 4-5 Carbean Road / Site Access / Storage Access Lane Widths

Road	Lane Width (m)
Northbound Lane (Carbean Road)	3.5m
Southbound Lane (Carbean Road)	3.5m
Carriageway Width (Site Access Road)	9.6m
Carriageway Width (Storage Access)	8.1m

The Safe Intersection Sight Distance (SISD) results for Carbean Road / Site Access / Storage Access are outlined in Table 4-6.





Table 4-6 Carbean Road / Site Access / Storage Access Intersection Sight Distance (SISD)

Direction	SISD	SISD Requirement (100km/h)	Site Photo
Left out of Site Access Road	550m+ (Along Carbean Road)	285m	
Right out of Site Access Road	400m+ (Along Carbean Road)	285m	

Table 4-7 illustrates a list of findings on site relevant to the Carbean Road / Site Access / Storage Access intersection.

Table 4-7 Carbean Road / Site Access / Storage Access Intersection Findings

Description	Existing Condition
Intersection clear zones	Good
Signage	Fair
Line marking	Worn
Pavement	Fair





4.4 Incident History

4.4.1 Subject Intersection

Crash data over the previous five years (July 2016 to June 2021) was obtained from TMR in order to determine any incident trends in the vicinity of the construction traffic access routes. The crash location, severity, type, year and are tabulated in Table 4-8

Table 4-8 Study Intersection Crash History Summary

Study Intersections	Number of Crashes in last 5 years at intersections
Cunningham Highway / Carbean Road / Waraghai Road	0
Carbean Road / Site Access Road	0
Total	0

There has been a total of zero (0) crashes reported in the last 5 years across the study intersections.





5. Traffic Considerations

5.1 Traffic Count Data

5.1.1 Intersection Data

To understand the existing traffic conditions in the vicinity of the site, a traffic survey was undertaken by Austraffic during the AM and PM peak periods on Tuesday 14th May 2024 at the Cunningham Highway / Carbean Road / Waraghai Road intersection.

The surveyed and adopted peak periods have been summarised in Table 5-1 below.

Table 5-1 Assessment Peak Periods

Survey Details	Peak Period	
	AM	PM
Surveyed Peak Periods	6:00am – 9:00am	4:00pm – 7:00pm
Adopted Hourly Peak Periods	7:30am – 8:30am	4:15pm – 5:15pm

Figure 5-1 shows the AM and PM peak traffic volume at the intersection of Cunningham Highway / Carbean Road / Waraghai Road intersection.

Waraghai Road						
Cunningham Highway	(0)	2	L	(2)	(1)	(0)
	(44)	39	T	1	0	1
	(0)	5	R	R	T	L
	L	T	R	R	0	(0)
AM	2	0	7	T	39	(37)
	(1)	(2)	(84)	L	24	(8)
Carbean Road						
Cunningham Highway						

Figure 5-1 Traffic Survey Volumes AM and PM Peaks

Detailed traffic count information is included at Appendix B.

5.2 Traffic Growth

The anticipated growth rates on Cunningham Highway have been sourced from Traffic Census AADT data from 2022 (Site ID: 50005). An annual growth rate of 1.5% has been identified and used for the purpose of this assessment.

5.3 Traffic Generation

5.3.1 Construction Workforce Numbers

To determine the traffic generation associated with the Project, Burchills has assessed the supplied workforce numbers associated with the construction phase. The typical daily staff numbers during the construction phase of the BESS is expected to be 80 staff with the occasional maximum of up to 200 staff members on-site.

It is anticipated that all 90% of workers will reside in the Warwick or Toowoomba area.





5.4 Workforce Transportation Mode

Burchills has been advised that staff will commute daily to and from the work site which will occur via shuttle bus (14-seater) services as well as private vehicle transportation.

The workforce transportation mode splits are outlined below for the construction phases:

- 50% of the workforce travelling to and from the worksite via private vehicles (Drive-In Drive-Out) Carpooling with other staff; an
- Remaining 50% of the workforce travelling to and from the worksite via shuttle bus (14-seater) service.

The workforce transportation mode split for the BESS construction phase is reproduced in Table 5-2 below.

Table 5-2 Workforce Transportation Distribution

Workforce Transportation Mode	Daily Workforce
Private Vehicle	40
Bus (14-seater)	40
Total	80

5.5 Workforce Vehicle Trip

Burchills has been advised that the shuttle bus service in the construction phase will have a capacity of 14 people per bus, while the carpooling occupancy ratio of 1.2 people per car has been adopted.

Therefore, the number of vehicle trips likely to be generated by the development is summarised in Table 5-3

Table 5-3 BESS Trip (Construction Phase)

Workforce	Mode of Transport	Trip Rate	Trip Generated			
			AM		PM	
			IN	OUT	IN	OUT
40	Shuttle Buses	14 people per bus	3	3	3	3
40	Private Vehicle (PV)	1.2 people per PV	33	nil	nil	33
Total Trips (per shift)			36	3	3	36

As seen in Table 5-3, a total of 39 trips are generated during both peak hours.

5.6 Heavy Vehicle / Delivery Vehicle Movements

In addition to workforce trip generation for the BESS, Burchills has also assessed the Heavy Vehicle / Delivery Vehicle movements during the construction phase. Burchills has been advised of the following heavy vehicle / delivery movements per peak hour during the construction phase.





Table 5-4 Heavy Vehicle / Delivery Vehicle Trips (Two-way)

Vehicle Type	Total Vehicles During Construction	Vehicle Trips / Peak Hour
13m Rigid	10,920	2.6
19m Semi	1,768	2.8
Low Loader	920	1.2
Mobile Crane	12	0.4
OSOM Truck	6	0.2
Truck & Dog	2,606	7.0
Van	5,460	1.0
Total	21,694	15.2

As shown in Table 5-4 above, a total of 15 two-way heavy vehicle and delivery movements are anticipated per peak hour during the construction stage.

The above equates to a total of 15 heavy and delivery vehicle movements (rounded up to 8 entry and 8 exit) during both the AM and PM peak hours during the construction period, assuming an even distribution of deliveries through the day.

5.7 Directional Trip Distribution (Heavy Vehicle / Delivery Vehicle)

For robust traffic assessment, the directional distribution has been estimated based on the worst-case scenario, assuming all heavy vehicles arrive and leave the site in the same peak hour with a split of 50% In and 50% Out used for both AM and PM peak.

5.8 Traffic Distribution

It is anticipated that the majority of private vehicles and shuttle buses will originate from the east (i.e. Karara Town), while a smaller proportion will originate from the west (i.e. Gore). As such, an 80% east / 20% west split has been adopted for private vehicle trips.

It is expected that 90% of heavy vehicles used for deliveries proposed during the construction phase will be travelling to and from the east and the remaining will originate from the west.

For the purpose of this assessment, the external distribution of the BESS is summarised in Table 5-5 below.

Table 5-5 External Traffic Distribution

Transportation Mode	Cunningham Highway	
	Trip Originated in West	Trip Originated in East
Light Vehicles	20%	80%
Heavy Vehicles	10%	90%

Figure 5.2 below, shows the total anticipated construction traffic volumes during both the AM and PM peak hours at the study intersections.





Warahgai Road							
(0) 2 L			(2) (1) (0)				
(45) 40 T			1 0 1				
(1) 13 R			R T L				
Cunningham Highway	L	T	R	R	0	(0)	Cunningham Highway
	3	0	17	T	40	(38)	
	(9)	(2)	(122)	L	60	(18)	
Carbean Road							
(44) 11 L			(11) (9) (0)				
(0) 0 T			44 30 0				
(0) 0 R			R T L				
Site Access Road	L	T	R	R	0	(0)	MWF Laydown Area
	0	9	0	T	0	(0)	Access
AM	(0)	(90)	(0)	L	0	(0)	
(PM)							
Carbean Road							

Figure 5-2 Construction Traffic Volume

The intersection turn movement shown in Figure 5-2 is utilised as input for SIDRA Software analysis. A summary of the SIDRA analysis is provided at Section 6.





