ATLAS-CAMPASPE
Mineral Sands Project
ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D 〉 ROAD TRANSPORT ASSESSMENT

CRISTAL Resource Strategies

Atlas-Campaspe
Mineral Sands Project
Road Transport Assessment

transportation planning, design and delivery

12S1252000 30/11/12

GTAconsultants

Atlas-Campaspe

Mineral Sands Project

Road Transport Assessment

Issue: A 30/11/12

Client: Cristal Mining Australia Limited
Reference: 12S1252000
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Quality Record

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1. Introduction

1.1 Background

GTA Consultants has prepared an assessment of the road transport implications of the proposed Atlas-Campaspe Mineral Sands Project (the Project) for Cristal Mining Australia Limited (Cristal Mining). The Project includes the development of a mineral sands mining operation (herein referred to as the Atlas-Campaspe Mine), together with the construction and operation of a rail loadout facility located near the township of Ivanhoe (herein referred to as the Ivanhoe Rail Facility).

1.2 Purpose of this Report

The study has been undertaken with reference to the road-based aspects of the traffic and transport components of the Director-General's Requirements (DGRs) for the Project, which require:

Traffic and Transport *– including:*

- *accurate predictions of the road and rail traffic generated by the project;*
- *an assessment of the capacity of the rail network to accommodate the transport of concentrate; back-loaded waste material and product;*
- *an assessment of potential traffic impacts on the safety and efficiency of the road network;*
- *a detailed description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road and rail networks in the surrounding area over the life of the project.*

The rail implications of the Project have been assessed separately by Cristal Mining in the main text of the Environmental Impact Statement (EIS). As specified in the DGRs, the assessment has been prepared in accordance with the New South Wales (NSW) Roads and Traffic Authority's (RTA) *Guide to Traffic Generating Developments* (2002), and where relevant, makes reference to the RTA's *Road Design Guide* (1996). It is noted that while the DGRs refer to the *Road Design Guide* (RTA, 1996), NSW Roads and Maritime Services (RMS) (formerly RTA), together with all road agencies across Australia, has agreed to adopt the Austroads guides. The Austroads guides and the Australian Standards referenced in them are now the primary technical references for use within RMS. The Austroads *Guide to Road Design* and the accompanying RMS Supplement (RMS, 2011) are therefore the relevant reference rather than the *Road Design Guide* (RTA, 1996).

In addition, the issues raised by RMS in their letter to the NSW Department of Planning and Infrastructure (DP&I) (dated 21 December 2011) have been considered and addressed during the preparation of this assessment.

2. Project Description

2.1 Site Location

The proposed Atlas-Campaspe Mine is located approximately 80 kilometres (km) north of Balranald, NSW and 270 km south-east of Broken Hill, NSW (Figure 1). The proposed Ivanhoe Rail Facility is located approximately 135 km north-east of the Atlas-Campaspe Mine (Figure 1).

2.2 Project Summary

The Project would involve two main development components (Figure 1):

1. Construction and development of infrastructure for mining operations at the Atlas and Campaspe deposits (the proposed Atlas-Campaspe Mine) (Figure 2)
2. Construction and operation of the Ivanhoe Rail Facility (Figure 3).

The Project would integrate with currently existing/approved Cristal Mining operations, including (Figure 1):

- Broken Hill Mineral Separation Plant (the MSP) located approximately 270 km north-west of the proposed Atlas-Campaspe Mine
- Snapper Mine located approximately 105 km to the west of the proposed Atlas-Campaspe Mine
- Ginkgo Mine located approximately 100 km to the west of the proposed Atlas-Campaspe Mine.

The proposed life of the Project is approximately 20 years, commencing approximately 1 July 2013 or upon the grant of all required approvals.

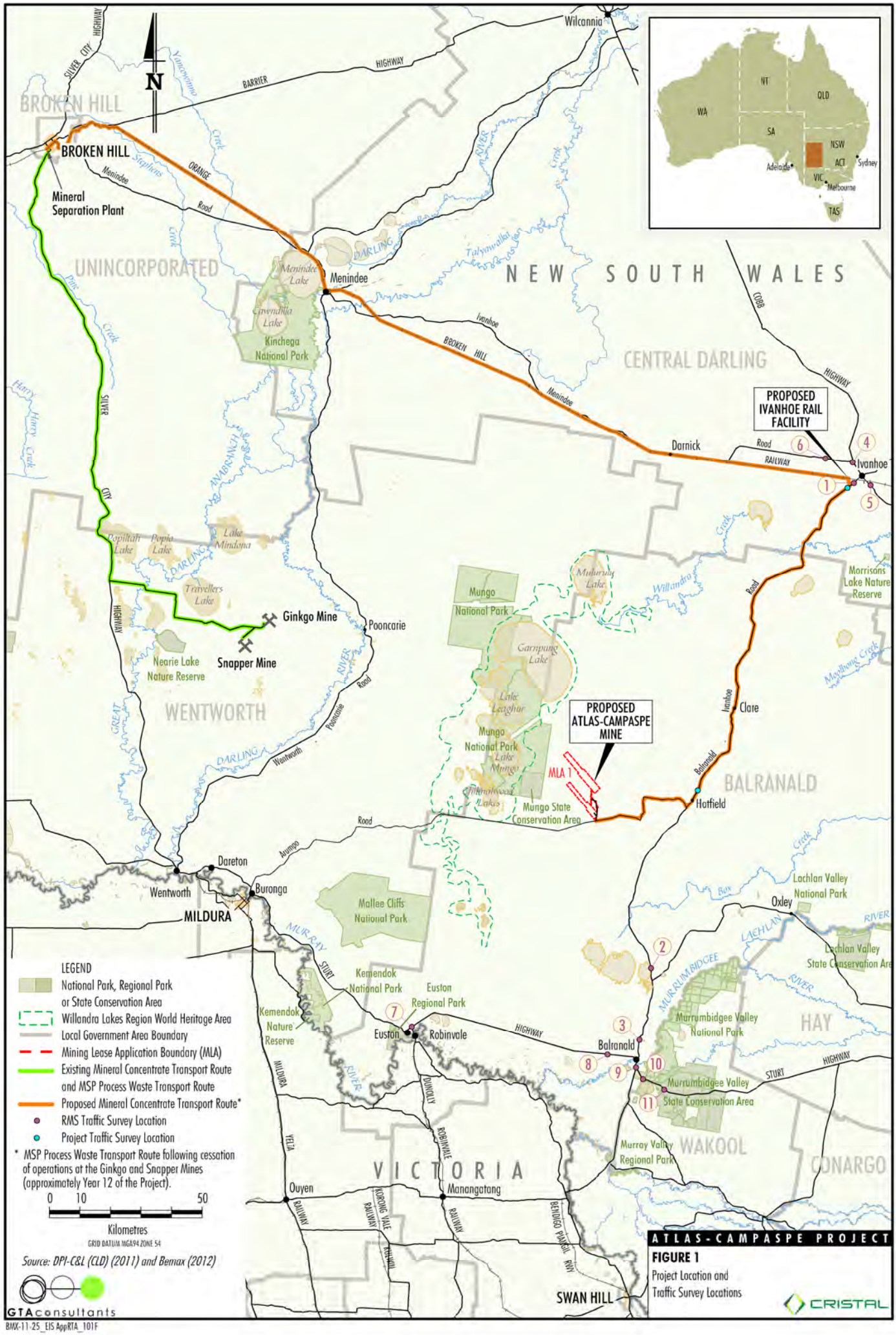
The activities associated with the two main development components of the Project are summarised below.

2.2.1 Atlas-Campaspe Mine

The activities associated with the development of the Atlas-Campaspe Mine component of the Project are summarised below:

- ongoing exploration activities
- sequential development and operation of two separate mineral sands ore extraction areas within the Mining Lease Application 1 area
- use of conventional mobile equipment to mine and place mineral sands ore into dry mining unit(s)[1] (DMU) at a maximum ore production rate of up to 7.2 million tonnes per annum
- mineral processing infrastructure including the primary gravity concentration unit, salt washing facility and a wet high intensity magnetic separation (WHIMS) circuit
- mineral concentrate stockpiles and materials handling infrastructure (e.g. towers and stackers)

[1] Mining would use conventional open pit methods and would not involve dredge mining.



ATLAS-CAMPASPE PROJECT

FIGURE 1

Project Location and Traffic Survey Locations

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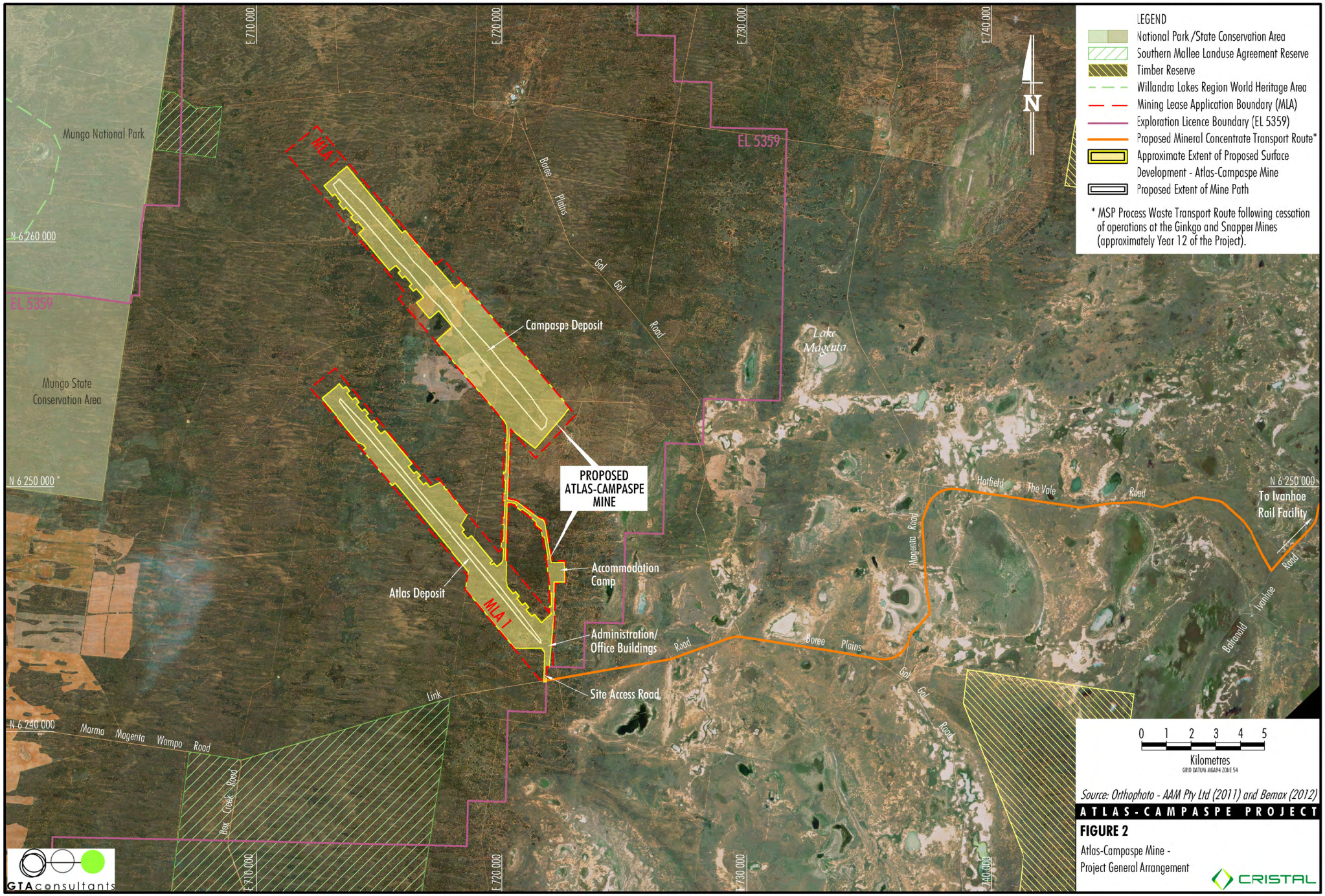

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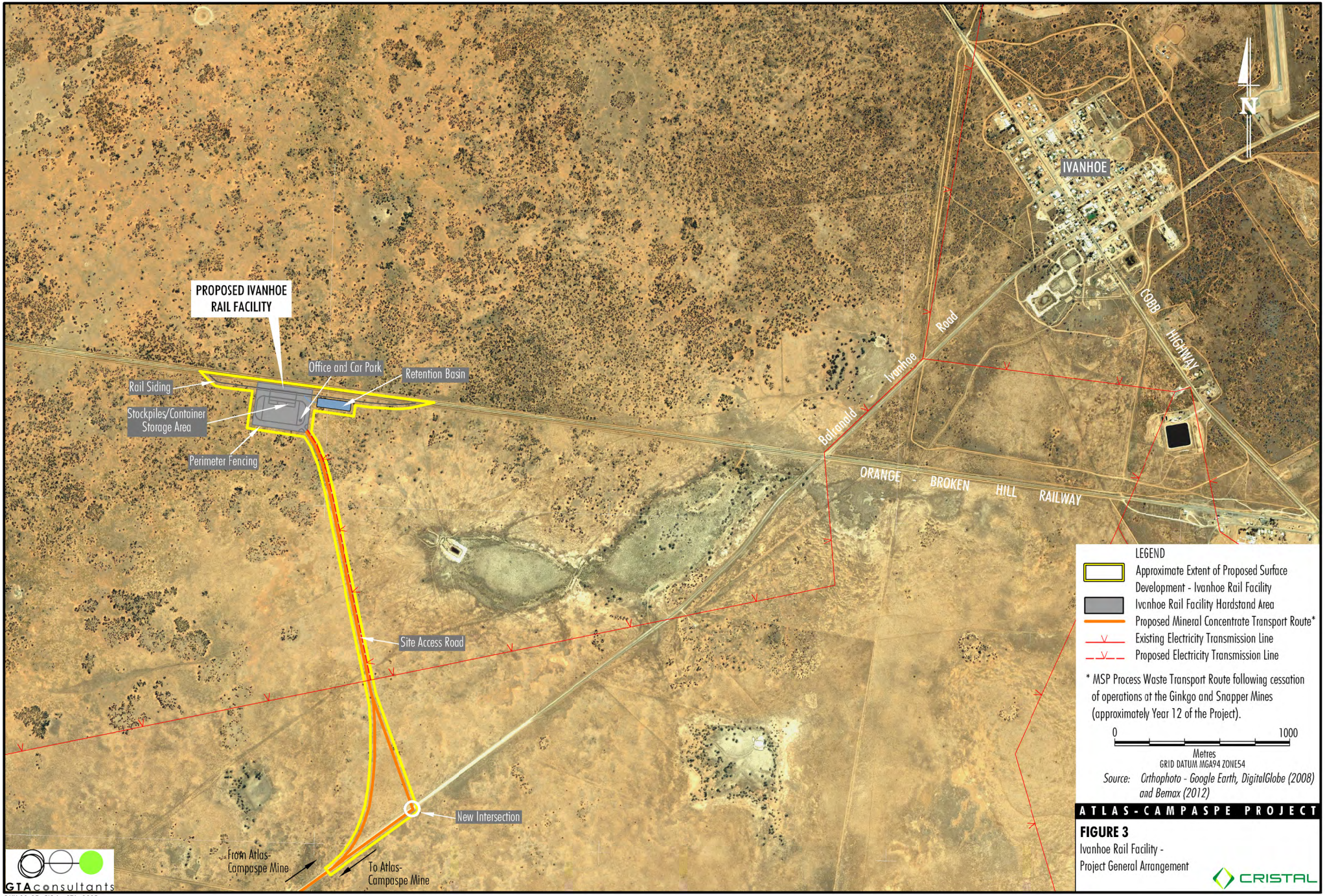
PROPOSED IVANHOE RAIL FACILITY
Office and Car Park
Retention Basin
Rail Siding
Stockpiles/Container Storage Area
Perimeter Fencing
Site Access Road
New Intersection
From Atlas-Campaspe Mine
To Atlas-Campaspe Mine
IVANHOE
Ivanhoe Road
Balranald
COBB HIGHWAY
ORANGE - BROKEN HILL RAILWAY
N
LEGEND
Approximate Extent of Proposed Surface Development - Ivanhoe Rail Facility
Ivanhoe Rail Facility Hardstand Area
Proposed Mineral Concentrate Transport Route*
Existing Electricity Transmission Line
Proposed Electricity Transmission Line
* MSP Process Waste Transport Route following cessation of operations at the Ginkgo and Snapper Mines (approximately Year 12 of the Project).
0
1000
Metres
GRID DATUM MGA94 ZONE54
Source: Orthophoto - Google Earth, DigitalGlobe (2008) and Bemax (2012)
ATLAS-CAMPASPE PROJECT
FIGURE 3
Ivanhoe Rail Facility - Project General Arrangement
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- progressive backfilling of mine voids with overburden behind the advancing ore extraction areas or in overburden emplacements adjacent to the mine path
- placement of sand residues and coarse rejects (and MSP process wastes[2]) following mineral processing to either the active mining area (behind the advancing ore extraction area) or in sand residue dams
- development of a groundwater borefield at the Atlas deposit and localised dewatering systems (bores, spearfields and trenches) at both the Atlas and Campaspe deposits, including associated pump and pipeline systems
- reverse osmosis (RO) plant to supply the salt washing facility and potable water
- progressive development of water storage dams, sediment basins, pumps, pipelines and other water management equipment and structures
- administration/office buildings, car parking facilities, workshop and stores
- on-site accommodation camp
- sewage treatment plant
- diesel powered generators, electricity distribution station and associated internal electricity transmission lines
- site access road, internal access roads and haul roads
- roadworks along the proposed mineral concentrate transport route to the Ivanhoe Rail Facility
- transport of mineral concentrates along the mineral concentrate transport route to the Ivanhoe Rail Facility
- road transport of MSP process waste[2] in sealed storage containers from the Ivanhoe Rail Facility to the Atlas-Campaspe Mine for subsequent unloading, stockpiling and placement behind the advancing ore extraction areas
- development of soil stockpiles and laydown areas
- monitoring and rehabilitation
- other associated minor infrastructure, plant, equipment and activities.

2.2.2 Ivanhoe Rail Facility

The activities associated with the development of the Ivanhoe Rail Facility component of the Project are summarised below:

- development of a rail siding for:
  - loading of train wagons with mineral concentrate for rail transport to the MSP via the Orange-Broken Hill Railway
  - unloading of MSP process waste in sealed storage containers (transported via the Orange-Broken Hill Railway) from train wagons[2]
- site access road and internal haul roads/pavements
- hardstand areas for mineral concentrate and MSP process waste[2] unloading, stockpiling/sealed container storage and loading
- a retention basin, drains, pumps, pipelines and other water management equipment and structures

[2] Following cessation of operations at the Ginkgo and Snapper Mines (approximately Year 12 of the Project).

- site office and car parking facilities
- extension to existing 11 kilovolt powerline
- monitoring, landscaping and rehabilitation
- other associated minor infrastructure, plant, equipment and activities.

Following cessation of operations at the Ginkgo and Snapper Mines (approximately Year 12 of the Project), MSP process waste in sealed storage containers would also be temporarily stored on-site prior to being loaded onto trucks and returned to the Atlas-Campaspe Mine.

2.3 Project Construction and Other Development Activities

2.3.1 Summary of Activities

The initial construction (or establishment) period (Year 1 of the Project) would be focussed on the development of the following Project infrastructure components:

- site access roads and internal access roads at the Atlas-Campaspe Mine and Ivanhoe Rail Facility
- on-site accommodation camp and sewage treatment plant at the Atlas-Campaspe Mine
- water supply infrastructure (including groundwater borefield, RO plant and associated pump and pipeline systems)
- power supply infrastructure (including diesel generators, electricity distribution station and transmission lines)
- fixed infrastructure areas (including administration/office buildings and car parking facilities, workshop and stores, services corridor and laydown areas)
- DMU assembly
- mineral processing infrastructure (including primary gravity concentration unit, salt washing facility and WHIMS)
- materials handling infrastructure (including pumps and pipelines for mineral sands ore, heavy mineral concentrate and process wastes, and towers and stackers for stockpiling mineral concentrates)
- off-path sand residue dams and process water storages
- roadworks along the mineral concentrate transport route (see below for more detail)
- Ivanhoe Rail Facility.

