Preliminary Documentation

Ghost Bat
(*Macroderma gigas*)

Carpentarian Antechinus
(*Pseudantechinus mimulus*)
Declaration of accuracy

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed:

[Signature]

Full name:
Dr Brent Jiang

Organisation:
Chinova Cloncurry Mines Pty Ltd

Date:
28/02/2017

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<td>Scott Burnett</td>
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1 EXECUTIVE SUMMARY

A referral (EPBC 2016/7773) of the proposed Mt Dore Heap Leach Copper Project was submitted to the Department of the Environment and Energy on 1st September 2016. The proposed action was determined to be a controlled action requiring assessment under the Environment Protection and Biodiversity Conservation (EPBC) Act on 10th October 2016. Specifically, it was considered that the proposed action is likely to have a significant impact on the Carpentarian Antechinus (*Psuedantechinus mimulus*) – vulnerable.

The purpose of this Environmental Management Plan is to meet the additional information requirements identified by the Department of the Environment and Energy in a letter dated 11th November 2016. This letter considered the project was likely to impact on the Carpentarian Antechinus (*Psuedantechinus mimulus*) and Ghost Bat (*Macroderma gigas*).

1.1 Persons Preparing the Documentation

This documentation has been compiled by RBC Environmental (Rod Coe and Andrew Holzheimer) on behalf of Chinova Resources Cloncurry Mines Pty Ltd (the proponent). All information sources are provided and referenced accordingly throughout the document. Figures were developed by Tony Baylis Senior GIS Officer (Chinova Resources Cloncurry Mines Pty Ltd) under direction of RBC Environmental.

1.2 Objectives of the Plan

The objective of the Plan is to ensure construction, operation and decommissioning activities of the Mt Dore Heap Leach Copper Project are undertaken with sufficient controls and management strategies to ensure protection of the local Carpentarian Antechinus population and any identified issues related to the Ghost Bat.

To achieve this objective the Plan provides:

- background to the Carpentarian Antechinus and Ghost Bat with detailed information regarding the baseline values of the Mt Dore Copper Heap Leach Copper Project mine tenements;
- an assessment of potential impacts to the Carpentarian Antechinus and Ghost Bat as a result of the proposed project;
- identification of environmental management measures and performance targets required to mitigate relevant impacts and provide for ongoing protection of the local populations;
- a residual risk assessment to identify and understand key areas of risk to the species from project activities; and
• an outline of the relevant systems for environmental management, reporting, monitoring, review and audit.

1.3 Main Impacts

A review of the survey effort in relation to the occurrence of the Ghost Bat in section 6 of this plan, indicates that it is highly unlikely that the Ghost Bat occurs in or utilises the proposed action area. Impact to the Ghost Bat is not further considered in this report, however the natural habitat favoured by the Ghost Bat also coincides with the habitat of the Carpentarian Antechinus.

The main impacts to the Carpentarian Antechinus identified in this plan are summarised as follows:
• Direct loss of individuals through clearing of known habitat during construction;
• Direct loss of 3.7 ha of mapped habitat as a result of the open pits;
• Feral cat activity potentially increasing as a result of the proposed action; and
• Impacts from uncontrolled bushfires.

1.4 Primary Management Strategies

The primary management strategies identified by this plan include:
• Amending the location of the northern and southern waste rock dumps to avoid mapped habitat;
• Trapping and removal of individuals from areas of habitat to be impacted by the open pits;
• Managing disturbance through a Permit to Disturb process and limiting the loss of mapped habitat to 1.6% or 4 ha;
• Creating rocky environments and associated micro-habitat with the aim of establishing suitable habitat favoured by the Carpentarian Antechinus on a minimum of 20% or 10.6 ha of waste rock dumps during decommissioning.
• Actively trapping and removing feral cats from the project area;
• Avoiding the use of buffel grass in rehabilitation of the proposed project area; and
• Establishing a Bushfire Management Plan including actively managing increased fire risk to known habitat from dispersal of buffel grass in disturbance areas.