6. SIDRA Assessment

A summary of the SIDRA Modelling parameters adopted for this assessment are summarised below:

- Peak Flow Factor – 0.95 (30min/60min)
- Basic Saturation Flow – 1,950tcu/hr

The SIDRA results for all intersections are tabulated below. The detailed SIDRA results are provided at Appendix C.

Table 6-1 Cunningham Highway / Carbean Road / Waraghai Road Intersection

Scenario	AM Peak			PM Peak		
	DOS	Critical Delay	95 th %ile Queue	DOS	Critical Delay	95 th %ile Queue
2026 Background	0.029	6.4sec	0.6m	0.103	6.4sec	2.9m
2026 Construction Traffic	0.043	6.6sec	1.4m	0.151	6.5sec	4.5m

Table 6-2 Carbean Road / Site Access / Storage Access Intersection

Scenario	AM Peak			PM Peak		
	DOS	Critical Delay	95 th %ile Queue	DOS	Critical Delay	95 th %ile Queue
2026 Background	0.019	5.5sec	0.1m	0.056	5.8sec	0.1m
2026 Construction Traffic	0.048	6.3sec	1.7m	0.056	6.7sec	1.2m

The results of the SIDRA analysis indicate that all priority-controlled intersections operate well within the typical performance thresholds (DOS ≤ 0.80 for priority-controlled), for the construction stage.





7. Turn Warrant Assessment

The turn warrant assessment has been conducted for the anticipated opening year of the proposed development (Year 2026) in accordance with the Austroads Guide to Traffic Management Part 6: *Intersections, Interchanges and Crossings Management*. A summary of the traffic movement parameters considered is shown below in Figure 1-1.

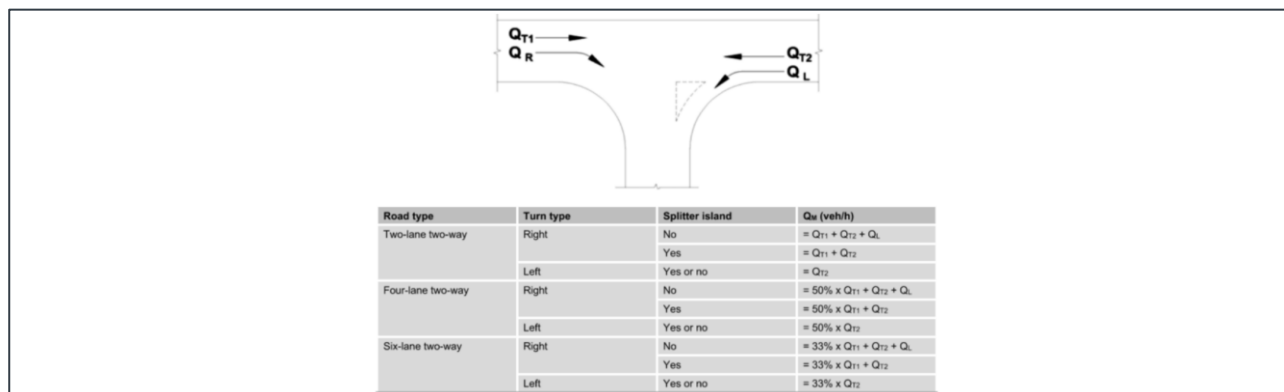


Figure 7-1 Turn Warrants Qm Traffic Flow Calculation

The resultant turn treatment requirements for each intersection have been summarised within the following sections of this report.

7.1 Cunningham Highway / Carbean Road / Wraghai Road

The adopted volumes for the Cunningham Highway / Carbean Road / Waraghai Road intersection turn warrant assessment as shown in Table 7.1 with the turn warrant diagram shown in Figure 7.2.

Table 7-1 Cunningham Highway / Carbean Road / Waraghai Road Trips Peak Hours

Traffic Volume	AM Peak hour	PM Peak Hour
Q _{T1}	40	45
Q _{T2}	40	38
Q _L (from north)	60	18
Q _R (from south)	13	1
Q _M Left	40	38
Q _M Right	141	101

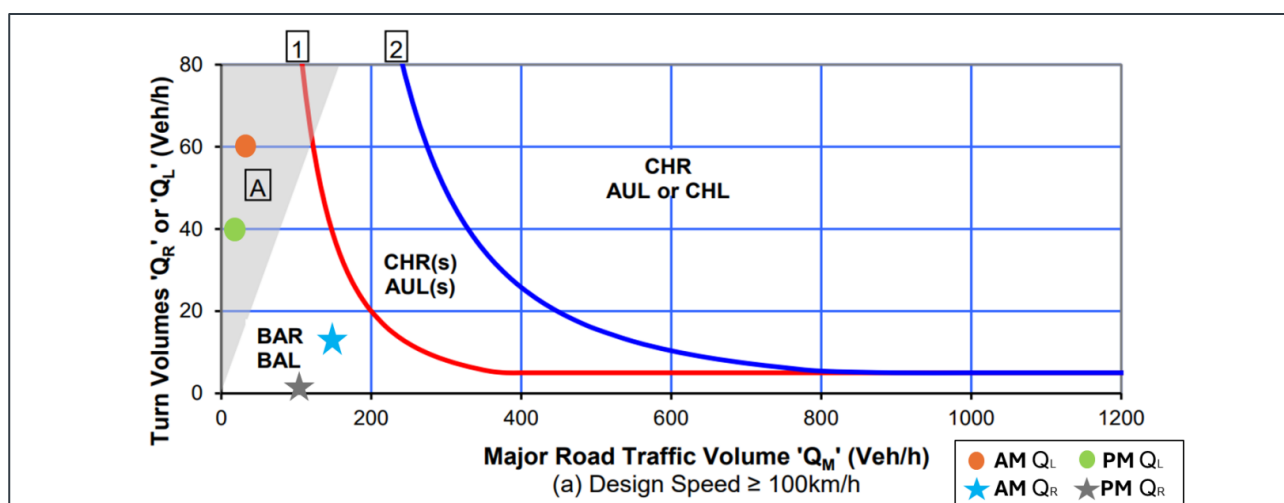


Figure 7-2 Turn Warrant Assessment Results - Cunningham Highway/ Carbean Road / Waraghai Road





The assessment above indicates that the Cunningham Highway / Carbean Road / Waraghai Road Access intersection will require the provision of a Basic Auxiliary Right (BAL) and Basic Auxiliary Right (BAR) treatment.

7.2 Cunningham Highway / Carbean Road / Wraghai Road

The adopted volumes for the Cunningham Highway / Carbean Road / Waraghai Road intersection turn warrant assessment as shown in Table 7.2 with the turn warrant diagram shown in Figure 7.3.

Table 7-2 Cunningham Highway / Carbean Road / Waraghai Road Trips Peak Hours

Traffic Volume	AM Peak hour	PM Peak Hour
Q_{T1}	30	9
Q_{T2}	9	90
Q_L (from south)	10	43
Q_R (from north)	43	10
Q_M Left	9	90
Q_M Right	49	142

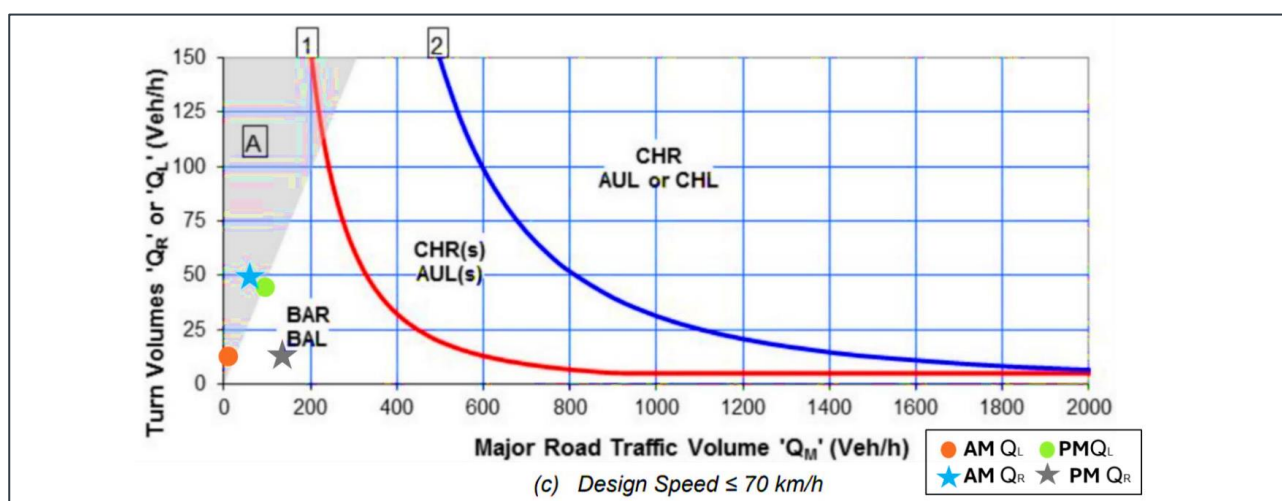


Figure 7-3 Turn Warrant Assessment Results - Carbean Road / Site Access / Storage Access

The assessment above indicates that the Carbean Road / Site Access / Storage Access intersection will require the provision of a Basic Auxiliary Left (BAL) and Basic Right Lane (BAR) treatment.

