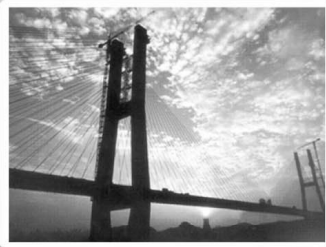




# **McArthur River Mine Phase 3 Development Project Road Impact Assessment**

14 November 2011



## **Halcrow**

### **Melbourne**

Level 40, 385 Bourke Street,  
Melbourne, VIC 3000  
Tel +61 (0)3 9899 9777 Fax +61 (0)3 9899 1214  
Email: [melbourne@halcrow.com](mailto:melbourne@halcrow.com)

### **Sydney**

PO Box R1573, Royal Exchange NSW 1225  
Level 22, 68 Pitt Street, Sydney, NSW 2000  
Tel +61 (0)2 9250 9900 Fax +61 (0)2 9241 2228  
Email: [sydney@halcrow.com](mailto:sydney@halcrow.com)

### **Brisbane**

Level 19, 215 Adelaide Street,  
Brisbane, QLD 4000  
Tel +61 (0)7 3169 2900  
Email: [brisbane@halcrow.com](mailto:brisbane@halcrow.com)

© Halcrow Pacific Pty Ltd 2011  
ABN: 45 061 920 849  
[www.halcrow.com/australasia](http://www.halcrow.com/australasia)

## Road Impact Assessment

### McArthur River Mine – Phase 3 Development Project

## Contents Amendment Record

This document has been issued and amended as follows:

| Issue 1 |                            |          |             |             |               |
|---------|----------------------------|----------|-------------|-------------|---------------|
| Rev     | Description                | Date     | Prepared by | Checked by  | Authorised by |
| A       | Draft for internal comment | 28/07/11 | Hayward D   | Robertson T |               |
| B       | Draft for Client issue     | 29/07/11 | Hayward D   | Robertson T | Hulbert M     |
| C       | Final for issue            | 26/08/11 | Robertson T | Hulbert M   | Hulbert M     |
| D       | Final for issue v2         | 14/11/11 | Hayward D   | Hulbert M   | Hulbert M     |
|         |                            |          |             |             |               |
|         |                            |          |             |             |               |

## Document Location

Y:\Consulting\Projects\CTLRSD - McArthur River Mine EIS\30 - Programme & Progress\32 - Reports\CTLRSD\_r01\_revD\_Final for Issue v2.doc

### Halcrow

#### Melbourne

Level 40, 385 Bourke Street,  
Melbourne, VIC 3000  
Tel +61 (0)3 9899 9777 Fax +61 (0)3 9899 1214  
Email: melbourne@halcrow.com

#### Sydney

PO Box R1573, Royal Exchange NSW 1225  
Level 22, 68 Pitt Street, Sydney, NSW 2000  
Tel +61 (0)2 9250 9900 Fax +61 (0)2 9241 2228  
Email: sydney@halcrow.com

#### Brisbane

Level 19, 215 Adelaide Street,  
Brisbane, QLD 4000  
Tel +61 (0)7 3169 2900 Fax +61 (0)7 3169 2999  
Email: brisbane@halcrow.com

## Contents

|           |                                                          |           |
|-----------|----------------------------------------------------------|-----------|
| <b>1.</b> | <b>Introduction .....</b>                                | <b>2</b>  |
| 1.1       | Background.....                                          | 2         |
| 1.2       | Information and Supporting Documentation .....           | 3         |
| 1.3       | Study Methodology .....                                  | 3         |
| 1.4       | Scope of this Report .....                               | 4         |
| <b>2.</b> | <b>Development Proposal.....</b>                         | <b>6</b>  |
| 2.1       | Site Description.....                                    | 6         |
| 2.2       | Project Timing.....                                      | 7         |
| 2.3       | Site Access .....                                        | 7         |
| 2.4       | Proposed Haulage Activity .....                          | 7         |
| 2.5       | Proposed Haul Routes.....                                | 7         |
| 2.6       | Traffic Generation .....                                 | 10        |
| <b>3.</b> | <b>Existing Conditions.....</b>                          | <b>14</b> |
| 3.1       | Road Network .....                                       | 14        |
| 3.2       | Existing Traffic Flows .....                             | 14        |
| 3.3       | Road Safety .....                                        | 15        |
| <b>4.</b> | <b>Road Impact Analysis .....</b>                        | <b>18</b> |
| 4.1       | Link Analysis.....                                       | 18        |
| 4.2       | Intersection Analysis .....                              | 19        |
| <b>5.</b> | <b>Mitigation &amp; Management of Road Impacts .....</b> | <b>21</b> |
| 5.1       | Road Link Impacts .....                                  | 21        |
| 5.2       | Intersection Impacts.....                                | 21        |
| <b>6.</b> | <b>Summary &amp; Conclusions .....</b>                   | <b>22</b> |
| 6.1       | Traffic Generation .....                                 | 22        |
| 6.2       | Road Link Impact.....                                    | 22        |
| 6.3       | Intersection Impact .....                                | 23        |

