

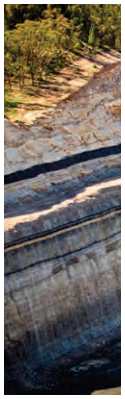



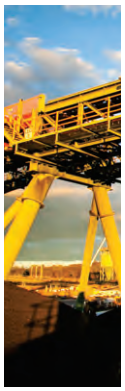

MOOLARBENCOAL

Moolarben Coal Complex
UG1 Optimisation Modification

Environmental Assessment

APPENDIX H

ROAD TRANSPORT ASSESSMENT

Moolarben Coal Complex
UG1 Optimisation Modification
Road Transport Assessment

Client //	Yancoal Australia Ltd
Office //	NSW
Reference //	15S9026000
Date //	21/05/15

Moolarben Coal Complex

UG1 Optimisation Modification

Road Transport Assessment

Issue: A 21/05/15

Client: Yancoal Australia Ltd
Reference: 15S9026000
GTA Consultants Office: NSW

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A	21/05/15	Final	Penny Dalton	Ken Hollyoak	Ken Hollyoak	

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Table of Contents

Attachments

Figures

Tables

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1. Introduction

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).

Moolarben Coal Operations Pty Ltd (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 1-2).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 and would continue to be carried out in accordance with Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified and Project Approval (08_0135) (Moolarben Coal Project Stage 2).

The current mining operations are also conducted in accordance with the requirements of the conditions of Mining Lease (ML) 1605, ML 1606, ML 1628 and ML 1691 granted under the *Mining Act, 1992*.

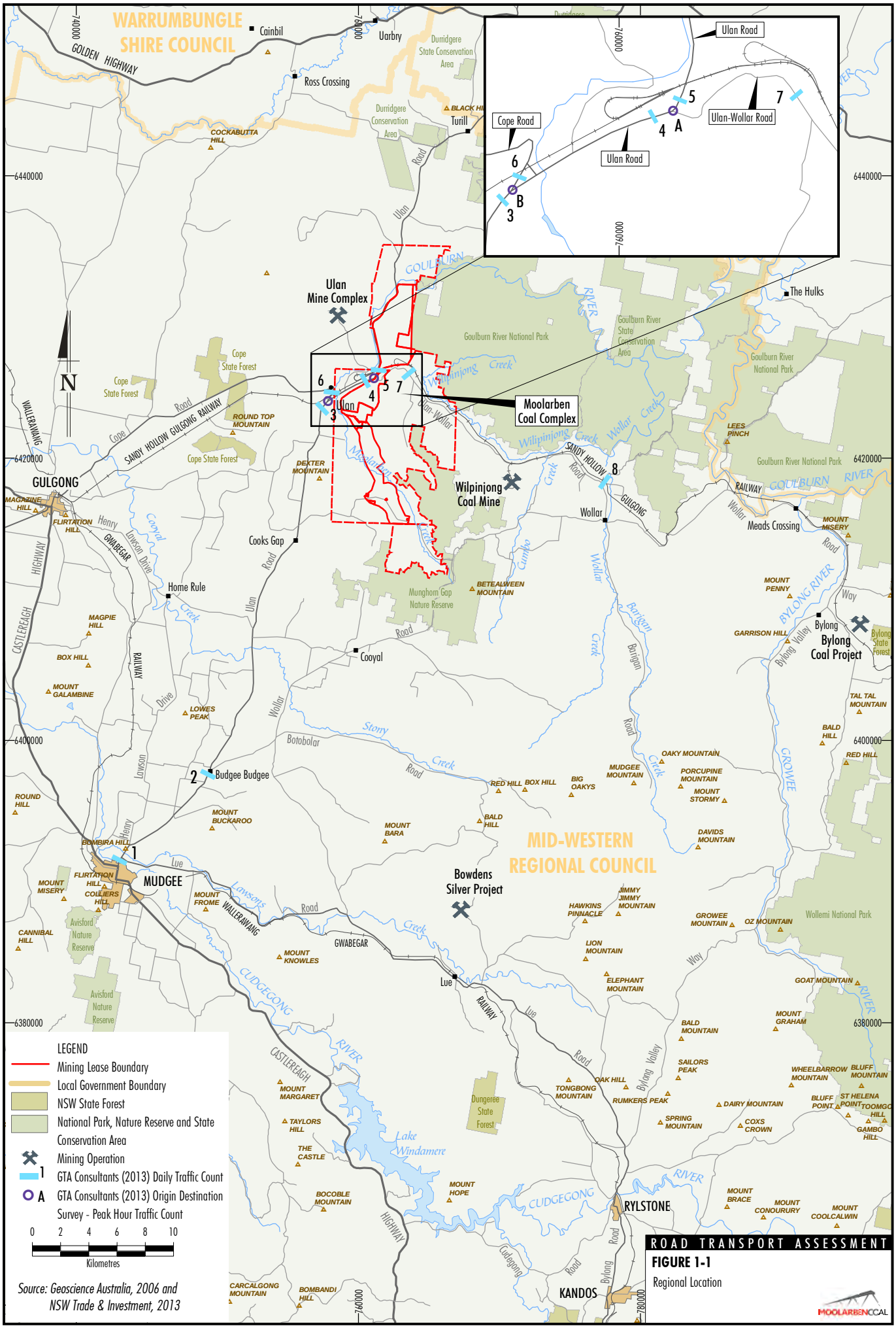
Since commencement of coal mining operations in 2010, mining activities have occurred within OC1 and OC2 (Figure 1-2). Subject to all necessary approvals being in place (both State and Commonwealth), development of the OC4 pit (Stage 2) is planned to commence during 2015. The development of the UG1 (i.e. highwall stabilisation, portal construction and underground roadway development) would also commence in 2015.

MCO is requesting to modify Project Approval (05_0117) and Project Approval (08_0135) under section 75W of the NSW *Environmental Planning and Assessment Act, 1979* (the UG1 Optimisation Modification [the Modification]).

This report has been prepared on behalf of MCO to present the findings of an assessment of the road transport implications of the Modification to the approved operations at the Moolarben Coal Complex.

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 Austroads *Guide to Road Design and Guide to Traffic Management* series, and the accompanying Roads and Maritime Services (RMS) Supplements.



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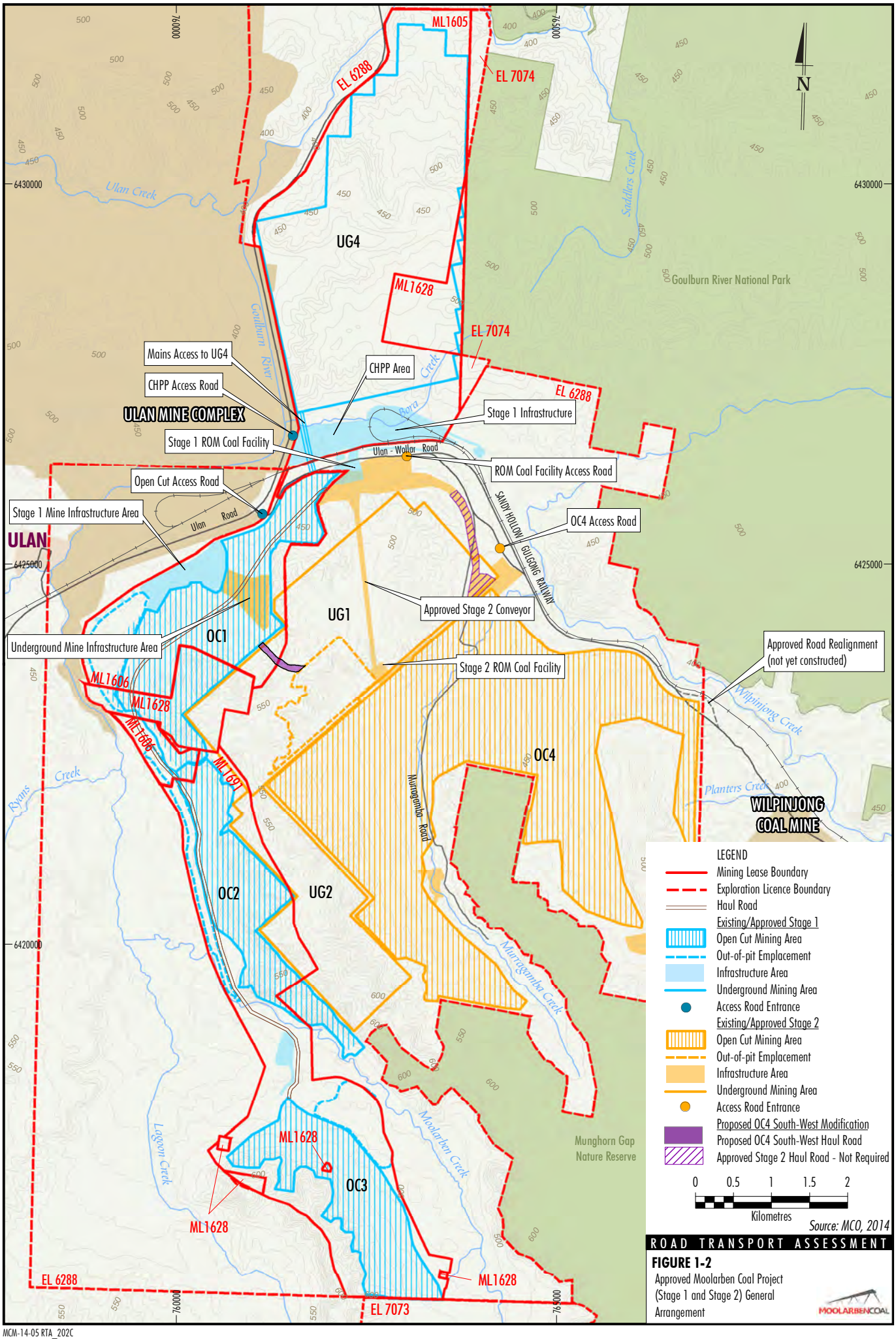

ROAD TRANSPORT ASSESSMENT

FIGURE 1-2

Approved Moolarben Coal Project (Stage 1 and Stage 2) General Arrangement

MOOLARBENCOAL

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2. Moolarben Coal Complex

2.1 Existing Operations

Mining activities at the Moolarben Coal Complex commenced in 2010, and have occurred within OC1 and OC2. Development of the OC4 pit (Stage 2) and UG1 are expected to commence in 2015, subject to all necessary approvals being in place.

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. Up to 13 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal is permitted to be extracted from the open cut mining operations and up to 4 Mtpa of ROM coal can be extracted from the underground mining operations.

At the time of the traffic surveys (Section 3.3), the operational activity at Moolarben Coal Complex employed approximately 280 people, of which approximately 12% work in administration (7.00am to 5.00pm Monday to Friday) and the remainder work in two shifts each day, as follows:

- Day 6.30am to 7.00pm; and
- Night 6.30pm to 7.00am.

At full development, the Moolarben Coal Complex requires a workforce of up to approximately 440 people. In addition, Stage 2 has an approved short term construction workforce of 220 workers.

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, and via the Open Cut Access Road off Ulan-Wollar Road approximately 120 metres (m) east of Ulan Road (Figure 1-2). An access to the ROM coal facilities from Ulan-Wollar Road approximately 2.4km east of Ulan Road (the ROM Coal Facility Access Road) has also been approved but is yet to be constructed (Figure 1-2). An access to OC4 from Ulan-Wollar Road approximately 4.6km east of Ulan Road (the OC4 Access Road) has not yet been commissioned (Figure 1-2).

MCO has realigned and upgraded sections of Ulan-Wollar Road. MCO will realign an additional section of Ulan-Wollar Road to allow for OC4 (Figure 1-2).

2.2 UG1 Optimisation Modification

The Modification includes the following key components (Figure 2-1):

- recovery of approximately 3.7 million tonnes (Mt) of additional ROM coal over the life of the mine;
- an extension of UG1 longwall panels in the north-east by approximately 150 to 500 metres (m);
- an extension of two UG1 longwall panels in the south-west by approximately 75 m;
- relocation of the approved UG1 central main headings to the north-east;
- relocation of underground access to UG2 and UG4;
- longwall extraction of the portion of coal that forms the approved (central) main headings;
- an increase in the coal seam extraction height by approximately 300 millimetres to a maximum extraction thickness of 3.5 m;

- an increase to longwall panel void width from approximately 305 to 311 m;
- construction of a ROM coal conveyor between the UG1 pit top facilities in OC1 and the coal handling and preparation plant (CHPP) to transport underground ROM coal;
- extension to the underground product coal stockpile in the CHPP area and relocation and expansion of the underground ROM coal stockpile at the UG1 pit top facilities;
- an increase in the maximum underground ROM coal production rate up to 8 Mtpa from UG1, UG2 and UG4 (combined);
- an increase in the maximum total site ROM coal rate to 21 Mtpa (i.e. 13 Mtpa from open cut operations and 8 Mtpa from underground operations);
- an increase in average daily rail departures from five to seven and increase in peak daily rail departures to nine;
- construction of Remote Services Facilities and rear air intake shaft and associated fans above the extended UG1 longwall panels; and
- relocation of the underground Mine Infrastructure Area and site administration offices.

The Modification would increase the peak Moolarben Coal Complex workforce from approximately 439 (440) to approximately 740 personnel.

The Modification does not involve any change to the Moolarben Coal Project (Stages 1 and 2) for the following relevant approval components:

- operational mine life;
- hours of operation;
- blasting limits;
- site access; or
- open cut coal extraction limits.

A detailed description of the proposed Modification is provided in Section 3 of the Environmental Assessment.

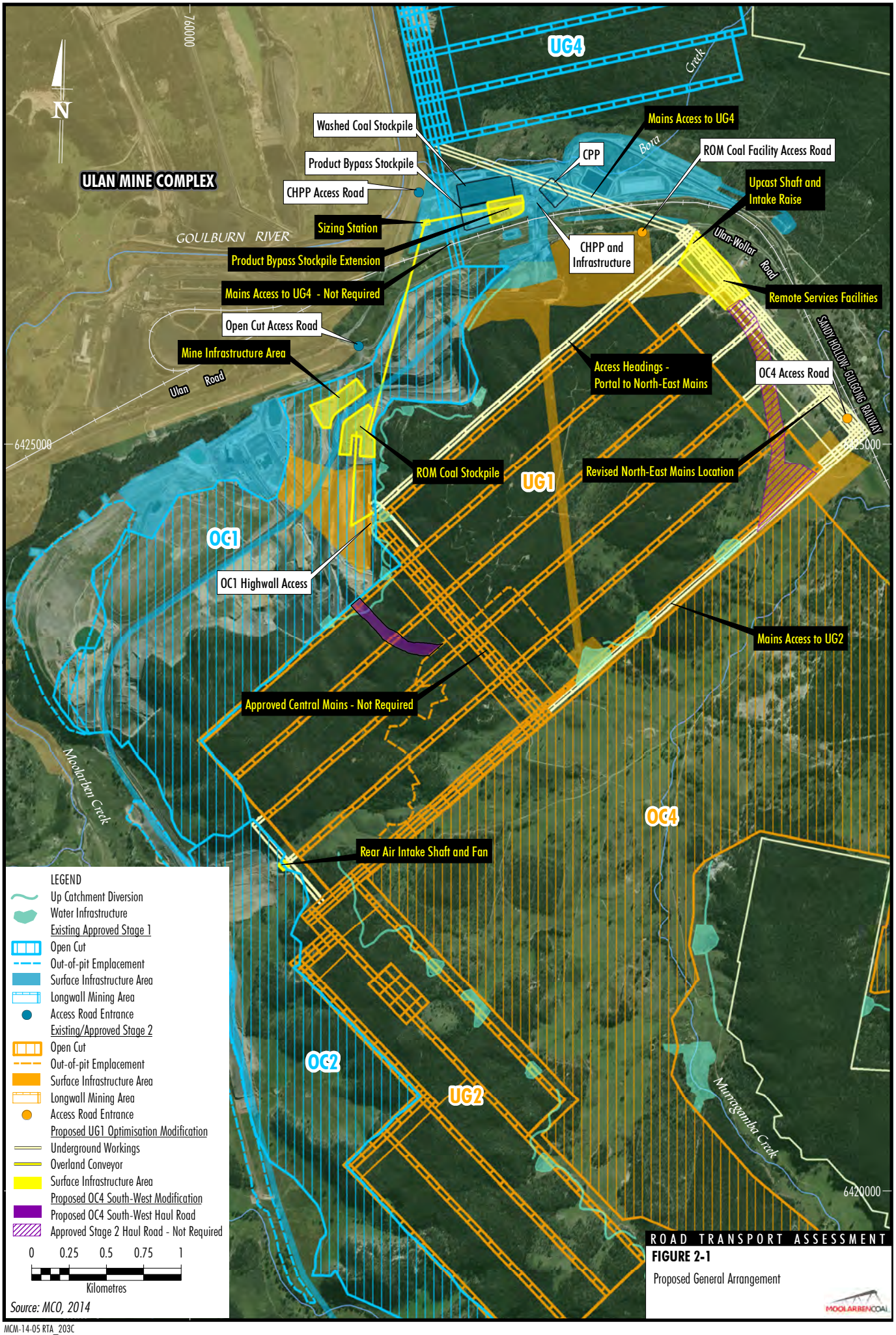
2.3 Road Transport Aspects and Future Scenarios

The Modification includes the following key components which are expected to directly impact on the road transport characteristics of the Moolarben Coal Complex:

- The operational workforce is proposed to increase from a peak of approximately 440 to 740 people, with an average workforce of approximately 670 people.
- Construction activity associated with the Modification would be undertaken during 2016 and 2017 or when relevant approvals are in place, and would be restricted to daytime hours, i.e. 7.00am to 6.00pm up to seven days per week. Construction activity would employ an average of 120 people and a peak of 250 people.
- On average, the transport of up to 18 Mtpa of product coal would generate up to seven trains per day and a peak of nine trains per day to meet cargo assembly timeframes at the Port of Newcastle.

For the purpose of this assessment, two future scenarios have been investigated:

- Year 2017 – representing peak construction conditions with 250 construction workers and the peak operational workforce of 740 workers; and
- Year 2027 – operational workforce of 670 workers.



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While the construction activity would occur over a period of 12 to 18 months, the peak construction workforce would be present for up to two months. The peak operational workforce would occur for 12 to 18 months during 2016 and 2017. The 2017 scenario assumes that the peak operational workforce occurs at the same time as the busiest construction conditions.

As described in Section 2.1, the OC4 Access Road has not yet been commissioned. For the purposes of this assessment, it has been assumed that the Open Cut, CHPP and ROM Coal Facility Access Roads will be used and the OC4 Access Road will remain uncommissioned. If the OC4 Access Road is commissioned, it will reduce the impacts at the Open Cut Access Road intersection predicted in this assessment as OC4-related traffic will no longer utilise the Open Cut Access Road. In addition, potential impacts at the OC4 Access Road intersection would be less than those predicted at the Open Cut Access Road intersection given the lower traffic volumes. Given the above, this assumption is considered to be robust.

3. Existing Conditions

3.1 Road Network

The road network serving the Moolarben Coal Complex is shown on Figure 1-1 and Figure 1-2 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 vehicular access to the Moolarben Coal Complex OC1 via the Open Cut Access Road which intersects with Ulan-Wollar Road approximately 120m east of Ulan Road. The tee intersection has channelised right turn lane in Ulan-Wollar Road for vehicles turning into the Open Cut Access Road. An additional access to OC4 from Ulan-Wollar Road approximately 4.6km east of Ulan Road is approved but is not currently used. 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. An access to the ROM coal facilities from Ulan-Wollar Road (the ROM Coal Facility Access Road) approximately 2.4km east of Ulan Road has also been approved but is yet to be constructed.

