



Reach
SOLAR ENERGY

APPENDIX **M**

TRAFFIC IMPACT ASSESSMENT (SLR Report)

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August 2018

SLR 

YARRABEE SOLAR PROJECT

Environmental Impact Statement - Appendix M Traffic Impact Assessment

Prepared for:

Reach Solar énergy
Level 16, 461 Bourke Street
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Reach Solar énergy (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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ATTACHMENTS

Attachment A	Preliminary Layout
Attachment B	Detailed Intersection Assessment Results

1 Introduction

1.1 Context

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Reach Solar énergy (Reach Solar) to prepare a Traffic Impact Assessment (TIA) for a large-scale solar development in Western New South Wales (NSW). Reach Solar is proposing the staged development of the 900 MegaWatt Alternating Current (MWac) Yarrabee Solar Project (the Project) to be located approximately 23 kilometres (km) southwest of Narrandera.

The Project will potentially occupy 2,600 hectares (ha) within a 3,000 ha Project site and is planned to include solar photovoltaic (PV) modules mounted on single axis tracking systems, inverter stations, a new substation, potential energy storage, grid connection, security perimeter fencing, internal access roads, underground cabling and a project site office and maintenance workshop.

A preliminary layout plan is reproduced at **Attachment A**.

1.2 Statutory Requirements

This TIA has been prepared to form part of the Environmental Impact Statement (EIS), which identifies and assesses the potential environmental impacts associated with construction, operation and decommissioning of the Project. SLR has prepared this EIS on behalf of the proponent, Reach Solar.

This EIS has been prepared in accordance with Part 4 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) to support a Development Application (DA) to be lodged with NSW Department of Planning and Environment (DP&E).

The report has been prepared to provide sufficient information about the Project to the DP&E in response to the Secretary's Environmental Assessment Requirements (SEARs).

1.3 Assessment Scope

The TIA has been carried out in accordance with the Road and Transport Authority (RTA) Technical Direction *Land Use Development Assessment RTA Guidelines* which provides the methodology for assessing a project's potential transport impacts. The objective of the TIA is to identify the potential impacts of the Project on the State-controlled and Council-controlled road networks, and where appropriate, identify management and mitigation strategies.

The TIA has been completed in response to the *Yarrabee Solar (SSD 9237) Environmental Assessment Requirements* (EAR) issued by DP&E on 19 April 2018, which includes the following transport-related requirements:

- *An assessment of the site access routes (including Newell Highway, Sturt Highway, Morundah Road, Back Morundah Road and Yamma Road) – discussed in Section 7 and 8;*
- *Assessment of site access points – discussed in Sections 7;*
- *Any potential rail safety issues and likely transport impacts (including peak and average traffic generation, over-dimensional vehicles and construction worker transportation) of the development on the capacity condition of roads (including on any Crown land) – discussed in Sections 3, 5, 7 and 8;*

- A description of the measures that would be implemented to mitigate any impacts during construction (including cumulative impacts from nearby developments) – **discussed in Sections 4, 7 and 8**; and
- A description of any proposed road upgrades developed in consultation with the relevant road and rail authorities (if required) – **discussed in Sections 7 and 8**.

1.4 Report Structure

Table 1 details the structure of the TIA, including a brief description of the content of each section.

Table 1 TIA Report Structure

Section	Description
1	Identifies the context, statutory requirements and the assessment scope.
2	Describes the project including location, site design and access arrangements.
3	Describes the existing transport network including traffic volumes, crash history, bus services and rail infrastructure.
4	Details the future road network conditions including improvements planned by road authorities as well as the likely cumulative impacts associated with nearby developments.
5	Details the project generated traffic demands and assessed traffic volumes.
6	Outlines the scope of the road network performance assessment measures including the relevant performance criteria and assessment methodology adopted for the TIA.
7	Presents the assessments undertaken for the study road network.
8	Presents consideration of the potential pavement impacts and cross-sectional requirements associated with the Project's transport task.
9	Identifies the requirements in relation to the future preparation of a Road-Use Management plan.
10	Summarises the findings of the assessment and recommends approval conditions.

2 Project Description

2.1 Overview

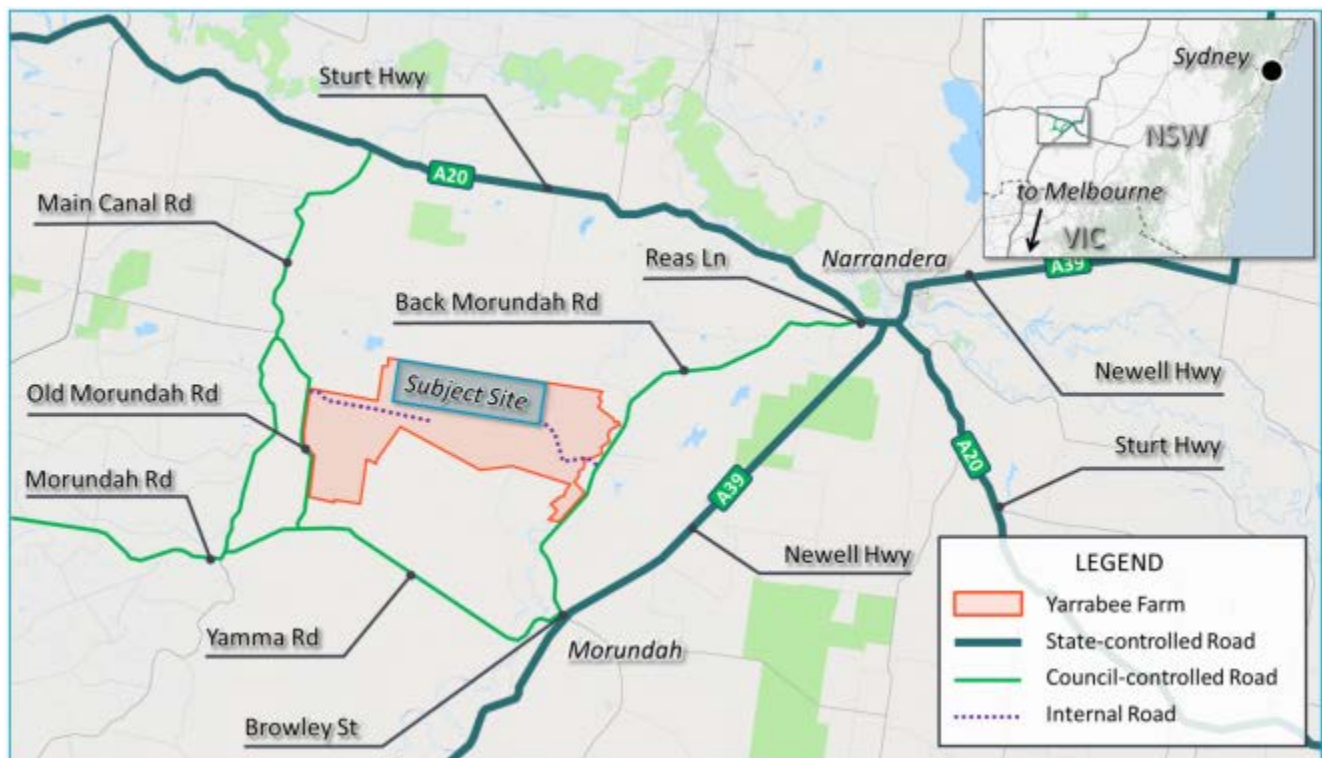
The Project comprises the construction of a 900 MWac PV solar project to be developed in stages. The site is bounded to the north, south and west by flat, grassy landscapes that are rural in nature, to the east the site is bounded by the Washpen Creek. There are a number of small dams on site as well as some sparse stands of existing vegetation. The Project site is illustrated on **Figure 1**.

The majority of the land adjoining and surrounding the Project site is within Narrandera Shire Council, with a smaller section of the Project site situated within Murrumbidgee Shire Council. The Project site is zoned “RU1 – Primary Production” under the provisions of the Local Environment Plan 2013 for both local government areas (LGA).

The Project will consist of PV panel arrays supported by galvanised steel piles that will typically be either driven or screwed into place. The exact location for the placement of the individual PV arrays is still to be determined. Based upon currently available PV panel technology, it is estimated that approximately 3 million panels will be required if the full 900 MWac project is ultimately developed.

The Project proposes the use of single-axis tracking arrays which will tilt to follow the sun as it tracks east to west throughout the day, in order to maximise the amount of sunlight made available to the panels. The height of the panels will be sufficiently above the natural ground level to provide access to the panels for maintenance. The Project will be decommissioned at the end of its operational life.

Figure 1 Site Location



Source: Google, Note: Site bounds indicative only.

2.2 Summarised Particulars

Table 2 provides a detailed summary of the project tasks, fleet, infrastructure and workforce relevant to the TIA. Readers requiring further details in relation to the Project description are directed to refer to the relevant sections of the main EIS report.

Table 2 Detailed Project Summary

Description	Commentary
Construction Tasks	• Preparation of the site including site mark-out and establishment of buffer zones; • Erection of the temporary and permanent security fencing; • Establishment of the temporary and permanent road access; • Piling for the panel tracking system; • Installation of the single-axis tracking system to the piles; • Affixing solar panels to the single-axis tracking system; • Completion of trenching for the cable runs, laying of cables and backfilling of cable trenches; • Preparation of foundations for the inverter and transformer cabinets; • Installation of the inverter and transformer cabinets; • Completion of the solar array cable, inverter and transformer connections; • Installation of the communications system; • Construction of the potential energy storage including associated hardstands; • Construction of the substation for, and connection to the existing transmission line; and • Construction of the permanent operations and maintenance facilities.
Construction Fleet	• Excavators for cable trenching; • Dump trucks (or relocation and/or removal of excavation spoil); • Compaction rollers for soil compaction; • Piling machines for installation of tracking system piles; • Telehandlers for distribution of materials including piles, tracking system, solar panels, cables, etc.; and • Mobile cranes for lifting equipment for transformers, inverters, etc.

2.3 Project Programme

2.3.1 Construction Period

The number of stages ultimately constructed will be dependent on factors including:

- Establishment of contractual obligations for the purchase of electricity with one or more third-parties;
- Capacity of the external high voltage transmission network to export generated electricity; and
- the future schedule for upgrading the high voltage transmission network.

For the purposes of the TIA, a nominal construction scenario has been assessed whereby it has been assumed that the Project will be constructed in three stages with each stage taking approximately 18 months to complete. Adoption of this assumption results in an assumed 4.5 year total construction period. It is important to note that this construction scenario has been derived for the purposes of the TIA and whilst it is considered to provide a representative scenario for assessment of potential traffic impacts the ultimate construction staging is likely to vary somewhat from this nominal scenario. Nevertheless, the assumed construction scenario has been developed in consultation with Reach Solar and who have advised that it is feasible and realistic albeit the ultimate staging will likely vary slightly dependant on market conditions.

2.3.2 Operation and Decommissioning Period

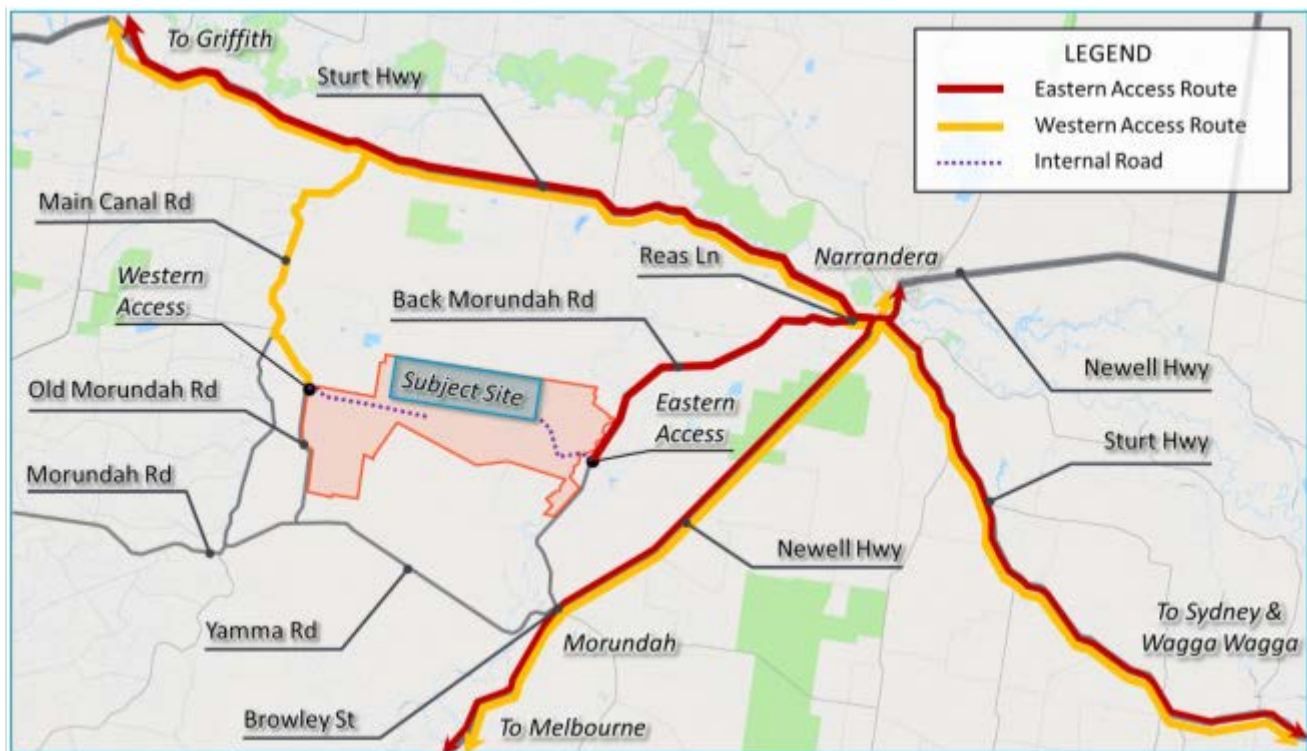
The Project is expected to operate for between 30 to 50 years providing short, medium and long term local employment opportunities. The proponent is obliged to decommission the plant and rehabilitate the site at the end of its operational life if the lease is not renewed. This would involve the removal of all above ground infrastructure and returning the site to its existing land capacity.

2.4 Access

The site will be accessed by two potential access routes as illustrated in **Figure 2**.

Internal access tracks will be utilised throughout to facilitate vehicle movements between the external road network access points, site offices, inverter compounds and construction areas. The primary access roads that facilitate access from the external network are existing unsealed roads that are used by the landholder for farming operations.

Figure 2 Proposed Access Routes



Source: Google, Note: Site bounds indicative only.

2.5 Construction Phase

2.5.1 Activities

For the purposes of forecasting peak project traffic demands associated with each stage of construction, the following construction activities are anticipated for each project stage:

- Phase One – Site clearance and access roads;
- Phase Two – Establish site compounds;
- Phase Three – Delivery and installation of electrical equipment.

2.5.2 Workforce

Table 3 details the forecast construction phase workforce associated with the Project (indicative only).

Table 3 Construction Workforce

Element	Assumption
Workforce	150 persons on site (135 Labourers, 15 Supervisors)
Shift Rotation	Up to 12 hours during daylight
Accommodation	50% East (towards Narrandera), 50% East (towards Wagga Wagga)

Note: For the purposes of the TIA assessment, SLR has adopted a 50/50 split between Narrandera and Wagga Wagga for the workforce accommodation. This is currently considered the most likely workforce accommodation arrangement however this assumption may be subject to change post-EIS approval once the Engineering, Procurement and Construction (EPC) contract is awarded. Any significant changes from the assumptions presented herein post the EIS approval would be captured by the future Road-use Management Plan prepared by the proponent (or the EPC contractor on their behalf) as discussed in Section 9.

2.5.3 Materials

Table 4 presents the forecast material requirements (indicative only) during the Project's entire construction phase.

Table 4 Indicative Construction Material Requirements for full 900 MWac Construction Period

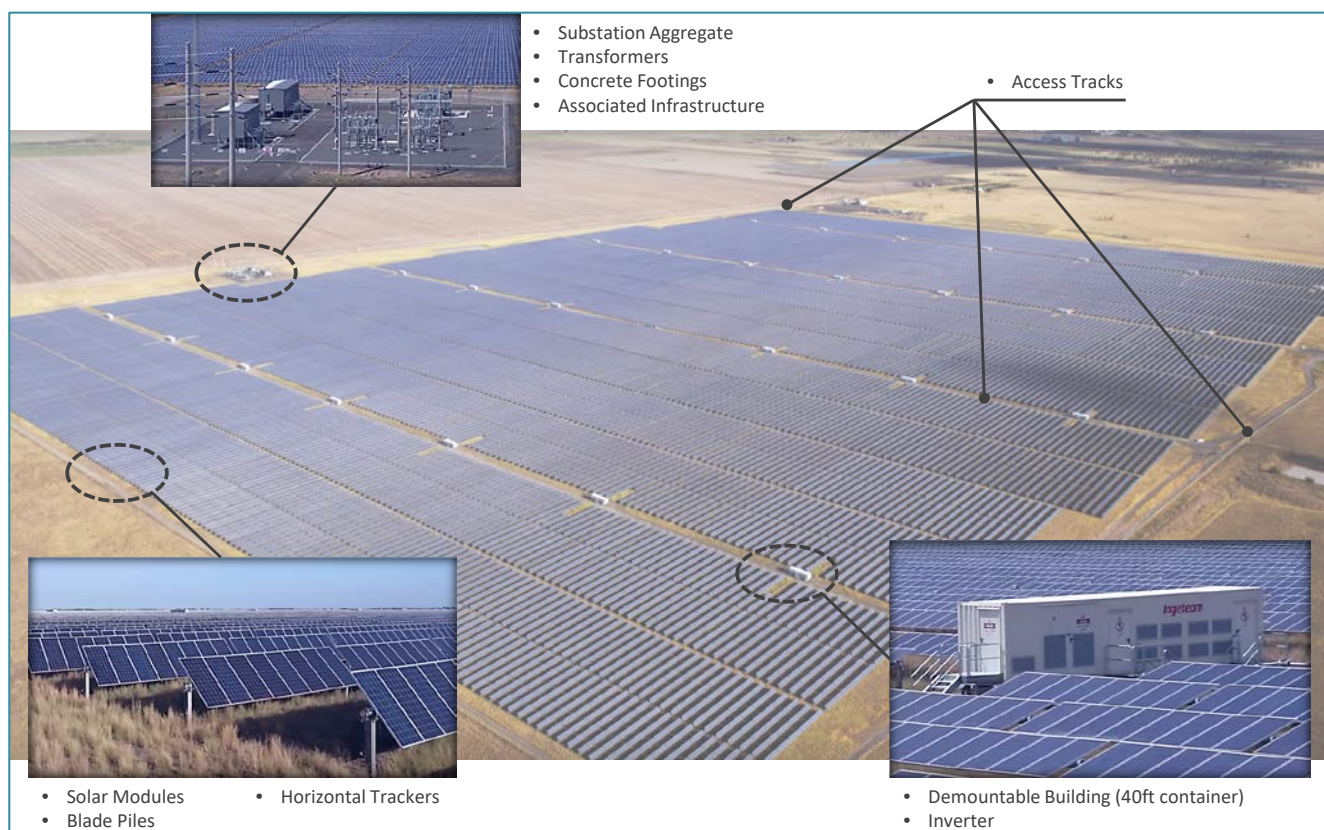
Material/Component	Quantity
Phase One – Site Clearance and Access Roads	
Access Track Road Base	23,750t
Road Surface	4,750t
Fencing	30,000m
Demountable Buildings	12
Phase Two – Establish Site Compounds	
Concrete	1,750m ³
Compound Aggregate	2,375t
Substation Aggregate	11,875t
Phase Three – Delivery and Installation of Electrical Equipment	

Material/Component	Quantity
Upright Piles	450,000
Tracking Horizontals	390,000
Solar Panels	3,000,000
AC Reticulation	85,000m
DC Reticulation	2,700,000m
Inverters	450 units
Battery Storage	30 units
Power Conditioning Units	220 units

Note: Quantities are indicative only, with large figured rounded to the nearest 1,000.

Figure 3 provides a visual representation of a comparable, albeit smaller Australian solar project located in Moree, NSW to aid interpretation of the material estimates presented in **Table 4**.

Figure 3 Visual Summary of Moree Solar Project



Source: NEXTracker, composite of images prepared by SLR

2.6 Operational Phase

2.6.1 Activities

During the Project's operational phase, activities requiring large numbers of workforce on-site will be unlikely.

It is understood that for the majority of the Project's life, operations will include a select number of routine tasks involving cleaning of solar modules and maintenance of electrical components, vegetation and fencing maintenance.

An example of the vehicle type likely to be associated with solar module cleaning and maintenance is shown on **Figure 4**. The external movements associated with these tasks will generally be performed by light to medium rigid vehicles.

Figure 4 Sample Module Cleaning Procedures



Source: NEXTracker

2.6.2 Workforce

Table 5 details the forecast construction phase workforce associated with the ongoing operation and maintenance of the Project.

