APPENDIX Q

Traffic and Transport Impact Assessment

COALPAC CONSOLIDATION PROJECT ENVIRONMENTAL ASSESSMENT

TRAFFIC AND TRANSPORT IMPACT ASSESSMENT

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COALPAC CONSOLIDATION PROJECT

ENVIRONMENTAL ASSESSMENT

TRAFFIC AND TRANSPORT IMPACT ASSESSMENT

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CONTENTS

1 INTRODUCTION

1.1 Background

Coalpac Pty Ltd (Coalpac) currently operates two coal mining operations. Invincible Colliery and Cullen Valley Mine. These are located in the Western Coalfields of NSW, approximately 25km north-west of Lithgow, NSW.

The Invincible Colliery is located on the eastern side of the Castlereagh Highway (see Figure 1-1), approximately 1km south of Cullen Bullen. As the owner and operator of the colliery, Coalpac hold an approval under Project Approval (PA) 07_0127 and associated Modifications to extract up to 1.2Mtpa of run of mine (ROM) coal. The majority of this ROM coal is supplied to Delta Electricity's Mt. Piper Power Station (MPPS) in Boulder Road, approximately 3km to the south of Invincible Colliery.

Cullen Valley Mine is located on the western side of the Castlereagh Highway (see Figure 1-1), immediately to the west of the township of Cullen Bullen. As owners and operators of the mine, Coalpac has approval under Development Consent DA 200-5-2003 (as modified in 2004) to extract up to 1.0Mtpa of product coal. The majority of this coal is supplied to MPPS. Furthermore, under the Conditions of DA 200-5-2003, no more than 0.25Mtpa may be supplied to domestic customers other than MPPS.

For the Coalpac Consolidation Project (the Project), Coalpac seeks a Project Approval under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) to consolidate the operations and management of the Cullen Valley Mine and Invincible Colliery sites under a single, contemporary Planning Approval to allow coal mining operations within its current mining tenements to continue for a further period of 21 years. The Project Boundary is shown on Figure 1-1. The scope of the Project is described in Section 1.2.

1.2 Scope of Consolidation Project

Project Approval is sought for the following Project:

- Consolidation and extension of the existing Cullen Valley Mine and Invincible Colliery operations to produce up to a total of 3.5 Mtpa product coal, including:
  - The continuation of mining operations at Cullen Valley Mine (the area west of the Castlereagh Highway) via both open cut and highwall mining methods to access an additional resource of approximately 40 Mt ROM; and
  - The continuation of mining operations at Invincible Colliery including an extension north into the East Tyldesley area via open cut and highwall mining methods to access an additional resource of approximately 60 Mt ROM;
- Continuation of coal supply to the local Mount Piper Power Station (MPPS) via a dedicated coal conveyor over the Castlereagh Highway (to be constructed), and (emergency supply to) Wallerawang Power Station, with flexibility for supply to additional domestic destinations and Port Kembla for export;
- Upgrades to existing administration, transport and other infrastructure;
- Construction and operation of additional Offices at Cullen Valley Mine;
- Construction and use of the previously approved Coal De-shaling preparation Plant (CDP) at Cullen Valley Mine;

- Construction and use of a bridge over the Castlereagh Highway to link operations east and west of the highway and the development of required access roads to the East Tyldesley area;
- Construction and operation of a bridge and haul road across the Wallerawang - Gwabegar Railway line to permit access to mine the previously approved Hillcroft resource;
- The extraction of the Marangaroo Sandstone horizon from immediately below the Lithgow Coal Seam in the northern coal mining area of Cullen Valley Mine. This material will to be trucked for crushing on site prior to sale into the Sydney (and surrounds) industrial sand market;
- Construction of a rail siding and associated infrastructure to permit transport of product coal and sand products;
- Integration of the water management of both sites into a single system; and
- Integration of the management of mine rehabilitation and conceptual final landform outcomes for Cullen Valley Mine and Invincible Colliery.

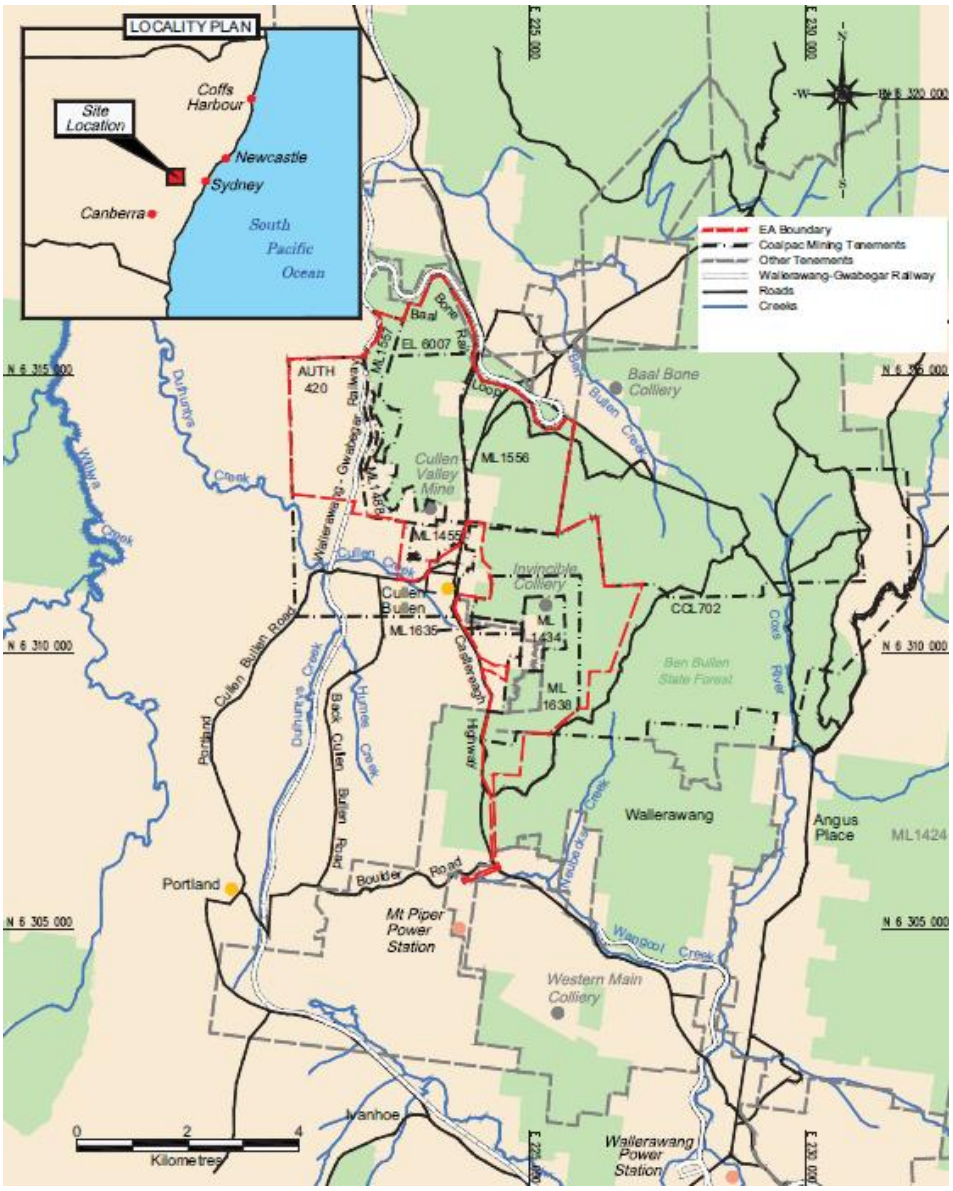


Figure 1-1 Locality map (Source: Hansen Bailey, 2010a)

1.3 Scope of Traffic and Transport Impact Assessment

This Traffic and Transport Impact Assessment was undertaken generally in accordance with the RTA's Guide to Traffic Generating Developments (RTA, 2002).

The scope of this Traffic and Transport Impact Assessment was based on the Director-General's Requirements and correspondence from the RTA for the Project as described in Appendix A which also indicates where each item has been addressed in the report. The study scope includes:

- Traffic (capacity) impact assessment of the road traffic generated by the construction and operational phases of the mine. This is covered in Section 4.
- Road safety impact assessment of the projected increases in traffic volumes and the nominated access and haulage routes. This is covered in Section 5.
- Commentary on the impacts to the safety and efficiency of the rail network. This is covered in Section 6.
- Recommendation of management/ mitigation measures to address any identified impacts.

2 EXISTING AND BASE CASE TRAFFIC CONDITIONS

2.1 RTA traffic surveys – Castlereagh Highway

The RTA has two sample traffic survey locations on the Castlereagh Highway in close proximity to the Project. These are detailed as follows:

- Station 99.254 located on Castlereagh Highway to the north of Boulder Road which had survey results for 1980, 1984, 1988, 1992, 1996, 1999 and 2002.
- Station 99.253 located on Castlereagh Highway to the south of Boulder Road which had survey results for 1980, 1984, 1988, 1992 and 1996.

The traffic volume data collected at each of these sites is in average annual daily traffic (AADT) volumes expressed in vehicles/day and account for the combined total traffic volume in both directions.

The traffic survey results have been presented in Figure 2-1 along with an approximate linear trend line. As shown, the through traffic volumes on Castlereagh Highway to the north of Boulder Road (Station 99.254) fluctuated between 2,200 to 3,500 vehicles/day. The approximate trend line equates to 1.3% growth per annum over the 22 years from 1980 to 2002.

The surveyed through volumes to the south of Boulder Road fluctuated between 2,500 and 4,000 vehicles/day. The approximate trend line equates to 1.9% growth per annum over the 16 years from 1980 to 1996.

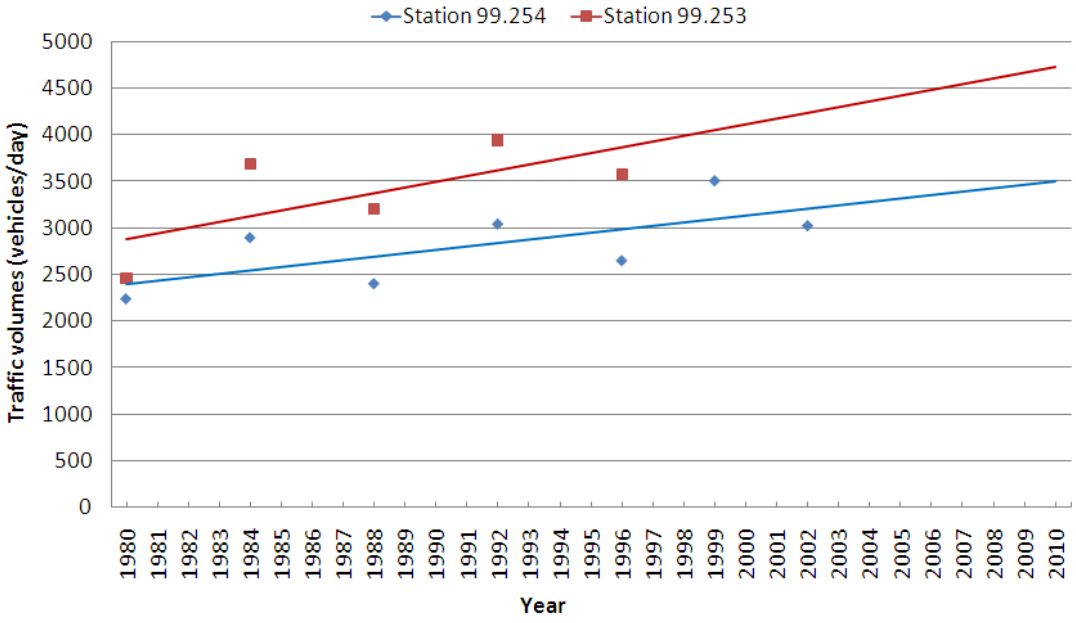


Figure 2-1 RTA AADT traffic volume data and approximate trend lines

Based on the historic trend in traffic volumes, a conservative annual growth of 2% per annum has been assumed for the background traffic on the Castlereagh Highway. That is, the traffic not related to the Project.

2.2 2010 traffic surveys

In 2010 traffic surveys were commissioned for Coalpac and carried out at the following intersections:

- I-01: Castlereagh Highway/ Invincible Colliery Access;
- I-02: Castlereagh Highway/ Boulder Road; and
- I-03: Boulder Road/ MPPS Truck Access

The traffic surveys were via tube counters and collected traffic volume, vehicle classification and speed data for a continuous seven-day period between 29 April 1010 and 5 May 2010. The location of the traffic tubes are shown in Figures 2-2, 2-3 and 2-4.

The traffic survey consisted of a number of detector tubes placed across the road surface. The tube counts provided data on traffic volumes, vehicle classification and vehicle speed. Furthermore, the tubes were strategically placed (ie. across specific lanes) in a way that enabled individual turning movements at the three intersections to be derived. Tables 2-1, 2-2 and 2-3 describe how the individual tube counts were used to derive these turning movements.

It should be noted that since these traffic surveys were undertaken, Invincible Colliery have been granted approval to increase their product coal yield and hence the volume of coal transported from the site. As such, the base case traffic volumes adopted for this study included the 2010 surveyed traffic volumes plus the additional traffic generated by the approved increase in coal production.

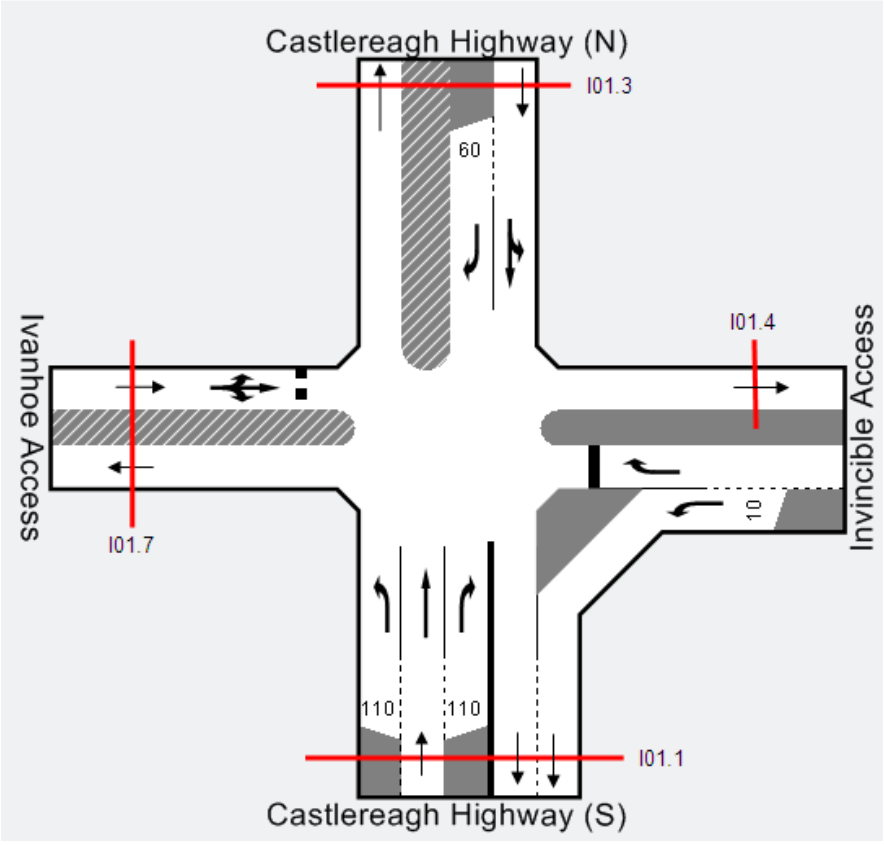


Figure 2-2 Location of tube counters used to determine turning movement volumes at Intersection I-01 – Castlereagh Highway/ Invincible Colliery Access.

Table 2-1 Derivation of turning movement counts for the Castlereagh Highway/ Invincible Access intersection (I-01).

