



Moolarben Coal Complex UG4 Ancillary Works Modification

Modification Report

APPENDIX G

ROAD TRANSPORT REVIEW





Moolarben Coal Complex UG4 Ancillary Works Modification Road Transport Review

Prepared for:

Moolarben Coal Operations Pty Limited

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Moolarben Coal Complex UG4 Ancillary Works Modification Road Transport Review

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1 Introduction

This report has been prepared on behalf of Moolarben Coal Operations Pty Ltd (MCO) to present the findings of an assessment of the road transport implications of a modification to the approved operations at the Moolarben Coal Complex. The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee in the Western Coalfields of New South Wales (NSW) (Figure 1.1).

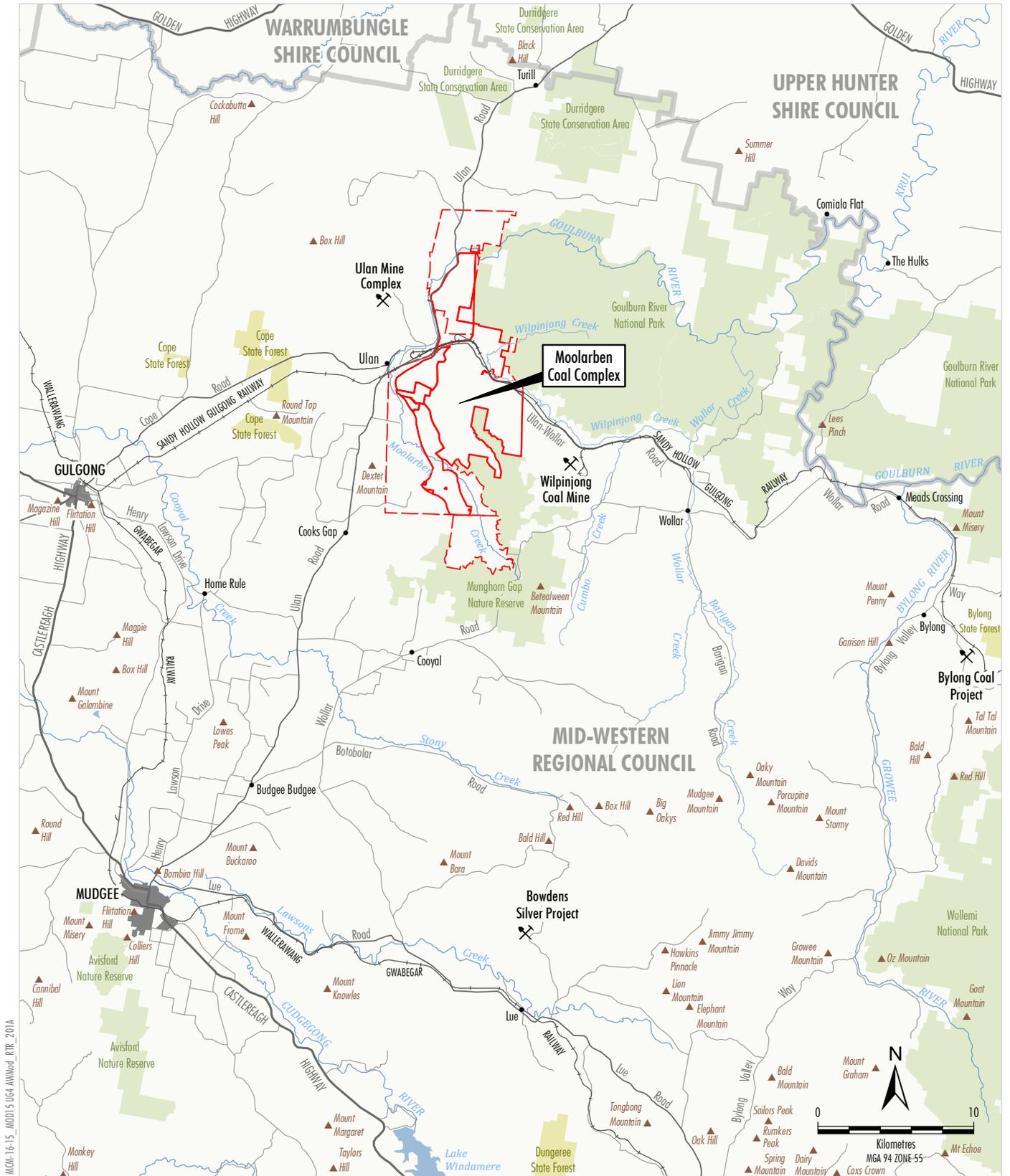
MCO is the operator of the Moolarben Coal Complex on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Sojitz Moolarben Resources Pty Ltd and a consortium of Korean power companies). MCO and MCM are wholly owned subsidiaries of Yancoal Australia Limited.

The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities) (Figure 1.1). Since commencement of coal mining operations in 2010, mining activities have occurred within OC1, OC2, OC4, and UG1 (Figure 1.1).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 in accordance with Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified. The current mining operations are also conducted in accordance with the requirements of the conditions of Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691 and ML1715 granted under the *Mining Act, 1992*.

MCO is seeking to modify the Project Approval for Stage 1 of the Moolarben Coal Complex, referred to as the UG4 Ancillary Works Modification (the Modification) to allow for changes to the currently approved operations. This study considers the potential road transport implications of the Modification with regard to the capacity, efficiency and safety of the road network, and with regard to other changes expected to occur to traffic conditions in the region.

The assessment has been prepared in accordance with the *Guide to Traffic Generating Developments* (NSW Roads and Traffic Authority, 2002), the *Austrroads Guide to Road Design and Guide to Traffic Management* series, and the accompanying Roads and Maritime Services (RMS) Supplements.



ANON-16-15_AWD15UG4_AWMed_RTR_2014



- LEGEND**
- State Forest
 - NSW National Parks and Wildlife Service
 - Local Government Boundary
 - Exploration Licence Boundary
 - Mining Lease Boundary
 - Mining Operation

Source: NSW Land & Property Information (2017); NSW Department of Industry (2019); Office of Environment and Heritage NSW (2019)

MOOLARBEN COAL
MOOLARBEN COAL COMPLEX
Site Location

Figure 1.1

2 Moolarben Coal Complex

2.1 Approved Operations

The Moolarben Coal Complex is approved to operate until 31 December 2038, and mining operations are permitted to occur 24 hours per day, seven days per week. The Moolarben Coal Complex operates two stages, Stage 1 and Stage 2 concurrently with a total run-of-mine (ROM) coal extracted (open cut and underground mining) limited to 24 million tonnes per annum (Mtpa).

Vehicular access to the Moolarben Coal Complex is provided via:

- the CHPP Access Road off Ulan Road, approximately 1 km north of its intersection with Ulan-Wollar Road;
- the Open Cut Access Road off Ulan-Wollar Road approximately 120 metres (m) east of Ulan Road;
- the ROM Coal Facilities and existing Underground RSIA Access Road from Ulan-Wollar Road approximately 2.4 km east of Ulan Road; and
- the OC4 Access Road from Ulan-Wollar Road approximately 4.6 km east of Ulan Road.

MCO has realigned and upgraded sections of Ulan-Wollar Road, and made financial contributions to the upgrading of Ulan Road.

Vehicular access for construction and maintenance of the approved borefield surface infrastructure is approved via existing crown roads off Ulan Road. The Environmental Assessment (Coffey Natural Systems, 2010) relating to those arrangements indicates that:

“use of these access arrangements by dozers, drilling rigs and delivery trucks will generally be infrequent and for short periods of time during construction of the borefield. Access by light vehicles will be more frequent during construction and then less frequent during operation. Only small numbers of construction vehicles (earth moving equipment, drilling rigs, delivery trucks and support vehicles) will be required during the construction of the borefield.”

MCO has committed to implementing appropriate traffic management for construction vehicles entering and exiting the borefield site to Ulan Road and along Saddlers Creek Road, where required (Moolarben Coal, 2010).

2.2 Existing Traffic Characteristics

GTA Consultants (2015b) last assessed the road transport implications of the Moolarben Coal Complex under the now-approved Moolarben UG1 Optimisation Modification, which included:

- a peak operational workforce of 740 people with an average workforce of approximately 670 people; and
- a peak construction workforce of 250 people with an average of 120 people.

GTA Consultants (2015a) identified the main routes which would be used by traffic travelling to and from the Moolarben Coal Complex. Table 2.1 summarises the traffic generation forecasts of the Moolarben Coal Complex on Ulan Road for 2017 during peak construction activity and for 2027 during peak operational workforce. All vehicles using the site accesses on Ulan-Wollar Road were assumed to arrive and depart via Ulan Road.