7.3 Resultant Turn Treatment Requirements

On the basis of the above, the required turn treatments at each intersection are summarised below in Table 7.3.

Table 7-3 Turn Warrant Existing Treatments and Required Treatments

Intersection	Existing Treatments		Required Treatments	
	Left Turn	Right Turn	Left Turn	Right Turn
Cunningham Highway / Carbean Road / Waraghai Road	AUL	BAR	BAL	BAR
Carbean Road / Site Access / Storage Access	BAL	BAR	BAL	BAR

The turn warrant assessment for all the subject intersections for the construction period (Year 2026) indicated that no intersections required upgrades to any turn treatments. On this basis, the existing turn treatments are sufficient to accommodate the construction volumes for the BESS and no upgrades are required.





8. Road Safety Assessment

Reference to TMRs GTIA indicates that road safety is to be considered at:

- All intersections where the development traffic exceeds 5% of the base traffic for any movement in the design peak periods in the year of opening of each stage.
- All road links where the development traffic exceeds 5% of the base traffic in either direction on the link in the design peak periods in the year of opening of each stage.

Further discussion in this regard is provided below.

8.1 Road Link Safety Scoping Assessment

A summary of the Road link scoping assessment is provided in Table 8-1.

Table 8-1 Link Performance with Baseline Traffic Volumes

Road	Link	AM Peak Hour Volume	PM Peak Hour Volume	Development Volume	Impact %	
					AM	PM
Cunningham Highway	17C	113	178	54vph	48%	30%
Carbean Road	Between the intersection with Cunningham Highway and Site Access Road	39	99	54vph	138%	55%

As shown above, the proposed development does trigger an assessment of road safety impacts for road links.

8.2 Intersection Safety Scoping Assessment

A review of the intersection turning movement volumes indicates that the proposed development exceeds 5% of the existing turn movements at the following intersections:

- Cunningham Highway / Carbean Road / Waraghai Road intersection.
- Carbean Road / Site Access / Storage Access Intersection.

As such, further discussion regarding the road safety risks at these intersections is provided below.

In terms of road safety, TMR's GTIA states:

“Development should ensure that a road's safety is not significantly worsened as a result of development and that any pre-existing or development-introduced unacceptable safety risk is addressed. ‘Significantly worsened’ is defined in terms of the change in the safety risk rating (for example, from low to medium or from medium to high).”

Table 8-2 below details the required safety risk score matrix outlined in the GTIA.





Table 8-2 Risk Safety Matrix

		Potential consequence				
		Property only (1)	Minor injury (2)	Medical treatment (3)	Hospitalisation (4)	Fatality (5)
Potential likelihood	Almost certain (5)	M	M	H	H	H
	Likely (4)	M	M	M	H	H
	Moderate (3)	L	M	M	M	H
	Unlikely (2)	L	L	M	M	M
	Rare (1)	L	L	L	M	M

A summary of the identified risks is provided in the following sections.

8.3 Identified Risks

In identifying risks, it's important to note that the route currently accommodates heavy vehicles including delivery vehicles associated with the MWF. The following road safety risks have been identified.

- Increase to turning movements at the Cunningham Highway / Carbean Road / Waraghai Road intersection;
- Increase to turning movements at the existing Carbean Road / Site Access / Storage Access Intersection; and
- Risk of incidents due to driver fatigue.

8.4 Risk Assessment

The Road Safety Assessment has documented its findings by numbered issues referenced to locations within the study area. Recommendations for potential remedial treatments have been identified and each issue is allocated with a priority, as shown in Table 8-3.



Table 8-3 Specific Issues and Recommendations

Item	Issue Description	Without Development			With Development			Recommendation	Residual Risk		
		L	C	Risk	L	C	Risk		L	C	Risk
1	Increase to turning movements at the Cunningham Highway / Carbean Road / Waraghai Road intersection may result in an increase in incidents at the intersection including through / right incidents.	2	5	M	2	5	M	- Measures to mitigate the identified risks will include monitoring workforce hours, monitoring of driver behaviours, and implementing standard operating procedures. - Drivers will also strictly adhere to existing speed limits and road rules.	2	5	M
2	Increase to Carbean Road / Site Access / Storage Access Intersection Access intersection may result in incidents at the intersection including through / right incidents.	3	3	M	3	3	M	- Measures to mitigate the identified risks will include monitoring workforce hours, monitoring of driver behaviours, and implementing standard operating procedures. - Drivers will also strictly adhere to existing speed limits.	3	3	M
3	Risk of incidents (including veer of carriageway incidents) due to driver fatigue.	2	4	M	2	4	M	- Measures to mitigate the identified risks will include monitoring workforce hours, monitoring of driver behaviours, and implementing standard operating procedures. - Driver fatigue to be managed and overseen by the heavy vehicle operators.	2	4	M





In addition to the above assessment, it is important to note that:

- Cunningham Highway is classified as a gazetted B-double and AB triple haulage route (RT1 route, Road Train Type 1 network);
- The intersections are currently existing heavy vehicle routes for site delivery purposes associated with the MWF;
- The site access intersection was upgraded as part of the MacIntyre Wind Farm application process and includes Basic Left and Basic Right turn lanes;
- Sight distances at the intersection according with Austroads Guide to Road Design;
- The proposed development will result in 54 additional turn movements during both peak periods which results in approximately one (1) vehicle every 1 minute and 6 seconds on average;
- An assessment of the intersection using the SIDRA intersection indicates that queues and delays are acceptable during the post-development design scenario with a significant level of remaining capacity (approximately 65% or 0.649 DOS); and
- No incidents have been reported at the intersection during the last five years.

On the basis of the above, the proposed application is considered to be satisfactory from a road safety perspective.





9. Conclusion

In light of the above, the following concluding statements are made:

- The proposed BESS development is located adjacent to Powerlink Queensland's MacIntyre Intermediate Switching Station (MISS) and Over-Head Transmission Line, and in close proximity to the MacIntyre Wind Farm;
- The proposed BESS will connect to the high-voltage transmission network via the MISS;
- The BESS will function by receiving and storing electricity during periods of low-energy demand or oversupply and export back to the grid during periods of high demand;
- The estimated timing of the construction stage for BESS is the year 2026, A construction period of 18 months is anticipated;
- A total of 80 daily staff are anticipated on-site during the construction period with maximum estimates in the order of 200 construction staff to be on-site during peak periods;
- A total of 54 trips (39 private vehicles & buses and 15 heavy vehicles/delivery vehicles) are anticipated during both the AM and PM peak hours;
- Site investigation has been undertaken for the SISD at the location of the intersections along the haul route. From site investigations and SISD checks, all intersections meet the required sight distance requirements;
- SIDRA analysis confirms all intersections will operate within capacity thresholds of DOS < 0.8 for priority-controlled arrangements and will safely cater for the haulage traffic; and
- Turn Warrant Assessments for the most significant development traffic (construction stage) indicated that the current turn treatments at all study intersections can accommodate the development traffic.