# 1. Introduction

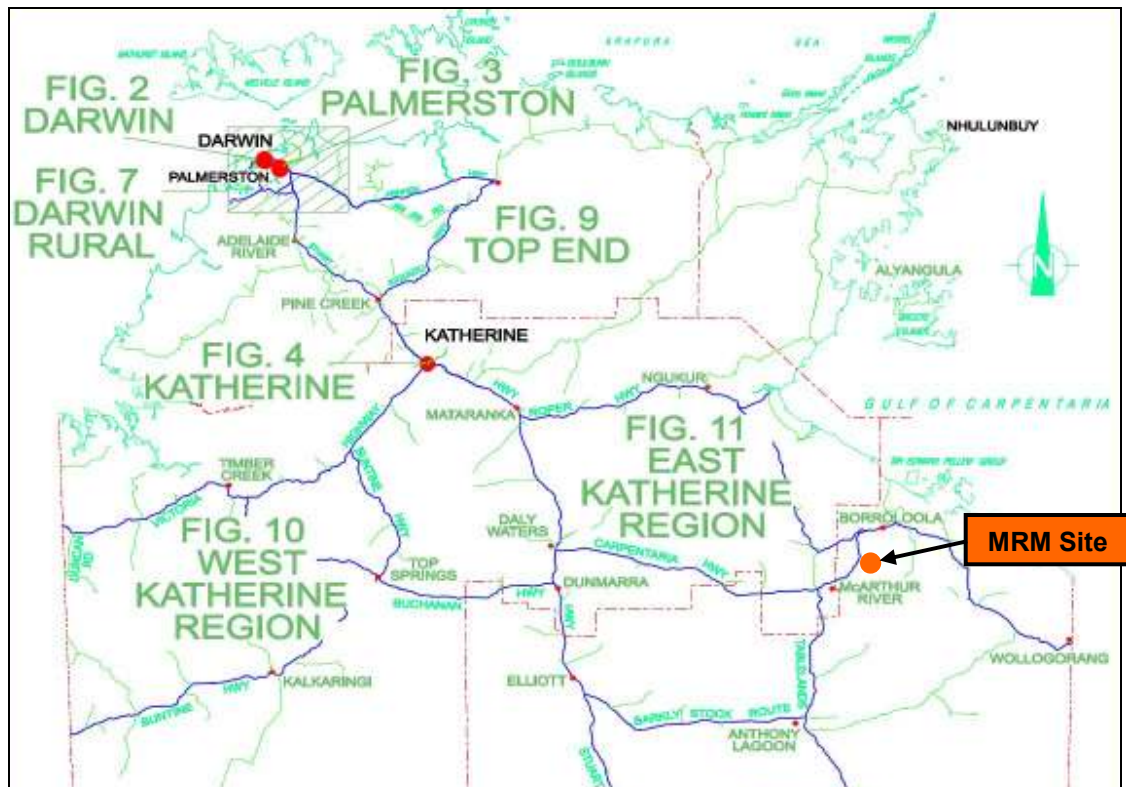
## 1.1 Background

Mining and Energy Technical Services Pty Ltd (MET Serve), representing Xstrata Zinc Australia (Xstrata Zinc), commissioned Halcrow Pacific Pty Ltd (Halcrow) to prepare a Road Impact Assessment (RIA) for the proposed McArthur River Mine (MRM) Phase 3 Development Project (the Project). The site locality is shown in Figure 1 and Figure 2.

It is understood the RIA will form part of the Project's overarching Environmental Impact Assessment (EIS) which will be submitted to the Northern Territory Government (NTG) for assessment. This RIA provides an outline of anticipated Project impacts on the external traffic network and responds to the Project's Draft EIS Guidelines which was released for public comment on the 23<sup>rd</sup> July 2011.



**Figure 1**      **MRM Locality Map**



\*Source: NTG Department of Lands and Planning Annual Traffic Report 2009.

**Figure 2 MRM Road Network Locality Map**

## 1.2 Information and Supporting Documentation

As agreed through discussions between Halcrow and NTG's Corridor Land Management – Road Network Division, the RIA has been prepared on the basis of the following Queensland Department of Transport and Main Roads (DTMR) planning documents and standards:

- Guidelines for Assessment of Road Impacts of Development (GARID) (DTMR, 2006); and
- Road Planning and Design Manual – Chapter 13 Intersections at Grade (RPDM) (DTMR, 2006).

## 1.3 Study Methodology

An outline of the study methodology to undertake the RIA is presented in Table 1.

**Table 1 Study Methodology**

|                               |                                                                                                                                                                                                                                                                            |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Investigation            | Halcrow undertook a site inspection of the MRM site and Carpentaria Highway (between the Mine and Bing Bong Port) on Monday 16 <sup>th</sup> May 2011.                                                                                                                     |
| Consultation                  | The following authorities were contacted as part of this study: <ul style="list-style-type: none"> <li>• NT Government</li> </ul>                                                                                                                                          |
| Data Collection and Collation | Data that have been input into the analyses are listed below: <ul style="list-style-type: none"> <li>• Timelines for each phase of construction and operation (provided by MET Serve);</li> <li>• Anticipated location for each traffic generating component of</li> </ul> |

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   | <p>the project (provided by MET Serve);</p> <ul style="list-style-type: none"> <li>• Expected employee and visitor requirements during each phase of construction and operation (provided by MET Serve);</li> <li>• Assumed employee shift times (provided by MET Serve);</li> <li>• Expected number of heavy vehicle movements to and from the site by times of day and vehicle type (provided by MET Serve);</li> <li>• Likely origins and destinations for construction materials (provided by MET Serve);</li> <li>• Likely modes of transport used during the construction and operational phases (provided by MET Serve);</li> <li>• Existing road network details such as network geometry, existing road hierarchy and posted speed limits (provided by NTG);</li> <li>• Future road network provision; and</li> <li>• Tube count data, along with associated historical growth rates (provided by NTG).</li> </ul>                                             |
| Traffic Generation and Assignment | <p>Determination of anticipated vehicle movements was undertaken through the following:</p> <ul style="list-style-type: none"> <li>• Consultation with MET Serve regarding project specific details as outlined above (see data collection and collation);</li> <li>• Conversion of these development details into peak hour flows for the intersection impact assessment;</li> <li>• Conversion of these development details into daily flows for the link assessment;</li> </ul> <p>Rather than using standard trip generation rates from DTMR's RPDM or any other reference resource, trip generation was calculated through first principles and the knowledge of employee / heavy vehicle movements for different periods of the day.</p> <p>Traffic was distributed onto the road network based on engineering judgement and information provided by MET Serve.</p>                                                                                               |
| Traffic Impact Assessment         | <p>The impact analysis presented in this report is based upon the principles defined within GARID, as agreed with the NTG.</p> <p>The analysis identifies the road links that incur an increase of more than 5% of baseline AADT traffic volumes as a result of the traffic generated from the MRM Phase 3 Expansion Project. These roads are then assessed on a volume to capacity ratio basis by comparing the estimated capacity of the road (in accordance with Austroads calculations) against the estimated future traffic volumes of the road.</p> <p>Due to the very low existing traffic volumes at the Carpentaria Highway / MRM Mine Access Road intersection, it is considered that operational performance assessment is not required. However, the layout of the intersection has been compared with DTMR's RPDM to ensure that the intersection can adequately and safely accommodate turn movements from all vehicle types (including road trains).</p> |
| Impact Management and Mitigation  | <p>Based on the outcomes of the intersection and link impact analysis, alternative intersection / link forms and associated traffic management strategies were recommended for the MRM Phase 3 Development Project.</p> <p>These have been based on Queensland State Government</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|  |                                                                                                                                                                              |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | requirements with due consideration of both operational and safety characteristics. Any proposed treatments also consider future infrastructure provision within the region. |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 1.4 Scope of this Report

The RIA is presented in this report through the following chapters:

- **Chapter 2** describes the development proposal in terms of its site location, proposed access locations, proposed haul routes and expected traffic generation;
- **Chapter 3** describes the existing conditions in the vicinity of the MRM Phase 3 Development Project;
- **Chapter 4** assesses the potential traffic impacts of the proposed development and describes the requirements of the external road network where development generated traffic has resulted in considerable impact;
- **Chapter 5** summarises the required impact mitigation solutions; and
- **Chapter 6** presents the study conclusions.