With the exception of approximately 37 km of existing unsealed roads between the Atlas-Campaspe Mine site access road and the intersection with the sealed Balranald-Ivanhoe Road (Figure 4), the remaining section of the approximate 175 km long proposed mineral concentrate transport route is approved to accommodate road trains (RMS, 2012a).

Roadworks along the 37 km section would therefore be required during construction of the Project and would include (Figure 4):

- upgrade of the intersection at Hatfield-The Vale Road and Balranald-Ivanhoe Road
- road widening and associated drainage works (up to approximately 23 metres (m) total width) along a 14.5 km section of Hatfield-The Vale Road to accommodate an unsealed two-lane road
- new intersections at Hatfield-The Vale Road and Magenta Road

- a new unsealed two-lane road formation (approximately 2 km long and up to approximately 23 m total width) between the new intersections at Hatfield-The Vale Road and Magenta Road
- road widening and associated drainage works (up to approximately 23 m total width) along two sections (approximately 2 km and 1 km, respectively) of Magenta Road to accommodate an unsealed two-lane road
- sealing and associated drainage works (up to approximately 21 m total width) along a 2 km section of Magenta Road to accommodate a two-lane road
- new intersections at Magenta Road and Boree Plains-Gol Gol Road
- a new unsealed two-lane road formation (approximately 2 km and up to approximately 23 m total width) between the new intersections at Magenta Road and Boree Plains-Gol Gol Road
- road widening and associated drainage works (up to approximately 23 m total width) along a 5.5 km section of Boree Plains-Gol Gol Road to accommodate an unsealed two-lane road
- road widening and associated drainage works (up to approximately 23 m total width) along a 8 km section of Link Road to accommodate an unsealed two-lane road
- a new intersection at Link Road and the Atlas-Campaspe Mine site access road.

The roadworks would be undertaken in consultation with Balranald Shire Council and in accordance with the requirements of the relevant RMS guidelines.

In addition to the above, a new intersection would be required for the Ivanhoe Rail Facility site access road off Balranald-Ivanhoe Road. The new intersection would be designed and constructed in accordance with the requirements of the relevant RMS guidelines and in consultation with Central Darling Shire Council.

2.3.2 Construction Workforce

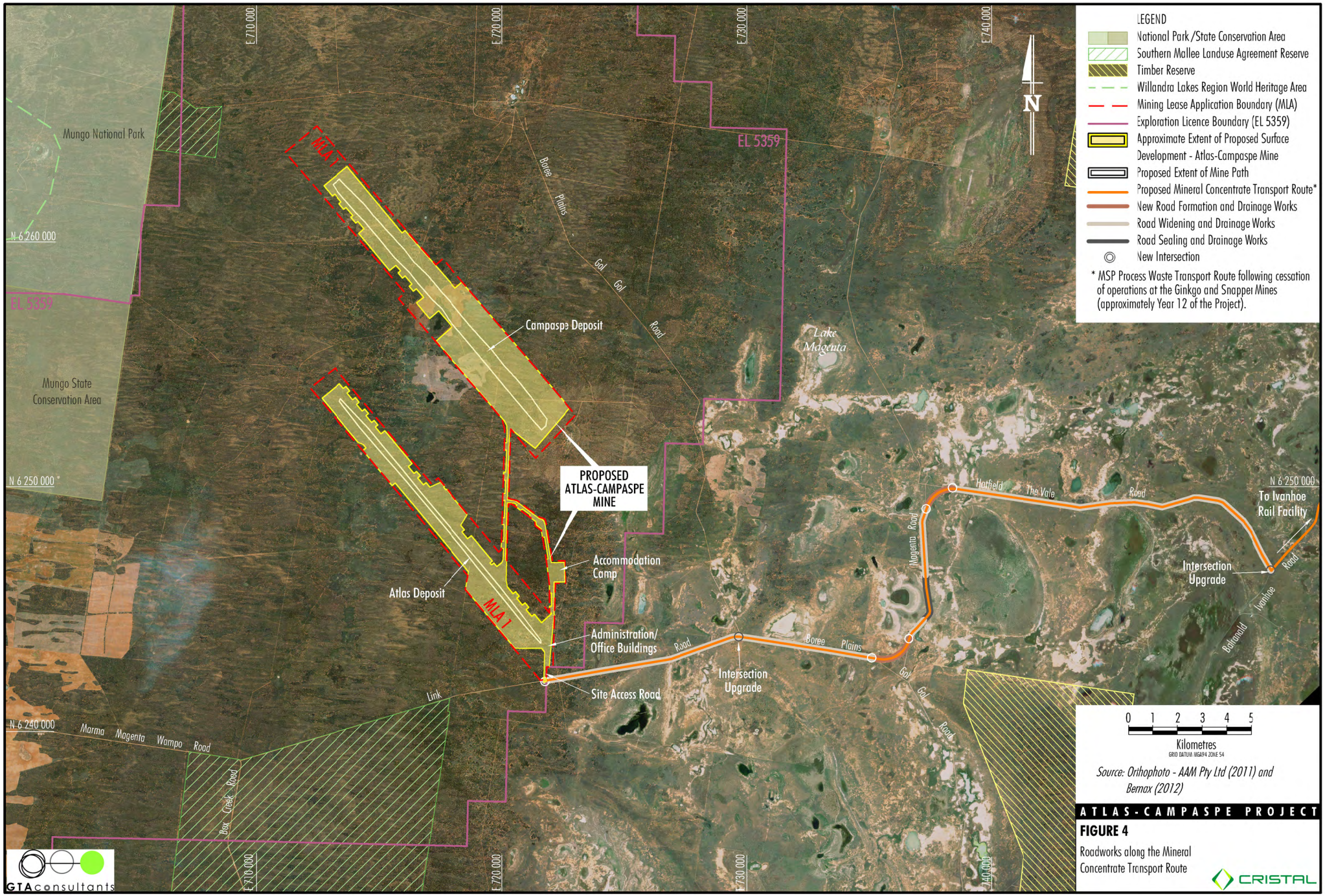
It is expected that construction activities would peak during Year 1 of the Project, requiring a short-term peak construction workforce of up to 300 people[3] for approximately two to three months, but averaging approximately 150 people during the initial construction phase.

Construction activities associated with the initial development of the Campaspe footprint at the Atlas-Campaspe Mine would also be required during the life of the Project (approximately Year 5), and would require a short-term construction workforce averaging approximately 100 people.

Construction would be undertaken up to 24 hours per day, seven days per week. Employees would generally work 12 hour shifts, starting at 7.00 am or 7.00 pm.

The majority of the construction workforce would utilise the proposed accommodation camp at the Atlas-Campaspe Mine.

[3] Including approximately 10 people required for construction of the Ivanhoe Rail Facility. Construction activities associated with Ivanhoe Rail Facility would generally be restricted to daylight hours (i.e. 7.00 am to 6.00 pm).



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2.4 Project Operations

2.4.1 Transport Aspects of Project Operations

Mineral concentrate would be hauled via road approximately 175 km from the Atlas-Campaspe Mine to the Ivanhoe Rail Facility, located to the south of the Orange-Broken Hill Railway. The mineral concentrate would be transported in road trains[4]. Road transport of mineral concentrate would be undertaken 24 hours per day, seven days per week.

The proposed mineral concentrate transport route to the Ivanhoe Rail Facility is shown on Figure 1. The road haulage route would comprise sections of the following public roads (Figures 1 and 2):

- Link Road
- Boree Plains-Gol Gol Road
- Magenta Road
- Hatfield-The Vale Road
- Balranald-Ivanhoe Road.

The proposed mineral concentrate transport route would not cross the Orange-Broken Hill Railway south of Ivanhoe nor would it pass through the township of Ivanhoe (Figure 3). Access to the Ivanhoe Rail Facility would be provided via an unsealed two-lane access road off Balranald-Ivanhoe Road.

From approximately Year 12 of the Project, MSP process waste containers would be unloaded from trains at the Ivanhoe Rail Facility and temporarily held in a designated area prior to loading onto haulage vehicles for the return trip to the Atlas-Campaspe Mine. The movement of the MSP process waste would therefore not result in any additional haulage vehicle movements.

2.4.2 Operations Workforce

At full development, the proposed Project operational workforce would be approximately 200 people, including a mixture of direct Cristal Mining employees and contractors. The Project would operate 24 hours per day, seven days per week. Employees would generally work 12 hour shifts, starting at 7.00 am or 7.00 pm. It is expected that approximately 80 percent (%) of the positions created by the Project would be filled from the Broken Hill, Wentworth Shire, Mildura and the Murray Darling and Far West Regions.

[4] Type 1 road train, as defined by RMS, 2012b.

3. Road Transport Conditions

An appreciation of the existing road transport environment can be gained by examining the road network, existing traffic volumes, past growth in traffic volumes, the safety history of the locality, the availability of other transport modes and the efficiency of the road system. These aspects are discussed in Sections 3.1 to 3.7.

3.1 Road Hierarchy

It is usual to classify roads according to a road hierarchy, in order to determine their functional role within the road network. Changes to traffic flows on the roads can then be assessed within the context of the road hierarchy. Roads are classified according to the role they fulfil and the volume of traffic they should appropriately carry given their classification. There are various classification systems used by local authorities and RMS. RMS has set down the following guidelines for the functional classification of roads (Traffic Authority of NSW, 1978):

- Arterial Road – typically a main road carrying over 15,000 vehicles per day (vehicles/day) and fulfilling a role as a major inter-regional link (over 1,500 vehicles per hour [vehicles/hour])
- Subarterial Road – defined as secondary inter-regional links, typically carrying volumes between 5,000 and 20,000 vehicles/day (500 to 2,000 vehicles/hour)
- Collector Road – provides a link between local roads and regional roads, typically carrying between 2,000 and 10,000 vehicles/day (250 to 1,000 vehicles/hour). At volumes greater than 5,000 vehicles/day, residential amenity begins to decline noticeably
- Local Road – provides access to individual allotments, carrying low volumes typically less than 2,000 vehicles/day (250 vehicles/hour).

The NSW *Roads Act, 1993* provides for roads to be classified as Freeways, Controlled Access Roads, Tollways, State Highways, Main Roads, Secondary Roads, Tourist Roads, Transitways and State Works. The classification of a road empowers RMS to exercise broad authority over some, or all, aspects of legally classified roads and to provide financial assistance to councils. To simplify administration of the various legal road classes, the roads in which RMS has an interest and council roads are grouped into a three tier administrative classification system of State, Regional and Local Roads:

- State Roads – roads performing an important state function for which RMS funds 100% of the maintenance cost. State roads are essentially arterial roads
- Regional Roads – roads performing a significant regional function and for which the RMS and Council contribute 50% each towards maintenance. Regional roads are essentially subarterial roads
- Local Roads – roads performing a local or collector function and for which the Council funds 100% of the maintenance cost.

3.2 Existing Road Network

The existing road network in the vicinity of the Project site is shown in Figures 1 to 3 of this report, and is described below.

Sturt Highway (HW14)

Sturt Highway (HW14) is a State Road, which links from the Hume Highway at Lower Tarcutta via Wagga Wagga and Collingullie to the Newell Highway at Narrandera, then via Hay, Balranald and Euston to the bridge over the Murray River at Mildura. In the vicinity of Balranald, Sturt Highway has a sealed surface and a single travel lane in each direction. It is an approved RMS route for road trains and 4.6 m high vehicles.

Cobb Highway (HW21)

Cobb Highway (HW21) is a State Road, which links from the bridge over the Murray River at Moama, via Deniliquin, Wanganella, Hay, One Tree, Booligal and Ivanhoe to the Barrier Highway (HW8) near Wilcannia. In the vicinity of Ivanhoe, Cobb Highway typically has a sealed carriageway with a broken centreline. It is an approved RMS route for road trains and 4.6 m high vehicles.

Silver City Highway (HW22)

Silver City Highway (HW22) is a State Road, which links from the Sturt Highway at Buronga to Broken Hill. The Silver City Highway has a sealed surface and a single travel lane in each direction. It is an approved RMS route for road trains and 4.6 m high vehicles.

Balranald-Ivanhoe Road (MR67)

Balranald-Ivanhoe Road (MR67) is a Regional Road which links from the Sturt Highway at Balranald, generally north-south via Hatfield to the Cobb Highway (HW21) at Ivanhoe (Figure 1). It is known as both Balranald-Ivanhoe Road and Swan Hill-Ivanhoe Road. This road is an approved route for road trains and 4.6m high vehicles. Balranald-Ivanhoe Road is a two-lane road, and has a sealed surface between Balranald and a point 71 km north of its intersection with Hatfield-The Vale Road. North of this point, the road is generally unsealed, with short sections of sealed road. The unsealed sections are signposted as non-traversable during wet conditions.

Ivanhoe-Menindee Road (MR433)

Ivanhoe-Menindee Road (MR433) is a Regional Road which provides a link from the Cobb Highway (HW21) near Ivanhoe to the Wentworth-Menindee Road (MR68) near Menindee, via Quamby, Darnick, Gum Lake siding and Amphi Sandhills. This road is an approved route for road trains and 4.6 m high vehicles.

Hatfield-The Vale Road

Hatfield-The Vale Road is a local road which provides an east-west link between Balranald-Ivanhoe Road and Magenta Road (Figure 2). It is unsealed with a poor road surface which does not allow for wet weather access or for two large vehicles to pass without one vehicle entering the verge. The intersection of Hatfield-The Vale Road with Balranald-Ivanhoe Road is a T-intersection.

Magenta Road

Magenta Road is a local road which extends in a north-south direction between Hatfield-The Vale Road and Boree Plains-Gol Gol Road (Figure 2). It is unsealed with a poor road surface which does not allow for wet weather access or for two large vehicles to pass without one vehicle entering the verge. The intersections at each end of Magenta Road are T-intersections, with Magenta Road as the terminating leg. Traffic on Hatfield-The Vale Road and Boree Plains-Gol Gol Road has priority at these intersections.

Link Road

Link Road is a local road which provides a link from Boree Plains-Gol Gol Road to the intersection of Marma Magenta Wampo Road and Box Creek Road to the west of the Project (Figure 2). It is unsealed with a poor road surface which does not allow for wet weather access. The road width is sufficient for two large vehicles to pass.

Boree Plains-Gol Gol Road

Boree Plains-Gol Gol Road extends from Balranald-Ivanhoe Road to Boree Plains Station (Figure 2). Its intersection with Magenta Road is a T-intersection and is aligned such that Boree Plains-Gol Gol Road has priority. The Boree Plains-Gol Gol Road and Link Road intersection is also aligned such that Boree Plains-Gol Gol Road has priority. Boree Plains-Gol Gol Road is an unsealed road with a poor road surface. East of its intersection with Link Road, it has sufficient width for two large vehicles to pass.

Marma Magenta Wampo Road

Marma Magenta Wampo Road (Figure 2) is a local road which provides an east-west link between the Link Road and Box Creek Road intersection and Arumpo Road. It is unsealed with a poor road surface which does not allow for wet weather access. The intersection of Marma Magenta Wampo Road with Link Road and Box Creek Road is a T-intersection with Link Road, with Link Road as the terminating leg.

Arumpo Road (MR431)

Arumpo Road is a Regional Road which links from the Silver City Highway (HW22) north of Buronga to the Mungo National Park (Figure 1). Its intersection with Marma Magenta Wampo Road is a T-intersection and is aligned such that Arumpo Road has priority. Arumpo Road is a two-lane road, and has a sealed surface between the Silver City Highway and a point approximately 18 km north-east of its intersection with the Silver City Highway. North-east of this point, it has a good quality unsealed road surface. The Arumpo Road is an approved route for road trains and 4.6m high vehicles. The Arumpo Road does not provide for wet weather access.

3.3 Historic Annual Average Daily Traffic on RMS Roads

The RMS publishes traffic volume data at selected locations on its roads. RMS records Annual Average Daily Traffic (AADT) which is the total volume of traffic recorded at a specific road location taken over a calendar year, divided by the number of days in that year. AADT is typically measured by axle pairs, rather than vehicles, i.e. a typical car is represented by one axle pair, a three axle truck by one and a half axle pairs and a six axle semi-trailer as three axle pairs.

Relevant historic AADT data in the vicinity of the Project is summarised in Table 3.1. The locations of these count sites are shown on Figure 1.

Table 3.1: Historic AADT Data 1994 to 2006

Road[A]		1994	1996	1997	1999	2000	2002	2003	2005	2006[B]
MR67 Balranald-Ivanhoe Road										
1	West of Cobb Hwy	-	47	-	36	-	30	-	43	-
2	North of MR514 Oxley Rd	-	-	77	-	106	-	67	-	50
3	5km North of Sturt Hwy	-	-	320	-	448	-	396	-	259
HW21 Cobb Highway										
4	North of Menindee Rd	-	-	-	-	-	63	-	65	-
5	South of Ivanhoe Level Crossing	-	68	-	84	-	83	-	94	-
MR433 Ivanhoe-Menindee Rd										
6	8 km West of Cobb Hwy	-	-	-	-	-	29	-	43	-
HW14 Sturt Highway										
7	Euston East of MR583 Murray River Bridge Rd	1,658	-	-	-	2,074	-	2,181	-	1,215
8	Balranald 8 km West of MR67 Mayall St	1,304	-	-	-	-	-	-	-	-
9	Balranald North of MR67 Kyalite Rd	1,861	-	-	-	-	-	2,674	-	-
10	Balranald East of MR67 Kyalite Rd	1,697	-	1,865	-	2,053	-	2,165	-	969
11	Yanga Lake at Railway Crossing	1,718	-	-	-	-	-	-	-	-

[A] Refer to Figure 1 for locations.

[B] 2006 volumes are vehicles not axle pairs.

The RMS data indicates that background AADT volumes on the surrounding road system are typically low and that traffic growth has been negligible, with only minor fluctuations recorded rather than steady growth in volumes at any location. In 2006, Sturt Highway carried approximately 970 vehicles/day near Balranald. As a guide, it would be expected that peak hourly volumes would be in the range of 8% to 12% of the daily volume, or typically around 100 vehicles/hour near Balranald. In 2006, Balranald-Ivanhoe Road carried approximately 260 vehicles/day near Balranald, reducing to 50 vehicles/day farther to the north.

3.4 Road Safety

Validated crash data was obtained from RMS South West Region for the proposed mineral concentrate transport route and other Project access routes for most recent five year period of data available, being from 2006 to 2012. The data is presented in Attachment A.

The data is based on crashes reported to the Police, and included the full length of Balranald-Ivanhoe Road between Balranald and Ivanhoe, Sturt Highway for a distance of 50 km east and west of Balranald, and the roads in the Balranald township. Data for the nine month period prior to July 2012 is incomplete and subject to change.

3.4.1 Mineral Concentrate Transport Route

The data shows five crashes on the proposed mineral concentrate transport route over the five year period, which are summarised in Table 3.2.

Table 3.2: Reported Crashes on the Proposed Mineral Concentrate Transport Route 2006 to 2012

Day and Date	Location[A]	Crash Description	Factors
2.55 pm Wednesday 11 April 2007	20 km South of Cobb Highway	Northbound 4WD left the carriageway to the right and struck a tree/bush	Fine weather Dry road surface 1 injured
8.05 am Saturday 11 August 2007	35.3 km South of Cobb Highway	Southbound car left the carriageway to the right on a left hand bend	Fine weather Dry road surface Speed 0 injured
9.25 am Friday 10 July 2009	45 km South of Ivanhoe	Northbound Car left the carriageway on a straight roadway to the right and struck a drain/culvert	Fine weather Dry road surface 3 injured
4.20 pm Thursday 31 December 2009	50 km West of Cobb Highway	Eastbound truck left the carriageway to the left and struck an embankment	Raining Wet road surface Fatigue 1 injured
3.00 am Friday 19 March 2010	60 km South of Ivanhoe	Northbound 4WD left the carriageway on a straight roadway to the left	Fine weather Dry road surface 1 injured

[A] Refer to Attachment A for locations.