MCO has realigned and upgraded sections of Ulan-Wollar Road to a general standard of 8.0m carriageway width and unsealed shoulders. This includes some 2.3km that has been re-aligned to allow for OC4. MCO will realign an additional section of Ulan-Wollar Road to allow for OC4 (Figure 1-2) and it will be constructed to a similar standard to the existing Ulan-Wollar Road realignment.

The intersection of Ulan-Wollar Road with Ulan Road was upgraded by MCO, and 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.

Main Road 208 (MR208) extends between Castlereagh Highway (B55) at Mudgee and Golden Highway (B84) at Sandy Hollow. Between Mudgee and Bylong, it is known as **Ulan Road** (between Mudgee and Budgee Budgee), **Wollar Road** (between Budgee Budgee and Wollar) and **Wollar-Bylong Road** (between Wollar and Bylong). MR208 is a two lane rural road with bitumen seal and unsealed shoulders. Between Mudgee and Budgee Budgee, the sealed carriageway is 7.0m to 7.5m wide and the unsealed shoulders are 2.0m to 3.0m wide. Between Budgee Budgee and Sandy Hollow, the sealed carriageway varies in width between 6.0m and 7.5m, and the unsealed shoulders have an average width about 2.0m. A section between Wollar and Bylong Valley Way is also unsealed. The intersection of Ulan Road and Wollar Road is currently being upgraded to provide a CHR treatment in Ulan Road for vehicles turning right into Wollar Road.

Main Road 214 (MR214) extends from MR208 at Budgee Budgee to the Golden Highway at Cassilis to the north. It is known as **Ulan Road** between Budgee Budgee and Ulan, and as **Ulan-Cassilis Road** between Ulan and Cassilis.

Between Mudgee and the entrance to the Ulan Mine Complex underground surface facilities, Ulan Road (MR208 and MR214) has been the subject of a study, the *Ulan Road Strategy* (ARRB, 2011a) which details the road surface conditions such as the road surface condition index, pavement deflection testing and visual rating. That assessment found that nearly 55 percent (%) of Ulan Road is considered to be adequate, while the remainder requires rehabilitation and widening to desirable design standard. Since that study was undertaken, some upgrading of Ulan Road has occurred, and more work is planned. MCO makes financial contributions towards the implementation of the *Ulan Road Strategy* (ARBB, 2011a).

Main Road 598 (MR598) is known as **Cope Road**, and provides an east-west link between Gulgong and Ulan. It is a sealed road with a width of 6.0m to 7.5m, with unsealed 2.0m wide shoulders. This route extends farther to the east of Ulan as Ulan-Wollar Road (see above), and it intersects with MR208 at the Village of Wollar. Mid-Western Regional Council has received State Government funding for capital works on Cope Road, which will occur over two and a half years. MCO separately makes financial contributions to the maintenance of Cope Road in accordance with Condition 49, Schedule 3 of Project Approval (08_0135).

3.2 Historic Traffic Volume Data

Publicly available traffic data for roads of relevance to the Moolarben Coal Complex was collated, and is summarised below. The most recent comprehensive data set available was that collected during December 2012 for inclusion in the Wilpinjong Coal Mine Modification Road Transport Assessment (GTA Consultants, 2013). Table 3.1and Table 3.2 summarise the average weekday daily and peak hour results of automatic tube counts on roads in the vicinity of the Moolarben Coal Complex.

Table 3.1: Average Weekday Daily Traffic Volume Data December 2012

Site[A]	Road and Location	Vehicles per Day	Percent Heavy
1	Ulan Road north of Hollyoak Bridge	9,727	8.8%
2	Ulan Road south of Wollar Road	3,856	8.7%
3	Ulan Road south of Cope Road	2,736	14.5%
4	Ulan Road south of Ulan-Wollar Road	3,345	11.6%
5	Ulan Road north of Ulan-Wollar Road	2,633	20.1%
6	Cope Road west of Ulan Road	1,570	15.0%
7	Ulan-Wollar Road east of Moolarben Coal Complex	838	19.4%
8	Ulan-Wollar Road east of Slate Gully Road	142	12.1%

Source: GTA Consultants (2013)

[A] Refer to Figure 1-1 for locations

Table 3.2: Average Weekday Peak Hourly Traffic Volume Data December 2012

Site[A]	Road and Location	AM Peak Hour		PM Peak Hour	
		Vehicles per Hour	Hour Starting	Vehicles per Hour	Hour Starting
1	Ulan Road north of Hollyoak Bridge	667	8am	866	5pm
2	Ulan Road south of Wollar Road	333	6am	348	5pm
3	Ulan Road south of Cope Road	428	6am	242	5pm
4	Ulan Road south of Ulan-Wollar Road	453	6am	261	4pm
5	Ulan Road north of Ulan-Wollar Road	307	6am	194	4pm
6	Cope Road west of Ulan Road	156	6am	129	5pm
7	Ulan-Wollar Road east of Moolarben Coal Complex	129	6am	83	5pm
8	Ulan-Wollar Road east of Slate Gully Road	16	7am	14	5pm

Source: GTA Consultants (2013)

[A] Refer to Figure 1-1 for locations

As noted in Table 3.2, the time of the peak hour varied at the different locations, with the peak hours typically occurring between 6.00am and 8.00am, and between 4.00pm and 6.00pm.

The results of peak period surveys of vehicle turning movements conducted in December 2012 at the intersections of Ulan Road with Ulan-Wollar Road, and Ulan Road with Cope Road are summarised in Table 3.3, which presents the two way traffic volumes on each approach of the surveyed intersections.

Table 3.3: Peak Hour Two Way Traffic at Intersections December 2012 (vehicles/hour)

Site[A]	Intersection	AM Peak Hour 6-7am			PM Peak Hour 4-5pm		
		Light	Heavy	Total	Light	Heavy	Total
A	**Ulan Road and Ulan-Wollar Road**						
	Ulan Road north of Ulan-Wollar Road	288	29	317	181	35	216
	Ulan Road south of Ulan-Wollar Road	475	33	508	250	42	292
	Ulan-Wollar Road east of Ulan Road	207	14	221	93	13	106
B	**Ulan Road and Cope Road**						
	Ulan Road north of Cope Road	553	30	583	269	43	312
	Ulan Road south of Cope Road	460	26	486	228	30	258
	Cope Road west of Ulan Road	167	4	171	103	19	122

Source: GTA Consultants (2013)

[A] Refer to Figure 1-1 for locations

The turning movements at the intersections above provide information on the directional distribution of traffic turning into and out of Ulan-Wollar Road and Cope Road at Ulan Road. This distribution is summarised in Table 3.4 over the two three-hour survey periods.

Table 3.4: Distribution of Traffic at Intersections December 2012

Approach	6am to 9am		3pm to 6pm	
	Light	Heavy	Light	Heavy
Inbound to Ulan-Wollar Road (vehicles)	**269**	**26**	**57**	**12**
Percent from South	89.6	50.0	75.4	66.7
Percent from North	10.4	50.0	24.6	33.3
Outbound from Ulan-Wollar Road (vehicles)	**91**	**11**	**170**	**19**
Percent to South	72.5	45.5	88.8	78.9
Percent to North	27.5	54.5	11.1	21.1
Inbound to Cope Road (vehicles)	**128**	**9**	**181**	**24**
Percent from South	35.9	22.2	14.9	12.5
Percent from North	64.1	77.8	85.1	87.5
Outbound from Cope Road (vehicles)	**192**	**15**	**130**	**21**
Percent to South	12.0	13.3	53.8	42.9
Percent to North	88.0	86.7	46.2	57.1

Source: GTA Consultants (2013)

The distribution of traffic confirms a tendency for northbound and eastbound traffic during the morning and southbound and westbound traffic during the evening, i.e. inbound to the mines in the morning, and outbound during the evening. It is noted that vehicular accesses for the Ulan Mine Complex lie off Ulan Road between Cope Road and Ulan-Wollar Road and north of the CHPP Access Road.

3.3 Traffic Survey Program

To supplement the available traffic data, a program of traffic surveys was conducted during March 2015 to quantify existing traffic conditions associated with the Moolarben Coal Complex. Automatic tube counts were undertaken over one week on:

- Open Cut Access Road south of Ulan-Wollar Road; and
- CHPP Access Road east of Ulan Road.

Peak period turning movement surveys were also undertaken at the following two intersections:

- Ulan-Wollar Road and Open Cut Access Road; and
- Ulan Road and CHPP Access Road.

During the survey period, MCO has advised that of the 280 person workforce, there was typically 240 employees on site each day, and that crushed rock was being transported between the open cut area and the CHPP area. Approximately 30 loads of crushed rock were transported each day between the two accesses and occurred on a temporary basis only. There was also a significant but unquantified number of "internal" trips between the two accesses throughout the day, not associated with workers travelling to and from the site at the start and end of their shifts.

3.3.1 Surveyed Traffic Volumes

Table 3.5 summarises the key findings of the tube count surveys, including the surveyed peak hourly traffic volume during the morning (midnight to midday) and the evening (midday to midnight), the times at which the peak hours occurred, the daily traffic volume, and the proportion of heavy vehicles over the day. Heavy vehicles include single unit trucks and buses, semitrailers and rigid trucks with trailers, B-Doubles and road trains (where permissible). Full survey results are presented in Attachment A.

Table 3.5: Surveyed Average Weekday Traffic March 2015

	Hour Starting	Light Vehicles	Heavy Vehicles	Total Vehicles
AM Peak Hour				
Open Cut Access Road South of Ulan-Wollar Road	6.00am	55	9	64
CHPP Access Road East of Ulan Road	6.00am	47	15	61
Total of Access Roads	6.00am	102	23	125
PM Peak Hour				
Open Cut Access Road South of Ulan-Wollar Road	12.00pm	29	18	47
CHPP Access Road East of Ulan Road	2.00pm	27	17	44
Total of Access Roads	12.00pm	56	33	89
Daily				
Open Cut Access Road South of Ulan-Wollar Road	-	399	216	615
CHPP Access Road East of Ulan Road	-	383	185	568
Total of Access Roads	-	782	401	1,183

The results of the surveys indicate that the busiest hours overall for traffic generated by the Moolarben Coal Complex occurred from 6.00am to 7.00am, when 125 vehicle movements were surveyed and from 12.00 midday to 1.00pm, when 89 vehicle movements were surveyed. Over the average weekday, the two access roads generated 1,183 vehicle trips per day, of which approximately two-thirds were made by light vehicles and one-third percent by heavy vehicles.

The CHPP Access Road carried approximately 48 percent of the total Moolarben Coal Complex traffic, and the Open Cut Access Road carried 52 percent. The proportion of heavy vehicles at each of the two accesses was similar, at approximately 33 percent of all vehicles on the CHPP Access Road and 35 percent of all vehicles on the Open Cut Access Road.

3.3.2 Surveyed Intersection Volumes

To provide information on the directional distribution of traffic entering and exiting the Moolarben Coal Complex, the turning movements of vehicles were surveyed at the intersections of Ulan Road with the CHPP Access Road and of Ulan-Wollar Road with the Open Cut Access Road during morning and evening periods in March 2015. The surveys were conducted between 3.00pm and 6.00pm on Tuesday 10 March, and between 6.00am and 9.00am on Wednesday 11 March. Full survey results are presented in Attachment A.

It is noted that the number of vehicles was recorded at 15 minute intervals. The busiest hour during the morning occurred between 6.00am and 7.00am at both intersections, while the busiest hour during the evening occurred between 4.30pm and 5.30pm at the CHPP Access Road intersection, and between 5.00pm and 6.00pm at the Open Cut Access Road intersection.

Table 3.6: Peak Hour Two Way Traffic at Intersections March 2015 (vehicles/hour)

Intersection	AM Peak Hour			PM Peak Hour		
	Light	Heavy	Total	Light	Heavy	Total
Ulan Road and CHPP Access Road	**6.00am-7.00am**			**4.30pm-5.30pm**		
Ulan Road north of CHPP Access Road	146	16	162	142	16	158
Ulan Road south of CHPP Access Road	202	24	226	175	9	184
CHPP Access Road east of Ulan Road	72	8	80	43	3	46
Ulan-Wollar Road and Open Cut Access Road	**6.00am-7.00am**			**5.00pm-6.00pm**		
Ulan-Wollar Road west of Open Cut Access Road	132	13	145	108	10	118
Ulan-Wollar Road east of Open Cut Access Road	66	9	75	91	6	97
Open Cut Access Road south of Ulan-Wollar Road	66	5	71	25	6	31

Table 3.7 summarises the surveyed distribution of traffic into and out of the access roads over the two three-hour survey periods.

Table 3.7: Distribution of Traffic In/Out of Moolarben Coal Complex Accesses

Approach	6am to 9am		3pm to 6pm	
	Light	Heavy	Light	Heavy
Inbound to CHPP Access Road (vehicles)	**108**	**17**	**28**	**19**
Percent from South	91.7	100	89.3	100
Percent from North	8.3	0	10.7	0
Outbound from CHPP Access Road (vehicles)	**45**	**15**	**85**	**23**
Percent to South	91.1	100	85.9	100
Percent to North	8.9	0	14.1	0
Inbound to Open Cut Access Road (vehicles)	**75**	**14**	**21**	**18**
Percent from East	6.7	7.1	19.0	0
Percent from West	93.3	92.9	81.0	100
Outbound from Open Cut Access Road (vehicles)	**37**	**12**	**50**	**19**
Percent to East	10.8	0	6.0	5.3
Percent to West	89.2	100	94.0	94.7

The surveyed distribution highlights that the majority of traffic into and out of the Moolarben Coal Complex approaches and departs to and from the south on Ulan Road and west on Ulan-Wollar Road. Over the six hours surveyed, approximately 9 percent of the light traffic entering the CHPP Access Road approached from the north, and approximately 12 percent of light traffic exiting the CHPP Access Road departed to the north. No heavy vehicles entered from or departed to the north.

3.3.3 Comparison with 2012 Data

The surveys conducted at the intersections of Ulan-Wollar Road with Ulan Road and with the Open Cut Access Road allow for a direct comparison between traffic volumes on Ulan-Wollar Road in 2012 and 2015. The total volumes of light and heavy vehicles by direction over the two 3-hour survey periods are compared in Table 3.8.

Table 3.8: Comparison of Surveyed Traffic on Ulan-Wollar Road East of Ulan Road

	6am to 9am		3pm to 6pm	
	Light	Heavy	Light	Heavy
December 2012[A]				
Eastbound	269	26	57	12
Westbound	91	11	170	19
Two Way	360	37	227	31
March 2015				
Eastbound	170	27	71	25
Westbound	78	15	155	30
Two Way	248	42	226	55
Change 2012 to 2015				
Eastbound	-99	+1	+14	+13
Westbound	-13	+4	-15	+11
Two Way	-112	+5	-1	+24

[A] Sourced from GTA Consultants (2013)

The comparison suggests that over the two 3-hour periods, the most significant change has been a decrease in eastbound light traffic during the morning period, being the inbound direction to the Moolarben Coal Complex and the Wilpinjong Coal Mine. At the time of the 2012 surveys, construction work was being undertaken along Ulan-Wollar Road, including a temporary build site related to the Wilpinjong Coal Mine and road works related to Moolarben Coal Complex. These works would have temporarily increased traffic volumes on Ulan-Wollar Road.

This suggests that overall, the traffic conditions surveyed in 2012 on Ulan Road, Ulan-Wollar Road and Cope Road are considered to somewhat overestimate the current traffic conditions. However for the purpose of this assessment, the 2012 conditions are considered to be a robust and reasonable estimate of baseline conditions.

3.4 Moolarben Coal Complex Traffic

The contribution of the Moolarben Coal Complex to traffic on the surrounding road network has been estimated by considering the surveyed traffic volumes at the access roads, and the likely distribution of that traffic. For the purpose of this assessment, the overall traffic generation of the Moolarben Coal Complex as surveyed is assumed to be made up of the following:

Light Vehicles

- Workers travelling to/from site 480 vehicles/day
- Internal trips between accesses 200 vehicles/day
- Visitors travelling to/from site 102 vehicles/day
- Total 782 vehicles/day

Heavy Vehicles

- Internal trips between accesses 120 vehicles/day (temporary crushed rock transport)
- Internal trips between accesses 80 vehicles/day (other operational trips)
- Deliveries travelling to/from site 201 vehicles/day
- Total 401 vehicles/day

The distribution of vehicles on the road system is estimated as follows (and does not apply to the internal trips which travel directly between the two access roads):

Light Vehicles

- to/from north along Ulan Road 10%
- to/from south along Ulan Road 75%
- to/from west along Cope Road 15%

Heavy Vehicles

- to/from south along Ulan Road 90%
- to/from west along Cope Road 10%

Table 3.9 summarises the daily distribution of the surveyed traffic generated by the Moolarben Coal Complex on the surrounding road network.

Table 3.9: Average Weekday Trips to/from Moolarben Coal Complex 2015 (vehicles/day)

Site[A]	Location	Light	Heavy	Total
1	Ulan Road north of Hollyoak Bridge	349	131	480
2	Ulan Road south of Wollar Road	349	131	480
3	Ulan Road south of Cope Road	437	164	600
4	Ulan Road south of Ulan-Wollar Road	482	181	662
5	Ulan Road north of Ulan-Wollar Road	342	177	519
6	Cope Road west of Ulan Road	87	20	107
7	Ulan-Wollar Road east of Moolarben Coal Complex	0	0	0
8	Ulan-Wollar Road east of Slate Gully Road	0	0	0

[A] Refer to Figure 1-1 for locations

3.5 Existing Roadway Capacity and Efficiency

The Austroads (2013) *Guide to Traffic Management Part 3: Traffic Studies and Analysis* provides guidelines for the capacity and Levels of Service (LOS) of two lane, two way rural roads, which in turn, refers to the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2010).

The capacity of a road is defined as the maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under the prevailing roadway, traffic and control conditions. The capacity of a single traffic lane will be affected by factors such as the pavement width and restricted lateral clearances, the presence of heavy vehicles and grades.

Level of Service (LOS) is defined as a qualitative measure describing the operational conditions within a traffic stream as perceived by drivers and/or passengers. A LOS definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety. LOS A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. LOS B to D describes progressively worse traffic conditions. LOS E occurs when traffic conditions are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre in the traffic stream. The service flow rate for LOS E is taken as the capacity of a lane or roadway. In rural situations, LOS C is generally considered to be acceptable. At LOS C, most vehicles are travelling in platoons, and travel speeds are curtailed. At LOS D, platooning increases significantly, and the demand for passing is high, but the capacity to do so is low.

The LOS experienced by drivers on two way rural roads is dependent on the drivers' expectations regarding the road, and three classes of road are defined in the HCM. Class I are roads on which motorists expect to travel at relatively high speeds. They most often serve long-distance trips or provide connecting links between facilities that serve long-distance trips. Class II roads are those on which motorists do not necessarily expect to travel at high speeds, and may function as access routes to Class I facilities, serve as scenic or recreational routes or pass through rugged terrain. Class III roads serve moderately developed areas, and may be portions of a Class I or Class II highway that pass through small towns or developed recreational areas, where local traffic mixes with through traffic, and the density of unsignalised roadside access points increases.

The LOS criteria for Class I, Class II and Class III two-lane roads are as shown in Table 3.10. The HCM has been published only in US customary units, thus Average Travel Speed (ATS) is calculated and reported in miles per hour (mi/h).

Table 3.10: Level of Service Criteria for Two Lane Roads

Level of Service	Class I Roads		Class II Roads	Class III Roads
	Percent-Time-Spent-Following	Average Travel Speed (ATS) (mi/h)	Percent-Time-Spent-Following (PTSF)	Percent of Free Flow Speed (PFFS)
A	35	> 55	40	>91.7
B	> 35-50	> 50-55	> 40-55	>83.3-91.7
C	> 50-65	> 45-50	> 55-70	>75.0-83.3
D	> 65-80	> 40-45	> 70-85	>66.7-75.0
E	> 80	40	> 85	66.7

The primary determinant of a road's classification for operational analysis is the drivers' expectations, which may not necessarily agree with the functional classification. The surveyed roads serving the Moolarben Coal Complex would typically be considered as Class II roads under the HCM descriptions, as drivers would expect some level of restriction to their freedom of movement along the routes as a result of characteristics of the route such as limits on the opportunities for overtaking (e.g. centre linemarking, sight distances, lack of overtaking lanes). The exception would be the location on Ulan Road north of Hollyoak Road, where conditions are influenced by the proximity to Mudgee. This location may therefore be considered a Class III road.