Move-ment code	Diagram	Derivation method	Surveyed AM peak vol	AM base case vol	Surveyed midday peak vol	Midday base case vol	Surveyed PM peak vol	PM base case vol
A		Average of northbound volumes recorded at I01.1 and I01.3.	45 (11)	45 (11)	118 (29)	118 (29)	143 (34)	143 (34)
B		**Light vehicles:** Assumed to be 60% of the eastbound light vehicles recorded at I01.4. **Heavy vehicles:** Assumed to be equal to the consignment records for the survey week, as supplied by Invincible Colliery.	4 (0)	4 (0)	21 (12)	25 (16)	12 (12)	16 (16)
C		**Light vehicles:** Assumed to be 60% of the westbound light vehicles recorded at I01.7. **Heavy vehicles:** Assumed to be 80% of westbound heavy vehicle volumes recorded at I01.7.	29 (4)	29 (4)	21 (7)	21 (7)	18 (3)	18 (3)
D		Average of southbound volumes recorded at I01.1 and I01.3.	146 (25)	146 (25)	105 (27)	105 (27)	109 (20)	109 (20)
E		**Light vehicles:** Assumed to be 40% of eastbound vehicles recorded at I01.4. **Heavy vehicles:** The consignment records showed that there were no movements from Cullen Valley Mine to Invincible Colliery in the surveyed week.	3 (0)	3 (0)	6 (0)	7 (1)	0 (0)	1 (1)
F		**Light vehicles:** Assumed to be 40% of westbound light vehicles recorded at I01.7. **Heavy vehicles:** Assumed to be 20% of westbound heavy vehicles recorded at I01.7.	18 (1)	18 (1)	11 (2)	11 (2)	11 (1)	11 (1)
G		Mirror image of movement F. Assumed that all movements would be between 1-7pm to reflect end of work shift.	4 (4)	4 (4)	7 (7)	7 (7)	23 (3)	23 (3)
H		The traffic surveys did not indicate that this movement was strong during the surveyed week.	0 (0)	0 (0)	0 (0)	5 (5)	0 (0)	5 (5)
I		Mirror image of C. Assumed that all light vehicles would leave between 1-7pm to reflect end of work shift.	4 (4)	4 (4)	7 (7)	7 (7)	30 (3)	30 (3)
J		Mirror image of movement E. Assumed that all vehicles would be between 3-7pm to reflect end of work shift.	0 (0)	0 (0)	0 (0)	1 (1)	15 (0)	16 (1)

Move-ment code	Diagram	Derivation method	Surveyed AM peak vol	AM base case vol	Surveyed midday peak vol	Midday base case vol	Surveyed PM peak vol	PM base case vol
K		Mirror image of movement B. Assumed that all light vehicle movements would be between 3-7pm to reflect end of work shift. Heavy vehicle movements were evenly distributed throughout the period from 7am to 5pm.	0 (0)	0 (0)	12 (12)	21 (21)	32 (12)	41 (21)

Notes:
(i) AM peak period was adopted as 6-7am. Midday peak was adopted as 11am to 12pm. PM peak was adopted as 4-5pm. All periods are on weekdays (see Section 2.3);
(ii) Top figure is all vehicles. Figures in brackets are heavy vehicles. All figures in vehicles/hour.
(iii) Since the 2010 surveys, Invincible Colliery was granted approval to increase its product coal yield. As such, the base case volumes may differ from the surveyed volumes.

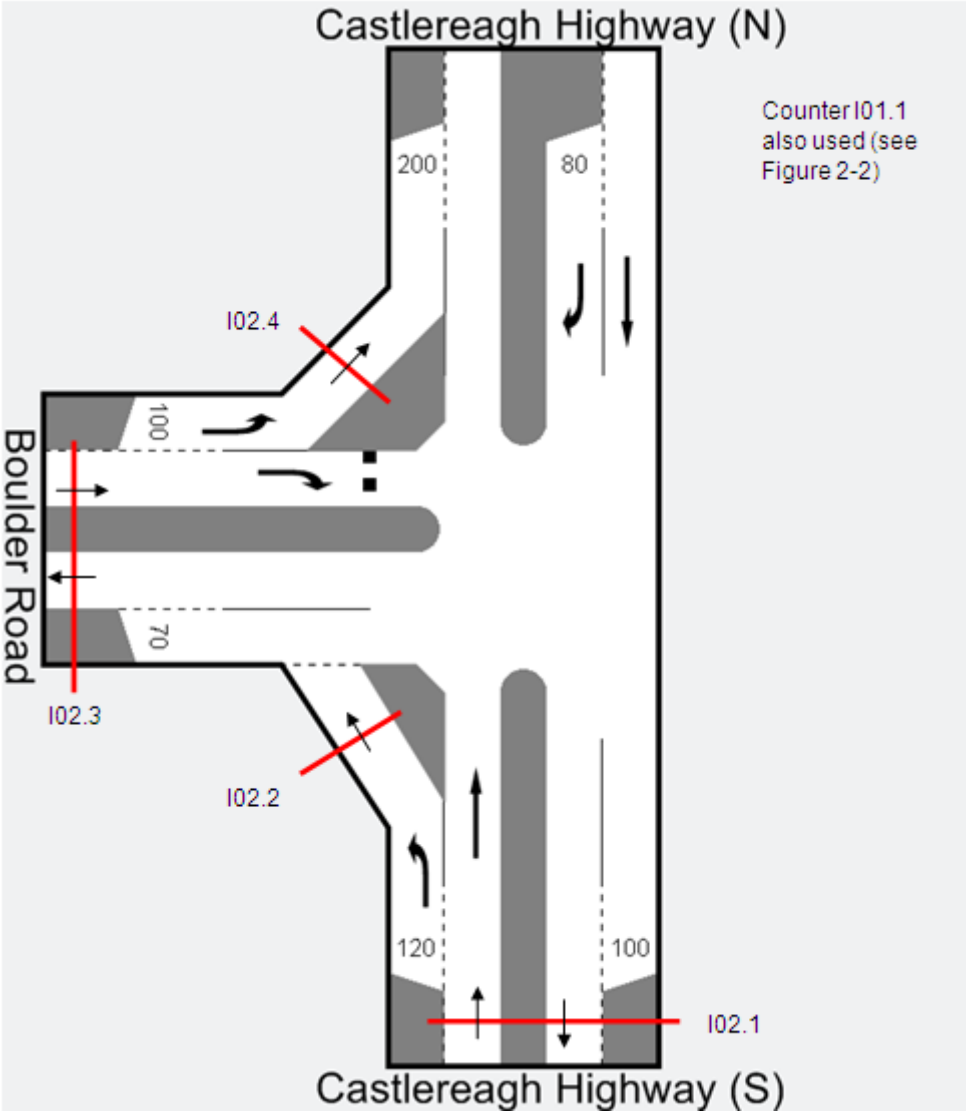


Figure 2-3 Location of tube counters at Intersection I-02 – Castlereagh Highway/ Boulder Road intersection.

Table 2-2 Derivation of turning movement counts for the Castlereagh Highway/ Boulder Road intersection (I-02)

Movement code	Diagram	Derivation method	Surveyed AM peak volume	AM base case	Surveyed midday peak volume	Midday base case	Surveyed PM peak volume	PM base case
A		Average of northbound volumes recorded at I01.1 and I02.1	61 (11)	61 (11)	132 (31)	133 (32)	163 (34)	164 (35)
C		Volumes obtained from I02.2.	56 (7)	56 (7)	32 (8)	32 (8)	41 (4)	41 (4)
D		**Light vehicles:** Assumed to be average of southbound light vehicle volumes from I01.1 and I02.1. **Heavy vehicles:** Assumed to be 30% of southbound heavy vehicle volumes from I01.1.	164 (8)	164 (8)	101 (9)	102 (10)	114 (7)	115 (12)
F		**Light vehicles:** The difference between westbound volumes from I02.3 and I02.2. Negative values were changed to 0. **Heavy vehicles:** Assumed to be 70% of southbound heavy vehicle volumes from I01.1.	18 (18)	18 (18)	38 (21)	41 (24)	26 (16)	29 (19)
G		**Light vehicles:** Light vehicle volumes were obtained from I02.4. **Heavy vehicles:** Mirror image of movement F. It was assumed that all inbound and outbound movements were in the same hour.	21 (18)	21 (18)	22 (21)	25 (24)	18 (16)	21 (19)
I		The difference between eastbound volumes from I02.3 and I02.4. Negative values were changed to 0.	57 (2)	57 (2)	50 (7)	50 (7)	71 (6)	71 (6)

Notes:
(i) AM peak period was adopted as 6-7am. Midday peak was adopted as 11am to 12pm, and PM peak was adopted as 4-5pm. All periods on weekdays (see Section 2.3);
(ii) Top figure is all vehicles. Figures in brackets are heavy vehicles. All figures in vehicles/hour..
(iii) Since the 2010 surveys, Invincible Colliery was granted approval to increase its product coal yield. As such, the base case volumes may differ from the surveyed volumes.

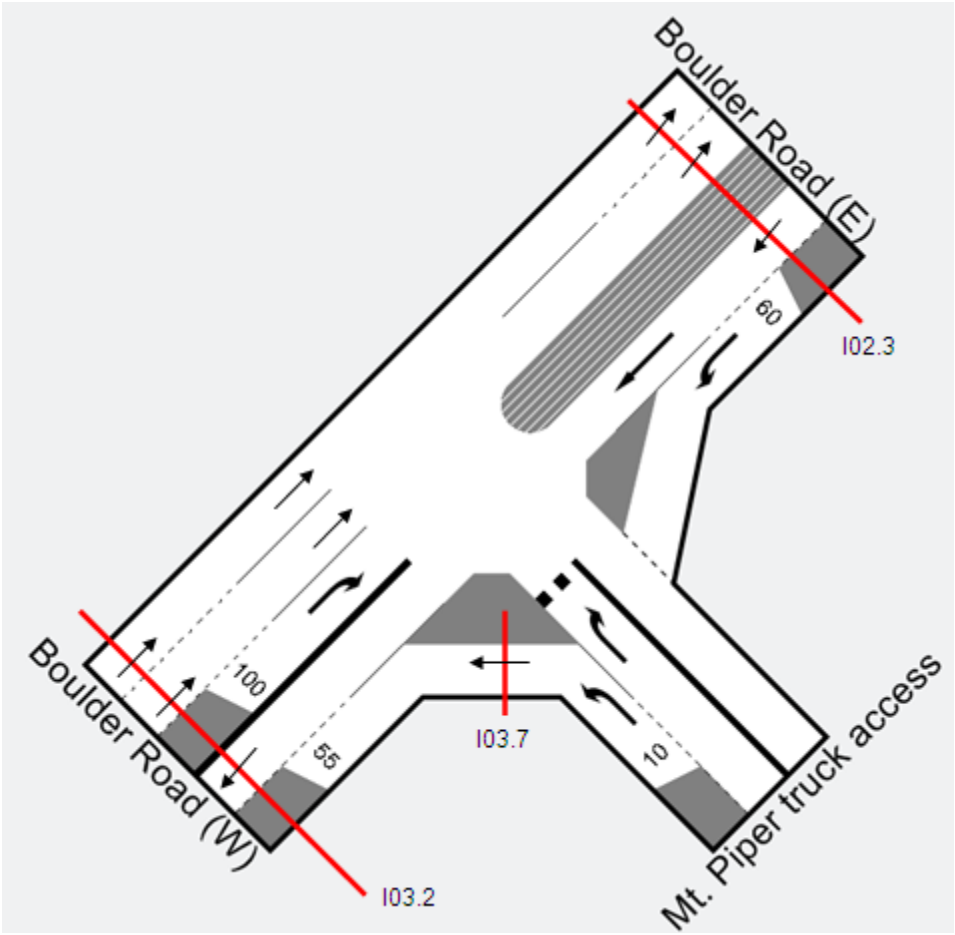


Figure 2-4 Location of tube counters at Intersection I-03 – Boulder Road/ MPPS Truck Access.

Table 2-3 Derivation of turning movement counts for the Boulder Road/ MPPS Truck Access intersection (I-03)

Movement code	Diagram	Derivation method	Surveyed AM peak volume	AM base case	Surveyed midday peak volume	Midday base case	Surveyed PM peak volume	PM base case
A		**Light vehicles:** Assumed to be all westbound light vehicles at I02.3 since this MPPS access is for truck access only. **Heavy vehicles:** Assumed to be 0.	46 (0)	46 (0)	40 (0)	40 (0)	47 (0)	47 (0)
C		**Light vehicles:** Assumed to be 0 since this is a truck only access. **Heavy vehicles:** Assumed that 100% of heavy vehicles recorded at I02.3 would turn left into Mt. Piper.	10 (10)	10 (10)	17 (17)	20 (20)	15 (15)	18 (18)
D		**Light vehicles:** Assumed to be 100% of light vehicles recorded at I03.2 since Mt. Piper access is for trucks access only. **Heavy vehicles:** Assumed that 80% of heavy vehicles recorded at I03.2 would be through traffic.	55 (3)	55 (3)	25 (3)	25 (3)	33 (2)	33 (2)
F		**Light vehicles:** Assumed to be 0 since this is a truck only access. **Heavy vehicles:** Assumed that 20% of heavy vehicles recorded at I02.3 would turn right into Mt. Piper.	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
G		Volumes obtained from I03.7.	3 (0)	3 (0)	2 (0)	2 (0)	4 (1)	4 (1)
I		Mirror image of movement C. It was assumed that all inbound and outbound movements were in the same hour.	10 (10)	10 (10)	17 (17)	20 (20)	15 (15)	18 (18)

Notes:
(i) AM peak period was adopted as 6-7am. Midday peak was adopted as 11am to 12pm. PM peak was adopted as 4-5pm on weekdays (see Section 2.3);
(ii) Top figure is all vehicles. Figures in brackets are heavy vehicles. All figures in vehicles/hour..
(iii) Since the 2010 surveys, Invincible Colliery was granted approval to increase its product coal yield. As such, the base case volumes may differ from the surveyed volumes.

2.3 Adopted peak periods for traffic model

Figure 2-5 shows a weekday 24-hour profile of traffic volume as recorded on the Castlereagh Highway to the north and south of Invincible Colliery and south of Boulder Road which is based on the traffic surveys conducted in 2010.

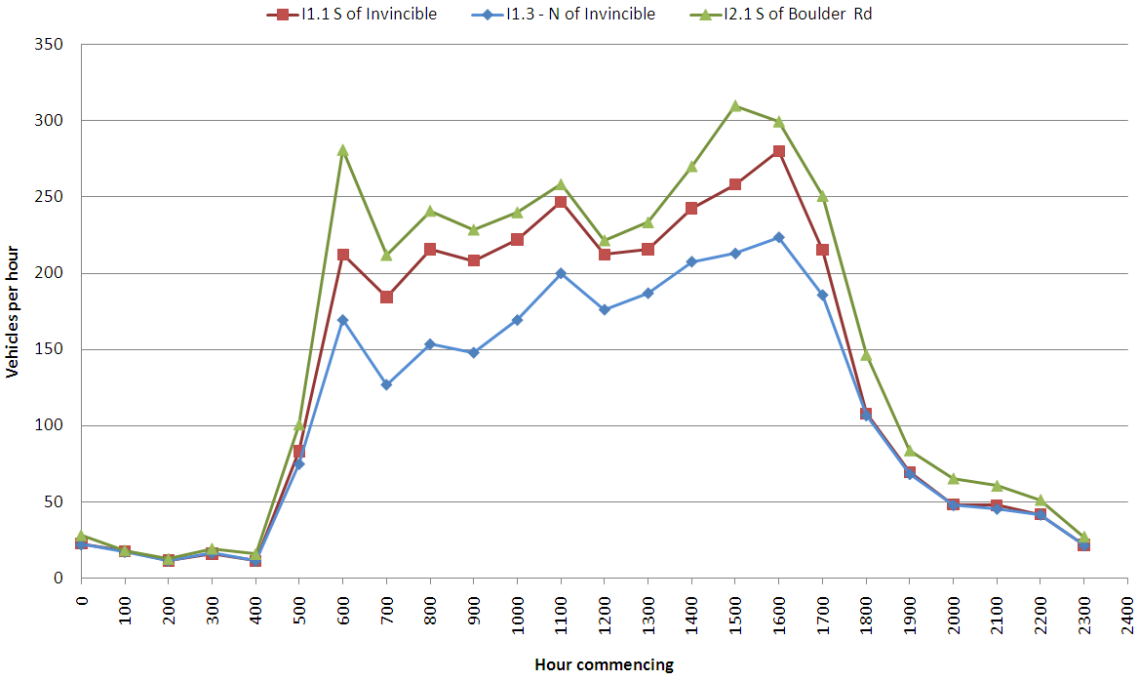


Figure 2-5 24-hour traffic profile for the Castlereagh Highway during the traffic survey week.

All sites have a similar profile with a distinct peak between 6-7am, an isolated peak between 11am and 12pm and an afternoon peak between 4-5pm. The following peak periods were adopted for the traffic modelling work based on the hourly distribution of traffic:

- **AM peak between 6-7am:** This would primarily include journey-to-work trips as the currently approved coal haulage hours commence at 7am.
- **Midday peak between 11am and 12pm:** This period is more relevant to product coal transportation compared with the AM and PM peaks which are dominated by journey-to-work traffic.
- **PM peak between 4-5pm:** This would include both journey from work trips as well as coal haulage trips.

2.4 Base case traffic conditions

As stated in Section 2.2, since the traffic surveys were undertaken in 2010, Coalpac were granted approval to increase their product coal yield from the Invincible Colliery. As such, the base case traffic volumes (which reflect this approved increase in production) are shown in Tables 2-1, 2-2 and 2-3 alongside the surveyed volumes. It should be noted that since no road haulage of coal is permitted before 7am, the surveyed traffic volumes for the AM peak period of 6-7am are considered to be the same as the base case conditions. That is, no adjustments have been required to the surveyed traffic volumes in order to account for the subsequent approval for increased coal haulage.

Road traffic impacts associated with the Project were assessed using SIDRA, an intersection performance and simulation software.

The SIDRA model outputs for the AM, Midday and PM peak periods for the base case conditions have been shown in Table 4-1. This is to enable these base case models to be compared with the construction and post-development scenarios.

3 TRAFFIC GENERATION IMPLICATIONS OF THE PROJECT

3.1 Construction traffic generation

Coalpac have prepared a detailed construction program outlining the schedule and timing of construction activities, as well as the personnel and plant required on site for each of the construction items. The construction works are anticipated to be carried out over an approximate 15-18 month period. The Castlereagh Highway overbridge and the internal haul roads will be constructed by month 5 of the program. This will offer early benefits for both construction vehicle access between both sides of the Project, as well as providing a grade-separated crossing of the Castlereagh Highway for ICPP-bound haulage trucks.

Tables 3-1 to 3-6 show the traffic volume build up due to forecast traffic generation due to construction trucks and construction staff. Traffic generation implications of construction trucks are described in Section 3.1.1, whilst those for construction staff are described in Section 3.1.2.