The five reported crashes were single vehicle crashes in which the driver lost control and left the carriageway, and of these, three vehicles then struck a roadside object. There was no concentration of crashes at any particular location. One crash occurred during darkness, and one during wet weather.

A Road Safety Audit of the proposed mineral concentrate transport route was undertaken by GTA Consultants during May 2012. The results of that audit are presented in a separate report, *Atlas-Campaspe Mineral Sands Project Mineral Concentrate Transport Route Stage 5 (Existing Conditions) Road Safety Audit* (the Road Safety Audit) (GTA Consultants, 2012). The key issues identified from the audit are presented in the deficiency log in that report, which reviews risk levels and probabilities to rate the non-conformances by priority:

- High: Very important, and needs to be addressed urgently
- Medium: Important, and needs to be addressed as soon as possible
- Low: Needs to be considered as part of regular maintenance/planning program.

The high priority deficiencies identified during the audit were (GTA Consultants, 2012):

- unprotected watercourses
- inconsistent guideposts
- poor linemarking
- lack of curve guidance
- lack of raised reflective pavement markers
- unprotected headwalls.

3.4.2 Balranald-Ivanhoe Road South of Hatfield-The Vale Road

Three crashes occurred on Balranald-Ivanhoe Road to the south of Hatfield-The Vale Road, and these are summarised in Table 3.3.

Table 3.3: Reported Crashes on Balranald-Ivanhoe Road South of Hatfield-The Vale Road 2006 to 2012

Day and Date	Location[A]	Crash Description	Factors
9.00 am Wednesday 14 February 2007	25 km North of Homebush Pub Hotel	Westbound truck left the carriageway to the left	Fine weather Dry road surface 1 injured
12.10 am Saturday 11 July 2009	150 m North of Tin Tin Road	Southbound car left the carriageway to the right on a left hand bend	Fine weather Dry road surface Speed Alcohol 1 injured
3.00 am Sunday 17 December 2006	33 km North of Balranald	Northbound car left the carriageway on a straight roadway to the left and struck an embankment	Fine weather Dry road surface 0 injured

[A] Refer to Attachment A for locations.

The reported crashes on Balranald-Ivanhoe Road south of Hatfield-The Vale Road were similar to those on the proposed mineral concentrate transport route, in that they were single vehicle crashes in which a vehicle left the carriageway in fine weather and dry road conditions, and did not occur at a single location.

3.4.3 Sturt Highway

Over the 100 km section of Sturt Highway (50 km east and 50km west of Balranald), there were 41 crashes reported over the five year period. Of these 41 crashes, the following is noted:

- Seventeen crashes involved a single vehicle leaving the carriageway on a straight section of road, of which seven vehicles then struck an object (tree/fence)
- Ten crashes involved a single vehicle striking an animal on the road, typically a kangaroo or straying stock
- Four crashes involved a single vehicle losing control on the carriageway (one fatal)
- Two crashes were rear end between vehicles travelling in the same lane – one involved two motorcycles, the other involved three motorcycles
- Two crashes involved cross traffic, both at the intersection of Sturt Highway and Mayall Street in Balranald
- One crash was head on (fatal)
- One crash involved a driver losing control while overtaking (fatal)
- One crash involved a single vehicle leaving the carriageway on a bend (fatal)
- One crash involved a parking manoeuvre
- One crash involved a vehicle striking an object on the carriageway
- One crash involved a pedestrian standing on the carriageway.

Thus, the majority of the crashes on Sturt Highway involved single vehicles either leaving the carriageway or striking an animal. Fatigue was noted as a contributing factor in 11 of the 41 crashes, noting that all 11 were single vehicle crashes in which the vehicle left the carriageway or lost control.

The locations of the crashes are spread along the route. The four fatal crashes are summarised in Table 3.4.

Table 3.4: Fatal Crashes on Sturt Highway 2006 to 2012

Day and Date	Location[A]	Crash Description	Factors
6.30 pm Thursday 22 January 2009	38 km West of Balranald	Eastbound car lost control while overtaking	Unknown weather Dry road surface 1 killed, 2 injured
6.20 pm Tuesday 10 July 2012	2 km East of Mallee Highway	Westbound car on the incorrect side of the road (not overtaking) struck an eastbound B-Double head on	Raining Wet road surface Fatigue 1 killed, 0 injured
7.50 am Thursday 23 November 2006	2.29 km East of Impimi Road	Eastbound car left the carriageway to the right on a right hand bend	Fine weather Dry road surface 1 killed, 1 injured
4.30 am Thursday 27 November 2008	40 km East of Swan Hill Road	Westbound car lost control on the carriageway	Fine weather Dry road surface Fatigue 1 killed, 1 injured

[A] Refer to Attachment A for locations.

The review of the history of crashes on Sturt Highway does not highlight any particular location with a poor accident record. The majority of crashes were single vehicle crashes, with a high incidence of driver fatigue being a contributing factor.

3.5 Existing Traffic Volumes and Composition

3.5.1 Project Traffic Surveys

Traffic survey data has been collected on roads relevant to the Project. At each location, hourly traffic volumes were recorded by direction, and the classification of vehicles was also undertaken using the Austroads (2006) *Vehicle Classification System*, which is included in Attachment B with the traffic surveys.

The surveys were conducted over one week from Friday 11 May to Thursday 17 May 2012 at the following locations (see Figure 1):

- Balranald-Ivanhoe Road south of the Orange-Broken Hill Railway crossing
- Balranald-Ivanhoe Road north of Hatfield-The Vale Road.

Surveys of the local roads such as Hatfield-The Vale Road were not possible due to the condition of the road surfaces. It is expected however that volumes on the local roads between the Atlas-Campaspe Mine and Balranald-Ivanhoe Road would be lower than those surveyed on Balranald-Ivanhoe Road north of Hatfield.

3.5.2 Daily Traffic Volumes

The daily two way traffic volume results of the traffic surveys are summarised in Table 3.5.

Table 3.5: Surveyed Daily Two Way Traffic Volumes (vehicles/day)

	Balranald-Ivanhoe Rd South of Orange-Broken Hill Railway[A]	Balranald-Ivanhoe Rd North of Hatfield-The Vale Rd[A]
Monday	37	38
Tuesday	48	36
Wednesday	43	22
Thursday	38	37
Friday	31	44
Saturday	21	19
Sunday	28	28
Average Weekday	**39**	**35**
Average Day	**35**	**32**

[A] Refer to Figure 1 for location.

Table 3.5 demonstrates that the surveyed daily traffic volumes on Balranald-Ivanhoe Road are very low, ranging between 19 and 48 vehicles/day at the two locations. While there is no general pattern evident in the variation in volumes over the days of the week, the lowest volumes at each location were recorded on Saturday.

3.5.3 Peak Hourly Traffic Volumes

Table 3.6 summarises the surveyed peak hour traffic volumes, noting that the morning peak hour results are for the busiest hour before midday, and the evening peak hour results are for the busiest hour after midday. The peak hours do not necessarily occur at the same time at the two locations or at the same time each day. It is noted that in Table 3.6, the average weekday and average day peak hour volumes are not the average of the peak volumes on weekdays or all days. The average weekday and average day profiles were developed from the daily survey results, and the peak hours from those profiles are reported in Table 3.6.

Table 3.6: Surveyed Peak Hour Two Way Traffic Volumes (vehicles/hour)

	Balranald-Ivanhoe Rd South of Orange-Broken Hill Railway[A]		Balranald-Ivanhoe Rd North of Hatfield-The Vale Rd[A]	
	AM Peak	PM Peak	AM Peak	PM Peak
Monday	3	7	7	5
Tuesday	8	5	4	7
Wednesday	3	6	3	4
Thursday	5	8	6	6
Friday	4	4	7	6
Saturday	4	4	2	3
Sunday	5	4	2	5
Average Weekday[B]	**3**	**5**	**3**	**4**
Average Day[B]	**3**	**4**	**3**	**3**

[A] Refer to Figure 1 for locations.

[B] The average weekday and average day peak hours are not the average of the peak hours over weekdays or all days, see above.

The results indicate that the peak hour traffic volumes are very low, and vary between 7% and 21% of the daily total (refer to Table 3.5 and Table 3.6). This wide variation is a result of the low traffic volumes, as small changes in volumes hour-by-hour represent a moderate proportion of the small daily volumes. The time at which the peak occurred varied considerably day-to-day, with the morning peak hour occurring at various times between 7.00 am and midday, and the afternoon peak hour occurring at various times between midday and 7.00 pm.

3.5.4 Traffic Composition

The surveys described in Section 3.5.1 also provided data on the composition of traffic at the survey locations. Due to the low volumes, the composition of traffic has been considered over the whole survey period, rather than for the average day. Table 3.7 presents the surveyed number of vehicles by general type over the surveyed week.

Table 3.7: Surveyed Seven Day Two-Way Traffic Composition

	Balranald-Ivanhoe Rd South of Orange-Broken Hill Railway[A]		Balranald-Ivanhoe Rd North of Hatfield-The Vale Rd[A]	
	Vehicles	Percent	Vehicles	Percent
Light Vehicles	164	66.7%	149	66.5%
Heavy Rigid Vehicles	53	21.5%	45	20.1%
Articulated Vehicles	10	4.1%	2	0.9%
B Doubles	14	5.7%	13	5.8%
Road Trains	5	2.0%	15	6.7%
Total	**246**	**100%**	**224**	**100%**

[A] Refer to Figure 1 for locations.

The classification of vehicles (Attachment B) is based on the Austroads (2006) *Vehicle Classification System*. Light vehicles include motorcycles, cars, vans, 4WDs, and utes (including those towing a trailer or caravan). Heavy rigid vehicles include single unit trucks and buses with two, three or four axles and up to 14.5 m long. Articulated vehicles include semi-trailers and rigid trucks with trailers, with three to six or more axles, and between 11.5 m and 19.0 m long. B-Doubles includes B-Doubles and heavy trucks with trailers with more than six axles in four groups. Road trains includes double and triple road trains, medium articulated vehicles with one dog trailer, and heavy trucks with three trailers.

Thus at both of these locations, light vehicles made up approximately two-thirds of total traffic, and heavy rigid vehicles made up approximately one-fifth of total traffic. Articulated and combination vehicles made up the remaining approximately one-eighth of the total traffic.

3.6 Road System Efficiency

The *Guide to Traffic Management Part 3: Traffic Studies and Analysis (*Austroads, 2009) and its associated RMS Supplement (RMS, 2011) provide guidelines for the capacity of two lane, two-way rural roads. The Austroads guide refers to the methodology presented in the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2000). The capacity of a road is defined as the maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under the prevailing roadway, traffic and control conditions.

The capacity of a single traffic lane will be affected by factors such as the pavement width and restricted lateral clearances, the presence of heavy vehicles and grades.

Level of Service is defined as a qualitative measure describing the operational conditions within a traffic stream as perceived by drivers and/or passengers. A Level of Service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety. Level of Service A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. Level of Service B to D describes progressively worse traffic conditions. Level of Service E occurs when traffic conditions are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre in the traffic stream. The service flow rate for Level of Service E is taken as the capacity of a lane or roadway.

The HCM and the *Guide to Traffic Management Part 3: Traffic Studies and Analysis* (Austroads, 2009) present a guide to the Levels of Service attained under various traffic volume demands on two way, two lane roads, and also under various travel conditions, with Percent-Time-Spent-Following (PTSF) being a key performance measure for the Level of Service experienced on two lane rural roads. PTSF is a measure of the level of opportunities to overtake, and increases as traffic demand increases, as the length of road where overtaking is prohibited increases, and as the directional split of traffic in each direction becomes more unbalanced. Table 3.8 presents the typical Levels of Service measures.

Table 3.8: Level of Service on Two Way Two Lane Roads

Level of Service	Average Travel Speed Class I[A]	Percent Time Spent Following	
		Class I[A]	Class II[B]
A	> 90	35	40
B	> 80 – 90	> 35 – 50	> 40 – 55
C	> 70 – 80	> 50 – 65	> 55 – 70
D	> 60 – 70	> 65 – 80	> 70 – 85
E	60	> 80	> 85

[A] Class I highways on which drivers expect to travel at relatively high speeds.
[B] Class II roads on which drivers do not expect to travel at high speeds.

The HCM indicates that under base conditions, with a two way peak hourly volume of approximately 600 passenger car equivalents per hour (pc/h) and 650 pc/h, the PTSF would be approximately 35% and 40%, i.e. the upper limit for Level of Service A on Class I and Class II roads respectively. Level of Service on Class I roads is defined in terms of both PTSF and average travel speed, and on Class II roads it is defined in terms of PTSF only.

While detailed traffic data is not available for Balranald-Ivanhoe Road close to Balranald, it is estimated from the historic RMS data (refer to Table 3.1) and allowing for 1% per annum growth, that it is currently carrying around 275 vehicles/day, and fewer than 30 vehicles/hour during peak hours. Farther to the north, the peak hour volumes are even lower (Section 3.5.3). These peak volumes are significantly below the 650 pc/h and 40% PTSF threshold for Level of Service A on Class II roads. The Level of Service on Balranald-Ivanhoe Road is therefore very good, and represents free flow conditions in which individual drivers are virtually unaffected by the presence of others in the traffic stream.

It is expected that traffic volumes on the local roads such as Hatfield-The Vale Road, Magenta Road and Link Road would be lower than those surveyed on Balranald-Ivanhoe Road near Hatfield. It follows that the PTSF would be below 40% at all these locations, and the Level of Service experienced would be A at these locations.

It is estimated from the historic RMS data (refer to Table 3.1) that Sturt Highway is currently carrying a little over 1,000 vehicles/day, or a peak of 100 vehicles/hour. This is well below the 600 pc/h and 35% PTSF threshold for Level of Service A on Class I roads. The Level of Service on Sturt Highway is therefore very good, and represents free flow conditions in which individual drivers are virtually unaffected by the presence of others in the traffic stream.

The Levels of Service on the local roads, Balranald-Ivanhoe Road and Sturt Highway are thus very good, and represent free flow conditions in which individual drivers are virtually unaffected by the presence of others in the traffic stream.

3.7 Public Transport

There are no regular public bus routes operating along the proposed mineral concentrate transport route.

CountryLink operates a coach service, Route 725 from Cootamundra to Mildura, which stops at Balranald at 9.28 pm, seven days per week. Route 726 operates in the reverse direction, Mildura to Cootamundra, and stops at Balranald at 5.40 am seven days per week.

Greyhound Australia operates a coach service between Sydney and Adelaide, which stops at Balranald at around 7.00am en route to Adelaide, and 9.00pm en route to Sydney. These services operate weekdays with the exception of Tuesdays.

The CountryLink "Outback Xplorer" train operates from Sydney to Broken Hill on Mondays, stopping at Ivanhoe at 4.31 pm, and from Broken Hill to Sydney on Tuesdays, stopping at Ivanhoe at 11.07 am.

4. Project Traffic Generation and Distribution

4.1 Project Assessment Scenarios

The Project life would be approximately 20 years, commencing in 2013. Construction activity would occur over a period of approximately one year in 2013, with peak construction activity occurring over a two to three month period, and for approximately one year in 2017. The assessment which follows considers two future scenarios which represent key stages in the Project combined with potential background traffic activity:

- **Year 1 (2013)** – this scenario includes peak construction (or establishment) activity associated with the Project, combined with growth in background (non-Project) traffic, as well as peak construction traffic associated with Iluka Resources Limited's (Iluka Resources) Balranald Mineral Sands Project (the BMSP) (Section 5.1).
- **Year 20 (2032)** – this scenario includes operational activity at the Project, combined with growth in background (non-Project) traffic, operational traffic associated with the BMSP[5], as well as maximum mineral concentrate transport activity.

It is noted that during Year 5 (2017) there would be operational and construction activities associated with the Project. The Project workforce during Year 5 would be the same as during Year 1. The cumulative workforce (i.e. the Project and the BMSP) during Year 5 would be less than during Year 1, therefore the cumulative impacts during Year 5 would be less than Year 1. The implications of the Year 1 activity have therefore been assessed.

4.2 Construction Traffic

4.2.1 Construction Employees

Construction employees would generate traffic on the road system as they arrive at and depart from the Atlas-Campaspe Mine and the Ivanhoe Rail Facility. Construction activity is expected to require an average workforce of approximately 150 people, with a maximum of approximately 300 people during the peak activity period. This assessment reviews road transport conditions on the basis of the anticipated maximum construction workforce, which represents a period of some two to three months during Year 1.

An average of 5 and a maximum of 10 employees would work at the Ivanhoe Rail Facility. Those employees working on the Ivanhoe Rail Facility would be accommodated at Ivanhoe. Construction activity at the Ivanhoe Rail Facility would occur during the daytime only. Carpooling is expected to be common for the construction workforce, and this assessment assumes that average car occupancy would be 1.2 employees per vehicle for the construction workforce.

[5] It has conservatively been assumed that the BMSP would still be operating in Year 20 of the Project (2032) (see Section 5.1 for more detail).

The Ivanhoe Rail Facility construction workforce would generate 16 vehicle trips per day between Ivanhoe and the Ivanhoe Rail Facility. Traffic generated by the Ivanhoe Rail Facility construction employees would tend to peak as the employees arrive to start work each day and again as they depart at the end of the day. With one shift operating per day, it can be expected that there would be a peak of eight vehicle trips per hour during the morning, and a peak of eight vehicle trips per hour in the evening.

The remaining 290 employees would be accommodated within the accommodation camp at the Atlas-Campaspe Mine, and would be rostered to work five days (weekdays) followed by two days off (weekend days). Construction activity would occur at the Atlas-Campaspe Mine 24 hours per day. Employees would work on a shift basis, with two 12 hour shifts worked in each 24 hour period, with shifts commencing at 7.00am and 7.00pm. Up to 90% of construction employees would work on-site on any one day. Carpooling is expected to be common for the construction workforce, and this assessment assumes that average car occupancy would be 1.2 employees per vehicle for the construction workforce.

The Atlas-Campaspe Mine construction workforce would generate traffic on the road system when travelling to and from the accommodation camp at the beginning and end of their roster, expected to be Monday mornings/afternoons and Friday afternoons/Saturday mornings. It is expected that most employees would leave at the end of their shift on either Friday evening (after 7.00 pm) or Saturday morning (after 7.00 am) for their place of residence. They would arrive back before the start of their shift on Monday, either before 7.00 am or before 7.00 pm.

For the purpose of this assessment, it is conservatively estimated that all of the Project workforce present at site (i.e. 90% of the total workforce – see above) would leave for the weekend, departing on Friday evening or Saturday morning after their shift and arriving back on Monday morning or evening before their shift. Such trips would generate 218 trips arriving on Monday (109 trips before 7.00 am and 109 trips before 7.00 pm) and 109 trips departing on Friday (after 7.00 pm) and 109 trips departing on Saturday after 7.00 am). It is further assumed that these employees would arrive in the one hour prior to the start of the shift on Monday, and leave in the one hour after conclusion of the shift on Friday evening or Saturday morning. As total daily Project-related movements are expected to be greatest on Monday, the Monday traffic movements have been assessed.

In addition, personal trips to and from the local townships for a variety of purposes such as shopping, dining and medical services may occur. The number and distribution of personal trips to local townships is difficult to quantify, however considering the distance between the accommodation camp and the nearest townships, it expected that the number of trips made to the local towns for personal purposes would be negligible and are therefore not considered any further.