It should be noted that despite the similarity in naming, this classification system is different from the classification system referenced in the *Ulan Road Strategy* (ARRB, 2011a) (refer to Section 4.1), so no comparison should be made between the Class types referred to in this report and that referred to in the *Ulan Road Strategy* (ARRB, 2011a) report.

On Class II roads, LOS is defined only in terms of Percent Time Spent Following (PTSF). The PTSF is a measure of the level of opportunities to overtake, and is estimated from the demand traffic volumes, the directional distribution of that traffic, and the percentage of no-passing zones. On Class III roads, LOS is defined only in terms of Percent Free Flow Speed (PFFS). The PFFS represents the ability of vehicles to travel at or near the posted speed limit.

The baseline 2012 peak hour volumes have been assessed and the PTSF, PFFS and Levels of Service results are presented in Table 3.11.

Table 3.11: Existing Midblock Levels of Service

Site[A]	Location	Class	North or Eastbound				South or Westbound			
			AM Peak		PM Peak		AM Peak		PM Peak	
			PTSF	LOS	PTSF	LOS	PTSF	LOS	PTSF	LOS
1	Ulan Road north of Hollyoak Bridge[B]	III	87.0	B	83.7	B	86.2	B	83.9	B
2	Ulan Road south of Wollar Road	II	50.3	B	36.9	A	15.4	A	45.0	B
3	Ulan Road south of Cope Road	II	56.8	C	14.9	A	11.6	A	43.0	B
4	Ulan Road south of Ulan-Wollar Road	II	57.8	C	12.1	A	14.3	A	46.0	B
5	Ulan Road north of Ulan-Wollar Road	II	48.9	B	13.9	A	14.3	A	38.5	A
6	Cope Road west of Ulan Road	II	32.9	A	20.3	A	17.3	A	27.9	A
7	Ulan-Wollar Road east of Moolarben Coal Complex	II	36.6	A	18.1	A	4.5	A	23.5	A
8	Ulan-Wollar Road east of Slate Gully Road	II	13.8	A	17.3	A	18.5	A	14.7	A

[A] Refer to Figure 1-1 for locations

[B] Reported value is PFFS not PTSF

The results indicate that the roads operate at acceptable levels of service during the peak hours, with Ulan Road south of Ulan-Wollar Road and south of Cope Road being on the threshold of LOS B and C in the northbound direction during the morning peak hour. The LOS is A or B during all other hours of the day at those locations.

3.6 Existing Intersection Operation

The operation of the surveyed intersections has been analysed using the SIDRA Intersection program, an analysis program which determines characteristics of intersections 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 operating characteristics can be compared with the performance criteria set out in Table 3.12. It is noted that average delay per vehicle is expressed in seconds per vehicle (sec/veh) and is measured for the movement with the highest average delay per vehicle at priority intersections such as the three surveyed intersections.

Table 3.12: Level of Service Criteria at Priority Intersections

Level of Service	Worst Movement Average Delay per Vehicle (sec/veh)	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 and accident study required
E	57 to 70	At capacity, requires other control mode
F	> 70	Extreme delay, traffic signals or other major treatment required

The results of the analyses are summarised in Table 3.13.

Table 3.13: Surveyed Peak Hour Intersection Operating Conditions

Intersection	X-value		Average Delay (sec/veh)[A]		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Ulan Road and CHPP Access Road	0.04	0.06	7.9	8.0	A	A
Ulan-Wollar Road and Open Cut Access Road	0.04	0.03	7.9	7.9	A	A
Ulan Road and Ulan-Wollar Road	0.20	0.10	9.8	8.5	A	A
Ulan Road and Cope Road	0.16	0.12	9.5	9.1	A	A

A for movement with highest average delay per vehicle

The SIDRA Intersection results indicate that during the surveyed peak hours, the intersections operate at good levels of service, with low delays to vehicles and with spare capacity.

3.7 Road Safety

Road crash data was obtained from RMS for the most recent five year period available on key roads serving the Moolarben Coal Complex. The data covers the period from 1 January 2009 to 31 December 2013, and data includes those crashes which conform to the national guidelines for reporting and classifying road vehicle crashes and are based on the following criteria:

- The crash was reported to the police.
- The crash occurred on a road open to the public.
- The crash involved at least one moving vehicle.
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away.

Crash data was obtained and reviewed for the following roads, being the primary access roads for traffic travelling to and from the Moolarben Coal Complex:

- Ulan Road between Mudgee outskirts (start of 100km/h zone) and Golden Highway;
- Cope Road between Ulan Road and Gulgong outskirts; and
- Ulan-Wollar Road between Ulan Road and Wollar.

Table 3.14 summarises the number and general types of crashes which occurred on the sections of road under consideration.

Table 3.14: Reported General Crash Types on Key Access Routes (2009 to 2013)

Road	Pedestrian	Multiple Vehicles					Single Vehicle			Other
		Adjacent Approaches	Opposing Directions	Same Direction	U-turn/Parking	Overtaking	On Path	Off Path on Straight	Off Path on Curve	
Ulan-Wollar Road Ulan Road to Wollar	-	-	-	-	-	-	-	-	2	-
Cope Road Gulgong to Ulan Road	-	-	1	1	-	4	1	9[B]	6	-
Ulan Road Mudgee to Golden Highway	1[A]	-	3	8	-	4	12	27	9	2
Total by Crash Type	**1**	**0**	**4**	**9**	**0**	**8**	**13**	**36**	**17**	**2**
Total Casualties	**1[A]**	**0**	**2**	**3**	**0**	**3**	**4**	**30[B]**	**5**	**2**

[A] Includes one fatal crash
[B] Includes three fatal crashes

Over the five years and routes reviewed, a total of 90 crashes occurred, resulting in four fatalities and 46 people being injured.

Table 3.14 demonstrates that over all the roads investigated, the most common types of crashes involved single vehicle "off path" crashes, i.e. vehicles leaving the carriageway, known as run-off-road (ROR) crashes, which made up 59 percent of the reported crashes in Table 3.14, and 70 percent of casualties. This is consistent with Austroads (2015), which found that in rural road environments in Australia, off-path crashes were the most likely, and were associated with the greatest numbers of fatalities. ARRB (2011b) states that known causes of ROR crashes include:

- driver behaviours such as speed, inattention, avoidance manoeuvres, errant vehicles;
- driver impairment including fatigue, alcohol, drugs, mood state;
- road conditions such as horizontal alignment, shoulder deficiencies, slippery surface, poor delineation, damaged surfaces;
- vehicle failure; and
- environmental conditions such as rain, fog, snow, livestock or native fauna.

The road safety history of the various roads has been reviewed with regard to each road's crash exposure, which considers the rate at which crashes occur in crashes per vehicle kilometres travelled (VKT). One VKT is equivalent to one vehicle travelling a distance of 1km, or alternatively two vehicles travelling for a distance of half a kilometre. The crash exposure increases as the length of a trip increases, and as traffic volumes increase. This is a general measure of the performance of the roads, and enables a comparison to be made between the relative safety of roads. RMS (2004) indicates that based on a review of data on 36 classified roads in NSW, undivided two lane rural roads have an average crash rate of 32.8 crashes per 100 million VKT, of which 28.6 were non-intersection crashes, and 4.2 were intersection crashes. The overall crash rate was higher where sealed shoulders of less than 1.0m width were provided, at 38.1 crashes per 100 million VKT, and lower where sealed shoulders greater than 1.0m width were provided, at 28.5 crashes per million VKT.

Table 3.15 presents the estimated ADT for each of the route sections described in Table 3.14, and the calculated crash rates for those routes.

Table 3.15: Crash Rates on Moolarben Access Routes 2009-2013

	Distance (km)	Estimated ADT 2009-2013[A]	MVKT 2009-2013	Number of Crashes 2009-2013	Crashes per 100 MVKT
Ulan-Wollar Road Ulan Road to Wollar	21.7	392	15.5	2	12.9
Cope Road Gulgong to Ulan	23.5	1,342	57.5	22	38.2
Ulan Road Mudgee to Golden Highway	67.8	2,234	276.4	66	23.9

[A] ADT based on seven day average volumes 2012 surveys results

Comparison with the RTA (2004) average crash rate of 32.8 crashes/100 million VKT indicates that the overall crash rate on Ulan Road and Ulan-Wollar Road are below average, while that on Cope Road is consistent with the reported average rate of 38.1 crashes/100 million VKT where sealed shoulders less than 1.0m width are provided. The shoulders on Cope Road are generally unsealed, noting that the capital works being undertaken would be expected to improve safety along the route. A detailed review of the crashes on each route is provided in the following sections.

3.7.1 Ulan-Wollar Road Crash History Review

A significant amount of the Moolarben Coal Complex traffic uses Ulan-Wollar Road to access the Open Cut Access Road. The details of the crash history of Ulan-Wollar Road between 2009 and 2013 are summarised in Table 3.16.

Table 3.16: Crash Summary on Ulan-Wollar Road (Ulan Road to Wollar) 2009-2013

Date	Location	Weather and Road Conditions	What Occurred	Factors[A]
10.15am 18/02/2011	6km east of Ulan Road	Fine, daylight, dry road surface	Large rigid truck went off carriageway to the right on a right hand bend and struck an embankment. One injury.	-
4.00pm 16/11/2012	2.75km east of Ulan Road	Raining, daylight, wet road surface	Car went off carriageway to right on a left hand bend and struck a tree. One injury.	Speed

[A] Factors considered to have contributed to the crash, identified in RMS crash data reports.

Provisional data provided by RMS for the period 2014-15 does not include any other crashes on Ulan-Wollar Road. The crash history of Ulan-Wollar Road suggests there is not a significant safety issue on Ulan-Wollar Road, with two crashes resulting in two injuries over five years. Both of these occurred to the west of the Wilpinjong Coal Mine access.

Moolarben Coal Complex traffic would have its greatest potential for interaction with opposing traffic movements at the intersections of Ulan-Wollar Road with Ulan Road and the Open Cut Access Road. Over the five year period reviewed, it is noted that no crashes have occurred at either of those intersections.

3.7.2 Ulan Road Crash History Review

Ulan Road is a key access route for Moolarben Coal Complex traffic, and has been the subject of a previous detailed review of its crash history as part of development of the *Ulan Road Strategy* (ARRB, 2011a). That study reviewed the crash history along Ulan Road between Mudgee and the entrance to the Ulan Mine Complex in detail, including crash rates and casualty rates. The recommended upgrades to intersections and the road profile (refer to Section 4.1) are expected to reduce the crash rate along Ulan Road. An updated review of the types of crashes on Ulan Road and contributing factors is presented in Table 3.17 based on the validated crash data for 2009 to 2013.

Table 3.17: Ulan Road (Mudgee Outskirts to Cassilis) Crash Summary 2009-2013

		Multiple Vehicles					Single Vehicle			
	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-turn/Parking	Overtaking	On Path	Off Path on Straight	Off Path on Curve	Other
Total Crashes	1	-	3	8	-	4	12	27	9	2
Road Surface Condition										
Dry Road	1	-	2	4	-	4	10	23	6	2
Wet Road	-	-	1	4	-	-	2	4	3	-
Natural Lighting										
Daylight	1	-	1	2	-	3	1	13	6	2
Darkness	-	-	1	4	-	-	11	8	1	-
Dawn	-	-	1	-	-	1	-	2	2	-
Dusk	-	-	-	2	-	-	-	4	-	-
Vehicle Type										
Motorcycle	-	-	-	-	-	-	-	-	-	
Car, station wagon, 4WD, van	1	-	2	6	-	5	10	16	6	1
Light or Large Truck or Bus	-	-	4	9	-	2	3	10	3	2
Articulated Vehicle	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	1	-	-	-	1	-	1
Severity of Crash										
Fatal	1	-	-	-	-	-	-	-	-	-
Injury	-	-	1	2	-	-	4	19	3	2
Non-injury	-	-	2	6	-	4	8	8	6	-
Factors[A]										
Speed	-	-	-	2	-	1	-	1	4	-
Fatigue	-	-	1	-	-	-	-	10	1	-
Alcohol	-	-	-	-	-	-	-	3	2	-
None	1	-	2	6	-	3	12	16	3	2

[A] Factors considered to have contributed to the crash, identified in RMS crash data reports. More than one factor can be nominated for a single crash.

Of the 66 crashes reported on Ulan Road, nine occurred at or within 10m of an intersection, although not all of these were necessarily related to the intersection itself. It is noted that the majority of the "vehicles from the same direction" crashes were rear end crashes, of which three occurred at intersections (one each at Mudhut Creek Road, Wollar Road and Eurunderee Lane).

The majority of "on path" crashes involved a vehicle striking an animal in dark lighting conditions. Of the 36 crashes in which a driver lost control and the vehicle left the carriageway (on straight or curved road), 29 occurred on a dry road surface, 11 involved driver fatigue, five involved alcohol and five involved inappropriate speed. The 66 crashes reported on Ulan Road resulted in 37 injuries.

Eight of the reported crashes on Ulan Road occurred during the NSW standard school travel times, taken to be from 7.30am to 9.30am and from 2.30pm to 5.00pm. The hour with the highest number of crashes over the five year period was between 6.00am and 7.00am, when 11 of the 66 crashes occurred. The worst days of the week for crashes were Friday (16 crashes), Thursday (14 crashes) and Monday (11 crashes).

3.7.3 Cope Road Crash History Review

Cope Road is the primary access route to and from the west of the Moolarben Coal Complex. A review of the types of crashes on Cope Road and contributing factors is presented in Table 3.18 based on the validated crash data for 2009 to 2013.

Of the 22 crashes reported on Cope Road, three occurred at or within 10m of an intersection (one each at Happy Valley Road, Wyoming Road and Springfield Park Road). All three were the result of a driver attempting to overtake (on the right) a vehicle which was turning right at the intersection.

Table 3.18: Cope Road (Gulgong to Ulan Road) Crash Summary 2009-2013

	Pedestrian	Multiple Vehicles					Single Vehicle			Other
		Adjacent Approaches	Opposing Directions	Same Direction	U-turn/Parking	Overtaking	On Path	Off Path on Straight	Off Path on Curve	
Total Crashes	-	-	1	1	-	4	1	9	6	-
Road Surface Condition										
Dry Road	-	-	1	1	-	4	1	8	5	-
Wet Road	-	-	-	-	-	-	-	1	1	-
Natural Lighting										
Daylight	-	-	1	1	-	3	-	5	3	-
Darkness	-	-	-	-	-	-	-	3	3	-
Dawn	-	-	-	-	-	-	-	-	-	-
Dusk	-	-	-	-	-	1	1	1	-	-
Vehicle Type										
Motorcycle	-	-	-	-	-	-	-	2	-	-
Car, station wagon, 4WD, van	-	-	2	1	-	5	-	6	4	-
Light or Large Truck or Bus	-	-	-	2	-	2	1	1	2	-
Articulated Vehicle	-	-	-	-	-	1	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-
Severity of Crash										
Fatal	-	-	-	-	-	-	-	3	-	-
Injury	-	-	1	-	-	2	-	5	1	-
Non-injury	-	-	-	-	-	2	1	1	5	-
Factors[A]										
Speed	-	-	-	-	-	-	-	1	3	-
Fatigue	-	-	-	-	-	-	-	1	-	-
Alcohol	-	-	-	-	-	4	-	5	-	-
None	-	-	1	1	-	3	1	3	3	-

[A] Factors considered to have contributed to the crash, more than one factor can be nominated for a single crash

3.8 Rail Network

The rail network in the vicinity of the Moolarben Coal Complex is owned by the Australian Rail Track Corporation (ARTC). Product coal from Moolarben Coal Complex is railed east from the Moolarben Coal Complex Loop via the Sandy Hollow-Gulgong Railway, Muswellbrook-Merriwa Railway and the Main Northern Railway to the Port of Newcastle. The Sandy Hollow-Gulgong Railway line forms a connection between the Wallerawang-Gwabegar Railway at Gulgong and the Muswellbrook-Merriwa Railway at Sandy Hollow. The Muswellbrook-Merriwa Railway connects to the Main Northern Railway at Muswellbrook. ARTC refers to the railway as the Ulan Line between Muswellbrook and Ulan. The Ulan Line is a single track line with a series of passing loops, and carries only limited non-coal trains.

The ARTC releases annual strategies for its Hunter Valley infrastructure, which set out how it intends to ensure sufficient rail corridor capacity is provided to meet coal demand. The *2014-2023 Hunter Valley Corridor Capacity Strategy (Consultation Draft)* identifies the future constraints on the coal network's capacity in the Hunter Valley, the options to resolve these constraints and a proposed course of action to achieve increased coal throughput.

The *2014-2023 Hunter Valley Corridor Capacity Strategy (Consultation Draft)* notes that a constraint on the Ulan Line is the ventilation in the tunnels, in particular "purge times" for air in the Bylong tunnel. Trains were previously limited to 30 minute minimum frequency due to this constraint, however this has now been reduced to 20 minutes following monitoring and analysis. In the longer term, the Bylong loop will require extension to accommodate prospective train volumes. The design of the upgrade would further mitigate the air quality issue at Bylong tunnel.

The 2011 Strategy identified that construction of a 11.5km bypass of Denman from just east of Sandy Hollow to just west of Mangoola would provide operational efficiencies and create capacity by effectively making the section double rather than single track. ARTC will continue to assess this option.

Increasing the maximum train speeds on the Ulan Line is not expected to result in any significant capacity benefit due to train performance and curve speed constraints, however will continue to be reviewed periodically.

ARTC has a preference to operate standard train sets across the network, and has been working with operators to assess the benefits of increasing train lengths to approximately 1,610m. Such an increase would require lengthening of two loops on the Ulan Line at Sandy Hollow and Kerabbi, and will continue to be considered by ARTC to address longer term capacity requirements. Additional passing loops at Mt Pleasant and Widden Creek are anticipated to be required in the first quarter of 2021 under current volume forecasts.

The ARTC Master Train Timetable (effective 15 January 2015) indicates that the timetabled train schedule does not change significantly from day to day. On a typical day, 25 trains are scheduled in each direction. Over a day, this is equivalent to an average of one train movement every half an hour. The actual frequency varies throughout the day and night, and train running does not necessarily follow the schedule of the Master Train Timetable, which sets fixed paths for trains to run and cross. ARTC is of the view that track utilisation would be increased through its dynamic pathing project, which it is progressing.

3.9 Railway Level Crossings

The Moolarben Coal Complex generates rail traffic between the Moolarben Coal Complex Loop and Newcastle. Rail traffic impacts on road traffic through delays to vehicles at level crossings. There is a number of railway level crossings in the vicinity of the Moolarben Coal Complex which carry road traffic directly attributable to activity at the Moolarben Coal Complex, and/or rail traffic directly attributable to activity at the Moolarben Coal Complex.

Information regarding each of the local public level crossings has been collated from the Transport for New South Wales *Public Level Crossing Finder* and information provided to GTA by ARTC's Third Party Works Manager (by email 27 March 2015), and is tabulated in Table 3.19.