It should be noted that Chinova Resources have already sponsored a $55,000 joint research project with the Sunshine Coast University in 2013 to map the regional occurrence of the Carpentarian Antechinus. There was a total of 247 detections of the Carpentarian Antechinus at 44 sites, with no detections at the 39 non-rocky habitat sites. The study approximately quadrupled the number of sites from which the species was known at the time and revealed new information regarding its preferred habitats (Burnett, et al., 2014).
Chinova Resources is committed to continuing joint research projects with Sunshine Coast University and MMG to support a defined project for two monthly monitoring for one year of Carpentarian Antechinus at known habitat locations in the Selwyn Ranges. The project aims to gain an understanding of variations in detectability and life cycle of the species. In addition the Sunshine Coast University will be contracted to complete the trapping and removal of individuals from the proposed disturbance areas and to determine the statistical effectiveness of this approach. Chinova Resources has committed a budget of $42,000 to complete this work.

2 PROJECT DESCRIPTION

The Cloncurry Project Operations are owned by Chinova Resources Limited (Chinova) a mineral exploration and mining development company (formerly known as Ivanhoe Australia Limited) focussed on mining and exploration tenements in north-west Queensland. Chinova through its wholly owned subsidiary, Chinova Resources Cloncurry Mines Pty Limited (CRCM), owns 100% of the Cloncurry Project Operations which was acquired in 2003. Chinova also acquired the Osborne Project Operations on 30 September 2010 by taking control of Barrick (Osborne) Pty Limited, a subsidiary of Barrick Gold Corporation. Chinova currently operates an open pit copper/gold mining operation and copper flotation processing plant at Osborne approximately 195 kilometres (km) south-east of Mt Isa and 48 kilometres south of the proposed Mt Dore Heap Leach Copper Project. The Osborne operation is scheduled for completion by mid-2018 with Chinova committed to rehabilitating and managing this site while continuing to progress other projects in the region.

The CRCM Mt Dore Heap Leach Copper Project is part of the Cloncurry Project mining leases and will involve a five year development and operational phase of the Mt Dore Copper Oxide ore body as well as the establishment of a Heap Leach and associated Solvent Extraction Electro-Winning (SXEW) processing circuit. Water will be provided from the Mt Dore aquifer for this period of operation with any excess water being disposed into the existing Southern Tailings Dam. Diesel generators (4-5MW capacity) will provide initial power for the Mt Dore Camp and early construction and production activities, with the establishment of a powerline from Osborne along the existing 56 kilometre mining lease corridor after the initial operating period. The existing Mt Dore Camp and Osborne Village will be used to accommodate a proposed workforce of approximately 150 during construction, reducing to 100 for operations. Note a proposed powerline from Osborne is considered a separate standalone project to provide power to other future projects that Chinova is studying in the area as well as the Mt Dore Heap Leach Copper Project. The powerline project does not trigger any matters of national environmental significance and is not considered further in this document.

An Environmental Authority amendment application (MIM100894709) has been lodged with the Queensland Department of Environment and Heritage Protection (DEHP) to allow for the establishment of a 2Mtpa Heap Leach Copper Project. The
proposed mining operation will include simultaneous extraction from two open pits to maximise efficiencies for both the drill and blast and earth-moving fleet. Mining will proceed at a maximum rate of 2Mtpa of ore extracted with the following proposed operation.

- 2 open pits
- 2 non-acid forming (NAF) waste rock dumps
- 8.5 Mt of copper ore at 0.85% Cu

The proposed disturbance areas are detailed in Table 1 below and the disturbance area initially proposed in the referral application is shown in Figure 1. It should be noted that both the open pits will remain open at the completion of this proposed phase of operation. Both pits will offer future potential underground access to the underlying Merlin molybdenum/rhenium deposit.

The Environmental Authority amendment has been determined by DEHP to be a major amendment with no EIS requirement.