Cristal Mining has advised that the likely residential distribution of the employees would be:

- Mildura 50%
- Broken Hill 25%
- Balranald 20%
- Ivanhoe 5%.

The employees residing in Mildura would travel either along the Sturt Highway via Balranald or travel west via Link Road, Marma Magenta Wampo Road and Arumpo Road to Mildura. The western route is the shorter route, being approximately 175 km, while the southern route via Balranald is approximately 250 km. The quality of the routes however differs significantly, and while some drivers will chose the shorter route on poorer roads, others will prefer the better quality roads on the longer route. It is difficult to gauge what proportion of drivers will chose each of these routes. This assessment has therefore conservatively allocated all the traffic expected to travel between Mildura and the Project to both the Sturt Highway southern route and the Arumpo Road western route. The resulting volumes on each route therefore represent the maximum volume which may be expected on those roads, however the maximums would not occur on both roads simultaneously. In reality, as drivers chose one route or the other, the actual volumes would be somewhat lower on both routes than those presented in this assessment.

Thus for the purposes of this assessment, 70% of the construction employee traffic is assumed to travel to and from the south along Balranald-Ivanhoe Road (50% to/from Mildura and 20% to/from Balranald), 50% is assumed to travel to and from the west along Link Road, Marma Magenta Wampo Road and Arumpo Road (to/from Mildura), and 30% is assumed to travel to and from the north along Balranald-Ivanhoe Road (to/from Ivanhoe and Broken Hill).

4.2.2 Construction Deliveries

Cristal Mining has advised that construction activity would generate an average of five heavy vehicle deliveries per day. Deliveries would be sourced from:

- Melbourne 50%
- Sydney 20%
- Mildura 20%
- Broken Hill 10%.

All deliveries to the Atlas-Campaspe Mine would be via Balranald-Ivanhoe Road. Deliveries during the construction phase are expected therefore to generate eight vehicle trips to or from the south of the Project and two vehicle trips to or from the north of the Project on an average day.

Construction delivery trips would tend to be spread throughout the day with no distinct peak in activity. For the purpose of the assessment, it has been assumed that up to two delivery trips may occur during a single hour.

In addition, during Project construction a relatively number of oversize vehicle movements would be required to transport construction and mining equipment and infrastructure to and from the Project. Oversize vehicle movements are discussed in more detail in Section 6.11.

4.2.3 Construction Visitors

Cristal Mining has advised that five visitors would be expected on a typical day during construction. These would generate 10 light vehicle trips per day. For the purpose of this assessment, the distribution of visitors to and from the site is assumed to be similar to that of the heavy vehicle deliveries (refer to Section 4.3.2). All visitors to the Atlas-Campaspe Mine would travel via Balranald-Ivanhoe Road.

On this basis, visitors during the construction phase are expected to generate eight vehicle trips to or from the south of the Project and two vehicle trips to or from the north of the Project on an average day.

Construction visitor traffic would tend to arrive and depart at any time throughout the day. The distribution would be random, and for the purpose of this assessment, it is conservatively assumed that up to four light vehicle trips could occur in any hour.

4.3 Operational Traffic

4.3.1 Employees

An operational workforce of approximately 200 employees and contractors is anticipated, of which up to three employees would work at the Ivanhoe Rail Facility and are expected to reside in Ivanhoe. The remainder would work at the Atlas-Campaspe Mine and would be housed in the accommodation camp there. Employees would work on a shift basis, with two 12 hour shifts worked in each 24 hour period. Shifts would start at 7.00am and 7.00pm.

A number of rosters would be operated at the Atlas-Campaspe Mine including:

- Administration – Monday to Friday (15.5% of workforce)
- Administration – Monday to Thursday (10.4% of workforce)
- Trade – Monday to Friday (2.6% of the workforce)
- Trade – Wednesday to Wednesday (17.1% of the workforce)
- Operations – 5 days on/5 days off roster (54.4% of the workforce).

Operational employees would travel to and from the Atlas-Campaspe Mine accommodation camp at the start and end of their roster periods. A review of the proposed rostering arrangement indicates that on this basis, a maximum of 83% of the operational workforce would start or end a roster on any one day. Carpooling is expected to be common, and this assessment assumes the average car occupancy would be 1.2 employees per vehicle for the operational workforce. The Atlas-Campaspe Mine operational workforce is expected to generate up to 136 vehicle trips per day.

By way of comparison, on an average day, only 22% of the total workforce would travel to or from the Atlas-Campaspe Mine per day, and would generate 36 vehicle trips. It is usual to consider a "design" level for transport impacts, which would typically be the 85th percentile generation. In this case, this would represent 54% of the total workforce travelling in any one day, which would generate 88 vehicle trips. However, for this assessment, the maximum of 83% has been applied, which will reflect the busiest days associated with employee travel, generating 136 vehicle trips per day, which could be expected to occur on 10 to 11 days per year.

Cristal Mining has advised that the likely residential distribution of the Atlas-Campaspe Mine employees would be:

- Mildura 40%
- Broken Hill 20%
- Balranald 30%
- Ivanhoe 10%.

As mentioned in Section 4.2.1, the employees residing in Mildura would travel either along the Sturt Highway via Balranald or travel west via Link Road, Marma Magenta Wampo Road and Arumpo Road to Mildura. This assessment has therefore conservatively allocated all the traffic expected to travel between Mildura and the Project to both the Sturt Highway southern route and the Arumpo Road western route. The resulting volumes on each route therefore represent the maximum volume which may be expected on those roads, however the maximums would not occur on both roads simultaneously. In reality, as drivers chose one route or the other, the actual volumes would be somewhat lower on both routes than those presented in this assessment.

Thus for the purposes of this assessment, 70% of the construction employee traffic is assumed to travel to and from the south along Balranald-Ivanhoe Road (50% to/from Mildura and 20% to/from Balranald), 50% is assumed to travel to and from the west along Link Road, Marma Magenta Wampo Road and Arumpo Road (to/from Mildura), and 30% is assumed to travel to and from the north along Balranald-Ivanhoe Road (to/from Ivanhoe and Broken Hill).

Operational employee traffic would tend to peak as the employees arrive prior to the start of their shift and depart at the end of their shift. Half of the busiest days identified above would occur when the Administration, Trade and Operations rosters all commence on a Monday, which would occur around five to six times per year. On these days, the peak hour would occur prior to 7.00 am when all Administration and Trade employees and half of the Operations employees arrive prior to the 7.00am commencement of their shift. Assuming these employees all travel within one hour, they would generate 92 vehicle trips. A second peak of 44 vehicle trips per hour would occur when the remaining half of the Operations employees arrive prior to the commencement of the 7.00 pm shift.

The remaining five to six busiest days of the year would occur when the Administration and Trade rosters start on a Monday, and the Operations roster ends on the same day. On these days, two peaks would occur, with one being when the Administration and Trade employees arrive prior to the commencement of their 7.00am shift, and the other when the Operations employees depart after their shift concludes at 7.00pm.

As a worst case assessment, the busiest peak hour has been assessed, equivalent to 92 vehicle trips per hour, assuming all employees travel in one hour prior to commencement of their shift. This peak may only be expected to occur prior to 7.00 am on 5 or 6 days per year.

The Ivanhoe Rail Facility construction workforce would generate 6 vehicle trips per day between Ivanhoe and the Ivanhoe Rail Facility. Traffic generated by the Ivanhoe Rail Facility operational employees would tend to peak as the employees arrive to start work each day and again as they depart at the end of the day. With two shifts operating per day, it can be expected that there would be a peak of up to 4 vehicle trips per hour at the shift changeover time.

4.3.2 Operational Deliveries

Cristal Mining has advised that operational activity at the Project would generate an average of five heavy vehicle deliveries per day, which is equivalent to 10 heavy vehicle trips per day. Deliveries would be sourced from:

- Melbourne 50%
- Sydney 20%
- Mildura 20%
- Broken Hill 10%.

All deliveries to the Atlas-Campaspe Mine would be via Balranald-Ivanhoe Road. On this basis, deliveries during the operational phase are therefore expected to generate eight vehicle trips to or from the south of the Project and two vehicle trips to or from the north of the Project on an average day.

Operational delivery trips would tend to be spread throughout the day with no distinct peak in activity. For the purpose of the assessment, it has been assumed that up to two delivery trips may occur during a single hour.

In addition, during Project operations a relatively small number of oversize vehicle movements would be required to transport mining equipment and infrastructure to and from the Project. Oversize vehicle movements are discussed in more detail in Section 6.11.

4.3.3 Operational Visitors

Cristal Mining has advised that 10 visitors would be expected on a typical day during operations. These would generate 20 light vehicle trips per day. For the purpose of this assessment, the distribution of visitors to and from the Atlas-Campaspe Mine is assumed to be similar to that of the heavy vehicle deliveries (refer to Section 4.3.2). All visitors to the Atlas-Campaspe Mine would travel via Balranald-Ivanhoe Road.

On this basis, visitors during the operational phase are expected to generate 18 vehicle trips to or from the south of the Project and two vehicle trips to or from the north of the Project on an average day.

Operational visitor trips would tend to be spread throughout the day with no distinct peak in activity. For the purpose of the assessment, it has been assumed that up to five visitor trips may occur during a single hour.

4.3.4 Other Operational Traffic

As discussed in Section 4.2.1, employees who are housed in the accommodation camp can be expected to generate personal trips to and from the local townships for a variety of purposes such as shopping, dining and medical services. The number and distribution of personal trips is difficult to quantify, however considering the distance between the accommodation camp and the nearest townships, it expected that the number of trips made to the local towns for the personal purposes would be negligible and therefore have not been considered further in this assessment.

4.3.5 Mineral Concentrate and MSP Process Waste Transport

Mineral concentrate would be hauled via road approximately 175 km from the Atlas-Campaspe Mine to the Ivanhoe Rail Facility. The mineral concentrate would be transported in road trains[6] (Section 2.4.1).

Based on the planned maximum production rate, up to 24 haulage vehicle departures per day (i.e. 48 haulage vehicle trips) would be required, with approximately 19 haulage vehicle departures per day (i.e. 38 haulage vehicle trips) on average over the life of the Project.

[6] Type 1 road train, as defined by RMS, 2012b.

Road transport would take place 24 hours per day, so the trips would be spread throughout the day and night, with an average of two to three road train trips per hour. For the purpose of the assessment, a slightly higher allowance of five road train trips per hour has been made for the peak hourly generation, to take account of hour-to-hour variations in production and transport rates.

From approximately Year 12 of the Project, MSP process waste containers would be unloaded from trains at the Ivanhoe Rail Facility, and temporarily held in a designated area prior to loading onto haulage vehicles for the return trip to Atlas-Campaspe Mine. Therefore no additional haulage movements for the MSP process waste, in addition to the mineral concentrate haulage vehicle movements, would be required for the Project. Additional discussion regarding the transport of MSP process waste is provided in Section 6.5.

Balranald-Ivanhoe Road is currently an RMS-approved road train route (Section 2.4.1). Upgrading of the other local roads and intersections is proposed to facilitate their use by road trains. The upgrades are discussed in Section 2.3.1.

4.4 Total Project Traffic

4.4.1 Total Daily Project Traffic

The Project (i.e. the Atlas-Campaspe Mine and the Ivanhoe Rail Facility) is expected to generate 254 vehicle trips per day during the busiest construction period and 220 vehicle trips per day during the busiest few days of the year during the operational period.

Table 4.1 presents the daily traffic expected to be generated by the Project at key locations on the surrounding road network (Figure 5) during both the construction and operational phases. It should be noted that these estimates represent the peak Project traffic generation and are higher than the Project traffic generation on an average day for both the construction and operational scenarios.

Table 4.1 demonstrates that the Project traffic would be concentrated on the local roads off Balranald-Ivanhoe Road, as these would provide the main vehicular access route to and from the Atlas-Campaspe Mine.

The Project would generate up to 168 and 121 vehicle trips per day on Balranald-Ivanhoe Road to the south of Hatfield-The Vale Road during the construction and operational phases respectively, with the majority being light vehicles (Table 4.1).

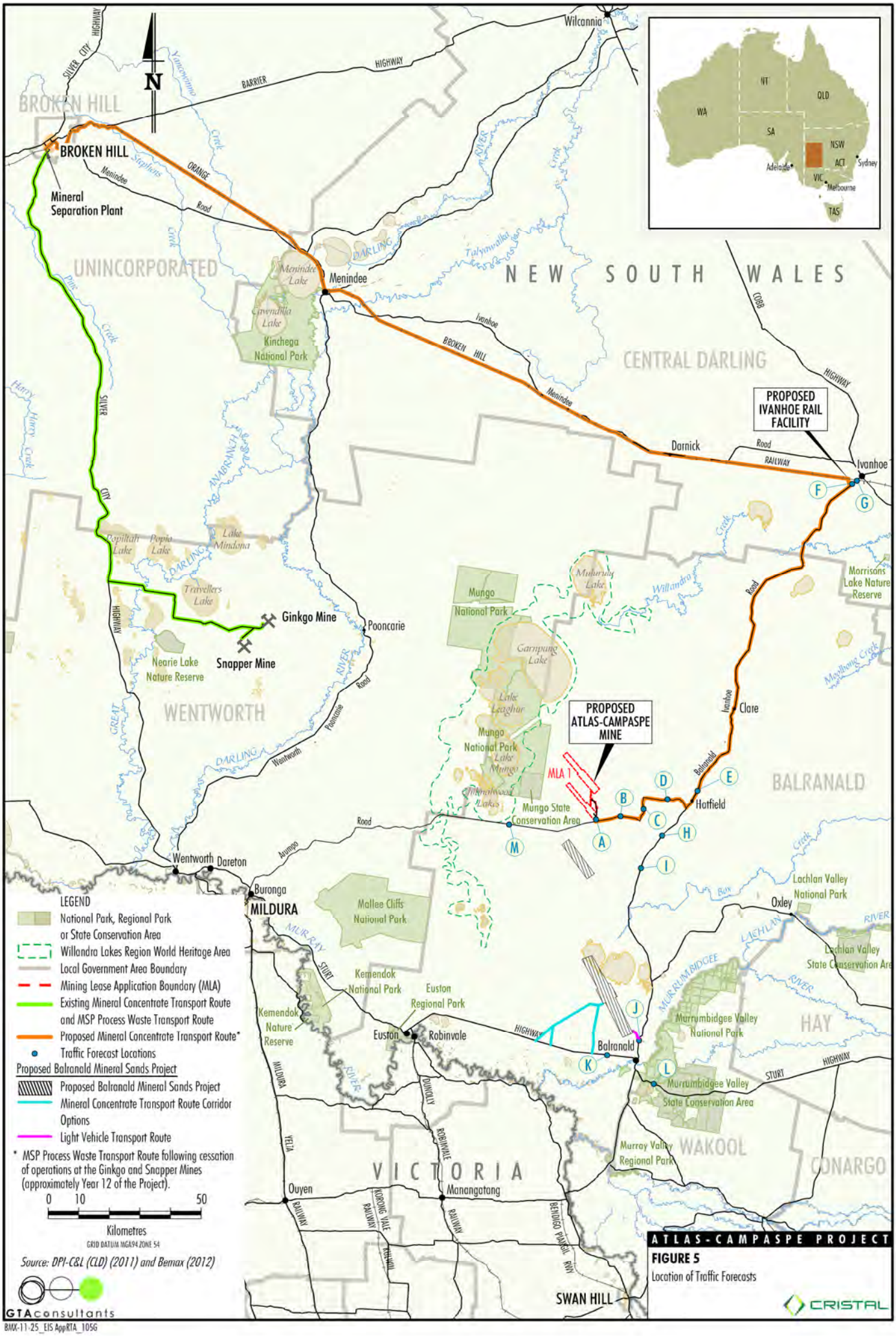
To the north, the Project would generate up to 70 and 91 vehicle trips per day during the construction and operational phases respectively (Table 4.1). During the operational phase, approximately 52% of the daily generated traffic on Balranald-Ivanhoe Road between Hatfield and the Ivanhoe Rail Facility would be road trains travelling between the Atlas-Campaspe Mine and the Ivanhoe Rail Facility.

Table 4.1: Peak Daily Project Traffic on the Road Network (vehicles/day)

Road and Location[A]		Light	Heavy	Mineral Concentrate Transport	Total
Construction					
A	Atlas-Campaspe Mine Access Rd	228	10	0	238
B	Link Rd	228	10	0	238
C	Magenta Rd	228	10	0	238
D	Hatfield-The Vale Rd	228	10	0	238
E	Balranald-Ivanhoe Road – North of Hatfield-The Vale Rd	68	2	0	70
F	Ivanhoe Rail Facility Access Rd	16	0	0	16
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	84	2	0	86
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	160	8	0	168
I	Balranald-Ivanhoe Rd – North of BMSP	160	8	0	168
J	Balranald-Ivanhoe Rd – South of BMSP	160	8	0	168
K	Sturt Hwy – West of Balranald	110	2	0	112
L	Sturt Hwy – East of Balranald	2	2	0	4
M	Marma Magenta Wampo Rd – West of Link Rd	108	0	0	108
Operations					
A	Atlas-Campaspe Mine Access Rd	156	10	48	214
B	Link Rd	156	10	48	214
C	Magenta Rd	156	10	48	214
D	Hatfield-The Vale Rd	156	10	48	214
E	Balranald-Ivanhoe Road – North of Hatfield-The Vale Rd	41	2	48	91
F	Ivanhoe Rail Facility Access Rd	6	0	48	54
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	47	2	0	49
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	113	8	0	121
I	Balranald-Ivanhoe Rd – North of BMSP	113	8	0	121
J	Balranald-Ivanhoe Rd – South of BMSP	113	8	0	121
K	Sturt Hwy – West of Balranald	58	2	0	60
L	Sturt Hwy – East of Balranald	4	2	0	6
M	Marma Magenta Wampo Rd – West of Link Rd	54	0	0	54

[A] Refer to Figure 5 for locations.

As mentioned in Sections 4.2.1 and 4.3.1 , employees travelling to and from Mildura may use Link Road, Marma Magenta Wampo Road and Arumpo Road from the Atlas-Campaspe Mine rather than the longer route via Balranald. Assuming all of these employees travelling to Mildura use the alternative western route to and from Mildura, the Project would generate up to approximately 108 and 54 vehicle trips per day along this route during the construction and operational phases, respectively (Table 4.1). This estimate is considered conservative as some employees would travel via the southern route to Mildura. No deliveries or visitors would use the alternative route to and from Mildura. As noted previously, the assessment conservatively allocates all the employee trips between Mildura and the Atlas-Campaspe Mine to both routes, thus resulting in the potential maximum volumes on both routes. The maximum volumes on each route would not both occur.



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4.4.2 Peak Hourly Project Traffic

The distribution of the various components of the Project traffic throughout the day would influence the overall peak volume of traffic generated in any one hour. Employee traffic would tend to be concentrated in two distinct peaks at the start and end of shifts, while deliveries, visitors and mineral concentrate transport would tend to be spread throughout the day. As employee traffic makes up the largest component of the daily traffic generation and also would occur in distinct peaks, it follows that the busiest hours for traffic generated by the Project would be those hours during which employees travel to and from the Project.

Table 4.2 summarises the peak hour Project traffic at key locations on the surrounding road network during both the construction and operational phases. This is considered to be a conservatively high assessment of the peak activity, as it assumes that a busy hour for each type of trip would coincide.