Table 3.19: Ulan Line Railway Level Crossings near Moolarben Coal Complex

LXM ID	Road Location	Rail Location	Control	Moolarben Traffic	AS1742.7 Compliance	Risks
1304	Cope Road, Ulan	438.83	Active – lights	Road	3	Queuing 2
1815	Ulan Colliery Road, Ulan	437.97	Active – lights	None	5	Queuing 2
1302	Unnamed local road, Ulan	425.21	Passive – stop	Rail	3	-
1301	Ulan-Wollar Road, Wollar	423.74	Passive – stop	Rail	5	-
1300	Ulan-Wollar Road, Wollar	420.06	Active – lights and boom gates	Rail	0	-
1298	Unnamed local road, Wollar	417.34	Passive – stop	Rail	3	-
1297	Mogo Road, Wollar	415.11	Active – lights and boom gates	Rail	3	-

LXM ID = Level Crossing Management system identification number
Sources: ARTC and Transport for New South Wales Public Level Crossing Finder https://appln.transport.nsw.gov.au/mapservices/proxy/levelCrossings/map.html and advice from ARTC

Signage and road marking requirements associated with railway level crossings are set out in the *Manual of Uniform Traffic Control Devices Part 7: Railway Crossing* (Australian Standard 1742.7, 2007). The Standard does not provide guidance on when a crossing should progress from one treatment to another, as such guidance is found in risk assessment models such as the Australian Level Crossing Assessment Model (ALCAM). ARTC identifies a number of risk factors associated with level crossings, including:

- queuing risk, i.e., whether vehicles can queue back across the crossing from an adjacent road intersection;
- short stacking risk, i.e., whether the distance between the crossing and adjacent road intersection is long enough to accommodate the largest stationary gazetted vehicle without the rear of the vehicle fouling the track; and
- proximity to siding/shunting yard, a guide as to whether an adjacent siding, signal etc. can cause trains to block the crossing or shunt across the crossing.

Risks identified by ARTC are presented in Table 3.19. The numbers 0 to 5 represent an increasing risk level for each of these categories.

Table 3.19 notes where ARTC has identified that crossings do not comply with the Australian Standard, or present one of the risk factors above. The numbers 0 to 5 represent an increasing risk level for each of these categories.

ARTC's Third Party Works Officer advised GTA that there are currently no plans to upgrade any level crossings in this area. Additional information about each of the level crossings is provided in Attachment B.

3.10 Delays to Road Traffic at Level Crossings

The ARTC Master Train Timetable (effective 15 January 2015) indicates that there is an average of one train movement timetabled every half an hour on the Ulan Line.

In order to gauge the delays experienced by drivers as a result of trains passing through the crossings, the probability of a vehicle and a train occupying the level crossing simultaneously (and therefore resulting in delay to vehicles) has been estimated. To estimate this probability, the following assumptions have been made regarding travel through the level crossing "occupation zone":

- a train occupies the potential occupation zone for 3 minutes, noting this is considered a conservatively long period; and
- vehicles occupy the potential occupation zone for the equivalent time of 30 m of travel at the posted speed limit, advisory speed or estimated average travel speed plus an additional delay of 4 seconds per vehicle at passive crossings to account for the requirement to stop to allow the driver to ascertain if it is safe to cross.

As a robust assessment, the assessment assumes that during the road peak hour, up to three trains may pass through any crossing on the Ulan Line, noting that the timetable suggests that during the majority of on-street peak hours, no more than two train movements occur. The level crossing at the Ulan Mine Complex access road has not been assessed, as the Moolarben Coal Complex contributes neither road nor rail traffic at that crossing.

Table 3.20: Peak Hour Probability of Delay to Vehicles at Railway Level Crossings

Level Crossing Location	Vehicles per Hour	Vehicle Travel Speed (km/h)	Trains per Hour	Probability of Delay
1304 Cope Road, Ulan	156	50	3	1.24%
1302 Unnamed local road, Ulan	2	20	3	0.07%
1301 Ulan-Wollar Road, Wollar	130	60	3	2.63%
1300 Ulan-Wollar Road, Wollar	15	60	3	0.10%
1298 Unnamed local road, Wollar	2	20	3	0.07%
1297 Mogo Road, Wollar	20	30	3	0.28%

The results indicate that the probability of a vehicle being delayed at the level crossings on the Ulan Line near the Moolarben Coal Complex is very low. The probability of vehicles being delayed by a train if the peak number of trains coincides with the peak number of vehicles would be highest at the Ulan-Wollar Road level crossing located approximately 250m east of the Wilpinjong Coal Mine access road, with a probability of 2.63%, or 1 in 38. If the peak traffic volume coincided with the peak hourly number of train movements once every day, a driver passing through that level crossing during that hour each day could be expected to be delayed approximately once each 38 days, and less frequently at all other level crossings.

3.11 School Buses

Ulan Road is currently used by school buses operated by Eggtranz Pty Ltd (Eggtranz) and other operators. Eggtranz has advised that all school buses operate on Ulan Road between 7.30am and 8.35am (southbound) and 3.35pm and 4.35pm (northbound). The school buses therefore operate on Ulan Road over a period of approximately 1 hour each morning and afternoon.

3.12 MCO Road Maintenance Contributions

In accordance with Project Approval (05_0117) and Project Approval (08_0135), MCO works with the proponents of the Ulan Mine Complex and Wilpinjong Coal Mine to implement the *Ulan Road Strategy* (ARBB, 2011a). MCO makes financial contributions towards the implementation of the *Ulan Road Strategy* (ARBB, 2011a).

In addition, MCO will make financial contributions to the maintenance of Cope Road in accordance with Condition 49, Schedule 3 of Project Approval (08_0135).

4. Future Traffic Changes

The operation of the road network would be expected to change over time due to the impacts of other developments in the region, unrelated to the proposed Modification. These are described in this section.

4.1 Ulan Road Strategy

ARRB (2011a) prepared the *Ulan Road Strategy*, which presents recommendations regarding improvements works along Ulan Road between Mudgee and the access to the Ulan Mine Complex. Traffic forecasts in the *Ulan Road Strategy* (ARRB, 2011a) include projections of vehicle use associated with the Ulan Mine Complex, Moolarben Coal Complex and Wilpinjong Coal Mine. The report identifies road works to upgrade and maintain Ulan Road over the operating life of the mines, including upgrading over 20 intersections, typically to either basic left-turn (BAL)/ basic right-turn (BAR), or channelised left-turn (CHL)/channelised right-turn (CHR) configurations, upgrading of Ulan Road to a desirable design formation of two 3.5m wide sealed lanes with 1.0m wide sealed shoulders and 1.0m wide unsealed shoulders, and adoption of noise attenuation measures.

The proposed intersection upgrades generally involve widening of the carriageway to allow through vehicles to pass around vehicles slowing to turn into or out of side roads. "CHR" refers to provision of a channelised right-turn only bay on the major road. "CHL" refers to a channelised left-turn only bay on the major road for vehicles turning into the minor road, and/or a channelised left-turn only bay on the minor road for vehicles turning into the major road. The report presents an indicative program for the upgrades, based on consideration of priorities relating to the pavement conditions, crash history, traffic volumes and timing of other nearby works.

The recommended desirable design standard for Ulan Road in the *Ulan Road Strategy* (ARBB, 2011a) is a carriageway width of 11.0m, consisting of two 3.5m wide sealed lanes, two 1.0m wide sealed shoulders and two 1.0m unsealed shoulders. Where road widening works would be impractical, a minimum design standard with an 8.2m formation width is recommended.

4.2 Wilpinjong Coal Mine

The Wilpinjong Coal Mine is located to the east of the Moolarben Coal Complex (Figure 1-1). Vehicular access to the Wilpinjong Coal Mine is provided via Ulan-Wollar Road.

4.2.1 Wilpinjong Modification 5

Modification 5 to Project Approval (05_0021) for the Wilpinjong Coal Mine was approved in February 2014. With regard to road transport implications, Modification 5 was anticipated to result in:

- limited increase in heavy vehicle deliveries to the site due to increases in the rates of CHPP processing and waste rock production, in combination with the proposed on-site disposal of inert building waste;
- reduction in heavy vehicle movements on local roads around Mudgee due to the disposal of limited volumes of building and demolition inert waste material on-site;

- changes in workforce and contractor-generated traffic due to an increase in the maximum workforce to 550 people until 2019, and reduction back to 460 people thereafter; and
- short term increases in traffic during construction, due to 20 additional employees and additional heavy vehicle movements.

GTA Consultants (2013) assessed the traffic implications of Modification 5, which examined the future traffic generation of the Wilpinjong Coal Mine during the construction phase with peak operational employment in 2014 and in the longer term operational phase in 2024, with a reduced operational workforce.

During the future years relevant to the Modification, it is assumed that the following traffic would be generated by the Wilpinjong Coal Mine:

- 2017 – peak operational traffic (as per 2014 conditions, excluding construction traffic)
- 2027 – operational traffic (as per 2024 conditions).

Table 4.1 presents the expected traffic generation of the Wilpinjong Coal Mine and its distribution on the surrounding road network for those scenarios, based on the results of the Modification 5 assessment traffic study (GTA Consultants, 2013). The peak hours used in that assessment were on-street peaks of 6.00am to 7.00am, and 6.00pm to 7.00pm, noting that the volume of traffic generated by Wilpinjong Coal Mine may be higher outside of those hours.

It is noted that a separate modification (Modification 6) to Project Approval (05_0021) for the Wilpinjong Coal Mine was approved in February 2014. Modification 6 did not include any changes to Wilpinjong Coal Mine traffic and therefore the road transport impacts described in GTA Consultants (2013) are considered to represent the approved Wilpinjong Coal Mine road transport impacts.

Table 4.1: Wilpinjong Coal Mine Traffic Generation with Modification 5

Site[A]	Location	2012			2017			2027		
		AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	57	194	327	67	225	381	53	176	298
2	Ulan Road south of Wollar Road	57	194	327	67	225	381	53	176	298
3	Ulan Road south of Cope Road	74	244	370	87	284	482	68	222	378
4	Ulan Road south of Ulan-Wollar Road	103	332	564	121	388	660	95	303	516
5	Ulan Road north of Ulan-Wollar Road	12	38	65	14	45	76	11	37	62
6	Cope Road west of Ulan Road	29	87	150	34	102	176	26	80	137
7	Ulan-Wollar Road east of Moolarben Coal Complex	107	346	587	125	404	687	98	316	537
8	Ulan-Wollar Road east of Slate Gully Road	14	42	73	16	50	86	13	39	67

[A] Refer to Figure 1-1 for locations
AM Peak = 6.00am to 7.00am, PM Peak = 6pm to 7pm
Source: GTA Consultants (2013)

4.2.2 Wilpinjong Extension Project

A Preliminary Environmental Assessment (PEA) (Wilpinjong Coal Pty Ltd, 2014) has been prepared and submitted to the NSW Department of Planning and Environment for the proposed Wilpinjong Extension Project, and Secretary Environmental Assessment Requirements (SEARs) have been issued.

The proposed Wilpinjong Extension Project would increase the Wilpinjong Coal Mine workforce from approximately 550 to 625 personnel and require a short-term (12 to 18 months) construction workforce of approximately 100 personnel (Wilpinjong Coal Pty Ltd, 2014). It has been assumed that the Wilpinjong Extension Project would commence in 2017, and the expected implications for traffic on the surrounding road network have been estimated based on the project's characteristics set out in the PEA, and with reference to the surveys conducted at Wilpinjong Coal Mine in 2012 (GTA Consultants, 2013).

For the purpose of this assessment, it is assumed that in 2017, the peak construction activity would occur, with up to 100 construction workers employed, and 80% present on-site during daylight hours, typically 7.00am to 6.00pm. Construction workers would travel by car, with average car occupancy of 1.0 persons per vehicle. It has been assumed that construction workers all arrive in one hour at the beginning of the day, and depart in one hour at the end of the day. In reality, the arrival and departure of construction workers would be spread over a longer period.

Construction activity in 2017 would also generate additional delivery and visitor trips, which are not quantified in the PEA. For the purpose of this assessment, an allowance has been made for 50 deliveries and visitors per day, assumed to be 40 heavy vehicles and 10 light vehicles per day, which would be spread throughout the day.

In 2027, it is assumed that the operational workforce at Wilpinjong Coal Mine would increase by 75 people, of whom 80% (60 people) would be present on any one day, consistent with the rostering arrangements expected with Modification 5. The additional workers would travel by car, with average car occupancy of 1.1 persons per vehicle. The additional workers are assumed to be spread across the existing operational shifts, noting that the night shift end time has changed since the 2012 surveys were conducted.

The increase in the workforce and activity as a result of the Wilpinjong Extension Project is assumed to generate additional deliveries and visitors, which are not quantified in the PEA. For the purpose of this assessment, an allowance has been made for an additional 30 deliveries and visitors per day, assumed to be 20 heavy vehicles and 10 light vehicles per day. Table 4.2 summarises the resulting additional traffic generated by the Wilpinjong Extension Project over the average weekday.

Table 4.2: Wilpinjong Extension Project Additional Traffic Generation (vehicle trips)

Hour Starting	2017			2027		
	Workforce	Deliveries and Visitors	Total	Workforce	Deliveries and Visitors	Total
5:00	0	0	0	16	0	16
6:00	80	9	89	37	6	43
7:00	0	8	8	2	6	8
8:00	0	8	8	0	6	6
9:00	0	8	8	0	6	6
10:00	0	8	8	0	6	6
11:00	0	6	6	0	4	4
12:00	0	6	6	0	4	4
13:00	0	6	6	0	2	2
14:00	0	8	8	0	4	4
15:00	0	8	8	0	4	4
16:00	0	8	8	1	4	5
17:00	0	8	8	15	4	19
18:00	80	9	89	17	4	21
19:00	0	0	0	22	0	22
Daily	**160**	**100**	**260**	**110**	**60**	**170**

The distribution of the additional Wilpinjong Extension Project traffic on the surrounding road network is assumed to be similar to that of the Wilpinjong Coal Mine operational traffic. Table 4.3 summarises the distribution of the additional Wilpinjong Extension Project traffic on the road network.

Table 4.3: Additional Wilpinjong Extension Project Traffic on Road Network

Site[A]	Location	2017			2027		
		AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	43	43	158	21	11	101
2	Ulan Road south of Wollar Road	43	43	158	21	11	101
3	Ulan Road south of Cope Road	53	53	180	26	13	116
4	Ulan Road south of Ulan-Wollar Road	72	72	218	35	17	142
5	Ulan Road north of Ulan-Wollar Road	8	8	24	4	2	16
6	Cope Road west of Ulan Road	18	18	39	9	4	26
7	Ulan-Wollar Road east of Moolarben Coal Complex	75	75	232	37	18	151
8	Ulan-Wollar Road east of Slate Gully Road	9	9	18	4	2	12

[A] Refer to Figure 1-1 for locations
AM Peak = 6.00am to 7.00am, PM Peak = 6pm to 7pm

4.3 Ulan Mine Complex

The Ulan Mine Complex is located approximately 38km north-east of Mudgee (Figure 1-1). The Ulan Mine Complex has vehicular access via two access roads. The Ulan Mine Complex Open Cut Mine Access Road is located off Ulan Road approximately 900m north of the intersection of Cope Road and 2km south of the intersection of Ulan-Wollar Road. The Ulan Mine Complex Underground and Administration Access Road is located off Ulan Road approximately 3.6km north of the intersection of Ulan-Wollar Road.

The Ulan Coal Continued Operations Project was approved in November 2010, and involves an extension to the open cut operations as well as concurrently mining the approved Ulan No. 3 Underground and Ulan West under a modified mine plan for 20 years. A traffic and transport impact assessment for that Modification was undertaken by Transport & 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.

The *Ulan Road Strategy* (ARRB, 2011a) refers to commencement of the Ulan Coal Continued Operations Project in 2011. This is confirmed by the Ulan Mine Complex website which indicates that the current workforce is approximately 931 people, including ancillary contractors. This workforce figure is consistent with the Year 5 estimate of total workforce used in the Transport & Urban Planning (2009) assessment.

The traffic surveys conducted on the road system during 2012 can therefore be considered to include the Year 2 traffic generation of the Ulan Coal Continued Operations Project, estimated to be 1,486 trips per weekday by workforce and visitors, and 34 deliveries per weekday (Transport and Urban Planning, 2009). That study estimated the future traffic generation of the Ulan Mine Complex as a result of the Ulan Coal Continued Operations Project.

Two modifications have since been approved and a third modification is currently proposed, however none of the modifications involve changes to the number of employees, so no further significant changes to the traffic generation are expected to occur.

The Transport & Urban Planning (2009) assessment of peak hour implications of the Ulan Coal Continued Operations Project was based on the busiest hour of the week, being a Friday morning during the construction phase of the project. For the purpose of this assessment of average weekday conditions, the existing typical weekday (Tuesday to Thursday) hourly traffic generation of the Ulan Mine Complex has been estimated based on the shift and traffic generation information presented in Transport & Urban Planning (2009).

The traffic generation of the Ulan Mine Complex can be expected to change as the size of the workforce changes. Table 4.4 presents the estimated traffic generation of the Ulan Mine Complex at the time of the traffic surveys in 2012, and during the future years of relevance to the Modification, with the workforce numbers interpolated between the given years as required, and based on the shift arrangements presented Transport and Urban Planning (2009). This assumes workers arrive in the half hour before the start of their shift, and leave in the half hour following the end of their shift.

Table 4.4: Ulan Coal Continued Operations Project Future Operational Characteristics

	2012		2017		2027	
	No.3 & UG	OC	No.3 & UG	OC	No.3 & UG	OC
Workforce (people)[A]	717	130	758	98	375	0
Average Weekday Traffic Generation						
Workforce	887	228	938	172	464	0
Visitors	290	86	324	68	112	0
Deliveries	26	8	28	6	34	0
Average Weekday AM Peak Hour Traffic Generation (6-7am)						
Workforce	196	93	208	70	103	0
Visitors	20	6	22	4	8	0
Deliveries	2	2	2	2	3	0
Average Weekday PM Peak Hour Traffic Generation (4-5pm)						
Workforce	141	48	149	36	74	0
Visitors	20	6	22	4	8	0
Deliveries	2	2	2	2	3	0

[A] Source and interpolated from Transport and Urban Planning (2009)

Based on the assessment and traffic distribution presented by Transport & Urban Planning (2009), the anticipated traffic generated by the Ulan Coal Continued Operations Project has been quantified for the survey locations, and are presented in Table 4.5. It is noted that the distribution used (Transport & Urban Planning, 2009) assumes 69 percent and 38 percent of workforce and delivery trips respectively use Ulan Road between Mudgee and the Ulan Mine Complex access roads. The traffic surveys conducted for the Wilpinjong Coal Mine Modification 5 indicate that some of the mine-related trips to and from the south have their origin or destination along the route itself, with mine-related traffic reducing by approximately 20 percent between the survey location south of Cope Road and that south of Wollar Road. The following assessment therefore assumes a similar reduction in traffic generated by Ulan Mine Complex in 2012.

Table 4.5: Ulan Coal Continued Operations Project Traffic

Site[A]	Location	2012			2017			2027		
		AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	164	158	58	111	109	43	749	752	304
2	Ulan Road south of Wollar Road	164	158	58	111	109	43	749	747	304
3	Ulan Road south of Cope Road	211	203	75	142	139	55	929	932	379
4	Ulan Road south of Ulan-Wollar Road	305	294	109	208	204	81	1,430	1439	578
5	Ulan Road north of Ulan-Wollar Road	305	294	109	208	204	81	1,430	1439	578
6	Cope Road west of Ulan Road	86	83	31	60	59	23	445	450	178
7	Ulan-Wollar Road east of Moolarben Coal Complex	0	0	0	0	0	0	0	0	0
8	Ulan-Wollar Road east of Slate Gully Road	0	0	0	0	0	0	0	0	0

[A] Refer to Figure 1-1 for locations
AM Peak = 6am to 7am, PM Peak = 4pm to 5pm

4.4 Bylong Coal Project

A PEA (Hanson Bailey, 2014) has been prepared and submitted to NSW Department of Planning and Environment in relation to a proposed coal mine which would be located approximately 55km to the north-east of Mudgee (Figure 1-1). SEARs have been issued for the Bylong Coal Project.