On the basis of the above, the proposed development is considered to be satisfactory from a traffic engineering perspective.

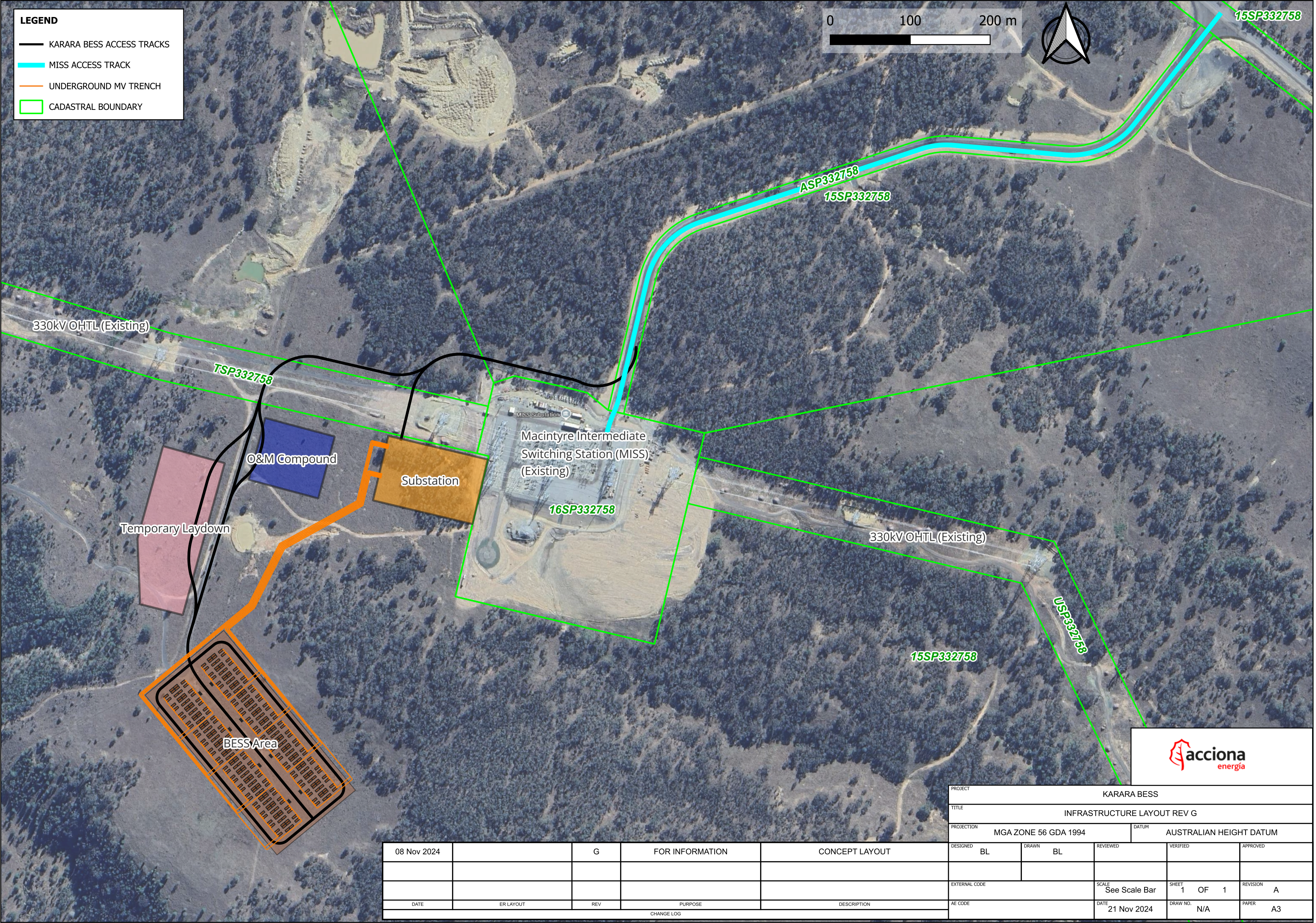




Appendix A – Site Layout

LEGEND

- KARARA BESS ACCESS TRACKS
- MISS ACCESS TRACK
- UNDERGROUND MV TRENCH
- CADASTRAL BOUNDARY



08 Nov 2024		G	FOR INFORMATION	CONCEPT LAYOUT
DATE	ER LAYOUT	REV	PURPOSE	DESCRIPTION
CHANGE LOG				

PROJECT					KARARA BESS				
TITLE					INFRASTRUCTURE LAYOUT REV G				
PROJECTION			MGA ZONE 56 GDA 1994		DATUM		AUSTRALIAN HEIGHT DATUM		
DESIGNED	BL	DRAWN	BL	REVIEWED	VERIFIED	APPROVED			
EXTERNAL CODE			SCALE		SHEET		OF		REVISION
AE CODE			See Scale Bar		1		1		A
			DATE		DRAW NO.		PAPER		
			21 Nov 2024		N/A		A3		

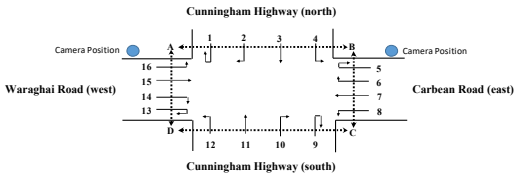


Appendix B – Traffic Count



AUSTRAFFIC VIDEO INTERSECTION COUNT

Site No.: 1 Weather: Fine
Location: Cunningham Highway/Carbean Road, Karara
Day/Date: Tuesday, 14 May 2024
AM Peak: Hour ending - 8:30 AM
PM Peak: Hour ending - 5:15 PM

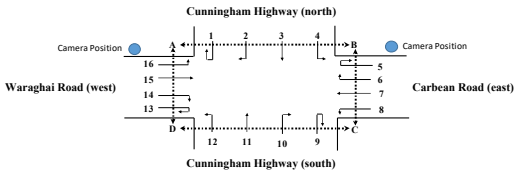


TIME (1/4 hr end)	Movement 1				Movement 2				Movement 3				Movement 4				Movement 5				Movement 6				Movement 7				Movement 8			
	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists
6:15 AM	0	0	0	0	0	0	0	0	2	4	6	0	3	1	4	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0
6:30 AM	0	0	0	0	0	0	0	0	1	2	3	0	8	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 AM	0	0	0	0	0	0	0	0	6	6	12	0	21	1	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 AM	0	0	0	0	0	0	0	0	6	2	8	0	12	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
7:15 AM	0	0	0	0	0	0	0	0	4	4	8	0	9	1	10	0	0	0	0	1	1	2	0	0	0	0	0	1	0	1	0	0
7:30 AM	0	0	0	0	0	0	0	0	9	9	18	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	9	3	9	0	5	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
8:00 AM	0	0	0	0	0	0	0	0	10	3	13	0	7	6	13	0	0	0	0	5	5	10	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	9	1	10	0	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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3 hr Total	0	0	0	0	0	0	0	0	65	21	86	0	74	15	89	0	0	0	0	9	5	14	0	1	0	0	0	4	0	4	0	0
AM Peak	0	0	0	0	0	0	0	0	21	8	29	0	14	10	24	0	0	0	0	5	2	7	0	0	0	0	0	2	0	2	0	0

TIME (1/4 hr end)	Movement 1				Movement 2				Movement 3				Movement 4				Movement 5				Movement 6				Movement 7				Movement 8					
	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists		
4:15 PM	0	0	0	0	0	0	0	0	8	2	10	0	1	0	1	0	0	0	15	1	16	0	0	0	0	0	0	0	0	0	0	0	0	
4:30 PM	0	0	0	0	0	0	0	0	5	1	6	0	0	0	0	0	0	0	26	1	27	0	0	0	0	0	0	0	0	0	0	0	0	
4:45 PM	0	0	0	0	0	0	0	0	9	3	12	0	0	0	2	0	0	0	18	0	18	0	0	0	0	0	0	0	0	0	0	0	0	
5:00 PM	0	0	0	0	0	0	0	0	12	1	13	0	1	2	0	0	0	0	24	0	24	0	2	2	0	0	0	0	0	0	1	1	0	0
5:15 PM	0	0	0	0	0	0	0	0	5	1	6	0	4	1	5	0	0	0	15	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	2	2	4	0	3	0	3	0	0	0	18	0	18	0	0	0	0	0	0	2	0	2	0	0	0	
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6:45 PM	0	0	0	0	0	0	0	0	1	3	4	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:00 PM	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
3 hr Total	0	0	0	0	0	0	0	0	68	34	102	0	23	1	24	0	0	0	146	2	148	0	2	2	0	0	2	0	2	0	0	0	0	0
PM Peak	0	0	0	0	0	0	0	0	21	6	27	0	7	1	8	0	0	0	83	1	84	0	2	2	0	0	0	1	1	1	0	0	0	0