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<th>Disturbance</th>
<th>Area (ha)</th>
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<td>North Pit</td>
<td>6.9</td>
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<tr>
<td>South Pit</td>
<td>28.7</td>
</tr>
<tr>
<td>North Waste Rock Dump</td>
<td>23.3</td>
</tr>
<tr>
<td>South Waste Rock Dump</td>
<td>29.8</td>
</tr>
<tr>
<td>Heap Leach Pad</td>
<td>28.7</td>
</tr>
<tr>
<td>Process Plant</td>
<td>1.1</td>
</tr>
<tr>
<td>Process Ponds</td>
<td>5.9</td>
</tr>
<tr>
<td>ROM / Agglomerator / Crusher</td>
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<td>ROM Dam</td>
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<td><strong>TOTAL</strong></td>
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Table 1: Proposed disturbance areas
Figure 1: Proposed Project Disturbance Areas
2.1 Mt Dore Open Pits and Waste Rock Dumps

The proposed mining operation will include simultaneous extraction from two open pits to maximise efficiencies for both the drill and blast and earth-moving fleet. Mining will proceed at a maximum rate of 2Mtpa of ore extracted with the following proposed operation.

- 2 open pits
  - North 450 x 220 x 90m depth;
  - South 530 x 515 x 150m depth;
- 2 non-acid forming (NAF) waste rock dumps
  - North – 2,460,000 bcm
  - South – 6,102,335 bcm
- 8.5 Mt of copper ore at 0.85% Cu
- 15,375m$^3$ of potentially acid forming waste (PAF >0.5% S)

It should be noted that both the open pits will remain open at the completion of this proposed operation. Both pits will offer future potential underground access to the underlying Merlin molybdenum/rhenium deposit. Any identified PAF material will be disposed into the existing Starra 257 open pit. Ores and waste will be blasted for removal by typical open cut heavy earthmoving equipment and hauled on a 24 hour 7 day a week basis.

A list of mining machinery and supporting equipment proposed to be used at the Mt Dore Heap Leach Copper Project includes but is not limited to the following:

- Sandvik DP1100 drill
- Emulsion truck
- 2 x D10 bulldozers
- PC2500 excavator
- PC1700 excavator
- 6 x 785 Cat dump trucks
- 8 x 777 Cat dump trucks
- Service truck
- Water Cart

2.2 Three Stage Crushing and Agglomeration

The crushing and agglomeration activity will occur on the ROM pad along with the stockpiling of ore. Three stages of crushing are employed to produce a final product with a P100 of 12.5 mm. The selection of this product size is based on test work for Mt Dore copper leaching kinetics, indicating that the copper leach kinetics were significantly increased when crushed to 12.5mm compared to 25mm. A Belt Feeder transfers the ore from the Agglomerator Feed Bin to the Agglomerator Feed Conveyor. Process water and sulphuric acid are added to the Agglomeration Drum at controlled rates via pipe manifolds and spray nozzles.
The agglomeration process involves the fine particles adhering to the coarser material, which is promoted by the tumbling action of the agglomeration drum to produce rounded ball shape lumps or agglomerates. The main objective of the agglomeration process is to firstly produce agglomerates that can be transported and stacked without breaking down and secondly the agglomerates must maintain integrity when the heap is irrigated with an acidic solution.

The agglomerated ore is directly conveyed to the leach pad. The overland conveyor will be equipped with a tripper car chute for variable position offloading. This would be followed by a series of conveyors including a portable ramp conveyor, several portable conveyors and a horizontal conveyor. The stacking of the agglomerated ore on the heap would be performed by a radial stacker and stinger conveyor.

2.3 Heap Leach

The process utilises biologically assisted heap leaching to facilitate the solubilisation of secondary sulphide minerals contained in the ore. Iron oxidising bacteria are introduced to the ore surface during agglomeration and they in turn provide a mechanism to solubilise secondary sulphide minerals, notably chalcocite, and improve copper leach kinetics.

Once stacked, the agglomerated material is subjected to rest and curing in the leach pad area. During this period the irrigation net is installed. The irrigation system consists of a main pipe, a system of distribution pipes of decreasing diameter and drop emitters, all constituting a net type arrangement. The emitters or drippers distribute the solution on the heap and are positioned to ensure efficient wetting of the agglomerate bed. The overall leach cycle comprises heap establishment, stacking, curing, primary leaching and secondary leaching.

Primary leaching would be carried out on freshly cured agglomerates using a stream of intermediate leach solution (ILS) combined with sulphuric acid in a static mixer. This part of the cycle produces the pregnant leach solution (PLS), which contains dissolved copper and some impurities.