The Bylong Coal Project is estimated to have a workforce of approximately 1,000 personnel during construction and an operational workforce of approximately 550 personnel (Hanson Bailey, 2014).

An accommodation facility is proposed to be constructed near the mine site that would be able to accommodate "a fair proportion" of the construction workforce and the entire operational workforce. Employees would be encouraged to reside in Rylstone, Kandos, Sandy Hollow, Denman and Mudgee (Hanson Bailey, 2014).

Given the use of an accommodation facility and the likely residential locations of the workforce, the Bylong Coal Project construction and operational employees are not likely to use the routes used by Moolarben Coal Complex traffic, and so would not significantly impact on the future traffic volumes on those roads.

4.5 Bowdens Silver Project

A PEA (R.W. Corkery & Co, 2012) has been prepared and submitted to NSW Department of Planning and Environment in relation to a proposed silver mine located approximately 25 km east of Mudgee (Figure 1-1), and SEARs have been issued.

The PEA suggests that the Bowdens Silver Project would employ some 300 people during construction, and 200 people once operational. Operational employees would be encouraged to reside in Mudgee, Lue, Kandos and Rylstone. The majority of the construction workforce is expected to be drawn from the surrounding communities with a small number of specialists being brought in from outside the immediate districts (R.W. Corkery & Co, 2012). Based on the likely residential locations of the workforce, Bowdens Silver Project construction and operational employees are not likely to use the routes used by Moolarben Coal Complex traffic, and so would not significantly impact on the future traffic volumes on those roads.

Bulk silver/lead concentrate and zinc concentrate would be transported off-site for further refining and treatment. It is understood that the concentrates would be transported by truck to a port, and that trucks would travel to and from the east of Lue (R.W. Corkery & Co, 2012). The trucks would therefore not use the same routes as the Moolarben Coal Complex traffic.

The Bowdens Silver Project is therefore not likely to use the same roads as the Moolarben Coal Complex traffic, and so its impacts in the longer term are not included in this assessment.

4.6 Cobbora Coal Project

The Cobbora Coal Project is an approved coal mine approximately 58 km north-west of Mudgee.

The approved average construction workforce is approximately 350 (peaking at 550) and the operation workforce is expected to be 300 in 2016 and peaking at 590 around 2030 (EMM, 2013).

Given the location of the Cobbora Coal Project, project-related traffic is not likely to use the routes used by Moolarben Coal Complex traffic, and so will not significantly impact on the future traffic volumes on those roads.

4.7 Approved Moolarben Coal Complex Operations

The existing operations at Moolarben Coal Complex do not include the full approved mining activities, which allow for a total operational workforce of 440 workers.

Table 4.6 summarises the expected changes in the workforce with the approved operations.

Table 4.6: Moolarben Workforce Changes with Approved Operations

	Existing	Approved	Change
Construction Workforce	**0**	**220**	**+220**
Operational Workforce	**280**	**440**	**+160**
- Administration	34	53	+19
- Open Cut workers	246	260	+14
- Underground workers	0	127	+127

Based on the Moolarben Coal Project Stage 2 road traffic assessment (SKM, 2008) and expected staffing, shift and access arrangements, the change in traffic generated by the operational workforce from that occurring in 2015 will be as presented in Table 4.7. This assumes that with the approved workforce, the proportion of the total employees who are on-site on any day remains the same as existing, and that the distribution of employees to the various accesses would be as follows:

Administration and Open Cut Workers

- 50% CHPP Access on Ulan Road; and
- 50% Open Cut Access on Ulan-Wollar Road.

Underground Workers

- 5% CHPP Access on Ulan Road;
- 90% Open Cut Access on Ulan-Wollar Road; and
- 5% ROM Coal Facility Access on Ulan-Wollar Road.

Table 4.7: Changes in Traffic Generation With Approved Operational Workforce

Hour Starting	CHPP Access	Open Cut Access	ROM Coal Facility Access	Total
6:00	4	44	8	56
7:00	-3	37	8	42
14:00	2	33	2	37
15:00	2	33	2	37
17:00	7	7	0	14
18:00	-5	4	6	5
19:00	-5	4	6	5
22:00	2	33	2	37
23:00	2	33	2	37
Daily	**6**	**228**	**36**	**270**

Construction activity will also involve some 220 workers over a short term period in 2015, with construction activity occurring between 7.00am and 6.00pm. This construction period will not coincide with the years of relevance to the Modification, and thus is not considered further.

Table 4.8 summarises the expected traffic volumes generated by the Moolarben Coal Complex at the key locations on the surrounding road network with the approved operational workforce. The distribution of traffic is as assumed in SKM (2008), with the reduction in existing mine traffic to the south along Ulan Road as demonstrated by the results of the origin-destination survey undertaken for the Wilpinjong Coal Mine Modification 5 road transport assessment (GTA Consultants, 2013).

Table 4.8: Approved Moolarben Coal Complex Traffic on Road Network

Site[A]	Location	Existing			2017 Approved			2027 Approved		
		AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily	AM Peak	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	77	31	477	104	51	612	104	51	612
2	Ulan Road south of Wollar Road	77	31	477	104	51	612	104	51	612
3	Ulan Road south of Cope Road	96	40	600	132	66	776	132	66	776
4	Ulan Road south of Ulan-Wollar Road	114	47	713	158	79	924	158	79	924
5	Ulan Road north of Ulan-Wollar Road	62	43	570	70	48	598	70	48	598
6	Cope Road west of Ulan Road	18	7	107	25	12	143	25	12	143
7	Ulan-Wollar Road east of Moolarben Coal Complex	0	0	0	0	0	0	0	0	0
8	Ulan-Wollar Road east of Slate Gully Road	0	0	0	0	0	0	0	0	0

[A] Refer to Figure 1-1 for locations

AM Peak = 6am to 7am, PM Peak = 3pm to 4pm

4.8 Background Growth

The *Ulan Road Strategy* (ARRB, 2011a) adopted a growth rate of 1.8 percent per annum, which was applied to the general community traffic over the 21 year period of operation of the mines. The general community traffic excludes traffic directly associated with each of the mines discussed above.

The estimated contribution of the Wilpinjong Coal Mine, Moolarben Coal Complex and the Ulan Mine Complex to the surveyed 2012 traffic volumes has been identified, and is summarised in Table 4.9.

Table 4.9: Contribution of Mines to Average Weekday Traffic 2012 (vehicles/day)

Site[A]	Location	Surveyed	Wilpinjong	Moolarben	Ulan	Non-Mine	Non-Mine Percent
1	Ulan Road north of Hollyoak Bridge	9,727	327	477	749	8,174	84.0%
2	Ulan Road south of Wollar Road	3,856	327	477	749	2,303	59.7%
3	Ulan Road south of Cope Road	2,736	370	600	929	837	30.6%
4	Ulan Road south of Ulan-Wollar Road	3,345	564	713	1,430	637	19.1%
5	Ulan Road north of Ulan-Wollar Road	2,633	65	570	1,430	568	21.6%
6	Cope Road west of Ulan Road	1,570	150	107	445	867	55.3%
7	Ulan-Wollar Road east of Moolarben Coal Complex	838	587	0	0	250	29.9%
8	Ulan-Wollar Road east of Slate Gully Road	142	73	0	0	69	48.6%

[A] Refer to Figure 1-1 for locations

As the times for the peak hourly generation of the various mines differs and traffic tends to spread over longer peaks than has been assumed in the assessments of mine-generated traffic, the peak hourly non-mining traffic has been estimated based on the percent contribution over the average weekday. This is considered to overestimate the contribution of the mines during their peak hours, which will result in conservatively high estimates of future traffic growth in the peak hours.

Table 4.10 summarises the estimated growth in non-mine traffic at the survey locations for the two future scenarios. The growth rate of 1.8 percent per annum was also applied to the other routes in the area, notably Cope Road and Ulan-Wollar Road.

Table 4.10: Additional Background Non-Mine Traffic (1.8% per annum)

Site[A]	Location	2012 to 2017				2012 to 2027			
		Total Growth	AM Peak	PM Peak	Daily	Total Growth	AM Peak	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	7.6%	33	59	736	22.7%	99	178	2,207
2	Ulan Road south of Wollar Road	5.4%	18	17	207	16.1%	54	50	622
3	Ulan Road south of Cope Road	2.8%	12	7	75	8.3%	35	20	226
4	Ulan Road south of Ulan-Wollar Road	1.7%	8	4	57	5.1%	23	13	172
5	Ulan Road north of Ulan-Wollar Road	1.9%	6	4	51	5.8%	18	11	153
6	Cope Road west of Ulan Road	5.0%	8	6	78	14.9%	23	18	234
7	Ulan-Wollar Road east of Moolarben Coal Complex	2.7%	3	1	23	8.1%	10	4	68
8	Ulan-Wollar Road east of Slate Gully Road	4.4%	1	0	6	13.1%	2	1	19

[A] Refer to Figure 1-1 for locations
AM Peak = 6am to 7am, PM Peak = 4pm to 5pm

These results indicate that background growth in traffic unrelated to activity at the Wilpinjong Coal Mine, Ulan Mine Complex and Moolarben Coal Complex is expected to result in significant increases in traffic on the surrounding road network.

4.9 Future Traffic Volumes

The future traffic volumes on the surrounding road network have been forecast based on the combined effects of background growth and the aforementioned changes to traffic generated by the mines in the local area. The resulting peak hourly and daily traffic volumes are summarised in Table 4.11 for 2017, and Table 4.12 for 2027. This includes the effect of redistribution of existing Moolarben Coal Complex traffic to the three access roads, which will impact traffic volumes at the surveyed location on Ulan Road north of Ulan-Wollar Road only. The peak hour results are the busiest hour before and after midday at each location.

Table 4.11: Future Peak Hour and Daily Traffic Volumes in 2017

Site[A]	Location	Hour Starting	AM Peak	Hour Starting	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	8:00	729	17:00	947	10,808
2	Ulan Road south of Wollar Road	6:00	425	17:00	382	4,408
3	Ulan Road south of Cope Road	6:00	535	16:00	290	3,277
4	Ulan Road south of Ulan-Wollar Road	6:00	583	16:00	325	3,925
5	Ulan Road north of Ulan-Wollar Road	6:00	274	16:00	184	2,468
6	Cope Road west of Ulan Road	6:00	191	16:00	138	1,747
7	Ulan-Wollar Road east of Moolarben Coal Complex	6:00	226	18:00	140	1,192
8	Ulan-Wollar Road east of Slate Gully Road	6:00	24	16:00	17	179

A Refer to Figure 1-1 for locations

Table 4.12: Future Peak Hour and Daily Traffic Volumes in 2027

Site[A]	Location	Hour Starting	AM Peak	Hour Starting	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	8:00	787	17:00	1,054	11,696
2	Ulan Road south of Wollar Road	5:00	376	17:00	396	4,240
3	Ulan Road south of Cope Road	6:00	385	17:00	252	2,710
4	Ulan Road south of Ulan-Wollar Road	6:00	350	15:00	252	2,969
5	Ulan Road north of Ulan-Wollar Road	5:00	204	15:00	165	1,696
6	Cope Road west of Ulan Road	6:00	137	17:00	138	1,586
7	Ulan-Wollar Road east of Moolarben Coal Complex	6:00	167	17:00	106	1,006
8	Ulan-Wollar Road east of Slate Gully Road	7:00	18	17:00	17	167

A Refer to Figure 1-1 for locations

4.10 Future Roadway Efficiency

The future midblock LOS during the peak hours have been reassessed using the HCM method and assessment criteria (Section 3.5). The resulting relevant midblock LOS results are presented in Table 4.13 for the peak hour volumes forecast in 2017 and 2027. It is noted that this assessment assumes that the background conditions along the routes remain as surveyed in 2012, and so do not take account of upgrades to Ulan Road and Cope Road, which may provide greater opportunities for overtaking and wider shoulders.

Table 4.13: Future Peak Hour Midblock Levels of Service in 2017 and 2027

Site[A]	Location	North or Eastbound				South or Westbound			
		AM Peak		PM Peak		AM Peak		PM Peak	
		2017	2027	2017	2027	2017	2027	2017	2027
1	Ulan Road north of Hollyoak Bridge	B	B	C	C	B	B	C	C
2	Ulan Road south of Wollar Road	C	C	A	A	A	A	B	B
3	Ulan Road south of Cope Road	C	B	A	A	A	A	B	B
4	Ulan Road south of Ulan-Wollar Road	C	B	A	A	A	A	B	B
5	Ulan Road north of Ulan-Wollar Road	B	B	A	A	A	A	A	A
6	Cope Road west of Ulan Road	A	A	A	A	A	A	A	A
7	Ulan-Wollar Road east of Moolarben Coal Complex	B	B	A	A	A	A	A	A
8	Ulan-Wollar Road east of Slate Gully Road	A	A	A	A	A	A	A	A

[A] Refer to Figure 1-1 for locations

Times of peak hours are as given in Table 4.11 and Table 4.12

The results indicate that in the future, the LOS experienced during peak hours on the roads serving the Moolarben Coal Complex will be expected to remain at satisfactory levels.

4.11 Future Intersection Operation

The operation of the key intersections has been reassessed using SIDRA Intersection with the forecast changes in vehicle turning movements resulting from the expected changes in 2017 and 2027. The results are summarised in Table 4.14. As the turning volumes at the ROM Access Road would be very low, formal analysis of its operating conditions is not warranted.

Table 4.14: Future Peak Hour Intersection Operating Conditions

Intersection	X-value		Average Delay (sec/veh)[A]		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
2017						
Ulan Road and CHPP Access Road	0.04	0.06	7.9	8.3	A	A
Ulan-Wollar Road and Open Cut Access Road	0.09	0.05	7.9	7.9	A	A
Ulan Road and Ulan-Wollar Road	0.27	0.12	11.2	8.8	A	A
Ulan Road and Cope Road	0.20	0.15	10.1	9.1	A	A
2027						
Ulan Road and CHPP Access Road	0.42	0.05	7.8	8.3	A	A
Ulan-Wollar Road and Open Cut Access Road	0.06	0.04	7.9	7.9	A	A
Ulan Road and Ulan-Wollar Road	0.20	0.09	8.5	8.3	A	A
Ulan Road and Cope Road	0.15	0.12	9.1	9.3	A	A

[A] For movement with highest average delay per vehicle

4.12 Future Road Safety

The crash history of the main access routes to and from the Moolarben Coal Complex (Section 3.7) indicates that between 2009 and 2013, the overall rate of crashes was average or below average for undivided two lane two way rural roads. The works programs for Ulan Road and Cope Road are expected to improve road safety through intersection and carriageway improvements. These would reduce the overall crash rate on these routes through carriageway and shoulder widenings, as set out in the *Ulan Road Strategy* (ARRB, 2001a).

The crash history does not highlight any particular safety concerns with the access intersections for the Moolarben Coal Complex, nor with the intersection of Ulan Road with Ulan-Wollar Road, which is used by all traffic travelling to and from the Moolarben Coal Complex. The history also does not suggest any inherent safety concerns with the access intersections for the other mines where changes in traffic generation can be expected to occur in the future.

4.13 Future Delays to Road Traffic at Level Crossings

The changes in traffic volumes will increase the probability that a vehicle would be delayed by a train at the level crossings in the vicinity of the Moolarben Coal Complex. The probability that a vehicle will be delayed has been reassessed for the future 2017 conditions, assuming the number of trains moving through each crossing during the road peak hours will remain the same as existing. The results are summarised in Table 4.15.

Table 4.15: Future Peak Hour Probability of Delay to Vehicles at Railway Level Crossings

Level Crossing Location	Vehicles per Hour in 2017	Vehicle Travel Speed (km/h)	Trains per Hour	Probability of Delay
1304 Cope Road, Ulan	191	50	3	1.51%
1302 Unnamed local road, Ulan	2	20	3	0.07%
1301 Ulan-Wollar Road, Wollar	226	60	3	4.25%
1300 Ulan-Wollar Road, Wollar	24	60	3	0.53%
1298 Unnamed local road, Wollar	2	20	3	0.07%
1297 Mogo Road, Wollar	20	30	3	0.28%

The results indicate that with the forecast increase in traffic in 2017, the probability of a vehicle being delayed at the level crossings on the Ulan Line near Moolarben Coal Complex remains very low. The probability of vehicles being delayed by a train if the peak number of trains coincides with the peak number of vehicles would be highest at the Ulan-Wollar Road level crossing located approximately 250m east of the Wilpinjong Coal Mine access road, with a probability of 4.25%, or 1 in 24. If the peak traffic volume coincided with the peak hourly number of train movements once every day, a driver passing through that level crossing during that hour each day could be expected to be delayed approximately once each 24 days, and less frequently at all other level crossings.

When a train closes the Cope Road crossing, there is the potential for the queue of westbound traffic on Cope Road to extend back to Ulan Road, noting that the intersection layout provides additional queuing space beyond the 36m distance between the crossing and edge of Ulan Road without blocking the flow of through traffic along Ulan Road. The available space clear of Ulan Road allows up to six light vehicles to queue clear of the edgeline of Ulan Road.

The highest westbound volume on Cope Road in any hour is forecast to be 83 vehicles per hour in 2017, which represents a small increase from a maximum of 75 westbound vehicles per hour surveyed in 2012. Within the maximum three minute period assumed for the crossing to be closed, an average of four vehicles could be expected to arrive at the eastern side of the crossing. Allowing for variations in the arrival rate of vehicles, the available queueing space is considered to adequate at most times, noting that if any heavy vehicles arrive during the closure of the level crossing, there is a risk that the queue would extend into the auxiliary lanes on Ulan Road. This risk factor has been identified by ARTC (Table 3.19), and the forecast traffic growth is not expected to significantly exacerbate the risk.

5. Modification Traffic Generation

The volume of traffic expected to be generated by the Modification has been estimated based on the characteristics of the expected workforce, visitors and delivery vehicles travelling to and from the site. The details of these anticipated characteristics are outlined in this section. It is noted that a vehicle trip is a one way movement, thus a vehicle arriving at the site and then departing generates two vehicle trips.

5.1 Construction Workers

The construction phase of the Modification would occur in 2016 and 2017, and would employ an average of 120 people, with a peak of 250 people for two months during 2017. It is expected that up to 90 percent of the construction workforce, or 225 people, would be present on any one day.

Overall, it is expected that while all construction workers would travel by car or bus, each vehicle would carry an average of 2.0 workers per vehicle. This is somewhat higher than would generally be experienced for a short term construction workforce, however, the construction contractors would provide shuttle bus transport for their personnel, which would reduce the overall travel and parking demands of the construction workforce.

Construction activity would occur during daytime hours, with shifts from 7.00am to 6.00pm, seven days per week. This assessment assumes that construction workers would arrive during the hour prior to commencement of the shift, and depart in the hour following completion of the shift. In reality, the arrival and departures of construction workers is likely to be spread over several hours, thus the impact in any one hour would be less than anticipated by this assessment.

The construction workforce would travel to the Moolarben Coal Complex from the following locations:

- 80% Mudgee;
- 10% Gulgong;
- 6% outside of Mid-Western Regional LGA (e.g. Hunter Valley);
- 2% Rylstone; and
- 2% Kandos.

Traffic between the Moolarben Coal Complex and Rylstone and Kandos would tend to travel via Mudgee, being the most direct route, while those travelling to and from the Hunter Valley would travel via Golden Highway and Ulan Road, thus the routes used by the construction workforce would be:

- 84% via Ulan Road to/from Mudgee and beyond;
- 10% via Ulan Road and Cope Road to/from Gulgong; and
- 6% via Ulan Road to/from the Golden Highway and beyond.

MCO has advised that based on the construction activities, the construction workforce would be expected to access the Moolarben Coal Complex via the currently approved vehicular access locations as follows:

- 15% CHPP Access on Ulan Road;
- 75% Open Cut Access on Ulan-Wollar Road; and
- 10% ROM Coal Facility Access on Ulan-Wollar Road.