3.1.1 Traffic generated by construction-related trucks

Coalpac are proposing a 15-month construction program including the following works:

- A noise bund at Pine Lodge;
- Offices at the Cullen Valley Mine site;
- Construction of internal haul roads HR1, HR2 and HR3;
- A rail siding;
- A rail overpass to access the Hillcroft resource and associated haul road;
- East Tyldesley Coal Handling and Preparation Plant; and
- Overland conveyor to MPPS.

Month 4 of the construction program is forecast to generate the highest number of truck movements on the public road network. The planned works include the haul bridge over the Castlereagh Highway and the rail overpass to the Hillcroft resource. During this month, approximately 12 one-way truck movements would be generated per week. Each truck movement would generate a return trip and as such a total of 24 truck trips would be generated per week.

As these works would be carried out 24 hours per day, seven days per week, this would equate to less than one truck movement per hour. There is sufficient spare capacity along Castlereagh Road to absorb this additional traffic.

Tables 3-1 to 3-6 show the traffic generation build up of the peak construction period including both journey from work and truck traffic generation for the AM, Midday and PM peak periods.

3.1.2 Traffic generated by construction workers

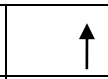
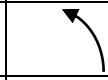
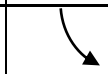
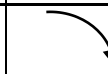
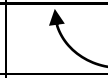
The peak construction period is likely to generate approximately 60 one-way car trips associated with journey to work trips for construction workers. This is also forecast to occur in month 4 of the construction program.

The site offices are proposed to be at the southern end of the project and would be accessible via the existing Invincible Colliery gates. The trips would be inbound immediately prior to the

start of work shift and outbound in the hour after the end of shift. This is likely to occur in mid 2012.

Tables 3-1 to 3-6 show the traffic generation build up of the peak construction period including both journey from work and truck traffic generation for the PM peak period.

Table 3-1 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation for peak construction conditions (AM peak)

Movement code		Base case AM peak volumes	Plus growth in background traffic (to 2012)	Plus staff figures	Plus construction trucks	Total for construction case
A		45 (11)	2 (0)			47 (11)
B		4 (0)		60 (0)		64 (0)
C		29 (4)				29 (4)
D		146 (25)	6 (1)			152 (26)
E		3 (0)				3 (0)
F		18 (1)				18 (1)
G		4 (4)				4 (4)
H		0 (0)				0 (0)
I		4 (4)				4 (4)
J		0 (0)				0 (0)
K		0 (0)				0 (0)

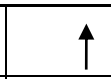
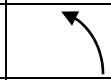
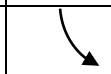
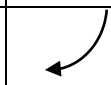
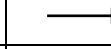
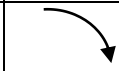
Notes:
(i) The forecast maximum construction workforce of 60 persons was conservatively assumed to have a vehicle occupancy of one person per vehicle.
(ii) Growth in background traffic determined at 2% per year for two years between 2010 and 2012 (ie. x 1.02^2). Background traffic volume growth was only assumed for the non-Project related traffic.
(iii) It was assumed that there would be no construction vehicles other than the workers generated during the AM peak.
(iv) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-2 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation for peak construction conditions (Midday peak)

Movement code		Base case Midday peak volumes	Plus growth in background traffic (to 2012)	Plus staff figures	Plus construction trucks	Total for construction case
A		118 (29)	5 (1)		1 (1)	124 (31)
B		25 (16)				25 (16)
C		21 (7)				21 (7)
D		105 (27)	4 (1)		1 (1)	110 (29)
E		7 (1)				7 (1)
F		11 (2)				11 (2)
G		7 (7)				7 (7)
H		5 (5)				5 (5)
I		7 (7)				7 (7)
J		1 (1)				1 (1)
K		21 (21)				21 (21)

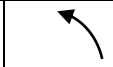
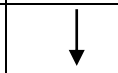
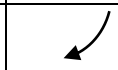
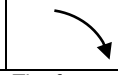
Notes:
(i) Growth in background traffic determined at 2% per year for two years between 2010 and 2012 (ie. x 1.02^2). Background traffic volume growth was only assumed for the non-Project related traffic.
(ii) The construction traffic would be travelling to the Castlereagh Highway overbridge and Cullen Valley construction sites.
(iii) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-3 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation for peak construction conditions (PM peak)

Movement code		Base case PM peak volumes	Plus growth in background traffic (to 2012)	Plus staff figures	Plus construction trucks	Total for construction case
A		143 (34)	5 (1)		1 (1)	149 (36)
B		16 (16)				16 (16)
C		18 (3)				18 (3)
D		109 (20)	4 (1)		1 (1)	114 (22)
E		1 (1)				1 (1)
F		11 (1)				11 (1)
G		23 (3)				23 (3)
H		5 (5)				5 (5)
I		30 (3)				30 (3)
J		16 (1)				16 (1)
K		41 (21)		60 (0)		101 (21)

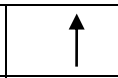
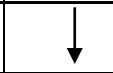
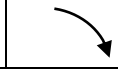
Notes:
(i) The forecast maximum construction workforce of 60 persons was conservatively assumed to have a vehicle occupancy of one person per vehicle.
(ii) Growth in background traffic determined at 2% per year for two years between 2010 and 2012 (ie. x 1.02^2). Background traffic volume growth was only assumed for the non-Project related traffic.
(iii) The construction traffic would be travelling to the Castlereagh Highway overbridge and Cullen Valley construction sites.
(iv) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-4 Intersection I-02 – Castlereagh Highway/Boulder Road: Traffic generation for peak construction conditions (AM peak)

Movement code		Base case AM peak volumes	Plus growth in background traffic (to 2012)	Plus staff figures	Plus construction trucks	Total for construction case
A		61 (11)	2 (0)	60 (0)		123 (11)
C		56 (7)	2 (0)			58 (7)
D		164 (8)	7 (0)			171 (8)
F		18 (18)	1 (1)			19 (19)
G		21 (18)	1 (1)			22 (19)
I		57 (2)	2 (0)			59 (2)

(i) The forecast maximum construction workforce of 60 persons was conservatively assumed to have a vehicle occupancy of one person per vehicle.
(ii) Growth in background traffic determined at 2% per year for two years between 2010 and 2012 (ie. x 1.02^2).
(iii) The construction traffic would be travelling to the Castlereagh Highway overbridge and Cullen Valley construction sites.
(iv) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-5 Intersection I-02 – Castlereagh Highway/Boulder Road: Traffic generation for peak construction conditions (Midday peak)

Movement code		Base case Midday peak volumes	Plus growth in background traffic (to 2012)	Plus staff figures	Plus construction trucks	Total for construction case
A		133 (32)	5 (1)		1 (1)	139 (34)
C		32 (8)	1 (0)			33 (8)
D		102 (10)	4 (0)		1 (1)	107 (11)
F		41 (24)	2 (1)			43 (25)
G		25 (24)	1 (1)			26 (25)
I		50 (7)	2 (0)			52 (7)

(i) Growth in background traffic determined at 2% per year for two years between 2010 and 2012 (ie. x 1.02^2). Background traffic volume growth was only assumed for the non-Project related traffic.
(ii) The construction traffic would be travelling to the Castlereagh Highway overbridge and Cullen Valley construction sites.
(iii) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-6 Intersection I-02 – Castlereagh Highway/Boulder Road: Traffic generation for peak construction conditions (PM peak)

Movement code		Base case PM peak volumes	Plus growth in background traffic (to 2012)	Plus staff figures	Plus construction trucks	Total for construction case
A		164 (35)	7 (1)		1 (1)	172 (37)
C		41 (4)	2 (0)			43 (4)
D		115 (12)	5 (0)	60 (0)	1 (1)	181 (13)
F		29 (19)	1 (1)			30 (20)
G		21 (19)	1 (1)			22 (20)
I		71 (6)	3 (0)			74 (6)

(i) The forecast maximum construction workforce of 60 persons was conservatively assumed to have a vehicle occupancy of one person per vehicle.
(ii) Growth in background traffic determined at 2% per year for two years between 2010 and 2012 (ie. x 1.02^2). Background traffic volume growth was only assumed for the non-Project related traffic.
(iii) The construction traffic would be travelling to the Castlereagh Highway overbridge and Cullen Valley construction sites.
(iv) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

The SIDRA models for the AM, Midday and PM peak periods during the peak construction period have been shown in Table 4-1. These outputs have been placed alongside the model outputs from other scenarios to allow for a comparison of relative differences in traffic performance.

3.2 Operational traffic generation

3.2.1 Interim operational case

As the overland conveyor, Castlereagh Highway overpass and rail siding are scheduled for completion in year 2 of the Project, product coal would continue to be transported from the site by road during this interim period. As such, the maximum quantities of product coal transported during the interim period between Project approval and the construction of the new infrastructure, would be the same as the existing (pre-approval) conditions. Furthermore, the access arrangements and source and destination locations of the dispatched trucks would be the same as the existing arrangements. This is summarised as follows:

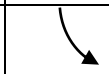
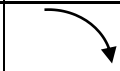
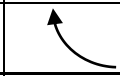
- Maximum total product coal yield – 2.2Mtpa.
- Total product coal dispatched from Cullen Valley Mine, via Private Haul Road – 1.0Mtpa.
- Total product coal dispatched from Invincible Colliery – 1.2Mtpa.
- The distribution of product coal to MPPS and to other domestic customers would be similar to the existing conditions, ie. up to 0.45Mtpa would be delivered to other domestic customers.

As such, the road traffic generation implications of the interim period up to year 2 of the mine plan would be similar to the existing. Therefore, the traffic impacts to the Castlereagh Highway/ Boulder Road, and Boulder Road/ MPPS truck access intersections would be very similar to the base case models (see Table 4-1).

It should be noted that the completion of the Castlereagh Highway overbridge in approximately month 5 of the construction program would allow all product coal to be dispatched through the Invincible Colliery gate. Tables 3-7 to 3-9 show the traffic volume build-up for the AM, Midday and PM peak periods for the Invincible Colliery gate (Castlereagh Highway/ Invincible Colliery gate intersection).

The AM peak would only be affected by the increase in staff numbers and increase in background traffic as there is no coal haulage by road permitted before 7am.

Table 3-7 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation for interim operational conditions (AM peak)

Movement code		Base case AM peak volumes	Plus growth in background traffic (to 2014)	Plus staff figures	Plus Cullen Valley product coal	Total for interim case
A		45 (11)	4 (1)			49 (12)
B		4 (0)		21 (0)		25 (0)
C		29 (4)	-29 (-4)			0 (0) Note ii
D		146 (25)	12 (2)			158 (27)
E		3 (0)				3 (0)
F		18 (1)	-18 (-1)			0 (0) Note ii
G		4 (4)	-4 (-4)			0 (0) Note ii
H		0 (0)				0 (0) Note ii
I		4 (4)	-4 (-4)			0 (0) Note ii
J		0 (0)				0 (0)
K		0 (0)				0 (0)

Notes:
(i) Growth in background traffic determined at 2% per year for four years between 2010 and 2014 (ie. x 1.02^4). Background traffic volume growth was only assumed for the non-Project related traffic.
(ii) Ivanhoe North Colliery will cease operations in 2012. As such, all traffic into and out of the western approach to the intersection have been removed.
(iii) No coal haulage is permitted by road before 7am.
(iv) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour

Table 3-8 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation for interim operational conditions (Midday peak)

Movement code		Base case Midday peak volumes	Plus growth in background traffic (to 2014)	Plus staff figures	Plus Cullen Valley product coal	Total for interim case
A		118 (29)	9 (2)			127 (31)
B		25 (16)			12 (12)	37 (28)
C		21 (7)	-21 (-7)			0 (0) Note ii
D		105 (27)	8 (2)			113 (29)
E		7 (1)				7 (1)
F		11 (2)	-11 (-2)			0 (0) Note ii
G		7 (7)	-7 (-7)			0 (0) Note ii
H		5 (5)	-5 (-5)			0 (0) Note ii
I		7 (7)	-7 (-7)			0 (0) Note ii
J		1 (1)				1 (1)
K		21 (21)			12 (12)	33 (33)

Notes:

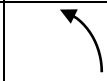
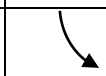
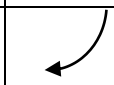
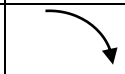
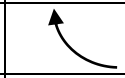
(i) Growth in background traffic determined at 2% per year for four years between 2010 and 2014 (ie. x 1.02^4). Background traffic volume growth was only assumed for the non-Project related traffic.

(ii) Ivanhoe North Colliery will cease operations in 2012. As such, all traffic into and out of the western approach to the intersection have been removed.

(iii) Cullen Valley pre-approval limits are 1.0Mtpa of product coal. This equates to 12 one-way trucks per hour assuming 290 haul days per year, 30t payload per truck, and a conservative assumption that haulage would take place over 10h each weekday.

(iv) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour

Table 3-9 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation for interim operational conditions (PM peak)

Movement code		Base case PM peak volumes	Plus growth in background traffic (to 2014)	Plus staff figures	Plus Cullen Valley product coal	Total for interim case
A		143 (34)	11 (3)			154 (37)
B		16 (16)			12 (12)	28 (28)
C		18 (3)	-18 (-3)			0 (0) Note ii
D		109 (20)	9 (2)			118 (22)
E		1 (1)				1 (1)
F		11 (1)	-11 (-1)			0 (0) Note ii
G		23 (3)	-23 (-3)			0 (0) Note ii
H		5 (5)	-5 (-5)			0 (0) Note ii
I		30 (3)	-30 (-3)			0 (0) Note ii
J		16 (1)				16 (1)
K		41 (21)		21 (0)	12 (12)	113 (33)

(i) Growth in background traffic determined at 2% per year for four years between 2010 and 2014 (ie. x 1.02^4). Background traffic volume growth was only assumed for the non-Project related traffic.
(ii) Ivanhoe North Colliery will cease operations in 2012. As such, all traffic into and out of the western approach to the intersection have been removed.
(iii) Cullen Valley pre-approval limits are 1.0Mtpa of product coal. This equates to 12 one-way trucks per hour assuming 290 haul days per year, 30t payload per truck, and a conservative assumption that haulage would take place over 10h each weekday.
(iv) The additional staff numbers would enter/egress the Project via Invincible gates.
(v) Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour

SIDRA models were also prepared for the interim operational period using the traffic volumes in Tables 3-7 and 3-8. The SIDRA outputs are also shown in Table 4-1 alongside the results for all other scenarios.

3.2.2 Ultimate operational case

From year 2 onwards, under the ultimate operational case, the overland conveyor would be used to transport product coal to MPPS. This would effectively negate the need for truck haulage of the coal with the exception of periods when the conveyor is out of operation (ie. maintenance).

The rail siding and link to the Wallerawang-Gwabegar Rail Line would also be available from year 2 onwards. This would allow product coal to be hauled by railway to Port Kembla for export overseas.

The construction of the Castlereagh Highway overbridge would also provide a connection within the Project Boundary to allow heavy vehicles to move between areas of the site on the eastern and western sides of the highway without using external roads.

This scenario would involve the following with respects to traffic and transport generation:

- Increased yield of product coal from 2.2Mtpa up to 3.5Mtpa. This includes:
  - Up to 1.0Mtpa of product coal to be transported by rail to Port Kembla for export.
  - Up to 2.6Mtpa of product coal to be transported by conveyor to MPPS.
  - Up to 0.45Mtpa of product coal to be transported by truck to other domestic customers (mostly to the south of Lithgow) via the Invincible Colliery gate. This is the same as the base case conditions.
- Up to 0.64Mtpa of product sand to be transported by truck to Sydney-based customers via the Invincible Colliery gate. Currently there is no sand production.
- An increase in mine employees from 90 to 120 full time staff.

The transportation of product coal to MPPS by road would only be used as an option when the overland conveyor is out of operation, such as during maintenance down time. This would only be for limited periods.

Table 3-10 summarises the road traffic generation implications of the Project compared with the base case conditions.

Table 3-10 Road traffic generation implications of the Project compared with the base case.

Source	Base case	Project	Differences
Product coal and sand	▪ 2.2Mtpa of product coal. ▪ Approximately 1.75 Mtpa product coal transported to MPPS. This equates to 202 one-way truck movements per haul day. ▪ Approximately 0.45Mtpa product coal transported to other domestic customers south of Lithgow. This equates to 51 one-way truck movements per haul day. ▪ No sand production. (See note i)	▪ 3.5Mtpa of product coal. ▪ Up to 1.0Mtpa transported by rail to Port Kembla. Therefore no road traffic generation. ▪ Up to 2.6Mtpa transported by conveyor to MPPS. Therefore no road traffic generation. ▪ Up to 0.45Mtpa transported by truck to other domestic customers, predominately south of Lithgow. This equates to 51 one-way truck movements per haul day. ▪ Up to 0.64Mtpa of product sand to be transported to Sydney-based customers. This equates to 64 one-way truck movements per haul day.	▪ Reduction in Project-MPPS truck hauls by 202 one-way truck movements per day. ▪ Continuation of up to 51 one-way truck movements from the Project to other domestic coal customers south of Lithgow. ▪ Increase in Project-Sydney truck hauls by 64 one-way movements per day for product sand transportation.
Staff	▪ 90 full time equivalent staff. (See note iii)	▪ 120 full time equivalent staff.	▪ 21 additional journeys to work between 6-7am. ▪ 21 additional journeys from work between 7-8pm. ▪ 9 additional journeys from work between 6-7am. ▪ 9 additional journeys from work between 7-9pm. (See note iv)

Notes:
(i) Truck volume generation is based on 30t payload per haulage truck and 290 haul days per year.
(ii) All truck hauls presented as one-way truck movements will also generate a return unladen movement.
(iii) For modelling purposes, it has been conservatively assumed that 70% of these full time staff are required to be on site during the day shift.
(iv) Assumed that each worker generates 1 light vehicle trip per direction to attend work (assumed conservative vehicle occupancy of 1 person per vehicle). It was conservatively assumed that the outbound/inbound journeys associated with the end/start of work shifts would coincide in the same hour. In reality, there may be an overlap to ensure continuity of operations.