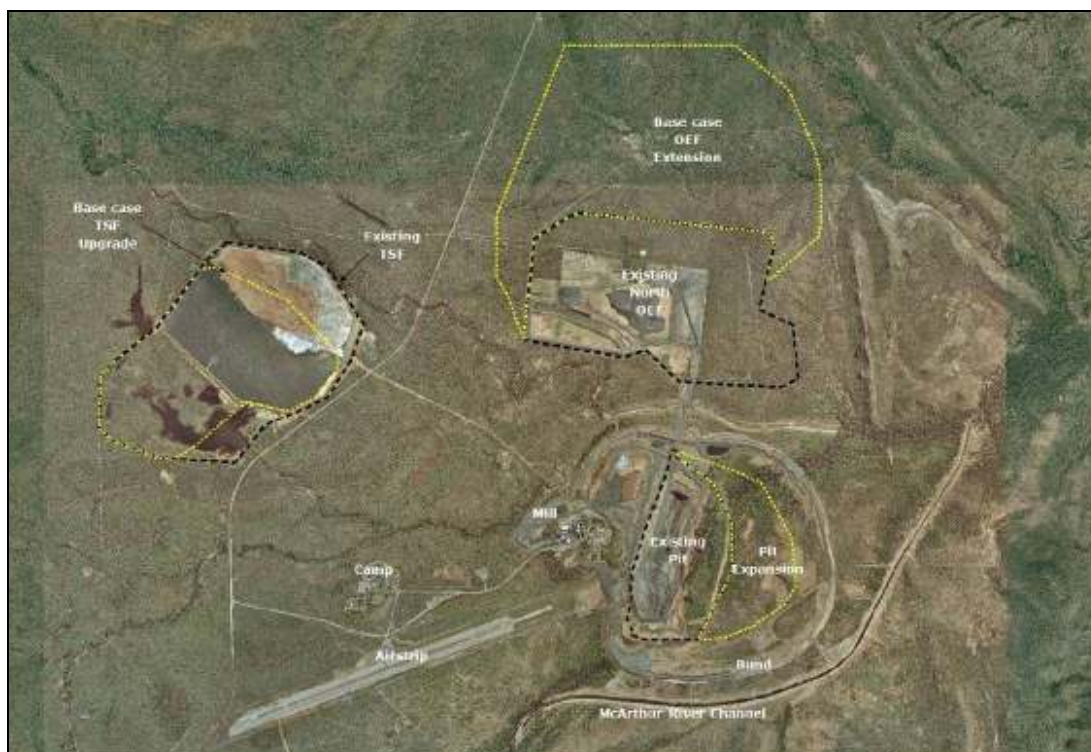
## 2. Development Proposal

### 2.1 Site Description

The MRM is located in the Northern Territory, approximately half way between Darwin and Mount Isa. Its nearest township is Borroloola, located approximately 60 kilometres to the north east of the existing mine site. The Bing Bong Port is the nearest loading facility for the mine and is located on the Gulf of Carpentaria, approximately 100 kilometres to the north east of the MRM.

The MRM Phase 3 Development Project is planned to increase bulk concentrate production using ore extracted from an expanded open pit mining operation. The project plans to expand the current open pit mine to a level that produces a total annual capacity of approximately 5 million tonnes (Mt) of ore mined and 0.8Mt of bulk zinc, silver, and lead concentrate.

The MRM site spans five mineral leases, namely MLN1121, MLN1122, MLN1123, MLN1124 and MLN1125. A scoping study of the MRM Phase 3 Development Project identified that the proposed open pit expansion would not go beyond the current boundary of the bund wall within MLN1121 and MLN1122 as presented in Figure 3.



**Figure 3** MRM Phase 3 Expansion Project Plan

## 2.2 Project Timing

The MRM Phase 3 Development Project is planned for commencement in 2012. Timing considered for this assessment is as follows:

- 2012 – Year 1 of construction;
- 2013 – Year 2 of construction (peak construction period);
- 2014 – First year of operations;
- 2020 – Peak MRM Phase 3 Development Project operations; and
- 2024 – 10 year design horizon.

These years represent the expected periods of critical traffic generation, along with an effective 10 year design horizon as required by the “Guidelines for Assessment of Road Impacts of Development” (DTMR, 2006).

## 2.3 Site Access

The MRM site is accessed by a sealed road from Carpentaria Highway approximately 1.5km to the west of site. This site also comprises of its own airfield which is used for the transportation of staff and visitors. The airfield is located such that all personnel movements between MRM and the airfield are conducted on the site’s internal road network.

## 2.4 Proposed Haulage Activity

The proposed haulage activity for construction and operational phases are shown in Table 2 and Table 3 respectively.

## 2.5 Proposed Haul Routes

The expected origin of the majority of construction and operational inputs will be Darwin and the destination of all bulk concentrate will be Bing Bong Port. Haul routes to and from the MRM site are as follows:

- Mine Input Delivery Haul Route (Darwin to MRM site) → Stuart Highway → Carpentaria Highway.
- Bulk Concentrate Delivery Haul Route (MRM site to Bing Bong Port) → Carpentaria Highway → Bing Bong Road.