Secondary leaching would be carried out on the partially leached agglomerates subsequent to the primary leaching. The secondary leachate is a combined stream of raffinate (barren liquor) and water make-up. The residual acid contained in this combined solution results in the recycling of acid and assists in reducing the overall acid consumption.

Air would be required to achieve bacterial oxidation of both primary and secondary copper mineralisation. To assist in this process, air is injected into the heap using a set of low-pressure high volume blowers via headers and perforated pipe networks installed through the base of the heap.
The heaps will be under irrigation for a period of 365 days with a corresponding predicted recovery of 80% of total copper over this period.

The leach heaps are built on an impermeable base consisting of a high-density polyethylene liner with a compacted clay layer beneath and a finely crushed rock layer above. This permits collection of the leached copper and prevents solution penetration into the underlying environment. The base of the pad is sloped to direct copper rich solution to a collection basin which drains by gravity to the process pond.

### 2.4 Solvent Extraction – Electro-Winning

#### Solvent Extraction:

Acidic copper sulphate solution produced in the heap leach circuit is collected in the PLS pond before being pumped to two extraction mixer settlers in series. PLS is mixed with organic in the primary and secondary mixer and copper is extracted from the PLS solution and selectively transferred to the organic phase. Organic exits E1 settler and flows by gravity to the Loaded Organic Tank before being pumped to the strip settler (S1). The raffinate solution exiting the extraction stages will be returned under gravity to the raffinate pond.

The loaded organic will be pumped from the Loaded Organic Tank to the strip stage S1 where it is contacted with spent electrolyte returned from the electrowinning plant. Copper is transferred from the organic into the spent electrolyte to create strong electrolyte (Advance Electrolyte).

Advance electrolyte reports to the filter feed tank and is pumped to the electrolyte multimedia filter to remove the entrained organic. Filtered electrolyte flows to the filtered electrolyte tank. From here it is pumped to the electrowinning plant. A filtered electrolyte tank is required to smooth surges and maintain a reservoir for whenever the single electrolyte filter is backwashed. On a regular cycle, some of the filtered electrolyte is used to backwash the multi-media filter. The electrolyte filter is controlled by programmable logic control (PLC) and is automatically backwashed with spent electrolyte. Filter backwash is returned to SX circuit from the backwash collection tank.

Crud from various areas within the SX plant is pumped to the Crud Collection Tank prior to treatment. Crud treatment involves firstly decanting aqueous from the Crud Collection Tank prior to pumping the remaining mixture of organic and crud through a centrifuge. Crud is periodically removed by the centrifuge which splits the crud into its three constituent phases, i.e.: aqueous, organic and solids. Both the aqueous and organic phases are returned to the SX circuit. Contaminated solids are collected in a Crud Skip and transferred to the heap leach pad for disposal at a rate of approximately 50kg/day.

Cleaned organic can also be transferred to the crud / clay treatment tank for further treatment with activated clay. During clay treatment, activated bentonite clay is added.
to the organic in the organic clay treatment tank and the slurry is transferred to the centrifuge for separation. The function of the activated bentonite is to absorb unwanted oxidation products from the organic that affect the extraction and separation performance.

**Electrowinning:**

Advance electrolyte that has been filtered by the electrolyte filter will be pumped into the tank house. The advance electrolyte will exchange heat in the electrolyte inter-exchanger with the spent electrolyte returning to the solvent extraction plant. A trimming heat exchanger will be used to maintain the temperature of the advance electrolyte at a constant temperature to maintain the electrolyte at optimum temperature for copper deposition and to aid reaching this set point during the operation start-up.

Advance electrolyte will flow into the polishing cells for final capture of any organic. Overflow from the polishing cells will be collected and flow into the electrolyte circulation tank where it will mix with spent electrolyte, from the remainder of the EW. The electrolyte circulation pump will circulate electrolyte to the commercial cells. Commercial cell overflow (spent electrolyte) will report to the spent electrolyte tank. Spent electrolyte in excess of that sent back to SX will flow into the circulation electrolyte tank. When required, concentrated acid is added to the polishing cell overflow return to the circulating electrolyte tank. The number of polishing cells to commercial cells is approximately 20% of total.