Table 2.1: Moolarben Coal Complex Traffic Forecasts

Location	6:00 am to 7:00 am (vehicles per hour)		6:00 pm to 7:00 pm (vehicles per hour)		Daily (vehicles per day)	
	2017	2027	2017	2027	2017	2027
Moolarben Coal Complex Traffic						
All Accesses Combined	397	250	232	96	2,175	1,741
Open Cut Access	208	104	111	14	1,163	855
ROM Facilities Access	16	2	13	0	52	12
CHPP Access	173	144	108	82	960	874
Distribution on Ulan Road						
North of Ulan-Wollar Road	179	141	110	75	1,010	869
South of Ulan-Wollar Road	360	227	195	72	1,565	1,218
South of Cope Road	308	190	169	60	1,331	1,022

Source: GTA Consultants (2015a)

Table 2.1 indicates that the total traffic generation of the Moolarben Coal Complex can be expected to decrease after 2017. GTA Consultants (2015b) found that approximately 10 per cent of the trips would travel to and from the north along Ulan Road.

GTA Consultants (2015b) assessed the peak hour operational characteristics of key intersections in the vicinity of the Moolarben Coal Complex with the additional traffic associated with the UG1 Optimisation Modification. The assessment included the intersections of Ulan Road with the CHPP Access Road, Ulan-Wollar Road with Ulan Road, Ulan-Wollar Road with the Open Cut Access Road, and Ulan Road with Cope Road. The results of that assessment found that in 2017 and 2027, the intersections would all operate at good levels of service, with spare capacity and short delays to traffic.

2.3 Modification Description

The key features associated with the Modification include:

- relocation and expansion of dewatering sites and associated infrastructure;
- development of a downcast ventilation shaft for UG4 and associated compound (including service drop holes); and
- development of a Remote Services Infrastructure Area (RSIA) (including service drop holes) above the UG4 mains.

With regard to the road transport environment, the Modification proposes:

- construction of a new site vehicular access to the ventilation shaft compound via Ulan Road, which will be used throughout construction, operation, maintenance and decommissioning activities;
- all construction traffic for the northern dewatering site via the approved access from Saddlers Creek Road due to the relocation/expansion of pre-approved existing dewatering bores in the north west region of UG1;
- new internal access tracks from the CHPP Access Road to dewatering sites at the southern end of UG4 within a corridor shared with drainage, power, communications and water pipelines, which will be used throughout construction, operation, maintenance and decommissioning activities;
- new internal access road and road crossing of Bora Creek from the existing CHPP Access Road to the RSIA within a corridor shared with power supply and water pipelines, which would remain in use throughout construction, operation, maintenance and decommissioning activities.

3 Existing Road Environment

3.1 Road Network

The road network serving the Moolarben Coal Complex is shown on Figure 1.1 and is briefly described below. It is noted that some of the roads are known by several names. For consistency throughout this report, the names below will be used to refer to the relevant sections of road as described here.

Ulan-Wollar Road is a local rural road which provides an east-west connection between the villages of Ulan and Wollar. Ulan-Wollar Road provides several direct vehicular accesses to the Moolarben Coal Complex, the primary accesses being:

- to OC1 via the Open Cut Access Road which intersects with Ulan-Wollar Road approximately 120 m east of Ulan Road. The intersection has channelised right turn lane in Ulan-Wollar Road for vehicles turning into the Open Cut Access Road.
- via the ROM Coal Facility and existing Underground RSIA Access Road, located approximately 2.4 km east of Ulan Road. That intersection has no auxiliary turn lanes, and forms a four-way intersection with a secondary access road which crosses the Sandy Hollow Gulgong Railway within the Moolarben Coal Complex.
- to OC4 via the OC4 Access Road approximately 4.6 km east of Ulan Road. That intersection includes a “CHR” channelised right-turn bay in Ulan-Wollar Road, allowing eastbound vehicles to pass around vehicles turning right into the OC4 Access Road.

The intersection of Ulan-Wollar Road with Ulan Road includes a “CHR” channelised right-turn and passing bay in Ulan Road, allowing northbound vehicles to pass around vehicles turning right into Ulan-Wollar Road, and an “AUL” auxiliary left-turn lane (deceleration lane) in Ulan Road for the left turn into Ulan-Wollar Road, and intersection lighting. Ulan-Wollar Road also provides access to the Wilpinjong Coal Mine located east of the Moolarben Coal Complex.

Ulan Road forms part of Main Road 208 (MR208) which extends between Castlereagh Highway (B55) at Mudgee and Golden Highway (B84) at Sandy Hollow, and of Main Road 214 (MR214) which extends from MR208 at Budgee Budgee to the Golden Highway at Cassilis. MR208 continues from Budgee Budgee to Bylong via Wollar.

Ulan Road provides direct vehicular access to the Moolarben Coal Complex via the CHPP Access Road, located approximately 1 km north of Ulan-Wollar Road. At that intersection, Ulan Road includes a “CHR” channelised right-turn and passing bay in Ulan Road, allowing northbound vehicles to pass around vehicles turning right into the CHPP Access Road, and an “AUL” auxiliary left-turn lane (deceleration lane) in Ulan Road for the left turn into the CHPP Access Road. Access from Ulan Road to the surface of UG4, including the approved northern borefield is via existing crown roads, including Saddlers Creek Road. The posted speed limit on this part of Ulan Road is 100 km/h, with advisory speed signs on bends, where appropriate.

Saddlers Creek Road is a local road which extends eastwards from Ulan Road, approximately 5.5 km north of Ulan-Wollar Road and 3.0 km north of the access road to the Ulan Coal Complex. It is an unsealed two-way road which provides access to local properties and access to the northern UG4 mine area, and does not fulfil any through traffic function. The intersection of Saddlers Creek Road with Ulan Road is a basic rural T-intersection, with no localised widening of the sealed surface of Ulan Road in the vicinity of the intersection.

3.2 Traffic Surveys

To quantify existing traffic conditions, an automatic traffic survey was undertaken on Ulan Road near the site of the proposed new access road. The survey was conducted over one week between Friday 12 October 2018 and Thursday 18 October 2018 inclusive. Table 3.1 summarises the surveyed daily and peak hourly volumes throughout the survey period.

Table 3.1: Surveyed Traffic on Ulan Road (12-18 October 2018)

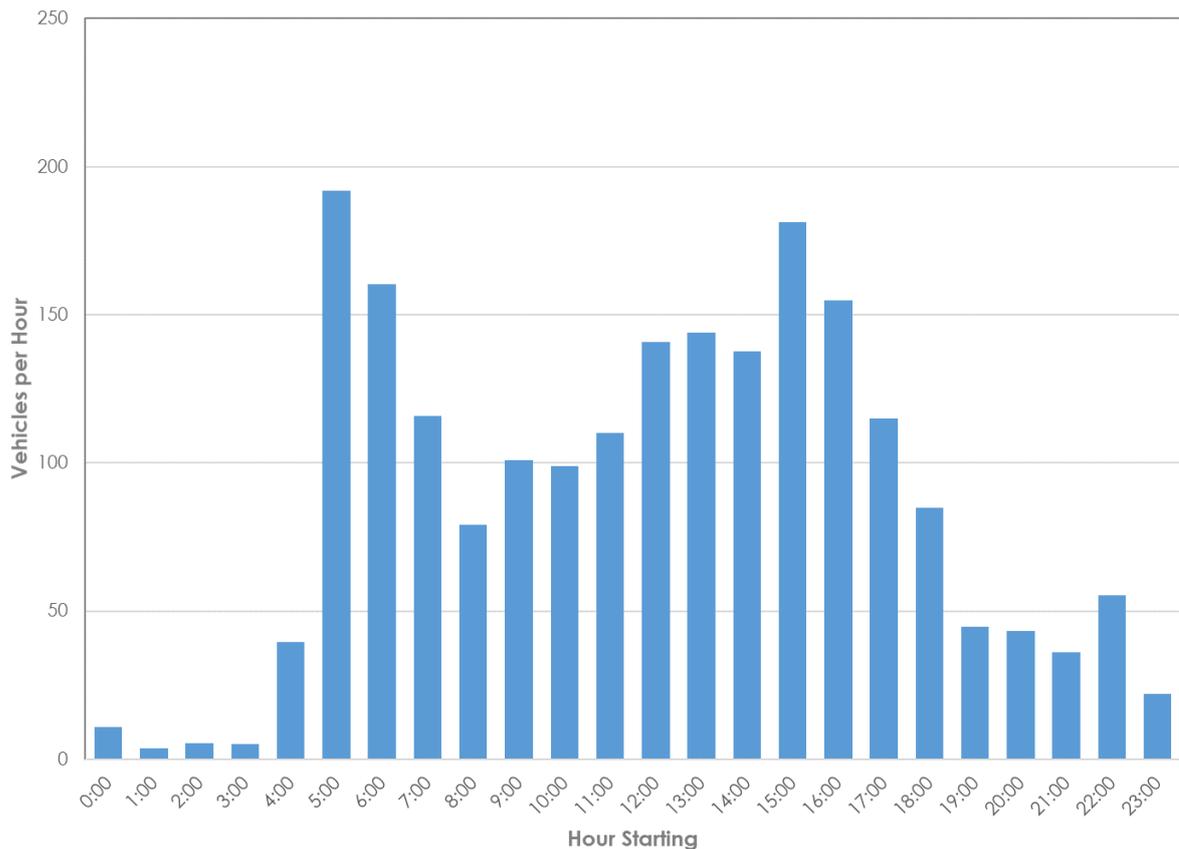
Day	Daily (vehicles per day)	AM Peak Hour		PM Peak Hour	
		Hour Start	Vehicles	Hour Start	Vehicles
Monday	2,057	5:00	184	15:00	181
Tuesday	2,062	5:00	192	16:00	181
Wednesday	1,947	5:00	205	15:00	150
Thursday	2,062	5:00	178	15:00	189
Friday	2,283	5:00	200	15:00	242
Saturday	1,207	10:00	113	12:00	100
Sunday	1,497	11:00	104	13:00	139
Average Weekday	2,082	5:00	192	15:00	181