**Table 2 Heavy Vehicle Movement Description – Construction MRM Phase 3 Expansion Project**

|                                                   | Movement 1                                                                                             | Movement 2                                 | Movement 3                                      | Movement 4                                                | Movement 5                                       | Movement 6                                                                                  | Movement 7                                                                                                     | Movement 8                                                  | Movement 9                                  | Movement 10                                         |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------|-----------------------------------------------------|
| Haulage Description                               | Delivery of fuel & other general supplies                                                              | Delivery of Concentrator Process Equipment | Delivery of Concentrator Steelwork              | Delivery of Raw Materials for Concrete batching           | Delivery of conveyor modules                     | Low Loader Fleet                                                                            | Semi-trailer Fleet                                                                                             | Delivery of Village buildings & other transportable offices | Delivery of Civil Works machinery           | Delivery of Power Station Extension                 |
| Austrroads Vehicle Class                          | Class 10                                                                                               | Class 10                                   | Class 10                                        | Class 10                                                  | Class 10                                         | Class 10                                                                                    | Class 10                                                                                                       | Class 10                                                    | Class10                                     | Class 10                                            |
| Description of goods & material to be transported | Fuel for construction, General supplies                                                                | Process Machinery                          | 2,500T of fabricated Steelwork and Platework    | 10,000 cubic metres of cement and aggregates for concrete | 1300m of conveyor galleries                      | Mobilise EX and Cat trucks, wheel loader, wheel dozer, dozer trucks, water cart & excavator | Mobilise EX and Cat trucks, wheel loader, wheel dozer, grader, dozer trucks, water cart, compactor & excavator | 30 Transportable Buildings                                  | 12 items comprising Excavators/Trucks Dozer | 16 Gas Engines<br>16 Enclosures<br>Switchrooms, etc |
| Quantity of goods to be transported               | Allowance of 1 extra road train of fuel per month and one extra triple per week of general consumables | 100 truck deliveries of components         | 50 truck deliveries (semi-trailers)             | 150 truck deliveries (triple road trains)                 | 60 truck deliveries (extendable single trailers) | 87 machines to be transported                                                               | 169 machines to be transported                                                                                 | 2 transportable buildings per truck movement                | 1 piece equipment per truck, both ways      | 60 truck deliveries                                 |
| Origin & Destination of goods                     | Darwin – Site                                                                                          | Various Aust. – Site                       | Various Aust. – Site                            | Darwin/Katherine – Site                                   | Various Aust. – Site                             | Darwin – Site                                                                               | Darwin – Site                                                                                                  | Darwin – Site                                               | Various Aust. – Site                        | Darwin Port – Site                                  |
| Is the product hazardous or oversized?            | Hazardous                                                                                              | Approx. 30% oversized                      | Approx. 50% oversized                           | Unknown                                                   | 90% oversized                                    | Unknown                                                                                     | Unknown                                                                                                        | Oversized                                                   | Oversized                                   | Oversized                                           |
| Duration of haul movement                         | Construction requirements in addition to current site demand: 1 per week in 2012 1 per week in 2013    | 50% - Q4 2012<br>50% - Q1 2013             | 25% - Q3 2012<br>50% - Q4 2012<br>25% - Q1 2013 | 25% - Q2 2012<br>50% - Q3 2012<br>25% - Q4 2012           | 100% - H2 2012                                   | 2012                                                                                        | 2012                                                                                                           | 100% - Q4 2012                                              | 100% - Q1 2012                              | 100% - Q4 2012                                      |

**Table 3 Heavy Vehicle Movement Description – Operation MRM Phase 3 Expansion Project**

|                                                   | Movement 1                                                                                             | Movement 2                                                                                                                | Movement 3                                                              | Movement 4                                                              | Movement 5                                       | Movement 6                                                                                                                                                                                                                                                                                                                                                                                       | Movement 7                                                                                 |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Haulage Description                               | Low Loader Fleet                                                                                       | Semi-trailer Fleet                                                                                                        | Delivery of fuel                                                        | Delivery of tyres                                                       | General deliveries                               | Chemical deliveries                                                                                                                                                                                                                                                                                                                                                                              | Concentrate haulage                                                                        |
| Vehicle Class                                     | Class 10                                                                                               | Class 10                                                                                                                  | Class 12                                                                | Class 12                                                                | Class 12                                         | Class 12                                                                                                                                                                                                                                                                                                                                                                                         | Class 12                                                                                   |
| Description of goods & material to be transported | Mobilise EX and Cat trucks, wheel loader, wheel dozer, drill rig, dozer trucks, water cart & excavator | Mobilise EX and Cat trucks, drill rig, wheel loader, wheel dozer, grader, dozer trucks, water cart, compactor & excavator | Fuel deliveries split between triple and quad trucks                    | Tyres delivered on triples which carry 6 tyres per trailer              | General deliveries come in triples               | Flotation process inputs                                                                                                                                                                                                                                                                                                                                                                         | Bulk concentrate of zinc and lead bearing minerals                                         |
| Quantity of goods to be transported               | 276 machines to be transported                                                                         | 645 machines to be transported                                                                                            | Diesel deliveries to range from 3000kL per year to 38000kL per year     | Tyre requirements to range from 20 tyres per year to 310 tyres per year | Range between 18-40 trailers per week            | 60t trucks delivering 5555t/y mill steel media, 555t/h liners, 611t/y ceramic media, 450t/y ferrosilicon medium, 940t/y of ethyl xanthate, 2820t/y of isopropyl xanthate, 150t/y of MIBC, 1300t/y of dextrin, 1430t/y of suparex, 11000t/y of copper sulphate pentahydrate, 150t/y flocculent                                                                                                    | The plant will produce 800k dry metric tonnes per year of bulk concentrate                 |
| Origin & Destination of goods                     | Darwin – Site                                                                                          | Darwin – Site                                                                                                             | Darwin – Site                                                           | Darwin – Site                                                           | Darwin – Site                                    | Darwin – Site                                                                                                                                                                                                                                                                                                                                                                                    | Bing Bong Port – Site                                                                      |
| Is the product hazardous or oversized?            | Unknown                                                                                                | Unknown                                                                                                                   | Hazardous                                                               | Unknown                                                                 | Unknown                                          | Hazardous                                                                                                                                                                                                                                                                                                                                                                                        | Unknown                                                                                    |
| Duration of haul movement                         | Major haul movement years:<br>4 in 2014<br>107 in 2020<br>1 in 2024                                    | Major haul movement years:<br>6 in 2014<br>245 in 2020<br>1 in 2024                                                       | Major fuel delivery years:<br>169 in 2014<br>301 in 2020<br>305 in 2024 | Major tyre delivery years:<br>9 in 2014<br>16 in 2020<br>16 in 2024     | Estimated average delivery of 10 trucks per week | Estimated yearly chemical deliveries:<br>2 per week for mill steel media<br>1 per month for liners<br>1 per month for ceramic media<br>1 per month for ferrosilicon medium<br>4 per Q for ethyl xanthate<br>1 per week for isopropyl xanthate<br>1 per Q for MIBC<br>2 per month for dextrin<br>2 per month for suparex<br>4 per week for copper sulphate pentahydrate<br>1 per Q for flocculent | 9 additional truck trips per day (on top of existing 9 trips per day), seven days per week |

## 2.6 Traffic Generation

### 2.6.1 Journey to Work Trips

The traffic generation of workforce related journey to and from work trips is dependant on a number of factors, these being:

- Number of staff required for each shift;
- Number of shifts per day; and
- Mode of travel to work (i.e. internal transportation or external private car trips).

For the purposes of this assessment, the following assumptions of workforce requirements and typical shift times have been considered. Information supplied by MET Serve is presented in Table 4 below.