Table 4.2: Peak Hour Project Traffic Distribution (vehicles/hour)

Road and Location[A]		Light	Heavy	Mineral Concentrate Transport	Total
Construction					
A	Atlas-Campaspe Mine Access Rd	114	5	0	119
B	Link Rd	114	5	0	119
C	Magenta Rd	114	5	0	119
D	Hatfield-The Vale Rd	114	5	0	119
E	Balranald-Ivanhoe Road – North of Hatfield-The Vale Rd	34	1	0	35
F	Ivanhoe Rail Facility Access Rd	8	0	0	8
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	42	1	0	43
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	80	4	0	84
I	Balranald-Ivanhoe Rd – North of BMSP	80	4	0	84
J	Balranald-Ivanhoe Rd – South of BMSP	80	4	0	84
K	Sturt Hwy – West of Balranald	55	1	0	56
L	Sturt Hwy – East of Balranald	1	1	0	2
M	Marma Magenta Wampo Rd – West of Link Rd	54	0	0	54
Operations					
A	Atlas-Campaspe Mine Access Rd	96	4	5	105
B	Link Rd	96	4	5	105
C	Magenta Rd	96	4	5	105
D	Hatfield-The Vale Rd	96	4	5	105
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	28	0	5	33
F	Ivanhoe Rail Facility Access Rd	4	0	5	9
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	32	0	0	32
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	68	4	0	72
I	Balranald-Ivanhoe Rd – North of BMSP	68	4	0	72
J	Balranald-Ivanhoe Rd – South of BMSP	68	4	0	72
K	Sturt Hwy – West of Balranald	38	0	0	38
L	Sturt Hwy – East of Balranald	2	0	0	2
M	Marma Magenta Wampo Rd – West of Link Rd	36	0	0	36

[A] Refer to Figure 5 for locations.

The Project is estimated to generate a peak of up to 35 and 84 vehicle trips per hour on Balranald-Ivanhoe Road to the north and south of Hatfield-The Vale Road, respectively, during the construction phase of the Project (Table 4.2). During the construction phase, the Project is estimated to generate up to 54 vehicle trips per hour on Link Road, Marma Magenta Wampo Road and Arumpo Road. These peak volumes would occur only on a Friday evening/Saturday morning and Monday morning/afternoon. This assumes that construction workers would all arrive immediately prior to the start of their first shift of the week, and depart immediately after completion of their final shift for the week. This is considered a conservatively high estimate, as it is expected that the employees travel would be spread over several hours rather than all occurring in the one hour.

The Project is expected to generate a peak of up to 33 and 72 vehicle trips per hour on Balranald-Ivanhoe Road to the north and south of Hatfield-The Vale Road, respectively, during the operational phase of the Project (Table 4.2). During the operational phase, the Project is estimated to generate up to 36 vehicle trips per hour on Link Road, Marma Magenta Wampo Road and Arumpo Road. These peak volumes are expected to occur on only 5 or 6 days per year, and assumes that all employees arrive immediately prior to the start of their rostered shift on a Monday morning. In reality, these trips would tend to be spread over a longer period. On an average day, the number of employees travelling would be significantly lower, and the resulting peak hour traffic generation would be significantly lower.

Table 4.2 demonstrates that the local roads would be expected to carry approximately up to 119 vehicle trips per hour generated by the Project during the peak hours during construction, with light vehicles making up 96% of those trips. During the busiest operational days, the local roads would be expected to carry 105 vehicles/hour generated by the Project, with light vehicles making up 91% of those trips (Table 4.2).

5. Non-Project Traffic Changes

This section considers other changes which may occur to traffic conditions in the vicinity of the Project which are not related to the Project itself. These include the BMSP to the south of the Project, and background growth in traffic which is unrelated to a specific development. The cumulative implications of these changes combined with Project traffic is discussed in Section 6.

5.1 Balranald Mineral Sands Project

Iluka Resources has recently submitted the *Balranald Mineral Sands Project - Project Scoping Report* (the BMSP Project Scoping Report) (EMGA Mitchell McLennan, 2012) to the DP&I for the BMSP, which would include construction, mining and rehabilitation of two linear mineral sand deposits known as West Balranald and Nepean, located approximately 12 km and 42 km respectively north-west of the town of Balranald. The BMSP would comprise (EMGA Mitchell McLennan, 2012):

- construction, operation and rehabilitation of a mineral sands mine, including the extraction of ore from the West Balranald and Nepean deposits
- processing of extracted ore within the mine disturbance area to produce mineral concentrates (including ilmenite)
- transport of mineral concentrates from the mine by a combination of road and rail to Iluka Resources mineral processing facilities in Hamilton, Victoria
- transport of ilmenite from the mine by either road or a combination of road and rail to port facilities in Victoria
- potential transportation of by-product (by road, rail or combination) from the processing of mineral concentrate at Hamilton back to the mine site.

The likely annual production rate of mineral concentrates (including ilmenite) would be 1,100,000 tonnes per annum. Mineral concentrates (including ilmenite) would be transported from the BMSP to the Sturt Highway by B-Doubles, with a combined average of 126 trips per day (EMGA Mitchell McLennan, 2012).

Light vehicle only access for the BMSP would be via a new access road from Balranald-Ivanhoe Road, located approximately 6 km north of Balranald. The site would also be accessed from Burke and Wills Road, approximately 15 km north of Balranald. The construction workforce is expected to be between 150 and 250 contractor personnel. The operational workforce would be approximately 100 to 120 personnel, with haulage and other services generating additional employees (EMGA Mitchell McLennan, 2012).

The Project Scoping Report (EMGA Mitchell McLennan, 2012) provides only general details regarding the likely road transport implications of the BMSP, thus assumptions have been made regarding the possible implications as they relate to the road system serving the Project. Where the BMSP Project Scoping Report (EMGA Mitchell McLennan, 2012) does not provide detail, the travel characteristics of the BMSP are assumed to be similar to those of the Project. This assessment focuses on the volume of traffic generated by the BMSP on those roads also expected to be used by the Project traffic, namely, Balranald-Ivanhoe Road and Sturt Highway.

The expected operational life of the mine would be approximately 10 years, with construction expected to commence in 2014. It is understood that a separate application will be made to Balranald Shire Council for the construction of an accommodation village to be located in the vicinity of Balranald for the construction and operational workforce for the BMSP (EMGA Mitchell McLennan, 2012).

5.1.1 Employees

The BMSP is expected to source its construction and operational workforce from both local and non-local workers. The majority of the construction and operational workforce is expected to be accommodated within the BMSP accommodation camp, which is likely to be located in or in close proximity to the township of Balranald. Access to the BMSP (including from the BMSP accommodation camp) would be via a new access road from Balranald-Ivanhoe Road approximately 6 km north of Balranald (EMGA Mitchell McLennan, 2012).

On a day-to-day basis, the majority of BMSP employees would travel between the accommodation camp and the BMSP, with a minority travelling between their usual place of residence and the BMSP. For this assessment however, it is assumed that all employees would live at the accommodation camp during the periods they are rostered on to work, and that the accommodation camp would be located in or very close to Balranald. At the start and end of rosters, it is assumed that the employees would travel directly between their usual place of residence and the BMSP rather than diverting to the accommodation camp. It is assumed that the BMSP would have a similar roster system and car pooling rate as the Project (Sections 4.2.1 and 4.3.1).

The peak BMSP construction activity is likely to occur in 2014, and the peak Project construction activity is likely to occur in 2013. For this cumulative assessment however, the peak construction workforce for the BMSP of 250 people has been conservatively considered to be present at the same time as the peak Project construction workforce. It is assumed that the construction employees would work five days per week as for the Project, with 90% attendance, 24 hour operations and two shifts per day. As the busiest days for Project construction employee traffic generation would occur on Mondays and Fridays (refer to Section 4.2.1), the BMSP construction employee traffic for Mondays and Fridays is considered in this cumulative assessment. At the start and end of their rosters (Mondays and Fridays), employees are assumed to travel directly between the BMSP worksite and their place of residence.

On Mondays, BMSP construction employees would generate approximately:

- 94 vehicle trips from the employees' residences to the BMSP prior to commencement of the day shift (7.00 am)
- 94 vehicle trip from the BMSP to the accommodation camp at the end of the day shift (7.00 pm)
- 94 vehicle trips from the employees' residences to the BMSP prior to commencement of the night shift (7.00 pm).

Similarly, on Fridays, the BMSP construction employees would be expected to generate approximately:

- 94 vehicle trip from the BMSP to the accommodation camp at the end of the night shift (7.00 am)
- 94 vehicle trips from the accommodation camp to the BMSP at the commencement of the day shift (7.00 am)
- 94 vehicle trips from the BMSP to the employees' residences at the conclusion of the day shift (7.00 pm)
- 94 vehicle trips from the accommodation camp to the BMSP at the commencement of the night shift (7.00 pm).

Thus on Mondays and Fridays, the BMSP construction employees are expected to generate 282 and 376 vehicle trips per day respectively, with a peak of approximately 188 vehicle trips per hour, assuming all arrivals and departures at the changeover times occur within a one hour period. The peak hours would occur on Monday evening, Friday morning and Friday evening only. The distributions of traffic would be slightly different on the Friday morning compared with the Monday morning and Friday evening, as it would involve only traffic travelling between the accommodation camp and the BMSP. For the purpose of this assessment, the Monday morning and Friday evening peak hours are considered.

The forecasts for the Project operational employee traffic generation are based on the busiest days of the year, and it is considered very unlikely that these occasional very busy days at the Project would coincide with the very busiest days at the BMSP. The BMSP operational employee traffic generation for this cumulative assessment is therefore based on the following:

- average day for travel at the start/end of rosters with 22% of employees travelling between the BMSP and their place of residence (22 vehicle trips); plus
- average day for shift travel with 56% of employees (average daily attendance from rosters) travelling between the accommodation camp or place of residence and the BMSP (112 vehicle trips).

Assuming that, like the Project, the BMSP operations would operate with two shifts per day, the peak volume of traffic generated in one hour by employees would be 56 vehicle trips per hour between the accommodation camp and the BMSP. It is assumed that half of the travel for the start and end of rosters may occur during that same hour, or 11 vehicle trips.

As the BMSP accommodation camp would be located closer to the township of Balranald than the Project's accommodation camp, it is considered more likely that BMSP workers would occasionally travel to and from Balranald for shopping, dining, medical services, etc. This may increase the rate at which such trips are made to and from the south of the BMSP, but these are considered to be minor and are not considered further.

It is noted that if the BMSP operators provided a shuttle service between the accommodation camp and the BMSP, the volume of traffic generated would be significantly reduced below those assumed in this assessment.

5.1.2 Visitors and Deliveries

The Project Scoping Report (EMGA Mitchell McLennan, 2012) does not provide details on the likely level of activity associated with visitors and deliveries during the construction or operational phase of the BMSP.

The peak number of construction employees for the BMSP would be approximately 85% that of the peak construction employees for the Project. For the purpose of this cumulative assessment it is conservatively assumed that the visitor and delivery traffic activity during the peak construction phase would be equal to that assessed for the Project, noting that the total visitor and delivery traffic is a relatively low component of the total traffic generation. Other general travel characteristics such as the distribution on the road system are assumed to be the same as the Project (Sections 4.2.1, 4.2.2 and 4.2.3). It is therefore assumed that visitors to the BMSP would generate 10 light vehicle trips per day, and deliveries would generate 10 heavy vehicle trips per day during construction.

The BMSP would have a maximum production rate approximately double the Project, thus it is considered that the overall level of activity associated with deliveries and visitors would be approximately double that for the Project (Sections 4.3.2 and 4.3.3). For the purpose of this assessment, it is therefore assumed that visitors to the BMSP would generate 40 light vehicle trips per day and deliveries would generate 20 heavy vehicle trips per day.

It is assumed that all light vehicles would access the BMSP via the access road from Balranald-Ivanhoe Road, and all heavy vehicles would access the BMSP via the access/haulage road from Sturt Highway.

5.1.3 Mineral Concentrate Transport

All mineral concentrate transportation is expected to occur between the BMSP and locations farther to the south in Victoria. The Project Scoping Report (EMGA Mitchell McLennan, 2012) sets out options being considered for the transportation of product and by-products to the Sturt Highway, which include road links southwards from the BMSP to one of several locations on Sturt Highway between approximately 15 km and 35 km west of Balranald. Approximately 126 B-Double trips per day would be required (EMGA Mitchell McLennan, 2012). It is assumed that transport would occur 24 hours per day, with an average of five to six trips per hour.

5.1.4 Total Balranald Mineral Sands Project Traffic

Table 5.1 summarises the estimated daily and peak hourly traffic generation of the BMSP, and the trips generated on Balranald-Ivanhoe Road and the Sturt Highway during the BMSP construction and operational phases. This assumes that all BMSP light vehicular access would be from Balranald-Ivanhoe Road approximately 6 km north of Balranald, all heavy vehicle access is assumed to be via a road from the BMSP to Sturt Highway west of Balranald, and that the accommodation camp is located in or very close to Balranald.

Table 5.1: Balranald Mineral Sands Project Traffic

Road and Location[A]		Daily (vehicles/day)				Peak Hour (vehicles/hour)			
		Light	Heavy	MCT	Total	Light	Heavy	MCT	Total
Construction (Years 1 and 2 of the Project)									
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	0	0
B	Link Rd	0	0	0	0	0	0	0	0
C	Magenta Rd	0	0	0	0	0	0	0	0
D	Hatfield-The Vale Rd	0	0	0	0	0	0	0	0
E	Balranald-Ivanhoe Rd – North of Hatfield -The Vale Rd	30	2	0	32	28	0	0	28
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	0	0
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	30	2	0	32	28	0	0	28
H	Balranald-Ivanhoe Rd – Sth of Hatfield-The Vale Rd	30	2	0	32	28	0	0	28
I	Balranald-Ivanhoe Rd – North of BMSP	30	2	0	32	28	0	0	28
J	Balranald-Ivanhoe Rd – South of BMSP	356	2	0	358	164	0	0	164
K	Sturt Hwy West of Balranald[B]	49	8	0	57	49	2	0	51
L	Sturt Hwy East of Balranald	2	2	0	4	2	0	0	2
M	Marma Magenta Wampo Rd – West of Link Rd	0	0	0	0	0	0	0	0
Operations (Years 3 to 13 of the Project)									
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	0	0
B	Link Rd	0	0	0	0	0	0	0	0
C	Magenta Rd	0	0	0	0	0	0	0	0
D	Hatfield-The Vale Rd	0	0	0	0	0	0	0	0
E	Balranald-Ivanhoe Rd – North of Hatfield -The Vale Rd	10	2	0	12	5	0	0	5
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	0	0
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	10	2	0	12	5	0	0	5
H	Balranald-Ivanhoe Rd – Sth of Hatfield-The Vale Rd	10	2	0	12	5	0	0	5
I	Balranald-Ivanhoe Rd – North of BMSP	10	2	0	12	5	0	0	5
J	Balranald-Ivanhoe Rd – South of BMSP	164	2	0	166	72	0	0	72
K	Sturt Hwy – West of Balranald	19	16	126	161	10	4	6	20
L	Sturt Hwy – East of Balranald	8	2	0	10	4	1	0	5
M	Marma Magenta Wampo Rd – West of Link Rd	0	0	0	0	0	0	0	0

[A] Refer to Figure 5 for locations.

[B] Assumed to be west of the proposed BMSP mineral concentrate access road to the Sturt Highway.

MCT = Mineral Concentrate Transport

The BMSP is therefore expected to generate 32 vehicles/day and 12 vehicles/day on Balranald-Ivanhoe Road past the Project during the construction and operational phases, respectively (Table 5.1). Between the BMSP and the accommodation camp (assumed to be located in Balranald), the BMSP is expected to generate up to 358 vehicles/day during construction, and 166 vehicles/day on a typical day during operation (Table 5.1).

The BMSP is expected to generate 28 vehicles/hour and 5 vehicles/hour on Balranald-Ivanhoe Road past the Project during the peak hour on construction and operational phases, respectively (Table 5.1). Between the BMSP and the accommodation camp (assumed to be located in Balranald), the BMSP is expected to generate peaks of 164 vehicles/hour during construction, and 72 vehicles/hour on a typical day during operations (Table 5.1).

5.2 Background Growth

Irrespective of the Project, changes to traffic conditions can be expected as a result of natural growth in traffic. The historic AADT data (Section 3.3) indicate that daily traffic volumes have not altered significantly over recent years, suggesting negligible growth in background traffic over that period. For the purpose of this assessment, however, it is conservatively assumed that future growth in background traffic on Balranald-Ivanhoe Road and the Sturt Highway would occur at a rate of 1% per annum. Background traffic on Balranald-Ivanhoe Road and the Sturt Highway is thus expected to remain low over the life of the Project. It is also assumed for the purpose of assessment that local roads would currently carry 20 vehicles/day, with peak hour volumes of 5 vehicles/hour, and that the local roads would not experience any background growth in traffic. Table 5.2 summarises the anticipated growth in background traffic for the two future scenarios being considered.

Table 5.2: Growth in Daily and Peak Hour Background Traffic

	Road and Location[A]	2006 Survey	2012 Survey	2013 Forecast	2032 Forecast
Daily (vehicles/day)					
A	Atlas-Campaspe Mine Access Rd	-	0	0	0
B	Link Rd[B]	-	20	20	20
C	Magenta Rd[B]	-	20	20	20
D	Hatfield-The Vale Rd[B]	-	20	20	20
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	-	44	45	54
F	Ivanhoe Rail Facility Access Rd	-	0	0	0
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	-	48	49	58
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd[C]	-	44	45	54
I	Balranald-Ivanhoe Rd – North of BMSP[C]	-	44	45	54
J	Balranald-Ivanhoe Rd – South of BMSP[D]	259	275	294	346
K	Sturt Hwy – West of Balranald[D, E]	969	1,029	1,097	1,291
L	Sturt Hwy – East of Balranald[D]	969	1,029	1,097	1,291
M	Marma Magenta Wampo Rd – West of Link Rd[B]		20	20	20
Peak Hour (vehicles/hour)					
A	Atlas-Campaspe Mine Access Rd	-	0	0	0
B	Link Rd[B]	-	5	5	5
C	Magenta Rd[B]	-	5	5	5
D	Hatfield-The Vale Rd[B]	-	5	5	5
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	-	7	8	9
F	Ivanhoe Rail Facility Access Rd	-	0	0	0
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	-	8	9	10
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd[C]	-	7	8	9
I	Balranald-Ivanhoe Rd – North of BMSP[C]	-	7	8	9
J	Balranald-Ivanhoe Rd – South of BMSP[F]	-	25	29	35
K	Sturt Hwy – West of Balranald[E, F]	-	103	110	129
L	Sturt Hwy – East of Balranald[F]	-	103	110	129
M	Marma Magenta Wampo Rd – West of Link Rd[B]		5	5	5

[A] Refer to Figure 5 for locations.
[B] Assumed to currently carry 20 vehicles/day, and peak of 5 vehicles/hour.
[C] Assumed to have the same traffic volume as Site E.
[D] 2012 volume forecast from 2006 survey at 1% growth per annum.
[E] Assumed to have the same traffic characteristics as Site L.
[F] Assumes peak hour equals 10% of daily.

The composition of the additional traffic is assumed to be similar to the existing surveyed composition (Section 3.5.4), i.e. approximately two-thirds light vehicles, and one-third heavy vehicles.

5.3 Total Traffic – No Project

The changes in traffic conditions which can be expected to occur without the Project traffic are summarised in Table 5.3. This assumes that the local roads currently carry 20 vehicles/day, with peak hour volumes of 5 vehicles/hour, and that the local roads would not experience any background growth in traffic.