Ulan Road between CHPP Access Road and Ulan Coal Mine Underground Access Road

The survey results indicate that weekday and weekend traffic volumes on Ulan Road are distinctly different. The surveyed Friday was the busiest day, and over the average weekday, Ulan Road carried 2,082 vehicles per day. On the surveyed weekdays, Ulan Road carried up to 242 vehicles per hour.

Figure 3.1 presents the hourly distribution throughout the average weekday on Ulan Road. This indicates that over the average weekday, Ulan Road has distinct morning and afternoon peaks of below 200 vehicles per hour, which occur during the early morning and mid-afternoon. Volumes during the traditional “commuter” peak periods are significantly lower.

Figure 3.1: Average Weekday Traffic on Ulan Road



The automatic tube counters collected vehicle speed data throughout the week, recording the mean and 85th percentile vehicle speed in each direction on Ulan Road. The 85th percentile speed is the speed below which 85 percent of vehicles travel, i.e. 15 percent of vehicles travel at speeds greater than the 85th percentile speed. The speed survey results demonstrate that over the surveyed week, the 85th percentile speed on Ulan Road near the location of the proposed new access road exceeded the 100 km/h posted speed limit for both light and heavy vehicles, at approximately 106 km/h for northbound vehicles and 104 km/h for southbound vehicles.

3.3 Road Safety History

Road crash data published by RMS has been reviewed for the five year period from 2013 to 2017 on the roads in the vicinity of the Moolarben Coal Complex. The data includes those crashes which conform to the national guidelines for reporting and classifying road vehicle crashes. The review included Ulan Road between the crossing of the Goulburn River north of Saddlers Creek Road and 1 km south of Ulan-Wollar Road; and Ulan-Wollar Road between Ulan Road and 1 km east of the Moolarben Coal Complex.

The data indicate that two crashes occurred over that five year period:

- a rear-end crash on Ulan Road approximately 1 km north of Ulan-Wollar Road. The crash occurred in fog or mist and darkness, and on a wet road surface. A northbound car travelling at 25 km/h was struck by a northbound vehicle. No injuries occurred and neither speed nor fatigue were nominated as contributing factors.
- a southbound vehicle lost control and left the carriageway to the left on a right hand bend and struck an object in darkness on Ulan Road approximately 1.2 km north of the access to the Ulan Coal Complex. No injuries occurred, and speed was nominated as a contributing factor.

The review of the crash history of the roads in the vicinity of the Moolarben Coal Complex does not highlight any crash causation factors which may suggest an inherent safety issue with the roads.

3.4 Changes to the Road Environment

Changes to traffic conditions may be expected to occur which are unrelated to the Modification. Such changes may result from other major developments in the region and as a result of non-specific growth in background traffic. These are discussed in this section.

3.4.1 Background Traffic Growth

The *Ulan Road Strategy* (ARRB, 2011) adopted a rate of 1.8 per cent per annum for growth in general community traffic (i.e. excluding traffic directly associated with mining developments) on Ulan Road over the 21 year period of operation of the mines.

3.4.2 Wilpinjong Coal Mine

The Wilpinjong Coal Mine is an open cut coal mining operation located approximately 40 km north-east of Mudgee, with vehicular access via Ulan-Wollar Road. The Wilpinjong Extension Project was approved in April 2017, and permits mining operations to continue on the site until 2033. GTA Consultants (2015b) assessed the road transport implications of the Wilpinjong Extension Project, including the impacts of an increase in the operational workforce from 476

people in 2015 to a peak of 625 people in 2024; and construction activity employing 100 people in 2017, 40 people in 2018 and 40 people in 2024.

Table 3.2 summarises the traffic generation forecasts of the Wilpinjong Coal Mine and Wilpinjong Extension Project on Ulan Road and Ulan-Wollar Road in the vicinity of the Moolarben Coal Complex.

Table 3.2: Wilpinjong Coal Mine Daily Traffic (vehicles per day)

Location	2017	2024
Combined Wilpinjong Coal Mine Accesses on Ulan-Wollar Road	1,078	1,007
Ulan Road North of Ulan-Wollar Road	100	93
Ulan Road South of Ulan-Wollar Road	889	827
Ulan-Wollar Road East of Ulan Road	989	920

Source: GTA Consultants (2015b)

Table 3.2 indicates that the traffic generation of the Wilpinjong Coal Mine is expected to slightly decrease after 2017.

3.4.3 Ulan Coal Mine

The Ulan Mine Complex is located approximately 38 km north-east of Mudgee, and has vehicular accesses off Ulan Road north of Cope Road, south of Ulan-Wollar Road, and north of Ulan-Wollar Road.

The approved Ulan Coal Continued Operations Project permits mining operation on the site until 2033. A traffic and transport impact assessment was undertaken by Transport and Urban Planning (2009), which found that the peak workforce and traffic generation of the mine would occur in Year 4, with the operational phase of the Project commencing in Year 5. It is expected that Year 4 occurred in 2014, based on commencement of the Continued Operations Project in 2011, and reported workforce numbers during 2015. Modifications to the Continued Operations Project have since been approved, however have not involved changes to the number of employees, so no further traffic assessments have been undertaken.

A further Modification (Modification 4) was approved on 17 July 2019. The Environmental Assessment (EA) (Umwelt, 2018) prepared in support of that modification states that,

“Workforce numbers, operating hours, product volumes and transport routes will not change. Traffic impacts associated with the proposed modification are expected to be consistent with the existing approved development.”

Modification 4 is therefore not expected to impact future traffic conditions.

GTA Consultants (2015b) developed forecasts of traffic generated by the Ulan Coal Continued Operations Project, based on the assessment and traffic distribution presented by Transport and Urban Planning (2009), and modified to reflect the result of an Origin-Destination survey conducted in 2012 at the Wilpinjong Coal Mine, and adjusted for average weekday conditions and shift times. Table 3.3 summarises daily traffic generation of the Ulan Coal Complex.

Table 3.3: Ulan Coal Complex Traffic (vehicles per day)

Location	2017	2024
Combined Ulan Coal Complex Accesses	1,535	692
Ulan Road North of Ulan-Wollar Road	1,416	654
Ulan Road South of Ulan-Wollar Road	1,416	654

Source: GTA Consultants (2015b)

Table 3.3 indicates that the traffic generated by the Ulan Coal Complex can be expected to significantly decrease after 2017 with expected decreases in the workforce at the site.

3.4.4 Cumulative Traffic Changes

The review above indicates that the cumulative impact of planned changes to the mines in the vicinity of the Moolarben Coal Complex is expected to result in a decrease in the total volume of traffic generated by those mines. This will lead to decreases in mine-generated traffic on Ulan Road and Ulan-Wollar Road near the Moolarben Coal Complex. Forecast increases in traffic volumes resulting from background growth would be more than offset by the expected decreases in traffic generation of the mines, such that traffic volumes are expected to decrease in the future. The forecast conditions for 2017 represent the peak volumes, with a decrease expected thereafter.