Table 5 Operation Workforce

Element	Assumption
Permanent Workforce	5-15 Staff
Contractor Workforce	Up to an additional 10 Staff
Shift Rotation	Up to 12 hours during daylight
Workforce Distribution	50% East (towards Narrandera), 50% East (towards Wagga Wagga)

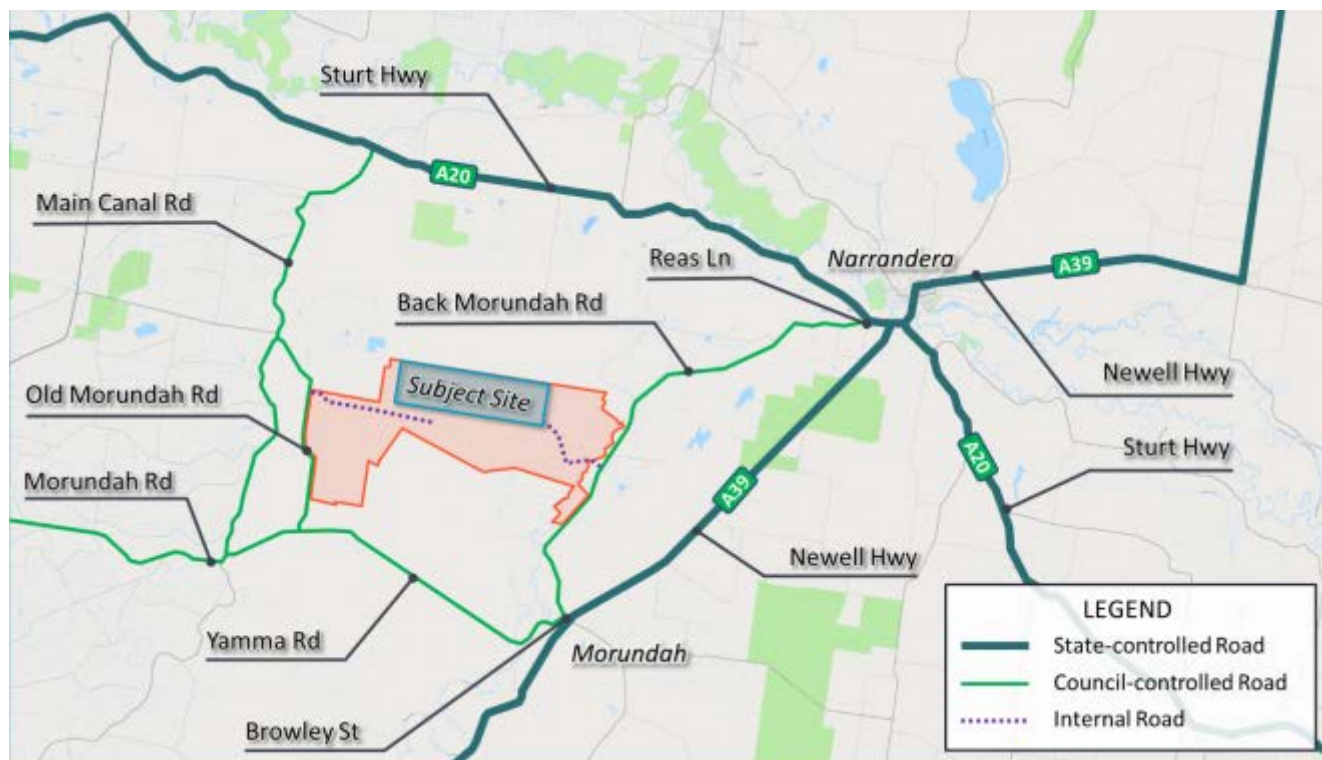
Source: Reach Solar, Note: Maximum operational workforce calculated by adopting a 'worst-case' scenario with all permanent and sub-contracted personnel on-site at any particular time.

3 Existing Road Conditions

3.1 Road Network

The key roads located within proximity to the site are illustrated on **Figure 5**, with the detailed road characteristics summarised in **Table 6**.

Figure 5 Road Network



Source: Google, Note: Site bounds indicative only.

Table 6 Road Network

Road Name	Jurisdiction	LGA Classification
Sturt Highway	Roads and Maritime Service	State Road
Newell Highway	Roads and Maritime Service	State Road
Reas Lane	Narrandera Shire Council	Local Road
Back Morundah Road	Narrandera Shire Council	Local Road
Browley Street	Federation Council	-
Main Canal Road	Murrumbidgee Council	-
Old Morundah Road	Murrumbidgee Council	-
Morundah Road	Murrumbidgee Council	-
Yamma Road	Federation Council	-

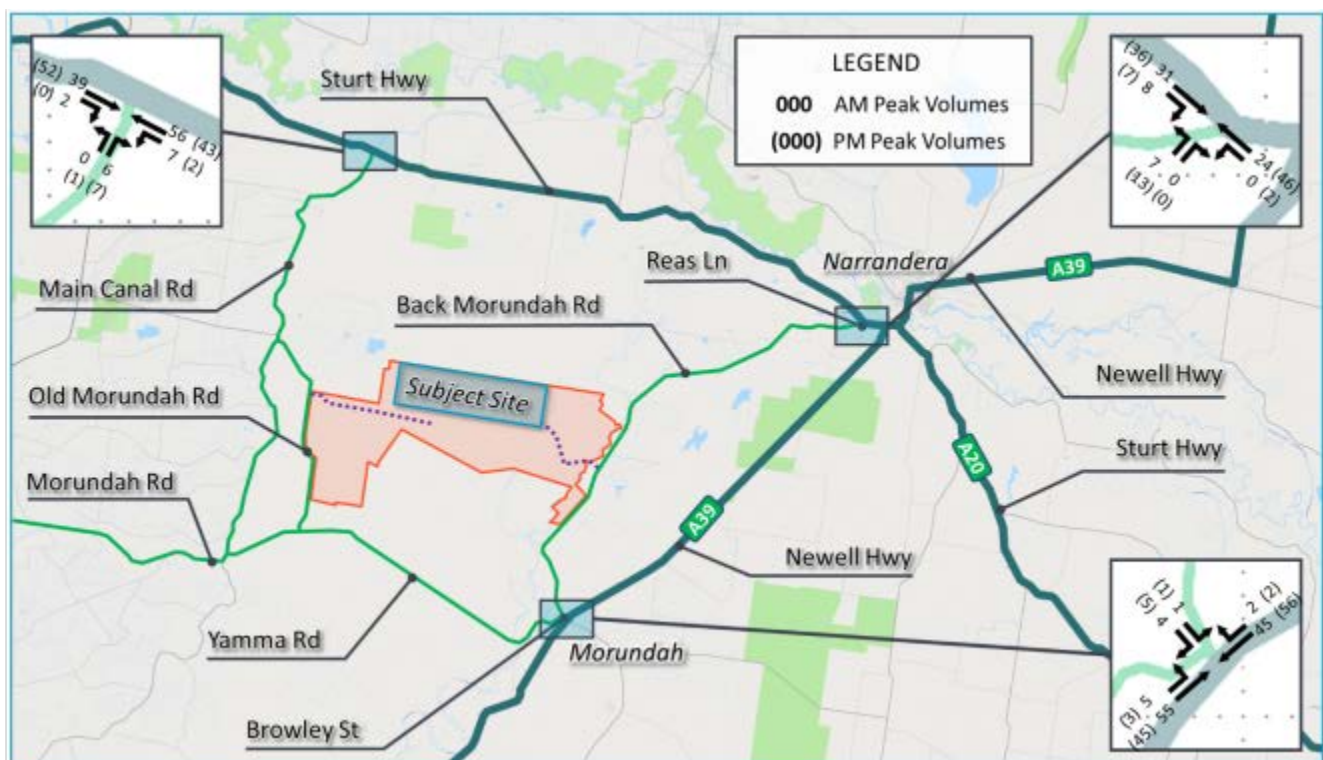
3.2 Intersection Traffic Volumes

SLR commissioned traffic surveys at the following intersections to inform the TIA:

- Sturt Highway / Reas Lane (Back Morundah Road);
- Sturt Highway / Main Canal Road; and
- Newell Highway / Browley Street (Back Morundah Road).

The surveyed traffic volumes are summarised on **Figure 6**.

Figure 6 2018 Survey Volumes



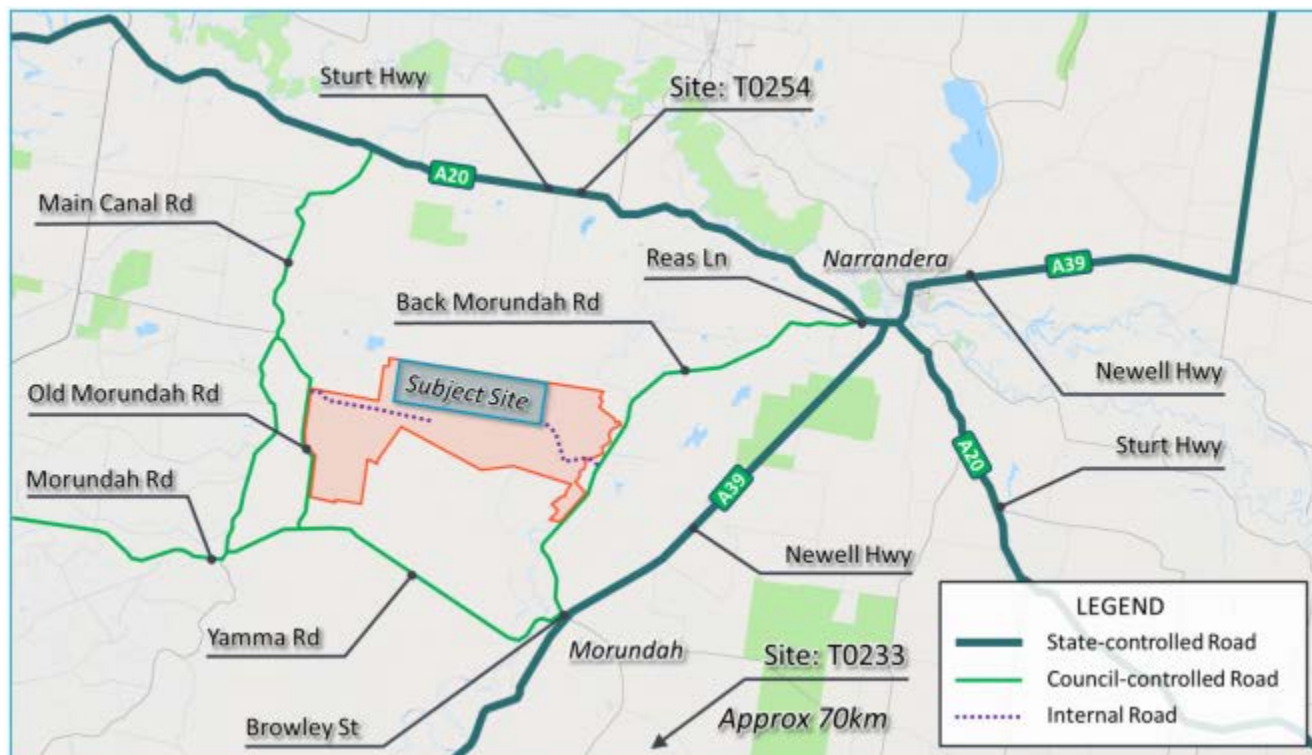
Source: Google, Trans Traffic Survey, Note: Site bounds indicative only.

3.3 Historic Traffic Growth

Annual Average Daily Traffic Data (AADT) for the State-controlled road network has been sourced to inform the future traffic growth projections utilising the count locations illustrated on **Figure 7**.

The observed historical growth is summarised in **Table 7**.

Figure 7 AADT Count Locations



Source: Google, RMS, Note: Site bounds indicative only.

Table 7 Daily Traffic Volumes

Road Name	Site ID	Description	Count Year	AADT	% HV	Growth	Period	Source
Sturt Highway	T0254	240m North of Innisvale Road, Euroley 2700	2018	1,164	37%	1.11%	*3 years	RMS
Newell Highway	T0233	330m East of Showground Road, Jerilderie 2716	2018	1,858	41%	-1.78%	*3 years	RMS

Source: RMS, Note: 3 years is the largest available historic data collection period

It is noted that there are no AADT count locations along the Newell Highway within the immediate proximity to the Project site, with the closest permanent counter being located some 95 km southwest of Narrandera.

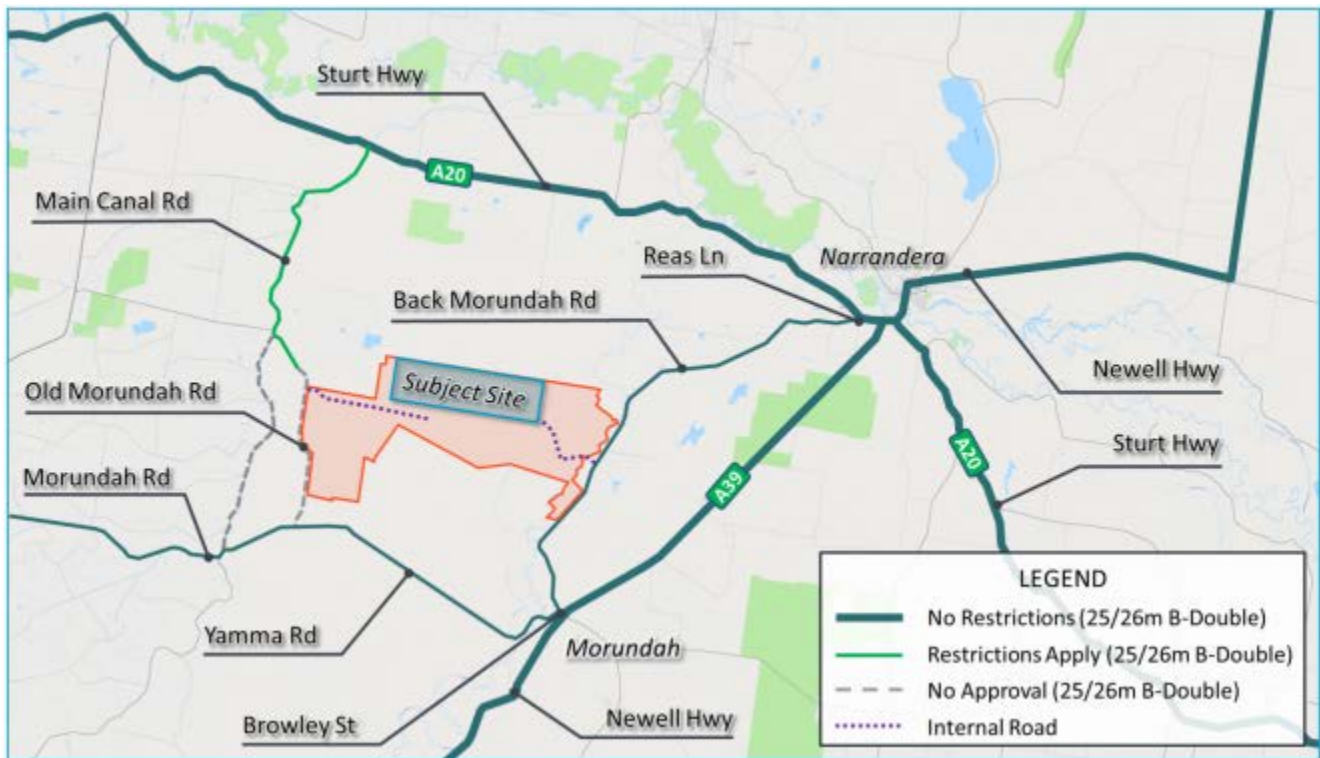
Despite the distance between the Project site and the Newell Highway count location, it is considered that the traffic growth identified at this AADT count location would be generally representative of the historic growth patterns experienced along the State-controlled network in proximity to the Project site.

3.4 National Heavy Vehicle Regulator Approved Routes

A review of the National Heavy Vehicle Regulator (NHVR) approved routes has been completed in order to identify any potential constraints associated with construction vehicle access.

Figure 8 illustrates the existing approved NHVR routes.

Figure 8 B-Double (25/26m) – Existing Approved Routes



Source: Google, NHVR, Note: Site bounds indicative only.

Table 8 summarises the existing NHVR road use conditions for B-Double (25/26m) movement. It is noted that, subject to appropriate upgrade works being implemented and relevant approvals obtained, these existing road use conditions could potentially be modified subject to road authority approval as described later in **Section 8**.

Table 8 NHVR Route Restriction Conditions

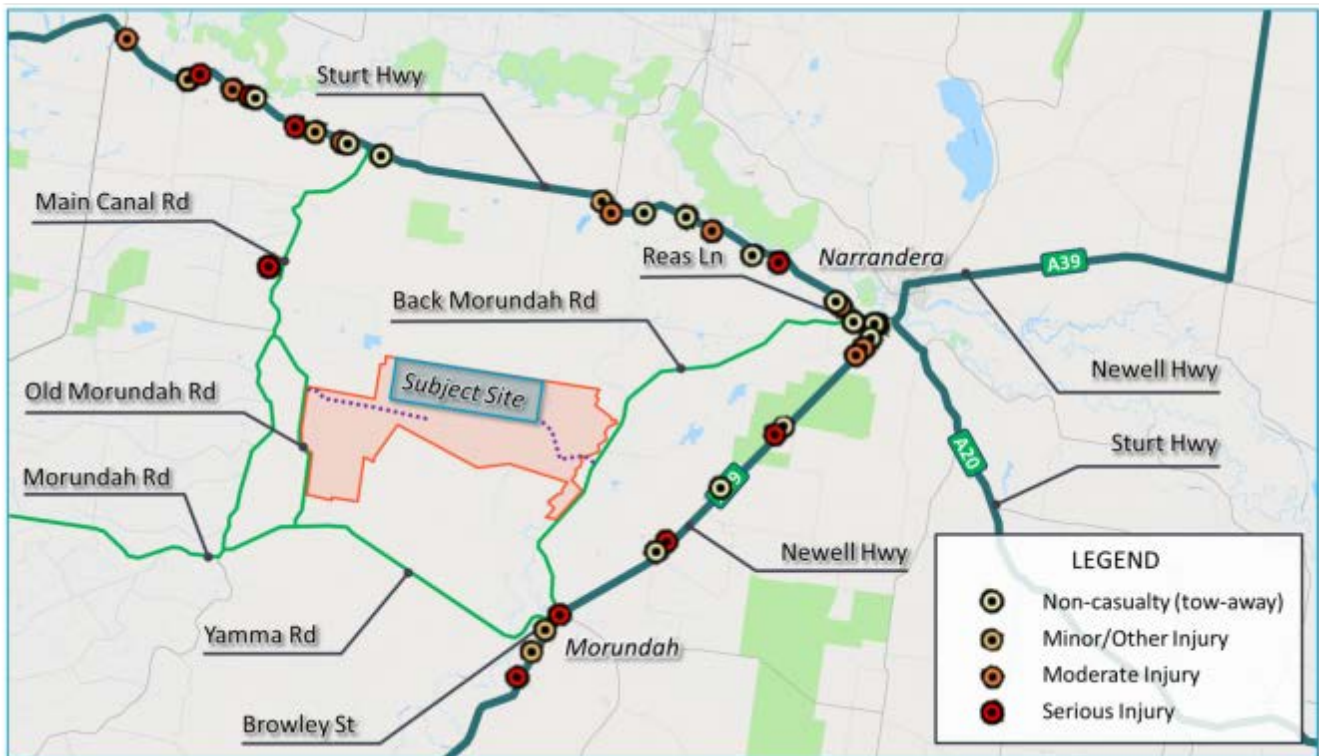
Road Name	Description	Travel Description
Newell Highway	No Restrictions (with HML)	- No restrictions identified along this section of Newell Highway. - Also allows provisions for payloads of a Higher Mass Limit (HML).
Sturt Highway	No Restrictions (with HML)	- No restrictions identified along this section of Newell Highway. - Also allows provisions for payloads of a Higher Mass Limit (HML).
Back Morundah Road (including Reas Lane & Browley Street)	No Restrictions (No HML):	- No restrictions identified along this section of Newell Highway; - Not approved for Higher Mass Limit (HML) payloads.
Main Canal Road	From Sturt Highway to Old Morundah Road – Restrictions Apply	80km/h Speed limit on sealed roads; 70km/h Speed limit on unsealed roads; and - No access during school bus times. - Road conditions: - Single Lane Traffic on all bridge (no overtaking or passing); - Max 20t Tri-axle loading on B-doubles and Road Trains; and - No heavy vehicle movements during wet weather and a minimum of 48hours after the rain has ceased.
Old Morundah Road	From Main Canal Road to Tubbo Farm Gate – Restrictions Apply	80km/h Speed limit on sealed roads; 70km/h Speed limit on unsealed roads; and - No access during school bus times. - Road conditions: - Single Lane Traffic on all bridge (no overtaking or passing); - Max 20t Tri-axle loading on B-doubles and Road Trains; and - No heavy vehicle movements during wet weather and a minimum of 48hours after the rain has ceased.

Source: NHVR, Note: These route restrictions are for existing operations approved for the site to the north of the subject site and whilst the wet weather restriction strictly relates to the whole section of road, it is assumed that in practice it is only relevant to the existing unsealed sections.

3.5 Crash History

Figure 9 details the crash data sourced from the RMS *Interactive Crash Statistics* portal (http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tblga=4) for all crashes occurring between 2012-2017 on the study road network.

Figure 9 Study Road Network Crash Data



Source: Google, RMS, Note: Site bounds indicative only.

The supplied data indicates that a number of crashes were recorded during the data collection period. The data indicates that a fatal crash occurred during 2017 on approach to the Sturt Highway / Reas Lane intersection. The crash is reported as being associated with a vehicle overtaking and colliding with a turning vehicle. A second tow away crash is reported as having occurred during 2013 and as having been associated with a vehicle travelling westbound failing to track the right hand curve at the intersection.

3.6 Bus Routes

Table 9 details the scheduled public long distance and private school bus routes currently operating in the vicinity of the Project site. Services travelling through Narrandera utilise both the Newell Highway and Sturt Highway, accounting for major east-west and north-south routes. It is noted that no services have been identified that travel along the study Council-controlled roads.

The routes associated with the school bus services identified in **Table 9** are subject to modification over time in response to changes in the residential address of students. It should therefore be assumed that school bus services may also potentially utilise the two access routes servicing the Project and consideration of this use should therefore occur as part of the future preparation of the RMP closer to commencement of construction.