**Table 4 Employee Requirements**

|                                                                                                   | Personnel                             |                                       |                                       |                                       |                                       |
|---------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
|                                                                                                   | Construction Period                   |                                       | Operational Period                    |                                       |                                       |
|                                                                                                   | 2012                                  | 2013                                  | 2014                                  | 2020                                  | 2024                                  |
| Total Employee Requirements                                                                       | 491                                   | 750                                   | 496                                   | 621                                   | 627                                   |
| Estimated Fly-in/Fly-out Employees (FIFO)                                                         | 461                                   | 720                                   | 466                                   | 571                                   | 577                                   |
| Estimated Township Based Employees                                                                | 30                                    | 30                                    | 30                                    | 50                                    | 50                                    |
| Number of Employees per Shift on average                                                          | 100                                   | 300                                   | 198                                   | 248                                   | 251                                   |
| Number of Shifts per Day                                                                          | 1                                     | 1                                     | 2                                     | 2                                     | 2                                     |
| Anticipated Shift Times                                                                           | 6:00 - 18:00                          |                                       | 6:00 - 18:00 & 18:00 – 6:00           |                                       |                                       |
| Residence of Employees                                                                            | MRM Accommodation Camp & Townships    |                                       |                                       |                                       |                                       |
| Mode of Travel to Work <ul style="list-style-type: none"><li>MRM Camp</li><li>Townships</li></ul> | Internal Transport<br>Private Vehicle | Internal Transport<br>Private Vehicle | Internal Transport<br>Private Vehicle | Internal Transport<br>Private Vehicle | Internal Transport<br>Private Vehicle |

The MRM construction camp is located on site and employees are transported from the airport to construction camp and construction camp to work site via the MRM internal road network. Consequently there are no external road network traffic impacts of employee movements who reside at the MRM construction camp.

With regards to estimating the daily traffic generation of the township based employees, the following assumptions (considered conservative) have been made:

- All non FIFO employees reside in the township of Borroloola;
- Vehicle occupancy is 1 person per vehicle;

- 2 vehicle trips are made per day (i.e. to and from MRM work site); and
- 100% of township based employees work at the MRM site every day.

Based on the assumptions above it is estimated there will be the following daily traffic generation from township based employees from Borroloola to the MRM site:

- 60 vehicle trip ends per day from 2012-14; and
- 100 vehicle trip ends per day during the 2020 and 2024 future year scenarios.

## 2.6.2 Heavy Vehicle Movements

Based on the information provided in Section 2.4, the number of expected annual truck deliveries required for each phase of construction and operation can be calculated. Table 5 details the anticipated heavy vehicle generation for use in the RIA.

**Table 5 Annual Heavy Vehicle Generation**

| Movement description                        | Annual No. Deliveries |      |      |      |      |
|---------------------------------------------|-----------------------|------|------|------|------|
|                                             | 2012                  | 2013 | 2014 | 2020 | 2024 |
| <b>Construction</b>                         |                       |      |      |      |      |
| Delivery of fuel and other general supplies | 52                    | 52   | -    | -    | -    |
| Delivery of concentrator process equipment  | 50                    | 50   | -    | -    | -    |
| Delivery of concentrator steelwork          | 37                    | 13   | -    | -    | -    |
| Delivery of raw materials for concrete      | 150                   | -    | -    | -    | -    |
| Delivery of conveyor modules                | 60                    | -    | -    | -    | -    |
| Delivery of machinery on low loader fleet   | 87                    | -    | -    | -    | -    |
| Delivery of machinery on semi-trailer fleet | 169                   | -    | -    | -    | -    |
| Delivery of village buildings and other     | 15                    | -    | -    | -    | -    |
| Delivery of civil works machinery           | 12                    | -    | -    | -    | -    |
| Delivery of power station extension         | 60                    | -    | -    | -    | -    |
| <b>Operation</b>                            |                       |      |      |      |      |
| Delivery of fuel                            | -                     | -    | 169  | 301  | 305  |
| Delivery of tyres                           | -                     | -    | 9    | 16   | 16   |
| General deliveries                          | -                     | -    | 520  | 520  | 520  |
| Delivery of chemicals                       | -                     | -    | 416  | 416  | 416  |
| Delivery of machinery on low loader fleet   | -                     | -    | 4    | 107  | 1    |

| Movement description                                                  | Annual No. Deliveries |            |              |              |              |
|-----------------------------------------------------------------------|-----------------------|------------|--------------|--------------|--------------|
|                                                                       | 2012                  | 2013       | 2014         | 2020         | 2024         |
| Delivery of machinery on semi-trailer fleet                           | -                     | -          | 6            | 245          | 1            |
| Delivery of bulk concentrate                                          | -                     | -          | 3,285        | 3,285        | 3,285        |
| <b>Total Annual Truck Deliveries</b>                                  | <b>632</b>            | <b>115</b> | <b>4,197</b> | <b>4,678</b> | <b>4,332</b> |
| <b>Total Annual Truck Trip Ends</b><br>(i.e. Sum of IN:OUT movements) | <b>1,264</b>          | <b>230</b> | <b>8,394</b> | <b>9,356</b> | <b>8,664</b> |

Link and intersection analyses are conducted using peak and daily trip generation. Table 6 details the process that was used to convert the information provided by MET Serve in Section 2.4 (see Table 2 and Table 3) into peak and daily breakdowns.

The trip generation by trip purpose, shown in Table 6, is disaggregated by the number of weekly deliveries by each yearly quarter. For example, delivery of fuel and other general supplies are anticipated to be delivered once per week for the whole of years of 2012 and 2013. Delivery of the concentrator process equipment and components will occur in Q4 of 2012 and Q3 of 2013, with the frequency of deliveries being four per week.

Note that the number of truck deliveries presented in Table 6 is taken to be the maximum number of deliveries per week based on the addition of deliveries within each quarter. Therefore, the total weekly truck deliveries represents the critical week for each assessment year.

**Table 6 Heavy Vehicle Generation - Peak and Daily Movements**

|                                             | Trip Generation                                 |                 |      |      |      |
|---------------------------------------------|-------------------------------------------------|-----------------|------|------|------|
|                                             | 2012                                            | 2013            | 2014 | 2020 | 2024 |
| <b>Construction</b>                         |                                                 |                 |      |      |      |
| Delivery of fuel and other general supplies | 1/wk<br>(Q1-Q4)                                 | 1/wk<br>(Q1-Q4) | -    | -    | -    |
| Delivery of concentrator process equipment  | 4/wk<br>(Q4)                                    | 4/wk<br>(Q1)    | -    | -    | -    |
| Delivery of concentrator steelwork          | 1/wk<br>(Q3) &<br>2/wk<br>(Q4)                  | 1/wk<br>(Q1)    | -    | -    | -    |
| Delivery of raw materials for concrete      | 3/wk<br>(Q2),<br>6/wk<br>(Q3) &<br>3/wk<br>(Q4) | -               | -    | -    | -    |
| Delivery of conveyor modules                | 2/wk<br>(Q3,Q4)                                 | -               | -    | -    | -    |
| Delivery of machinery on low loader fleet   | 2/wk<br>(Q1-Q4)                                 | -               | -    | -    | -    |
| Delivery of machinery on semi-trailer fleet | 3/wk<br>(Q1-Q4)                                 | -               | -    | -    | -    |