Table 5.3: Daily and Peak Hour Traffic Without the Project

Road and Location[A]		Daily (vehicles/day)				Peak Hour (vehicles/hour)			
		Light	Heavy	MCT	Total	Light	Heavy	MCT	Total
Year 2013 (Year 1 of Project)									
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	0	0
B	Link Rd	13	7	0	20	3	2	0	5
C	Magenta Rd	13	7	0	20	3	2	0	5
D	Hatfield-The Vale Rd	13	7	0	20	3	2	0	5
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	60	17	0	77	33	3	0	36
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	0	0
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	63	18	0	81	34	3	0	37
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	60	17	0	77	33	3	0	36
I	Balranald-Ivanhoe Rd – North of BMSP	60	17	0	77	33	3	0	36
J	Balranald-Ivanhoe Rd – South of BMSP	552	100	0	652	183	10	0	193
K	Sturt Hwy West of Balranald[B]	780	374	0	1,154	122	39	0	161
L	Sturt Hwy East of Balranald	733	368	0	1,101	75	37	0	112
M	Marma Magenta Wampo Rd – West of Link Rd[B]	13	7	0	20	3	2	0	5
Year 2032 (Year 20 of Project)[C]									
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	0	0
B	Link Rd	13	7	0	20	3	2	0	5
C	Magenta Rd	13	7	0	20	3	2	0	5
D	Hatfield-The Vale Rd	13	7	0	20	3	2	0	5
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	46	20	0	66	11	3	0	14
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	0	0
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	49	21	0	70	12	3	0	15
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	46	20	0	66	11	3	0	14
I	Balranald-Ivanhoe Rd – North of BMSP	46	20	0	66	11	3	0	14
J	Balranald-Ivanhoe Rd – South of BMSP	394	118	0	512	95	12	0	107
K	Sturt Hwy West of Balranald[B]	879	447	126	1,452	96	47	6	149
L	Sturt Hwy East of Balranald	868	433	0	1,301	90	44	0	134
M	Marma Magenta Wampo Rd – West of Link Rd[B]	13	7	0	20	3	2	0	5

[A] Refer to Figure 5 for locations.
[B] Assumed to be west of the proposed BMSP mineral concentrate access road to the Sturt Highway.
[C] Conservatively includes BMSP traffic, which is expected to cease in Year 13 of the Project.
MCT = Mineral Concentrate Transport

These results indicate that without the Project, traffic volumes on Balranald-Ivanhoe Road can be expected to increase to approximately 81 vehicles/day near Ivanhoe and 652 vehicles/day near Balranald during the construction phase of the BMSP (Table 5.3). In the longer term, with BMSP operational traffic and background growth, volumes would be approximately 70 vehicles/day near Ivanhoe, and 512 vehicles/day near Balranald. The highest volumes on Balranald-Ivanhoe Road would occur between the BMSP access road and Balranald.

Without the Project, traffic volumes on Sturt Highway can expected to increase to approximately 1,154 vehicles/day during the BMSP construction phase. In the longer term, with BMSP operational traffic and background growth, volumes on Sturt Highway would be approximately 1,301 to 1,452 vehicles/day (Table 5.3). The highest volumes would be on Sturt Highway to the west of whichever location the BMSP uses for its mineral concentrate transport and heavy vehicle access.

6. Future Traffic Conditions With The Project

6.1 Future Daily Traffic Volumes

As described in Section 4.1, the following two future scenarios which represent key stages in the Project combined with potential background traffic activity have been considered:

- **Year 1 (2013)** – this scenario includes peak construction activity associated with the Project, combined with growth in background (non-Project) traffic, as well as peak construction traffic associated with Iluka Resources' BMSP (Section 5.1)
- **Year 20 (2032)** – this scenario includes operational activity at the Project, combined with growth in background (non-Project) traffic, operational traffic associated with the BMSP, as well as maximum mineral concentrate transport activity.

It is noted that during Year 5 (2017) there would be operational and construction activities associated with the Project. The Project workforce during Year 5 would be the same as during Year 1. The cumulative workforce (i.e. the Project and the BMSP) during Year 5 would be less than Year 1, therefore the cumulative impacts during Year 5 would be less than Year 1.

The BMSP is expected to commence construction in 2014, after construction of the Project commences in 2013. For the purpose of the cumulative assessment of traffic conditions in the region, it is conservatively assumed that the construction phases of the Project and the BMSP would occur simultaneously in 2013/14. Similarly, the BMSP is expected to cease operation by approximately 2025, while the Project would continue until 2032. For the purpose of the cumulative assessment of traffic conditions in the region, it is conservatively assumed that the BMSP would continue to operate until the end of the life of the Project. Overall, these assumptions will result in conservatively high estimates of future traffic volumes for the Project assessment scenarios.

Table 6.1 summarises the future two way daily traffic volumes expected during Project Years 1 and 20. The greatest impact of the Project is expected to occur on the local roads between the Atlas-Campaspe Mine and Balranald-Ivanhoe Road with future traffic volumes expected to increase to approximately 258 and 234 vehicles/day in Years 1 and 20 of the Project, respectively.

Balranald-Ivanhoe Road north of Hatfield-The Vale Road can be expected to carry approximately 147 vehicles/day in Year 1 and 157 vehicles/day in Year 20, with the majority of the traffic being associated with the Project (Table 6.1). Future traffic volumes on Balranald-Ivanhoe Road north of Balranald can be expected to increase to approximately 820 vehicles/day in Year 1 and 633 vehicles/day in Year 20, with the majority of the traffic being light vehicles associated with the BMSP.

Future traffic volumes on Sturt Highway west of Balranald (and west of the BMSP access) can be expected to increase to approximately 1,266 vehicles/day in Year 1 and 1,512 vehicles/day in Year 20, with the majority of the additional traffic being associated with the BMSP.

Table 6.1: Future Daily Traffic Volumes with Project (vehicles/day)

	Road and Location[A]	Existing			Non-Project Changes			Project			Total			
		Light	Heavy	MCT	Light	Heavy	MCT	Light	Heavy	MCT	Light	Heavy	MCT	Total
Year 2013 (Year 1 of Project)														
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	228	10	0	228	10	0	238
B	Link Rd	13	7	0	0	0	0	228	10	0	241	17	0	258
C	Magenta Rd	13	7	0	0	0	0	228	10	0	241	17	0	258
D	Hatfield-The Vale Rd	13	7	0	0	0	0	228	10	0	241	17	0	258
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	29	15	0	31	2	0	68	2	0	128	19	0	147
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	16	0	0	16	0	0	16
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	32	16	0	31	2	0	84	2	0	147	20	0	167
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	29	15	0	31	2	0	160	8	0	220	25	0	245
I	Balranald-Ivanhoe Rd – North of BMSP	29	15	0	31	2	0	160	8	0	220	25	0	245
J	Balranald-Ivanhoe Rd – South of BMSP	183	92	0	369	8	0	160	8	0	712	108	0	820
K	Sturt Hwy West of Balranald[B]	685	344	0	95	30	0	110	2	0	890	376	0	1,266
L	Sturt Hwy East of Balranald	685	344	0	48	24	0	2	2	0	735	370	0	1,105
M	Marma Magenta Wampo Rd – West of Link Rd	13	7	0	0	0	0	108	0	0	121	7	0	128
Year 2032 (Year 20 of Project)[C]														
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	156	10	48	156	10	48	214
B	Link Rd	13	7	0	0	0	0	156	10	48	169	17	48	234
C	Magenta Rd	13	7	0	0	0	0	156	10	48	169	17	48	234
D	Hatfield-The Vale Rd	13	7	0	0	0	0	156	10	48	169	17	48	234
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	29	15	0	17	5	0	41	2	48	87	22	48	157
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	6	0	48	6	0	48	54
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	32	16	0	17	5	0	47	2	0	96	23	0	119
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	29	15	0	17	5	0	113	8	0	159	28	0	187
I	Balranald-Ivanhoe Rd – North of BMSP	29	15	0	17	5	0	113	8	0	159	28	0	187
J	Balranald-Ivanhoe Rd – South of BMSP	183	92	0	211	26	0	113	8	0	507	126	0	633
K	Sturt Hwy West of Balranald[B]	685	344	0	194	103	126	58	2	0	937	449	126	1,512
L	Sturt Hwy East of Balranald	685	344	0	183	89	0	4	2	0	872	435	0	1,307
M	Marma Magenta Wampo Rd – West of Link Rd	13	7	0	0	0	0	54	0	0	67	7	0	74

[A] Refer to Figure 5 for locations.
[B] Assumed to be west of the proposed BMSP mineral concentrate access road to the Sturt Highway.
[C] Conservatively includes BMSP traffic, which is expected to cease in Year 13 of the Project.
MCT = Mineral Concentrate Transport

6.2 Future Peak Hour Traffic Volumes

Table 6.2 summarises the future peak hourly traffic volumes expected during Project Years 1 and 20. As noted previously, these are considered conservatively high forecasts, as they:

- are based on the highest surveyed peak hour volumes on Balranald-Ivanhoe Road
- assume that "busy hour" traffic activity associated with the BMSP would coincide with "busy hour" Project traffic activity
- do not take into account spreading of peak traffic volumes as distance from the traffic generator increases.

Table 6.2 demonstrates that the greatest impact of the Project is expected to occur on the local roads between the Atlas-Campaspe Mine and Balranald-Ivanhoe Road with future traffic volumes expected to increase to approximately 124 and 110 vehicles/hour in Years 1 and 20 of the Project respectively.

Balranald-Ivanhoe Road north of Hatfield-The Vale Road can be expected to carry approximately 71 and 47 vehicles/hour in Years 1 and 20 respectively, with the majority of the traffic being associated with the Project. Future traffic volumes on Balranald-Ivanhoe Road immediately to the north of Balranald can be expected to increase to approximately 277 and 179 vehicles/hour in Years 1 and 20 respectively.

Future traffic volumes on Sturt Highway west of Balranald (and west of the BMSP access road) can be expected to increase to approximately 217 and 187 vehicles/hour in Years 1 and 20 respectively.

6.3 Changes to the Road System

As described in Section 2.3, with the exception of approximately 37 km of existing unsealed roads between the Atlas-Campaspe Mine site access road and the intersection with the sealed Balranald-Ivanhoe Road (Figure 2), the remaining section of the approximate 175 km long proposed mineral concentrate transport route is approved to accommodate road trains (RMS, 2012a).

Roadworks along the 37 km section would therefore be required during construction of the Project and would include (Figure 4):

- upgrade of the intersection of Hatfield-The Vale Road and Balranald-Ivanhoe Road
- road widening and associated drainage works (up to approximately 23 m total width) along a 14.5 km long section of Hatfield-The Vale Road to accommodate an unsealed two-lane road
- new intersection at Hatfield-The Vale Road and Magenta Road
- a new unsealed two-lane road formation (approximately 2 km long and up to approximately 23 m total width) between the new intersection at Hatfield-The Vale Road and Magenta Road
- road widening and associated drainage works (up to approximately 23 m total width) along two sections (approximately 2 km and 1 km long, respectively) of Magenta Road to accommodate an unsealed two-lane road
- sealing and associated drainage works (up to approximately 21 m total width) along a 2 km long section of Magenta Road to accommodate a two-lane road
- new intersection at Magenta Road and Boree Plains-Gol Gol Road

Table 6.2: Future Peak Hour Traffic Volumes with Project (vehicles/hour)

Road and Location[A]		Existing			Non-Project Changes			Project			Total			
		Light	Heavy	MCT	Light	Heavy	MCT	Light	Heavy	MCT	Light	Heavy	MCT	Total
Year 2013 (Year 1 of Project)														
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	114	5	0	114	5	0	119
B	Link Rd	3	2	0	0	0	0	114	5	0	117	7	0	124
C	Magenta Rd	3	2	0	0	0	0	114	5	0	117	7	0	124
D	Hatfield-The Vale Rd	3	2	0	0	0	0	114	5	0	117	7	0	124
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	5	2	0	28	1	0	34	1	0	67	4	0	71
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	8	0	0	8	0	0	8
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	5	3	0	29	0	0	42	1	0	76	4	0	80
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	5	2	0	28	1	0	80	4	0	113	7	0	120
I	Balranald-Ivanhoe Rd – North of BMSP	5	2	0	28	1	0	80	4	0	113	7	0	120
J	Balranald-Ivanhoe Rd – South of BMSP	17	8	0	166	2	0	80	4	0	263	14	0	277
K	Sturt Hwy West of Balranald[B]	69	34	0	53	5	0	55	1	0	177	40	0	217
L	Sturt Hwy East of Balranald	69	34	0	6	3	0	1	1	0	76	38	0	114
M	Marma Magenta Wampo Rd – West of Link Rd	3	2	0	0	0	0	54	0	0	57	2	0	59
Year 2032 (Year 20 of Project)[C]														
A	Atlas-Campaspe Mine Access Rd	0	0	0	0	0	0	96	4	5	96	4	5	105
B	Link Rd	3	2	0	0	0	0	96	4	5	99	6	5	110
C	Magenta Rd	3	2	0	0	0	0	96	4	5	99	6	5	110
D	Hatfield-The Vale Rd	3	2	0	0	0	0	96	4	5	99	6	5	110
E	Balranald-Ivanhoe Rd – North of Hatfield-The Vale Rd	5	2	0	6	1	0	28	0	5	39	3	5	47
F	Ivanhoe Rail Facility Access Rd	0	0	0	0	0	0	4	0	5	4	0	5	9
G	Balranald-Ivanhoe Rd – North of Ivanhoe Rail Facility	5	3	0	7	0	0	32	0	0	44	3	0	47
H	Balranald-Ivanhoe Rd – South of Hatfield-The Vale Rd	5	2	0	6	1	0	68	4	0	79	7	0	86
I	Balranald-Ivanhoe Rd – North of BMSP	5	2	0	6	1	0	68	4	0	79	7	0	86
J	Balranald-Ivanhoe Rd – South of BMSP	17	8	0	78	4	0	68	4	0	163	16	0	179
K	Sturt Hwy West of Balranald[B]	69	34	0	27	13	6	38	0	0	134	47	6	187
L	Sturt Hwy East of Balranald	69	34	0	21	10	0	2	0	0	92	44	0	136
M	Marma Magenta Wampo Rd – West of Link Rd	3	2	0	0	0	0	36	0	0	39	2	0	41

A Refer to Figure 5 for locations.
B Assumed to be west of the proposed BMSP mineral concentrate access road to the Sturt Highway.
C Conservatively includes BMSP traffic, which is expected to cease in Year 13 of the Project.
MCT = Mineral Concentrate Transport

- a new unsealed two-lane road formation (approximately 2 km long and up to approximately 23 m total width) between the new intersection at Magenta Road and Boree Plains-Gol Gol Road
- road widening and associated drainage works (up to approximately 23 m total width) along a 5.5 km long section of Boree Plains-Gol Gol Road to accommodate an unsealed two-lane road
- road widening and associated drainage works (up to approximately 23 m total width) along a 8 km long section of Link Road to accommodate an unsealed two-lane road
- a new intersection at Link Road and the Atlas-Campaspe Mine site access road.

The roadworks would be undertaken in consultation with Balranald Shire Council and in accordance with the requirements of the relevant RMS guidelines.

In addition to the above, a new intersection would be required for the Ivanhoe Rail Facility site access road off Balranald-Ivanhoe Road. The new intersection would be designed and constructed in accordance with the relevant RMS guidelines and in consultation with Central Darling Shire Council.

6.4 Future Road System Efficiency

The forecast traffic volumes with the Project traffic combined with non-Project traffic changes (refer to Table 6.1 and Table 6.2) indicate that on the busiest section of Balranald-Ivanhoe Road between Balranald and the BMSP access, peak hour traffic would be approximately 277 vehicles/hour during the peak Project construction period, and approximately 179 vehicles/hour on the busiest five or six days per year during the operational phase in the long-term. Peak hourly volumes farther to the north on Balranald-Ivanhoe Road would be lower during these periods.

Under base conditions, Level of Service A would be experienced for a two way volume of up to approximately 650 pc/h on Balranald-Ivanhoe Road. The forecast peak hourly volume is well below this threshold during both the construction and operational phases, thus it follows that even taking into account variations from the base conditions, the Level of Service experienced on Balranald-Ivanhoe Road would be A.

Similarly, the expected volumes on the local roads of up to 124 vehicles/hour during peak construction and 110 vehicles/hour on the busiest five or six days per year during the operational phase would be well below the threshold for Level of Service A.

To the west of Balranald and the BMSP access road, Sturt Highway is forecast to carry approximately 217 vehicles/hour during the peak Project construction phase and 187 vehicles/hour during the busiest days during the operational phase in the long-term. These volumes are well below the 600 pc/h threshold for Level of Service A on Class I roads, thus the Level of Service experienced on Sturt Highway would remain A.

Future traffic volumes would be sufficiently low that no specific measures to provide additional capacity along Sturt Highway or Balranald-Ivanhoe Road or its intersections would be warranted by the Project traffic.

6.5 Mineral Concentrate and MSP Process Waste Transport

As described in Section 2.4, mineral concentrate would be hauled via road approximately 175 km from the Atlas-Campaspe Mine to the Ivanhoe Rail Facility. The mineral concentrate would be transported in road trains[7]. Road transport of mineral concentrate would be undertaken 24 hours per day, seven days per week.

It is anticipated that a Transport Management Plan would be developed prior to commencement of the operational phase of the Project, which would define and address aspects of mineral concentrate transport, including (but not limited to):

- driver training
- operating hours
- vehicle identification
- driver code of conduct
- load covering
- labelling and placarding requirements for transporting MSP process waste
- fatigue management
- drug and alcohol policy
- vehicle maintenance and safety program
- emergency response plan.

The forecast number of truck movements is sufficiently low that the potential for interaction with other vehicles would remain low. However, an agreed road transport protocol would provide a means to manage truck movements and minimise any adverse impacts on other road users as a result of the additional heavy vehicle movements on the haulage route.

As also mentioned in Section 2.4, from approximately Year 12 of the Project, MSP process waste containers would be unloaded from trains at the Ivanhoe Rail Facility, and temporarily held in a designated area prior to loading onto haulage vehicles for the return trip to Atlas-Campaspe Mine. Therefore movement of MSP process waste would result in no additional haulage movements in addition to the mineral concentrate haulage vehicle movements.

A Mineral Concentrate and Process Waste Materials Assessment (Radiation Advice & Solutions, 2012) has been prepared for the Project and is provided as Appendix L of the EIS. Radiation Advice & Solutions (2012) has determined that MSP process waste would be classified Hazardous under the NSW *Protection of Environment Operations Act, 1997*. The potential impacts of transporting the MSP process waste on the mineral concentrate transport route have been assessed in the Mineral Concentrate and Process Waste Materials Assessment (Appendix L of the EIS).

[7] Type 1 road train, as defined by RMS, 2012b.

6.6 Road Safety Implications

The review of road crashes which have occurred along the mineral concentrate transport route (Section 3.4) found that there was no pattern regarding the location of crashes, indicating that there was no particular location requiring upgrading to address an existing safety concern. The increases in traffic resulting from the Project would be relatively minor, and when considered in the context of the overall changes in traffic conditions resulting from general background growth and the BMSP, future traffic volumes are not considered likely to result in safety concerns on the surrounding road network.

Notwithstanding the above, the Road Safety Audit (GTA Consultants, 2012) identified deficiencies on the mineral concentrate transport route and ranked them by priority (refer to Section 3.4.1). On Balranald-Ivanhoe Road, a number of "high risk" deficiencies were identified in the Road Safety Audit, which suggests these deficiencies should be addressed as a matter of high priority. Other deficiencies were identified as "medium risk", requiring attention but at lower priority, and yet others were identified as "low risk" suggesting they may be appropriately dealt with as part of routine maintenance programs. Balranald-Ivanhoe Road is a Regional Road, thus maintenance is shared between Balranald Shire Council, Central Darling Shire Council and RMS.

The deficiencies identified on Balranald-Ivanhoe Road would be progressively addressed in conjunction with Balranald Shire Council, Central Darling Shire Council and RMS during maintenance activities in accordance with the requirements of the relevant RMS guidelines.

With regard to the local access roads, the deficiencies identified in the Road Safety Audit would be appropriately addressed as part of the roadworks planned to realign and improve the road conditions to allow for road train access (Section 6.3).

6.7 Road Level Crossing

The current rail movements on the Orange-Broken Hill Railway in the vicinity of Ivanhoe are relatively low at approximately 40 movements each week, or approximately six movements each day. The Project would not result in any change to the existing rail movements through the road level crossing to the south of Ivanhoe as the Ivanhoe Rail Facility is located to the west of the road level crossing (Figure 3).