3.2.3 Proposed changes to coal transportation

Existing coal haulage traffic

Currently, product coal from the Invincible Coal Preparation Plant (ICPP) is transported to MPPS via the Castlereagh Highway and Boulder Road. The product coal from the ICPP generates the following outbound[1] (laden) trips:

- Left-turn from Invincible Colliery to Castlereagh Highway;
- Right-turn from Castlereagh Highway to Boulder Road; and
- Left-turn from Boulder Road to MPPS truck access.

A small proportion of product coal is transported to other domestic customers to south of Invincible Colliery. This makes up 20% of all product coal.

Cullen Valley Mine also generates truck traffic between the mine and MPPS. Direct hauls generate the following outbound[1] (laden) trips:

- Egress from site via the private haul road to the south-west of the Cullen Bullen township;
- Right-turn onto the Castlereagh Highway;
- Right-turn from Castlereagh Road to Boulder Road; and
- Left-turn from Boulder Road to MPPS truck access.

Cullen Valley mine also generates truck traffic for the transportation of raw coal to the ICPP for processing. This generates the following movements:

- Egress from site via the private haul road to the south-west of the Cullen Bullen township;
- Right-turn onto the Castlereagh Highway; and
- Left-turn from Castlereagh Road to Invincible Colliery Access.

Proposed coal haulage traffic

The Project will include the construction of a bridge over the Castlereagh Highway which will effectively link the two existing mines. This will negate the need for ICPP-bound trucks from Cullen Valley Mine to use the Castlereagh Highway to access Invincible Colliery. This will also result in a substantial reduction in truck traffic on the private haul road to the south-west of the Cullen Bullen township. Once the two mines are consolidated, the primary access/egress point for the Project will be via the existing Invincible Colliery Access gate.

The Project will also include the construction of a new overland conveyor from the Invincible Colliery site to MPPS. This will allow all product coal bound for MPPS to be transported by conveyor by Year 2.

The Project will also produce coal for export to international customers. This product coal will be transported to Port Kembla via the railway network.

As such, the Project will result in the following benefits:

- Reduced truck traffic generation on the Castlereagh Highway, by:
  - (i) eliminating the Cullen Valley to Invincible ICPP-hauls, and

[1] The return (unladen) trips generate the opposing turning movements.

(ii) eliminating road haulage of product coal to MPPS.

- Reduced safety risk exposure for road users due to reduced traffic volumes.
- Significantly reduced axle loading on the road pavement, and hence less pavement deterioration.

Although Coalpac seeks approval for the continuation of coal transportation by road after year 2 of the mine plan, it is noted that this would only be on an emergency and temporary basis, such as when the conveyor is out of operation and would occur with prior notification to the relevant regulators. The volume of coal transported would also be at a rate consistent with that currently approved for Invincible Colliery and Cullen Valley Mine (ie. 2.2Mtpa). This is expected to be an infrequent occurrence and would be limited to short periods.

It should be noted that the sale of product coal to other domestic customers will still generate the same number of truck trips as the base case as detailed in Table 3-7.

3.2.4 Traffic generated by product sand hauls

There is currently no traffic generation from either mine for the movement of product sand. Under the Project, it is proposed to extract and transport up to 0.64Mtpa of product sand per annum. Coalpac have confirmed that this will generate approximately 64 one-way truck trips per day, or a maximum of eight one-way trips per hour. Sand trucks will leave the Project via the Invincible gates only.

All product sand trucks will be Sydney-bound and have an assumed destination in the Parramatta-Granville industrial area near James Ruse Drive. The nominated haulage route would include the following roads:

- Castlereagh Highway from the Project to Wallerawang: The Castlereagh Highway is a gazetted B-double route and would be appropriate for heavy vehicle movements.
- Great Western Highway from Wallerawang to Penrith: The Great Western Highway is the preferred road route across the Blue Mountains (compared with the Bells Line of Road). This route has undergone substantial improvement due to the Government commitment to provide four traffic lanes between Penrith and Katoomba, and other initiatives to the west of Katoomba. A number of current initiatives include:
  - The proposed Mt. Victoria to Lithgow upgrade will provide a vastly improved route which will bypass the steep-graded sections of Mt. Victoria Pass and the River Lett Hill. The government has also committed to an early works safety program which includes the upgrade to some intersections in the Hartley Valley.
  - Wentworth Falls East Upgrade which is currently under construction.
  - Lawson Upgrade which is currently under construction.
  - Bullaburra Upgrade which recently commenced construction.
- M4 Motorway from Penrith to Granville: The M4 is a high standard motorway of mostly a four lane divided road configuration and a speed limit between 90-110km/h in the section between Penrith and Granville. This motorway also provides linkages to the Sydney Orbital Network via the Lighthorse Interchange with the M7 Motorway.

3.2.5 Proposed changes to staff numbers

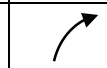
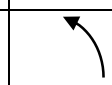
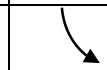
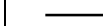
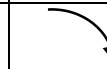
The Project will involve an increase in full time staffing from the current 90 persons to 120 persons. It has been assumed that 70% of these will need to access the Project Boundary for the day time shift. It has further been assumed that all of these additional personnel will access

the Project from the south (ie. from Lithgow and beyond). As a conservative measure, these staff were assumed to exit the site during the PM peak period of 4-5pm as adopted in the model.

3.2.6 Modelled impacts due to operational phase

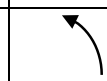
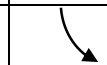
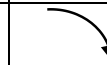
The traffic generation build up due to the coal, sand and staff transport issues described in Sections 3.2.3 to 3.2.5 have been presented in Tables 3-8 to 3-15. The year 2016 has been adopted as the model year to represent the peak operational period.

Table 3-8 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation ultimate operational phase (2016) - AM peak.

Movement code		AM peak volumes as surveyed (2010)	Plus growth in background traffic to 2016 (note ii)	Plus coal truck for other domestic customers (note iii)	Plus product sand trucks (note iv)	Increases in staff numbers	Total for operational case
A		45 (11)	6 (2)				51 (13)
B		4 (0)				21 (0)	25 (0)
C		29 (4)	-29 (-4)				0 (0) note v
D		146 (25)	19 (3)				165 (28)
E		3 (0)					3 (0)
F		18 (1)	-18 (-1)				0 (0) note v
G		4 (4)	-4 (-4)				0 (0) note v
H		0 (0)					0 (0)
I		4 (4)	-4 (-4)				0 (0) note v
J		0 (0)					0 (0)
K		0 (0)				9 (0)	9 (0)

Notes:
(i) The 2% growth rate per annum was only applied to non-Project related traffic streams.
(ii) Growth in background traffic determined at 2% per year for six years between 2010 and 2016 (ie. x 1.02^6)
(iii) No road haulage of sand or coal is allowed before 7am.
(iv) Product sand would generate 64 trucks/day (eight trucks/hour) as noted in the Preliminary Environmental Assessment.
(v) Ivanhoe North Colliery to cease operations in 2012.
(vi) All figures rounded to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-9 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation peak operational phase (2016) - Midday peak.

Movement code		AM peak volumes as surveyed (2010)	Less Invincible haulage traffic in survey week (note i)	Less Cullen Valley haulage traffic in survey week (note i)	Subtotal	Plus growth in background traffic to 2016 (note ii)	Plus coal truck for other domestic customers (note iii)	Plus product sand trucks (note iv)	Total for operational case
A		118 (29)		-5 (-5)	113 (24)	14 (3)			127 (27)
B		21 (12)	-12 (-12)		9 (0)		5 (5)	8 (8)	22 (13)
C		21 (7)			21 (7)	-21(-7)			0 (0) note v
D		105 (27)		-5 (-5)	100 (22)	13 (3)			113 (25)
E		6 (0)			6 (0)				6 (0)
F		11 (2)			11 (2)	-11(-2)			0 (0) note v
G		7 (7)			7 (7)	-7(-7)			0 (0) note v
H		0 (0)			0 (0)				0 (0) note v
I		7 (7)			7 (7)	-7(-7)			0 (0) note v
J		0 (0)			0 (0)				0 (0)
K		12 (12)	-12 (-12)		0 (0)		5 (5)	8 (8)	13 (13)

Notes:

(i) The haulage traffic was removed as the Project would no longer haul coal to MPPS. This was also removed to allow the sub-total (the background) traffic to be determined. The 2% growth rate per annum was only applied to the background traffic.

(ii) Growth in background traffic determined at 2% per year for six years between 2010 and 2016 (ie. x 1.02^6)

(iii) 0.45Mtpa product coal would continue to be supplied to domestic customers other than MPPS. This equates to 15,000 one-way truck movements per year, or 52 one –way truck movements per day assuming a 30t payload per truck, and 290 haul days per year. There would be approximately 10 hours of the day (conservative assumption) over which the product would be hauled with an average of 5 one-way truck trips generated per hour. Each laden outbound trip would be preceded by an unladen inbound trip.

(iv) Product sand would generate 64 trucks/day (eight trucks/hour) as noted in the Preliminary Environmental Assessment.

(v) Ivanhoe North Colliery to cease operations in 2012.

(vi) All figures rounded up to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-10 Intersection I-01 – Castlereagh Highway/Invincible Colliery Access: Traffic generation peak operational phase (2016) - PM peak.

Movement code		PM peak volumes as surveyed (2010)	Less Invincible haulage traffic in survey week (note i)	Less Cullen Valley haulage traffic in survey week (note i)	Subtotal	Plus growth in background traffic to 2016 (note ii)	Plus coal truck for other domestic customers (note iii)	Plus product sand trucks (note iv)	Plus increase in staff numbers.	Total for operational case
A	↑	143 (34)		-5 (-5)	138 (29)	16 (4)				154 (33)
B	↗	12 (12)	-12 (-12)		0 (0)		5 (5)	8 (8)		13 (13)
C	↖	18 (3)			18 (3)	-18 (-3)				0 (0) note v
D	↓	109 (20)		-5 (-5)	104 (15)	13 (2)				117 (17)
E	↘	0 (0)			0 (0)					0 (0)
F	↙	11 (1)			11 (1)	-11 (-1)				0 (0) note v
G	↗	23 (3)			23 (3)	-23 (-3)				0 (0) note v
H	→	0 (0)			0 (0)					0 (0) note v
I	↘	30 (3)			30 (3)	-30 (-3)				0 (0) note v
J	↖	15 (0)			15 (0)					15 (0)
K	↙	32 (12)	-12 (-12)		20 (0)		5 (5)	8 (8)	21 (0)	54 (13)

Notes:
(i) The haulage traffic was removed as the Project would no longer haul coal to MPPS. This was also removed to allow the sub-total (the background) traffic to be determined. The 2% growth rate per annum was only applied to the background traffic.
(ii) Growth in background traffic determined at 2% per year for six years between 2010 and 2013 (ie. x 1.02^6)
(iii) 0.45Mtpa product coal would continue to be supplied to domestic customers other than MPPS. This equates to 15,000 one-way truck movements per year, or 52 one –way truck movements per day assuming a 30t payload per truck, and 290 haul days per year. There would be approximately 10 hours of the day over which the product would be hauled with an average of 5 one-way truck trips generated per hour. Each laden outbound trip would be preceded by an unladen inbound trip.
(iv) Product sand would generate 64 trucks/day (eight trucks/hour) as noted in the Preliminary Environmental Assessment.
(v) Ivanhoe North Colliery to cease operations in 2012.
(vi) All figures rounded up to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour

Table 3-11 Intersection I-02 – Castlereagh Highway/Boulder Road: Traffic generation peak operational phase (2016) - AM peak.

Movement code	Diagram	AM base case	Plus growth in background traffic	Increases in staff numbers	Total for operational case
A		61 (11)	8 (1)	21 (0)	90 (12)
C		56 (7)	7 (1)		63 (8)
D		164 (8)	8 (1)	9 (0)	181 (9)
F		18 (18)	2 (2)		20 (20)
G		21 (18)	3 (2)		24 (20)
I		57 (2)	7 (0)		64 (2)

Notes:
(i) Growth in background traffic determined at 2% per year for six years between 2010 and 2016 (ie. x 1.02^6)
(ii) All figures rounded up to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-12 Intersection I-02 – Castlereagh Highway/Boulder Road: Traffic generation peak operational phase (2016) - Midday peak.

Movement code	Diagram	Midday base case	Less Invincible haulage traffic in survey week	Less Cullen Valley haulage traffic in survey week	Subtotal	Plus growth in background traffic	Plus coal for other domestic customers	Plus product sand hauls	Total for operational case
A		133 (32)			133 (32)	17 (4)	5 (5)	8 (8)	163 (49)
C		32 (8)			32 (8)	4 (1)			36 (9)
D		102 (10)			102 (10)	13 (1)	5 (5)	8 (8)	128 (24)
F		41 (24)	-12 (-12)	-5 (-5)	24 (7)	3 (1)			27 (8)
G		25 (24)	-12 (-12)	-5 (-5)	8 (7)	1 (1)			9 (8)
I		50 (7)			50 (7)	6 (1)			56 (8)

Notes:
(i) Growth in background traffic determined at 2% per year for six years between 2010 and 2016 (ie. x 1.02^6)
(ii) All figures rounded up to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour

Table 3-13 Intersection I-02 – Castlereagh Highway/Boulder Road: Traffic generation peak operational phase (2016) - PM peak.

Movement code	Diagram	PM base case	Less Invincible haulage traffic in survey week	Less Cullen Valley haulage traffic in survey week	Subtotal	Plus growth in background traffic	Plus coal for other domestic customers	Plus product sand hauls	Total for operational case
A		164 (35)			164 (35)	21 (4)	5 (5)	8 (8)	198 (52)
C		41 (4)			41 (4)	5 (1)			46 (5)
D		115 (12)			115 (12)	15 (2)	5 (5)	8 (8)	143 (27)
F		29 (19)	-12 (-12)	-5 (-5)	12 (2)	2 (0)			14 (2)
G		21 (19)	-12 (-12)	-5 (-5)	4 (2)	1 (0)			5 (2)
I		71 (6)			71 (6)	9 (1)			80 (7)

Notes:
(i) Growth in background traffic determined at 2% per year for six years between 2010 and 2016 (ie. x 1.02^6)
(ii) All figures rounded up to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour

Table 3-14 Intersection I-03 –Boulder Road/ MPPS Truck Access: Traffic generation peak operational phase (2016) - Midday peak

Movement code	Diagram	Midday base case	Less Invincible haulage traffic in survey week	Less Cullen Valley haulage traffic in survey week	Subtotal	Plus growth in background traffic (note i)	Plus coal for other domestic customers	Plus product sand hauls	Total for operational case
A		40 (0)			40 (0)	5 (0)			45 (0)
C		20 (20)	-12 (-12)	-5 (-5)	3 (3)				3 (3)
D		25 (3)			25 (3)	3 (0)			28 (3)
F		1 (1)			1 (1)				1 (1)
G		2 (0)			2 (0)				2 (0)
I		20 (20)	-12 (-12)	-5 (-5)	3 (3)				3 (3)

Notes:
(i) Growth in background traffic determined at 2% per year for six years between 2010 and 2016 (ie. x 1.02^6).
(ii) All figures rounded up to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour.

Table 3-15 Intersection I-03 –Boulder Road/ MPPS Truck Access: Traffic generation peak operational phase (2016) - PM peak

Movement code	Diagram	PM base case	Less Invincible haulage traffic in survey week	Less Cullen Valley haulage traffic in survey week	Subtotal	Plus growth in background traffic (note i)	Plus coal for other domestic customers	Plus product sand hauls	Total for operational case
A		47 (0)			47 (0)	6 (0)			53 (0)
C		18 (18)	-12 (-12)	-5 (-5)	1 (1)				1 (1)
D		33 (2)			33 (2)	4 (0)			37 (2)
F		1 (1)			1 (1)				1 (1)
G		4 (1)			4 (1)				4 (1)
I		18 (18)	-12 (-12)	-5 (-5)	1 (1)				1 (1)

Notes:
(i) Growth in background traffic determined at 2% per year for six years between 2010 and 2016 (ie. x 1.02^6)
(ii) All figures rounded up to nearest whole number. Top figure = all vehicles. Bottom figure in brackets = heavy vehicles. All figures in vehicles per hour

3.3 Likely road asset impacts

Table 3-10 outlined the differences in truck traffic generation between the base case and Project conditions. From this, it is possible to conclude that:

- There will be a reduction in the number of truck trips generated on the section of the Castlereagh Highway between the Project and MPPS from 506 to 230 trucks per day. As such, with all things equal, there would be a reduction in Equivalent Standard Axles (ESA) by 54%. As such, the rate of consumption of the road pavement's residual life would be slowed down. That is, under the Project conditions, it would take 2.2 times as long to generate the same number of ESAs (and hence have the same road asset impact) as the base case conditions.
- There will be an increase in the number of truck trips generated on the section of the Castlereagh Highway between Boulder Road and the Great Western Highway from 102 to 230 trucks per day. As such, the increase in sand hauls would be increasing the number of ESAs generated on this section of the highway by 2.3 times.
- It is more difficult to track the impacts on the rest of the road network due to the lack of certainty in destination and route choice.