|                                                                                                                    | Trip Generation |          |               |               |               |
|--------------------------------------------------------------------------------------------------------------------|-----------------|----------|---------------|---------------|---------------|
|                                                                                                                    | 2012            | 2013     | 2014          | 2020          | 2024          |
| Delivery of village buildings and other                                                                            | 1/wk (Q4)       | -        | -             | -             | -             |
| Delivery of civil works machinery                                                                                  | 1/wk (Q1)       | -        | -             | -             | -             |
| Delivery of power station extension                                                                                | 5/wk (Q4)       | -        | -             | -             | -             |
| <b>Operation</b>                                                                                                   |                 |          |               |               |               |
| Delivery of fuel                                                                                                   | -               | -        | 3/wk (Q1-Q4)  | 6/wk (Q1-Q4)  | 6/wk (Q1-Q4)  |
| Delivery of tyres                                                                                                  | -               | -        | 1/mth (Q1-Q4) | 1/mth (Q1-Q4) | 1/mth (Q1-Q4) |
| General deliveries                                                                                                 | -               | -        | 10/wk (Q1-Q4) | 10/wk (Q1-Q4) | 10/wk (Q1-Q4) |
| Delivery of chemicals                                                                                              | -               | -        | 9/wk (Q1-Q4)  | 9/wk (Q1-Q4)  | 9/wk (Q1-Q4)  |
| Delivery of machinery on low loader fleet                                                                          | -               | -        | 1/mth (Q1-Q4) | 2/wk (Q1-Q4)  | 1/yr (Q1-Q4)  |
| Delivery of machinery on semi-trailer fleet                                                                        | -               | -        | 1/mth (Q1-Q4) | 5/wk (Q1-Q4)  | 1/yr (Q1-Q4)  |
| Delivery of bulk concentrate                                                                                       | -               | -        | 63/wk (Q1-Q4) | 63/wk (Q1-Q4) | 63/wk (Q1-Q4) |
| <b>Total weekly Truck Deliveries*</b>                                                                              | <b>23</b>       | <b>6</b> | <b>86</b>     | <b>96</b>     | <b>89</b>     |
| <b>Average No. Truck Deliveries per day</b><br>(Assumes 7 day working week)                                        | <b>4</b>        | <b>1</b> | <b>13</b>     | <b>14</b>     | <b>13</b>     |
| <b>Peak Period Generation</b><br>(To be conservative, assumes that each trip end coincides with the commuter peak) | <b>4</b>        | <b>1</b> | <b>13</b>     | <b>14</b>     | <b>13</b>     |
| <b>Daily Generation</b><br>(Sum of IN:OUT movements)                                                               | <b>8</b>        | <b>2</b> | <b>26</b>     | <b>28</b>     | <b>16</b>     |

\*Total weekly truck deliveries taken to be the critical week for the year based on the identified yearly quarters.

## 3. Existing Conditions

### 3.1 Road Network

The current access to the MRM site is via the Carpentaria Highway which connects Borroloola to the east and the Stuart Highway to the west.

#### 3.1.1 Carpentaria Highway

The Carpentaria Highway is a Northern Territory controlled road (NTCR) connecting the Daly Waters area, Macarthur and Borroloola. It is a sealed, 6.8m-7.4m wide, two lane single carriageway with one lane in each direction. The maximum posted speed limit is 110km/hr.

It should be noted that during the site inspection it was observed that the condition of the existing road carriageway includes water damage, uneven surfaces and pot holes.

There are no proposed road upgrades for the Carpentaria Highway as per the Northern Territory Government's Department of Construction and Infrastructure *Construction Snapshot* dated March 2011.

#### 3.1.2 Stuart Highway

The Stuart Highway is a NTCR connecting Darwin, Katherine, Daly Waters, Tennant Creek, Alice Springs and Port Augusta. It is a sealed, approximately 7m wide, two lane single carriageway with one lane in each direction surrounding the Carpentaria Highway intersection. The speed limit on the Stuart Highway is predominantly 130km/hr.

There are no proposed road upgrades for the Stuart Highway as per the Northern Territory Government's Department of Construction and Infrastructure *Construction Snapshot* dated March 2011.

#### 3.1.3 Bing Bong Road

Bing Bong Road is a NTCR connecting the Carpentaria Highway (near Borroloola) and Bing Bong Port. It is a sealed, 6m wide, two lane single carriageway with one lane in each direction. The maximum speed limit is 110km/hr.

There are no proposed road upgrades for Bing Bong Road as per the Northern Territory Government's Department of Construction and Infrastructure *Construction Snapshot* dated March 2011.

### 3.2 Existing Traffic Flows

The existing traffic volumes for the Stuart Highway and Carpentaria Road for 2009 have been provided by NTG's Department of Lands and Planning. A summary of the Average Annual Daily Traffic Volumes (AADT) and the percentage of heavy vehicles are provided in Table 7.

**Table 7 Background 2009 Traffic Volumes (State Controlled Roads)**

| Road           | Description                           | AADT | % Heavy Vehicles |
|----------------|---------------------------------------|------|------------------|
| Bing Bong Road | Carpentaria Highway to Bing Bong Port | 80*  | N/A              |

| Road                | Description                                      | AADT  | % Heavy Vehicles |
|---------------------|--------------------------------------------------|-------|------------------|
| Carpentaria Highway | Bing Bong Road (Borrooloola) to Mine Access Road | 100** | N/A              |
|                     | Mine Access Road to Tablelands Highway           | 70**  | N/A              |
|                     | Tablelands Highway to Stuart Highway             | 60    | 17.3%            |
| Stuart Highway      | Carpentaria Highway to Roper Highway             | 390   | 19.85%***        |
|                     | Roper Highway to Victoria Highway                | 540** | 15.0%            |
|                     | Victoria Highway to Kakadu Highway               | 1,310 | 10.05%***        |

\*2009 AADT is estimated from 2006 AADT based on a 3% per annum compounding growth rate.

\*\*2009 AADT is estimated from 2008 AADT based on a 3% compounding growth rate.

\*\*\*Vehicle Classification for the month of April in 2009

### 3.3 Road Safety

During Halcrow's site investigation, consultation was undertaken with the haul contractors which transport zinc product from the mine to port. From these discussions, and as observed on the road network, a number of deficiencies with the existing Carpentaria Highway (between the mine access road and Bing Bong Port) were observed. These included the following:

- Water damage and pot holes on sections on the roadway which are a safety hazard to both light and heavy vehicles;
- Uneven surfaces and reverse cambers which have been reported to cause road train trailers to swing both off-road and out onto the opposing carriageway (see Figure 4 and Figure 5) ; and
- Narrow sections of road (particularly on causeways), where road train operators have reported that there is a potential for road trains to rollover if the vehicle accidentally leaves the paved carriageway (see Figure 6).

These deficiencies will need to be further investigated and rectified to cater for existing traffic. This will be required regardless of whether the MRM Phase 3 Development Project proceeds.