Cobalt sulphate and salt solution will be added to the electrolyte to maintain set cobalt and chloride concentrations. Cobalt protects the anodes from severe corrosion; while chloride is a crystal growth modifier that improves the cathode quality. A smoothing agent or Guar will also be added to the electrolyte to improve the deposit quality. Potable water will be added to the spent electrolyte tank to make up for process, evaporation and chemistry losses.

A DC current will be applied to the electrolytic cells that contain lead anodes and stainless steel cathode plates. Oxygen will be liberated at the anodes and copper will be deposited at the cathodes in accordance with the current density, targeted to an industry standard 300A/m$^2$.

**Stripping and Packaging:**

The cathode plates will be removed and transported by overhead crane to the semi-automatic cathode stripping machine where adherent electrolyte is washed from the copper deposit with hot water. The cathode plates will then be delivered one at a time to a flexing-stripping station where the sheets of copper deposit will be removed from both sides.
Copper will be harvested on a seven day growth cycle from the electrowinning cells by an overhead crane that transports the cathode plates to the cathode stripping machine. Harvesting will be conducted on a nominal three day/week (every second or third day) to ensure good copper growth morphology and simple harvesting management. This allows newly stripped cathodes in the cell for two days to grow copper before stressing them (electrically) by harvesting the ones next to them.

The cathode stripping machine will be semi-automatic and contain a flexing stripping and knifing station. Cathode plates will be delivered to the feed-in conveyor of the machine and indexed automatically through the wash station where adherent copper sulphate electrolyte will be washed off.

The stripping machine operator will pick up a single electrode from the wash station using the stripping machine hoist and deliver it to the flexing/stripping station. The flexing stripping station operation will be initiated by the operator and the cathode deposit will be automatically removed from the plate and delivered to a bundling station on either side of the stripping machine. While, the freshly stripped cathode plate will be delivered to the feed-out conveyor and automatically spaced for return to the cells.

The copper sheets (deposits) will be sampled, bundled, weighed, marked and strapped ready for shipment to export customers. Shipment will be by truck to an export terminal.

2.5 Mt Dore Village

The existing Mt Dore village has been used in various forms since at least 1987 when it serviced the Selwyn Project Mining Operation and may be utilised for this project.

Water Treatment

The Mt Dore camp currently has an 80,000L/day Reverse Osmosis (RO) water treatment plant which treats raw water from the Mt Dore Aquifer. An 80,000L RO plant produces 1,800L/h (0.5L/s) waste water which will be transferred via the existing dewatering pipeline to the Southern Tailings Dam.

Sewerage Treatment

The Mt Dore village will utilise the existing 50m³ Heal secondary treatment plant with effluent transferred to the Southern Tailings Dam. If the plant operates at full capacity which is unlikely, the effluent would add approximately 0.6L/sec to the mine dewater and would be available for irrigation. Effluent will be irrigated onto the existing oval during dry conditions.
2.6 Project Construction Schedule

The following is the proposed schedule of activities for the Mt Dore Heap Leach Copper Project:

- Land clearing and site preparation – August 2017
- Open pit mining commences – November 2017
- Crusher, Heap Leach and Plant construction – February 2018
- First ore delivery – March 2018
- Heap Leach irrigation commences – April 2018
- First copper cathode production – May 2018
- Project completion – December 2022
- Rehabilitation commences January 2023

2.7 Decommissioning

Decommissioning of the project and rehabilitation will be undertaken in accordance with the commitments within this document, the associated Cloncurry Project Closure Plan and the Project Environmental Authority. Work will commence immediately following project completion while equipment and manpower is still available on site with rehabilitation activities completed within 6 months. Rehabilitation monitoring will be ongoing until the relevant completion criteria and regulatory conditions have been met.

3 TENURES

The Cloncurry Project is located 140km south-east of Mt Isa in the south west corner of the Selwyn Ranges in the state of Queensland (Figure 2).

CRCM holds 23 mining leases totalling 4,990.18ha. The tenements of the projects are listed in Figure 2: Project Location

Table 2, which also includes the expiry date, area and background tenure information.

Mining lease numbers 90215 and 90217 were granted over a 100m wide access corridor to Osborne Mine in 2012. The mining leases allow for the development of a power-line, gas pipe-line and water pipe-line in addition to the already constructed haul-road access.