4 Modification Traffic Generation

4.1 Construction Traffic

4.1.1 Dewatering Sites

Vehicular access to the southern dewatering sites would be via the CHPP Access Road. Vehicles would pass through the CHPP to access each site via new internal access tracks, which would remain in use throughout construction, operation, maintenance and decommissioning activities. Vehicular access to the two northern sites would be via Saddlers Creek Road and Ulan Road. Construction activity at the northern and southern sites would not coincide, with the northern sites to be constructed approximately three years after the southern dewatering sites.

Generated traffic during construction at the dewatering sites is expected to include light vehicles, drill rigs, semitrailers, truck and dog combinations, cranes, wheeled cranes and equipment floats. Construction of each dewatering site would occur seven days per week during daytime hours for approximately eight to twelve weeks per site, except for earthworks at the two northern dewatering sites which would generally be limited to Monday to Friday, daytime hours. Earthworks and access would take approximately twelve weeks. Based on MCO's experience of similar facilities at the Moolarben Coal Complex, the construction activity associated with the dewatering sites is expected to generate:

- an average of 10 light vehicles per day and 15 heavy vehicles per day; and
- a peak of 20 light vehicles per day and 30 heavy vehicles per day.

Construction traffic would occur generally between the hours of 7:00 am and 6:00 pm, seven days per week, so the daily trips would be spread throughout the day. In a peak hour, it may be expected that up to four light and three heavy vehicles may arrive at each dewatering site during construction, matched by a similar number of vehicle departures in that same hour.

The majority of construction traffic for the sites is expected to travel to the Moolarben Coal Complex from Mudgee and Gulgong, and would therefore approach and depart the Moolarben Coal Complex via Ulan Road south of Ulan-Wollar Road.

In addition to the above, excavated material from the dewatering sites is proposed to be trucked from each site to the open cut operations, generally between 7:00 am and 6:00 pm. For the southern dewatering sites, it is proposed that this would occur via a new access track to the CHPP Access Road. Laden trucks would exit the CHPP Access Road to Ulan Road, then enter the open cut operations via the Open Cut Access Road off Ulan-Wollar Road. Empty trucks would return via the same route. For the northern dewatering sites, laden trucks would travel via Saddlers Creek Road to Ulan Road, then enter the open cut operations via the Open Cut Access Road off Ulan-Wollar Road.

The transport of excavated material is expected to use a mix of truck and dog or single trailer units, with a load capacity of between 10 and 20 tonnes. This would generate between 66 and 132 loads of material to be transported from the dewatering sites to the open cut operations, and a matching number of return trips from the open cut to the dewatering sites. This activity is expected to occur on a campaign basis rather than continually throughout the construction period.

4.1.2 Ventilation Shaft Compound

The downcast ventilation shaft and associated infrastructure (collectively referred to as the ventilation shaft compound) would be located approximately 2 km north of the CHPP disturbance area, with vehicular access via a new dedicated intersection on Ulan Road. Construction of the ventilation shaft would occur 24 hours per day, seven days per week over a six-month period. Based on MCO's experience of similar facilities at the Moolarben Coal Complex, the construction activity at the ventilation shaft site is expected to generate:

- an average of 10 light vehicles per day and 15 heavy vehicles per day; and
- a peak of 20 light vehicles per day and 30 heavy vehicles per day.

Construction traffic would occur 24 hours per day, seven days per week, so the daily trips would be spread throughout the day and night. In a peak hour, it may be expected that up to four light and three heavy vehicles may arrive at the ventilation shaft compound, matched by a similar number of vehicle departures in that same hour.

Heavy vehicles would include truck and dog or single trailer units, semitrailers and cranes. The majority of construction traffic for the ventilation shaft compound is expected to travel to the Moolarben Coal Complex from Mudgee and Gulgong, and would therefore approach and depart the Moolarben Coal Complex via Ulan Road south of Ulan-Wollar Road.

In addition to the above, excavated material from the ventilation shaft would be stockpiled and partially dried on site, then transported by truck to the open cut operations during daytime hours. Laden trucks would exit to Ulan Road, then enter the open cut operations via the Open Cut Access Road off Ulan-Wollar Road. Empty trucks would return via the same route. The transport of excavated material is expected to use a mix of truck and dog or single trailer units, with a load capacity of between 10 and 20 tonnes. This would generate between 210 and 420 loads of material to be transported from the ventilation shaft compound to the open cut operations, and a matching number of return trips from the open cut to the ventilation shaft compound. This activity is expected to occur on a campaign basis rather than continually throughout the construction period.

4.1.3 Remote Services Infrastructure Area

Vehicular access to the RSIA would be via the CHPP Access Road and a new internal access road with a road crossing of Bora Creek, which would remain in use throughout construction, operation, maintenance and decommissioning activities.

Construction at the RSIA would occur during daytime hours over approximately three to four months. Earthworks and access would occur over approximately 12 weeks. Based on MCO's experience of similar facilities at the Moolarben Coal Complex, the construction activity at the RSIA site is expected to generate:

- an average of 10 light vehicles per day and 15 heavy vehicles per day; and
- a peak of 20 light vehicles per day and 30 heavy vehicles per day.

Construction traffic would occur during daytime hours, seven days per week, so the daily trips would be spread throughout the day. In a peak hour, it may be expected that up to four light and three heavy vehicles may arrive at the RSIA, matched by a similar number of vehicle departures in that same hour.

Heavy vehicles would include truck and dog or single trailer units, semitrailers and cranes. The majority of construction traffic for the RSIA is expected to travel to the Moolarben Coal Complex from Mudgee and Gulgong, and would therefore approach and depart the Moolarben Coal Complex via Ulan Road south of Ulan-Wollar Road.

In addition to the above, excavated material from the RSIA service holes would be transported by truck to the open cut operations during daytime hours. Laden trucks would exit via the new access track to the CHPP Access Road, then enter the open cut operations via the Open Cut Access Road off Ulan-Wollar Road. Empty trucks would return via the same route. The transport of excavated material is expected to use a mix of truck and dog or single trailer units, with a load capacity of between 10 and 20 tonnes. This would generate between 15 and 30 loads of material to be transported from the RSIA to the open cut operations, and a matching number of return trips from the open cut to the RSIA. This activity is expected to occur on a campaign basis rather than continually throughout the construction period.

4.1.4 Haulage of Excavated Material

With regard to the transport of excavated material from the construction sites to the open cut operations via the Open Cut Access Road, the combined trip generation of this activity over the whole construction period would generate a total of 258 to 516 heavy vehicle trips to and from the Open Cut Access Road over a period of between approximately six and 18 months, depending on the extent of overlap between the various activities. The transport activity is expected to occur on a campaign basis rather than continually throughout the construction period, and hence the number of trips generated on any one day may vary substantially. The maximum number of trips able to be generated in one day would be dependent on the time required to load trucks at the relevant stockpile locations. It is estimated that up to three

trucks may be loaded in an hour, yielding up to 36 loads in a 12-hour day. On this basis, the transport of excavated material may generate up to 72 vehicle trips per day, being 36 loaded trucks departing to the Open Cut Access Road, and 36 empty trucks returning to the stockpile location.

4.1.5 Total Construction Traffic

The construction activities associated with the various work areas would generally not occur simultaneously, however some overlap of construction activity at the southern dewatering sites, RSIA and ventilation shaft can be expected. The northern dewatering sites would be constructed approximately three years after the southern dewatering sites are constructed, thus the vehicular traffic generated by the northern and southern sites would not occur simultaneously. For the purpose of this assessment, it has been conservatively assumed that the peak construction activity may include the northern or southern dewatering sites, overlapping with RSIA and ventilation shaft construction traffic.

On the basis of the above, the Modification construction traffic has been assessed by examining the potential impacts of the peak activity at each of the construction sites, noting that the peak day at each construction site is unlikely to overlap with those at the other construction sites.

Dewatering Sites Peak Activity

During the peak construction activity at the southern sites, the Modification is expected to generate:

- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) travelling northbound on Ulan Road past Ulan-Wollar Road and turning right from Ulan Road into the CHPP Access;
- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) turning left from the CHPP Access to Ulan Road southbound past Ulan-Wollar Road;
- 36 heavy vehicles per day (peak of three vehicles per hour) exiting the Open Cut Access Road to Ulan-Wollar Road westbound, turning right onto Ulan Road and then right into the CHPP Access Road; and
- 36 heavy vehicles per day (peak of three vehicles per hour) exiting the CHPP Access Road to Ulan Road southbound, turning left into Ulan-Wollar Road and then right into the Open Cut Access Road.