Table 5.1 summarises the traffic generation of the construction workforce during the peak construction phase over two months in 2017, when up to 250 construction workers would be employed.

Table 5.1: Peak Construction Workforce Traffic Generation 2017

Road and Location	AM Peak 6-7am (vehicles per hour)		PM Peak 6-7pm (vehicles per hour)		Daily (vehicles per day)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Total Accesses	113	0	0	113	113	113
Open Cut Access Road South of Ulan-Wollar Road	85	0	0	85	85	85
CHPP Access Road East of Ulan Road	17	0	0	17	17	17
ROM Coal Facility Access Road South of Ulan-Wollar Road	11	0	0	11	11	11

5.2 Construction Deliveries and Visitors

There is expected to be an average of 10 deliveries by heavy vehicles per day during construction, and 10 visitors or deliveries by light vehicles per day during construction. This would increase to a peak of 26 deliveries by heavy vehicles per day, and 26 visitors or deliveries by light vehicles per day during the peak construction phase. Construction-related deliveries and visitors would tend to arrive and depart during daylight hours, between 6.00am and 6.00pm. Visitor and delivery traffic would tend to be spread throughout the day, rather than having distinct peak periods. For the purpose of this assessment, the visitor and delivery traffic is assumed to spread throughout the day, with a slight peak in arrivals during the morning peak hour, and in departures during the evening peak hour. Visitor and delivery departures are assumed to continue until 7.00pm, with some of these vehicles departing at the same time as the workforce.

The construction deliveries and visitor trips would be sourced from the following locations:

- 60% Newcastle; and
- 40% Mudgee.

Travel to and from Newcastle would be via the Golden Highway and Ulan Road, while travel to and from Mudgee would be via Ulan Road.

The construction deliveries and visitors would access the Moolarben Coal Complex via the currently approved vehicular access locations as follows:

- 15% CHPP Access on Ulan Road;
- 75% Open Cut Access on Ulan-Wollar Road; and
- 10% ROM Coal Facility Access on Ulan-Wollar Road.

Table 5.2 summarises the peak hourly and daily traffic generation of the construction deliveries and visitors during the two month peak construction phase in 2017.

Table 5.2: Peak Construction Visitors and Deliveries Traffic Generation 2017

Road and Location	AM Peak 6-7am (vehicles per hour)		PM Peak 6-7pm (vehicles per hour)		Daily (vehicles per day)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Light Vehicles						
Combined Accesses	4	0	0	4	26	26
Open Cut Access Road South of Ulan-Wollar Road	2	0	0	2	19	19
CHPP Access Road East of Ulan Road	1	0	0	1	4	4
ROM Coal Facility Access Road South of Ulan-Wollar Road	1	0	0	1	3	3
Heavy Vehicles						
Combined Accesses	4	0	0	4	26	26
Open Cut Access Road South of Ulan-Wollar Road	2	0	0	2	19	19
CHPP Access Road East of Ulan Road	1	0	0	1	4	4
ROM Coal Facility Access Road South of Ulan-Wollar Road	1	0	0	1	3	3

5.3 Additional Operational Workers

The operational workforce is proposed to increase to an average of 670 workers and a peak of 740 workers, who would generate additional vehicle trips on the surrounding road network as they travel to and from the site. The peak operational workforce is expected to be present for 12 to 18 months during 2017-18, and would decline to the average 670 workers thereafter.

It is expected that some car pooling of workers would occur, which would increase the average car occupancy to 1.2 people per car, however the assessment which follows assumes the lower rate of 1.0 person per car, which will tend to overestimate the overall generation of the Moolarben Coal Complex. This assumption is consistent with that used in the Stage 1 and Stage 2 road traffic assessments (SKM, 2006 and 2008).

Based on the roster arrangements, it is anticipated that up to 75 percent of the operational workforce would be present on any one day, thus in 2017, up to 555 workers would be present each day, while in 2027, up to 503 workers would be present each day. The shift arrangements for the operational workers with the Modification are anticipated to be as shown in Table 5.3.

Table 5.3: Modification Operational Shift Times and Workforce

Shift	Shift Times	Workforce 2017	Workforce 2027
Administration	7.00am to 5.00pm	66	60
Open Cut Day	6.30am to 7.00pm	165	150
Open Cut Night	6.30pm to 7.00am	165	150
Underground Day	7.00am to 3.00pm	53	48
Underground Afternoon	3.00pm to 11.00pm	53	48
Underground Night	11.00pm to 7.00am	53	47

The majority of the operational workforce would travel to and from the Moolarben Coal Complex from the following locations:

- 74% Mudgee;
- 10% Gulgong;
- 6% outside of Mid-Western Regional LGA (e.g. Hunter Valley);
- 5% Rylstone; and
- 5% Kandos.

Traffic between the Moolarben Coal Complex and Rylstone and Kandos would tend to travel via Mudgee, being the most direct route, while those travelling to and from the Hunter Valley would travel via Golden Highway and Ulan Road, thus the routes used by the construction workforce would be as follows:

- 84% via Ulan Road to/from Mudgee and beyond;
- 10% via Ulan Road and Cope Road to/from Gulgong; and
- 6% via Ulan Road to/from the Golden Highway and beyond.

MCO has advised that the operational workforce would access the Moolarben Coal Complex via the existing and proposed vehicular access locations as follows:

Administration and Open Cut Workers

- 50% CHPP Access on Ulan Road; and
- 50% Open Cut Access on Ulan-Wollar Road.

Underground Workers

- 5% CHPP Access on Ulan Road;
- 90% Open Cut Access on Ulan-Wollar Road; and
- 5% ROM Coal Facility Access on Ulan-Wollar Road.

Table 5.4 summarises the traffic generation of the operational workers with the Modification over the average weekday, and during the busiest hours before and after midday. It is noted that during the evening, the forecast two way volume per hour would be the same from between 6pm and 8pm, however between 6pm and 7pm, the traffic would be inbound, while between 7pm and 8pm (the hour shown in Table 5.4), the traffic is outbound.

Table 5.4: Total Modification Operational Workforce Traffic Generation 2017 and 2027

Road and Location	AM Peak 6-7am (vehicles per hour)		PM Peak 7-8pm (vehicles per hour)		Daily (vehicles per day)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Year 2017						
Total Accesses	284	0	0	165	555	555
Open Cut Access Road South of Ulan-Wollar Road	163	0	0	83	340	340
CHPP Access Road East of Ulan Road	118	0	0	82	206	206
ROM Coal Facility Access Road South of Ulan-Wollar Road	3	0	0	0	9	9
Year 2027						
Total Accesses	258	0	0	150	503	503
Open Cut Access Road South of Ulan-Wollar Road	148	0	0	75	309	309
CHPP Access Road East of Ulan Road	108	0	0	75	188	188
ROM Coal Facility Access Road South of Ulan-Wollar Road	2	0	0	0	6	6

5.4 Additional Operational Deliveries and Visitors

Once operational there is expected to be typically 10 deliveries by heavy vehicles per day, and six visitors or deliveries by light vehicles per day. Operational deliveries and visitors would tend to arrive and depart during daylight hours, between 6.00am and 6.00pm. Visitor and delivery traffic would tend to be spread throughout the day, rather than having distinct peak periods. For the purpose of this assessment, the visitor and delivery traffic is assumed to spread throughout the day, and continue until after 6.00pm, with some of these vehicles departing at the same time as the administration workforce.

The operational deliveries and visitor trips would be sourced the following locations:

- 60% Mudgee; and
- 40% Newcastle.

Travel to and from Newcastle would be via the Golden Highway and Ulan Road, while travel to and from Mudgee would be via Ulan Road.

The operational deliveries and visitors would access the Moolarben Coal Complex via the currently approved vehicular access locations as follows:

- 5% CHPP Access on Ulan Road;
- 90% Open Cut Access on Ulan-Wollar Road; and
- 5% ROM Coal Facility Access on Ulan-Wollar Road.

Table 5.5 summarises the peak hourly and daily traffic generation of the operational deliveries and visitors. It is noted that as the generated traffic volumes are low, the small proportions of additional traffic estimated to use the CHPP Access and ROM Facility Access Roads result in no additional traffic using those accesses, i.e. all additional visitor and delivery traffic is assumed to use the Open Cut Access Road.

Table 5.5: Additional Operational Visitors and Deliveries Traffic 2017 and 2027

Road and Location	AM Peak (vehicles per hour)		PM Peak (vehicles per hour)		Daily (vehicles per day)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Light Vehicles						
Combined Accesses	1	0	0	1	6	6
Open Cut Access Road South of Ulan-Wollar Road	1	0	0	1	6	6
CHPP Access Road East of Ulan Road	0	0	0	0	0	0
ROM Coal Facility Access South of Ulan-Wollar Road	0	0	0	0	0	0
Heavy Vehicles						
Combined Accesses	1	0	0	1	10	10
Open Cut Access Road South of Ulan-Wollar Road	1	0	0	1	10	10
CHPP Access Road East of Ulan Road	0	0	0	0	0	0
ROM Coal Facility Access South of Ulan-Wollar Road	0	0	0	0	0	0

5.5 Total Modification Additional Traffic

Table 5.6 summarises the total additional traffic which would be generated as a result of the Modification during the peak construction and peak operational phase in 2017 and the ongoing operational phase assuming the average maximum workforce in 2027. This demonstrates that the greatest increases in traffic generated during the morning would occur from 6.00am to 7.00am in both 2017 and 2027. The greatest increases in traffic generated during the evening would occur from 6.00pm to 7.00pm during the construction peak in 2017, and from 2.00pm to 3.00pm in 2027.

Table 5.6: Changes to Existing Moolarben Coal Complex Traffic with Modification

Hour Starting	Construction		Operational				Total	
	Workforce	Visitors and Deliveries	Workforce		Visitors and Deliveries			
	2017	2017	2017	2027	2017	2027	2017	2027
6.00	113	8	149	123	2	2	**272**	**125**
7.00	0	8	113	92	1	1	122	93
8.00	0	8	0	0	4	4	12	4
9.00	0	8	0	0	2	2	10	2
10.00	0	8	0	0	4	4	12	4
11.00	0	8	0	0	1	1	9	1
12.00	0	8	0	0	4	4	12	4
13.00	0	8	0	0	1	1	9	1
14.00	0	8	53	48	4	4	65	**52**
15.00	0	8	53	48	2	2	63	50
16.00	0	8	0	0	4	4	12	4
17.00	0	8	36	30	1	1	45	31
18.00	113	8	60	45	2	2	**183**	47
19.00	0	0	60	45	0	0	60	45
20.00	0	0	0	0	0	0	0	0
21.00	0	0	0	0	0	0	0	0
22.00	0	0	53	47	0	0	53	47
23.00	0	0	53	48	0	0	53	48
Daily	**226**	**104**	**630**	**526**	**32**	**32**	**992**	**558**

6. Impacts of Modification Traffic

6.1 Traffic Volumes with Modification

The future traffic volumes on the surrounding road network have been forecast based on the combined effects of background growth and the aforementioned changes to traffic generated by the mines in the local area. The resulting peak hourly and daily traffic volumes are summarised in Table 6.1 for 2017, and Table 6.2 for 2027. The peak hour results are the busiest hour before and after midday at each location.

Table 6.1: Future Peak Hour and Daily Traffic Volumes in 2017 with Modification

Site[A]	Location	Hour Starting	AM Peak	Hour Starting	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	8:00	735	17:00	963	11,249
2	Ulan Road south of Wollar Road	6:00	561	18:00	405	4,850
3	Ulan Road south of Cope Road	6:00	711	18:00	362	3,833
4	Ulan Road south of Ulan-Wollar Road	6:00	785	18:00	422	4,568
5	Ulan Road north of Ulan-Wollar Road	6:00	383	16:00	188	2,880
6	Cope Road west of Ulan Road	6:00	218	17:00	142	1,833
7	Ulan-Wollar Road east of Moolarben Coal Complex	6:00	226	18:00	140	1,192
8	Ulan-Wollar Road east of Slate Gully Road	6:00	24	16:00	17	179

[A] Refer to Figure 1-1 for locations

Table 6.2: Future Peak Hour and Daily Traffic Volumes in 2027 with Modification

Site[A]	Location	Hour Starting	AM Peak	Hour Starting	PM Peak	Daily
1	Ulan Road north of Hollyoak Bridge	8:00	790	17:00	1064	11,890
2	Ulan Road south of Wollar Road	5:00	376	17:00	406	4,435
3	Ulan Road south of Cope Road	6:00	443	17:00	265	2,956
4	Ulan Road south of Ulan-Wollar Road	6:00	419	15:00	266	3,263
5	Ulan Road north of Ulan-Wollar Road	5:00	204	15:00	167	1,966
6	Cope Road west of Ulan Road	6:00	149	17:00	140	1,633
7	Ulan-Wollar Road east of Moolarben Coal Complex	6:00	167	17:00	106	1,006
8	Ulan-Wollar Road east of Slate Gully Road	7:00	18	17:00	17	167

[A] Refer to Figure 1-1 for locations

6.2 Roadway Capacity and Efficiency with Modification

The future midblock Levels of Service during the peak hours with the Modification have been reassessed using the HCM method and assessment criteria (Section 3.5). The resulting relevant midblock LOS results are presented in Table 6.3 for the peak hour volumes forecast in 2017 and 2027. It is noted that this assessment assumes that the background conditions along the routes remain as surveyed in 2012, and so do not take account of upgrades to Ulan Road and Cope Road, which may provide greater opportunities for overtaking and wider shoulders.

Table 6.3: Future Peak Hour Midblock Levels of Service with Modification

Site[A]	Location	North or Eastbound				South or Westbound			
		AM Peak		PM Peak		AM Peak		PM Peak	
		2017	2027	2017	2027	2017	2027	2017	2027
1	Ulan Road north of Hollyoak Bridge	B	B	C	C	B	B	C	C
2	Ulan Road south of Wollar Road	C	C	A	A	A	A	B	B
3	Ulan Road south of Cope Road	C	C	A	A	A	A	B	B
4	Ulan Road south of Ulan-Wollar Road	C	C	A	A	A	A	B	B
5	Ulan Road north of Ulan-Wollar Road	B	B	A	A	A	A	A	A
6	Cope Road west of Ulan Road	A	A	A	A	A	A	A	A
7	Ulan-Wollar Road east of Moolarben Complex	B	B	A	A	A	A	A	A
8	Ulan-Wollar Road east of Slate Gully Road	A	A	A	A	A	A	A	A

[A] Refer to Figure 1-1 for locations

The results indicate that with the Modification, the LOS experienced on the roads serving the Moolarben Coal Complex would remain satisfactory during the busiest hours. In the longer term once the Modification construction phase is completed, the LOS would be A or B at all surveyed locations except that closest to Mudgee.

6.3 Intersection Operation with Modification

The operating conditions of the key intersections have been reassessed using SIDRA Intersection with the forecast changes in vehicle turning movements resulting from the Modification and the other expected changes in 2017 and 2027. The results are summarised in Table 6.4. As the number of vehicles turning at the ROM Access Road would be very low, formal analysis of its operating conditions is not warranted.

Table 6.4: Peak Hour Intersection Operating Conditions with Modification

Intersection	X-value		Average Delay (sec/veh)[A]		Level of Service	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Year 2017						
Ulan Road and CHPP Access Road	0.11	0.05	8.0	7.8	A	A
Ulan-Wollar Road and Open Cut Access Road	0.10	0.05	7.9	7.9	A	A
Ulan Road and Ulan-Wollar Road	0.36	0.20	14.7	9.8	B	A
Ulan Road and Cope Road	0.26	0.20	11.4	9.7	A	A
Year 2027						
Ulan Road and CHPP Access Road	0.09	0.05	7.8	7.8	A	A
Ulan-Wollar Road and Open Cut Access Road	0.05	0.04	7.9	7.9	A	A
Ulan Road and Ulan-Wollar Road	0.23	0.09	9.1	9.9	A	A
Ulan Road and Cope Road	0.17	0.12	9.4	9.4	A	A

[A] For movement with highest average delay per vehicle

The results indicate that with the Modification, the LOS experienced at key intersections on the roads serving the Moolarben Coal Complex would remain satisfactory during the busiest hours. At all the intersections assessed, delays to vehicles would remain low, noting that the average delays in Table 6.4 are for the movement with the highest average delay per vehicle. Delays to through traffic past these intersections would be very low, as the intersection designs allow for through vehicles to pass around the slower turning vehicles. The intersections would all have spare capacity.

6.4 Road Safety Implications of Modification

The crash history of the main access routes to and from the Moolarben Coal Complex (Section 3.7) indicates that between 2009 and 2013, the overall rate of crashes was average or below average for undivided two lane two way rural roads. The works programs for Ulan Road and Cope Road are expected to improve road safety through intersection and carriageway improvements. These would reduce the overall crash rate on these routes through carriageway and shoulder widenings, as set out in the *Ulan Road Strategy* (ARRB, 2001a).

The crash history does not highlight any particular safety concerns with the access intersections for the Moolarben Coal Complex. The short right turn bay provided in Ulan-Wollar Road allows vehicles turning into the Open Cut Access Road to do so while maintaining the flow of eastbound through traffic on Ulan-Wollar Road. During the morning peak hour, the analysis indicates that the 95th percentile queue of vehicles waiting to turn right into the Open Cut Access Road would remain very low at less than one vehicle in both 2017 and 2027. This queue is satisfactorily accommodated in the existing turn bay, and so would not impede the flow of eastbound through traffic past the intersection. The additional traffic would therefore not warrant any amendments to the layout of the intersection.

At the other key intersections (e.g. Ulan Road with Ulan-Wollar Road, Ulan Road with CHPP Access Road, and Ulan Road with Cope Road), the turn bay lengths are significantly longer, to allow for deceleration of turning vehicles from 100km/h, thus queueing in those turn bays is not likely to overflow into the through lanes at any time.

6.5 Delays to Road Traffic at Level Crossings with Modification

With regard to road traffic at the level crossings in the vicinity of the Moolarben Coal Complex, the Modification would result in increases in the number of vehicles at the Cope Road level crossing only. The probability of delay to road traffic at each of the level crossings has been reassessed with the Modification traffic, and the results are summarised in Table 6.5.

Table 6.5: Peak Hour Probability of Delay to Vehicles at Railway Level Crossings with Modification

Level Crossing Location	Peak Vehicles per Hour	Vehicle Travel Speed (km/h)	Trains per Hour	Probability of Delay
1304 Cope Road, Ulan	218	50	3	1.71%
1302 Unnamed local road, Ulan	2	20	3	0.07%
1301 Ulan-Wollar Road, Wollar	226	60	3	4.25%
1300 Ulan-Wollar Road, Wollar	24	60	3	0.53%
1298 Unnamed local road, Wollar	2	20	3	0.04%
1297 Mogo Road, Wollar	20	30	3	0.28%

Table 6.5 demonstrates that the additional road traffic at the Cope Road level crossing would result in a probability of 1.71% (1 in 59) that a vehicle would be delayed by a train. As demonstrated in Table 4.15, without the Modification, the probability of delay would be 1.51% (1 in 66), thus the impact of the Modification road traffic is considered to be low.

The peak volume of traffic forecast to travel westbound across the Cope Road level crossing in any hour of the day would remain the same as that forecast without the Modification (Section 3.10), thus the Modification would not exacerbate the peak queue of vehicles from the level crossing towards Ulan Road.

6.6 Impacts on School Buses

The school buses on Ulan Road operate between 7.30am and 8.35am southbound, and between 3.35pm and 4.35pm northbound. The peaks of traffic generated by Moolarben Coal Complex on Ulan Road are expected to occur as workers travel to and from the site before and after their shifts. The movement of the construction workforce would not coincide with the school bus operating times.

During the morning, with the expected peak of 740 operational workers in 2017, the Moolarben Coal Complex (including the Modification) would involve the following total movement of operational workers:

- 165 Open Cut operational workers arriving for 6.30am start;
- 66 Administration workers arriving for 7.00am start;
- 53 Underground operational workers arriving for 7.00am start;
- 165 Open Cut operational workers departing after 7.00am finish; and
- 53 Underground operational workers departing after 7.30am finish.