As described in Section 2.4, the proposed mineral concentrate transport route would not cross the Orange-Broken Hill Railway south of Ivanhoe (Figure 3). The Project would however result in an increase of approximately 84 vehicles/day during construction and approximately 47 vehicles/day during operations through the road level crossing north of the Ivanhoe Rail Facility. The total vehicle movements through the road level crossing south of Ivanhoe would be approximately 167 vehicles/day during construction and 119 vehicles/day during operations.

As the total volume of road traffic through the road level crossing south of Ivanhoe would be relatively low and the Project would not generate additional rail traffic movements at this road level crossing, it is considered that the incremental risk of road and rail traffic interaction associated with the Project at this road level crossing would be low. No upgrades to the road level crossing are therefore required.

The Project would result in up to six movements per week on the Orange-Broken Hill Railway between Ivanhoe and Broken Hill. These additional rail movements (i.e. up to two per day) are not expected to significantly increase the risk of road and rail traffic interaction at road level crossings between Ivanhoe and Broken Hill.

6.8 School Buses

It is anticipated that the Transport Management Plan (Section 6.5) would address haulage management measures in the event that the mineral concentrate transport route is used by school buses during the life of the Project. Such management measures may include some of the following:

- restricting haulage activity to outside the times and/or locations that school buses use the route
- reducing haulage truck speeds during the hours and locations that the school buses use the route
- reducing haulage truck speeds while near to or passing a school bus.

The specific management measures would be most appropriately developed in consultation with school bus operators.

6.9 Other Transport Modes

The Project may generate additional demand for passengers on the existing coach and rail services in the region. It is not expected that the increase in demand would be sufficient to warrant increases in the capacity of such services. Any changes to the services to accommodate increased demand would however be at the discretion of the service operators.

6.10 Project Car Parking

Car parking would be provided at the Atlas-Campaspe Mine and the Ivanhoe Rail Facility to meet the expected demands. A car park for employees and visitors would be provided adjacent the buildings. Parking facilities would be constructed to meet the requirements of Balranald Shire Council and Central Darling Shire Council.

6.11 Oversize Vehicles

A number of oversize vehicle movements may be generated on an occasional basis during the life of the Project. These oversize vehicle movements would be associated with the transport of construction and mining equipment and infrastructure to and from the Project.

Although the number of oversize vehicle movements associated with the Project is anticipated to be small, the requirement for each proposed oversize vehicle movement would be reviewed and alternative transport options, such as rail, would be considered prior to the movement.

It is anticipated that oversize vehicles would approach the Project via Sturt Highway and Balranald-Ivanhoe Road. Notwithstanding, the proposed movement of any oversize vehicles would be negotiated with RMS and relevant local councils on a case-by-case basis. All oversize loads would be transported with the relevant permits obtained in accordance with *Operating Conditions: specific permits for oversize and over-mass vehicles and loads* (RTA, 2008), and any other licences and escorts as required by the regulatory authorities.

Given the expected infrequent nature of oversize vehicle movements to and from the Project, it is considered that there would be minimal cumulative impacts associated with oversize vehicle movements on the local road network.

6.12 Potential Road Noise and Dust Impacts

Potential road noise and dust impacts have been assessed in the Noise Assessment (Wilkinson Murray, 2012) (Appendix J of the EIS) and the Air Quality and Greenhouse Gas Assessment (Katestone Environmental, 2013) (Appendix K of the EIS) respectively.

6.13 Measures to Maintain or Improve Capacity, Efficiency and Safety

The discussions in Section 6.5 demonstrate that with the additional traffic expected to be generated by the Project, the operation of the road system would remain satisfactory with regard to midblock capacities during peak hours. The review of the history of road crashes (Section 3.4) has not identified any locations with inherent safety concerns which may be exacerbated by the additional traffic generated by the Project.

The Project would include roadworks along the 37 km section of the mineral concentrate transport route between the Atlas-Campaspe Mine and Balranald-Ivanhoe Road (Section 6.3). These roadworks would improve the capacity, efficiency and safety of this section of the mineral concentrate transport route through road widening and intersection improvements.

Notwithstanding, road widening would not be undertaken along approximately 2 km of the mineral concentrate transport route to avoid impacts on a threatened plant species (i.e. the Mossgiel Daisy) (Australian Museum Business Services, 2013) (Appendix A of the EIS). The speed limit through this section of road would be reduced and sign-posted to maintain appropriate safety standards. Site inductions would include speed limit requirements for this section of road.

In addition, the deficiencies identified on Balranald-Ivanhoe Road during the Road Safety Audit (Section3.4.2) would be progressively addressed in conjunction with Balranald Shire Council, Central Darling Shire Council and RMS during maintenance activities in accordance with the requirements of the relevant RMS guidelines.

Cristal Mining would enter into road maintenance agreements with Balranald Shire Council, Central Darling Shire Council and RMS to address the ongoing maintenance requirements for the Project. The road maintenance agreements would specify the timing for the implementation of maintenance to address the safety deficiencies identified in the Road Safety Audit (GTA Consultants, 2012).

Additional measures to provide additional capacity or improve the safety of the road system are therefore not considered to be warranted.

7. Conclusions

The proposal by Cristal Mining to develop the Project in the south-west of NSW would have acceptable impacts on the operation of the surrounding road system.

No significant impacts on the performance, capacity, efficiency and safety of the road network are expected to arise as a result of the Project.

The Project would include roadworks (Section 2.3) and the deficiencies identified on Balranald-Ivanhoe Road by the Road Safety Audit (Section 3.4.2) would be progressively addressed in conjunction with Balranald Shire Council, Central Darling Shire Council and RMS during maintenance activities in accordance with the requirements of the relevant RMS guidelines. With the exception of these works, no specific management or mitigation measures are considered to be warranted by the Project.

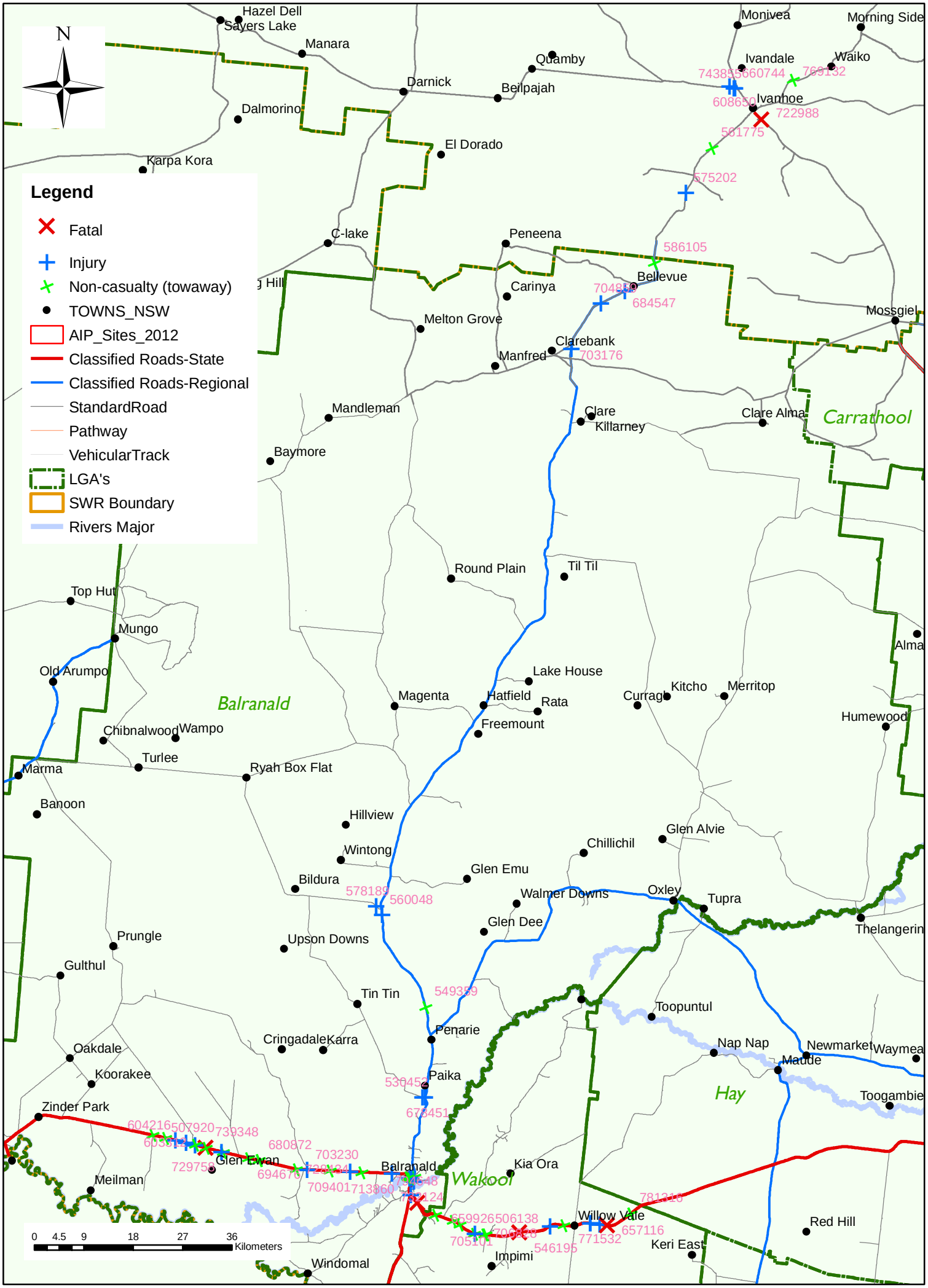
Cristal Mining would enter into road maintenance agreements with Balranald Shire Council, Central Darling Shire Council and RMS to address the ongoing maintenance requirements for the Project. The road maintenance agreements would specify the timing for the implementation of maintenance to address the safety deficiencies identified in the Road Safety Audit (GTA Consultants, 2012).

Development of a Transport Management Plan for the movement of mineral concentrate and MSP process waste between the Atlas-Campaspe Mine and the Ivanhoe Rail Facility would minimise any impacts of the heavy vehicles associated with the Project.

Attachment A

Attachment A

New South Wales Roads and Maritime Services Crash Data



Sturt Hwy from 50km East to 50km West of Balranald & Balranald-Ivanhoe Rd

Summary Crash Report

Transport Centre for Road Safety

# Crash Type		
Car Crash	42	68.9%
Light Truck Crash	13	21.3%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	7	11.5%
'Heavy Truck Crash	(7)	(11.5%)
Bus Crash	0	0.0%
"Heavy Vehicle Crash	(7)	(11.5%)
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	4	6.6%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	1	1.6%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	6	9.8%
Non intersection	55	90.2%

* Up to 10 metres from an intersection
~ 07:30-09:30 or 14:30-17:00 on school days

Collision Type		
Single Vehicle	52	85.2%
Multi Vehicle	9	14.8%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	42	68.9%
Other Classified Road	13	21.3%
Unclassified Road	6	9.8%

Contributing Factors		
Speeding	7	11.5%
Fatigue	15	24.6%
Alcohol	4	6.6%

Weather		
Fine	55	90.2%
Rain	4	6.6%
Overcast	1	1.6%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	4	6.6%
Dry	57	93.4%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	3	4.9%
Daylight	30	49.2%
Dusk	6	9.8%
Darkness	22	36.1%

Crash Movement		
Intersection, adjacent approaches	3	4.9%
Head-on (not overtaking)	1	1.6%
Opposing vehicles; turning	0	0.0%
U-turn	0	0.0%
Rear-end	3	4.9%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	12	19.7%
Off road, on straight	13	21.3%
Off road on straight, hit object	14	23.0%
Out of control on straight	4	6.6%
Off road, on curve	3	4.9%
Off road on curve, hit object	2	3.3%
Out of control on curve	1	1.6%
Other crash type	5	8.2%

Speed Limit				
40 km/h or less	0	0.0%	~ 40km/h or less	0 0.0%
50 km/h zone	8	13.1%	80 km/h zone	0 0.0%
60 km/h zone	0	0.0%	90 km/h zone	0 0.0%
70 km/h zone	0	0.0%	100 km/h zone	17 27.9%
			110 km/h zone	36 59.0%

CRASHES	61	
Fatal crash	5	8.2%
Injury crash	28	45.9%
Non-casualty crash	28	45.9%

Time Group		% of Day	
00:01 - 02:59	4	6.6%	12.5%
03:00 - 04:59	7	11.5%	8.3%
05:00 - 05:59	3	4.9%	4.2%
06:00 - 06:59	4	6.6%	4.2%
07:00 - 07:59	2	3.3%	4.2%
08:00 - 08:59	5	8.2%	4.2%
09:00 - 09:59	8	13.1%	4.2%
10:00 - 10:59	1	1.6%	4.2%
11:00 - 11:59	1	1.6%	4.2%
12:00 - 12:59	2	3.3%	4.2%
13:00 - 13:59	1	1.6%	4.2%
14:00 - 14:59	2	3.3%	4.2%
15:00 - 15:59	1	1.6%	4.2%
16:00 - 16:59	5	8.2%	4.2%
17:00 - 17:59	3	4.9%	4.2%
18:00 - 18:59	5	8.2%	4.2%
19:00 - 19:59	2	3.3%	4.2%
20:00 - 21:59	3	4.9%	8.3%
22:00 - 24:00	2	3.3%	8.3%

Street Lighting Off/Nil		% of Dark
21	of 22 in Dark	95.5%

CASUALTIES	49	
Killed	5	10.2%
Injured	44	89.8%
^ Unrestrained	2	4.1%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
4	2012	1
9	2011	8
11	2010	10
11	2009	11
5	2008	6
12	2007	6
9	2006	7

~ School Travel Time		
Involvement	9	14.8%

McLean Periods			% Week
A	14	23.0%	17.9%
B	7	11.5%	7.1%
C	11	18.0%	17.9%
D	0	0.0%	3.5%
E	4	6.6%	3.6%
F	9	14.8%	10.7%
G	4	6.6%	7.1%
H	3	4.9%	7.1%
I	2	3.3%	12.5%
J	7	11.5%	10.7%

Day of the Week						# Holiday Periods		
Monday	10	16.4%	Thursday	7	11.5%	Sunday	7	11.5%
Tuesday	4	6.6%	Friday	13	21.3%	WEEKDAY	45	73.8%
Wednesday	11	18.0%	Saturday	9	14.8%	WEEKEND	16	26.2%

New Year	0	0.0%	Queen's BD	1	1.6%	Easter SH	5	8.2%
Aust. Day	0	0.0%	Labour Day	1	1.6%	June/July SH	2	3.3%
Easter	1	1.6%	Christmas	2	3.3%	Sept./Oct. SH	3	4.9%
Anzac Day	0	0.0%	January SH	6	9.8%	December SH	3	4.9%

Crashid dataset Sturt Hwy from 50km East to 50km West of Balranald, Balranald Township, Balranald-Ivanhoe Rd, 2006-12 Crashes
Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Detailed Crash Report

Transport Centre for Road Safety — NSW Government

Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					A S F
South West Region																					
Balranald LGA																					
Abbotts Tank																					
Sturt Hwy																					
739348	21/01/2011	Fri	01:20	10 km	E	TILLARA RD	2WY	STR	Fine	Dry	110	1	CAR	M34	E in STURT HWY	110	Proceeding in lane	N	0	0	
E44033678							RUM:	67	Struck animal				Kangaroo								
Balranald																					
Arumpo Rd																					
530452	28/07/2006	Fri	06:40	500 m	W	BALRANALD RD	2WY	STR	Fine	Dry	100	1	TRK	M42	W in ARUMPO RD	60	Proceeding in lane	I	0	2	
E27748938							RUM:	67	Struck animal				Kangaroo								
578189	20/05/2007	Sun	17:30	1.3 km	W	IVANHOE RD	2WY	STR	Fine	Dry	100	1	CAR	F73	E in ARUMPO RD	80	Proceeding in lane	I	0	1	
E30456718							RUM:	73	Off rd rght => obj				Embankment								
Boynton St																					
521322	03/04/2006	Mon	17:55	39 m	E	CALLY ST	2WY	STR	Fine	Dry	50	1	CAR	F17	W in BOYNTON ST	40	Proceeding in lane	N	0	0	
E26532514							RUM:	71	Off rd left => obj				Building								
Island Rd																					
594117	04/10/2007	Thu	03:00	30 m	E	BANK ST	2WY	STR	Fine	Dry	50	1	CAR	U U	W in ISLAND RD	80	Proceeding in lane	N	0	0	S
E32169542							RUM:	71	Off rd left => obj				Tree/bush								
Ivanhoe Rd																					
560048	14/02/2007	Wed	09:00	25 km	N	HOMEBUSH PUB HO	2WY	STR	Fine	Dry	100	1	TRK	M47	W in IVANHOE RD	100	Proceeding in lane	I	0	1	
E29145420							RUM:	70	Off road to left												
678451	11/07/2009	Sat	00:10	150 m	N	TIN TIN RD	2WY	CRV	Fine	Dry	100	1	CAR	M23	S in IVANHOE RD	Unk	Proceeding in lane	I	0	1	A S
E37822147							RUM:	84	Off right/left bend												
Market St																					
732124	06/11/2010	Sat	03:00	230 m	E	MCCABE ST	2WY	CRV	Fine	Dry	50	1	CAR	M22	E in MARKET ST	60	Proceeding in lane	I	0	1	A S F
E42483654							RUM:	81	Off left/rt bnd=>obj				Body of water								
Mayall St																					
747264	30/03/2011	Wed	08:50		at	CHURCH ST	XJN	STR	Fine	Dry	50	2	TRK	F22	E in CHURCH ST	30	Proceeding in lane	I	0	2	
E44563567							RUM:	10	Cross traffic				CAR	M82	N in MAYALL ST	50	Proceeding in lane				
Sturt Hwy																					

Detailed Crash Report

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Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					A S F
713860	11/06/2010	Fri	21:10	9 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	TRK	F49	E in STURT HWY	100	Proceeding in lane	N	0	0	
E139794796							RUM:	67	Struck animal				Kangaroo								
709401	03/04/2010	Sat	16:30	10 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	4WD	M19	E in STURT HWY	110	Proceeding in lane	I	0	2	F
E41418908							RUM:	72	Off road to right												
583308	25/07/2007	Wed	07:15	15 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	SEM	M59	W in STURT HWY	100	Proceeding in lane	N	0	0	F
E31359028							RUM:	73	Off rd rght => obj				Tree/bush								
787956	10/03/2012	Sat	08:00	28 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	WAG	M25	W in STURT HWY	100	Proceeding in lane	N	0	0	
E47516919							RUM:	67	Struck animal				Kangaroo								
694676	12/10/2009	Mon	08:41	30 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	CAR	U U	W in STURT HWY	Unk	Other forward	N	0	0	F
E38733959							RUM:	79	Other straight												
729758	25/10/2010	Mon	03:00	34 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	BDBL	M40	E in STURT HWY	100	Proceeding in lane	I	0	2	
E42469048							RUM:	67	Struck animal				Straying stock								
793515	01/05/2012	Tue	19:00	34.7 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	CAR	M31	E in STURT HWY	100	Proceeding in lane	N	0	0	
E92274301							RUM:	67	Struck animal				Kangaroo								
648287	22/01/2009	Thu	18:30	38 km	W	BALRANALD TN	2WY	STR	Unk	Dry	110	1	CAR	M46	E in STURT HWY	110	Pull out opposite	F	1	2	
E36643663							RUM:	51	Out of control otake												
560287	01/03/2007	Thu	12:46	40 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	WAG	F37	E in STURT HWY	Unk	Proceeding in lane	N	0	0	
E56403202							RUM:	72	Off road to right												
603312	03/12/2007	Mon	18:20	40 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	M/C	M42	E in STURT HWY	110	Proceeding in lane	I	0	1	
E31935715							RUM:	70	Off road to left												
728214	13/10/2010	Wed	18:00	2 km	W	ENDEAVOUR DR	2WY	STR	Fine	Dry	100	2	SEM	M67	E in STURT HWY	100	Proceeding in lane	I	0	1	
E42404464							RUM:	3	Ped on carriageway				PED	M36	E in STURT HWY		Stand on carriageway				
604216	23/12/2007	Sun	09:00	35 km	E	EUSTON TN	2WY	STR	Fine	Dry	110	1	CAR	F39	E in STURT HWY	90	Proceeding in lane	I	0	1	F
E33652955							RUM:	70	Off road to left												
507920	02/02/2006	Thu	19:10	38 km	E	EUSTON TN	2WY	STR	Fine	Dry	110	1	TRK	M33	W in STURT HWY	100	Proceeding in lane	I	0	1	A F
E25887715							RUM:	73	Off rd rght => obj				Tree/bush								
794648	10/07/2012	Tue	18:20	2 km	E	MALLEE HWY	2WY	STR	Raining	Wet	100	2	CAR	M63	W in STURT HWY	100	Incorrect side	F	1	0	F
E48557803							RUM:	20	Head on				BDBL	M53	E in STURT HWY	95	Proceeding in lane				
521391	26/04/2006	Wed	11:07		at	MAYALL ST	XJN	STR	Fine	Dry	50	2	TRK	M42	W in MAYALL ST	Unk	Proceeding in lane	N	0	0	
E26945273							RUM:	10	Cross traffic				BDBL	M38	S in STURT HWY	45	Proceeding in lane				
581534	27/06/2007	Wed	16:00		at	MAYALL ST	XJN	STR	Overcast	Dry	50	2	CAR	M17	N in MAYALL ST	10	Proceeding in lane	N	0	0	
E32348287							RUM:	10	Cross traffic				CAR	F U	E in STURT HWY	20	Proceeding in lane				