During the peak construction activity at the northern sites, the Modification is expected to generate:

- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) travelling northbound on Ulan Road past Ulan-Wollar Road and turning right from Ulan Road into Saddlers Creek Road then entering the northern dewatering site access road;

- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) exiting the northern dewatering site access road to Saddlers Creek Road then turning left from Saddlers Creek Road to Ulan Road southbound past Ulan-Wollar Road;
- 36 heavy vehicles per day (peak of three vehicles per hour) exiting the Open Cut Access Road to Ulan-Wollar Road westbound, turning right onto Ulan Road and then right into Saddlers Creek Road then entering the northern dewatering site access road; and
- 36 heavy vehicles per day (peak of three vehicles per hour) exiting the northern dewatering site access road to Saddlers Creek Road then turning left to Ulan Road southbound, turning left into Ulan-Wollar Road and then right into the Open Cut Access Road.

Ventilation Shaft Compound Peak Activity

During the peak construction activity at the ventilation shaft compound, the Modification is expected to generate:

- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) travelling northbound on Ulan Road past Ulan-Wollar Road and turning right from Ulan Road into the New Ulan Road Access;
- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) turning left from the New Ulan Road Access to Ulan Road southbound past Ulan-Wollar Road;
- 36 heavy vehicles per day (peak of three vehicles per hour) exiting the Open Cut Access Road to Ulan-Wollar Road westbound, turning right onto Ulan Road and then right into the New Ulan Road Access; and
- 36 heavy vehicles per day (peak of three vehicles per hour) exiting the New Ulan Road Access to Ulan Road southbound, turning left into Ulan-Wollar Road and then right into the Open Cut Access Road.

Remote Services Infrastructure Area Peak Activity

During the peak construction activity at the RSIA, the Modification is expected to generate:

- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) travelling northbound on Ulan Road and turning right from Ulan Road into the CHPP Access;
- 20 light and 30 heavy vehicles per day (peak of four light and three heavy vehicles per hour) turning left from the CHPP Access to Ulan Road southbound past Ulan-Wollar Road;
- 30 heavy vehicles per day (peak of three vehicles per hour) exiting the Open Cut Access Road to Ulan-Wollar Road westbound, turning right onto Ulan Road and then right into the CHPP Access Road; and
- 30 heavy vehicles per day (peak of three vehicles per hour) exiting the CHPP Access Road to Ulan Road southbound, turning left into Ulan-Wollar Road and then right into the Open Cut Access Road.

Table 4.1 summarises the peak hourly two-way light and heavy vehicle trips generated by the various components of construction activity associated with the Modification. A trip is a one way movement, so a vehicle arriving and departing a site generates two vehicle trips. As a robust assessment, it has been assumed that all vehicles arriving at a site during a peak hour would also depart during that same hour.

Table 4.1: Construction Stage Peak Hour Modification Traffic (vehicles per hour)

	Dewatering Sites ^A		RSIA	Ventilation Shaft	Peak Total
	Southern	Northern			
Moolarben Coal Complex Access Roads					
Northern Dewatering Site Access Road	-	8 [12]	-	-	8 [12] ^B
New Ulan Road Access Road	-	-	-	8 [12]	8 [12]
CHPP Access Road	8 [12]	-	8 [12]	-	16 [24] ^C
Open Cut Access Road	0 [6]	0 [6]	0 [6]	0 [6]	0 [18]
ROM Coal Facility Access Road	-	-	-	-	-
Public Roads					
Saddlers Creek Road	-	8 [12]	-	-	8 [12] ^B
Ulan Road North of Saddlers Creek Road	-	-	-	-	-
Ulan Road North of New Access Road	-	8 [12]	-	-	8 [12] ^B
Ulan Road between New Access Road and CHPP Access Road	-	8 [12]	-	8 [12]	8 [12] ^B
Ulan Road between CHPP Access Road and Ulan-Wollar Road	8 [12]	8 [12]	8 [12]	8 [12]	24 [36]
Ulan Road South of Ulan-Wollar Road	8 [6]	8 [6]	8 [6]	8 [6]	24 [18]
Ulan-Wollar Road between Ulan Road and Open Cut Access Road	0 [6]	0 [6]	0 [6]	0 [6]	0 [18]
Ulan-Wollar Road between Open Cut Access Road and ROM Coal Facility Access Road	-	-	-	-	-
Ulan-Wollar Road East of ROM Coal Facility Access Road	-	-	-	-	-

Light vehicles [heavy vehicles].

^A Construction of southern and northern dewatering sites would not coincide.

^B Peak during northern dewatering sites construction only

^C Peak during southern dewatering sites construction only

4.2 Operational Traffic

When operational, the Modification is expected to result in no change to the number of vehicle trips generated by the Moolarben Coal Complex compared with existing approved conditions. It may however result in some minor redistribution of existing vehicle trips to or from the Moolarben Coal Complex, and some additional trips made on the public road network between the various Moolarben Coal Complex public road access points.

4.2.1 Dewatering Sites

The dewatering sites are expected to result in some minor redistribution of vehicle trips, with a slight increase to the number of vehicles using the CHPP Access Road with the modification. MCO expects that, on rare occasions, up to 15 light and 10 heavy vehicles per day would access the southern dewatering sites via the CHPP Access Road and a similar number of vehicles would access the northern dewatering sites via Saddlers Creek Road. These trips would partially be in place of previously assessed borefield maintenance vehicles and would generally be required on a campaign basis for short periods of time where maintenance and or replacement of installed infrastructure is required. For the purpose of this assessment, it is assumed that these trips would be drawn from Mudgee or Gulgong, arriving and departing on Ulan Road to and from the south.

Operational traffic would occur 24 hours per day, seven days per week, so the diverted daily trips would be spread throughout the day and night. In a peak hour, on rare occasions, it may be expected that the dewatering sites would generate up to three light and two heavy vehicles per hour, with an equivalent decrease in trips made to and from the ROM Coal Facility Access Road.

4.2.2 Ventilation Shaft Compound

Based on MCO's experience of similar projects, the ventilation shaft compound is expected to generate:

- an average of 5 light vehicles per day and 2 heavy vehicles per day; and
- a peak of 15 light vehicles per day and 10 heavy vehicles per day.

This operational traffic would travel to the ventilation shaft compound site from the Moolarben Coal Complex underground operations, exiting the Moolarben Coal Complex at the Open Cut Access Road on Ulan-Wollar Road and travelling via Ulan Road to the New Ulan Road Access. The heavy vehicles at the ventilation shaft compound would include rigid trucks, truck and dog combinations, semitrailers and cranes, among other potential operational support vehicles.

Operational traffic would occur 24 hours per day, seven days per week, so the daily trips would be spread throughout the day and night. In a peak hour, it may be expected that the

ventilation shaft compound would generate up to three light and two heavy vehicles per hour.

4.2.3 Remote Services Infrastructure Area

Based on MCO's experience of similar projects, the RSIA is expected to generate:

- an average of 8 light vehicles per day and 3 heavy vehicles per day; and
- a peak of 15 light vehicles per day and 10 heavy vehicles per day.

This operational traffic would travel to the RSIA from the Moolarben Coal Complex underground operations, exiting the Moolarben Coal Complex at the Open Cut Access Road on Ulan-Wollar Road and travelling via Ulan Road to CHPP Access Road. These trips would be matched by return trips from the RSIA to the Open Cut Access Road. The heavy vehicles at the RSIA would include rigid trucks, truck and dog combinations, semitrailers and cranes, among other potential operational support vehicles.

Operational traffic would occur 24 hours per day, seven days per week, so the daily trips would be spread throughout the day and night. In a peak hour, it may be expected that the RSIA would generate up to three light and two heavy vehicles per hour.

4.2.4 Total Operational Traffic

Table 4.2 summarises the peak hourly two-way vehicle trips generated by the various sites during a peak day of operational activity associated with the Modification, assuming peak activity occurs at the various sites simultaneously.

Table 4.2: Operational Stage Peak Hour Modification Traffic (vehicles per hour)

	Dewatering Sites		RSIA	Ventilation Shaft	Total
	Southern	Northern			
Moolarben Coal Complex Access Roads					
Northern Dewatering Site Access Road	-	6 [4]	-	-	6 [4]
New Ulan Road Access Road	-	-	-	6 [4]	6 [4]
CHPP Access Road	6 [4]	-	6 [4]	-	12 [8]
Open Cut Access Road	-	-	6 [4]	6 [4]	12 [8]
ROM Coal Facility Access Road ^A	-6 [-4]	-6 [-4]	-	-	-12 [-8]
Public Roads					
Saddlers Creek Road	-	6 [4]	-	-	6 [4]
Ulan Road North of Saddlers Creek Road	-	-	-	-	-
Ulan Road North of New Access Road	-	6 [4]	-	-	6 [4]
Ulan Road between New Access Road and CHPP Access Road	-	6 [4]	-	6 [4]	12 [8]
Ulan Road between CHPP Access Road and Ulan-Wollar Road	6 [4]	6 [4]	6 [4]	6 [4]	24 [16]
Ulan Road South of Ulan-Wollar Road	-	-	-	-	-
Ulan-Wollar Road between Ulan Road and Open Cut Access Road ^A	-6 [-4]	-6 [-4]	6 [4]	6 [4]	-
Ulan-Wollar Road between Open Cut Access Road and ROM Coal Facility Access Road ^A	-6 [-4]	-6 [-4]	-	-	-12 [-8]
Ulan-Wollar Road East of ROM Coal Facility Access Road	-	-	-	-	-

Light vehicles [heavy vehicles], total assumes peak operational activity at all sites coincides.