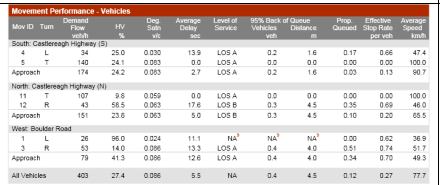
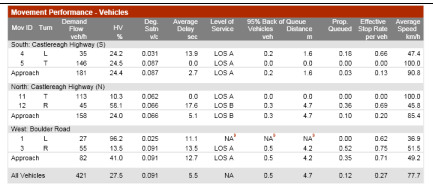
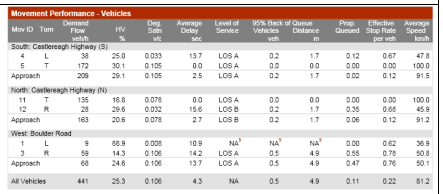
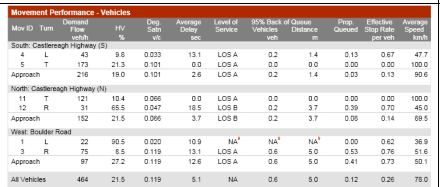
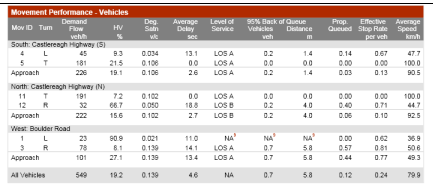
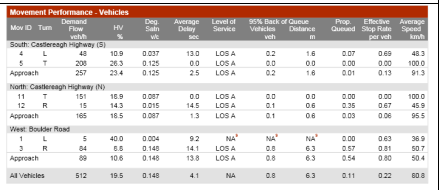
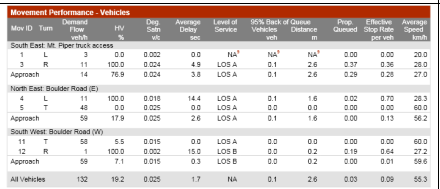
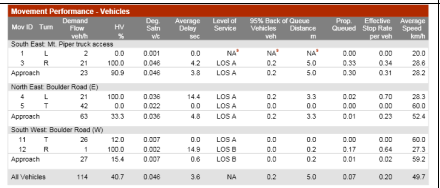
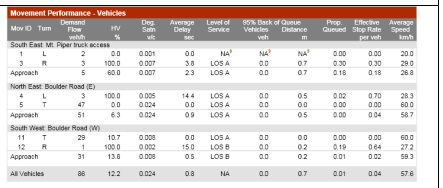
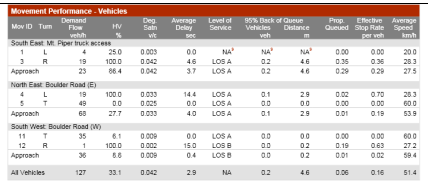
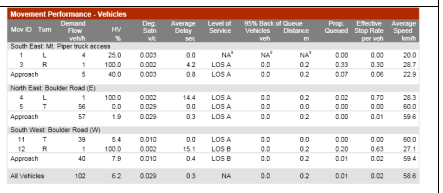
4 COMMENTARY ON MODELLED TRAFFIC IMPACTS

4.1 Model outputs and commentary

Table 4-1 shows the SIDRA model outputs for all study intersections and scenarios as described in Sections 2 and 3 of this report.

Table 4-1 Comparison in modelled performance of the four scenarios: (i) base case, (ii) peak construction case, (iii) Interim operational case, and (iv) peak operational phase (Project conditions).

Intersect -ion and peak period	(i) Base case condition (with maximum haulage of 1.2Mtpa coal from Invincible)	(ii) Peak construction condition (month 4 of the construction program.	(iii) Interim operational case (up to year 2 of the Program)	(iv) Ultimate operational case (Project condition)
I-01 AM	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 31 13.8 0.016 14.9 LOS B 0.0 0.0 0.00 0.71 67.3 11 T 47 24.4 0.026 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 4 0.0 0.004 14.6 LOS B 0.0 0.1 0.27 0.64 57.2 Approach 82 19.2 0.026 6.3 LOS B 0.0 0.1 0.01 0.30 84.6 East: Invincible Access 1 L 1 0.0 0.001 2.1 NA[1] NA[1] NA[1] 0.00 0.26 39.7 3 R 1 0.0 0.002 12.3 LOS A 0.0 0.1 0.42 0.62 49.8 Approach 2 0.0 0.002 7.2 LOS A 0.0 0.1 0.21 0.55 43.6 North: Castlereagh Highway (N) 4 L 3 0.0 0.090 13.6 LOS A 0.0 0.0 0.00 0.73 59.2 5 T 154 17.1 0.099 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 19 5.6 0.019 14.5 LOS A 0.1 0.6 0.19 0.65 65.1 Approach 176 15.6 0.099 1.8 LOS A 0.1 0.6 0.02 0.06 95.8 West: Ivanhoe Access 7 L 4 100.0 0.036 15.0 LOS B 0.2 3.1 0.39 0.47 47.0 8 T 1 0.0 0.036 8.5 LOS A 0.2 3.1 0.39 0.29 29.3 9 R 4 100.0 0.036 15.0 LOS B 0.2 3.1 0.39 0.64 47.0 Approach 9 66.9 0.036 14.2 LOS B 0.2 3.1 0.39 0.53 45.6 All Vehicles 269 19.1 0.090 3.6 NA 0.2 3.1 0.03 0.17 89.8	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 31 13.8 0.016 14.9 LOS B 0.0 0.0 0.00 0.71 51.3 11 T 49 23.4 0.029 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 67 0.0 0.068 14.8 LOS B 0.3 2.2 0.29 0.68 44.7 Approach 147 10.7 0.068 9.8 LOS B 0.3 2.2 0.13 0.46 63.7 East: Invincible Access 1 L 1 0.0 0.001 2.1 NA[1] NA[1] NA[1] 0.00 0.26 39.7 3 R 1 0.0 0.003 13.4 LOS A 0.0 0.1 0.47 0.82 48.8 Approach 2 0.0 0.003 7.8 LOS A 0.0 0.1 0.23 0.55 43.2 North: Castlereagh Highway (N) 4 L 3 0.0 0.093 13.8 LOS A 0.0 0.0 0.00 0.73 59.2 5 T 160 17.1 0.093 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 19 5.6 0.019 14.5 LOS A 0.1 0.6 0.19 0.65 65.0 Approach 182 15.6 0.093 1.7 LOS A 0.1 0.6 0.02 0.08 96.0 West: Ivanhoe Access 7 L 4 100.0 0.046 18.5 LOS B 0.2 3.7 0.43 0.48 43.8 8 T 1 0.0 0.046 12.0 LOS A 0.2 3.7 0.43 0.36 26.4 9 R 4 100.0 0.046 18.5 LOS B 0.2 3.7 0.43 0.69 43.8 Approach 9 66.9 0.046 17.8 LOS B 0.2 3.7 0.43 0.56 42.4 All Vehicles 341 15.4 0.093 5.7 NA 0.3 3.7 0.06 0.26 80.9	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 1 0.0 0.001 13.8 LOS A 0.0 0.0 0.00 0.72 67.3 11 T 52 24.5 0.031 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 26 0.0 0.027 14.7 LOS B 0.1 0.8 0.29 0.67 57.1 Approach 79 16.0 0.031 5.1 LOS B 0.1 0.8 0.10 0.23 81.0 East: Invincible Access 1 L 1 0.0 0.001 2.1 NA[1] NA[1] NA[1] 0.00 0.26 39.7 3 R 1 0.0 0.002 12.5 LOS A 0.0 0.1 0.43 0.82 49.6 Approach 2 0.0 0.002 7.3 LOS A 0.0 0.1 0.21 0.55 43.5 North: Castlereagh Highway (N) 4 L 3 0.0 0.096 13.8 LOS A 0.0 0.0 0.00 0.73 59.2 5 T 166 17.1 0.096 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 1 0.0 0.001 14.1 LOS A 0.0 0.0 0.15 0.65 65.5 Approach 171 16.7 0.096 0.3 LOS A 0.0 0.0 0.00 0.02 98.9 West: Ivanhoe Access 7 L 1 0.0 0.006 6.4 LOS A 0.0 0.2 0.26 0.40 60.6 8 T 1 0.0 0.006 2.4 LOS A 0.0 0.2 0.26 0.16 36.2 9 R 1 0.0 0.006 6.4 LOS A 0.0 0.2 0.26 0.48 60.6 Approach 3 0.0 0.006 5.1 LOS A 0.0 0.2 0.26 0.35 53.7 All Vehicles 255 16.1 0.096 1.9 NA 0.1 0.8 0.04 0.09 92.4	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 1 0.0 0.001 13.8 LOS A 0.0 0.0 0.00 0.72 67.3 11 T 54 25.5 0.032 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 26 0.0 0.027 14.9 LOS B 0.1 0.8 0.30 0.67 57.0 Approach 81 16.9 0.032 5.0 LOS B 0.1 0.8 0.10 0.23 81.4 East: Invincible Access 1 L 9 0.0 0.005 2.1 NA[1] NA[1] NA[1] 0.00 0.26 39.7 3 R 1 0.0 0.002 12.7 LOS A 0.0 0.1 0.44 0.82 49.5 Approach 11 0.0 0.005 3.2 LOS A 0.0 0.1 0.04 0.33 39.6 North: Castlereagh Highway (N) 4 L 3 0.0 0.102 13.8 LOS A 0.0 0.0 0.00 0.73 59.2 5 T 174 17.0 0.101 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 1 0.0 0.001 14.1 LOS A 0.0 0.0 0.15 0.65 65.5 Approach 178 16.6 0.101 0.3 LOS A 0.0 0.0 0.00 0.02 99.0 West: Ivanhoe Access 7 L 1 0.0 0.006 6.6 LOS A 0.0 0.2 0.26 0.40 60.3 8 T 1 0.0 0.006 2.5 LOS A 0.0 0.2 0.26 0.17 36.0 9 R 1 0.0 0.006 6.6 LOS A 0.0 0.2 0.26 0.48 60.3 Approach 3 0.0 0.006 5.2 LOS A 0.0 0.2 0.26 0.35 53.5 All Vehicles 273 15.6 0.102 1.9 NA 0.1 0.8 0.03 0.10 89.7
I-01 Midday	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 22 33.3 0.015 16.3 LOS B 0.0 0.0 0.00 0.71 67.3 11 T 124 24.6 0.074 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 26 64.0 0.044 20.3 LOS B 0.2 3.2 0.32 0.68 56.8 Approach 173 31.7 0.074 5.2 LOS B 0.2 3.2 0.05 0.19 66.7 East: Invincible Access 1 L 22 100.0 0.020 3.0 NA[1] NA[1] NA[1] 0.00 0.27 38.2 3 R 1 100.0 0.009 39.7 LOS C 0.0 0.8 0.70 0.92 33.6 Approach 23 100.0 0.020 4.6 LOS C 0.0 0.8 0.03 0.30 38.0 North: Castlereagh Highway (N) 4 L 7 14.3 0.071 14.4 LOS A 0.0 0.0 0.00 0.72 59.2 5 T 111 25.7 0.071 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 12 18.2 0.013 15.6 LOS B 0.1 0.6 0.29 0.65 63.8 Approach 129 24.4 0.071 2.2 LOS B 0.1 0.6 0.03 0.10 94.4 West: Ivanhoe Access 7 L 7 100.0 0.085 20.9 LOS B 0.4 7.0 0.55 0.61 41.8 8 T 1 0.0 0.085 14.4 LOS A 0.4 7.0 0.55 0.53 24.7 9 R 7 100.0 0.085 20.9 LOS B 0.4 7.0 0.55 0.76 41.8 Approach 16 93.3 0.084 20.5 LOS B 0.4 7.0 0.55 0.67 41.0 All Vehicles 341 36.4 0.088 4.7 NA 0.4 7.0 0.06 0.19 80.5	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 22 33.3 0.015 16.3 LOS B 0.0 0.0 0.00 0.71 51.3 11 T 131 25.0 0.076 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 26 64.0 0.045 20.4 LOS B 0.2 3.2 0.33 0.68 44.4 Approach 179 31.6 0.076 5.0 LOS B 0.2 3.2 0.05 0.19 65.9 East: Invincible Access 1 L 22 100.0 0.020 3.0 NA[1] NA[1] NA[1] 0.00 0.27 38.2 3 R 1 100.0 0.010 42.9 LOS D 0.0 0.9 0.73 0.93 32.3 Approach 23 100.0 0.020 4.8 LOS D 0.0 0.9 0.03 0.30 37.9 North: Castlereagh Highway (N) 4 L 7 14.3 0.074 14.4 LOS A 0.0 0.0 0.00 0.72 59.2 5 T 116 26.4 0.074 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 12 18.2 0.014 15.7 LOS B 0.1 0.6 0.30 0.65 63.8 Approach 136 25.0 0.074 2.1 LOS B 0.1 0.6 0.03 0.10 94.6 West: Ivanhoe Access 7 L 7 100.0 0.136 26.8 LOS B 0.6 11.9 0.63 0.66 37.9 8 T 5 100.0 0.136 20.3 LOS B 0.6 11.9 0.63 0.63 21.3 9 R 7 100.0 0.136 26.8 LOS B 0.6 11.9 0.63 0.80 37.9 Approach 20 100.0 0.137 25.1 LOS B 0.6 11.9 0.63 0.71 34.4 All Vehicles 357 37.5 0.136 5.0 NA 0.6 11.9 0.07 0.19 78.8	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 1 0.0 0.001 13.8 LOS A 0.0 0.0 0.00 0.72 67.3 11 T 134 24.4 0.079 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 39 75.7 0.073 21.7 LOS B 0.3 5.9 0.35 0.70 56.2 Approach 174 58.8 0.079 4.9 LOS B 0.3 5.9 0.06 0.16 86.2 East: Invincible Access 1 L 35 100.0 0.032 3.0 NA[1] NA[1] NA[1] 0.00 0.27 38.2 3 R 1 100.0 0.010 42.3 LOS C 0.0 0.8 0.72 0.93 32.6 Approach 36 100.0 0.032 4.1 LOS C 0.0 0.8 0.02 0.29 38.0 North: Castlereagh Highway (N) 4 L 7 14.3 0.075 14.4 LOS A 0.0 0.0 0.00 0.72 59.2 5 T 119 25.7 0.076 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 1 0.0 0.001 14.5 LOS B 0.0 0.0 0.26 0.63 64.3 Approach 127 24.8 0.076 1.0 LOS B 0.0 0.0 0.00 0.05 97.0 West: Ivanhoe Access 7 L 1 0.0 0.007 7.8 LOS A 0.0 0.2 0.41 0.43 58.3 8 T 1 0.0 0.007 3.7 LOS A 0.0 0.2 0.41 0.29 34.4 9 R 1 0.0 0.007 7.8 LOS A 0.0 0.2 0.41 0.54 58.3 Approach 3 0.0 0.007 6.4 LOS A 0.0 0.2 0.41 0.42 51.6 All Vehicles 340 36.1 0.079 3.4 NA 0.3 5.9 0.05 0.13 80.6	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 1 0.0 0.001 13.8 LOS A 0.0 0.0 0.00 0.72 67.3 11 T 134 21.3 0.078 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 23 59.1 0.039 19.9 LOS B 0.2 2.6 0.32 0.67 56.9 Approach 158 26.7 0.078 3.0 LOS B 0.2 2.6 0.05 0.10 90.8 East: Invincible Access 1 L 14 100.0 0.013 2.9 NA[1] NA[1] NA[1] 0.00 0.27 38.2 3 R 1 0.0 0.003 13.5 LOS A 0.0 0.1 0.47 0.82 48.8 Approach 15 92.9 0.013 3.7 LOS A 0.0 0.1 0.03 0.31 38.8 North: Castlereagh Highway (N) 4 L 6 0.0 0.073 13.8 LOS A 0.0 0.0 0.00 0.73 59.2 5 T 119 22.1 0.073 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 1 0.0 0.001 14.5 LOS A 0.0 0.0 0.25 0.63 64.3 Approach 126 20.6 0.073 0.8 LOS A 0.0 0.0 0.00 0.04 97.4 West: Ivanhoe Access 7 L 1 0.0 0.006 7.2 LOS A 0.0 0.2 0.39 0.43 59.2 8 T 1 0.0 0.006 3.2 LOS A 0.0 0.2 0.39 0.26 35.1 9 R 1 0.0 0.006 7.2 LOS A 0.0 0.2 0.39 0.53 59.2 Approach 3 0.0 0.006 5.9 LOS A 0.0 0.2 0.39 0.41 52.4 All Vehicles 302 27.2 0.078 2.2 NA 0.2 2.6 0.03 0.09 88.5
I-01 PM	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 19 16.7 0.011 15.1 LOS B 0.0 0.0 0.00 0.71 51.3 11 T 151 23.6 0.089 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 17 100.0 0.036 23.6 LOS B 0.2 3.4 0.34 0.68 44.8 Approach 186 29.9 0.089 3.7 LOS B 0.2 3.4 0.03 0.13 89.2 East: Invincible Access 1 L 43 51.2 0.032 2.5 NA[1] NA[1] NA[1] 0.00 0.27 38.7 3 R 17 6.3 0.046 15.5 LOS B 0.2 1.5 0.52 0.94 47.4 Approach 60 36.6 0.046 6.2 LOS B 0.2 1.5 0.14 0.46 40.8 North: Castlereagh Highway (N) 4 L 1 100.0 0.066 16.0 LOS B 0.0 0.0 0.00 0.70 56.5 5 T 115 16.3 0.067 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 12 9.1 0.012 15.2 LOS B 0.1 0.5 0.30 0.65 63.8 Approach 127 16.2 0.067 1.5 LOS B 0.1 0.5 0.03 0.07 96.6 West: Ivanhoe Access 7 L 24 13.0 0.164 10.9 LOS A 0.7 7.0 0.50 0.55 53.8 8 T 5 100.0 0.164 6.6 LOS A 0.7 7.0 0.50 0.50 31.0 9 R 32 10.0 0.164 10.8 LOS A 0.7 7.0 0.50 0.71 53.8 Approach 61 19.0 0.164 10.5 LOS A 0.7 7.0 0.50 0.63 52.2 All Vehicles 435 26.2 0.164 4.3 NA 0.7 7.0 0.11 0.23 74.8	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 19 16.7 0.011 15.1 LOS B 0.0 0.0 0.00 0.71 51.3 11 T 157 24.2 0.093 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 17 100.0 0.036 23.8 LOS B 0.2 3.4 0.35 0.68 44.7 Approach 193 30.1 0.093 3.6 LOS B 0.2 3.4 0.03 0.13 89.5 East: Invincible Access 1 L 106 20.6 0.066 2.3 NA[1] NA[1] NA[1] 0.00 0.27 38.7 3 R 17 6.3 0.048 15.8 LOS B 0.2 1.6 0.52 0.94 47.1 Approach 123 16.8 0.066 4.1 LOS B 0.2 1.6 0.07 0.37 39.7 North: Castlereagh Highway (N) 4 L 1 100.0 0.070 18.0 LOS B 0.0 0.0 0.00 0.70 56.5 5 T 120 19.3 0.070 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 12 9.1 0.013 15.2 LOS B 0.1 0.5 0.31 0.66 63.7 Approach 133 19.0 0.070 1.5 LOS B 0.1 0.5 0.03 0.06 96.8 West: Ivanhoe Access 7 L 24 13.0 0.169 11.4 LOS A 0.7 7.2 0.52 0.56 53.2 8 T 5 100.0 0.170 7.0 LOS A 0.7 7.2 0.52 0.52 30.6 9 R 32 10.0 0.170 11.3 LOS A 0.7 7.2 0.52 0.72 53.2 Approach 61 19.0 0.170 10.9 LOS A 0.7 7.2 0.52 0.64 51.6 All Vehicles 509 23.1 0.170 4.0 NA 0.7 7.2 0.10 0.23 67.9	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 1 0.0 0.001 13.8 LOS A 0.0 0.0 0.00 0.72 67.3 11 T 162 24.0 0.096 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 29 100.0 0.064 24.0 LOS B 0.3 6.1 0.37 0.70 51.2 Approach 193 35.5 0.096 3.7 LOS B 0.3 6.1 0.06 0.11 88.3 East: Invincible Access 1 L 76 44.6 0.055 2.5 NA[1] NA[1] NA[1] 0.00 0.27 38.7 3 R 17 6.3 0.047 15.6 LOS B 0.2 1.5 0.52 0.94 47.3 Approach 95 37.8 0.055 4.8 LOS B 0.2 1.5 0.09 0.39 40.0 North: Castlereagh Highway (N) 4 L 1 100.0 0.070 18.0 LOS B 0.0 0.0 0.00 0.70 56.5 5 T 124 16.6 0.072 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 1 0.0 0.001 14.7 LOS B 0.0 0.0 0.29 0.62 63.9 Approach 126 19.2 0.072 0.3 LOS B 0.0 0.0 0.00 0.01 99.3 West: Ivanhoe Access 7 L 1 0.0 0.007 8.1 LOS A 0.0 0.2 0.43 0.45 57.8 8 T 1 0.0 0.007 4.0 LOS A 0.0 0.2 0.43 0.31 34.1 9 R 1 0.0 0.007 8.1 LOS A 0.0 0.2 0.43 0.56 57.8 Approach 3 0.0 0.007 6.7 LOS A 0.0 0.2 0.43 0.44 51.1 All Vehicles 417 30.8 0.096 3.0 NA 0.3 6.1 0.05 0.15 73.9	Movement Performance - Vehicles South: Castlereagh Highway (S) 10 L 1 0.0 0.001 13.8 LOS A 0.0 0.0 0.00 0.72 51.3 11 T 162 21.4 0.095 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 14 100.0 0.029 23.7 LOS B 0.1 2.7 0.35 0.65 44.8 Approach 177 27.4 0.095 1.9 LOS B 0.1 2.7 0.03 0.06 93.6 East: Invincible Access 1 L 57 24.1 0.036 2.3 NA[1] NA[1] NA[1] 0.00 0.27 38.7 3 R 16 0.0 0.040 14.2 LOS A 0.2 1.2 0.49 0.82 46.2 Approach 73 16.8 0.040 4.9 LOS A 0.2 1.2 0.11 0.41 40.4 North: Castlereagh Highway (N) 4 L 1 0.0 0.070 13.8 LOS A 0.0 0.0 0.00 0.73 59.2 5 T 123 14.5 0.070 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 6 R 1 0.0 0.001 14.7 LOS B 0.0 0.0 0.26 0.62 64.0 Approach 125 14.3 0.070 0.2 LOS B 0.0 0.0 0.00 0.01 99.3 West: Ivanhoe Access 7 L 1 0.0 0.006 7.5 LOS A 0.0 0.2 0.42 0.45 58.7 8 T 1 0.0 0.006 3.5 LOS A 0.0 0.2 0.42 0.29 34.7 9 R 1 0.0 0.006 7.5 LOS A 0.0 0.2 0.42 0.54 58.7 Approach 3 0.0 0.006 6.2 LOS A 0.0 0.2 0.42 0.42 52.0 All Vehicles 378 21.2 0.095 2.0 NA 0.2 2.7 0.04 0.11 78.4
I-02 AM	Movement Performance - Vehicles South: Castlereagh Highway (S) 4 L 59 12.5 0.046 13.2 LOS A 0.2 2.0 0.12 0.68 47.9 5 T 64 18.0 0.037 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 Approach 123 15.4 0.046 6.3 LOS A 0.2 2.0 0.06 0.32 76.7 North: Castlereagh Highway (N) 11 T 173 4.9 0.091 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 19 100.0 0.036 19.4 LOS B 0.1 3.0 0.24 0.66 46.4 Approach 192 14.3 0.091 1.9 LOS B 0.1 3.0 0.02 0.07 92.9 West: Boulder Road 1 L 22 85.7 0.019 10.8 NA[1] NA[1] NA[1] 0.00 0.62 36.9 3 R 60 3.5 0.060 11.6 LOS A 0.4 3.1 0.46 0.70 52.8 Approach 82 25.6 0.060 11.4 LOS A 0.4 3.1 0.33 0.68 50.8 All Vehicles 397 17.0 0.091 5.2 NA 0.4 3.1 0.10 0.27 76.6	Movement Performance - Vehicles South: Castlereagh Highway (S) 4 L 61 12.1 0.047 13.1 LOS A 0.2 2.1 0.12 0.68 47.8 5 T 129 8.9 0.070 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 Approach 191 9.9 0.070 4.2 LOS A 0.2 2.1 0.04 0.22 84.7 North: Castlereagh Highway (N) 11 T 180 4.7 0.095 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 20 100.0 0.041 20.4 LOS B 0.2 3.6 0.35 0.68 45.6 Approach 200 14.2 0.095 2.0 LOS B 0.2 3.6 0.03 0.07 92.6 West: Boulder Road 1 L 23 86.4 0.020 10.8 NA[1] NA[1] NA[1] 0.00 0.62 36.9 3 R 62 3.4 0.092 12.4 LOS A 0.5 3.5 0.51 0.74 52.0 Approach 85 25.9 0.092 11.9 LOS A 0.5 3.5 0.37 0.71 50.2 All Vehicles 476 14.6 0.095 4.7 NA 0.5 3.6 0.10 0.24 79.1	In the interim operational period prior to the completion of the rail siding and overland conveyor, the product coal quantities would be the same as the existing (pre-approval scenario). As such, the impact to this intersection would be similar to the base case model.	Movement Performance - Vehicles South: Castlereagh Highway (S) 4 L 66 12.7 0.052 13.2 LOS A 0.3 2.3 0.13 0.66 47.0 5 T 95 13.3 0.053 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 Approach 161 13.1 0.053 5.4 LOS A 0.3 2.3 0.05 0.28 80.1 North: Castlereagh Highway (N) 11 T 191 5.0 0.101 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 12 R 21 100.0 0.042 19.9 LOS B 0.2 3.6 0.30 0.67 46.0 Approach 212 14.4 0.101 2.0 LOS B 0.2 3.6 0.03 0.07 92.8 West: Boulder Road 1 L 25 83.3 0.022 10.7 NA[1] NA[1] NA[1] 0.00 0.62 36.9 3 R 67 3.1 0.097 12.2 LOS A 0.5 3.8 0.50 0.73 52.2 Approach 93 25.0 0.097 11.8 LOS A 0.5 3.8 0.36 0.70 50.3 All Vehicles 465 16.1 0.101 5.1 NA 0.5 3.8 0.10 0.27 77.2