AUSTRAFFIC VIDEO INTERSECTION COUNT

Site No.: 1 Weather: Fine
Location: Cunningham Highway/Carbean Road, Karara
Day/Date: Tuesday, 14 May 2024
AM Peak: Hour ending - 8:30 AM
PM Peak: Hour ending - 5:15 PM



TIME (1/4 hr end)	Movement 9				Movement 10				Movement 11				Movement 12				Movement 13				Movement 14				Movement 15				Movement 16				Pedestrian Movements							
	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	Light Vehicles	Heavy Vehicles	Total	Cyclists	A - B	B - A	B - C	C - B	C - D	D - C	D - A	A - D				
6:15 AM	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
6:30 AM	0	0	0	0	3	1	4	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
6:45 AM	0	0	0	0	0	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
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7:15 AM	0	0	0	0	2	0	2	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
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7:45 AM	0	0	0	0	2	1	3	0	8	1	9	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0				
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9:00 AM	0	0	0	0	0	1	1	0	7	2	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
3 hr Total	0	0	0	0	8	6	13	0	66	22	88	0	2	0	2	0	0	0	0	0	1	0	1	0	1	0	0	0	1	2	0	0	0	0	0	0				
AM Peak	0	0	0	0	3	2	5	0	25	14	39	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				

TIME (1/4 hr end)	Movement 9				Movement 10				Movement 11				Movement 12				Movement 13				Movement 14	
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Appendix C – SIDRA Output



SITE LAYOUT

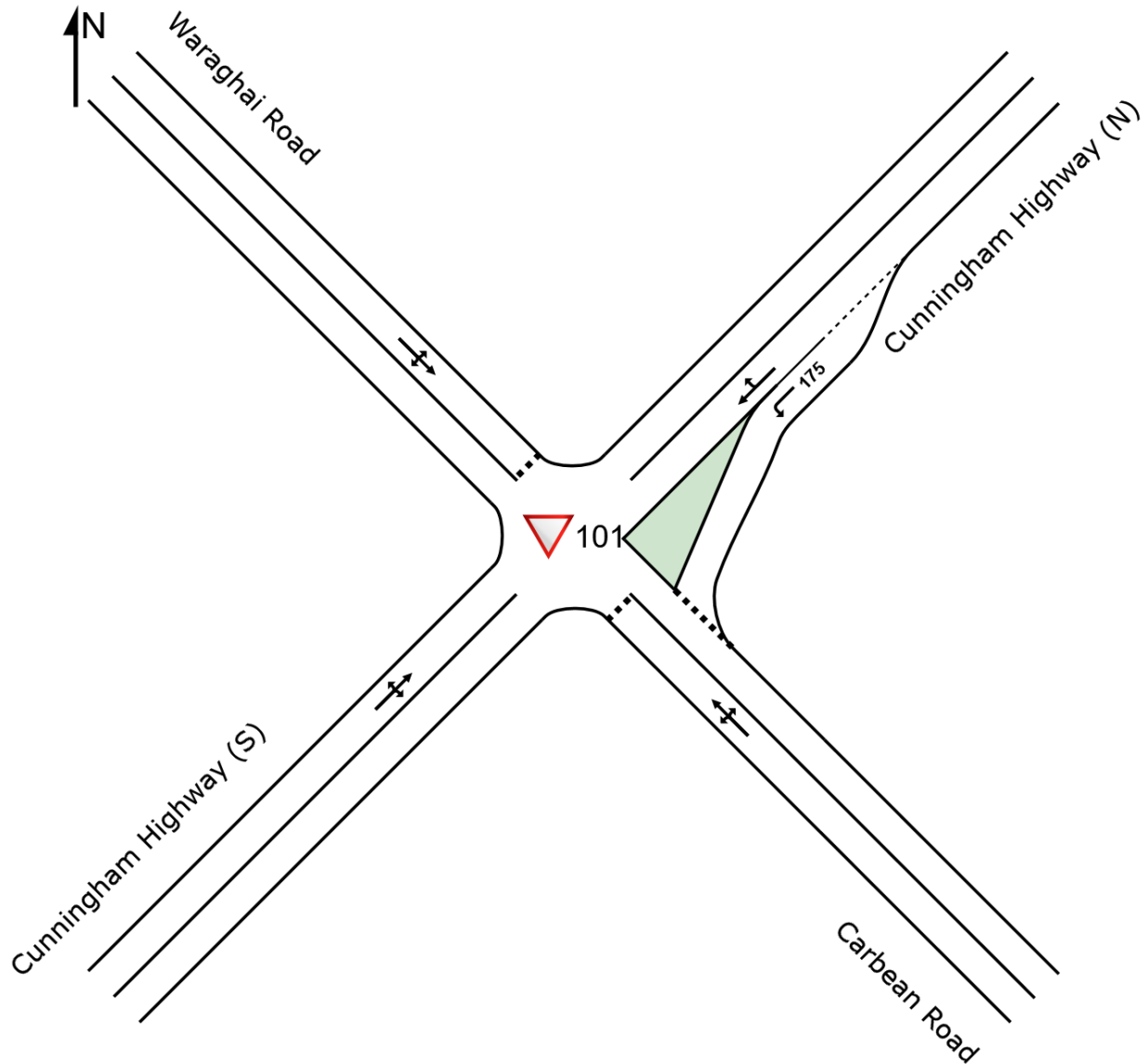
▽ Site: 101 [Cunningham Highway and Carbean Road 2026 BG
AM Peak (Site Folder: Cunningham Highway and Carbean
Road)]

New Site

Site Category: (None)

Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



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Organisation: BURCHILLS ENGINEERING SOLUTIONS | Licence: NETWORK / 1PC | Created: Friday, 6 December 2024 9:57:35 AM

Project: C:\12dS\data\Burchills\SYN\BE240125_BEES Project, Carbean Road, Karara_223\Traffic\SIDRA\20241205 - Karara
2024_Updated.sip9