The inbound morning workers would therefore tend to arrive between 6.00am and 7.00am, which does not coincide with the school bus operating time on Ulan Road. The outbound morning workers would tend to depart between 7.00am and 8.00am, which partly overlaps with the southbound school buses operating on Ulan Road. The 53 outbound Underground workers departing after 7.30am may overlap with the school buses which operate from 7.30am. These workers would generate approximately 40 southbound vehicles on Ulan Road south of Cope Road after 7.30am.

During the afternoon, with the expected peak of 740 operational workers, the Moolarben Coal Complex (including the Modification) would involve the following total movement of operational workers:

- 53 Underground operational workers arriving for 3.00pm start;
- 53 Underground operational workers departing after 3.30pm finish;
- 66 Administration workers departing after 5.00pm finish;
- 165 Open Cut workers arriving for 6.30pm start;
- 165 Open Cut workers departing after 7.00pm finish;
- 53 Underground workers arriving for 11.00pm start; and
- 53 Underground workers departing after 11.30pm finish.

The inbound afternoon workers would therefore tend to arrive between 2.30pm and 3.00pm, and between 6.00pm and 6.30pm, which do not coincide with the northbound school bus operating time on Ulan Road. The outbound afternoon workers would tend to depart between 3.30pm and 4.00pm, and between 5.00pm and 5.30pm. The outbound afternoon workers departing between 5.00pm and 5.30pm do not coincide with the northbound school bus operating times on Ulan Road, however the 53 outbound afternoon workers departing between 3.30pm and 4.00pm would coincide with the northbound school bus operating times. These workers would generate approximately 40 southbound vehicles on Ulan Road south of Cope Road after 3.30pm.

The majority of employee movements to and from the Moolarben Coal Complex (approximately 90%) would therefore occur outside the school bus operating times on Ulan Road.

The Moolarben Coal Complex shift times would minimise any interaction between traffic generated by the Moolarben Coal Complex and the school buses operating on Ulan Road, while also seeking to spread the generated traffic through the day and minimise interaction with traffic generated by the other mines in the area. MCO currently run regular toolbox talks at which drivers are reminded about acceptable behaviour on the road, particularly in proximity to school buses.

6.7 Mitigation Measures

The operating conditions of the ROM Coal Facility Access Road with Ulan-Wollar Road are expected to be good, with low delays and spare capacity as a result of the low volumes of traffic expected to turn into and out of the side road. The turning movements would tend to be right turns in from Ulan-Wollar Road, and left turns out to Ulan-Wollar Road. The intersection would be designed to meet Austroads guidelines, with a CHR or CHR(S) channelised right turn bay to allow through traffic to pass around vehicles slowing to turn into the side road.

The assessment indicates that satisfactory operating conditions can be expected on the road network without need for specific upgrades.

Notwithstanding the above, MCO will continue to contribute to road maintenance in accordance with Project Approval (05_0117) and Project Approval (08_0135).

7. Conclusion

This study has found that the Moolarben Coal Complex (including the Modification) would have acceptable impacts on the operation of the surrounding road system.

In the short-term, the Modification would have its greatest impact during the peak construction phase, which has been assumed to overlap with a peak in the operational workforce. This peak activity would occur for period of approximately two months, and no significant impacts on the performance, capacity, efficiency and safety of the road network are expected to arise as a result of that traffic, taking into account changes in the traffic environment from other sources unrelated to the Moolarben Coal Complex.

In the longer term, the impacts of the Modification would reduce and would result from an increase in the operational workforce above existing approved levels and increases in traffic generated by visitors and deliveries. No significant impacts on the performance, capacity, efficiency and safety of the road network are expected to arise as a result of that traffic, also taking into account changes in the traffic environment from other sources unrelated to the Moolarben Coal Complex.

No specific management or mitigation measures are considered to be warranted by the Modification, noting that upgrading of Ulan Road and Cope Road is underway irrespective of the Modification. MCO will continue to contribute to road maintenance in accordance with Project Approval (05_0117) and Project Approval (08_0135).

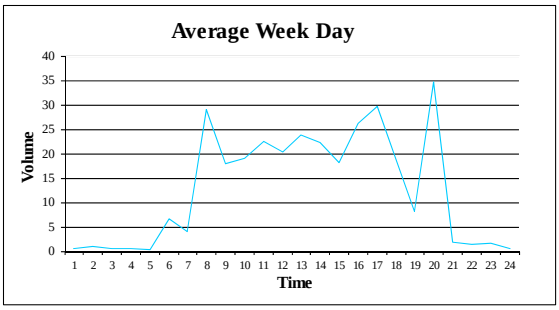
Based on the analysis and discussions presented within this report, it is concluded that the road network would satisfactorily accommodate the additional traffic generated by the Moolarben Coal Complex (including the Modification), together with other developments expected to occur in the region.

Attachment A

Traffic Survey Data

Moolarben Coal Complex Open Cut Access Road **Northbound (Outbound)**

Day	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*Thu*	*W/Day*	*W/End*	*7 Day*
Time	27/02/2015	28-Feb-15	1-Mar-15	2-Mar-15	3-Mar-15	4-Mar-15	5-Mar-15	*Ave.*	*Ave.*	*Ave*
0:00	1	0	2	0	1	1	0	1	1	1
1:00	2	0	0	0	1	1	1	1	0	1
2:00	0	0	1	0	1	0	2	1	1	1
3:00	0	1	1	0	1	2	0	1	1	1
4:00	1	0	0	0	1	0	0	0	0	0
5:00	9	8	6	8	6	6	4	7	7	7
6:00	6	1	1	3	3	4	4	4	1	3
7:00	23	16	18	27	34	26	35	29	17	26
8:00	17	2	1	13	21	16	23	18	2	13
9:00	19	2	2	9	22	22	23	19	2	14
10:00	19	2	5	16	27	23	28	23	4	17
11:00	24	1	4	20	23	19	16	20	3	15
12:00	20	3	3	22	26	35	16	24	3	18
13:00	20	2	2	21	22	22	26	22	2	16
14:00	21	1	3	23	17	15	15	18	2	14
15:00	22	3	2	25	33	30	21	26	3	19
16:00	11	3	1	30	38	30	39	30	2	22
17:00	10	3	7	17	24	22	20	19	5	15
18:00	4	6	10	8	12	12	5	8	8	8
19:00	31	28	24	37	35	35	35	35	26	32
20:00	2	2	0	1	1	3	2	2	1	2
21:00	1	0	2	0	2	3	1	1	1	1
22:00	0	1	1	2	1	2	3	2	1	1
23:00	1	0	0	0	1	0	1	1	0	0
Total	**264**	**85**	**96**	**282**	**353**	**329**	**320**	**310**	**91**	**247**

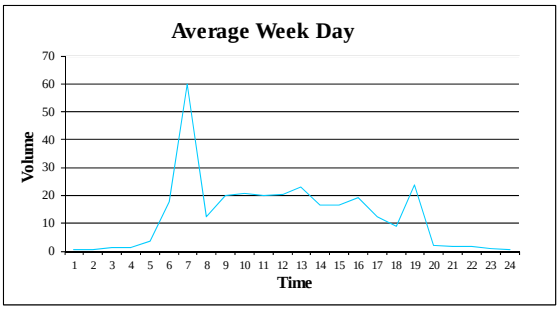


Summary

	from	to	
AM Peak	7:00 AM	8:00 AM	**35**
PM Peak	4:00 PM	5:00 PM	**39**
		Week Day Average	**310**
		Weekend Day Average	**91**
		7 Day Average	**247**

Moolarben Coal Complex Open Cut Access Road **Southbound (Inbound)**

Day	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*Thu*	*W/Day*	*W/End*	*7 Day*
Time	27/02/2015	28-Feb-15	1-Mar-15	2-Mar-15	3-Mar-15	4-Mar-15	5-Mar-15	*Ave.*	*Ave.*	*Ave*
0:00	0	1	1	0	0	2	0	0	1	1
1:00	1	0	1	0	1	1	0	1	1	1
2:00	2	0	0	0	2	0	2	1	0	1
3:00	0	0	1	1	2	1	2	1	1	1
4:00	3	2	3	4	5	3	3	4	3	3
5:00	15	5	4	16	24	18	15	18	5	14
6:00	69	31	30	60	53	58	60	60	31	52
7:00	12	1	2	6	14	14	16	12	2	9
8:00	14	2	2	19	21	19	27	20	2	15
9:00	21	1	3	11	26	22	24	21	2	15
10:00	15	1	5	17	21	24	23	20	3	15
11:00	21	2	3	19	24	21	17	20	3	15
12:00	19	4	3	20	29	31	17	23	4	18
13:00	10	2	2	21	16	18	18	17	2	12
14:00	12	2	4	17	20	15	18	16	3	13
15:00	6	1	2	20	21	24	25	19	2	14
16:00	7	1	4	7	19	14	14	12	3	9
17:00	4	4	3	9	13	14	4	9	4	7
18:00	21	20	21	26	25	23	24	24	21	23
19:00	1	1	2	2	2	2	3	2	2	2
20:00	3	1	0	2	1	1	2	2	1	1
21:00	2	1	1	0	2	3	2	2	1	2
22:00	0	0	1	1	1	2	0	1	1	1
23:00	0	1	1	1	0	0	1	0	1	1
Total	**258**	**84**	**99**	**279**	**342**	**330**	**317**	**305**	**92**	**244**

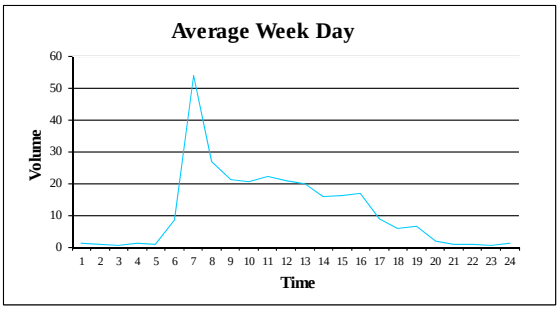


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**69**
PM Peak	12:00 PM	1:00 PM	**31**
		Week Day Average	**305**
		Weekend Day Average	**92**
		7 Day Average	**244**

Moolarben Coal Complex CHPP Access Road **Eastbound (Inbound)**

Day	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*Thu*	*W/Day*	*W/End*	*7 Day*
Time	27/02/2015	28-Feb-15	1-Mar-15	2-Mar-15	3-Mar-15	4-Mar-15	5-Mar-15	*Ave.*	*Ave.*	*Ave*
0:00	2	0	0	1	1	2	0	1	0	1
1:00	2	0	0	0	2	1	0	1	0	1
2:00	1	0	0	0	1	0	0	0	0	0
3:00	1	0	2	1	0	3	1	1	1	1
4:00	1	0	0	1	0	1	1	1	0	1
5:00	9	0	0	5	9	10	9	8	0	6
6:00	52	3	1	34	62	56	66	54	2	39
7:00	14	0	3	36	30	29	25	27	2	20
8:00	14	0	0	31	17	22	22	21	0	15
9:00	17	0	0	20	22	19	25	21	0	15
10:00	20	1	3	20	22	19	30	22	2	16
11:00	19	3	2	22	21	20	22	21	3	16
12:00	18	4	1	22	15	23	21	20	3	15
13:00	17	0	4	10	18	18	17	16	2	12
14:00	11	0	1	19	14	18	19	16	1	12
15:00	9	1	0	17	17	23	18	17	1	12
16:00	1	1	2	7	13	13	11	9	2	7
17:00	3	0	1	5	5	9	8	6	1	4
18:00	5	1	4	5	6	10	7	7	3	5
19:00	1	1	0	3	2	2	2	2	1	2
20:00	2	1	0	0	1	1	1	1	1	1
21:00	1	0	1	1	1	1	0	1	1	1
22:00	1	0	1	0	1	0	1	1	1	1
23:00	2	1	1	1	1	1	1	1	1	1
Total	**223**	**17**	**27**	**261**	**281**	**301**	**307**	**275**	**22**	**202**

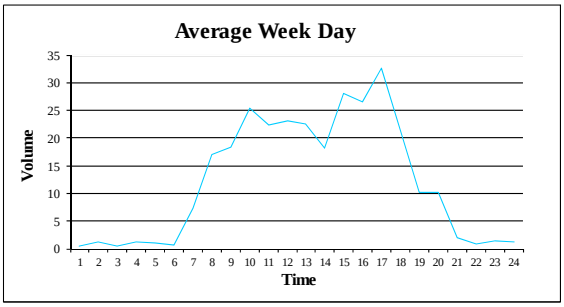


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**66**
PM Peak	12:00 PM	1:00 PM	**23**
		Week Day Average	**275**
		Weekend Day Average	**22**
		7 Day Average	**202**

Moolarben Coal Complex CHPP Access Road **Westbound (Outbound)**

Day	Fri	Sat	Sun	Mon	Tue	Wed	Thu	W/Day	W/End	7 Day
Time	27/02/2015	28-Feb-15	1-Mar-15	2-Mar-15	3-Mar-15	4-Mar-15	5-Mar-15	Ave.	Ave.	Ave
0:00	0	0	0	0	0	1	1	0	0	0
1:00	3	0	0	1	1	1	0	1	0	1
2:00	2	1	0	0	0	0	0	0	1	0
3:00	1	0	3	1	1	2	1	1	2	1
4:00	1	0	1	0	2	1	1	1	1	1
5:00	0	0	0	0	1	1	1	1	0	0
6:00	8	2	0	1	6	11	11	7	1	6
7:00	11	3	1	14	21	18	21	17	2	13
8:00	15	0	0	20	14	21	22	18	0	13
9:00	25	0	0	18	33	26	25	25	0	18
10:00	17	0	3	23	17	26	29	22	2	16
11:00	20	2	5	24	23	18	31	23	4	18
12:00	21	2	3	21	27	26	18	23	3	17
13:00	15	1	2	24	19	19	14	18	2	13
14:00	35	0	2	21	23	23	38	28	1	20
15:00	23	0	0	24	22	29	35	27	0	19
16:00	10	3	3	33	37	45	38	33	3	24
17:00	9	1	1	31	21	21	25	21	1	16
18:00	3	0	0	5	16	13	14	10	0	7
19:00	9	1	0	10	8	15	9	10	1	7
20:00	2	0	1	3	2	2	1	2	1	2
21:00	1	1	0	0	3	0	0	1	1	1
22:00	3	0	1	1	1	1	1	1	1	1
23:00	1	0	2	2	1	1	1	1	1	1
Total	**235**	**17**	**28**	**277**	**299**	**321**	**337**	**294**	**23**	**216**



Summary

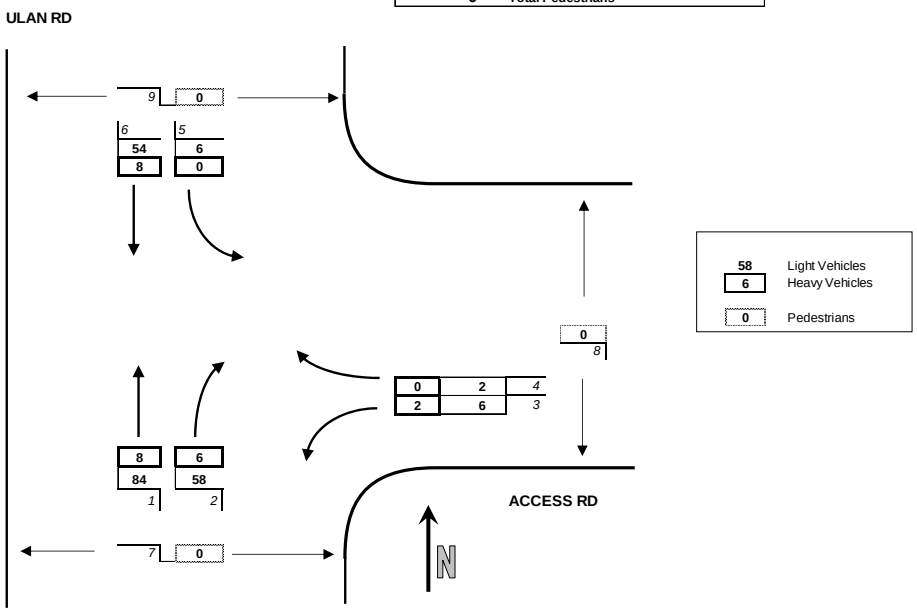
	from	to	
AM Peak	9:00 AM	10:00 AM	**33**
PM Peak	4:00 PM	5:00 PM	**45**
		Week Day Average	**294**
		Weekend Day Average	**23**
		7 Day Average	**216**

11/3/2015 - ULAN RD / ACCESS RD, ULAN

7:00 <<< HOUR ENDING **Wednesday**

Summary:	ULAN RD / ACCESS RD
210	Total Light Vehicles
24	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys
152283



11/3/2015 - ULAN RD / ACCESS RD, ULAN

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	21	15	0	1	1	11	49		0	0	0
06:30	20	13	0	0	2	13	48		0	0	0
06:45	17	20	1	0	3	10	51		0	0	0
07:00	26 <	10 <	5	1 <	0 <	20	62	210 <	0	0	0
07:15	14	7	3	1 <	1 <	8	34	195	0	0	0
07:30	7	7	6	0 <	1	4	25	172	0	0	0
07:45	12	5	2	0 <	1	8	28	149	0	0	0
08:00	10	10	6	1 <	0	7	34	121	0	0	0
08:15	8	1	2	0	0	14	25	112	0	0	0
08:30	10	2	3	0	0	25	40	127	0	0	0
08:45	6	5	8 <	0	0	13	32	131	0	0	0
09:00	6	4	5	0	0	13 <	28	125	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	0	0	0	0	0	1	1	
06:30	0	1	0	0	0	1	2	
06:45	3	3	0	0	0	0	6	
07:00	5	2	2	0	0	6	15	24
07:15	1	2 <	2	0	0	4	9	32
07:30	2	1 <	1	0	0	3	7	37
07:45	2	1	3 <	0	0	6 <	12	43 <
08:00	3	1	1	0	0	0	5	33
08:15	8	1	1	0	0	2	12	36
08:30	3	2	1	0	0	4	10	39
08:45	2	2	2	0	0	3	9	36
09:00	4 <	1	2	0	0	5	12	43 <

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	21	15	0	1	1	12	50	
06:30	20	14	0	0	2	14	50	
06:45	20	23	1	0	3	10	57	
07:00	31 <	12 <	7	1 <	0 <	26	77	234 <
07:15	15	9	5	1 <	1 <	12	43	227
07:30	9	8	7	0 <	1	7	32	209
07:45	14	6	5 <	0 <	1	14	40	192
08:00	13	11	7 <	1 <	0	7	39	154
08:15	16	2	3	0	0	16	37	148
08:30	13	4	4	0	0	29	50	166
08:45	8	7	10 <	0	0	16	41	167
09:00	10	5	7 <	0	0	18 <	40	168

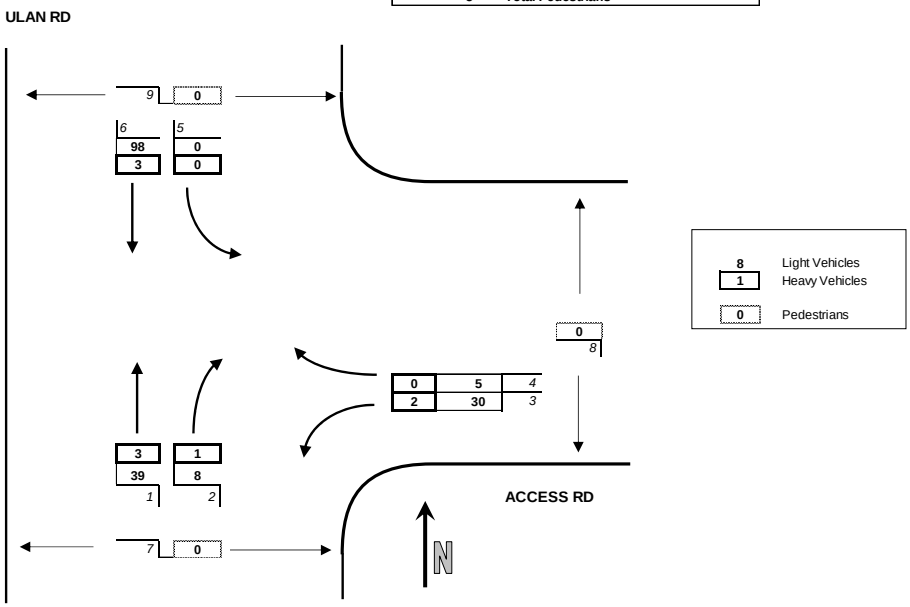
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