Table 9 Surrounding Bus Services

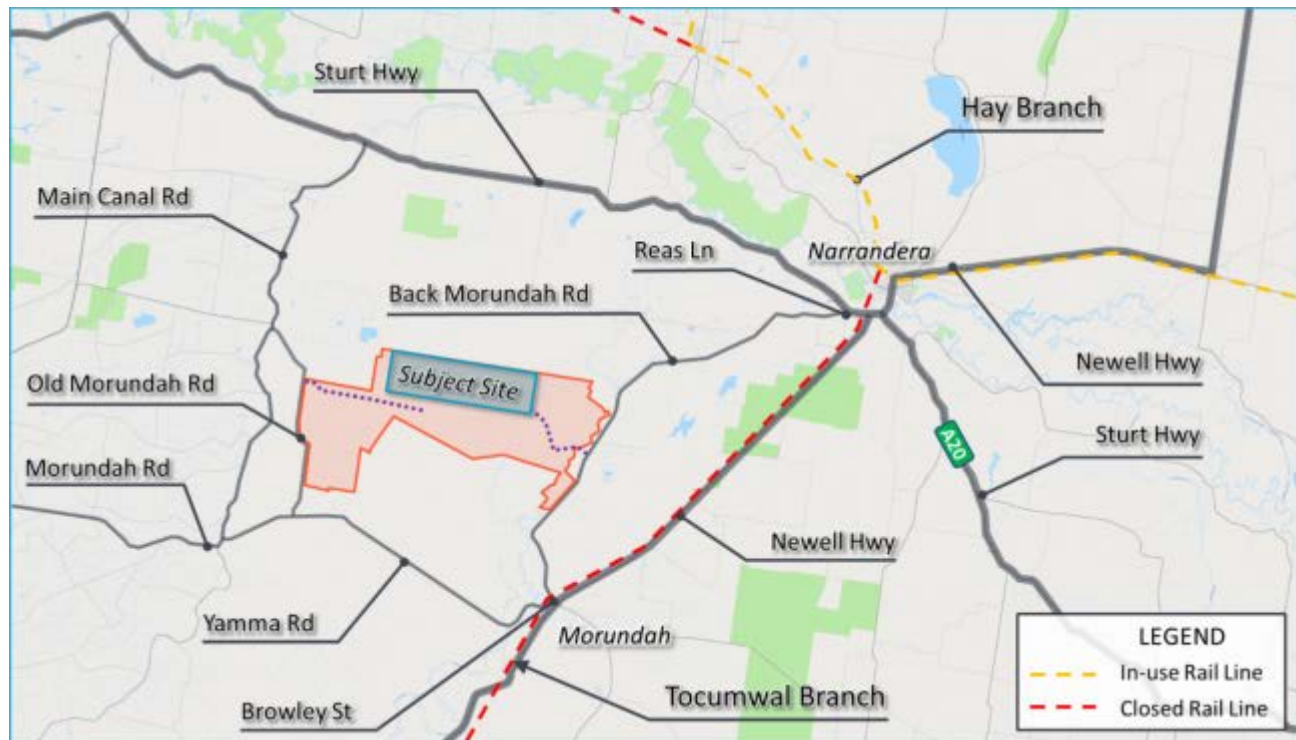
Operator	Frequency	Route
Transport for NSW (Rail)	Once weekly	Melbourne-Albury-Griffith-Sydney
Transport for NSW (Coach)	1-2 per day	Wagga Wagga to Griffith
Millers Buses	Twice Daily	Narrandera Town Route 1 Narrandera Town Route 2
Narrandera Bus Lines	School Times	Narrandera Town Route 1 Narrandera Town Route 2
Mahoney's Coaches – Narrandera	School Times	Narrandera - Paynters Siding Narrandera - Grong Grong - Matong Narrandera - Grong Grong - North Berembed Matong - Narrandera (Rosa) St Francis, Leeton - - Narrandera boarders charter St Francis, Leeton & Yanco

Source: New South Wales Fleet Lists (Australian Bus Fleet Lists, 2018)

3.7 Rail Network

Figure 10 details the rail network in proximity to the Project. There are no active at-grade crossings along either of the two access routes and therefore no further consideration for the potential impact of the Project on rail infrastructure has occurred as part of the TIA.

Figure 10 Surrounding Rail Network

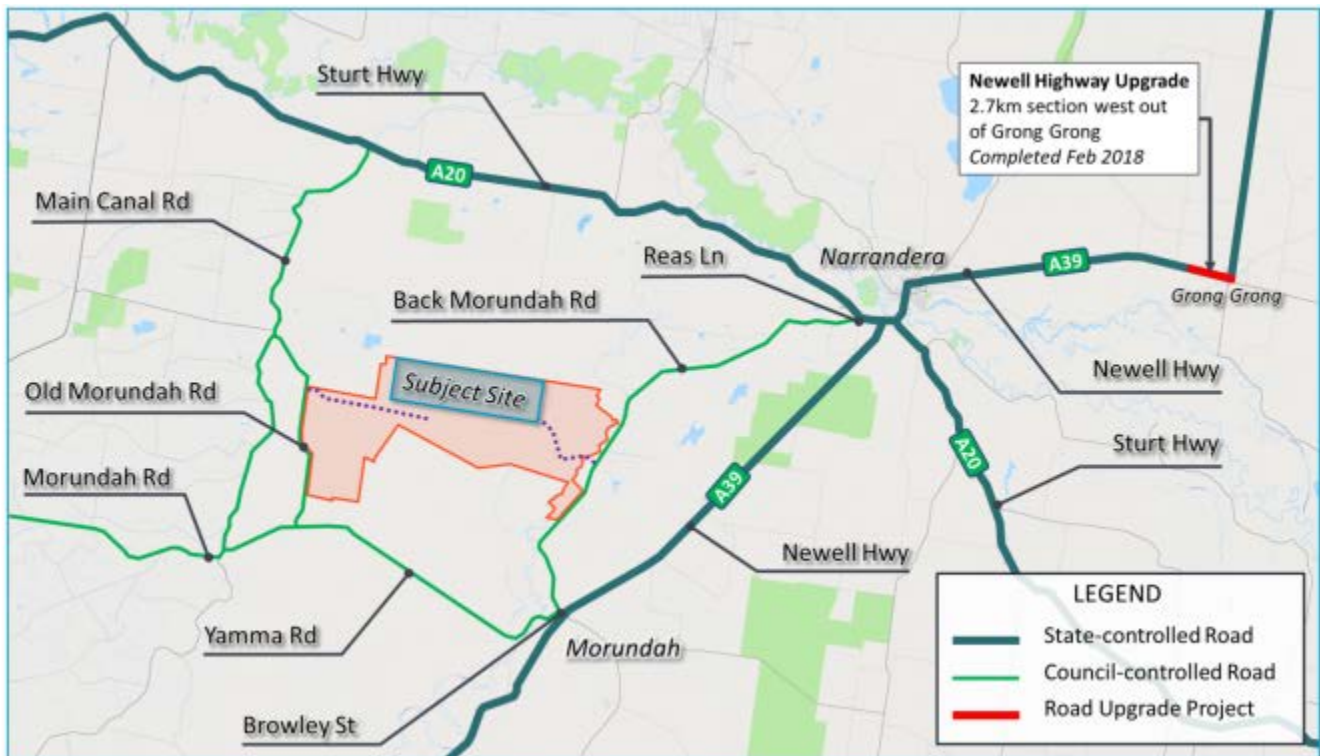


4 Future Road Conditions

4.1 Road Authority Planning

Figure 11 details the future and recently completed road upgrades planned for the surrounding road network.

Figure 11 Planned Road Upgrades



Source: Google, RMS (Newell Highway at Grong Grong, 2018), Note: Site bounds indicative only.

Figure 11 identifies that the only major road upgrade reported as being planned by RMS of relevance to the Project is the Newell Highway Improvement Project at Grong Grong (approximately 20 km east of Narrandera). This upgrade, which was completed in early 2018, was delivered as a strategy to improve freight efficiency along the State-controlled road network, as well as improving safety for all road users. Any resultant changes to network performance and traffic flows as a result of the upgrade would have been captured by the May 2018 traffic surveys.

In addition to the upgrade project identified above, it is understood that RMS has recently completed the Newell Highway Corridor Strategy planning exercise, which seeks to provide freight, road users and local communities with a safer, more reliable and accessible road. As a result of this study, there will be several minor upgrades along this entire State-controlled road over the next several years which will include upgraded rest areas, road geometry changes and the addition of overtaking lanes.

Generally the specifics of the upgrade elements are not known at this point in time, however it is understood that a small section of the Newell Highway at the two intersections with the Sturt Highway is currently underway, and will likely be completed prior to the commencement of any works associated with the Project. It is noted that there may be other minor road improvement works that occur on the broader study road network that are not currently reported by RMS such as pavement resurfacing however these are unlikely to be material to the assessment herein.

4.2 Cumulative Development Impacts

In preparing the TIA, a number of other developments that have the potential to result in cumulative impacts on the surrounding road network have been identified. **Table 10** summarises the nearby projects in proximity to the Yarrabee Solar Project including a description of the project type.

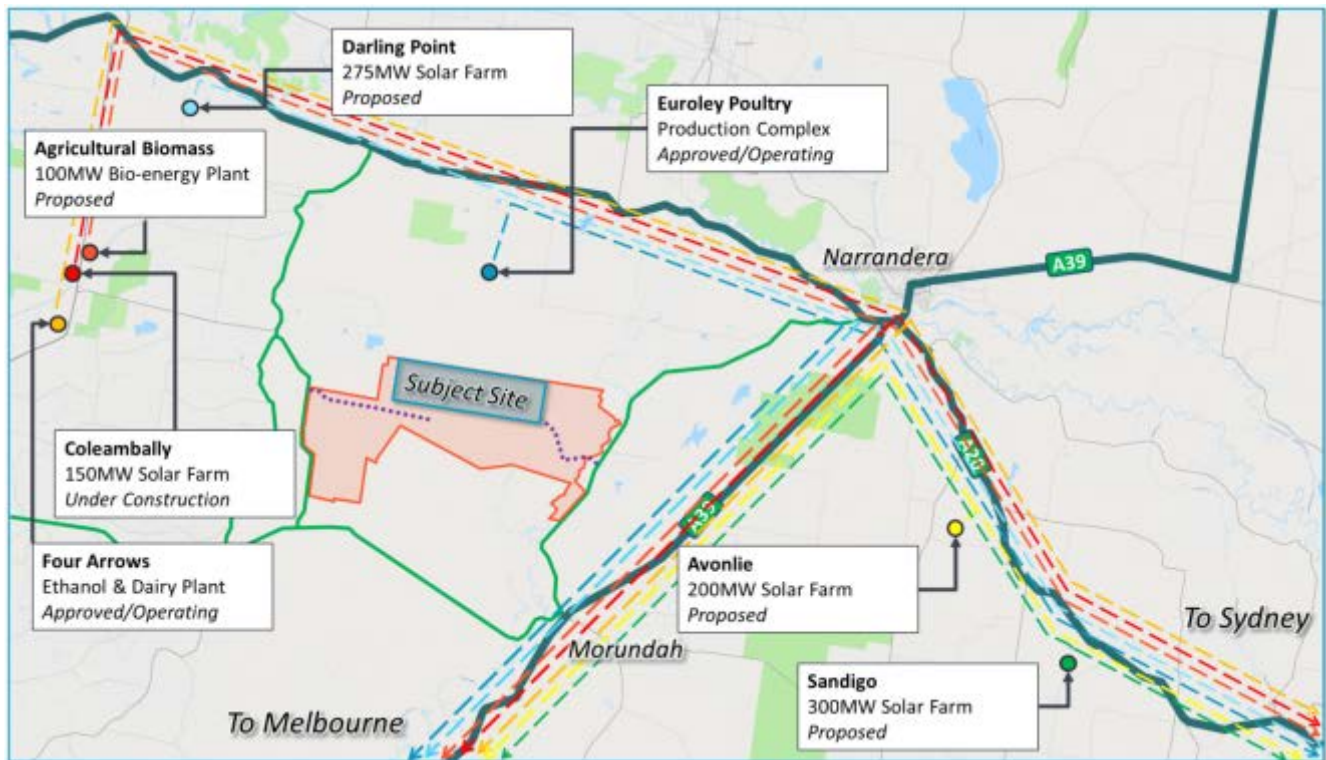
Table 10 Summary of Nearby Projects

Project Name	Description	Status
Avonlie Solar Farm	200MW Solar PV	Proposed
Sandigo Solar Farm	300MW Solar PV	Proposed
Euroley Poultry Production Complex	Poultry Farm & Plant	Approved / Operating
Darling Point Solar Farm	275MW Solar PV	Proposed
Coleambally Solar Farm	150MW Solar PV	Under Construction
Coleambally Bioenergy Plant	100MW Bioenergy	Proposed
Four Arrows Ethanol Plant	Dairy Plant & Ethanol Production	Approved / Operating

It is understood that traffic associated with these projects will only use common elements of the State-controlled road network, and that the traffic associated with these projects will not significantly utilise common elements of the Council-controlled road network.

The routes anticipated to be utilised by traffic associated with the nearby projects is illustrated in **Figure 12**.

Figure 12 Surrounding Project Status & Traffic Routes



Source: Google, Note: Site bounds indicative only.

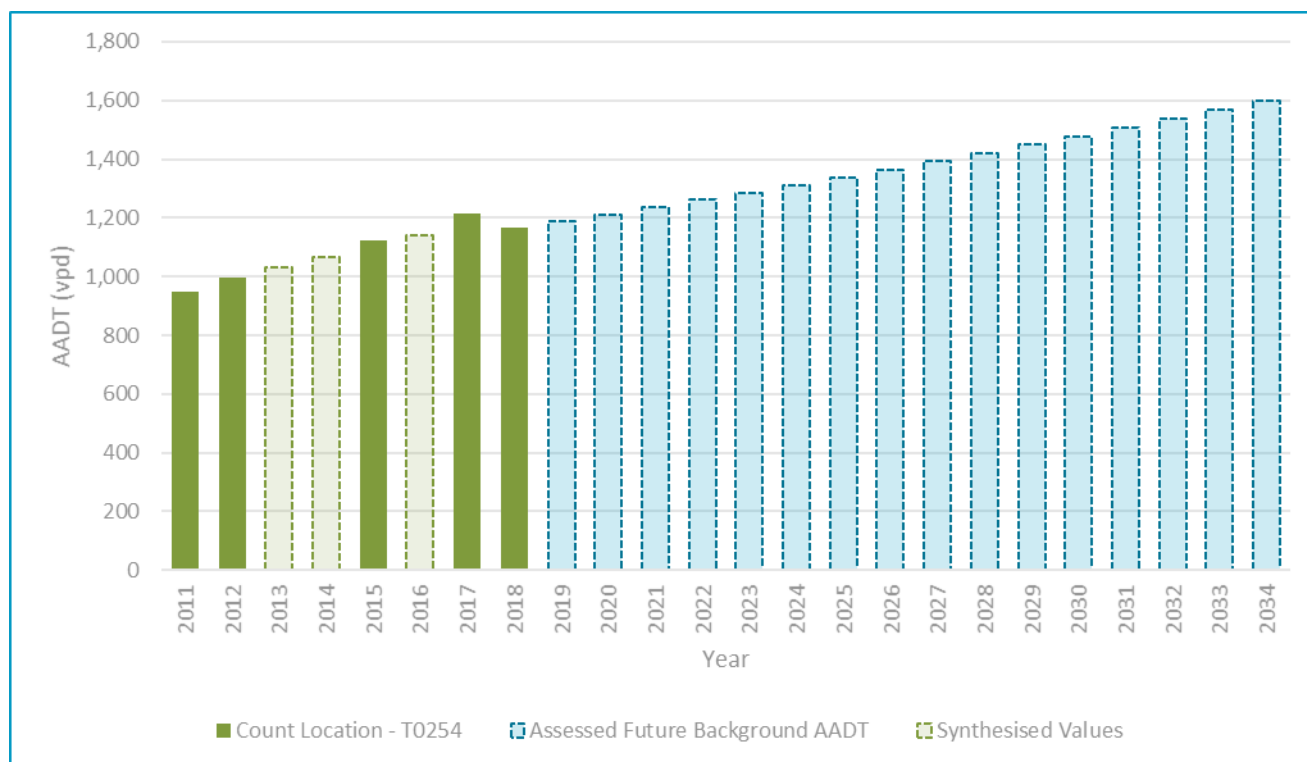
4.3 Projected Traffic Growth

In establishing the likely background traffic growth that may occur over the Project's assessment horizon consideration has been given to the scale of the negative growth (-1.78% p.a.) and the positive growth (1.11%) historically observed for the Newell Highway and the Sturt Highway respectively. In addition consideration has been made for the traffic growth potentially associated with the mapped surrounding projects.

For the purposes of conducting a conservative assessment, a 2% annual linear growth rate has therefore been adopted when forecasting future baseline traffic volumes.

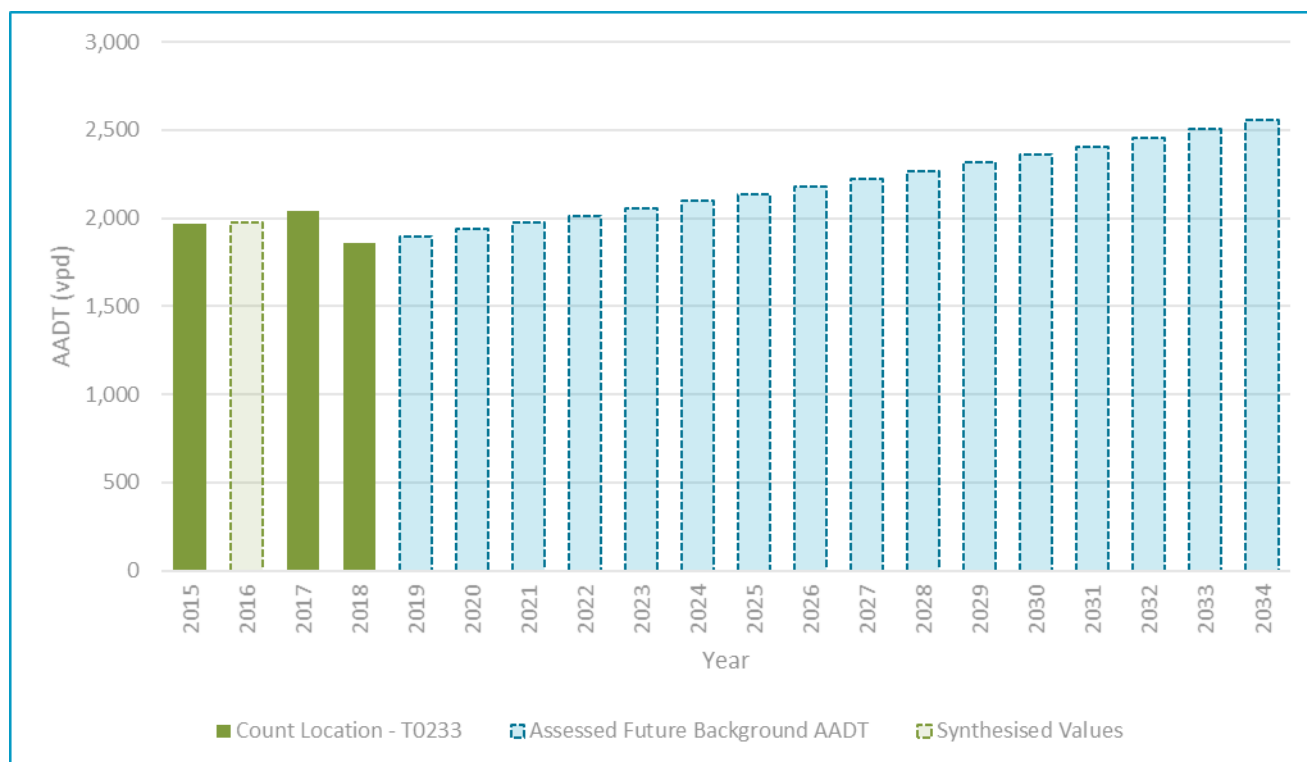
Figure 13 and **Figure 14** illustrate the resultant background daily traffic forecasts for the Sturt and Newell Highway respectively relative to the traffic growth that has historically occurred.

Figure 13 Historic and Forecast Background AADT – Sturt Highway



Source: RMS

Figure 14 Historic and Forecast Background AADT – Newell Highway



Source: RMS

5 Project Traffic Demands

5.1 Traffic Distribution

It has been assumed that container based haulage will originate from Sydney. For trips associated with the delivery of road based aggregates, it has been assumed that the trips would originate from local quarries within the vicinity of the Project site which based on a desktop assessment of the surrounding suppliers, has been assumed to be sourced from the east towards Wagga Wagga.

Workforce movements have been distributed to the external network as identified in Table 3 and 5, that being 50% to/from the east towards Narrandera, and 50% to/from the east towards Wagga Wagga. **Table 11** summarises the adopted in / out splits for the traffic generated by the Project.

Table 11 Project Traffic In / Out Split

Project Element	AM Peak		PM Peak	
	In	Out	In	Out
Material Deliveries	20%	20%	20%	20%
Workforce	100%*	0%	0%	100%*

**Note: It is likely that some portion of the workforce will arrive and depart outside of the peak periods, the adopted split represents a conservative assessment*

Reach has advised that it is proposed that vehicle access to the site will be separated between light vehicles and busses and heavy vehicles. Further site access requirements will form part of the construction Traffic Management Plan (TMP). The TMP will form one of the management plans required to be completed by the preferred EPC contractor. The EPC will be advised prior to their appointment of the intended site access protocol (i.e. splitting light and heavy vehicle traffic).

Reach has advised that preliminary traffic and site access requirements have been discussed with local council authorities and the local community during stakeholder communication meetings. The relevant council authorities will be engaged once more detail is available, to finalise the traffic plan and enter into any arrangements that may be required with respect to the initial condition of the road, proposed upgrades and ongoing maintenance.

Reach's preliminary plan is for heavy vehicles to enter and exit the site via the Western Access Route (via Main Canal Road) and for light vehicles and buses to access the site via the Eastern Access Route (via Back Morundah Road).

Reach expects that not more than 80% of total traffic would utilise either access route. In order to minimise potential rework of the traffic assessment upon finalisation of the material and workforce logistics strategy following award of the construction contract, SLR has however considered two potential demand scenarios whereby all project traffic has been assumed to utilise each of the access routes. This approach is highly conservative but provides road authorities confidence that irrespective of the ultimate proportionate use of the two proposed access routes that the road infrastructure will provide an appropriate level of safety and performance for the expected demands.

5.2 Traffic Generation

The traffic generation of the Project has been forecast based upon the workforce and material information previously discussed in this report.

- **Table 12** details the vehicle fleet anticipated to be associated with the Project.
- **Table 13** details the traffic demands assumed to be associated with the full construction period including all stages of construction (i.e. 900 MWac capacity)
- **Table 14** identifies the forecast operational traffic demands.

Table 13 indicates that the Project is anticipated to generate an average of 56 vehicle movements per day during the construction period (i.e. 28 vehicles travelling to the Project site and 28 vehicles travelling from the Project site per day). Of the 28 vehicles associated with the Project, 7 are anticipated to be light vehicles, 15 are anticipated to be Toyota Coaster (or similar) buses and the remaining 6 are anticipated to be freight vehicles such as B-doubles and 19 m articulated.

Furthermore **Table 13** indicates that during the peak Reach has advised that the project will generate up to 145 vehicle movements per day. The peak generation is anticipated to occur during Phase Three of each constructed stage.