**Figure 4**      **Example of uneven surface and incorrect camber**



**Figure 5**      **Example of uneven surface and incorrect camber**



**Figure 6**      **Narrow carriageway with sudden drop-off at causeway**

## 4. Road Impact Analysis

### 4.1 Link Analysis

#### 4.1.1 Impact Identification

The link impact assessment is provided in Appendix A. The impact analysis indicates that an increase in daily traffic of more than 5% would occur for the road sections as presented in Table 8.

**Table 8 Estimated More Than 5% Background Traffic Volume Increase Roads**

| Road                | Description                        | % Background Traffic Increase |       |       |       |       |
|---------------------|------------------------------------|-------------------------------|-------|-------|-------|-------|
|                     |                                    | 2012                          | 2013  | 2014  | 2020  | 2024  |
| Bing Bong Road      | Carpentaria Hwy to Bing Bong Port  | 46.4%                         | 46.4% | 46.4% | 51.8% | 49.6% |
| Carpentaria Highway | Old Bing Bong Rd to Mine Access Rd | 41.5%                         | 41.5% | 39.4% | 47.6% | 44%   |
|                     | Mine Access Rd to Tablelands Hwy   | 9.1%                          | <5%   | 9.1%  | 10%   | 7.4%  |
|                     | Tablelands Hwy to Stuart Hwy       | 11.8%                         | <5%   | 11.8% | 12.5% | 9.1%  |

All other assessed roads at all other assessment years are expected to experience insignificant impacts, as per DTMR's definition in the "Guidelines for Assessment of Road Impacts of Development".

Future year traffic volumes in 2024 for the impacted road sections are presented in Table 9.

**Table 9 Estimated 2024 Impacted Road Sections Daily Traffic Volumes**

| Road                | Description                        | Estimated 2024 Daily Traffic Volumes |                  |
|---------------------|------------------------------------|--------------------------------------|------------------|
|                     |                                    | 'Without' Expansion                  | 'With' Expansion |
| Bing Bong Road      | Carpentaria Hwy to Bing Bong Port  | 120vpd                               | 240vpd           |
| Carpentaria Highway | Old Bing Bong Rd to Mine Access Rd | 150vpd                               | 270vpd           |
|                     | Mine Access Rd to Tablelands Hwy   | 100vpd                               | 110vpd           |
|                     | Tablelands Hwy to Stuart Hwy       | 80vpd                                | 90vpd            |

\*vpd = vehicles per day.

The capacity calculation for these road sections is presented in the following Section 4.1.2. The analysis indicates that the capacity of Carpentaria Highway is estimated to be in the order of 9,000 vehicles per day between the Stuart Highway to the Mine Access Road and 3,900 vehicles per day between the Mine Access Road and Bing Bong Port. The anticipated future year traffic volumes at 2024 are expected to remain well below existing link capacity, and as such, no upgrade works (from an operational performance perspective) are warranted.

However, as noted in Section 3.1.1 the existing Carpentaria Highway carriageway has pavement condition issues which are required to be rectified to improve overall traffic safety. These works will be required regardless of whether the MRM Phase 3 Development Project proceeds.

#### **4.1.2 Link Capacity**

Link capacity can be calculated using the procedures prescribed in the AUSTROADS “Guide to Traffic Engineering Practice Part 2 – Roadway Capacity”. For the purposes of this assessment, the impacted sections of the Carpentaria Highway (as identified in Section 4.1.1) are assumed to be uninterrupted two lane two way roads.

The following assumptions were used in the link capacity calculations:

- Capacity is reached when the volume to capacity ratio is equivalent to 1;
- The identified sections operate under rolling terrain with approximately 20% of the total length having sight distances of less than 450m;
- Direction distribution is split 50 / 50 each way over the whole day;
- Lanes are 3m in width and have no usable shoulders;
- The traffic stream consists of the following heavy vehicle proportions:
  - approximately 20% heavy vehicles between Stuart Hwy and Mine Access Rd
  - approximately 90% heavy vehicles between Mine Access Rd and Bing Bong Port
- The peak hour to daily conversion rate is 6.67 (i.e. peak hour traffic is approximately 15% of total daily traffic as per DTMR advice published in GARID).

These adopted assumptions are considered to be conservative.

Based on the assumptions and equations provided in the AUSTROADS “Guide to Traffic Engineering Practice Part 2 – Roadway Capacity”, the calculated capacities for each of the road sections on the Carpentaria Highway are estimated to be the following:

- 9,000 vehicles per day between Stuart Hwy and Mine Access Rd; and
- 3,900 vehicles per day between Mine Access Rd and Bing Bong Port.

#### **4.2 Intersection Analysis**

The existing layout for the Carpentaria Highway / Mine Access Road intersection is shown in Figure 7.



**Figure 7      Carpentaria Hwy / Mine Access Rd - Existing Intersection Layout**

Due to the very low existing traffic volumes at the Carpentaria Highway / Mine Access Road intersection, it is considered that intersection turning movement analysis is not required. However, the layout of the intersection has been compared with the standard accepted layouts in DTMR's RPDM to ensure that the junction can adequately and safely accommodate turn movements for all vehicle types expected to use the intersection.

The intersection is consistent with the requirements of a Basic Right Turn Treatment (BAR) on a Two Lane Rural Road as specified in Section 13.7.10.1 of the RPDM for a 53.4m long A-Triple Road Train design vehicle. This standard would require a minimum 119m long widened shoulder on the approach to the right-turn and a minimum 57m long on the departure of the intersection. The intersection currently provides approximately 170m on each side of the intersection, and therefore adequately caters for an A-Triple Road Train.

The intersection is also consistent with the requirements for a 100km/h speed environment Auxiliary Left Turn Treatment with a Short Left Turn Slot AUL(S) on a Rural Road as specified in Section 13.7.13.3 of the RPDM. This standard requires a minimum Auxiliary Left Turn Lane of 70m, inclusive of a 30m taper. The intersection currently provides a 120m left turn lane with a 30m taper. This treatment is also considered acceptable for the safe manoeuvring of an A-Triple Road Train.

## **5. Mitigation & Management of Road Impacts**

Based on the findings presented in Section 4.1 and 4.2, the following works will be required in order to mitigate anticipated impacts arising from the proposed MRM Phase 3 Development Project:

### **5.1 Road Link Impacts**

- No impact mitigation works are required as direct result of the proposed MRM Phase 3 Development Project.
- The Carpentaria Highway will need to be reconstructed to a suitable pavement standard to provide adequate safety to all road users (see Section 3.3). These works will be required regardless of whether the MRM Phase 3 Development Project proceeds.