Intersection and peak period	(i) Base case condition (with maximum haulage of 1.2Mtpa coal from Invincible)	(ii) Peak construction condition (month 4 of the construction program.	(iii) Interim operational case (up to year 2 of the Program)	(iv) Ultimate operational case (Project condition)
I-02 Midday			In the interim operational period prior to the completion of the rail siding and overland conveyor, the product coal quantities would be the same as the existing (pre-approval scenario). As such, the impact to this intersection would be similar to the base case model.	
I-02 PM			In the interim operational period prior to the completion of the rail siding and overland conveyor, the product coal quantities would be the same as the existing (pre-approval scenario). As such, the impact to this intersection would be similar to the base case model.	
I-03 AM		The construction program is not expected to generate any additional traffic that would need to access MPPS. As such, this scenario was not modelled and it was assumed that this would have similar traffic implications as the base case.	In the interim operational period prior to the completion of the rail siding and overland conveyor, the product coal quantities would be the same as the existing (pre-approval scenario). As such, the impact to this intersection would be similar to the base case model.	This would be very similar to the base case model. This is due to the traffic generation implications of the Consolidation Project being concentrated on the Castlereagh Highway during the AM peak period.
I-03 Midday		The construction program is not expected to generate any additional traffic that would need to access MPPS. As such, this scenario was not modelled and it was assumed that this would have similar traffic implications as the base case.	In the interim operational period prior to the completion of the rail siding and overland conveyor, the product coal quantities would be the same as the existing (pre-approval scenario). As such, the impact to this intersection would be similar to the base case model.	
I-03 PM		The construction program is not expected to generate any additional traffic that would need to access MPPS. As such, this scenario was not modelled and it was assumed that this would have similar traffic implications as the base case.	In the interim operational period prior to the completion of the rail siding and overland conveyor, the product coal quantities would be the same as the existing (pre-approval scenario). As such, the impact to this intersection would be similar to the base case model.	

4.1.1 Potential traffic implications during the construction stage

The Castlereagh Highway/ Invincible Access intersection is not likely to be significantly impacted by the construction traffic generated by the Project. This is indicated by the marginal increase in the modelled delays for the intersection from 3.6 to 5.7 seconds/vehicle for the AM peak, 4.7 to 5.0 seconds/vehicle for the Midday peak, and a reduction from 4.3 to 4.0 seconds/vehicle for the PM peak.

The Castlereagh Highway/ Boulder Road intersection is also not likely to be impacted by the construction stage traffic. The modelled average delays for the intersection actually decrease for the AM and PM scenarios, and remain the same for the Midday peak.

As the traffic generated by the Project's construction activities are not likely to use Boulder Road, there were no SIDRA models prepared for the Boulder Road/ MPPS Truck Access intersection. It was assumed that the traffic performance of these intersections would be similar to the base case conditions.

4.1.2 Potential traffic impacts during the interim operational stage.

The interim operational stage would be the period up to and including year 2 of the mine plan. It is anticipated that the overland conveyor, Castlereagh Highway overbridge and rail siding would not be constructed nor operational until this point in time. As such, the product coal from both Invincible and Cullen Valley operations would continue to be transported by road.

During this interim period, the maximum volume of product coal transported from the Project would be the same as the existing (pre-Consolidation Project) conditions. Furthermore, the distribution of the truck traffic by source location (Cullen Valley gates versus Invincible gates) would also be the same as the pre-Consolidation conditions. There is not likely to be any substantial change to traffic generation at the Castlereagh Highway/Boulder Road intersection, or the Boulder Road/ MPPS Truck Access intersection. As such, there were no SIDRA models prepared for these intersections for this scenario and the traffic performance was assumed to be similar to the base case conditions.

The main change in this period would be the provision of the Castlereagh Highway overbridge linking the Cullen Valley Mine and Invincible Colliery coal operations. This would allow all product coal to be transported from the Invincible Colliery gate. Whilst this would add approximately 12 trucks per direction per hour at the Invincible gate, the cessation of the Ivanhoe North operations, and accompanying elimination of traffic generated from the access gate of that mine, would result in substantial improvements to the operation of the Castlereagh Highway/ Invincible Colliery Access intersection.

The SIDRA model forecasted reductions in average intersection delay from 3.6 to 1.9 seconds/vehicle in the AM peak, 4.7 to 3.4 seconds/vehicle in the Midday peak, and 4.3 to 3.0 seconds/vehicle in the PM peak. It is expected that the elimination of traffic from the Ivanhoe North approach would also result in substantial safety benefits as there would no longer be a demand for right-turn access onto the Highway. The right-turn from Ivanhoe North Colliery to the Castlereagh Highway was identified as a high risk manoeuvre which currently requires outbound trucks to cross the intersection, enter the Invincible gates, u-turn within the Invincible Colliery site and then turn left into the Castlereagh Highway.

4.1.3 Potential traffic impacts during the ultimate operational stage.

The ultimate operational period would have a number of benefits from a traffic operational perspective. These include:

- The cessation of the Ivanhoe North mining operations will free up more capacity at the Castlereagh Highway/ Invincible Access intersection. In fact, the elimination/ reduction of movements to and from Ivanhoe North would make this intersection more like a T-intersection with fewer crash conflicts and delay-inducing movements.
- The provision of an overland conveyor to MPPS will effectively negate the need for truck haulage to that facility. This would remove all intersection turning movements generated by those haulage runs including the left-turn from and right-turn into Invincible Colliery access gate, the right-turn into and left-turn out of Boulder Road, and the left-turn in and right-turn out of the MPPS Truck Access.
- The Castlereagh Highway overbridge will link Cullen Valley Mine with Invincible Colliery. The current truck traffic generated by Cullen Valley-ICPP hauls will no longer need to travel along Castlereagh Highway between the two mines. Rather this traffic would be re-distributed to the overbridge. Furthermore, this will lead to a corresponding reduction in truck turning movements into and out of these two mines.
- The provision of the rail siding will allow a substantial amount of the product coal to be transported by rail to Port Kembla. However, it is acknowledged that there is no coal transported to Port Kembla under the pre-Consolidation conditions.

The average intersection delays modelled for the Castlereagh Highway/ Invincible Access would reduce for all periods modelled (AM, Midday and PM peaks). This is largely due to the reduction in traffic demands due to the re-distribution of product coal to the Project-MPPS overland conveyor, and also due to the cessation of mining operations at Ivanhoe North. The truck traffic generated by the product sand hauls and product coal hauls to other domestic customers (other than MPPS) would not result in any noticeable impact to this intersection. This is demonstrated by the overall reductions in average intersection delays from 3.6 to 1.9 seconds/vehicle in the AM peak, 4.7 to 2.2 seconds/vehicle in the Midday peak, and 4.3 to 2.0 seconds/vehicle in the PM peak.

The replacement of the Project-MPPS truck hauls with the overland conveyor would also result in operational improvements at the Castlereagh Highway/ Boulder Road and Boulder Road/ MPPS Truck Access intersections. In particular, the removal of the right-turn volumes from Castlereagh Highway to Boulder Road, and from MPPS Truck Access to Boulder Road is the main source of improvement for these intersections.

4.2 Recommended mitigation measures for Project traffic impacts

The traffic assessment carried out as part of this study has confirmed that there are not likely to be significant traffic impacts resulting from this project. This is largely due to the proposed infrastructure such as the rail siding, overland conveyor and Castlereagh Highway overbridge. In these respects, the timing of these improvements is critical in terms of how early in the Project life the traffic benefits can be realised.

As such, the following management measures are recommended to minimise the impact of generated traffic from the Project:

- Consideration should be given to building the overland conveyor before any substantial increase in the product coal yields for the Project. This will immediately offset the demand for road hauls to MPPS.
- Consideration should also be given to building the Castlereagh Highway overpass bridge between the eastern and western sides of the Project as soon as possible following any approval of the Project. This will have several benefits including
  - (i) Consolidating most of the access and egress movements to and from the Project at a single point,
  - (ii) Reduced truck trips on the Castlereagh Highway between Cullen Valley Mine and Invincible Colliery as the haulage to processing infrastructure would be via the overbridge, and
  - (iii) Reduced truck traffic and associated noise adjacent to the village of Cullen Bullen.
- Although the truck traffic generated by the residual product coal yield and the product sand yield would not be substantial, consideration could be given to hauling more of this product in the off-peak periods, ie. outside the peak periods described in Section 2.3 and Figure 2-5. This would generate truck traffic on the network at times when there is more spare capacity and also less safety risk due to fewer vehicles on the road.