Table 12 Project Vehicle Fleet

Vehicle	Typical Vehicle Profile	Haulage Material
Private Vehicle		Workforce
Coach		Workforce
Concrete Truck		Concrete
Heavy Rigid Vehicle		20ft Containers
25m B-double (under General Mass Limit (GML))		40ft Containers Demountables
32t Truck and Dog		Aggregate
Low Loader		Excavator Bulldozer Grader Compactor Piling Rig

Table 13 Total Project Construction Traffic Demands – 900MW Project Capacity (4.5 Years)

Material/Component	Quantity	Delivery Vehicle	Delivered per Vehicle	Project Traffic Demands	Average Vehicles Per Day	Peak Vehicles Per Day
Phase One - Site Clearance and Access Roads						
Construction Vehicles ²	30	Low Loader	1	60	<1	21
Access Track Road Base ¹	23,750t	32t Truck and Dog	32t	1,484	1	
Road Surface	4,750t	32t Truck and Dog	32t	298	<1	
Fencing ¹	30,000m	12.5m HRV	375m	160	<1	
Demountable Buildings ²	12	19m AV	1	24	<1	
Phase Two - Establish Site Compounds						
Concrete ²	1750m ³	8m ³ Truck	8m ³	438	<1	17
Compound Aggregate ¹	2,375t	32t Truck and Dog	32t	184	<1	
Substation Aggregate ¹	11,875t	32t Truck and Dog	32t	740	<1	
Phase Three - Delivery and Installation of Electrical Equipment						
Piling Rig ²	9	Low Loader	1	18	<1	47
Upright Piles ¹	450,000	25m B-Double	400	2,250	1	
Tracking Horizontals ¹	390,000	25m B-Double	150	5,200	3	
Solar Panels	3,000,000	25m B-Double	1176	5,102	3	
Telehandlers	9	Low Loader	1	18	<1	
Trencher ²	9	Low Loader	1	18	<1	
AC Reticulation ¹	85,000m	19m AV	10,000m	18	<1	
DC Reticulation ¹	2,700,000m	19m AV	10,000m	540	<1	
Inverters ¹	450	19m AV	1	900	<1	
Mobile Crane	3	Low Loader	1	6	<1	
Battery Storage	30 Units	19m AV	1	60	<1	
Power Conditioning Unit	220	19m AV	4	110	<1	
Waste Collection						
Waste Allowance	702	Waste Vehicle	1	1,404	1	3
Workforce Requirements						
Labour	135 per day	20 pax Coaster	20	22,996	14	96
Engineer / Supervisor	15 per day	Light Vehicles	1	49,276	30	
Total Vehicle Movements						
Total Light Vehicles				49,276	30	145 (Phase 3 +Waste + Workforce)
Total Heavy Vehicles (including buses)				41,008	26	
Total Vehicles				90,284	56	

Source: Reach Solar

¹ Material is delivered consistently throughout relevant project phase

² Only one two-way trip per component is required to deliver and return from trip origin. It is assumed that only one construction vehicle type will be delivered per day (i.e. Bulldozers on day one, graders on day two etc.)

Table 14 Operational Traffic Demands

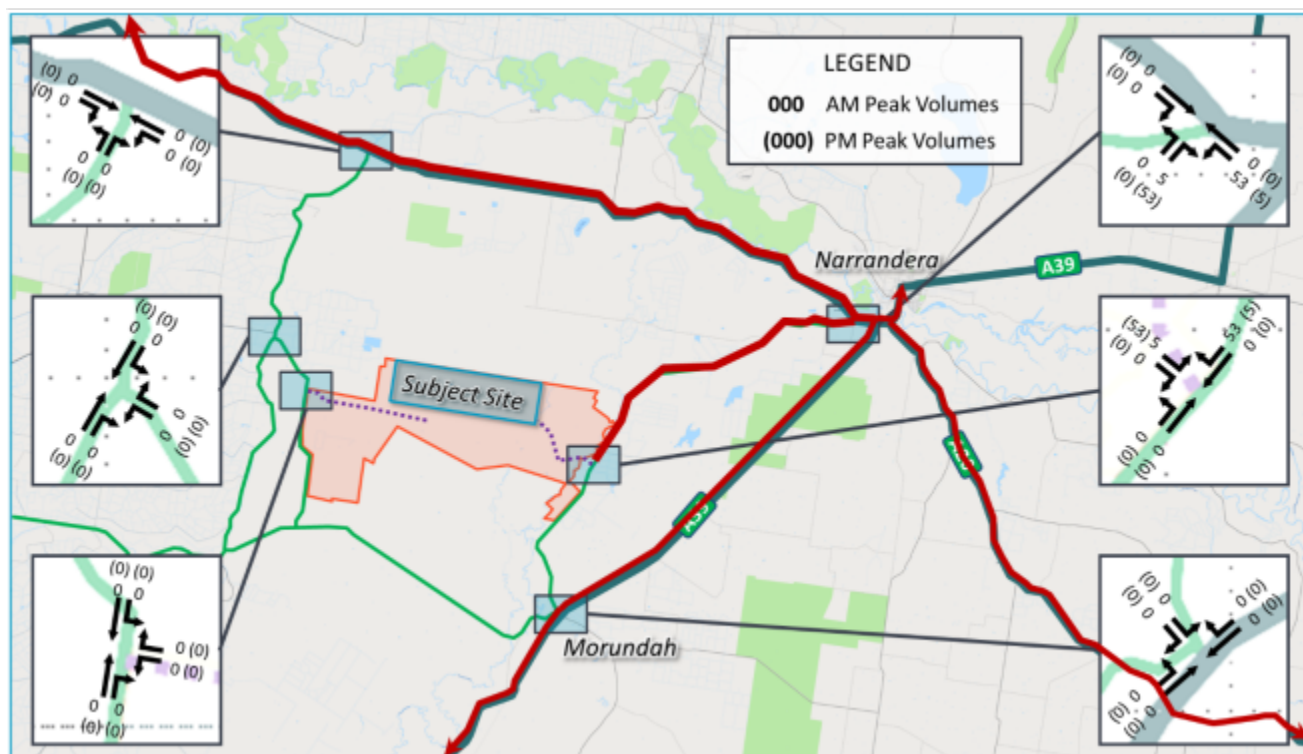
Component	Quantity	Delivery Vehicle	Per Vehicle	Daily Two-Way Trips
Workforce	25	Private Vehicle	1	50
Maintenance Vehicle	2	Remains On-site	-	0

5.3 Traffic Volumes

Figure 15 through to Figure 18 illustrate the assessed Project generated traffic demands.

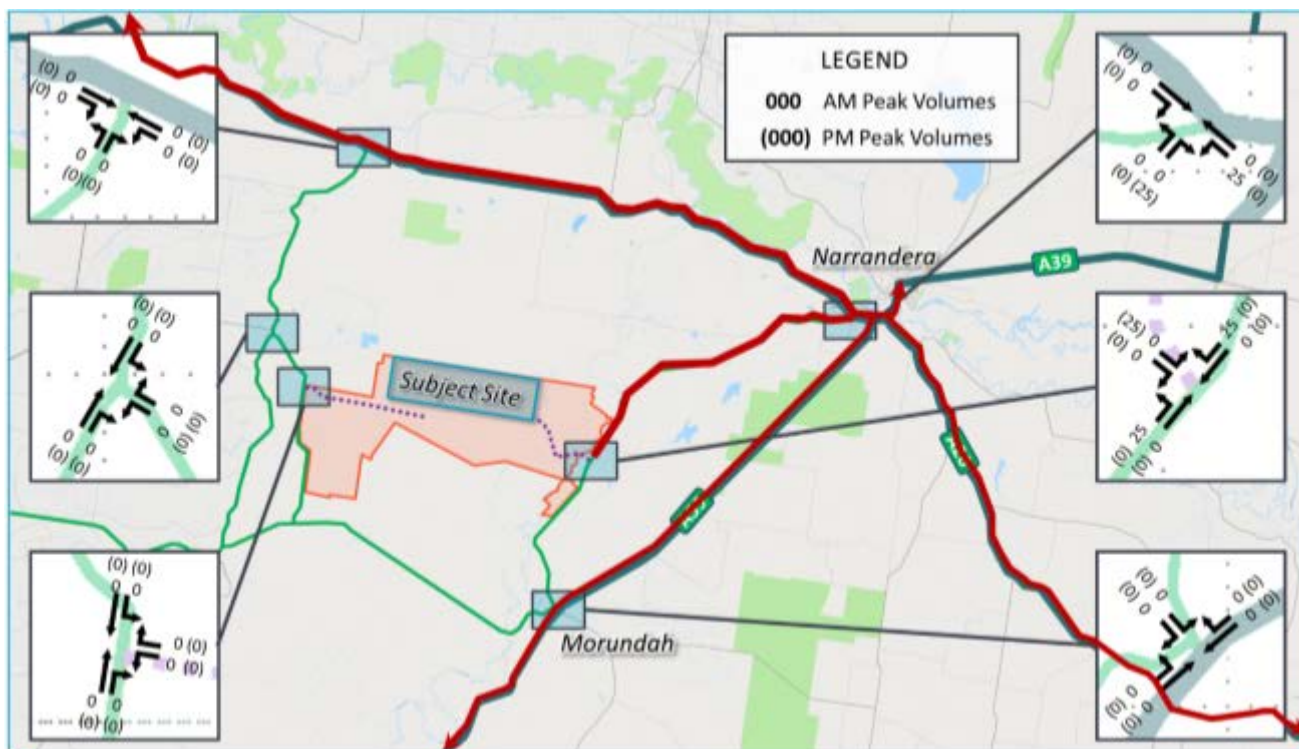
- **Figure 15** Access from the East Construction Phase
- **Figure 16** Access from the East Operational Phase
- **Figure 17** Access from the West Construction Phase
- **Figure 18** Access from the West Operational Phase

Figure 15 Peak Hour Construction Traffic – Eastern Access Only



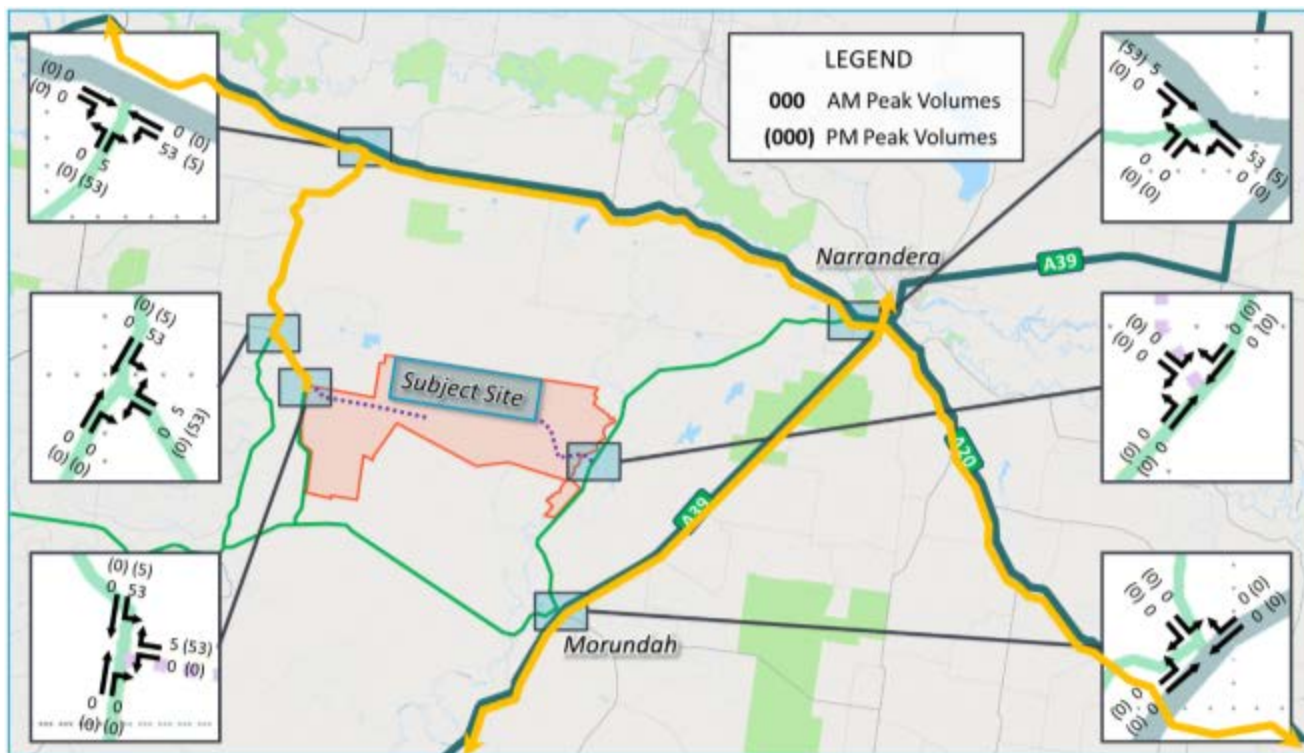
Source: Google, Note: Site bounds indicative only.

Figure 16 Peak Hour Operational Traffic – Eastern Access Only



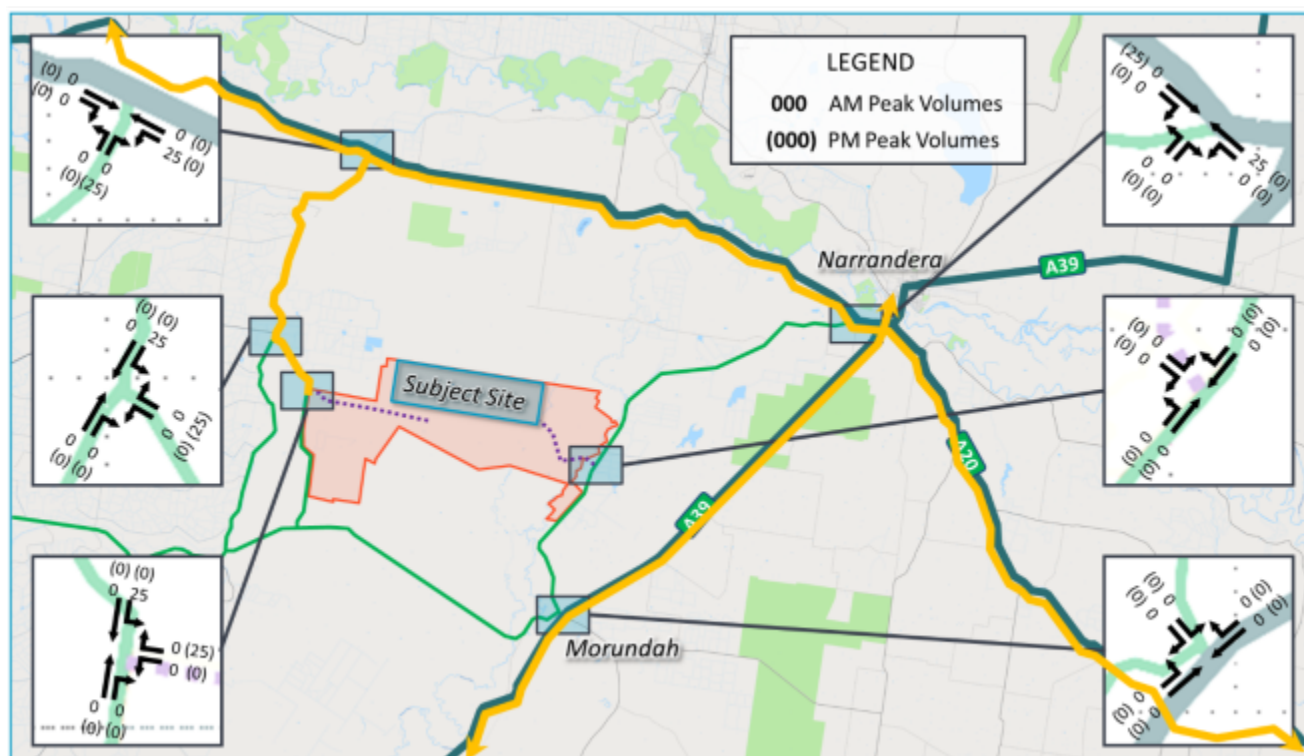
Source: Google, Note: Site bounds indicative only.

Figure 17 Peak Hour Construction Traffic – Western Access Only



Source: Google, Note: Site bounds indicative only.

Figure 18 Peak Hour Operational Traffic – Western Access Only



Source: Google, Note: Site bounds indicative only.

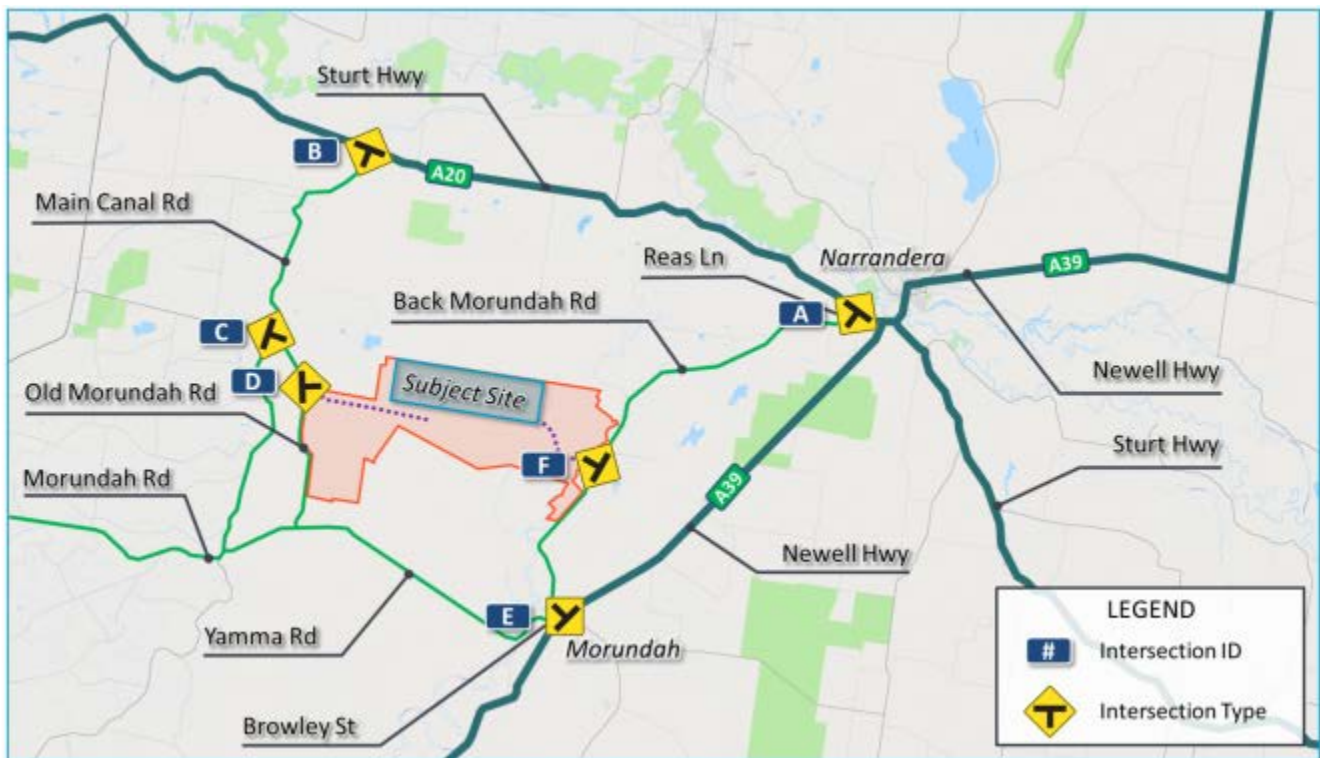
6 Assessment Scope and Thresholds

6.1 Spatial Scope of Intersection Assessment

A detailed intersection assessment has been completed for all intersections located within proximity to the Project site in addition to intersections between the Council and State-controlled roads. The study intersections include the following, as illustrated on **Figure 19**:

- Intersection A - Sturt Highway / Reas Lane (Back Morundah Road);
- Intersection B - Sturt Highway / Main Canal Road;
- Intersection C - Main Canal Road / Old Morundah Road;
- Intersection D - Old Morundah Road / Site Access Road;
- Intersection E - Newell Highway / Browley Street (Back Morundah Road); and
- Intersection F - Back Morundah Road / Site Access Road.

Figure 19 Study Intersections



Source: Google, Note: Site bounds indicative only.

6.2 Project Design Horizon

Consistent with standard traffic assessment practice, a design horizon 10 years after the commencement of the final stage of the Project has been considered. Assessment of the decommissioning phase has therefore not explicitly occurred as this is expected to be some 30 to 50 years in the future. This adopted assessment approach is considered appropriate as it accords with standard traffic engineering assessment practice and as the scale of traffic demands during the decommissioning phase is likely to be no more than those that occur during the construction phase for which an assessment has been completed.

The following design scenarios have been assessed, consistent with the anticipated construction schedule and standard industry practice:

- 2018 Survey (existing conditions);
- 2023 Background + Construction Traffic (Final Stage); and
- 2033 Background + Operational Traffic (10-year design horizon).

6.3 Safety Assessment

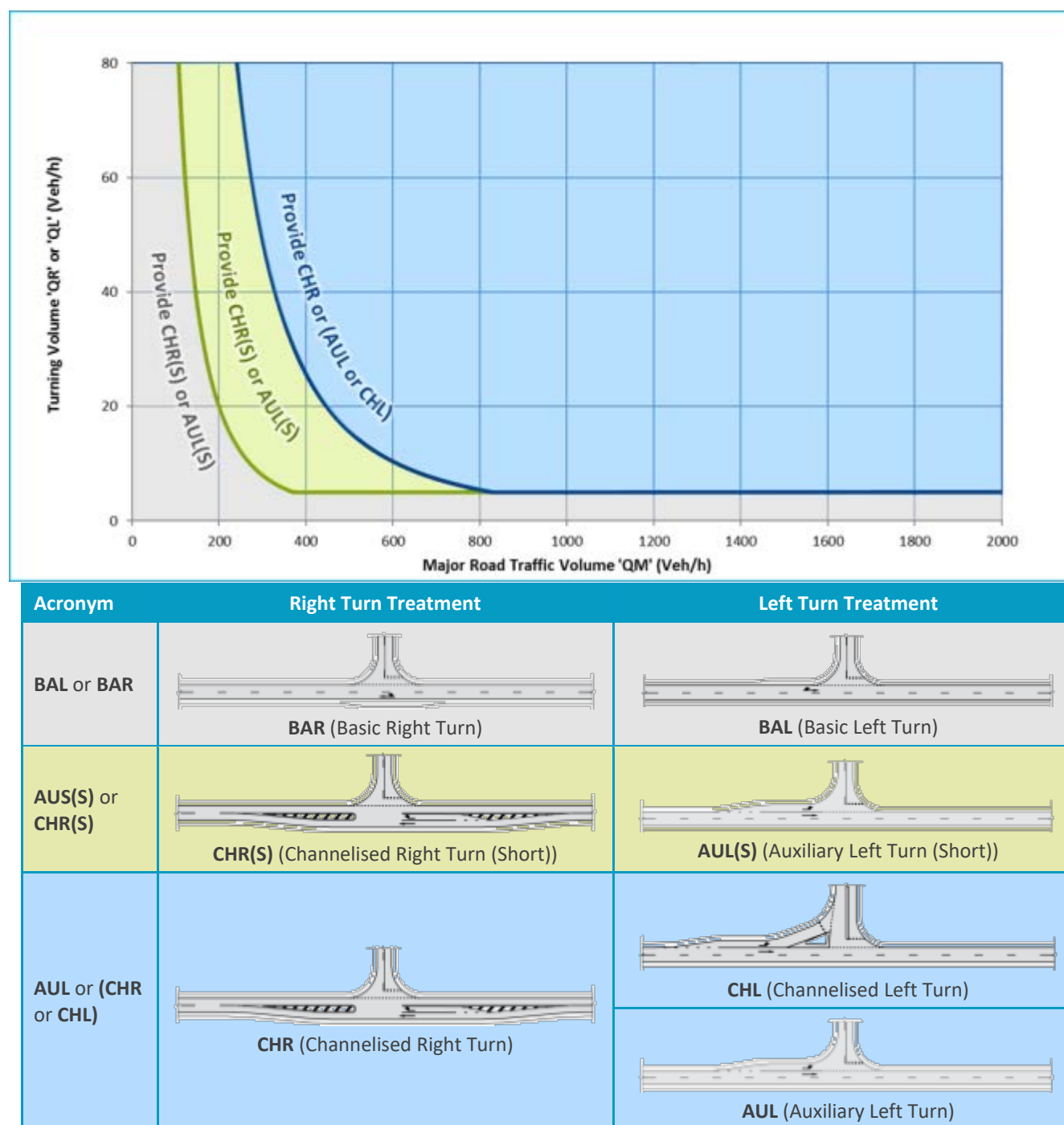
The assessment includes a variety of industry recognised analysis methods that determine the appropriate design requirements for each intersection location based on the anticipated future traffic demands as well as geometric considerations. A turn lane warrant assessment has been undertaken to establish the desirable form of the assessed intersections in accordance with the industry research summarised within *Austroads Guide to Road Design Part 4A*. The warrants provide guidance where turning lanes should be provided based on the design traffic volumes. To aid reader interpretation of the assessment **Figure 20** provides a pictorial description of the various turn treatments considered.