MOVEMENT SUMMARY

▼ Site: 101 [Cunningham Highway and Carbean Road 2026 BG AM Peak (Site Folder: Cunningham Highway and Carbean Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Carbean Road															
21	L2	All MCs	2	20.0	2	20.0	0.011	5.9	LOS A	0.0	0.3	0.19	0.54	0.19	51.6
22	T1	All MCs	1	20.0	1	20.0	0.011	5.2	LOS A	0.0	0.3	0.19	0.54	0.19	52.1
23	R2	All MCs	7	20.0	7	20.0	0.011	6.4	LOS A	0.0	0.3	0.19	0.54	0.19	51.5
Approach			11	20.0	11	20.0	0.011	6.2	LOS A	0.0	0.3	0.19	0.54	0.19	51.6
NorthEast: Cunningham Highway (N)															
24	L2	All MCs	26	20.0	26	20.0	0.018	5.8	LOS A	0.1	0.6	0.04	0.52	0.04	52.3
25	T1	All MCs	42	20.0	42	20.0	0.025	0.0	LOS A	0.0	0.1	0.01	0.02	0.01	59.8
26	R2	All MCs	1	20.0	1	20.0	0.025	5.7	LOS A	0.0	0.1	0.01	0.02	0.01	56.0
Approach			69	20.0	69	20.0	0.025	2.3	LOS A	0.1	0.6	0.02	0.21	0.02	56.7
NorthWest: Waraghai Road															
27	L2	All MCs	1	20.0	1	20.0	0.003	5.9	LOS A	0.0	0.1	0.16	0.52	0.16	51.9
28	T1	All MCs	1	20.0	1	20.0	0.003	5.1	LOS A	0.0	0.1	0.16	0.52	0.16	52.4
29	R2	All MCs	1	20.0	1	20.0	0.003	6.2	LOS A	0.0	0.1	0.16	0.52	0.16	51.6
Approach			3	20.0	3	20.0	0.003	5.7	LOS A	0.0	0.1	0.16	0.52	0.16	51.9
SouthWest: Cunningham Highway (S)															
30	L2	All MCs	2	20.0	2	20.0	0.029	5.8	LOS A	0.0	0.3	0.04	0.09	0.04	55.7
31	T1	All MCs	42	20.0	42	20.0	0.029	0.0	LOS A	0.0	0.3	0.04	0.09	0.04	59.0
32	R2	All MCs	5	20.0	5	20.0	0.029	5.8	LOS A	0.0	0.3	0.04	0.09	0.04	55.3
Approach			49	20.0	49	20.0	0.029	0.9	NA	0.0	0.3	0.04	0.09	0.04	58.5
All Vehicles			133	20.0	133	20.0	0.029	2.2	NA	0.1	0.6	0.04	0.20	0.04	56.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▼ Site: 101 [Cunningham Highway and Carbean Road 2026 BG PM Peak (Site Folder: Cunningham Highway and Carbean Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
SouthEast: Carbean Road															
21	L2	All MCs	1 20.0		1 20.0		0.103	5.9	LOS A	0.4	2.9	0.22	0.57	0.22	51.5
22	T1	All MCs	2 20.0		2 20.0		0.103	5.2	LOS A	0.4	2.9	0.22	0.57	0.22	52.0
23	R2	All MCs	92 20.0		92 20.0		0.103	6.4	LOS A	0.4	2.9	0.22	0.57	0.22	51.4
Approach			95 20.0		95 20.0		0.103	6.4	LOS A	0.4	2.9	0.22	0.57	0.22	51.4
NorthEast: Cunningham Highway (N)															
24	L2	All MCs	8 20.0		8 20.0		0.006	5.8	LOS A	0.0	0.2	0.02	0.53	0.02	52.4
25	T1	All MCs	40 20.0		40 20.0		0.024	0.0	LOS A	0.0	0.1	0.01	0.02	0.01	59.8
26	R2	All MCs	1 20.0		1 20.0		0.024	5.7	LOS A	0.0	0.1	0.01	0.02	0.01	56.0
Approach			49 20.0		49 20.0		0.024	1.1	LOS A	0.0	0.2	0.01	0.10	0.01	58.3
NorthWest: Waraghai Road															
27	L2	All MCs	1 20.0		1 20.0		0.004	5.9	LOS A	0.0	0.1	0.17	0.53	0.17	51.8
28	T1	All MCs	1 20.0		1 20.0		0.004	5.1	LOS A	0.0	0.1	0.17	0.53	0.17	52.3
29	R2	All MCs	2 20.0		2 20.0		0.004	6.2	LOS A	0.0	0.1	0.17	0.53	0.17	51.5
Approach			4 20.0		4 20.0		0.004	5.9	LOS A	0.0	0.1	0.17	0.53	0.17	51.8
SouthWest: Cunningham Highway (S)															
30	L2	All MCs	1 20.0		1 20.0		0.029	5.8	LOS A	0.0	0.1	0.01	0.03	0.01	56.3
31	T1	All MCs	47 20.0		47 20.0		0.029	0.0	LOS A	0.0	0.1	0.01	0.03	0.01	59.7
32	R2	All MCs	1 20.0		1 20.0		0.029	5.7	LOS A	0.0	0.1	0.01	0.03	0.01	55.9
Approach			49 20.0		49 20.0		0.029	0.2	NA	0.0	0.1	0.01	0.03	0.01	59.6
All Vehicles			198 20.0		198 20.0		0.103	3.5	NA	0.4	2.9	0.11	0.32	0.11	54.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▼ Site: 101 [Cunningham Highway and Carbean Road 2026 WD AM Peak (Site Folder: Cunningham Highway and Carbean Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Carbean Road															
21	L2	All MCs	3	20.0	3	20.0	0.024	5.9	LOS A	0.1	0.6	0.22	0.55	0.22	51.5
22	T1	All MCs	1	20.0	1	20.0	0.024	5.3	LOS A	0.1	0.6	0.22	0.55	0.22	52.0
23	R2	All MCs	18	20.0	18	20.0	0.024	6.6	LOS A	0.1	0.6	0.22	0.55	0.22	51.4
Approach			22	20.0	22	20.0	0.024	6.4	LOS A	0.1	0.6	0.22	0.55	0.22	51.4
NorthEast: Cunningham Highway (N)															
24	L2	All MCs	63	20.0	63	20.0	0.043	5.9	LOS A	0.2	1.4	0.07	0.52	0.07	52.2
25	T1	All MCs	42	20.0	42	20.0	0.025	0.0	LOS A	0.0	0.1	0.01	0.02	0.01	59.8
26	R2	All MCs	1	20.0	1	20.0	0.025	5.7	LOS A	0.0	0.1	0.01	0.02	0.01	56.0
Approach			106	20.0	106	20.0	0.043	3.5	LOS A	0.2	1.4	0.04	0.31	0.04	55.0
NorthWest: Waraghai Road															
27	L2	All MCs	1	20.0	1	20.0	0.003	5.9	LOS A	0.0	0.1	0.17	0.52	0.17	51.9
28	T1	All MCs	1	20.0	1	20.0	0.003	5.1	LOS A	0.0	0.1	0.17	0.52	0.17	52.4
29	R2	All MCs	1	20.0	1	20.0	0.003	6.3	LOS A	0.0	0.1	0.17	0.52	0.17	51.6
Approach			3	20.0	3	20.0	0.003	5.8	LOS A	0.0	0.1	0.17	0.52	0.17	51.9
SouthWest: Cunningham Highway (S)															
30	L2	All MCs	2	20.0	2	20.0	0.035	5.9	LOS A	0.1	0.7	0.07	0.17	0.07	55.0
31	T1	All MCs	42	20.0	42	20.0	0.035	0.1	LOS A	0.1	0.7	0.07	0.17	0.07	58.3
32	R2	All MCs	14	20.0	14	20.0	0.035	5.9	LOS A	0.1	0.7	0.07	0.17	0.07	54.6
Approach			58	20.0	58	20.0	0.035	1.6	NA	0.1	0.7	0.07	0.17	0.07	57.3
All Vehicles			189	20.0	189	20.0	0.043	3.3	NA	0.2	1.4	0.07	0.30	0.07	55.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▼ Site: 101 [Cunningham Highway and Carbean Road 2026 WD PM Peak (Site Folder: Cunningham Highway and Carbean Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Carbean Road															
21	L2	All MCs	9	20.0	9	20.0	0.151	5.9	LOS A	0.6	4.5	0.22	0.57	0.22	51.4
22	T1	All MCs	2	20.0	2	20.0	0.151	5.2	LOS A	0.6	4.5	0.22	0.57	0.22	52.0
23	R2	All MCs	128	20.0	128	20.0	0.151	6.5	LOS A	0.6	4.5	0.22	0.57	0.22	51.3
Approach			140	20.0	140	20.0	0.151	6.4	LOS A	0.6	4.5	0.22	0.57	0.22	51.4
NorthEast: Cunningham Highway (N)															
24	L2	All MCs	19	20.0	19	20.0	0.013	5.8	LOS A	0.1	0.4	0.02	0.53	0.02	52.4
25	T1	All MCs	40	20.0	40	20.0	0.024	0.0	LOS A	0.0	0.1	0.01	0.02	0.01	59.8
26	R2	All MCs	1	20.0	1	20.0	0.024	5.7	LOS A	0.0	0.1	0.01	0.02	0.01	56.0
Approach			60	20.0	60	20.0	0.024	1.9	LOS A	0.1	0.4	0.01	0.18	0.01	57.2
NorthWest: Waraghai Road															
27	L2	All MCs	1	20.0	1	20.0	0.004	5.9	LOS A	0.0	0.1	0.18	0.53	0.18	51.8
28	T1	All MCs	1	20.0	1	20.0	0.004	5.1	LOS A	0.0	0.1	0.18	0.53	0.18	52.3
29	R2	All MCs	2	20.0	2	20.0	0.004	6.3	LOS A	0.0	0.1	0.18	0.53	0.18	51.5
Approach			4	20.0	4	20.0	0.004	5.9	LOS A	0.0	0.1	0.18	0.53	0.18	51.8
SouthWest: Cunningham Highway (S)															
30	L2	All MCs	1	20.0	1	20.0	0.029	5.8	LOS A	0.0	0.1	0.01	0.03	0.01	56.3
31	T1	All MCs	47	20.0	47	20.0	0.029	0.0	LOS A	0.0	0.1	0.01	0.03	0.01	59.7
32	R2	All MCs	1	20.0	1	20.0	0.029	5.7	LOS A	0.0	0.1	0.01	0.03	0.01	55.9
Approach			49	20.0	49	20.0	0.029	0.2	NA	0.0	0.1	0.01	0.03	0.01	59.6
All Vehicles			254	20.0	254	20.0	0.151	4.1	NA	0.6	4.5	0.13	0.37	0.13	54.1