5 ROAD SAFETY IMPACT ASSESSMENT

Similar to the assessment of traffic impacts, the road safety impact assessment focused on the likely changes to crash risk on the section of the Castlereagh Highway between Cullen Bullen and the Great Western Highway, near Lithgow. Although the haulage trips generated (ie. product coal to domestic customers other than MPPS and product sand to Sydney-based customers) would use a wider road network to reach their end destinations, the portion of the trip on more distant parts of the network would constitute the general background traffic growth along those roads. This has been assumed particularly since route selection and the exact destination would not always be the same with each trip.

5.1 Existing road conditions

The Castlereagh Highway (MR18) is an undivided rural arterial road generally on a north-south alignment connecting Lithgow and Mudgee via the western coal field areas. Between the Invincible Colliery and Mt. Piper power station, it is predominately a two-lane, two-way road with short sections providing additional lanes for climbing/overtaking, for deceleration and storage of turning vehicles, and acceleration lanes for high-speed merges. The road contains moderately undulating alignment with curves, grades, and crest/sag vertical curves to match the surrounding environment. The posted speed limit is 100km/h.

The Castlereagh Highway is an approved B-double route from the Great Western Highway to Mudgee and beyond. It is also approved for use by vehicles up to 4.6m in height.

The Castlereagh Highway/ Invincible Colliery intersection is a four way intersection with the Castlereagh Highway as the major approaches from the north and south. The eastern and western approaches are for the Invincible Colliery access and the Ivanhoe North Coal Operations access respectively (see Figure 5-1). Both are priority controlled, with the Ivanhoe North access and the left-turn slip lane of Invincible Colliery controlled by *give way* signs. The right-turn from Invincible Colliery is controlled by a stop sign.

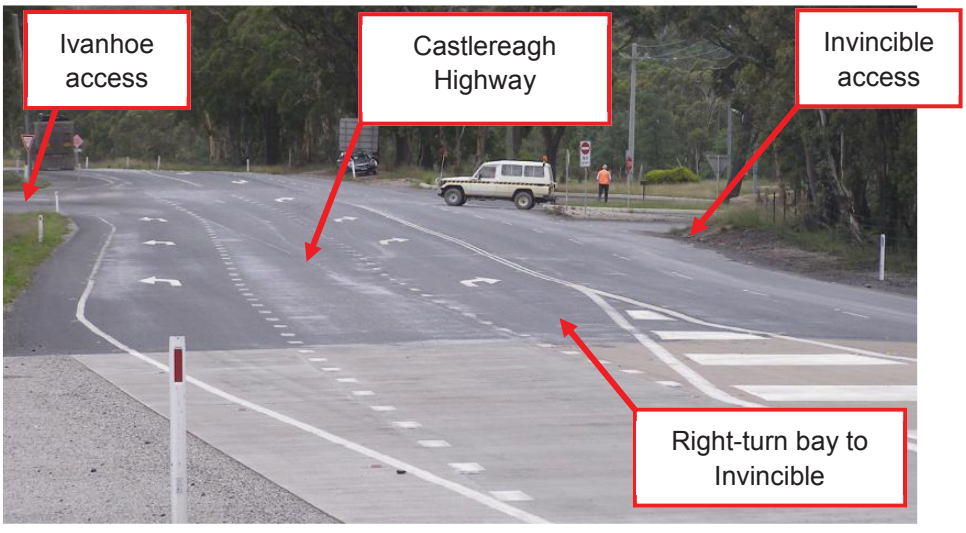


Figure 5-1 The Castlereagh Highway/ Invincible access/ Ivanhoe access intersection (looking north).

The Castlereagh Highway is on an approximate 2.5% downhill grade towards Cullen Bullen (uphill towards Lithgow) and has a posted speed limit of 100km/h. Both the Invincible Colliery and Ivanhoe North accesses are signposted as 40km/h zones.

The Invincible Colliery access provides a single ingress lane which is physically separated from the two egress lanes. Left-turn egress is provided via a slip lane although there is little storage

length available. Due to the lower elevation of the site from the highway, the ingress is on a downhill grade and the egress is on an uphill grade. A 4.6m vertical clearance applies to the site.

A 110m right-turn bay has been provided for the northbound right-turn into Invincible Colliery. A similar length left-turn bay has been provided for the northbound left-turn into the Ivanhoe north site. According to the RTA's Road Design Guide Section 4, a minimum distance of 110m is required to decelerate a vehicle from 100km/h to rest (using a maximum rate of deceleration of 3.5m/s/s). This length does not include any storage length required.

All entering sight distance assessments involved measuring the time gap between the head of platoon from the first instance when the vehicle could be seen to the point where it entered the conflict/controlled area of the intersection. On site observations indicated that the entering sight distance from the Invincible Colliery egress lanes is acceptable (see Figure 5-2). Furthermore, a southbound auxiliary lane has been provided at this location and commences at this point. This is primarily for slow vehicles climbing the southbound uphill grade. However, as it commences immediately south of the Invincible Colliery access, there is an opportunity for egressing drivers to use this as an acceleration lane. The entering sight distance from the Ivanhoe North access towards traffic approaching from the north is restricted due to the presence of a large cluster of trees on the western side of Castlereagh Road. However, this access is not used for any aspect of Invincible Colliery operations. Furthermore, the Ivanhoe North Operations are scheduled to finish in 2012.

Figure 5-2 Entering sight distance from the Invincible access to the north.

5.2 Existing safety conditions

During the five-year period between 1 January 2005 and 31 December 2009, there were a total of 36 reported crashes that occurred on the Castlereagh Highway between Cullen Bullen and the Great Western Highway, near Lithgow. Crash trends are summarised as follows:

- 18 (50%) injury crashes and 18 (50%) towaway non-casualty crashes.
- 18 (50%) single vehicle loss-of-control crashes, six head-on crashes, and five intersection crashes.
- 16 of the loss-of-control crashes were run-off-road crashes.
- Eight crashes (22%) occurred when the road was wet, and seven crashes (19%) during snow/ice surface conditions.
- 12 (33%) crashes involving a truck either as the primary or secondary vehicle.

The crash rate during this five-year period was approximately 29 crashes per 100MVKT[2] (or 0.29 crashes/MVKT) which is slightly less than the average crash rate of 32.8 crashes per 100MVKT (RTA, 2004) for this type of road.

The crash data analysis revealed that of the 36 crashes that occurred, four of these occurred at the intersection of Castlereagh Highway and Boulder Road. All four crashes involved trucks as either the first or second vehicle involved in the collision.

The Castlereagh Highway/ Invincible Colliery Access intersection also has a number of perceived safety risks. Outbound trucks from the Ivanhoe North Colliery (immediately opposite the Invincible Colliery Access) are currently not permitted to turn right onto the Castlereagh Highway (to head south towards Lithgow). Rather, they are required to proceed through the intersection, and perform a u-turn within Coalpac's property so that they can turn left onto the Highway. This requirement was in response to safety concerns with slow moving egressing trucks from Ivanhoe North and the poor entering sight distance from that side of the highway. The scheduled cessation of mining operations at Ivanhoe North Colliery would effectively address this safety risk.

There have also been anecdotal reports of hazardous overtaking practices in the southbound direction of the Castlereagh Highway at the Invincible Colliery Access. The lane and pavement markings, which were altered to accommodate the Ivanhoe North Mine access, resulted in removal of part of the overtaking lane that previously existed. With the reduction in length of the overtaking lane, the issue occurs when loaded southbound trucks slow down to climb the uphill grade (and on occasion, decelerate to turn left into Invincible Colliery) and faster moving traffic cross the centre line to pass around these vehicles. The overland conveyor to MPPS would address this existing safety risk. In addition, the construction of the Castlereagh Highway overbridge will enable trucks to cross the highway and access the ICPP without needing to use the Castlereagh Highway. As such, the overbridge would also partially address this existing safety risk.

[2] The number of MVKTs was determined by adopting an AADT of 4000 vehicles/day based on Figure 2-1, and an approximate length of 17km for the section of Castlereagh Highway between Cullen Bullen and the Great Western Highway, near Lithgow.

The generally accepted measure of crash exposure is million-vehicle-kilometres-travelled (MVKT). That is, the more kilometres a vehicle travels along, the more its occupants would be exposed to a crash event. Similarly, the greater the traffic volume, the greater the probability of a crash as there are a greater population of road users "available" for a crash. As such, crash rates are often expressed as crashes per MVKT to allow for more widespread comparison of road safety performance on a route-by-route basis.

5.3 Likely future conditions

5.3.1 Forecast road safety performance for the ultimate operational scenario

Table 5-1 shows the forecast changes in MVKT (crash exposure) in the sections of the Castlereagh Highway between (i) Cullen Bullen and Boulder Road, and (ii) Boulder Road and the Great Western Highway. This table shows that under the Project conditions, there would be an increase in crash exposure by 0.16MVKT/year for the section of the Castlereagh Highway between Cullen Bullen and the Great Western Highway.

Assuming all things equal and that a crash rate of 0.29 crashes/MVKT would remain constant, there would be an increase of 0.04 crashes per year (the equivalent of one additional crash every 25 years). As this is not a significant increase, it is expected that this could be managed through truck driver induction programs and a traffic management plan for the Project. Such plans would specify how and where truck drivers are to enter and egress from the site, and other general rules for operating trucks as part of the coal and sand haulage operations.

The analysis of existing road safety conditions (Section 5.2) indicated that all four crashes at the Castlereagh Road/Boulder Road intersection involved trucks. As the Project would no longer generate truck movements to MPPS, this would reduce the volume of right-turning trucks into, and left-turning trucks out of Boulder Road onto the Castlereagh Highway. This is expected to significantly reduce the intersection's crash potential.

It should also be noted that in 2012, Ivanhoe North Colliery (opposite Invincible Colliery) will cease mining operations. This will also reduce the truck traffic generated at the Castlereagh Highway/Invincible Colliery intersection. As noted in Section 5.2, outbound trucks from Ivanhoe North are currently required to proceed through the intersection and into the Invincible Colliery before u-turning and proceeding south towards MPPS and Lithgow. With the cessation of mining activities in 2012, these truck movements will no longer be generated. This would also significantly reduce safety risks for all road users at this intersection.

The planned construction of the overpass bridge linking the two sides of the mine will have a number of road safety benefits including:

(i) Removal of right-turning movements from the Cullen Valley private haul road to Castlereagh Highway and the opposing left-turn movement into the Cullen Valley haul road.

(ii) Removal of left-turning movements from the Castlereagh Highway to Invincible Colliery Access and the opposing right-turning movements onto the Castlereagh Highway. The removal of the left-turning movements from Castlereagh Highway will also address the hazardous overtaking risks described in Section 5.2.

Suggested measures to mitigate against the increased crash exposure between Boulder Road and the Great Western Highway are described in Section 5.4.

Table 5-1 Differences in crash risk in pre and post-Consolidation (ultimate scenario) conditions.

Source	Base case conditions	Project conditions	Differences in crash exposure
Product coal and product sand hauls.	146,700 truck movements generated per year All 146,700 trucks would use the 4km section of Castlereagh Highway between Cullen Bullen and Boulder Road. Crash exposure = 0.587 MVKT/year. 30,000 truck movements would use the 13km section of Castlereagh Highway between Boulder Road and the Great Western Highway. Crash exposure = 0.39MVKT/year. Total crash exposure = 0.97 MVKT/year.	30,000 truck movements per year to other customers south of Lithgow. 37,100 truck movements per year to Sydney based sand customers. Crash exposure for 4km section of Castlereagh Highway between Cullen Bullen and Boulder Road = 0.268MVKT/year. Crash exposure for 13km section of Castlereagh Highway between Boulder Road and the Great Western Highway = 0.872MVKT/year. Total crash exposure = 1.14 MVKT/year.	Changes in crash exposure: Between Cullen Bullen and Boulder Road = 0.319 fewer MVKT per year. Between Boulder Road and the Great Western Highway = 0.482 more MVKT per year. Total changes: = 0.16 more MVKT per year

5.3.2 Other safety issues

Overhead structures on the public road network

The Project will include the construction of the Castlereagh Highway overbridge linking both sides of the Project, as well as the overland conveyor which will connect the ICPP to MPPS. The Castlereagh Highway overbridge will be located approximately 2km north of the Cullen Bullen township, whilst the overland conveyor will cross the Castlereagh Highway near Boulder Road. These structures will be designed and constructed to meet road user safety requirements at the points where they cross the public road network as described below:

- **Vertical clearance:** The structures will be built to meet or exceed the minimum vertical clearance requirement for the route. This is typically 5.3m or the vertical clearance of the nearest overhead structure (ie. bridge immediately south of Boulder Road). The vertical clearance requirements will be confirmed in consultation with the RTA.
- **Structural supports:** The structures will be built to carry the design loads plus any tolerances required by the relevant RTA bridge design standards.
- **Safety barrier requirements:** Any non-frangible bridge support (ie. pier, retaining wall) that is within the clear zone would be risk assessed to determine the need for a safety barrier. Any safety barrier required would be built in accordance with the RTA model drawings.
- **Road occupancy:** Coalpac will consult the RTA regarding any lane or road occupancy requirements for the construction of these structures.

Provisions for safe driving on internal roads

All new internal roads will generally be designed to meet the functional requirements of the road. This includes:

- Sufficient width to accommodate the swept paths of the nominated design vehicle;
- Sufficient roadbase or pavement strength to support the design vehicle for a nominated design life.
- Sufficient drainage to ensure that surface water is drained away from the roadway.

5.4 Recommended mitigation measures for road safety impacts

Although the current truck haulage operation to MPPS would be replaced by the overland conveyor in the Project case, the traffic volumes generated by the longer product coal hauls (to other domestic customers) and product sand would lead to increased crash risk exposure along the section of the Castlereagh Highway between Cullen Bullen and the Great Western Highway. If more of these truck trips could be generated in the off-peak periods (ie. outside the peak periods described in Section 2.3 and Figure 2-5), the overall crash risk exposure would be limited. This is because the additional truck traffic on this section of the Castlereagh Highway would be generated during periods when there is relatively fewer traffic on the roads. Therefore, there would be a reduced range of available crash types that the truck drivers would be exposed to. For example, the risk of multiple (more than one) vehicle crashes would be reduced as there would be less traffic available to be “involved” in such a crash.

For the interim period until the overbridge (linking both sides of the Project) is constructed and opened, trucks associated with the Cullen Valley-ICPP hauls will continue to use the Castlereagh Highway. These trucks would be required to turn left from the Castlereagh Highway to the Invincible Colliery. As such, the following options could be considered to mitigate the

safety risks identified in Section 5.2 of this report. These are appropriate mitigation treatments over an interim period until the overbridge is constructed:

- Improve the delineation of the centreline with raised pavement flaps or a klemfix median;
- Install additional signs advising of the commencement of the overtaking lane (ie. “overtaking lane ahead”) immediately to the south of the Invincible Colliery Access; and
- Once the Ivanhoe North Colliery ceases mining operations, the left and right-turn lanes into that facility may become redundant. It may be possible to adjust the linemarking to provide an indented (protected) left-turn lane into Invincible Colliery.

6 RAIL NETWORK PERFORMANCE AND SAFETY IMPLICATIONS

6.1 Existing conditions and constraints

Rail transportation of coal products from the Western Coalfields to Port Kembla typically rely on two routes. These are:

- **Primary route:** (i) Southbound along the Wallerawang - Gwabegar Line, (ii) eastbound from Wallerawang to Lidcombe via the Blue Mountains, (iii) southbound from Lidcombe to Campsie via the Enfield Marshalling Yards, (iv) eastbound from Campsie to Tempe via a dedicated goods line, (v) southbound from Tempe to Port Kembla.
- **Secondary route:** (i) Southbound along the Wallerawang - Gwabegar Line, (ii) eastbound from Wallerawang to Harris Park via the Blue Mountains, (iii) southbound from Harris Park to Moss Vale via Liverpool, (iv) Eastbound from Moss Vale to Unanderra, (v) northbound from Unanderra to Port Kembla.

There are a number of physical and operational constraints along these routes such as the limited number of train paths through the Blue Mountains and the steep grades and associated tight horizontal curves of the eastern and western escarpments of the Blue Mountains (DOTARS, 2007c). These place restrictions on the train length and speeds. The section of the Western Line to the west of St Marys only contains two tracks and hence limits passing opportunity when there are conflicts with all-stop passenger services.

The primary route would be the preferred route as it is shorter in distance. The train movements from the eastern side of the Blue Mountains to Tempe are aided by the freight lines through Rookwood and the Enfield Marshalling Yards as well as the dedicated goods line between Campsie and Port Botany. However, the limited train paths available on the Illawarra Line due to the high demand for passenger services means there are time restrictions on the haulage operations. As a result, there are no coal trains on the Illawarra Line during the morning and evening commuter peak periods. This equates to seven hours per weekday when coal trains do not operate along this route. However, there is reportedly spare capacity during the non-peak periods with flexibility to add more train paths (DOTARS, 2007c).