As background it is identified that the warrants were produced by establishing the conflicting traffic volumes at which the benefits of providing a higher level of treatment (i.e. the reduction in estimated crash costs) are equal to the additional construction costs associated with providing the higher treatment. The benefits and costs of a higher level treatment were compared to the base case (minimum turn treatments).

Relevant to the assessment presented herein the research assumed the following:

- The warrants are strictly applicable to the construction of intersections on new roads (i.e. greenfield sites). For existing roads application of the warrants as adopted herein is therefore conservative as it tends to over-estimate the benefit ratio of providing higher order treatments; and
- The warrants are intended to be utilised to determine appropriate turn treatments at the intersection of public roads and are not strictly intended to be utilised for private access locations. Their application to private access locations as adopted herein is therefore conservative as it ensures that private accesses are afforded the same standard of safety as provided for public road intersections.

Figure 20 Turn Treatment Types



Source: Austroads Guide to Road Design Part 4A (Austroads)

6.4 Sight Distance Assessment

A sight distance assessment has been undertaken in accordance with *Part 4A: Unsignalised and Signalised Intersection* of the *Austroads Guide to Road Design*. Safe Intersection Sight Distance (SISD) is the minimum sight distance which should be provided on the major road at any intersection, providing sufficient distance for a driver of a vehicle on the major road to observe a vehicle on the minor road moving into a collision situation (e.g. in the worst case, stalling across the traffic lanes), and to decelerate to a stop before reaching the collision point.

Table 15 identifies the sight distances to and from the subject intersection assessing a reaction time of 2.0 seconds for various design speeds.

Table 15 Safe Intersection Sight Distance Requirements

Design Speed (km/hr)	SISD Requirement (m)
70	151
80	181
90	214
100	248
110	285
120	324

Source: Austroads

6.5 Capacity Assessment

6.5.1 Degree of Saturation Threshold

The study intersections were analysed for each of the traffic demand scenarios using SIDRA Intersection 7.0 (SIDRA). SIDRA is an industry recognised analysis tool used to estimate the capacity and performance of intersections based on input parameters, including geometry and traffic volumes. SIDRA provides an estimate of an intersection's Degree of Saturation (DOS), queues and delays. Part 12 of the *Austroads Guide to Traffic Management* identifies a maximum DOS threshold for each intersection type, which are reproduced in **Table 16**.

Table 16 Degree of Saturation Capacity Thresholds

Intersection Type	DOS Threshold
Signalised intersections	Less than or equal to 0.90
Roundabouts	Less than or equal to 0.85
Priority controlled intersections	Less than or equal to 0.80

Source: Austroads

DOS values exceeding those presented in **Table 16** indicate that an intersection is nearing its practical capacity and upgrade works may be required. Above these threshold values, users of the intersection are likely to experience rapidly increasing delays and queuing.

6.5.2 Critical Delay Threshold

The RMS *Guide to Traffic Generating Developments* states that the average delay statistic for the critical movement provides a better indication of intersection performance and safety for roundabouts and priority-controlled intersections than DOS. A summary of the delay thresholds recommended by the RMS is provided in **Table 17**.

Table 17 Critical Delay Capacity Thresholds

LOS	Description	Critical Delay (sec/vehicle)
A	Good operation	< 14 sec
B	Acceptable delays and spare capacity	15 - 28 sec
C	Satisfactory	29 - 42 sec
D	Near capacity	43 - 53 sec
E	At capacity, requires other control mode	57 - 60 sec

Source: RMS

7 Network Assessment

7.1 Overview

This section presents the summarised outcomes of the technical assessment undertaken to confirm the intersection upgrades required to safely and efficiently accommodate the potential project generated traffic demands. The assessments have been undertaken consistent with the methodologies and intervention thresholds described in **Section 6**.

Attachment B provides further details of the technical analysis beyond the summary presented in **Section 7**.

7.2 Safety Assessment

Table 18 identifies the stipulated and recommended intersection treatments for each of the key intersections.

Table 18 Summary of Safety Assessment Results

Intersection Location	Stipulated Treatment		Recommended Treatment	
	Left Turn Lane	Right Turn Lane	Left Turn Lane	Right Turn Lane
Intersection A Sturt Highway / Reas Lane (Back Morundah Road)	BAL	BAR	Western Access - Existing Eastern Access – AUL(S)	Western Access - Existing Eastern Access - Existing
Intersection B Sturt Highway / Main Canal Road	BAL	BAR	Western Access - AUL(S) Eastern Access - Existing	Western Access - Existing Eastern Access - Existing
Intersection C Main Canal Road / Old Morundah Road	BAL	-	Western Access - BAL Eastern Access - Existing	Western Access - Existing Eastern Access - Existing
Intersection D Old Morundah Road / Site Access Road	BAL	-	Western Access - BAL Eastern Access - Existing	Western Access - Existing Eastern Access - Existing
Intersection E Newell Highway / Browley Street (Back Morundah Road)	-	-	Western Access - Existing Eastern Access – Existing	Western Access - Existing Eastern Access – Existing
Intersection F Back Morundah Road / Site Access Road	-	BAR	Western Access - Existing Eastern Access – Existing	Western Access - Existing Eastern Access – BAR

Note: 'Existing' indicates that the existing lane configuration is appropriate for the assessed traffic demands.

7.3 Sight Distance Assessment

Table 19 identifies the minimum available and required sight distance at each of the key intersections, with **Table 20** illustrating the viewing angles at each intersection location.

Table 19 Summary of Sight Distance Assessment

Intersection Location	Required Sight Distance	Available Sight Distance		Compliant?
		Approach 1	Approach 2	
Intersection A Sturt Highway / Reas Lane (Back Morundah Road)	324m	420m+	380m+	✓
Intersection B Sturt Highway / Main Canal Road	324m	399m+	600m+	✓
Intersection C Main Canal Road / Old Morundah Road	285m	~230m	310m+	No - Increased sight distance to the north could potentially be achieved through the removal of vegetation.
Intersection D Old Morundah Road / Site Access Road	285m	400m+	300m+	✓
Intersection E Newell Highway / Browley Street (Back Morundah Road)	324m	443m+	655m+	✓
Intersection F Back Morundah Road / Site Access Road	285m	600m+	600m+	✓

Table 20 Viewing Ranges – Key Intersections

Intersection Location	Approach 1	Approach 2
Intersection A Sturt Highway / Reas Lane (Back Morundah Road)		
Intersection B Sturt Highway / Main Canal Road		
Intersection C Main Canal Road / Old Morundah Road		

Intersection Location	Approach 1	Approach 2
Intersection D Old Morundah Road / Site Access Road		
Intersection E Newell Highway / Browley Street (Back Morundah Road)		
Intersection F Back Morundah Road / Site Access Road		

7.4 Capacity Assessment

Table 21 summarises the performance parameters for the worst-case scenario at each key intersection location and the compliance with the assessment criteria.

Table 21 Summary of SIDRA Intersection Assessment

Intersection Location	DOS Limit	Worst DoS	Critical Delay Limit	Worst Critical Delay	Compliant?
Intersection A Sturt Highway / Reas Lane (Back Morundah Road)	0.80	0.08	56s	10.2s	✓
Intersection B Sturt Highway / Main Canal Road	0.80	0.10	56s	10.1s	✓
Intersection C Main Canal Road / Old Morundah Road	0.80	0.06	56s	8.9s	✓
Intersection D Old Morundah Road / Site Access Road	0.80	0.05	56s	8.9s	✓
Intersection E Newell Highway / Browley Street (Back Morundah Road)	0.80	0.05	56s	9.5s	✓
Intersection F Back Morundah Road / Site Access Road	0.80	0.04	56s	8.9s	✓

7.5 Summary of Results

Table 22 summarises the requirement for upgrades at each of the study intersection locations based on the results of the safety, sight distance and capacity assessments previously presented herein.

Table 22 Summary of Required Upgrades

Intersection Location	Required upgrade
Intersection A Sturt Highway / Reas Lane (Back Morundah Road)	Use of Western access route triggers: - No upgrade requirements. Use of Eastern access route triggers: - Provide AUxiliary Left (Short) turn lane (AUL(s)).
Intersection B Sturt Highway / Main Canal Road	Use of Western access route triggers: - Provide AUxiliary Left (Short) turn lane (AUL(s)) within bridge constraints; and Use of Eastern access route triggers: - No upgrade requirements.
Intersection C Main Canal Road / Old Morundah Road	Use of Western access route triggers: - Provide shoulder widening (i.e. BASic Left (BAL) treatment) to aid left turn; and - Trim vegetation along the northern approach. Use of Eastern access route triggers: - No upgrade requirements.
Intersection D Old Morundah Road / Site Access Road	Use of Western access route triggers: - Provide shoulder widening (i.e. BASic Left (BAL) treatment) to aid left turn. Use of Eastern access route triggers: - No upgrade requirements
Intersection E Newell Highway / Browley Street (Back Morundah Road)	Use of Western access route triggers: - No upgrade requirements Use of Eastern access route triggers: - No upgrade requirements.
Intersection F Back Morundah Road / Site Access Road	Use of Western access route triggers: - No upgrade requirements Use of Eastern access route triggers: - Provide shoulder widening (i.e. BASic Right (BAR) treatment) to aid right turn.

8 Link and Pavement Impact Assessment

8.1 State-controlled Network

The Newell and Sturt Highways are sealed high speed highways that are already designed to cater for significant traffic including significant freight haulage. Traffic associated with the Project will not require modification of the highway cross-sections as they are already fit for purpose for the transport task associated with the Project.

Haulage associated with the Project is likely to increase existing heavy vehicle traffic (including buses) on the State-controlled road network by not more than 5.7% during the peak construction phase with this reducing to well less than 1% following conclusion of construction activities. This maximum level assumes all heavy vehicle traffic utilises a single access route.

Whilst this increase has the potential to accelerate deterioration of the State-controlled road network and is above the typical assessment threshold of 5% a proponent contribution towards pavement maintenance activities is not considered warranted. This is because typical assessment practice has been to only require a contribution where an impact greater than 5% is sustained over a number of years, not just for a project's construction phase. For example, quarry's which continue to generate haulage demands for the life of their operations are commonly required to contribute toward pavement maintenance however shopping centre developments are typically not required to as the associated construction activity and heavy vehicle demands only occur for the construction period.

This practice is a result of the long timeframes of the maintenance and rehabilitation regimes associated with road pavements. For example an increase of 5.7% in the pavement loadings for a 4.5 year period as associated with the Project will only bring forward the likely timing of rehabilitation activities by 3 months in a 20 year management regime which is unlikely to significantly change the road authorities funding requirements and therefore necessitate a proponent contribution.

Furthermore, a contribution is not considered warranted as the potentially impacted section of the State-controlled network also forms part of the National Land Transport Network which by definition preforms a nationally significant freight task and as a result the maintenance of which is already partially funded by the Federal Government.

8.2 Council-controlled Network

Haulage associated with the Project is likely to accelerate deterioration of the Council-controlled road networks in particular Main Canal Road, Back Morundah Road and a short section of Reas Lane dependant on the proportionate use of the western and eastern access routes that ultimately eventuates.

Whilst numerical analysis could potentially be undertaken to quantify at this early stage the likely extent of deterioration and to define an appropriate contribution such analysis at this stage is at best an estimate only. In practice it has been found to be problematic to pre-estimate the extent of deterioration of Council-controlled road networks as it exposes Councils to the risk that greater deterioration may eventuate than initially calculated. This issue is particularly relevant to the Council-controlled road networks given the greater relative increase in pavement loadings that will potentially eventuate as a result of the Project and the typically lower and more variable construction standard of the Council-controlled road networks.

To minimise risk it is therefore recommended that a make good agreement be entered into with the Council road authorities in relation to road deterioration. Such an agreement would likely be established with assistance from the successful EPC following EIS approval. The agreement would likely involve road dilapidation surveys occurring prior to and following the completion of each construction stage. A comparison of the pre and post construction surveys would identify areas that require rectification with the repairs undertaken in accordance with the relevant Council standards.

Typically a make good agreements also stipulate the requirement for daily and weekly inspections and require that if the pavement deteriorates to a degree that safety issues arise that rectification works occur immediately rather than at the conclusion of the relevant construction stage. In addition, the RMP associated with a project will typically define haulage restrictions that occur in instances where safety issues arise such as temporary suspension of haulage until a safety issue is rectified.

It is recommended that the pre and post construction dilapidation surveys be undertaken in consultation with the relevant Council and to a suitable standard. A potential methodology could include that detailed in the *Condition Assessment & Asset Performance Guidelines – Road Pavements*, issued by the Institute of Public Works Engineering Australia (IPWEA).

As identified in **Section 3.4** restricted access for B-doubles applies to Main Canal Road and Old Morundah Road. The restricted access has been conditionally provided solely for the Global AG Properties II Australia Pty Ltd property to the north of the Project site along Old Morundah Road.

In order to facilitate 25m/26m B-double construction traffic via the western access route, an application would be required to be made to the NHVR. It is anticipated that the approval could be achieved with similar conditions to those currently applied to the property north of the Project site which includes for example restricted wet weather use. For the wet weather restriction to be removed it is anticipated that any existing unsealed sections of Main Canal Road and Old Morundah Road would need to be sealed to a width of 8 m with and an appropriate pavement capacity for the design traffic volumes provided.

9 Road-use Management Plan

It is recommended that an RMP or equivalent document be prepared following EIS approval and award of the EPC contract but prior to the substantial commencement of construction.

The purpose of the RMP will be to:

- Summarise and update (where appropriate) the latest condition of the road network and estimates of the Project's traffic generation potential considering the finalised workforce, procurement and logistics arrangements based upon advice from the EPC contractor;
- Update (if appropriate) the analysis presented herein where either the underlying road conditions or assumed traffic generating characteristics of the Project have changed;
- Identify any known over-dimension movements and the associated logistics strategy and required approvals; and
- Detail proposed/negotiated impact mitigation strategies, both "soft" strategies (for example, bussing workers, variable message signs/ media notices about increased project traffic and road-use management strategies such as avoiding peak hour traffic, fatigue management) and "hard" infrastructure strategies (for example, upgrading an intersection or contributing to maintenance).

A Traffic Management Plan (TMP) will also be required for construction activities, and is a separate document to the RMP. The TMP should be prepared using the relevant template prepared by RMS.

10 Conclusion

10.1 Background

SLR has been engaged by Reach Solar to prepare a TIA for a Solar Farm development in Western NSW. Reach Solar is proposing the staged development of the 900 MWac Yarrabee Solar Project (the Project) to be located approximately 23 km southwest of Narrandera.

The Project will potentially occupy 2,600 ha and is planned to include solar photovoltaic modules mounted on single axis tracking systems, inverter stations, a new substation, potential energy storage, grid connection, security perimeter fencing, internal access roads, underground cabling and a project site office and maintenance workshop.

The Project is anticipated to generate an average of 56 vehicle movements per day during the construction period (i.e. 28 vehicles travelling to the Project site and 28 vehicles travelling from the Project site per day). Of the 28 vehicles associated with the Project, 7 are anticipated to be light vehicles, 15 are anticipated to be Toyota Coaster (or similar) buses and the remaining 6 are anticipated to be freight vehicles such as B-doubles and 19 m articulated. Furthermore Reach has advised that the project will generate up to a peak of 145 vehicle movements per day. The peak generation is anticipated to occur during Phase Three of each constructed stage. Following completion of construction, it is anticipated that the Project will generate predominately light vehicle movements and limited heavy vehicle movements.

10.2 Access Routes

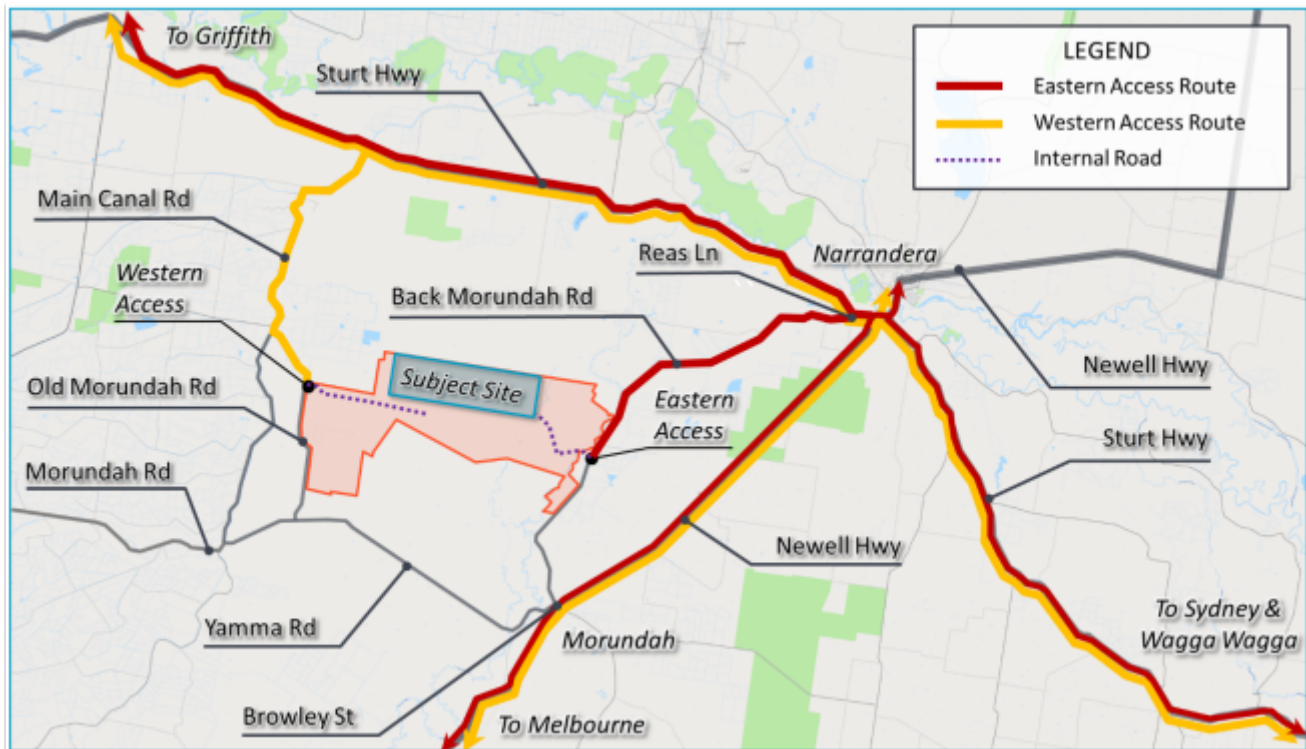
At this stage of project planning, it has not yet been confirmed which of the two access routes or if both will be utilised as the primary construction access.

Based upon experience with the construction of other solar projects SLR however anticipates that for ease of logistics management and inventory control that the majority of traffic during each of the construction stages will likely be concentrated to a single primary access with emergency access facilitated by the alternative route.

This assumption is however subject to finalisation with the EPC contractor (subject to EIS approval). Accordingly, a conservative assessment approach has been adopted herein to provide both flexibility for the future delivery of the Project but also certainty for road authorities that the impacts will be no worse than assessed herein.

The two proposed access routes that will service the Project are mapped on **Figure 21**.

Figure 21 Proposed Access Routes



Source: Google, Note: Site bounds indicative only.

10.3 Mitigation Requirements

Detailed assessment has been undertaken to establish the transport mitigation strategies recommended to support the Project which include the following:

- Enter into make good agreements for the pavement damage that occurs to the Council-controlled road networks during the duration of construction activity;
- Provide an 8m seal on Old Morundah Road with a pavement capacity suitable for the design traffic demands should all weather access be sought along the Western Access Route (i.e. should this be the primary point of access for any construction stage).
- Prepare a RMP generally in accordance with the specifications provided in Section 9 and in addition prepare any TMPs required to support works undertaken within the public road reserve; and
- Undertake the upgrade works documented in **Table 23** and **Table 24**.

Table 23 Summary of Required Upgrades (Should Western Access Route be Utilised)

Location	Required upgrade
General	• Enter into make good agreements for the pavement damage that occurs to the Council-controlled road networks during the duration of construction activity; • Prepare a RMP generally in accordance with the specifications provided in Section 9 and in addition prepare any TMPs required to support works undertaken within the public road reserve;
Old Morundah Road	• Provide an 8m seal on Old Morundah Road with a pavement capacity suitable for the design traffic demands should all weather access be sought along the Western Access Route (i.e. should this be the primary point of access for any construction stage).
Sturt Highway / Main Canal Road Intersection	• Provide AUxiliary Left (Short) turn lane (AUL(s)) within bridge constraints
Main Canal Road / Old Morundah Road Intersection	• Provide shoulder widening (i.e. BAsic Left (BAL) treatment) to aid left turn; and • Trim vegetation along the northern approach.
Old Morundah Road / Site Access Road Intersection	• Provide shoulder widening (i.e. BAsic Left (BAL) treatment) to aid left turn.