10/3/2015 - ULAN RD / ACCESS RD, ULAN

17:30 <<< HOUR ENDING **Tuesday**

Summary:	ULAN RD / ACCESS RD
180	Total Light Vehicles
9	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys
152283



10/3/2015 - ULAN RD / ACCESS RD, ULAN

Light Vehicles — **Total Vehicles** — **Pedestrians**

	1	2	3	4	5	6	15 MIN HOUR		7	8	9
15:15	6	3	6	0	1	23	39		0	0	0
15:30	6	3	3	0	1	15	28		0	0	0
15:45	3	1	4	0	1	20	29		0	0	0
16:00	3	4 <	5	3	0 <	10	25	121	0	0	0
16:15	1	1	7	2	0	15	26	108	0	0	0
16:30	3	0	4	0	0	20	27	107	0	0	0
16:45	9	3	5	0	0	23	40	118	0	0	0
17:00	7	0	13	0	0	25	45	138	0	0	0
17:15	8	4	5	1	0	25	43	155	0	0	0
17:30	15	1	7 <	4	0	25 <	52	180 <	0	0	0
17:45	10 <	4	4	0	0	17	35	175	0	0	0
18:00	4	1	10	2 <	0	11	28	158	0	0	0

Heavy Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
15:15	0	3	4	0	0	3	10	
15:30	0	3	3	0	0	2	8	
15:45	2	3	5	0	0	1	11	
16:00	0	4 <	4 <	0	0	4 <	12	41 <
16:15	1	0	3	0	0	2	6	37
16:30	1 <	1	1	0	0	2	5	34
16:45	2 <	0	0	0	0	1	3	26
17:00	0 <	0	2	0	0	1	3	17
17:15	0	1	0	0	0	1	2	13
17:30	1	0	0	0	0	0	1	9
17:45	0	3	1	0	0	1	5	11
18:00	1	1	2	0	0	1	5	13

All Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
15:15	6	6	10	0	1	26	49	
15:30	6	6	6	0	1	17	36	
15:45	5	4	9	0	1	21	40	
16:00	3	8 <	9	3	0 <	14	37	162
16:15	2	1	10	2	0	17	32	145
16:30	4	1	5	0	0	22	32	141
16:45	11	3	5	0	0	24	43	144
17:00	7	0	15 <	0	0	26	48	155
17:15	8	5	5	1	0	26	45	168
17:30	16 <	1	7	4	0	25 <	53	189 <
17:45	10	7	5	0	0	18	40	186
18:00	5	2	12	2 <	0	12	33	171

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

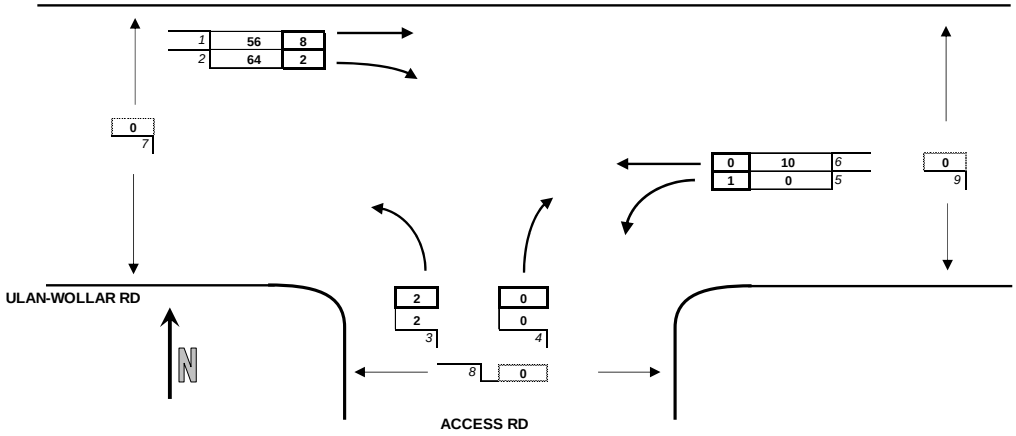
11/3/2015 - ULAN-WOLLAR RD / ACCESS RD, ULAN

7:00 <<< HOUR ENDING **Wednesday**

Summary: ULAN-WOLLAR RD / ACCESS RD	
132	Total Light Vehicles
13	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys
152283

56 Light Vehicles
8 Heavy Vehicles
0 Pedestrians



11/3/2015 - ULAN-WOLLAR RD / ACCESS RD, ULAN

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
06:15	29	10	0	0	0	2	41		0	0	0
06:30	12	21	0	0	0	3	36		0	0	0
06:45	12	25	1	0	0	4	42		0	0	0
07:00	3 <	8 <	1	0	0	1	13	132 <	0	0	0
07:15	8	0	5	1	0	16	30	121	0	0	0
07:30	9	0	9	0	2	9 <	29	114	0	0	0
07:45	5	0	4	1 <	0	3	13	85	0	0	0
08:00	4	1	9 <	0 <	0	2 <	16	88	0	0	0
08:15	5	1	1	1 <	1 <	0	9	67	0	0	0
08:30	1	2	1	0 <	0	0	4	42	0	0	0
08:45	5	1	2	1 <	0	3	12	41	0	0	0
09:00	7	1	0	0 <	2 <	2	12	37	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	1	0	0	0	0	0	1	
06:30	1	1	0	0	1	0	3	
06:45	1	0	0	0	0	0	1	
07:00	5	1	2	0	0 <	0	8	13
07:15	2 <	2	1	0	0 <	0	5	17
07:30	1 <	1	1	0	0	0	3	17
07:45	1 <	1	1	0	0	1	4	20 <
08:00	1	1	1	0	0	0	3	15
08:15	0	1	1	0	0	0	2	12
08:30	1	1	3 <	0	0	0	5	14
08:45	0	2	0	0	0	2 <	4	14
09:00	0	2 <	2 <	0	0	0 <	4	15

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	30	10	0	0	0	2	42	
06:30	13	22	0	0	1	3	39	
06:45	13	25	1	0	0	4	43	
07:00	8 <	9 <	3	0	0	1	21	145 <
07:15	10	2	6	1	0	16	35	138
07:30	10	1	10	0	2	9	32	131
07:45	6	1	5	1 <	0	4	17	105
08:00	5	2	10 <	0 <	0	2 <	19	103
08:15	5	2	2	1 <	1 <	0	11	79
08:30	2	3	4	0 <	0	0	9	56
08:45	5	3	2	1 <	0	5	16	55
09:00	7	3	2	0 <	2 <	2	16	52

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

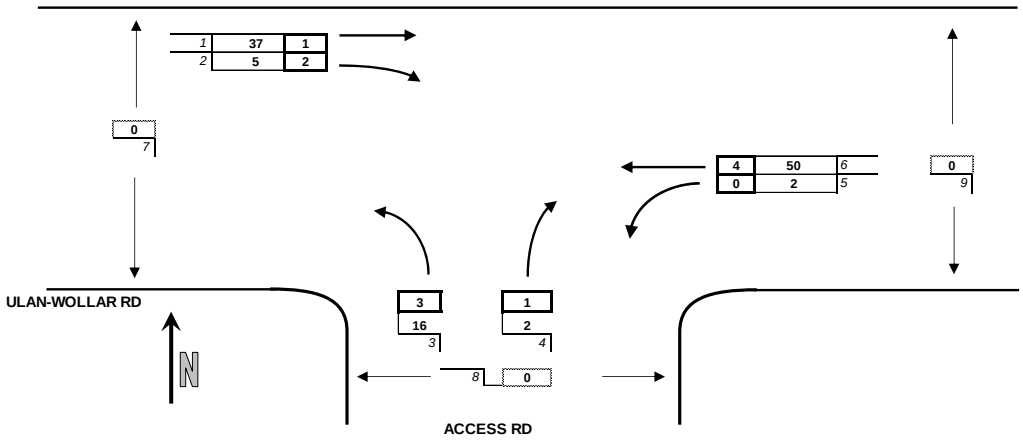
10/3/2015 - ULAN-WOLLAR RD / ACCESS RD, ULAN

18:00 <<< HOUR ENDING **Tuesday**

Summary: ULAN-WOLLAR RD / ACCESS RD	
112	Total Light Vehicles
11	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys
152283

37 Light Vehicles
1 Heavy Vehicles
0 Pedestrians



10/3/2015 - ULAN-WOLLAR RD / ACCESS RD, ULAN

Light Vehicles

	1	2	3	4	5	6	15 MIN	HOUR
15:15	2	2	6	0	1	2	13	
15:30	3	0	4	0	0	3	10	
15:45	3	2	6	0	0	9	20	
16:00	2	6 <	3 <	0	1 <	5	17	60
16:15	1	1	5	1	0	15	23	70
16:30	3	0	2	0	0	5	10	70
16:45	0	1	2	0	0	13	16	66
17:00	3	0	3	0	0	6	12	61
17:15	2	1	8	1	0	17	29	67
17:30	4	1	2	1 <	1	13	22	79
17:45	16	3	2	0 <	1 <	14 <	36	99
18:00	15 <	0	4	0 <	0 <	6 <	25	112 <

Pedestrians

	7	8	9
15:15	0	0	0
15:30	0	0	0
15:45	0	0	0
16:00	0	0	0
16:15	0	0	0
16:30	0	0	0
16:45	0	0	0
17:00	0	0	0
17:15	0	0	0
17:30	0	0	0
17:45	0	0	0
18:00	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	15 MIN	HOUR
15:15	1	3	4	0	0	0	8	
15:30	0	3	4	0	0	1	8	
15:45	2	5	2	0	0	3	12	
16:00	1 <	2 <	4 <	0	0	1	8	36 <
16:15	0	2	1	0	0	1 <	4	32
16:30	1 <	0	0	0	0	1 <	2	26
16:45	0	0	0	0	0	0	0	14
17:00	1	1	0	0	0	1	3	9
17:15	0	0	1	1 <	0	1	3	8
17:30	1	1	0	0 <	0	0	2	8
17:45	0	1	2	0 <	0	3	6	14
18:00	0	0	0	0 <	0	0	0	11

All Vehicles

	1	2	3	4	5	6	15 MIN	HOUR
15:15	3	5	10	0	1	2	21	
15:30	3	3	8	0	0	4	18	
15:45	5	7	8	0	0	12	32	
16:00	3	8 <	7 <	0	1 <	6	25	96
16:15	1	3	6	1	0	16	27	102
16:30	4	0	2	0	0	6	12	96
16:45	0	1	2	0	0	13	16	80
17:00	4	1	3	0	0	7	15	70
17:15	2	1	9	2	0	18	32	75
17:30	5	2	2	1 <	1	13	24	87
17:45	16	4	4	0 <	1 <	17 <	42	113
18:00	15 <	0	4	0 <	0 <	6	25	123 <

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

Attachment B

Railway Level Crossings Observations

LXM 1304 Cope Road, Ulan

The level crossing is located on Cope Road approximately 40m north-west of Ulan Road. The railway is single track, and Cope Road is a two-lane two-way rural road, which provides access between Ulan and Gulgong. Cope Road has a speed limit of 100km/h at the level crossing.

The level crossing is actively controlled with flashing signal assemblies (RX-5) incorporating the "RAILWAY CROSSING" sign (R6-24) and "STOP ON RED SIGNAL" (R6-9) signs on each approach. Stop lines have been painted on the carriageway on each side of the crossing, however these are badly worn and barely visible.

Approach warning for south-eastbound traffic includes a "railway crossing flashing signals ahead" (W7-4) sign on the left side of the road, and "RAIL X" markings on the carriageway beyond the advance warning sign. Approach warning for north-west bound traffic includes "railway crossing flashing signals ahead on side road" (RX-7) assemblies on each approach of Ulan Road. It is noted that "RAIL X" markings are not required on this approach by AS1742.7 due to the proximity of the crossing to Ulan Road.

Additional pedestrian warning signs are provided on each side of the level crossing, "1 TRACK DO NOT CROSS WHILE LIGHTS ARE FLASHING OR ALARM SOUNDING" (W7-14-3).

The proximity of the crossing to Ulan Road presents the possibility that queueing of north-westbound traffic from the level crossing could extend to Ulan Road, and impede the flow of through traffic on Ulan Road. While this is a possibility, the design of the intersection of Ulan Road and Cope Road assists to mitigate the potential impacts of queueing, as the auxiliary lanes for vehicles turning left and right into Cope Road provide additional queuing capabilities while maintaining through access for traffic along Ulan Road.

Photograph B-1: LXM 1304 Looking Southeast along Cope Road to the Ulan Road Intersection

Photograph B-2: LXM 1304 Looking Northwest along Cope Road from the Ulan Road Intersection

LXM 1302 Local Road, Ulan

The level crossing is located on an unnamed local access road which extends northwards from Ulan-Wollar Road approximately 10.5km east of Ulan Road. The crossing is approximately 150m from Ulan-Wollar Road. The railway is single track, and the access road is an unsealed single lane road which provides local property access only.

The level crossing is passively controlled with railway crossing stop assemblies (RX-2) incorporating the "RAILWAY CROSSING" (R6-24), "Stop" (R1-1) and "LOOK FOR TRAINS" (G9-48) signs on each approach. As the road is unsealed, no stop lines are provided on the approaches.

Approach warning for southbound traffic towards Ulan-Wollar Road is provided by a "stop sign ahead" (W3-1) sign. Approach warning for north bound traffic includes "railway crossing on side road" (RX-4) assemblies and diagrammatic warning signs on side road (W7-12 and W7-13) on each approach of Ulan Road. A "stop sign ahead" (W3-1) sign is also provided for northbound traffic on the local road.

While this crossing is a "public level crossing" it effectively provides only private access to the northern side of the Ulan line from Ulan-Wollar Road.

Photograph B-3: LXM 1302 Northbound along Local Road

Photograph B-4: LXM 1302 Southbound along Local Road towards Ulan-Wollar Road

LXM 1301 Ulan-Wollar Road, Wollar

The level crossing is located on Ulan-Wollar Road approximately250m east of the Wilpinjong Coal Mine access road. The railway is single track, and Ulan-Wollar Road is a sealed two-way two-lane rural road, with a speed limit of 100km/h.

The level crossing is passively controlled with railway crossing stop assemblies (RX-2) incorporating the "RAILWAY CROSSING" (R6-24), "Stop" (R1-1) and "LOOK FOR TRAINS" (G9-48) signs on each approach. Stop lines are provided on the carriageway on both approaches.

Approach warning for both eastbound and westbound traffic on Ulan-Wollar Road is provided by a "railway crossing ahead" (W7-7) sign, "RAIL X" pavement marking, and a non-standard diagrammatic warning sign of the approaching crossing on an S-bend in the road combined with a "stop sign ahead" (W3-1) sign. Chevron alignment markers (D4-6) are provided to guide traffic in both directions around the bends in Ulan-Wollar Road at the crossing.

Photograph B-5: LXM 1301 Eastbound along Ulan-Wollar Road

Photograph B-6: LXM 1301 Westbound along Ulan-Wollar Road

LXM 1300 Ulan-Wollar Road, Wollar

The level crossing is located on Ulan-Wollar Road approximately 15.5km east of Ulan Road. The railway is single track, and Ulan-Wollar Road is an unsealed two-lane two-way road in the vicinity of the crossing. The posted speed limit of Ulan-Wollar Road is 100km/h, however on the unsealed section, the advisory speed is 60km/h. A short section of road on each side of the level crossing is sealed.

The level crossing is actively controlled with flashing signal and boom barrier assemblies, which incorporate the "RAILWAY CROSSING" sign (R6-25) and "STOP ON RED SIGNAL" (R6-9) signs on each approach. Stop lines markings have been painted on the sealed carriageway on each side of the crossing, however these are badly worn and barely visible.

Approach warning for eastbound traffic on Ulan-Wollar Road includes a "railway crossing flashing signals ahead" (W7-4) signs on both sides of the road, a secondary "railway crossing flashing signals ahead" (W7-4) sign on the left side of the road. Chevron alignment markers (D4-6) are provided to guide eastbound around the bend at the eastbound approach to the crossing.

Approach warning for west bound traffic includes "railway crossing flashing signals ahead" (W7-4) with a 500m distance plate (W8-5) assembly on the left side of the road, and a "railway crossing flashing signals ahead" (W7-4) sign on the left side of the road. "RAIL X" markings are painted on the short section of sealed carriageway on the westbound approach.

Photograph B-7: LXM 1300 Westbound along Ulan-Wollar Road

Photograph B-8: LXM 1300 Eastbound along Ulan-Wollar Road

LXM 1298 Local Road, Wollar

The level crossing is located on an unnamed local access road which extends northwards from Ulan-Wollar Road approximately 19km east of Ulan Road. The crossing is approximately 80m from Ulan-Wollar Road. The railway is single track, and the access road is an unsealed single lane road which provides local property access only.

The level crossing is passively controlled with railway crossing stop assemblies (RX-2) incorporating the "RAILWAY CROSSING" (R6-24), "Stop" (R1-1) and "LOOK FOR TRAINS" (G9-48) signs on each approach. As the road is unsealed, no stop lines are provided on the approaches.

There is no approach warning for southbound traffic towards Ulan-Wollar Road, noting that this section of road is very short and access is limited by gates. Approach warning for north bound traffic is given by a "stop sign ahead" (W3-1) sign on the left side of the local road.

While this crossing is a "public level crossing" it effectively provides only private access to the northern side of the Ulan line from Ulan-Wollar Road.

Photograph B-9: LXM 1298 Northbound along Local Road

Photograph B-10: LXM 1298 Southbound along Local Road

LXM 1297 Mogo Road, Wollar

The level crossing is located on Mogo Road approximately120m north of its intersection with Ulan-Wollar Road. The railway is single track, and Mogo Road is a sealed two-lane two-way road in the vicinity of the crossing. On the northern side of the crossing, there is a tee intersection, where Araluen Road extends eastwards to provide access to and from a number of properties. Mogo Road (east) and Araluen Road form the major road at the intersection, and Mogo Road (north) forms the minor road. From about 50m north of the crossing, Mogo Road is unsealed. There is no signposted speed limit on Mogo Road.

The level crossing is actively controlled with flashing signal and boom barrier assemblies, which incorporate the "RAILWAY CROSSING" sign (R6-25) and "STOP ON RED SIGNAL" (R6-9) signs on each approach. Stop lines markings have been painted on the sealed carriageway on each side of the crossing, however these are badly worn and barely visible.

Approach warning for northbound traffic on Mogo Road includes "railway crossing flashing signals ahead" (W7-4) signs on both sides of the road, and "RAIL X" markings on the pavement. Diagrammatic warning signs of the crossing on the side road (W7-12 and W7-13) are provided on the Ulan Road approached to Mogo Road.

Approach warning for southbound traffic on Mogo Road includes "railway crossing flashing signals on side road" assembly (RX-7) on the left side of Mogo Road and a "railway crossing flashing signals ahead" (W7-4) sign on the right side of the road.

Photograph B-11: LXM 1297 Northbound along Mogo Road

Photograph B-12: LXM 1297 Southbound along Mogo Road

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