Detailed Crash Report

Transport Centre for Road Safety

Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					A S F
775797	25/11/2011	Fri	04:00	30 m	E	MAYALL ST	2WY	STR	Raining	Wet	50	1	CAR	M50	E in STURT HWY	60	Proceeding in lane	I	0	1	S
E46792269							RUM:	71	Off rd left => obj				Other non fixed object								
617137	03/03/2008	Mon	16:10	100 m	E	WE ST	2WY	STR	Fine	Dry	50	5	CAR	F74	E in STURT HWY	Unk	Pulling out	I	0	1	
E33201838							RUM:	44	Parking vehicles				CAR		E in STURT HWY	0	Parked				
													TRK		S in STURT HWY	0	Parked				
													VAN		S in STURT HWY	0	Parked				
													CAR		E in STURT HWY	0	Parked				
751053	30/04/2011	Sat	21:15	10 m	W	YANGA WAY	TJN	STR	Fine	Dry	110	1	CAR	F45	W in STURT HWY	92	Proceeding in lane	I	0	1	
E266039292							RUM:	71	Off rd left => obj				Tree/bush								
Box Creek																					
Sturt Hwy																					
728434	18/10/2010	Mon	22:30	21 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	TRK	M28	W in STURT HWY	100	Proceeding in lane	N	0	0	
E158589395							RUM:	67	Struck animal				Straying stock								
680872	28/08/2009	Fri	06:25	28 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	VAN	M35	W in STURT HWY	105	Proceeding in lane	N	0	0	
E38092135							RUM:	67	Struck animal				Kangaroo								
Clare																					
Balranald Rd																					
684547	10/07/2009	Fri	09:25	45 km	S	IVANHOE TN	2WY	STR	Fine	Dry	100	1	CAR	F29	N in BALRANALD RD	Unk	Proceeding in lane	I	0	3	
E38300728							RUM:	73	Off rd rght => obj				Drain/culvert								
703176	19/03/2010	Fri	03:00	60 km	S	IVANHOE TN	2WY	STR	Fine	Dry	100	1	4WD	F28	N in BALRANALD RD	80	Proceeding in lane	I	0	1	
E40298206							RUM:	70	Off road to left												
Euston																					
Sturt Hwy																					
655604	08/02/2009	Sun	09:15		at	TILLARA RD	TJN	STR	Fine	Dry	110	1	TRK	U U	W in STURT HWY	Unk	Proceeding in lane	N	0	0	
E69895602							RUM:	70	Off road to left												
Ivanhoe																					
Balranald Rd																					
586105	11/08/2007	Sat	08:05	35.3 km	S	COBB HWY	2WY	CRV	Fine	Dry	110	1	CAR	M32	S in BALRANALD RD	100	Proceeding in lane	N	0	0	S
E31243438							RUM:	84	Off right/left bend												
704859	31/12/2009	Thu	16:20	50 km	W	COBB HWY	2WY	STR	Raining	Wet	100	1	TRK	F20	E in BALRANALD RD	90	Proceeding in lane	I	0	1	F
E40577716							RUM:	71	Off rd left => obj				Embankment								
Penarie																					

Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					A S F
Ivanhoe Rd																					
549359	17/12/2006	Sun	03:00	33 km	N	BALRANALD TN	2WY	STR	Fine	Dry	100	1	CAR	M28	N in IVANHOE RD	100	Proceeding in lane	N	0	0	
E28649435							RUM:	71	Off rd left => obj				Embankment								
Topra Plain																					
Sturt Hwy																					
751839	09/04/2011	Sat	08:30	5 km	W	ABBOTTS TANK RD	2WY	STR	Fine	Dry	110	1	CAR	M41	W in STURT HWY	Unk	Proceeding in lane	N	0	0	F
E44395862							RUM:	73	Off rd rght => obj				Fence								
Waldaira Tank																					
Sturt Hwy																					
703230	21/03/2010	Sun	09:00	19 km	W	BALRANALD TN	2WY	STR	Fine	Dry	110	1	M/C	M62	E in STURT HWY	110	Proceeding in lane	I	0	2	
E40176114							RUM:	74	On road-out of cont.												
Wakool LGA																					
Balranald																					
Sturt Hwy																					
781316	04/01/2012	Wed	09:00	48 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	CAR	F41	E in STURT HWY	80	Proceeding in lane	N	0	0	
E154174097							RUM:	74	On road-out of cont.												
546195	23/11/2006	Thu	07:50	2.29 km	E	IMPIMI RD	2WY	CRV	Fine	Dry	110	1	CAR	F44	E in STURT HWY	110	Proceeding in lane	F	1	1	
E28642648							RUM:	82	Off right/right bend												
Willow Vale																					
Sturt Hwy																					
654773	17/12/2008	Wed	00:40	35 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	TRK	M32	W in STURT HWY	90	Proceeding in lane	N	0	0	F
E35648675							RUM:	72	Off road to right												
770746	10/10/2011	Mon	09:20	40 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	3	M/C	M54	E in STURT HWY	50	Proceeding in lane	I	0	2	
E147443098							RUM:	30	Rear end				M/C	M45	E in STURT HWY	100	Proceeding in lane				
													M/C	M52	E in STURT HWY	100	Proceeding in lane				
771532	10/10/2011	Mon	09:20	40 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	2	M/C	U U	E in STURT HWY	Unk	Proceeding in lane	I	0	1	
E147443098							RUM:	30	Rear end				M/C	M48	E in STURT HWY	100	Proceeding in lane				
657116	27/11/2008	Thu	04:30	40 km	E	SWAN HILL RD	2WY	STR	Fine	Dry	110	1	4WD	F66	W in STURT HWY	Unk	Proceeding in lane	F	1	1	F
E159745393							RUM:	74	On road-out of cont.												
Yanga Lake																					
Sturt Hwy																					

Crash No.	Date	Day of Week	Time	Distance		ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
																					A S F
653295	09/01/2009	Fri	10:30	10 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	WAG	M25	E in STURT HWY	110	Proceeding in lane	N	0	0	
E35697030							RUM:	67	Struck animal				Other large animal								
628165	24/06/2008	Tue	17:45	12 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	CAR	M29	W in STURT HWY	110	Proceeding in lane	N	0	0	
E34373404							RUM:	67	Struck animal				Kangaroo								
705101	28/03/2010	Sun	05:00	15 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	BDBL	F42	W in STURT HWY	90	Proceeding in lane	N	0	0	
E40918763							RUM:	73	Off rd rght => obj				Tree/bush								
659926	28/01/2009	Wed	06:00	18 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	CAR	F60	E in STURT HWY	Unk	Proceeding in lane	I	0	2	F
E36205659							RUM:	72	Off road to right												
659929	28/01/2009	Wed	06:00	18 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	CAR	M37	N in STURT HWY	110	Proceeding in lane	N	0	0	
E36205659							RUM:	66	Object on road				Other non fixed object								
506138	14/01/2006	Sat	16:10	20 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	4WD	M22	E in STURT HWY	100	Proceeding in lane	N	0	0	
E25559330							RUM:	72	Off road to right												
706828	17/04/2010	Sat	05:40	20 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	CAR	F48	E in STURT HWY	100	Proceeding in lane	N	0	0	
E168803794							RUM:	67	Struck animal				Kangaroo								
604169	17/12/2007	Mon	05:00	32 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	4WD	F36	E in STURT HWY	100	Proceeding in lane	I	0	1	
E33052441							RUM:	74	On road-out of cont.												
550211	26/12/2006	Tue	13:30	48 km	E	BALRANALD TN	2WY	STR	Fine	Dry	110	1	4WD	F50	W in STURT HWY	100	Proceeding in lane	N	0	0	F
E28744325							RUM:	71	Off rd left => obj				Fence								
537776	29/09/2006	Fri	14:25	4.57 km	E	KERI KERI RD	2WY	STR	Fine	Dry	110	1	CAR	M57	W in STURT HWY	110	Proceeding in lane	I	0	2	F
E28316738							RUM:	72	Off road to right												
Western Region																					
Central Darling LGA																					
Ivanhoe																					
Balranald Rd																					
575202	11/04/2007	Wed	14:55	20 km	S	COBB HWY	2WY	STR	Fine	Dry	100	1	4WD	F28	N in BALRANALD RD	85	Proceeding in lane	I	0	1	
E29713309							RUM:	73	Off rd rght => obj				Tree/bush								
561775	19/03/2007	Mon	15:30	10 km	W	IVANHOE TN	2WY	STR	Fine	Dry	100	1	4WD	F25	E in BALRANALD RD	80	Proceeding in lane	N	0	0	
E430520790							RUM:	70	Off road to left												
Cobar Rd																					
769132	16/09/2011	Fri	21:00	10 km	E	COBB HWY	2WY	STR	Fine	Dry	100	1	CAR	M25	E in COBAR RD	70	Proceeding in lane	N	0	0	
E46056258							RUM:	67	Struck animal				Kangaroo								

Detailed Crash Report

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																					A S F
Cobb Hwy																					
722988	29/10/2010	Fri	23:49		at	MITCHELL ST	TJN	CRV	Raining	Wet	100	1	UTE	M22	S in COBB HWY	120	Proceeding in lane	F	1	0	A S
E43339965							RUM:	81	Off left/rt bnd=>obj				Signpost								
Menindee Rd																					
743855	27/02/2011	Sun	12:25	500 m	W	COBB HWY	2WY	STR	Fine	Dry	100	2	TRK	M39	E in MENINDEE RD	70	Proceeding in lane	I	0	1	
E84382302							RUM:	30	Rear end				BDBL	M58	E in MENINDEE RD	10	Proceeding in lane				
660744	20/02/2009	Fri	00:01	700 m	W	COBB HWY	2WY	STR	Fine	Dry	100	1	TRK	M48	W in MENINDEE RD	60	Proceeding in lane	I	0	1	F
E36827177							RUM:	72	Off road to right												
608650	11/01/2008	Fri	18:40	1.53 km	W	COBB HWY	2WY	CRV	Fine	Dry	100	1	WAG	F26	E in MENINDEE RD	Unk	Proceeding in lane	I	0	3	S
E32210620							RUM:	88	Out of cont on bend												

Report Totals: Total Crashes: 61 Fatal Crashes: 5 Injury Crashes: 28 Killed: 5 Injured: 44

Crashid dataset Sturt Hwy from 50km East to 50km West of Balranald, Balranald Township, Balranald-Ivanhoe Rd, 2006-12 Crashes

Note: Data for the 9 month period prior to the generated date of this report are incomplete and are subject to change.

Attachment B

Traffic Survey Results

Job No	N818
Client	GTA
Road	Balranald Rd (south of Railway Line)
Location	Ivanhoe
Site No.	1
Start Date	11-May-12
Description	Volume Summary
Direction	Combined

Average Weekday	39
7 Day Average	35

	Day of Week								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Ave	7 Day
Time	14-May	15-May	16-May	17-May	11-May	12-May	13-May	W'day	Ave
AM Peak	3	8	3	5	4	4	5		
PM Peak	7	5	6	8	4	4	4		
0:00	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	1	0	0	0	0	0	0	0	0
5:00	0	2	0	0	0	0	0	0	0
6:00	2	4	1	2	0	0	4	2	2
7:00	1	8	2	2	3	0	1	3	2
8:00	3	4	1	1	1	2	0	2	2
9:00	3	1	2	0	3	1	1	2	2
10:00	0	2	2	1	4	4	1	2	2
11:00	2	3	3	5	2	1	5	3	3
12:00	7	2	4	8	3	3	3	5	4
13:00	5	2	4	3	1	1	1	3	2
14:00	4	5	6	7	1	1	0	5	3
15:00	0	4	4	3	4	0	3	3	3
16:00	4	4	6	4	2	3	4	4	4
17:00	3	4	3	0	3	4	0	3	2
18:00	0	1	2	0	1	0	2	1	1
19:00	1	0	1	0	0	0	2	0	1
20:00	1	0	1	0	0	0	0	0	0
21:00	0	1	1	1	2	0	0	1	1
22:00	0	1	0	1	1	0	1	1	1
23:00	0	0	0	0	0	1	0	0	0
Total	37	48	43	38	31	21	28	39	35

Ave = average.
W'day = week day.

Job No	N818
Client	GTA
Road	Balranald Rd (Hatfield)
Location	Hatfield
Site No.	2
Start Date	11-May-12
Description	Volume Summary
Direction	Combined

Average Weekday	35
7 Day Average	32

	Day of Week								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Ave	7 Day
Time	14-May	15-May	16-May	17-May	11-May	12-May	13-May	W'day	Ave
AM Peak	7	4	3	6	7	2	2		
PM Peak	5	7	4	6	6	3	5		
0:00	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	1	0	0	0
2:00	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	0	1	0	0	0	0	0	0	0
6:00	0	2	0	0	3	0	1	1	1
7:00	7	0	0	0	0	0	1	1	1
8:00	4	4	0	1	7	2	1	3	3
9:00	0	3	3	6	3	1	2	3	3
10:00	3	1	3	4	2	2	2	3	2
11:00	3	1	1	1	0	2	2	1	1
12:00	3	2	0	1	5	0	1	2	2
13:00	5	4	4	3	3	1	1	4	3
14:00	0	1	3	3	5	2	2	2	2
15:00	5	2	0	6	1	2	3	3	3
16:00	5	7	2	4	3	2	1	4	3
17:00	0	1	2	3	6	1	5	2	3
18:00	1	3	1	1	2	3	2	2	2
19:00	0	1	2	0	1	0	1	1	1
20:00	0	2	1	2	1	0	2	1	1
21:00	2	0	0	1	2	0	0	1	1
22:00	0	1	0	0	0	0	1	0	0
23:00	0	0	0	1	0	0	0	0	0
Total	38	36	22	37	44	19	28	35	32

Job No	N818
Client	GTA
Road	Balranald Rd (south of Railway Line)
Location	Ivanhoe
Site No.	1
Start Date	11-May-12
Description	Classification 7 Day Total

	Northbound						Southbound						Combined					
Time	Light	Rigid	Articulated	B Double	Road Trains	Total	Light	Rigid	Articulated	B Double	Road Trains	Total	Light	Rigid	Articulated	B Double	Road Trains	Total
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1
5:00	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	2	0	2
6:00	0	0	0	0	0	0	10	1	2	0	0	13	10	1	2	0	0	13
7:00	3	1	0	0	0	4	7	6	0	0	0	13	10	7	0	0	0	17
8:00	6	3	0	0	0	9	2	1	0	0	0	3	8	4	0	0	0	12
9:00	4	3	0	0	0	7	4	0	0	0	0	4	8	3	0	0	0	11
10:00	6	0	0	0	0	6	7	0	1	0	0	8	13	0	1	0	0	14
11:00	7	3	0	1	0	11	10	0	0	0	0	10	17	3	0	1	0	21
12:00	7	9	2	0	1	19	8	3	0	0	0	11	15	12	2	0	1	30
13:00	6	1	0	2	0	9	5	1	0	2	0	8	11	2	0	4	0	17
14:00	5	1	1	1	1	9	11	4	0	0	0	15	16	5	1	1	1	24
15:00	7	3	0	0	0	10	6	2	0	0	0	8	13	5	0	0	0	18
16:00	5	3	2	2	1	13	13	0	1	0	0	14	18	3	3	2	1	27
17:00	6	3	1	0	0	10	3	1	0	2	1	7	9	4	1	2	1	17
18:00	3	1	0	0	0	4	2	0	0	0	0	2	5	1	0	0	0	6
19:00	1	0	0	1	0	2	2	0	0	0	0	2	3	0	0	1	0	4
20:00	0	0	0	0	0	0	1	0	0	1	0	2	1	0	0	1	0	2
21:00	3	2	0	0	0	5	0	0	0	0	0	0	3	2	0	0	0	5
22:00	1	1	0	0	0	2	2	0	0	0	0	2	3	1	0	0	0	4
23:00	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1
Total	70	34	6	7	3	120	94	19	4	7	2	126	164	53	10	14	5	246

Job No	N818
Client	GTA
Road	Balranald Rd (Hatfield)
Location	Hatfield
Site No.	2
Start Date	11-May-12
Description	Classification 7 Day Total

Time	Northbound						Southbound						Combined					
	Light	Rigid	Articulated	B Double	Road Trains	Total	Light	Rigid	Articulated	B Double	Road Trains	Total	Light	Rigid	Articulated	B Double	Road Trains	Total
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1
6:00	0	0	0	0	1	1	3	1	0	1	0	5	3	1	0	1	1	6
7:00	6	1	0	0	0	7	1	0	0	0	0	1	7	1	0	0	0	8
8:00	4	4	1	1	0	10	5	3	0	0	1	9	9	7	1	1	1	19
9:00	7	4	0	1	0	12	5	1	0	0	0	6	12	5	0	1	0	18
10:00	7	3	0	0	1	11	2	2	0	0	2	6	9	5	0	0	3	17
11:00	3	1	0	0	0	4	6	0	0	0	0	6	9	1	0	0	0	10
12:00	1	1	0	1	1	4	4	2	0	0	2	8	5	3	0	1	3	12
13:00	5	0	0	1	0	6	13	1	0	1	0	15	18	1	0	2	0	21
14:00	6	2	0	0	0	8	6	2	0	0	0	8	12	4	0	0	0	16
15:00	5	1	0	1	1	8	7	1	1	2	0	11	12	2	1	3	1	19
16:00	8	1	0	0	0	9	8	6	0	1	0	15	16	7	0	1	0	24
17:00	7	0	0	0	1	8	10	0	0	0	0	10	17	0	0	0	1	18
18:00	5	3	0	0	0	8	2	2	0	0	1	5	7	5	0	0	1	13
19:00	1	2	0	0	0	3	0	0	0	2	0	2	1	2	0	2	0	5
20:00	5	1	0	0	1	7	0	0	0	0	1	1	5	1	0	0	2	8
21:00	3	0	0	1	0	4	1	0	0	0	0	1	4	0	0	1	0	5
22:00	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	2	2
23:00	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1
Total	76	24	1	6	8	115	73	21	1	7	7	109	149	45	2	13	15	224

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