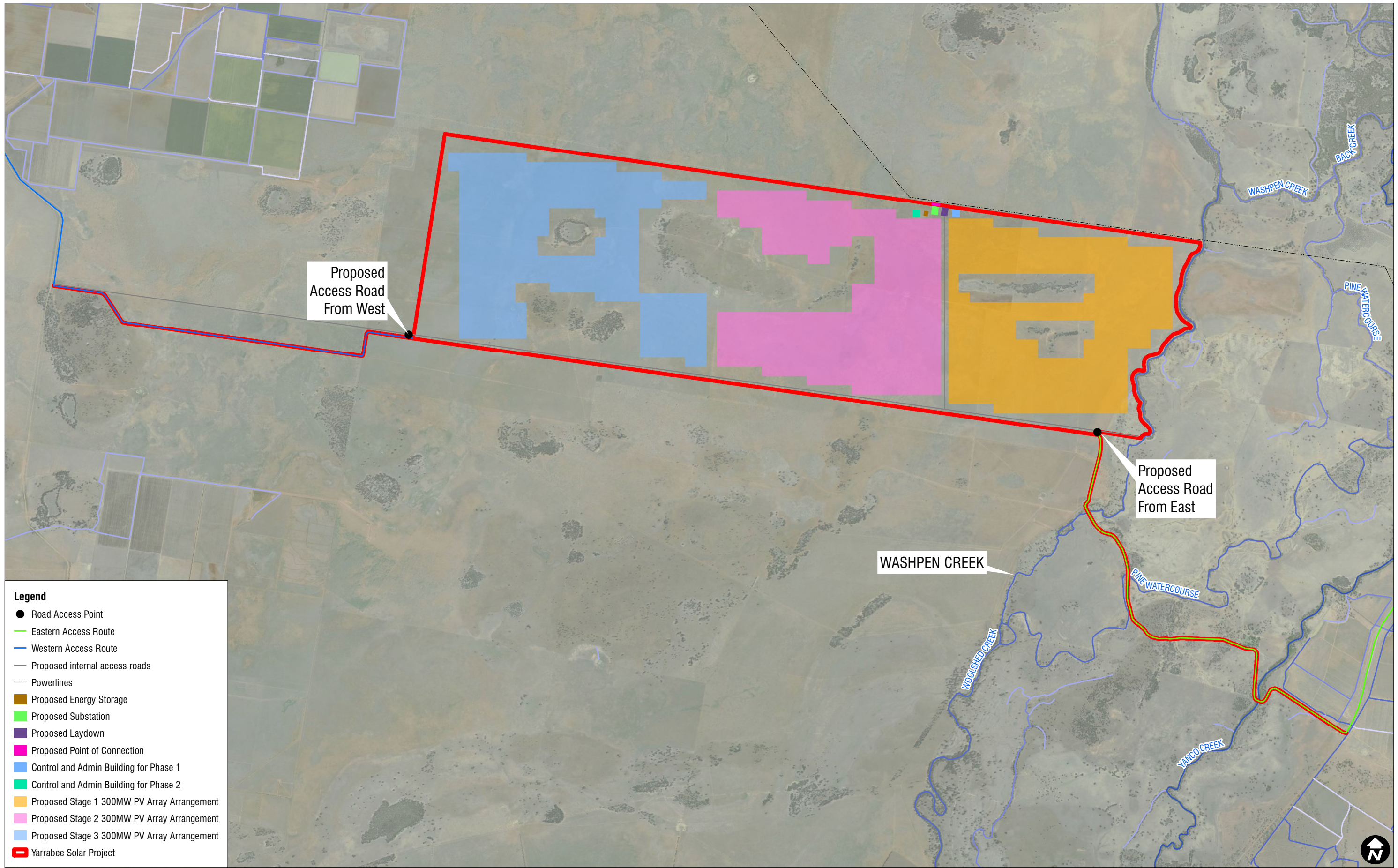
Table 24 Summary of Required Upgrades (Should the Eastern Access Route be Utilised)

Location	Required upgrade
General	• Enter into make good agreements for the pavement damage that occurs to the Council-controlled road networks during the duration of construction activity; • Prepare a RMP generally in accordance with the specifications provided in Section 9 and in addition prepare any TMPs required to support works undertaken within the public road reserve;
Sturt Highway / Reas Lane (Back Morundah Road) Intersection	• Provide AUxiliary Left (Short) turn lane (AUL(s))
Back Morundah Road / Site Access Road Intersection	• Provide shoulder widening (i.e. BAsic Right (BAR) treatment) to aid left turn;

APPENDIX A

Preliminary Layout

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ATTACHMENT B

Detailed Intersection Assessment Results

B-1 Intersection A – Sturt Highway / Reas Lane (Back Morundah Road)

B-1.1 Safety Assessment

Figure 1 to 4 detail the turn warrant assessments undertaken for the Sturt Highway / Reas Lane intersection for all design scenarios. Table 1 identifies the minimum turn treatment to be provided under the results of the turn warrant assessment.

Figure B.1 Intersection A (Eastern Access Only) – 2023 Background + Construction (AM & PM Peak)

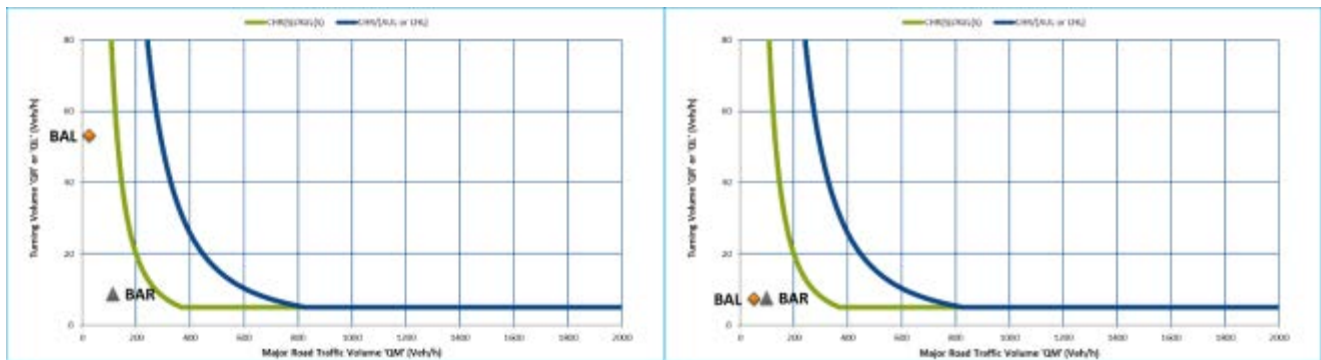


Figure B.2 Intersection A (Eastern Access Only) – 2023 Background + Operation (AM & PM Peak)

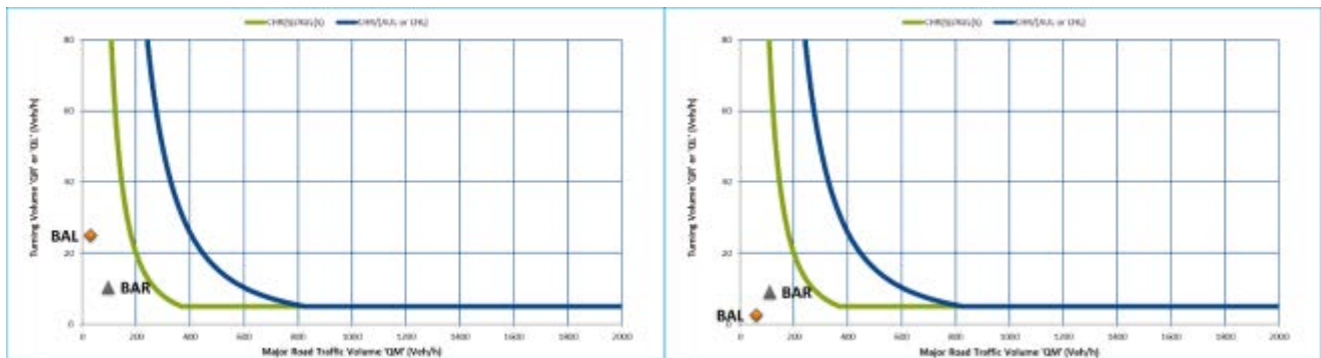


Figure B.3 Intersection A (Western Access Only) – 2023 Background + Construction (AM & PM Peak)

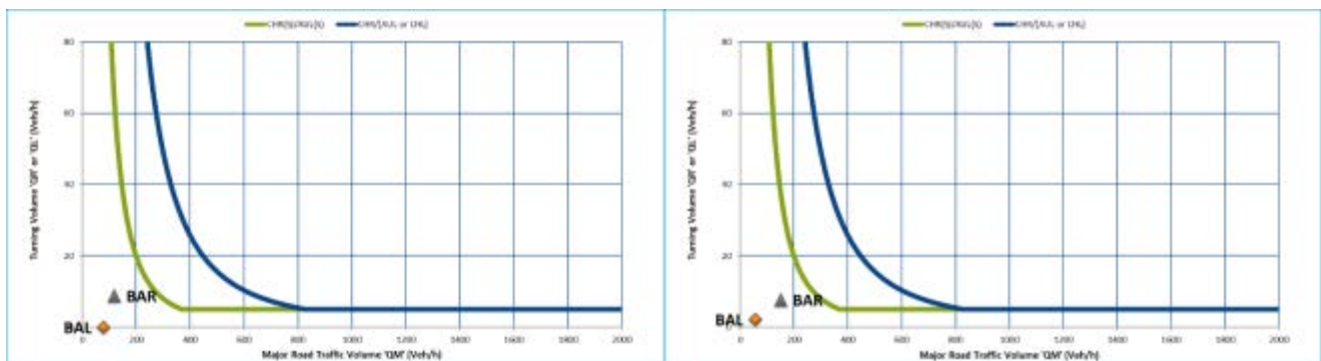


Figure B.4 Intersection A (Western Access Only) – 2033 Background + Operation (AM & PM Peak)

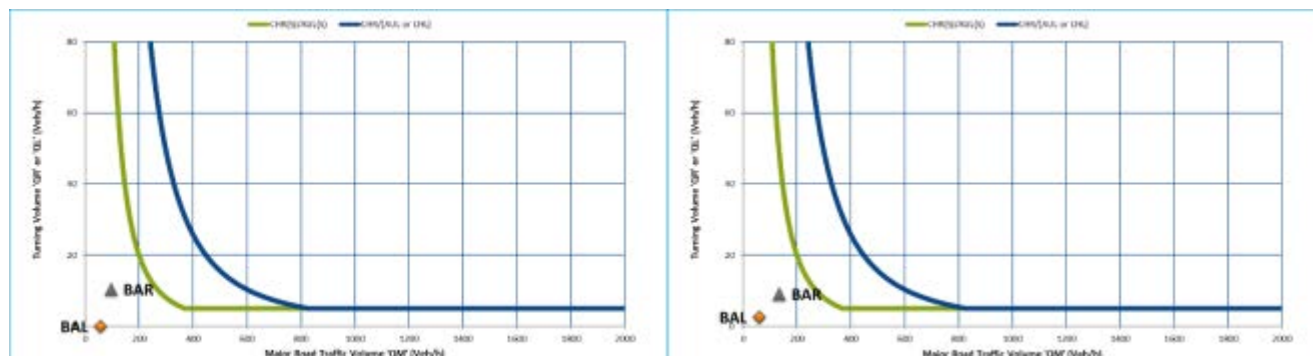


Table B.1 Sturt Highway / Reas Lane – Turn Warrant Assessment Results

Scenario	Peak Period	Left Turn Requirement	Right Turn Requirement
2033 Background + Construction <i>Eastern Access Only</i>	AM	BAL	BAR
	PM	BAL	BAR
2033 Background + Operation <i>Eastern Access Only</i>	AM	BAL	BAR
	PM	BAL	BAR
2033 Background + Construction <i>Western Access Only</i>	AM	BAL	BAR
	PM	BAL	BAR
2033 Background + Operation <i>Western Access Only</i>	AM	BAL	BAR
	PM	BAL	BAR

B-1.2 Sight Distance Assessment

Table 2 identifies the sight distances available at subject intersection.

Table B.2 Sturt Highway / Reas Lane – Sight Distance Assessment Results

Desirable Requirement	Measurement to East	Measurement to West
324m	420m+	380m+
		

The results presented in Table 2 indicate that the existing form of the Sturt Highway / Reas Lane intersection meets the minimum requirements for sight distance defined in *Austroads Guide to Road Design Part 4A*.

B-1.3 Capacity Assessment

Figure 5 illustrates the existing and assessed form of the Sturt Highway / Reas Lane intersection with the results for this form provided in Table 3.

Figure B.5 Existing and SIDRA Assessed Intersection Layouts



Source: Google

Table B.3 Summary of SIDRA Outputs – Sturt Highway / Reas Lane Intersection

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2018 Background	0.03	9.6s	0.8m	0.05	9.7s	1.6m
2023 Background + Con (Eastern Access Only)	0.06	10.0s	2.4m	0.06	10.2s	2.0m
2033 Background + Ops (Eastern Access Only)	0.05	9.8s	1.7m	0.06	10.1s	2.2m
2023 Background + Con (Western Access Only)	0.08	10.0s	2.7m	0.07	9.8s	2.1m
2033 Background + Ops (Western Access Only)	0.06	9.8s	1.9m	0.06	9.9s	2.1m

Based on the results presented in Table 3, the intersection will perform well within the maximum preferred operational capacity for a priority controlled intersection (DOS less than 0.80 and acceptable critical delay) for each assessed scenario, with no significant impact generated by the proposed solar project traffic. No mitigation upgrades are warranted based solely on intersection performance considerations.

B-2 Intersection B – Sturt Highway / Main Canal Road

B-2.1 Safety Assessment

Figure 6 to 9 detail the turn warrant assessments undertaken for the Sturt Highway / Main Canal Road intersection for all scenarios and phases of the Project's life. Table 4 identifies the minimum turn treatment to be provided under the results of the turn warrant assessment.

Figure B.6 Intersection B (Eastern Access Only) – 2023 Background + Construction (AM & PM Peak)

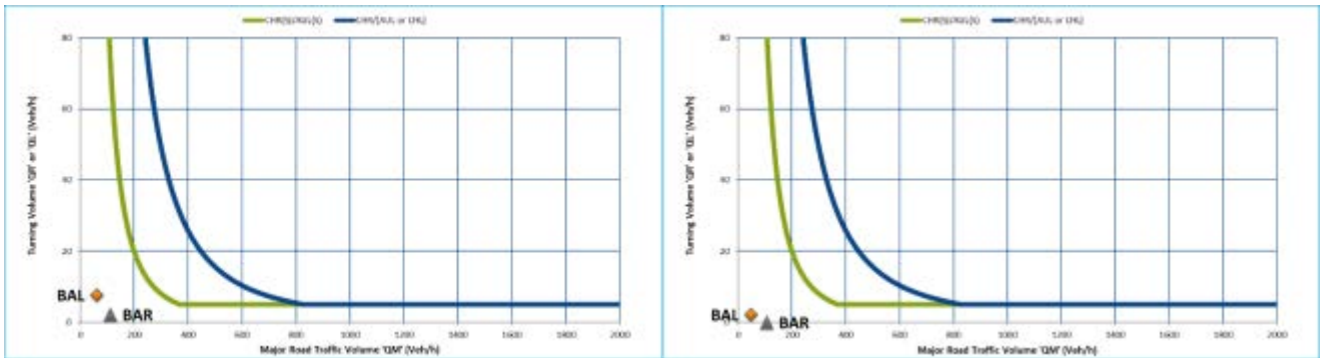


Figure B.7 Intersection B (Eastern Access Only) – 2023 Background + Operation (AM & PM Peak)

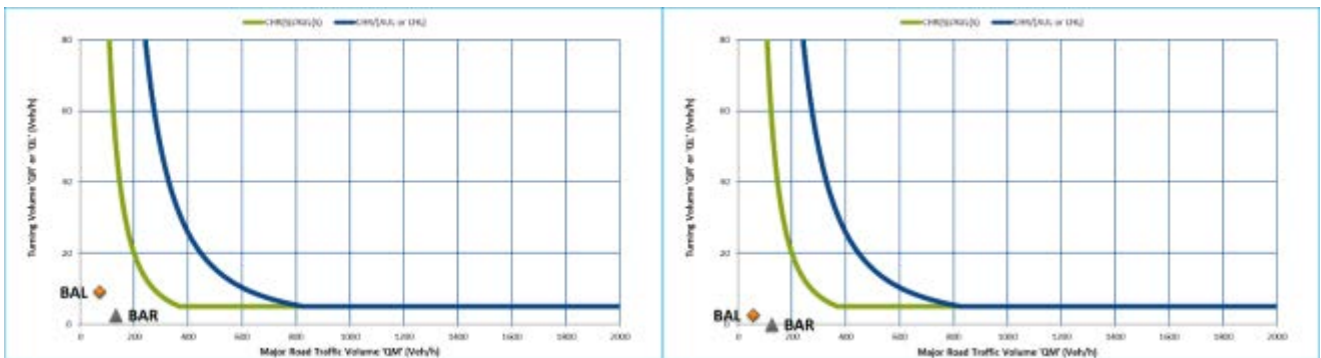


Figure B.8 Intersection B (Western Access Only) – 2023 Background + Construction (AM & PM Peak)

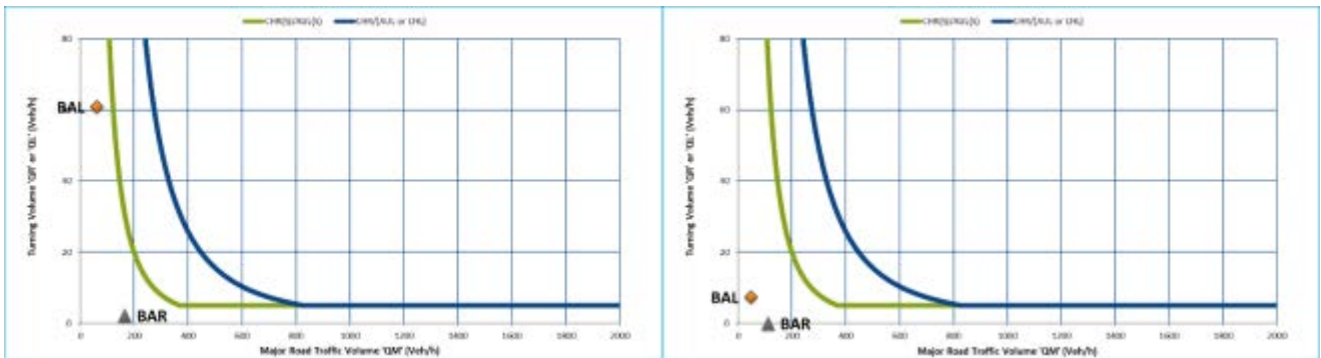


Figure B.9 Intersection B (Western Access Only) – 2023 Background + Operation (AM & PM Peak)

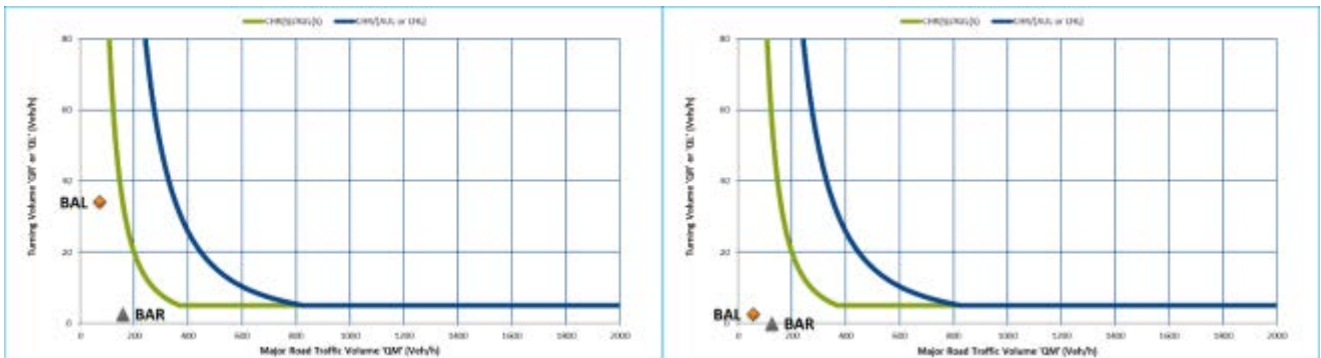


Table B.4 Sturt Highway / Main Canal Road – Turn Warrant Assessment Results

Scenario	Peak Period	Left Turn Requirement	Right Turn Requirement
2023 Background + Construction <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Operation <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Construction <i>Western Access Only</i>	AM	BAL	BAR
	PM	BAL	BAR
2023 Background + Operation <i>Western Access Only</i>	AM	BAL	BAR
	PM	BAL	BAR

Whilst the results of the turn warrant assessment identify the minimum turning treatments to include a BAL and BAR turn treatment, it is recommended that a higher order turn treatment be provided to ensure intersection safety is not compromised during the Project's design horizon, based on the potential access scenarios:

- **Eastern Access Route Scenario:** As Existing
- **Western Access Route Scenario:** AUL(S) (to the extent achievable within the constraints of the Coleambally Main Canal Kay Hull Bridge and associated guard rail).

It is noted that the above recommendation to provide an AUL(S) turn treatments is above and beyond that required based upon strict application of the industry standard turn warrants. Whilst the provision of this higher order turn treatment will provide significant safety benefits it is noted that slight departures from the standard requirements for the associated turn lane length may be required to minimise conflicts with existing infrastructure including the Coleambally Main Canal Kay Hull Bridge and associated guard rail. These departures to reduce construction costs are considered appropriate given that the requirement to provide turn lanes is above and beyond that strictly required based upon numerical analysis and given the vast majority of safety benefit will still be realised even with any slight departures.

B-2.2 Sight Distance Assessment

Table 5 identifies the sight distances available at subject intersection.