The Illawarra Line is restricted to two tracks south of Hurstville. Furthermore, Sutherland is frequently used as a terminus station for many passenger services and the maintenance workshops at Mortdale also generate additional train traffic. The physical constraints in the section between Hurstville and Wollongong include steep grades between Como and Sutherland, as well as to the south of Waterfall, and a 1.9km one-track section through the Scarborough Tunnel.

The secondary route has a longer haul distance and hence is used less frequently such as when there are track possessions and maintenance works along the primary route. The steep grades of the Illawarra escarpment also require heavier westbound trains to be banked with additional locomotives (DOTARS, 2007a). The track from the Sydney metropolitan area to the Southern Highlands is shared with urban and regional passenger services, which have priority over freight trains (DOTARS, 2007b). Despite this there are some advantages with this route such as:

- It bypasses the Tempe to Port Kembla section of the primary route which is heavily constrained by lack of train paths.
- The Moss Vale to Unanderra section of the network has ample spare capacity and is currently under-utilised. The freight traffic generated along this line includes coal, flour, grain and limestone.

- There are potential benefits that may arise from the future South Sydney Freight Line (SSFL). The SSFL will include a dedicated freight line adjacent to the passenger line between Sefton and Macarthur. This will provide more opportunities for freight trains to bypass the slower passenger services. This is irrespective of whether the coal trains head south towards Moss Vale via Merrylands, or via Sefton (by turning right at the Lidcombe Junction) as both routes will pass through part of the SSFL. At the time of writing, construction work on the section of SSFL between Leightonfield and Sefton had commenced.
- There are potential benefits that may arise from the proposed Maldon to Dombarton rail link. This 35km rail link would commence at Maldon (near Picton) and head south-east across the Illawarra escarpment to connect with the eastern part of the existing Moss Vale to Unanderra rail corridor. This route would significantly reduce the haul distance as it would bypass the Picton to Moss Vale portion of the route, as well as most of the Moss Vale to Unanderra portion. This upgrade would make the secondary route more cost competitive from a haulage distance perspective, as well as an operational perspective. This project is still in planning phase.

Port Kembla Coal Terminal (PKCT) is located immediately south of Wollongong CBD and handles approximately 10Mtpa of coal (based on 2005-06 figures in DOTARS, 2007a). The theoretical coal-handling capacity of PKCT is 15Mtpa (ACIL Tasman, 2009) indicating that the port has spare capacity for increased coal export quantities. Coal trains are restricted to a maximum length of 850m at the PKCT, and could therefore accommodate those proposed for this Project.

There are growing demands on Port Kembla due to the transfer of import tasks from Port Jackson, East Darling Harbour and Glebe including container, vehicle importation and break-bulk freight. This will inevitably lead to increased pressure on the access road and rail networks surrounding the Port which may impact the long-term capacity of PKCT and the coal supply chain.

6.2 Known network improvements and improvement strategies

As stated above, there are a number of proposed improvements to the wider rail network which may benefit the operation of coal trains between the Western Coalfields and Port Kembla. These include:

- The Southern Sydney Freight Line (SSFL) which will include a dedicated freight track between Sefton and Macarthur. If coal trains utilise this line there will be more opportunities to pass around the slower moving passenger services;
- The Maldon to Dombarton rail link is a 35km link between Maldon (near Picton) to Unanderra. This link will effectively bypass the section of the network between Picton and Moss Vale, and Moss Vale to Unanderra. This “short cut” will significantly reduce the haulage distance along the secondary route and make this route more competitive compared with the Illawarra Line;
- The proposed upgrade of the Enfield Marshalling Yards to an Intermodal Logistics Centre (ILC) will also lead to improvements in parts of the rail network, particularly between Port Botany and Enfield. If coal trains are to continue to use the primary route described above, the Enfield ILC project will also benefit these operations; and
- Port Kembla is also undergoing substantial redevelopment and expansion to handle the increase in throughput including the construction of Multi-purpose Berth Number 3 and the development of Eastern Basin Number 4.

In addition to these proposed network improvements, there are a number of known changes to the demand for train paths, particularly on the Wallerawang-Gwabegar Railway Line. Baal Bone Colliery will be ceasing operations in the near future. This coal project currently generates two up to train paths a day.

6.3 Rail transport generation

The Project would produce approximately 1Mtpa of coal product for export via Port Kembla. Assuming a maximum payload of each train of 3,465 tonnes/train[3], this equates to 290 one-way train movements per year. This equates to 1 one-way train movement per day, or 2 movements per day when accounting for the unladen mine-bound trip, as well as the laden port-bound trip.

Based on the information provided in Section 6.1, the additional two train paths required per haulage day could be accommodated as long as these are outside the morning and evening peak periods on weekdays.

6.4 Recommended mitigation measures

As outlined in Section 1.2, the Project would include the construction of a rail siding on the Wallerawang-Gwabegar Railway Line. This will enable coal trains to be loaded directly from the Project site without any need for truck haulage on public roads.

As outlined in Section 6.3, the proposed production of 1Mtpa of export quality coal product would generate 290 one-way train trips per year. The two train paths required per haulage day are not envisaged to have a significant impact on the rail network. Despite this, Section 6.1 and 6.2 described some known network improvements that would improve coal haulage operations by rail by either the primary route (via the Illawarra Line) or the secondary route via the Southern Highlands.

It is recommended that Coalpac continue to liaise with the ARTC and the DoP regarding the planning of these rail network improvements. ARTC's programming of these infrastructure improvements would be heavily reliant on the information provided by the individual businesses that generate the demand for train movements. These include all coal mines, cement manufacturers and other agriculture and light/heavy industries in the Western Coalfields area.

[3] Based on an assumed 45 wagons per train, and 77 tonne payload per wagon.

7 CONCLUSIONS

This Traffic and Transport Impact Assessment has included an assessment of the following:

Construction traffic impacts

The intersection simulation model (SIDRA) indicated that there would not be significant impacts to the three study intersections as a result of the construction stage of the mine.

Operational traffic impacts

The Project includes several components that will significantly offset impacts of generated traffic. These include an overbridge for the Castlereagh Highway which will link the two sides of the Project, the rail siding which will link into the Wallerawang-Gwabegar rail line, and the proposed overland conveyor from the ICPP to MPPS. These will significantly reduce the generation of road transportation. Despite the proposed increase in product coal yield from 2.2Mtpa to 3.5Mtpa, at least 87% of the total product coal will be transported by modes other than trucks (ie. train and overland conveyor). The sand haulage operations were also proven through the traffic modelling to have little risk with respect to traffic impact.

The traffic modelling indicated that there would not be a substantial difference in the performance of the three study intersections for the Project compared with the base case. However, to further manage any potential impacts from operational traffic, the following measures are recommended:

- Consideration should be given to building the overland conveyor before any substantial increase in the product coal yields. This will immediately offset the demand for road hauls to MPPS.
- Consideration should also be given to building the overpass bridge between the two sides of the project as soon as possible. This will have several benefits including:
  - (i) Consolidating most of the access and egress movements to and from the Project at a single point;
  - (ii) Reduced truck trips on the Castlereagh Highway between Cullen Valley and Invincible as the ICPP-hauls could be via the overbridge, and
  - (iii) Reduced truck traffic and associated noise adjacent to the village of Cullen Bullen.
- Although the truck traffic generated by the residual product coal yield and the product sand yield for the Project would not be substantial, consideration could be given to hauling more of this product in the off-peak periods. This would generate truck traffic on the network at times when there is more spare capacity and also less safety risk due to fewer vehicles on the road.

Road safety impacts

Although the truck haulage operation to MPPS would be replaced by the overland conveyor, the traffic volumes generated by the longer product coal hauls (to other domestic customers) and product sand would lead to a marginal increase in crash risk exposure along the section of the Castlereagh Highway between Cullen Bullen and the Great Western Highway. This study recommends that more of these truck trips should be scheduled/dispatched in the off-peak periods as this would limit the overall crash risk exposure. This is because the truck traffic would be generated during periods when there are relatively fewer vehicles on the roads. Therefore, there would be a reduced range of available crash types that the truck drivers would be exposed to.

For the interim period until the overbridge (linking both sides of the Project) is constructed and opened, trucks associated with the Cullen Valley-ICPP hauls will continue to use the Castlereagh Highway. The deceleration of southbound trucks climbing the uphill grade near the Invincible Colliery Access may continue to encourage the hazardous overtaking behaviour as described in Section 5.2. As such, the following options could be considered and are appropriate mitigation treatments over an interim period until the overbridge is constructed:

- Improve the delineation of the centreline with raised pavement flaps or a klemfix median;
- Install additional signs advising of the commencement of the overtaking lane (ie. “overtaking lane ahead”) immediately to the south of the Invincible Colliery Access; and
- Once the Ivanhoe North Colliery ceases mining operations, the left and right-turn lanes into that facility may become redundant. It may be possible to adjust the linemarking to provide an indented left-turn lane into Invincible Colliery.

Rail network impacts

The research conducted as part of this Traffic and Transport Impact Assessment indicated that there are a number of existing opportunities and constraints on the rail network between the Project and Port Kembla. These are outlined in Section 6.1 and 6.2 of this report.

Whilst the two generated train paths per day are not envisaged to significantly impact the rail network, the following mitigation/ management measures are recommended:

- Continue to liaise with the ARTC regarding the planning and schedule of the rail network improvements including the Enfield ILC project, SSFL, Maldon to Dombarton link and Port Kembla expansion.
- Maintain flexibility for using both the primary route via the Illawarra Line as well as the secondary route via the Moss Vale to Unanderra route.

8 REFERENCES

ARTC (2010) *Rail Network Map*.

ACIL Tasman (2009) *Vision 2020 Project: The Australian Minerals Industry's Infrastructure Path to Prosperity - An assessment of industrial and community infrastructure in major resources regions.*

DOTARS (2007a) *Sydney–Wollongong Corridor Strategy - Building our National Transport Future*.

DOTARS (2007b) *Sydney–Melbourne Corridor Strategy - Building our National Transport Future*.

DOTARS (2007c) *Sydney–DUbbo Corridor Strategy - Building our National Transport Future*.

Hyder (2010) *Invincible Modification Project – Traffic Impact Assessment*.

Hansen Bailey (2010a) *Locality map*.

Hansen Bailey (2010b) *Coalpac Consolidation Project – Preliminary Environmental Assessment*.

RTA (2010a) *Coalpac Consolidation Project (10_0178); Director General's Requirements*. Letter with no date.

RTA (2004) *Rural road crash rates by road stereotype*.

RTA (2002) *Guide to Traffic Generating Developments*.

NSW Planning (2010) Coalpac Consolidation Project (10_0178) *); Director General's Requirements.* Letter dated 16 December 2010.

APPENDIX A – RELEVANT PLANNING APPROVALS DOCUMENTS

The relevant Planning Approvals documents that were used to set the scope of this Traffic and Transport Impact Assessment have been described below:

Director General's Requirements (DGRs)

On 16 December 2010, NSW Planning issued the Director General's Requirements (DGRs) for the Coalpac Consolidation Project. The following DGRs were stated with relevance to traffic and transport issues.

Relevant DGRs	Comment/ qualification
Economic justification of transporting coal and sand products on public roads, including an assessment of the costs and benefits of alternative transport methods.	This has not been covered in this Traffic and Transport Impact Assessment Report. This is covered elsewhere in the EA.
An assessment of the potential traffic impacts from the proposal on the safety and efficiency of the rail and road networks.	This has been covered in Sections 3.0, 4.0, 5.0 and 6.0 of this Traffic and Transport Impact Assessment.
A description of the measures that would be implemented to upgrade and/or maintain rail and road infrastructure over the life of the project.	This has been covered in the recommended mitigation measures in Sections 4.2, 5.4 and 6.4 of this Traffic and Transport Impact Assessment.

RTA letter to NSW Planning

In their letter entitled Coalpac Consolidation Project (10_0178); Director General's Requirements, the RTA recommended that the following issues be addressed in the Environmental Assessment.

RTA recommended issues	Comment/ qualification
A detailed plan identifying locations and layout of the proposed accesses to the Castlereagh Highway including the intersection of Castlereagh Highway and: ▪ The haul road; ▪ The access to Invincible Colliery; and ▪ Boulder Road.	Detailed plans/ engineering drawings have not been included in this report as these would accompany a Works Authorisation Deed/ agreement established between Coalpac and the road asset owner. A detailed location plan and a series of conceptual crossing plans are included in the main EA volume.
Proposed access treatments should be identified and be in accordance with the RTA Road Design Guide including safe intersection sight distance.	The RTA's Road Design Guide has been the reference design standard for the road safety and site assessments carried out on the roads and intersections of relevance to this study. Any management/ mitigation measures recommended which involved road design improvements have been in accordance with the road design requirements specified in the RTA's Road Design Guide.

RTA recommended issues	Comment/ qualification
Accesses to and intersection of the road network should be minimised by careful route selection and utilisation of existing accesses as far as reasonably practicable.	This has been considered in the relevant assessments as well as management/ mitigation measures recommended.
With regard to the conveyor, a detailed plan identifying the proposed location and configuration of: ▪ Any public road crossings by the conveyor, particularly crossing of the Castlereagh Highway, taking into consideration the standard RTA requirements for classified road crossing; ▪ Conveyor infrastructure over or under the road or within the road reserve of a classified road; ▪ Permanent or temporary crossing, connection or access to a classified road by the conveyor or any associated infrastructure such as a service road.	This has been covered in Section 5.3.2.
Internal road layout demonstrating satisfactory provision for parking and circulation of heavy and light vehicles.	This has been covered in Section 5.3.2.
Clarification of whether any heavy vehicles will be travelling from Cullen Valley Mine to Invincible Colliery or vice versa, for instance for the purpose of cleaning coal before supply to market or carting fill. If so, details of the proposed transport route between mines and the ultimate destination of any such vehicles detailing any crossing or use of public roads.	All traffic between the Mines will use the proposed overbridge between the two mines. Interim mitigation measures have been suggested in this report.
The hours of operation, shift times and numbers of staff servicing the sites at those times including employees and contractors.	This has been discussed in Section 3.0 with respect to traffic generation.
A works schedule setting out the construction requirements for all phases of the project's life including the materials and machinery required.	Section 3.1 of this report discusses the construction program.
A traffic impact study in accordance with the methodology set out in the RTA Guide to Traffic Generating Developments including an assessment of the following issues: ▪ Those matters listed in 7.9.3 of the Preliminary Environmental Assessment; ▪ The origin and destination of all materials and machinery; ▪ Any over-mass or over-dimension loads; ▪ Evidence that the shortest and least trafficked route has been given priority for the movement of materials and machinery to minimise the risk and impact to other motorists so far as is reasonably practicable.	Matters listed in 7.9.3 of the PEA have been tabled later in this Appendix. The origin and destination of all materials and machinery have been discussed in Section 3.0 with respects to traffic generation and distribution. Details of the haulage route have been discussed in Section 3.0. With respect to the Project-MPPS generated traffic, the nominated haul route is the only road transport route available. With respect to all other hauls, evidence of the suitability of the route has been provided in terms of maximum allowable load limits and road function.

RTA recommended issues	Comment/ qualification
The quantity of product, coal and sand to be transported by road broken into: ▪ All phases of the project's life; ▪ The origin and destination of all product; ▪ The volumes and types of vehicles transporting the product; ▪ An hourly distribution of heavy and light vehicle trips on public roads.	These have been discussed in Section 3.0 of this report with respect to traffic generation and distribution.
The product to be transported by road in the event of the conveyor system not operating including: ▪ The trigger point for resorting to road transport; ▪ The estimated length of time road transport may be required; ▪ Road inspection and maintenance plan to ensure the transport route can safely and efficiently cater for any such intermittent use.	As conveyor outages would not be a frequent occurrence and any traffic implications would only be short-term (and similar to the current conditions), these have not been covered in this report.
Staff and contractor ▪ Numbers and number per shift; ▪ Shift times; ▪ Hourly traffic distribution; ▪ Parking.	These have already been mentioned as a recommended study scope item above.
The crash history of the road network within the area.	This is covered in Section 5.0.
Local climate conditions that may affect road safety for vehicles used during construction and operation of the project.	This has been discussed in Section 5.0.

Preliminary Environmental Assessment

Section 7.9.3 of the Preliminary Environmental Assessment recommended that the Traffic and Transport Impact Assessment include the following scope.

PEA recommended scope	Comment/ qualification
Evaluation of the existing road transport environment (e.g. road hierarchy, road conditions, traffic conditions and safety).	This is covered in Section 5.1.
Review and analysis of background traffic counts and the analysis of key intersections (with additional traffic counts undertaken as required).	This is covered in Section 2.0.
Assessment of the capacity of the affected road network to cater for the traffic volumes proposed for the Project. This will necessarily involve assessment of the capacity of affected public roads and intersections in accordance with Austroads guidelines.	This is covered in Section 4.0.

PEA recommended scope	Comment/ qualification
Identification of impacts for the Project relating to any works deemed to be required on the public road network, to ensure safety requirements continue to be met.	This is covered in Section 5.4.
Quantification of predicted increases in traffic during the construction and operational phases of the Project (including the consideration of predicted future traffic flows).	This is covered in Sections 3.0 and 4.0.
Assessment of potential impacts on traffic conditions, levels of service and intersection operation during peak periods of the Project.	This is covered in Sections 3.0 and 4.0.
The assessment other local traffic generating developments to determine cumulative impacts.	This is covered in Section 4.0.
Assessment of the existing rail transport environment and impacts of the operation of the proposed rail siding.	This is covered in Section 6.0.
Identification of any impact mitigation measures necessary for the Project.	This is covered in Section 4.2, 5.4 and 6.4.