CRCM has 35 granted Exploration Permits for Minerals (EPMs) with a total area of 4,083 km² including joint ventures and two EPM applications with a total area of 130 km². The granted EPMs include 25 that are 100% owned by Chinova subsidiaries Chinova Resources Cloncurry Mines Pty Ltd (CRCM) and Chinova Resources Osborne Pty Ltd (CRO), five EPMs in the CRCM / Exco JV (181 km²) and five EPMs in the Red Metal / CRO JV (60 km²) where Chinova are the operators.
Figure 2: Project Location
### Table 2: Cloncurry Project Mining Tenure

<table>
<thead>
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</tr>
<tr>
<td>2689</td>
<td>Mt Dore Extended No 2</td>
<td>31-May-29</td>
<td>129.6</td>
<td>Lot 564 on SP278014</td>
</tr>
<tr>
<td>2690</td>
<td>Mt Dore Extended No 3</td>
<td>31-May-29</td>
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<td>2691</td>
<td>Mt Dore Extended No 4</td>
<td>31-Jul-20</td>
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<td>Lot 564 on SP278014</td>
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<td>2692</td>
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<td>31-May-29</td>
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<td>2693</td>
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<td>31-May-29</td>
<td>129.6</td>
<td>Lot 564 on SP278014</td>
</tr>
<tr>
<td>2694</td>
<td>Mt Dore Extended No 7</td>
<td>31-May-29</td>
<td>106.34</td>
<td>Lot 564 on SP278014</td>
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<td>2724</td>
<td>Cobalt Bloom No 1</td>
<td>31-May-19</td>
<td>120.92</td>
<td>Lot 564 on SP278014 Lot 13 on SP150177</td>
</tr>
<tr>
<td>2733</td>
<td>Selwyn Hematites No 1</td>
<td>31-May-29</td>
<td>1363.4</td>
<td>Lot 564 on SP278014 Lot 13 on SP150177</td>
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<td>Swan No 1</td>
<td>30-Jun-29</td>
<td>129.4</td>
<td>Lot 564 on SP278014</td>
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<tr>
<td>2735</td>
<td>Swan No 2</td>
<td>30-Jun-31</td>
<td>129.4</td>
<td>Lot 564 on SP278014</td>
</tr>
<tr>
<td>2736</td>
<td>Swan No 3</td>
<td>30-Jun-31</td>
<td>125.43</td>
<td>Lot 564 on SP278014 Lot 8 on MN7</td>
</tr>
<tr>
<td>2737</td>
<td>Swan No 4</td>
<td>30-Jun-31</td>
<td>128.3</td>
<td>Lot 564 on SP278014</td>
</tr>
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<td>2738</td>
<td>Swan No 5</td>
<td>30-Jun-31</td>
<td>129.4</td>
<td>Lot 564 on SP278014</td>
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<td>2745</td>
<td>Selwyn Hematites No 3</td>
<td>31-May-29</td>
<td>688</td>
<td>Lot 564 on SP278014 Lot 13 on SP 150177</td>
</tr>
<tr>
<td>2746</td>
<td>Selwyn Hematites No 2</td>
<td>31-May-29</td>
<td>627.73</td>
<td>Lot 564 on SP278014</td>
</tr>
<tr>
<td>90043</td>
<td>Victoria</td>
<td>31-Mar-24</td>
<td>33.4</td>
<td>Lot 564 on SP278014</td>
</tr>
<tr>
<td>90061</td>
<td>Lady Ella</td>
<td>28-Feb-25</td>
<td>144.0</td>
<td>Lot 564 on SP278014</td>
</tr>
<tr>
<td>90217</td>
<td>Access South</td>
<td>31-Jul-30</td>
<td>379.21</td>
<td>Lot 13 on SP223510 Lot 5364 on SP278014 Lot 5 on WNR6 (USL)</td>
</tr>
<tr>
<td>90215</td>
<td>Access North</td>
<td>31-Jul-30</td>
<td>83.56</td>
<td>Lot 13 on SP223510</td>
</tr>
</tbody>
</table>

### 3.1 Previous Mining Activities

Historic copper mining was undertaken at Mount Elliott between 1905 and 1914 with copper smelted on site between 1908 and 1919. Historical records suggest that total production from the Elliott Smelter during this period was 24,862 tonnes of copper and 34,000 oz. of gold bullion from about 268,000 tonnes of ore. Some of the ore was sourced from the Hampden Consols Mine at Kuridala and other mines in the area. Incomplete historical records suggest that ore mined from the Upper Zone at Mount Elliott totaled about 160,000 tonnes at 11.85% Cu and 6.43g/t Au.