^A Negative values result from redistribution of trips which would otherwise use the ROM Coal Facility Access Road.

5 Impacts of the Modification

Section 4 indicates that the forecast changes in traffic volumes as a result of peak construction or operational activity associated with the Modification are expected to be low, with peak construction activity having the greatest potential impact on the road network in the local region (assuming coincidence of peak activity at the various construction sites, which is very unlikely).

Table 4.1 demonstrates that on the public roads, the impacts of the peak day construction stage of the Modification would be limited to Ulan Road south of the proposed New Ulan Road Access Road, and on Ulan-Wollar Road between Ulan Road and the Open Cut Access Road. Table 4.2 demonstrates that on the public roads, the changes to traffic expected as a result of the Modification when operational would be limited to Ulan Road between the proposed New Ulan Road Access Road and Ulan-Wollar Road, and Ulan-Wollar Road between Ulan Road and the ROM Coal Facility Access Road.

5.1 Existing Intersections

Intersections are typically the critical locations which determine the capacity of the road network, as opposing vehicles need to occupy the same road space. The impacts of the Modification have therefore been considered with regard to the operation of the key intersections serving the site. Considering the limited extent of the impacts of the Modification on traffic conditions, the impacts of the Modification are expected to be most significant at the intersections in the immediate vicinity of the Moolarben Coal Complex, namely:

- Ulan Road with the New Ulan Road Access Road (i.e. ventilation shaft compound access);
- Ulan Road with Ulan-Wollar Road; and
- Ulan-Wollar Road with the Open Cut Access Road.

The potential impacts of the Modification at each of the intersections is discussed below.

GTA Consultants (2015a) conducted surveys of vehicle turning movements during specific peak hours at key intersections in 2012 and 2015, and analysed their operational performance with forecast traffic changes for years 2017 and 2027. Those analyses included the cumulative effects of the Moolarben UG1 Optimisation Modification and other major projects in the region including those described in Section 3.4. As noted, the number of vehicle trips generated by major developments in the region is forecast to decrease after 2017, and GTA Consultants (2015a) demonstrates that the operation of the key intersections on the roads serving the Moolarben Coal Complex would remain satisfactory during the busiest hours, with low delays to vehicles and spare capacity.

To compare the forecasts against existing conditions, the inputs to the GTA Consultants (2015a) SIDRA analyses were compared with the surveyed volumes in 2018, which found the

following comparison between 2017 peak hour forecasts and 2018 surveys on Ulan Road north of the CHPP Access:

- 6.00 am to 7:00 am forecast for 2017: 147 vehicles per hour
- 6.00 am to 7:00 am surveyed 2018: 160 vehicles per hour
- 4.30 pm to 5:30 am forecast for 2017: 156 vehicles per hour
- 4.00 pm to 5.00 pm surveyed 2018: 155 vehicles per hour
- 5.00 pm to 6.00 pm surveyed 2018: 115 vehicles per hour.

This comparison suggests that the GTA Consultants (2015a) forecasts of peak hour volumes at intersections for 2017 are generally consistent with the surveyed conditions in 2018, and so may be considered to be reasonably representative of existing conditions. The potential impacts of the Modification on the operating conditions at the key intersections has therefore been reviewed by applying the changes resulting from the Modification to the conditions forecast by GTA Consultants (2015a) for both the 2017 and 2027 scenarios, and analysed using the SIDRA analysis software. The scenarios assessed assume:

- Modification construction activity would occur in the short term, and has been added to the 2017 base conditions (representing expected peak conditions with cumulative impacts of developments in the region); and
- Modification operational activity would continue through the longer term, and has been added to both the 2017 base conditions (representing the peak conditions as above) and the 2027 base conditions (representing longer term conditions with expected reductions in traffic).

SIDRA determines characteristics of intersection operating conditions including the degree of saturation, average delays, and levels of service. The degree of saturation, or x-value, is the ratio of the arrival rate of vehicles to the capacity. The average delay, expressed in seconds per vehicle, is measured over the movement with the highest average delay at priority intersections such as those being considered here. Average vehicle delay is the commonly used measure of intersection performance defined by RMS. Table 5.1 shows the criteria adopted by RMS for assessing the level of service at priority intersections.

Table 5.1: Level of Service Criteria at Priority Intersections

Level of Service	Average Delay per vehicle (seconds per vehicle)	Operational Character
A	Less than 14	Good operation
B	15 to 28	Acceptable delays and spare capacity
C	29 to 42	Satisfactory, but accident study required
D	43 to 56	Near capacity, accident study required
E	57 to 70	At capacity, requires other control mode
F	Greater than 70	Extreme delay, major treatment required

The results of the analyses are summarised in Table 5.2, which also presents the results from the GTA Consultants (2015a) assessments for comparison.

Table 5.2: Indicative Peak Hour Intersection Operating Conditions

Intersection	Base Year	X-value		Average Delay		Level of Service	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Approved Conditions and Cumulative Developments^A							
Ulan Road and CHPP Access Road	2017	0.11	0.05	8.0	7.8	A	A
	2027	0.09	0.05	7.8	7.8	A	A
Ulan Road and Ulan-Wollar Road	2017	0.36	0.20	14.7	9.8	B	A
	2027	0.23	0.09	9.1	9.9	A	A
Ulan-Wollar Road and Open Cut Access Road	2017	0.10	0.05	7.9	7.9	A	A
	2027	0.05	0.04	7.9	7.9	A	A
Approved Conditions^A Plus Modification Construction Traffic							
Ulan Road and CHPP Access Road ^B	2017	0.13	0.07	8.1	8.2	A	A
Ulan Road and Ulan-Wollar Road	2017	0.38	0.21	20.8	10.1	B	A
Ulan-Wollar Road and Open Cut Access Road	2017	0.10	0.06	7.9	7.9	A	A
Approved Conditions^A Plus Modification Operational Traffic							
Ulan Road and CHPP Access Road	2017	0.12	0.06	8.0	7.9	A	A
	2027	0.10	0.06	8.0	7.9	A	A
Ulan Road and Ulan-Wollar Road	2017	0.37	0.20	15.0	10.1	B	A
	2027	0.23	0.09	9.7	8.3	A	A
Ulan-Wollar Road and Open Cut Access Road	2017	0.10	0.05	7.9	7.9	A	A
	2027	0.05	0.03	7.9	7.9	A	A

^A GTA Consultants (2015a)

^B During peak construction activity at the southern dewatering sites

The results of the analyses demonstrate that the changes to traffic conditions which would occur with the Modification would have negligible impact on the operation of the existing intersections serving the Moolarben Coal Complex. The intersections would operate with low delays to vehicles and spare capacity. No changes to the existing intersections are required to accommodate the changed traffic conditions which would result from the Modification.

5.2 New Access Intersection on Ulan Road

The new access road to the ventilation shaft compound via Ulan Road will intersect with Ulan Road approximately 250 m south of the intersection of Ulan Road with the Ulan Coal Mine underground access road. The operational and design requirements for that intersection are discussed below.

5.2.1 Intersection Operating Characteristics

The operational characteristics of the proposed intersection have been assessed using SIDRA INTERSECTION, using the same assumptions as described in Section 5.1, and that the proposed intersection has a minimum geometric layout with no auxiliary turn lanes in Ulan Road. The results are summarised in Table 5.3.

Table 5.3: Peak Hour Operating Conditions at New Ulan Road Access Intersection

Intersection	X-value		Average Delay		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
2017 Approved Conditions ^A Plus Modification Construction Traffic	0.05	0.05	9.4	9.4	A	A
2017 Approved Conditions ^A Plus Modification Operational Traffic	0.06	0.06	8.8	8.9	A	A
2027 Approved Conditions ^A Plus Modification Operational Traffic	0.05	0.06	8.8	8.9	A	A

^A GTA Consultants (2015a)

The results demonstrate that the intersection can be expected to operate at a good level of service, with only short delays to turning vehicles and spare capacity. Northbound through vehicles on Ulan Road would experience negligible delay as a result of vehicles slowing to turn into the new access road.