### **5.2 Intersection Impacts**

Intersection volumes are anticipated to remain very light even with the presence of additional road traffic generated by the construction and operation of the MRM Phase 3 Development Project. No mitigation works are expected to be required on any of the intersections on the identified external haul roads.

## 6. Summary & Conclusions

The Road Impact Assessment for the construction and operational phases of the proposed MRM Phase 3 Development Project has been completed. The assessment was undertaken in accordance with the Guidelines for Assessment of Road Impacts of Development (DTMR, 2006), as agreed through discussion with the Northern Territory Government. Key findings and conclusions from this assessment are summarised below.

### 6.1 Traffic Generation

Traffic generation resulting from the MRM Phase 3 Development Project is anticipated to be in the order of the following:

#### Light Vehicles

- 60 vehicle trip ends per day from 2012-14; and
- 100 vehicle trip ends per day during the 2020 and 2024 future year scenarios.

#### Heavy Vehicles

- A maximum of 26 vehicle trip ends per day from 2012 to 2014; and
- A maximum of 28 vehicle trip ends per day during the 2020 and 2024 future year scenarios.

### 6.2 Road Link Impact

The impact analysis indicated that an increase in daily traffic of more than 5% would occur for the following road sections:

- Bing Bong Road between Carpentaria Highway to the Bing Bong Port;
- Carpentaria Highway between Bing Bong Road to the MRM Access Road;
- Carpentaria Highway between the MRM Access Road and Tablelands Highway; and
- Carpentaria Highway between Tablelands Highway and Stuart Highway.

However, despite the increase in traffic generation on these roads, upgrade works will not be required in order to accommodate projected future year traffic volumes.

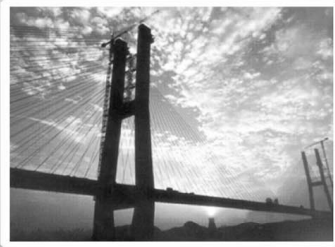
Notwithstanding this, a number of road safety deficiencies were identified on the Carpentaria Highway between the MRM mine and Bing Bong Port. These included:

- Water damage and pot holes on sections on the roadway which are a safety hazard to both light and heavy vehicles;
- Uneven surfaces and incorrect cambers which have been reported to cause road train trailers to swing both off-road and into the opposing carriageway; and
- Narrow sections of road (particularly on causeways), where road train operators have reported that there is a potential for road trains to rollover if the vehicle accidentally leaves the paved carriageway.

These deficiencies will need to be further investigated and rectified to cater for existing traffic. This will be required regardless of whether the MRM Phase 3 Development Project proceeds.

### **6.3 Intersection Impact**

Intersection volumes are anticipated to remain very light even with the presence of additional road traffic generated by the construction and operation of the MRM Phase 3 Development Project. No mitigation works are expected to be required on any of the intersections on the identified external haul roads.



## Appendices

# **Appendix A: Link Impact Assessment**

| Road            | Section                           | Traffic Count Data |      |      | Without Development Traffic Vol. |      |      |      |      | With Development Traffic Vol. |      |      |      |      | % Increase in Background Traffic |       |       |       |       |
|-----------------|-----------------------------------|--------------------|------|------|----------------------------------|------|------|------|------|-------------------------------|------|------|------|------|----------------------------------|-------|-------|-------|-------|
|                 |                                   | 2006               | 2008 | 2009 | 2012                             | 2013 | 2014 | 2020 | 2024 | 2012                          | 2013 | 2014 | 2020 | 2024 | 2012                             | 2013  | 2014  | 2020  | 2024  |
| Bing Bong Rd    | Carpentaria Hwy to Bing Bong Port | 75                 | -    | -    | 90                               | 90   | 90   | 110  | 120  | 78                            | 78   | 78   | 118  | 118  | 46.4%                            | 46.4% | 46.4% | 51.8% | 49.6% |
| Carpentaria Hwy | Robinson Rd to Mine Access Rd     | -                  | 99   | -    | 110                              | 110  | 120  | 130  | 150  | 78                            | 78   | 78   | 118  | 118  | 41.5%                            | 41.5% | 39.4% | 47.6% | 44.0% |
|                 | Mine Access Rd to Tablelands Hwy  | -                  | 68   | -    | 80                               | 80   | 80   | 90   | 100  | 8                             | 2    | 8    | 10   | 8    | 9.1%                             | 2.4%  | 9.1%  | 10.0% | 7.4%  |
|                 | Tablelands Hwy to Stuart Hwy      | -                  | 51   | 55   | 60                               | 60   | 60   | 70   | 80   | 8                             | 2    | 8    | 10   | 8    | 11.8%                            | 3.2%  | 11.8% | 12.5% | 9.1%  |
| Stuart Hwy      | Carpentaria Hwy to Roper Hwy      | -                  | -    | 388  | 420                              | 430  | 450  | 520  | 560  | 8                             | 2    | 8    | 10   | 8    | 1.9%                             | 0.5%  | 1.7%  | 1.9%  | 1.4%  |
|                 | Roper Hwy to Victoria Hwy         | -                  | 527  | -    | 590                              | 610  | 620  | 720  | 780  | 8                             | 2    | 8    | 10   | 8    | 1.3%                             | 0.3%  | 1.3%  | 1.4%  | 1.0%  |
|                 | Victoria Hwy to Kakadu Hwy        | -                  | -    | 1312 | 1430                             | 1470 | 1510 | 1740 | 1900 | 8                             | 2    | 8    | 10   | 8    | 0.6%                             | 0.1%  | 0.5%  | 0.6%  | 0.4%  |

Linear Growth Rate: 3%

100% of development generated traffic (heavy vehicles)

Input

Output

| Traffic Generation - Heavy Vehicles |      |      |      |      |
|-------------------------------------|------|------|------|------|
| 2012                                | 2013 | 2014 | 2020 | 2024 |
| 8                                   | 2    | 8    | 10   | 8    |
| 18                                  | 18   | 18   | 18   | 18   |

|            | Traffic Generation - Journey to Work |      |      |      |      |
|------------|--------------------------------------|------|------|------|------|
|            | 2012                                 | 2013 | 2014 | 2020 | 2024 |
| Borroloola | 30                                   | 30   | 30   | 50   | 50   |

Heavy Vehicle Input

Heavy Vehicle Output

Site to Darwin

Site to Bing Bong Port

100% -->

100% -->

Route Choice (Heavy Vehicles) -->

Carpentaria Highway from MRM Access Road to Stuart Highway

Stuart Highway from Carpentaria Highway to Kakadu Highway

Carpentaria Highway from MRM Access Road to Bing Bong Road

Bing Bong Road from Carpentaria Highway to Bing Bong Port

Site to Village:

Site to Borroloola

Route Choice (Journey to Work) -->

Private access, does not impact on local or NTCR network

Carpentaria Highway from Robinson Road to MRM Access Road