Table B.5 Sturt Highway / Main Canal Road – Sight Distance Assessment

Desirable Requirement	Measurement to East	Measurement to West
324m	399m+	599m+

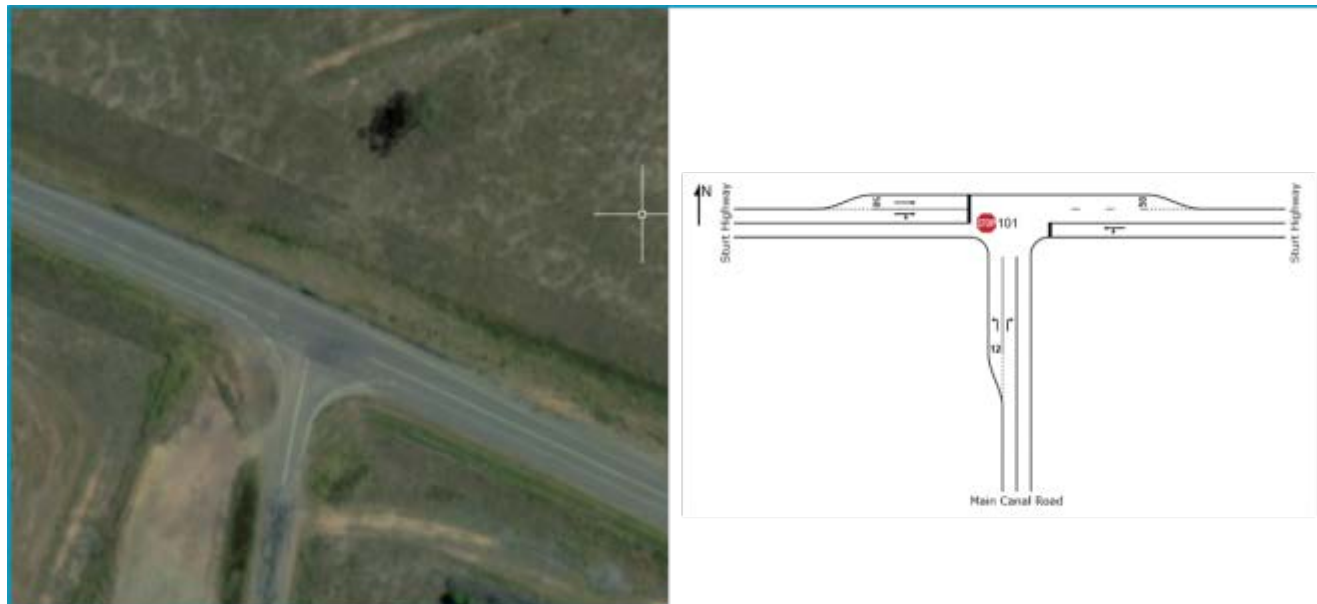
Desirable Requirement	Measurement to East	Measurement to West
		

The existing form of the Sturt Highway / Main Canal Road intersection meets the minimum requirements for sight distance defined in *Austroads Guide to Road Design Part 4A*.

B-2.3 Capacity Assessment

Figure 10 illustrates the existing and assessed form of the Sturt Highway / Main Canal Road intersection with the results for this form provided in Table 6.

Figure B.10 Existing and SIDRA Assessed Intersection Layouts



Source: Google

Table B.6 Summary of SIDRA Outputs – Sturt Highway / Main Canal Road Intersection

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2018 Background	0.06	9.6s	2.0m	0.04	9.6s	1.5m

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2023 Background + Con (Eastern Access Only)	-	-	-	-	-	-
2023 Background + Ops (Eastern Access Only)	-	-	-	-	-	-
2023 Background + Con (Western Access Only)	0.10	9.9s	4.0m	0.05	10.1s	1.9m
2023 Background + Ops (Western Access Only)	0.09	9.8s	3.5m	0.06	9.9s	2.0m

Based on the results presented in Table 6, the intersection will perform well within the maximum preferred operational capacity for a priority controlled intersection (DOS less than 0.80) for each assessed scenario, with no significant impact generated by the proposed solar project traffic. No mitigation upgrades are warranted based solely on intersection performance considerations.

B-3 Intersection C – Main Canal Road / Old Morundah Road

B-3.1 Safety Assessment

Figure 11 to 14 detail the turn warrant assessments undertaken for the Main Canal Road / Old Morundah Road intersection for all scenarios and phases of the Project's life. Table 7 identifies the minimum turn treatment to be provided under the results of the turn warrant assessment.

Figure B.11 Intersection C (Eastern Access Only) – 2023 Background + Construction (AM & PM Peak)

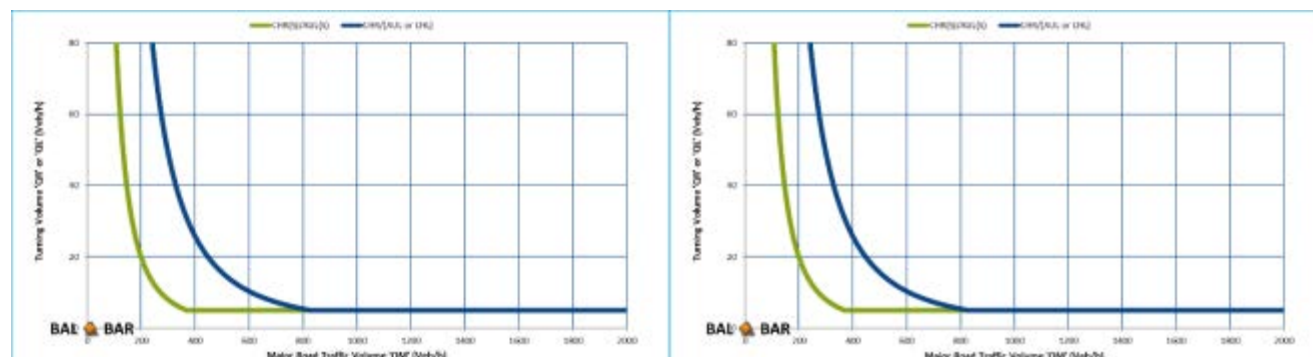


Figure B.12 Intersection C (Eastern Access Only) – 2023 Background + Operation (AM & PM Peak)

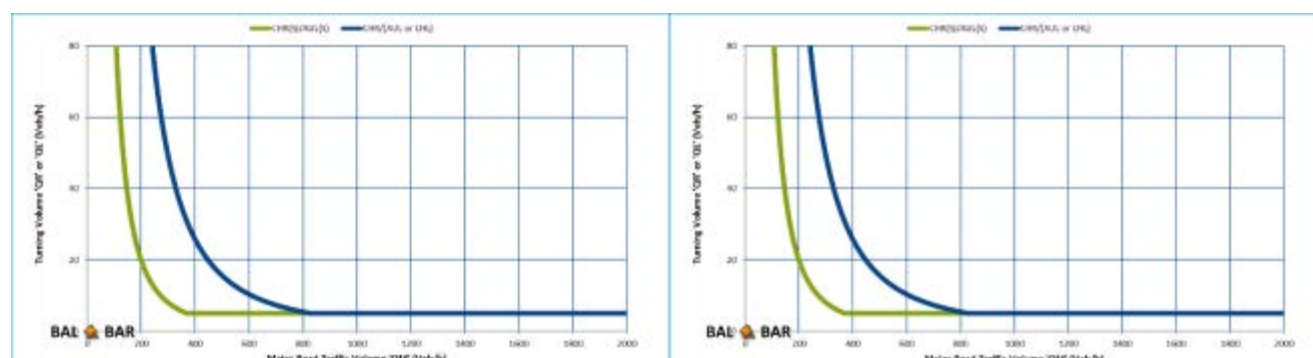


Figure B.1322 Intersection C (Western Access Only) – 2023 Background + Construction (AM & PM Peak)

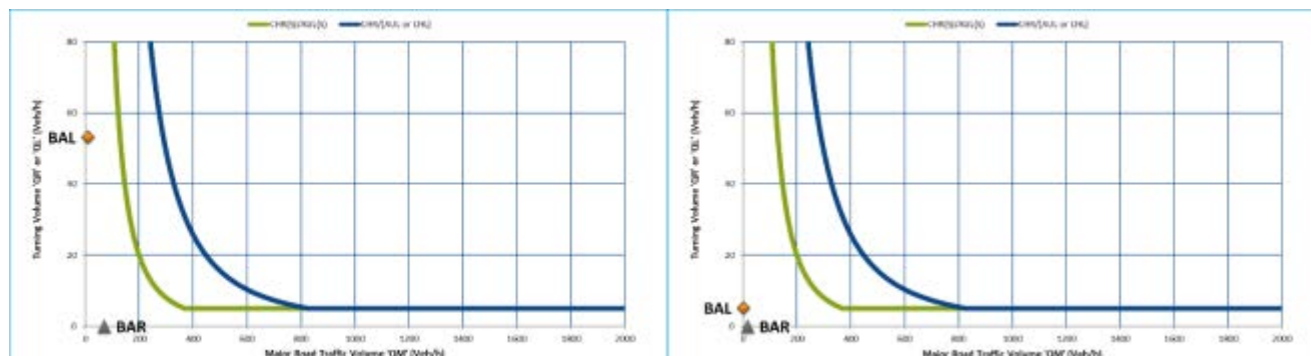


Figure B.14 Intersection C (Western Access Only) – 2023 Background + Operation (AM & PM Peak)

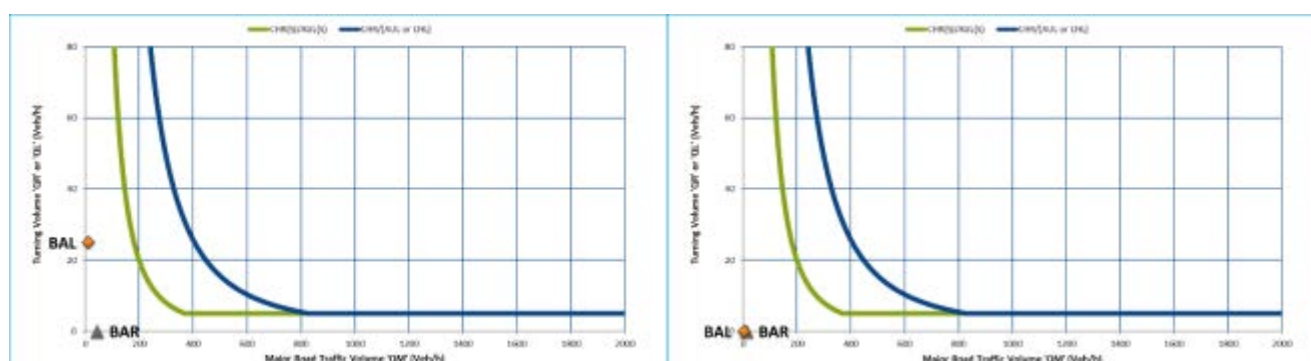


Table B.7 Main Canal Road / Old Morundah Road – Turn Warrant Assessment Results

Scenario	Peak Period	Left Turn Requirement	Right Turn Requirement
2023 Background + Construction <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Operation <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Construction <i>Western Access Only</i>	AM	BAL	-
	PM	BAL	-
2023 Background + Operation <i>Western Access Only</i>	AM	BAL	-
	PM	BAL	-

The results of the turn warrant assessment identifies the minimum turning treatments to include a BAL on the northern approach. The Project will not generate any right-turn demands from Main Canal Road, and as a result, will not require a BAR turn treatment.

It is recommended that the following upgrades be provided to ensure intersection safety is not compromised during the Project's design horizon, based on the potential access scenarios:

- **Eastern Access Route Scenario:** As Existing
- **Western Access Route Scenario:** BAL

B-3.2 Sight Distance Assessment

Table 8 identifies the sight distances available at subject intersection.

Table B.8 Main Canal Road / Old Morundah Road – Sight Distance Assessment

Desirable Requirement	Measurement to North	Measurement to South
285m	230m+ 	310m+ 

The results of the sight distance assessment indicate that the existing form of the Main Canal Road / Old Morundah Road intersection falls short of the standard requirements for sight distance as defined in *Austroads Guide to Road Design Part 4A* due to vegetation. It is however noted that in practice vehicles are unlikely to be travelling at 110km/h on the northern approach prior to the intersection due to the presence of bends. Increased sight distance could potentially be achieved through the removal of vegetation.

B-3.3 Capacity Assessment

Figure 15 illustrates the existing and assessed form of the Main Canal Road / Old Morundah Road intersection with the results for this form provided in Table 9.

Figure B.15 Existing and SIDRA Assessed Intersection Layouts



Source: Google

Table B.9 Summary of SIDRA Outputs – Main Canal Road / Old Morundah Road Intersection

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2018 Background	0.01	8.9s	0.1m	0.01	8.9s	0.3m
2023 Background + Con (Eastern Access Only)	-	-	-	-	-	-
2023 Background + Ops (Eastern Access Only)	-	-	-	-	-	-
2023 Background + Con (Western Access Only)	0.04	8.9s	0.2m	0.06	8.9s	1.5m
2023 Background + Ops (Western Access Only)	0.02	8.9s	0.1m	0.03	8.9s	0.7m

Based on the results presented in Table 9, the intersection will perform well within the maximum preferred operational capacity for a priority controlled intersection (DOS less than 0.80) for each assessed scenario, with no significant impact generated by the proposed solar project traffic. No mitigation upgrades are warranted based solely on intersection performance considerations.

B-4 Intersection D – Old Morundah Road / Site Access Road

B-4.1 Safety Assessment

Figure 16 to 19 detail the turn warrant assessments undertaken for the Old Morundah Road / Site Access Road intersection for all scenarios and phases of the Project's design horizon. Table 10 identifies the minimum turn treatment to be provided under the results of the turn warrant assessment.

Figure B.16 Intersection D (Eastern Access Only) – 2023 Background + Construction (AM & PM Peak)

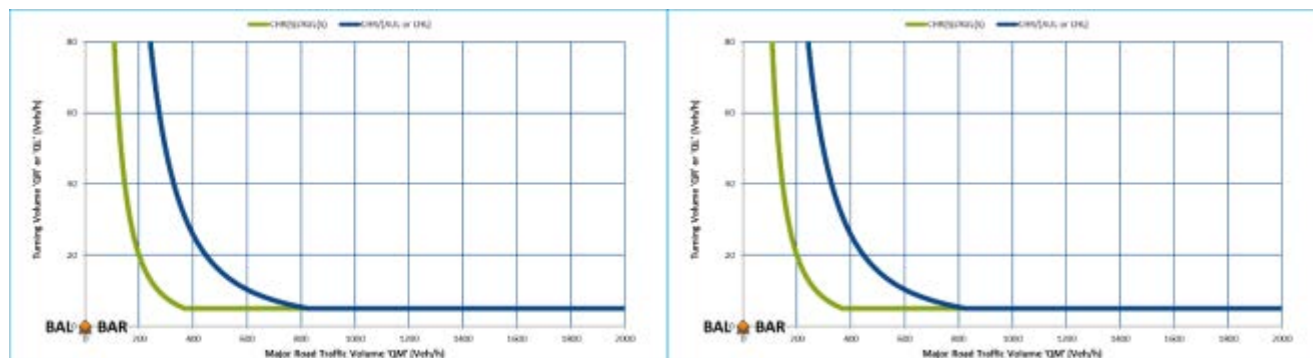


Figure B.17 Intersection D (Eastern Access Only) – 2023 Background + Operation (AM & PM Peak)

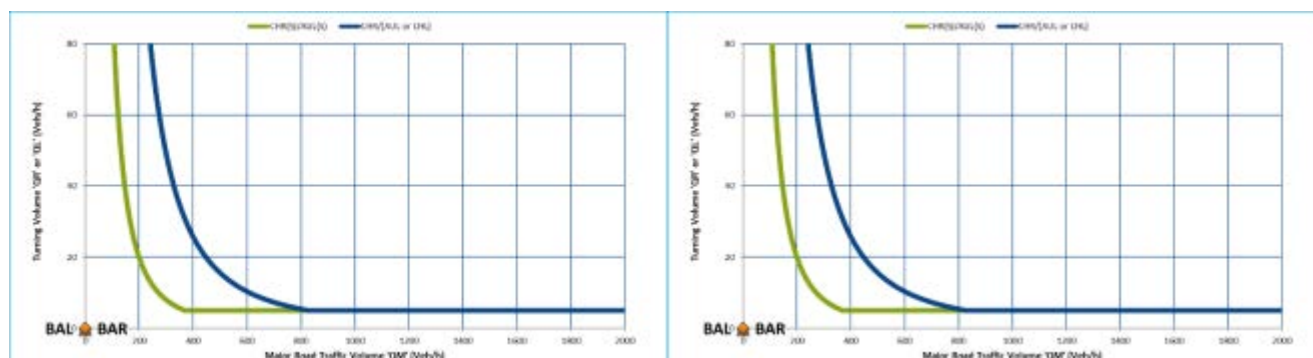


Figure B.18 Intersection D (Western Access Only) – 2023 Background + Construction (AM & PM Peak)

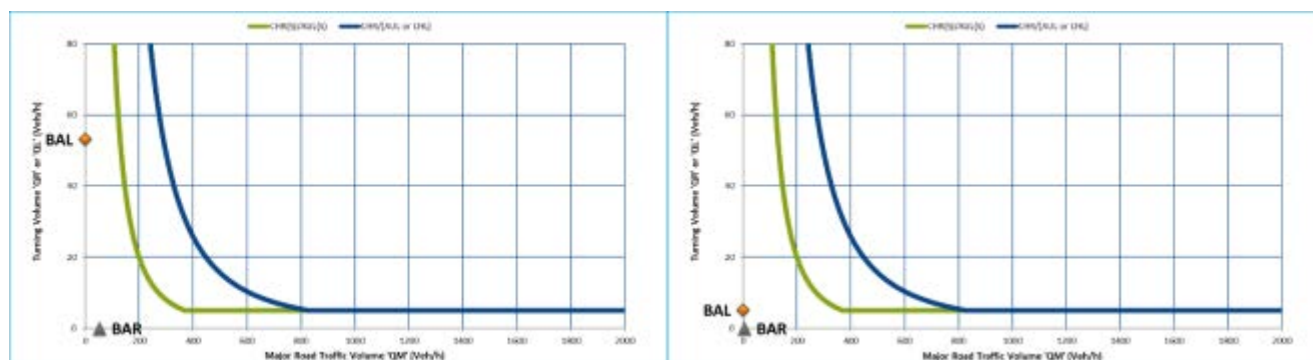


Figure B.19 Intersection D (Western Access Only) – 2023 Background + Operation (AM & PM Peak)

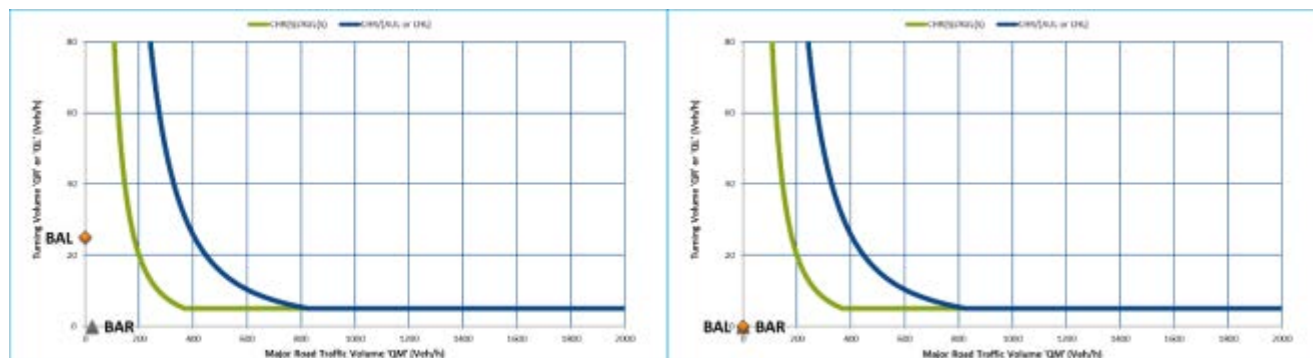


Table B.10 Old Morundah Road / Site Access Road – Turn Warrant Assessment Results

Scenario	Peak Period	Left Turn Requirement	Right Turn Requirement
2023 Background + Construction <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Operation <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Construction <i>Western Access Only</i>	AM	BAL	-
	PM	BAL	-
2023 Background + Operation <i>Western Access Only</i>	AM	BAL	-
	PM	BAL	-

The results of the turn warrant assessment identifies the minimum turning treatments to include a BAL on the northern approach. The Project will not generate any right-turn demands from Main Canal Road, and as a result, will not require a BAR turn treatment.

It is recommended that the following upgrades be provided to ensure intersection safety is not compromised during the Project's design horizon, based on the potential access scenarios:

- **Eastern Access Route Scenario:** As Existing
- **Western Access Route Scenario:** BAL

B-4.2 Sight Distance Assessment

Table 11 identifies the sight distances available at subject intersection.

Table B.11 Old Morundah Road / Site Access Road – Sight Distance Assessment

Desirable Requirement	Measurement to North	Measurement to South
	400m+	300m+
285m		

The existing form of the Old Morundah Road / Site Access Road intersection meets the minimum requirements for sight distance defined in Austroads Guide to Road Design Part 4A.

B-4.3 Capacity Assessment

Figure 20 illustrates the existing and assessed form of the Old Morundah Road / Site Access Road intersection with the results for this form provided in Table 12.

Figure B.20 Existing and SIDRA Assessed Intersection Layouts



Source: Google

Table B.12 Summary of SIDRA Outputs – Old Morundah Road / Site Access Road Intersection

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2018 Background	-	-	-	-	-	-
2023 Background + Con (<i>Eastern Access Only</i>)	-	-	-	-	-	-
2023 Background + Ops (<i>Eastern Access Only</i>)	-	-	-	-	-	-
2023 Background + Con (<i>Western Access Only</i>)	0.03	8.9s	0.2m	0.05	8.9s	1.5m
2023 Background + Ops (<i>Western Access Only</i>)	0.02	8.9s	0.1m	0.03	8.9s	0.7m

Based on the results presented in Table 12, the intersection will perform well within the maximum preferred operational capacity for a priority controlled intersection (DOS less than 0.80) for each assessed scenario, with no significant impact generated by the proposed solar project traffic. No mitigation upgrades are warranted based solely on intersection performance considerations.

B-5 Intersection E – Newell Highway / Browley Street (Back Morundah Road)

B-5.1 Safety Assessment

Figure 21 to 24 detail the turn warrant assessments undertaken for the Newell Highway / Browley Street intersection for all scenarios and phases of the Project's design horizon. Table 13 identifies the minimum turn treatment to be provided under the results of the turn warrant assessment.