5.2.2 Intersection Treatments

Austrroads (2017b) sets out warrants for rural intersection treatments, which are based on the number of turning and through vehicle movements at the intersection. The surveyed hourly traffic on Ulan Road (Table 3.1) demonstrates that the average weekday peak hourly volumes on Ulan Road are below 200 vehicles per hour. The ventilation shaft compound is expected to generate:

- up to 10 vehicles per hour during peak construction and material transport activity turning right into the New Ulan Road Access from Ulan Road and up to 10 vehicles per hour turning left out of the New Ulan Road Access; and
- up to 5 vehicles per hour on a peak operational day turning right into the New Ulan Road Access from Ulan Road and up to 5 vehicles per hour turning left out of the New Ulan Road Access.

The forecast peak hourly traffic volumes at the intersection of Ulan Road with the new access for the ventilation shaft area would warrant the minimum preferred treatment. The general minimum preferred treatments at rural road intersections are Basic Auxiliary Left (BAL) and Basic Auxiliary Right (BAR) treatments. The rural BAL treatment on the major road has a widened shoulder, which assists vehicles turning left into the minor road to move further off the through carriageway, making it easier for through vehicles to pass a vehicle turning left into the minor road. It is noted that there is expected to be negligible demand for left turn

movements from Ulan Road into the new access road, however it remains appropriate to provide a BAL treatment.

The rural BAR treatment features a widened shoulder on the major road that allows through vehicles, having slowed, to pass to the left of vehicles turning right into the minor road. The BAL treatment on the minor road allows turning movements to occur from a single lane, with a shoulder that is too narrow to be used by left-turning vehicles, so as to prevent vehicles from standing two abreast at the holding line.

These design features are preferred to safely manage the movement of vehicles in the high speed rural environment, and it is therefore recommended that BAL and BAR treatments be provided at the new intersection, and that the design of those treatments be consistent with Austroads requirements, taking into account the characteristics of the largest vehicle expected to use the access road, being a semitrailer or truck and dog combination.

5.2.3 Sight Distance

Sight distance at intersections must be provided to include (Austroads, 2017a):

- Approach sight distance (ASD);
- Safe intersection sight distance (SISD); and
- Minimum gap sight distance (MGSD).

Each of these requirements are assessed below with regard to the proposed new access from Ulan Road to the ventilation shaft compound. The design speed on Ulan Road is 100 km/h, however, the surveyed operating speeds are somewhat higher (Section 3.2) and so this assessment has conservatively assumed a higher design speed in both directions of 110 km/h.

5.2.3.1 Approach Sight Distance

ASD is the minimum sight distance which must be available on the minor road approach to ensure that drivers are aware of the presence of the intersection. It is also desirable that ASD is available on the major road so that drivers can see the pavement and markings, although this may not always be practical, in which case Stopping Sight Distance (SSD) is the minimum requirement for the major road. ASD is measured from a driver's eye height (1.1 m for cars and 2.4 m for trucks) to the road surface.

The new access road approach to the intersection would be designed to meet the Austroads ASD requirement based on an indicative design speed of 50 km/h, i.e., 55 m for cars and 62 m for trucks.

Assuming an approach speed on Ulan Road of 110 km/h, the ASD required for cars is 193 m and for trucks is 225 m (Austroads, 2016). Observations on site indicate that the available sight distance on Ulan Road exceeds the desired ASD for the major road traffic as above.

5.2.3.2 *Safe Intersection Sight Distance*

SISD is the minimum sight distance that should be provided on the major road, and provides sufficient distance for a driver on the major road to observe a vehicle on the minor road moving into a collision situation, and to decelerate to a stop before reaching the collision point. It is measured from a driver's eye height to a point 1.25 m above the pavement.

For car drivers on Ulan Road, assuming an operating speed of 110 km/h, SISD of 285 m should be available to the new intersection. Austroads (2017a) provides SISD check cases for trucks, which suggests that that the desirable minimum SISD for a truck driver at an approach speed of 110 km/h is 351 m for daytime travel.

Observations on site indicate that SISD of 285 m for cars and 351 m for trucks is available for travel in both directions on Ulan Road, subject to trimming or removal of trees growing on the eastern side of Ulan Road. The trees are located well within the clear zone, being that area adjacent to the traffic lane that should be kept free from features which would be potentially hazardous to errant vehicles. The clear zone should be kept free of non-frangible hazards where possible. Austroads (2010) suggests that for a design speed of 100 km/h and ADT of between 1,501 and 6,000 vehicles per day, a clear zone width of 8.0 m to 9.0 m should be provided from the edge of the through travel lane on a fill batter such as that on Ulan Road where it crosses a minor waterway at the trees.

MCO would confirm any works required to meet the clear zone requirements as part of the separate approval required under section 138 of the NSW Roads Act 1993 for the proposed new intersection in consultation with RMS and Council. This would provide the required SISD for southbound drivers on Ulan Road to observe a vehicle on the new access road moving into a collision situation, and to decelerate to a stop before reaching the collision point.

5.2.3.3 *Minimum Gap Sight Distance*

MGSD is based on distances corresponding to the critical gap that drivers are prepared to accept when undertaking a crossing or turning manoeuvre. It is measured along the centre of the travel lane from a driver's eye height of 1.1 m to a point 0.65 m above the pavement.

For a driver turning left or right from the new access road on to Ulan Road, MGSD of 153 m is required, noting that this may require a following vehicle on Ulan Road to slow while the entering vehicle accelerates to the prevailing operating speed. There is not expected to be any notable demand for vehicles to turn right from the new access road or left into the new access road, as most vehicles would approach and depart to and from the south. For a driver turning right into the new access road, MGSD of 122 m is required.

Observations on site indicate that the available sight distance on Ulan Road exceeds the MGSD required for the right turn in to the new access road. As above, the trees in the clear zone on the eastern side of Ulan Road north of the proposed new intersection restrict sight distance to the north for a driver exiting the new access road. Removal of those trees to meet clear zone requirements would result in the MGSD being available for drivers waiting to turn out of the new access road. Sight distance to the south for a driver waiting to exit the new access road meets MGSD requirements, noting that the demand for right turns out from the new access road would be negligible.

5.3 Access via Saddlers Creek Road

The northern dewatering sites would be accessed via Saddlers Creek Road, an existing road approximately 3 km north of the Ulan Coal Complex access. Saddlers Creek Road provides access to a limited number of properties only and is approved for use to access UG4 surface works, so existing vehicle turning movements at the intersection of Ulan Road with Saddlers Creek Road are expected to be very low.

The peak period background traffic volumes on Ulan Road past Saddlers Creek Road are expected to be lower than those surveyed on Ulan Road south of the Ulan Coal Complex access road (Section 3.2). This is because the Ulan Coal Complex traffic predominantly travels to and from the south along Ulan Road (Transport and Urban Planning, 2009) and so does not pass Saddlers Creek Road.

During peak hours, the Modification is forecast to generate the same number of vehicles turning into and out of Saddlers Creek Road as those forecast at the proposed new access intersection:

- up to 10 vehicles per hour during the northern dewatering sites peak construction and material transport activity turning right into Saddlers Creek Road from Ulan Road and up to 10 vehicles per hour turning left out of Saddlers Creek Road; and
- up to 5 vehicles per hour on a peak operational day turning right into Saddlers Creek Road from Ulan Road and up to 5 vehicles per hour turning left out of Saddlers Creek Road.

As the total peak period traffic demands at the intersection of Saddlers Creek Road with Ulan Road would be below those at the intersection of the proposed new access road with Ulan Road, it follows that the Saddlers Creek Road intersection would operate with greater spare capacity and lower delays to turning vehicles than the new access intersection. Section 5.2.1 demonstrates that, assuming no auxiliary turn lanes are provided, the new access intersection with Ulan Road can be expected to operate at a good level of service, with only short delays to turning vehicles and spare capacity. It is therefore expected that the intersection of Saddlers Creek Road with Ulan Road would also operate with only short delays to turning vehicles and spare capacity. Northbound through vehicles on Ulan Road would experience negligible delay as a result of vehicles slowing to turn into Saddlers Creek Road.

MCO has previously committed to implementing traffic management for construction vehicles entering and exiting the borefield site to Ulan Road and along Saddlers Creek Road, and with the Modification, this remains appropriate. Traffic management measures would be designed and implemented in accordance with the relevant RMS requirements, taking into consideration the traffic volumes and nature of the construction activity, and may include (for example) provision of advance warning signs on Ulan Road to alert drivers to the presence of trucks turning in and out of Saddlers Creek Road, and traffic controllers to manage passing traffic during the movement of any larger equipment floats or cranes into or out of Saddlers Creek Road.