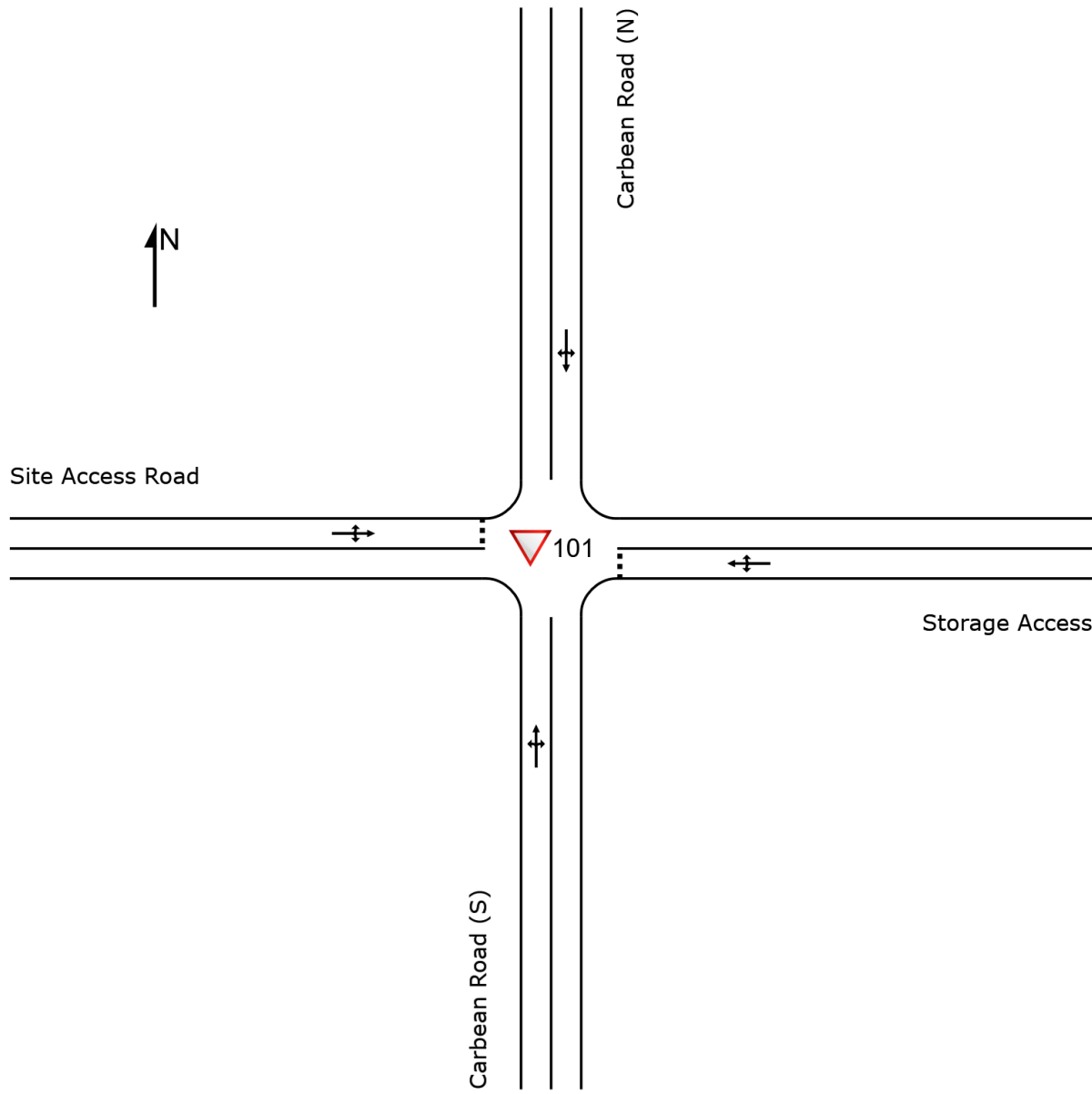
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SITE LAYOUT

▽ Site: 101 [Carbean Road and Site Access Road 2026 BG AM
Peak (Site Folder: Carbean Road and Site Access Road)]

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

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Carbean Road and Site Access Road 2026 BG AM Peak (Site Folder: Carbean Road and Site Access Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

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

Vehicle Movement Performance													
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %	Arrival Flows [Total HV] veh/h %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h	
South: Carbean Road (S)													
1	L2	All MCs	1 20.0	1 20.0	0.007	5.8	LOS A	0.0	0.1	0.03	0.11	0.03	55.5
2	T1	All MCs	9 20.0	9 20.0	0.007	0.0	LOS A	0.0	0.1	0.03	0.11	0.03	58.9
3	R2	All MCs	1 20.0	1 20.0	0.007	5.7	LOS A	0.0	0.1	0.03	0.11	0.03	55.2
Approach			12 20.0	12 20.0	0.007	1.1	NA	0.0	0.1	0.03	0.11	0.03	58.2
East: Storage Access													
4	L2	All MCs	1 20.0	1 20.0	0.003	5.9	LOS A	0.0	0.1	0.12	0.53	0.12	52.1
5	T1	All MCs	1 20.0	1 20.0	0.003	4.6	LOS A	0.0	0.1	0.12	0.53	0.12	52.6
6	R2	All MCs	1 20.0	1 20.0	0.003	5.9	LOS A	0.0	0.1	0.12	0.53	0.12	51.8
Approach			3 20.0	3 20.0	0.003	5.5	LOS A	0.0	0.1	0.12	0.53	0.12	52.2
North: Carbean Road (N)													
7	L2	All MCs	1 20.0	1 20.0	0.019	5.8	LOS A	0.0	0.1	0.01	0.04	0.01	56.2
8	T1	All MCs	32 20.0	32 20.0	0.019	0.0	LOS A	0.0	0.1	0.01	0.04	0.01	59.6
9	R2	All MCs	1 20.0	1 20.0	0.019	5.7	LOS A	0.0	0.1	0.01	0.04	0.01	55.9
Approach			34 20.0	34 20.0	0.019	0.4	NA	0.0	0.1	0.01	0.04	0.01	59.4
West: Site Access Road													
10	L2	All MCs	1 20.0	1 20.0	0.003	5.8	LOS A	0.0	0.1	0.08	0.54	0.08	52.2
11	T1	All MCs	1 20.0	1 20.0	0.003	4.6	LOS A	0.0	0.1	0.08	0.54	0.08	52.7
12	R2	All MCs	1 20.0	1 20.0	0.003	5.9	LOS A	0.0	0.1	0.08	0.54	0.08	51.9
Approach			3 20.0	3 20.0	0.003	5.4	LOS A	0.0	0.1	0.08	0.54	0.08	52.3
All Vehicles			52 20.0	52 20.0	0.019	1.1	NA	0.0	0.1	0.02	0.11	0.02	58.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Carbean Road and Site Access Road 2026 BG PM
Peak (Site Folder: Carbean Road and Site Access Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