Figure B.21 Intersection E (Eastern Access Only) – 2023 Background + Construction (AM & PM Peak)

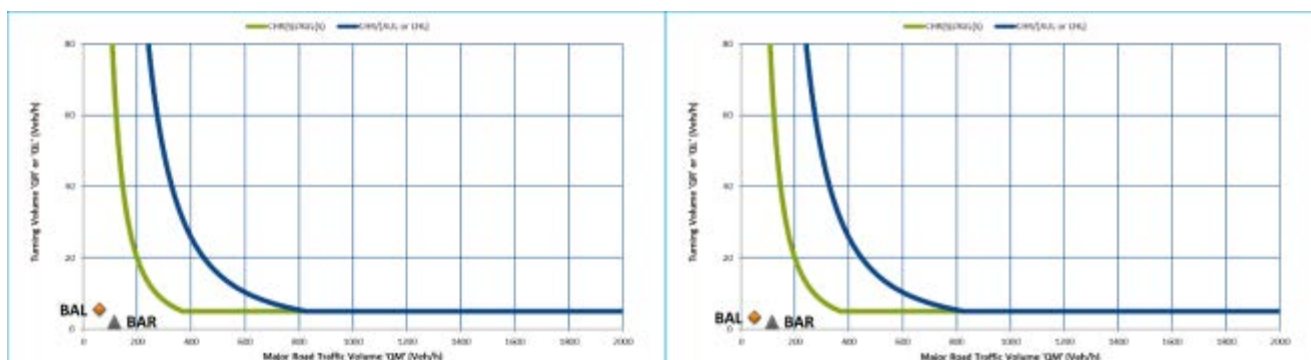


Figure B.22 Intersection E (Eastern Access Only) – 2023 Background + Operation (AM & PM Peak)

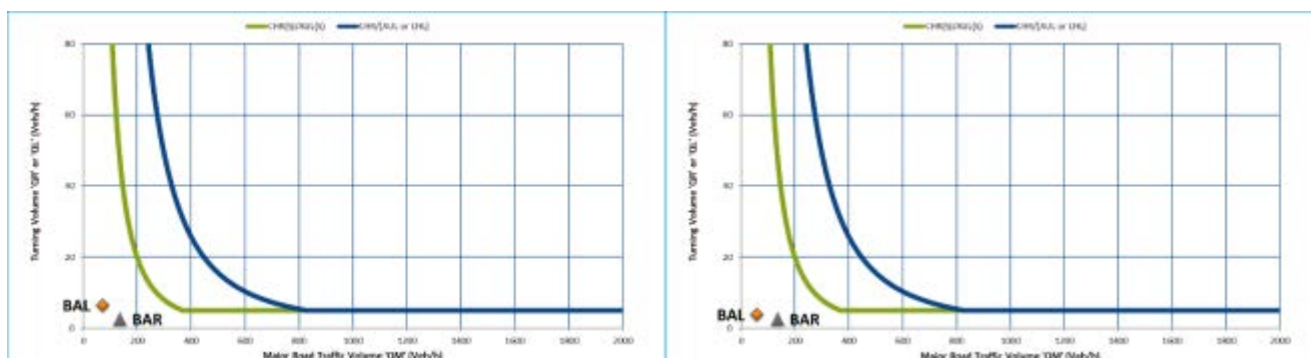


Figure B.23 Intersection E (Western Access Only) – 2023 Background + Construction (AM & PM Peak)

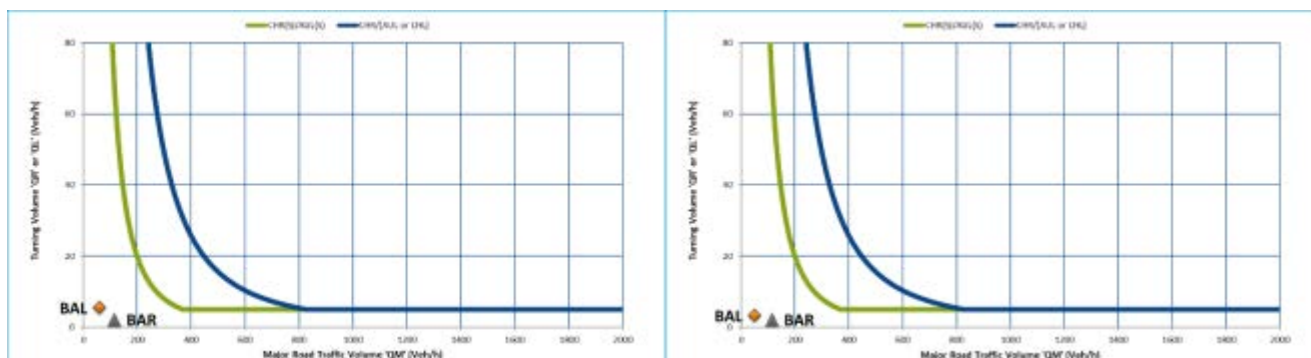


Figure B.24 Intersection E (Western Access Only) – 2033 Background + Operation (AM & PM Peak)

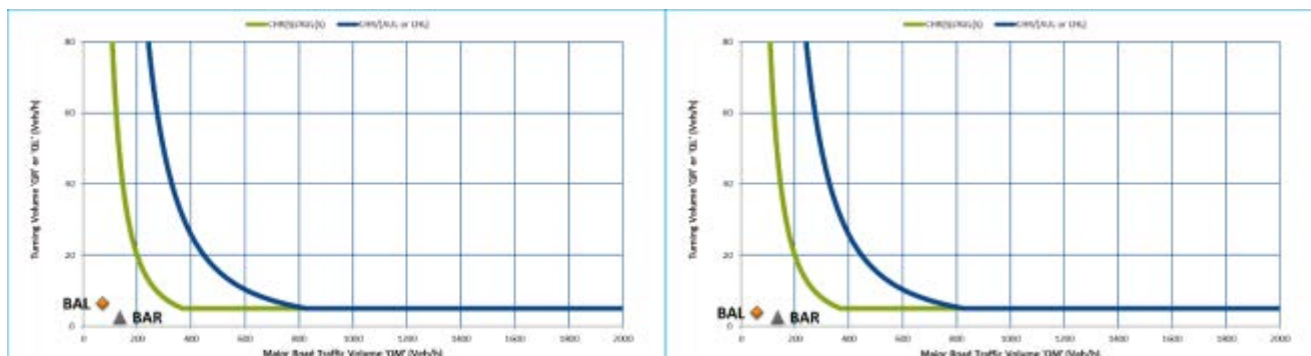


Table B.13 Newell Highway / Browley Street – Turn Warrant Assessment Results

Scenario	Peak Period	Left Turn Requirement	Right Turn Requirement
2023 Background + Construction <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Operation <i>Eastern Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Construction <i>Western Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Operation <i>Western Access Only</i>	AM	-	-
	PM	-	-

B-5.2 Sight Distance Assessment

Table 14 identifies the sight distances available at subject intersection.

Table B.14 Newell Highway / Browley Street – Sight Distance Assessment

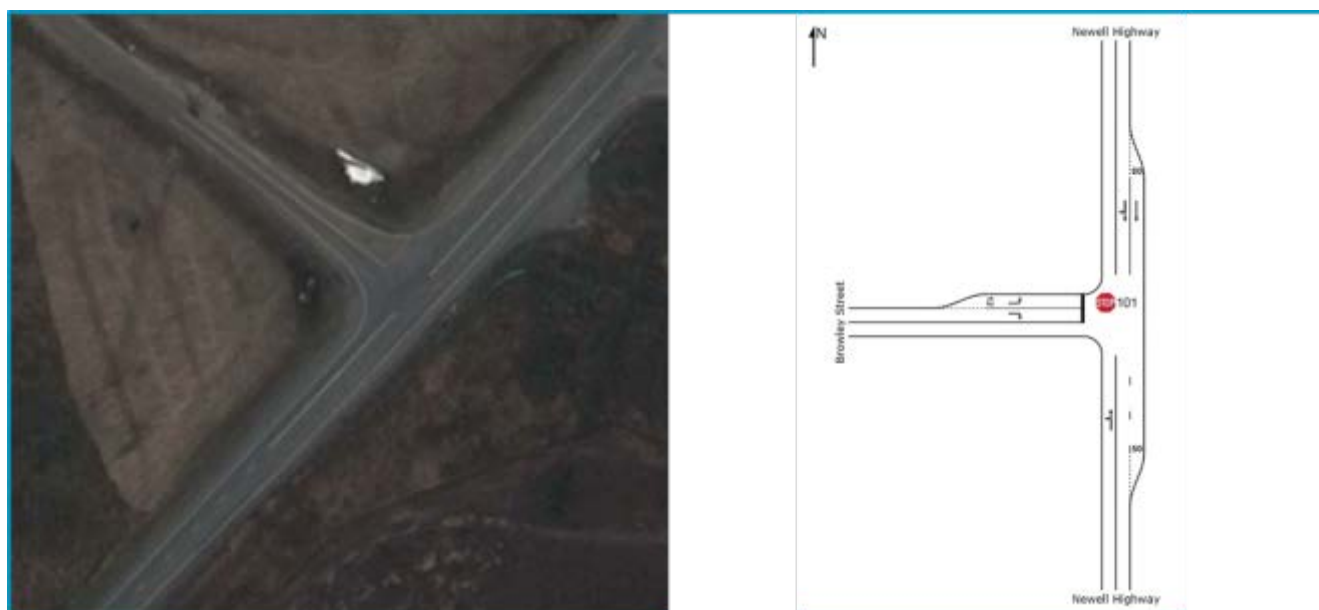
Desirable Requirement	Measurement to North	Measurement to South
324m	443m+	655m+
		

The existing form of the Newell Highway / Browley Street intersection meets the minimum requirements for sight distance defined in *Austroads Guide to Road Design Part 4A*.

B-5.3 Capacity Assessment

Figure 25 illustrates the existing and assessed form of the Newell Highway / Browley Street intersection with the results for this form provided in Table 15.

Figure B.25 Existing and SIDRA Assessed Intersection Layouts



Source: Google

Table B.15 Summary of SIDRA Outputs – Newell Highway / Browley Street Intersection

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2018 Background	0.04	9.2s	0.2m	0.03	9.2s	0.2m
2023 Background + Con (<i>Eastern Access Only</i>)	0.05	9.3s	0.2m	0.04	9.3s	0.2m
2023 Background + Ops (<i>Eastern Access Only</i>)	0.05	9.5s	0.2m	0.04	9.5s	0.3m
2023 Background + Con (<i>Western Access Only</i>)	0.05	9.3s	0.2m	0.04	9.3s	0.2m
2023 Background + Ops (<i>Western Access Only</i>)	0.05	9.5s	0.2m	0.04	9.5s	0.3m

Based on the results presented in Table 26, the intersection will perform well within the maximum preferred operational capacity for a priority controlled intersection (DOS less than 0.80) for each assessed scenario, with no significant impact generated by the proposed solar project traffic. No mitigation upgrades are warranted based solely on intersection performance considerations.

B-6 Intersection F – Back Morundah Road / Site Access Road

B-6.1 Safety Assessment

Figure 26 to 29 detail the turn warrant assessments undertaken for the Back Morundah Road / Site Access Road intersection for all scenarios and phases of the Project's design horizon. Table 16 identifies the minimum turn treatment to be provided under the results of the turn warrant assessment.

Figure B.26 Intersection F (Eastern Access Only) – 2023 Background + Construction (AM & PM Peak)

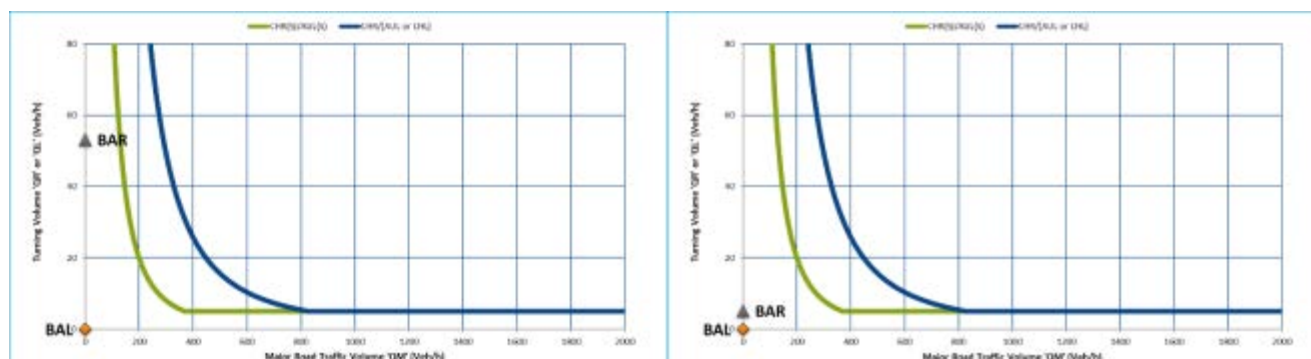


Figure B.27 Intersection F (Eastern Access Only) – 2023 Background + Operation (AM & PM Peak)

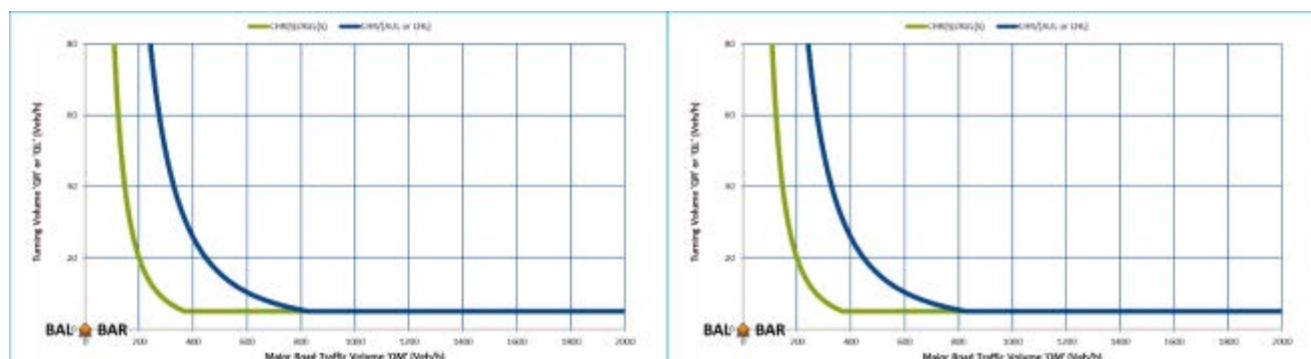


Figure B.28 Intersection F (Western Access Only) – 2023 Background + Construction (AM & PM Peak)

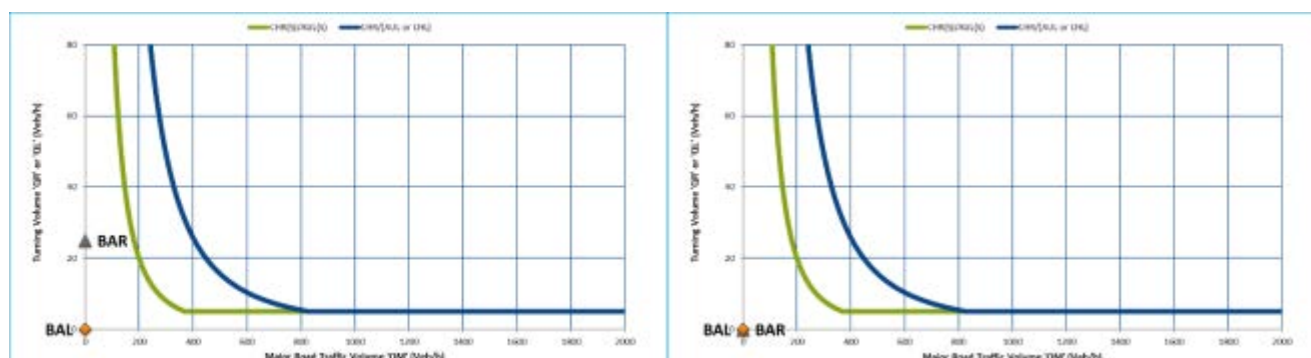


Figure B.29 Intersection F (Western Access Only) – 2033 Background + Operation (AM & PM Peak)

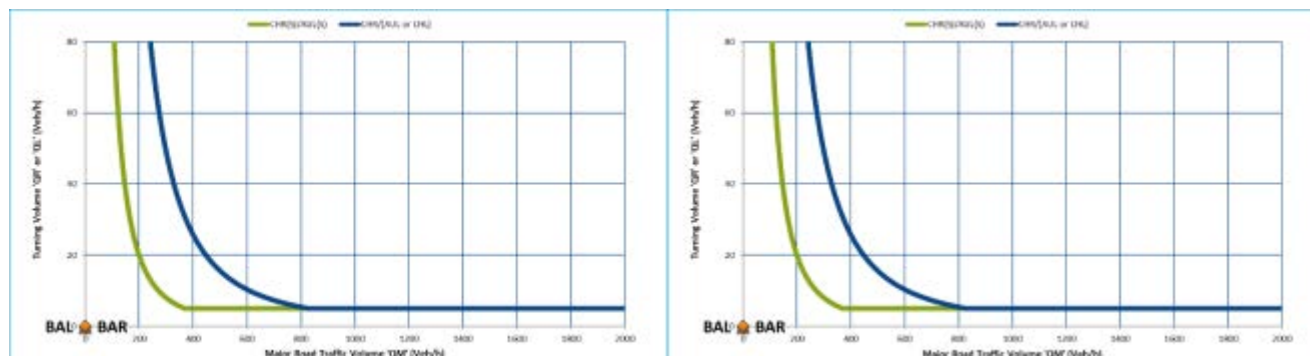


Table B.16 Back Morundah Road / Site Access Road – Turn Warrant Assessment Results

Scenario	Peak Period	Left Turn Requirement	Right Turn Requirement
2023 Background + Construction <i>Eastern Access Only</i>	AM	-	BAR
	PM	-	BAR
2023 Background + Operation <i>Eastern Access Only</i>	AM	-	BAR
	PM	-	BAR
2023 Background + Construction <i>Western Access Only</i>	AM	-	-
	PM	-	-
2023 Background + Operation <i>Western Access Only</i>	AM	-	-
	PM	-	-

It is recommended that the following upgrades be provided to ensure intersection safety is not compromised during the Project's design horizon, based on the potential access scenarios:

- **Eastern Access Route Scenario:** BAR
- **Western Access Route Scenario:** As Existing

B-6.2 Sight Distance Assessment

Table 17 identifies the sight distances available at subject intersection.

Table B.17 Back Morundah Road / Site Access Road – Sight Distance Assessment

Desirable Requirement	Measurement to North	Measurement to South
285m	600m+	600m+

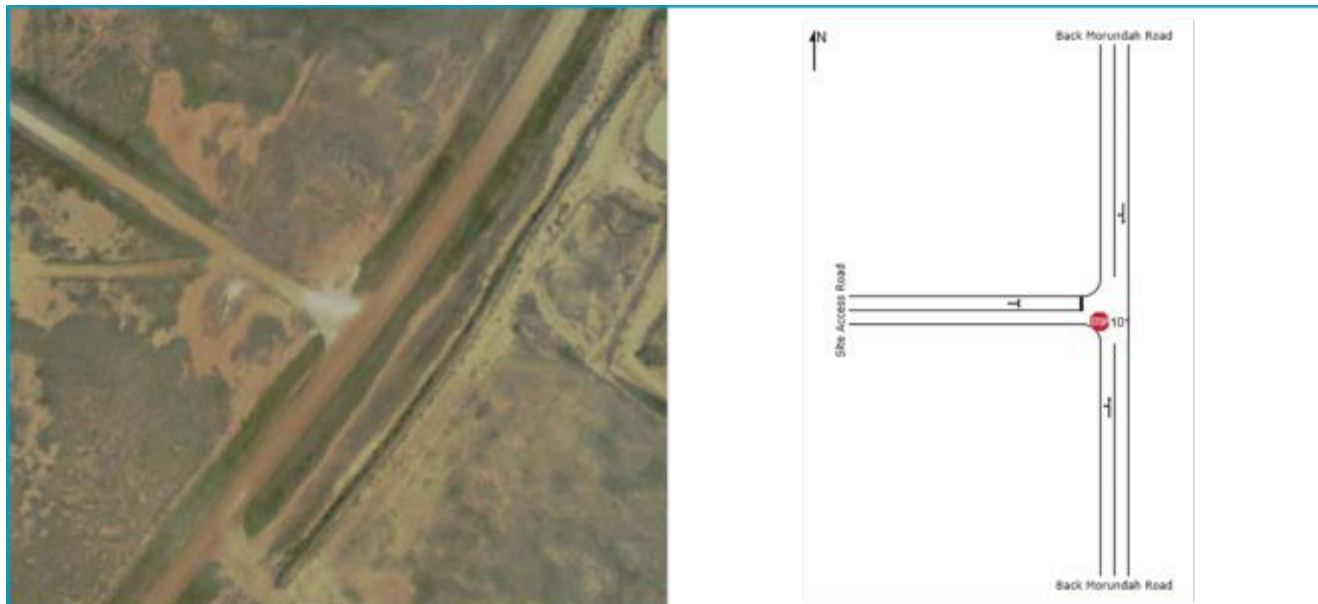
Desirable Requirement	Measurement to North	Measurement to South
		

The existing form of the Back Morundah Road / Site Access Road intersection meets the minimum requirements for sight distance defined in *Austrroads Guide to Road Design Part 4A*.

B-6.3 Capacity Assessment

Figure 30 illustrates the existing and assessed form of the Back Morundah Road / Site Access Road intersection with the results for this form provided in Table 18.

Figure B.30 Existing and SIDRA Assessed Intersection Layouts



Source: Google

Table B.18 Summary of SIDRA Outputs – Back Morundah Road / Site Access Road Intersection

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2018 Background	-	-	-	-	-	-

Scenario	AM Peak			PM Peak		
	DoS	Critical Delay	95 th Queue	DoS	Critical Delay	95 th Queue
2023 Background + Con (<i>Eastern Access Only</i>)	0.04	8.9s	1.3m	0.04	8.9s	1.4m
2033 Background + Ops (<i>Eastern Access Only</i>)	0.02	8.9s	0.6m	0.02	8.9s	0.7m
2023 Background + Con (<i>Western Access Only</i>)	-	-	-	-	-	-
2033 Background + Ops (<i>Western Access Only</i>)	-	-	-	-	-	-

Based on the results presented in Table 18, the intersection will perform well within the maximum preferred operational capacity for a priority controlled intersection (DOS less than 0.80) for each assessed scenario, with no significant impact generated by the proposed solar project traffic. No mitigation upgrades are warranted based solely on intersection performance considerations.

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