5.4 Impacts of Road Safety

The review of the crash history of the roads serving the Moolarben Coal Complex did not highlight any causation factors which may be exacerbated by the changed traffic conditions resulting from the Modification.

The new intersection on Ulan Road is recommended to be designed in accordance with Austroads requirements for rural road intersections, and subject to clearing of vegetation, would have adequate sight distances. On this basis, the proposed new intersection is not expected to result in any safety concerns.

With appropriate traffic management measures during construction activity, the increased use of Saddlers Creek Road would not warrant upgrading of the existing intersection.

6 Conclusions

This study has found that the impacts of the Modification would generally be limited to the road network in the immediate vicinity of the Moolarben Coal Complex. No specific management or mitigation measures are required to the existing road network and it is recommended that the following measures be implemented with regard to the use of access via the new intersection on Ulan Road:

- the clear zone on the eastern side of Ulan Road (north of the proposed new intersection) be maintained to ensure adequate sight distance is available; and
- rural road BAR and BAL treatments be provided in Ulan Road at the new access intersection, in accordance with Austroads requirements.

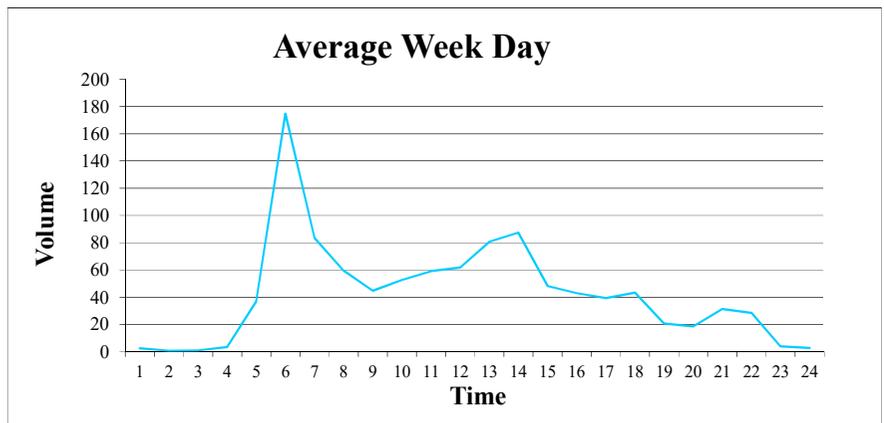
Appendix A

Traffic Surveys

Site 4 Ulan RD 900m S of Corporate RD [100]

Northbound

Day Time	Fri	Sat	Sun	Mon	Tue	Wed	Thu	W/Day Ave.	W/End Ave.	7 Day Ave
	12/10/18	13/10/2018	14/10/2018	15/10/2018	16/10/2018	17/10/2018	18/10/2018			
0:00	3	2	1	3	3	3	1	3	2	2
1:00	0	0	3	0	1	1	2	1	2	1
2:00	0	2	2	3	0	0	2	1	2	1
3:00	4	1	1	2	5	0	7	4	1	3
4:00	42	10	6	31	34	39	39	37	8	29
5:00	172	41	37	164	178	190	170	175	39	136
6:00	93	48	48	79	83	83	78	83	48	73
7:00	68	24	23	62	58	50	60	60	24	49
8:00	45	34	38	42	43	46	48	45	36	42
9:00	57	40	38	43	49	59	55	53	39	49
10:00	67	60	61	60	46	60	63	59	61	60
11:00	73	40	62	61	53	62	60	62	51	59
12:00	87	40	81	85	81	66	85	81	61	75
13:00	95	44	69	93	77	79	93	87	57	79
14:00	69	40	61	50	50	33	39	48	51	49
15:00	71	34	63	38	24	34	49	43	49	45
16:00	51	30	39	27	52	31	36	39	35	38
17:00	41	21	45	51	40	41	44	43	33	40
18:00	41	30	31	17	18	11	17	21	31	24
19:00	21	17	22	14	21	19	18	19	20	19
20:00	10	5	31	37	40	34	36	31	18	28
21:00	7	3	34	37	30	35	34	29	19	26
22:00	3	2	4	4	4	5	4	4	3	4
23:00	5	2	3	4	2	3	0	3	3	3
Total	1125	570	803	1007	992	984	1040	1030	687	932

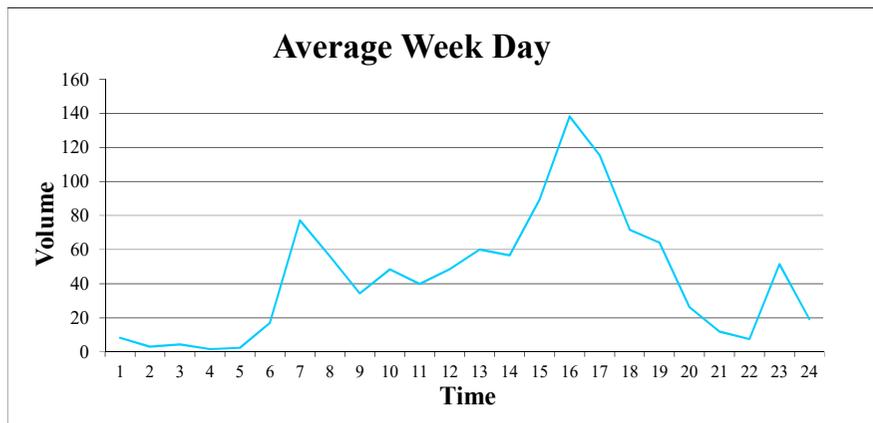


Summary			
	from	to	
AM Peak	5:00 AM	6:00 AM	190
PM Peak	1:00 PM	2:00 PM	95
Week Day Average			1030
Weekend Day Average			687
7 Day Average			932

Site 4 Ulan RD 900m S of Corporate RD [100]

Southbound

Day Time	Fri	Sat	Sun	Mon	Tue	Wed	Thu	W/Day Ave.	W/End Ave.	7 Day Ave
	12/10/18	13/10/2018	14/10/2018	15/10/2018	16/10/2018	17/10/2018	18/10/2018			
0:00	9	2	4	3	9	7	13	8	3	7
1:00	2	3	2	0	3	7	3	3	3	3
2:00	7	3	3	1	4	5	5	4	3	4
3:00	4	4	1	0	0	1	3	2	3	2
4:00	1	1	4	2	3	2	4	2	3	2
5:00	28	11	8	20	14	15	8	17	10	15
6:00	75	22	15	65	85	79	82	77	19	60
7:00	45	22	23	72	64	46	54	56	23	47
8:00	38	27	11	33	32	25	44	34	19	30
9:00	35	38	30	40	60	42	65	48	34	44
10:00	47	53	33	37	38	37	40	40	43	41
11:00	64	61	42	45	43	47	43	48	52	49
12:00	72	60	52	77	54	58	39	60	56	59
13:00	69	53	70	51	65	50	48	57	62	58
14:00	116	59	68	86	88	82	76	90	64	82
15:00	171	37	49	143	121	116	140	138	43	111
16:00	95	36	66	131	129	116	106	115	51	97
17:00	62	36	67	88	75	65	68	72	52	66
18:00	78	53	61	50	67	54	72	64	57	62
19:00	45	42	44	21	28	21	16	26	43	31
20:00	16	8	22	5	12	10	16	12	15	13
21:00	7	2	11	8	8	9	5	7	7	7
22:00	49	4	6	52	52	50	54	51	5	38
23:00	23	0	2	20	16	19	18	19	1	14
Total	1158	637	694	1050	1070	963	1022	1053	666	942



Summary			
	from	to	
AM Peak	6:00 AM	7:00 AM	85
PM Peak	3:00 PM	4:00 PM	171
Week Day Average			1053
Weekend Day Average			665
7 Day Average			942

Appendix B

Photographs

Details of the exact location of the proposed new access road were not available at the time of the site visit conducted by TTPP. Photograph 1 is taken from the northernmost likely location for the access road, Photograph 2 and Photograph 3, are from the southernmost likely location. Observations on site indicate that this study's findings regarding sight distance are not altered by the exact intersection location within the likely range of locations.



Photograph 1: Looking North on Ulan Road from Northernmost Location of New Access Road



Photograph 2: Looking North on Ulan Road from Southernmost Location of New Access Road



Photograph 3: Looking South on Ulan Road from Southernmost Location of New Access Road

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