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

Vehicle Movement Performance													
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %	Arrival Flows [Total HV] veh/h %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h	
South: Carbean Road (S)													
1	L2	All MCs	1 20.0	1 20.0	0.056	5.8	LOS A	0.0	0.1	0.00	0.01	0.00	56.4
2	T1	All MCs	95 20.0	95 20.0	0.056	0.0	LOS A	0.0	0.1	0.00	0.01	0.00	59.9
3	R2	All MCs	1 20.0	1 20.0	0.056	5.7	LOS A	0.0	0.1	0.00	0.01	0.00	56.1
Approach			97 20.0	97 20.0	0.056	0.1	NA	0.0	0.1	0.00	0.01	0.00	59.8
East: Storage Access													
4	L2	All MCs	1 20.0	1 20.0	0.003	5.8	LOS A	0.0	0.1	0.09	0.53	0.09	52.1
5	T1	All MCs	1 20.0	1 20.0	0.003	4.9	LOS A	0.0	0.1	0.09	0.53	0.09	52.7
6	R2	All MCs	1 20.0	1 20.0	0.003	6.3	LOS A	0.0	0.1	0.09	0.53	0.09	51.8
Approach			3 20.0	3 20.0	0.003	5.7	LOS A	0.0	0.1	0.09	0.53	0.09	52.2
North: Carbean Road (N)													
7	L2	All MCs	1 20.0	1 20.0	0.007	6.0	LOS A	0.0	0.1	0.06	0.12	0.06	55.4
8	T1	All MCs	9 20.0	9 20.0	0.007	0.0	LOS A	0.0	0.1	0.06	0.12	0.06	58.8
9	R2	All MCs	1 20.0	1 20.0	0.007	6.1	LOS A	0.0	0.1	0.06	0.12	0.06	55.1
Approach			12 20.0	12 20.0	0.007	1.1	NA	0.0	0.1	0.06	0.12	0.06	58.1
West: Site Access Road													
10	L2	All MCs	1 20.0	1 20.0	0.003	6.1	LOS A	0.0	0.1	0.21	0.52	0.21	51.8
11	T1	All MCs	1 20.0	1 20.0	0.003	4.9	LOS A	0.0	0.1	0.21	0.52	0.21	52.3
12	R2	All MCs	1 20.0	1 20.0	0.003	6.3	LOS A	0.0	0.1	0.21	0.52	0.21	51.5
Approach			3 20.0	3 20.0	0.003	5.8	LOS A	0.0	0.1	0.21	0.52	0.21	51.9
All Vehicles			115 20.0	115 20.0	0.056	0.5	NA	0.0	0.1	0.02	0.05	0.02	59.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Carbean Road and Site Access Road 2026 WD AM
Peak (Site Folder: Carbean Road and Site Access Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance													
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %	Arrival Flows [Total HV] veh/h %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h	
South: Carbean Road (S)													
1	L2	All MCs	1 20.0	1 20.0	0.007	5.8	LOS A	0.0	0.1	0.03	0.11	0.03	55.5
2	T1	All MCs	9 20.0	9 20.0	0.007	0.0	LOS A	0.0	0.1	0.03	0.11	0.03	58.9
3	R2	All MCs	1 20.0	1 20.0	0.007	5.7	LOS A	0.0	0.1	0.03	0.11	0.03	55.2
Approach			12 20.0	12 20.0	0.007	1.1	NA	0.0	0.1	0.03	0.11	0.03	58.2
East: Storage Access													
4	L2	All MCs	1 20.0	1 20.0	0.003	5.9	LOS A	0.0	0.1	0.15	0.52	0.15	52.0
5	T1	All MCs	1 20.0	1 20.0	0.003	4.8	LOS A	0.0	0.1	0.15	0.52	0.15	52.5
6	R2	All MCs	1 20.0	1 20.0	0.003	6.3	LOS A	0.0	0.1	0.15	0.52	0.15	51.7
Approach			3 20.0	3 20.0	0.003	5.6	LOS A	0.0	0.1	0.15	0.52	0.15	52.1
North: Carbean Road (N)													
7	L2	All MCs	1 20.0	1 20.0	0.048	5.8	LOS A	0.2	1.7	0.06	0.35	0.06	53.6
8	T1	All MCs	32 20.0	32 20.0	0.048	0.0	LOS A	0.2	1.7	0.06	0.35	0.06	56.7
9	R2	All MCs	46 20.0	46 20.0	0.048	5.7	LOS A	0.2	1.7	0.06	0.35	0.06	53.3
Approach			79 20.0	79 20.0	0.048	3.4	NA	0.2	1.7	0.06	0.35	0.06	54.6
West: Site Access Road													
10	L2	All MCs	12 20.0	12 20.0	0.010	5.8	LOS A	0.0	0.3	0.06	0.55	0.06	52.0
11	T1	All MCs	1 20.0	1 20.0	0.010	4.6	LOS A	0.0	0.3	0.06	0.55	0.06	52.5
12	R2	All MCs	1 20.0	1 20.0	0.010	6.0	LOS A	0.0	0.3	0.06	0.55	0.06	51.7
Approach			14 20.0	14 20.0	0.010	5.7	LOS A	0.0	0.3	0.06	0.55	0.06	52.0
All Vehicles			107 20.0	107 20.0	0.048	3.5	NA	0.2	1.7	0.06	0.35	0.06	54.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▼ Site: 101 [Carbean Road and Site Access Road 2026 WD PM
Peak (Site Folder: Carbean Road and Site Access Road)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance													
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %	Arrival Flows [Total HV] veh/h %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h	
South: Carbean Road (S)													
1	L2	All MCs	1 20.0	1 20.0	0.056	5.8	LOS A	0.0	0.1	0.00	0.01	0.00	56.4
2	T1	All MCs	95 20.0	95 20.0	0.056	0.0	LOS A	0.0	0.1	0.00	0.01	0.00	59.9
3	R2	All MCs	1 20.0	1 20.0	0.056	5.7	LOS A	0.0	0.1	0.00	0.01	0.00	56.1
Approach			97 20.0	97 20.0	0.056	0.1	NA	0.0	0.1	0.00	0.01	0.00	59.8
East: Storage Access													
4	L2	All MCs	1 20.0	1 20.0	0.003	5.8	LOS A	0.0	0.1	0.10	0.53	0.10	52.0
5	T1	All MCs	1 20.0	1 20.0	0.003	4.9	LOS A	0.0	0.1	0.10	0.53	0.10	52.6
6	R2	All MCs	1 20.0	1 20.0	0.003	6.7	LOS A	0.0	0.1	0.10	0.53	0.10	51.7
Approach			3 20.0	3 20.0	0.003	5.8	LOS A	0.0	0.1	0.10	0.53	0.10	52.1
North: Carbean Road (N)													
7	L2	All MCs	1 20.0	1 20.0	0.014	6.1	LOS A	0.1	0.5	0.20	0.35	0.20	53.3
8	T1	All MCs	9 20.0	9 20.0	0.014	0.3	LOS A	0.1	0.5	0.20	0.35	0.20	56.4
9	R2	All MCs	12 20.0	12 20.0	0.014	6.1	LOS A	0.1	0.5	0.20	0.35	0.20	53.0
Approach			22 20.0	22 20.0	0.014	3.6	NA	0.1	0.5	0.20	0.35	0.20	54.4
West: Site Access Road													
10	L2	All MCs	46 20.0	46 20.0	0.037	6.1	LOS A	0.1	1.2	0.21	0.54	0.21	51.5
11	T1	All MCs	1 20.0	1 20.0	0.037	5.0	LOS A	0.1	1.2	0.21	0.54	0.21	52.0
12	R2	All MCs	1 20.0	1 20.0	0.037	6.5	LOS A	0.1	1.2	0.21	0.54	0.21	51.2
Approach			48 20.0	48 20.0	0.037	6.1	LOS A	0.1	1.2	0.21	0.54	0.21	51.5
All Vehicles			171 20.0	171 20.0	0.056	2.4	NA	0.1	1.2	0.09	0.22	0.09	56.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
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Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.