Intensive exploration of the Western Ironstones (Starra Line) in the late 1970s by a consortium of companies resulted in a feasibility study in mid-1987.

Cyprus Minerals Australia initially developed the Cloncurry Project Environment Impact Assessment Study (EIAS) in 1987 to support a 500Kt/annum gold/copper project on the Selwyn Hematites (Starra Line) over a proposed 9-year mine life, including underground and open cut mining operations. It was proposed that future operations would include Mt Elliott and Mt Cobalt.
The ore was to be processed at a central mill site involving both flotation for sulphide ores and carbon-in-pulp process for oxide gold ore. A tailings dam was necessary for the storing the flotation and leached tailings.

Production commenced in 1988 and a total of four open pits (222, 244, 251 & 257) and 5 underground operations (222, 244, 251, 257 and 276) were developed along a 5.4km long strike length of the Starra Line.

Exploration at the historical Mount Elliott copper mine, some 18km north of Starra, resulted in the delineation of additional ore-grade mineralisation in and around the historically mined Upper Zone and defined a new, high grade copper-gold orebody, (the Lower Zone). Mining commenced in 1994 and ore from the Starra series of mines, Mount Elliott and, for a very short period, from two small open pits at Victoria, was treated through a mill located adjacent to the Starra mines.

Production from both Mount Elliott and Starra was suspended in February 1999 and the Project was purchased by Selwyn Mines Limited in 2000. Mining and treatment of Starra and Mount Elliott ore recommenced in 2000 and a small open pit was also developed and mined at Lady Ella. Operations ceased in 2003 and Ivanhoe Australia (now Chinova Resources) purchased the assets of the project and assumed management of the sites as Ivanhoe Cloncurry Mines Pty Ltd. Subsequently the mill and much of the associated infrastructure was sold and removed from site.

Metal produced since start-up in 1987 to closure in 2003 totaled approximately 217,700 tonnes of copper and 1.02 million ounces of gold. At the time of closure in 2003, ore reserves remained at both Starra and Mount Elliott.

Subsidence of the Mt Elliott historic workings was first recorded in 1920 following the earlier mining campaigns. More recent subsidence has occurred to the western side of the historic workings. These areas have been fenced with warning signs erected.

The mines at Starra and Mount Elliott are currently closed and the entrances sealed for safety.

Underground development of the Starra 276 mine by Chinova Resources, commenced early in February 2012 with a total of 856,280t of ore produced and hauled to Osborne for processing. The Mine was closed on 21st August 2014 with underground services removed and the majority of rehabilitation completed. Up to 150 workers were accommodated at the Mt Dore Camp during this period.

Development of the Merlin Decline commenced in October 2011 to access a small high grade molybdenum rhenium deposit that underlies the Mt Dore Copper Oxide orebody. The decline intersected the upper part of the orebody and the project is currently on care and maintenance due to the depressed molybdenum price.
4 STAKEHOLDER CONSULTATION

The Osborne site has an annual Local’s Day on Melbourne Cup day each year. This day is used to inform locals and other stakeholders of mining and exploration activity in the coming year. Local’s Day was held at Osborne on 1st November 2016 and the proposed Mt Dore Heap Leach Copper Project was discussed along with mining progress at Osborne and ongoing exploration activity.

4.1 Department of Environment and Heritage Protection (DEHP)

DEHP has been consulted on a regular basis in regards to the general operations and new projects. A meeting was held with DEHP in Cairns on 6th June 2016 to seek advice as to the most appropriate approach to the amendment of the EA such that the development of the Mt Dore Heap Leach Copper Project could proceed.

4.2 Commonwealth Department of Environment and Energy

A meeting was held with Elizabeth McMillan (Assistant Director – Queensland Major Projects) from the Department of Environment and Energy on Friday 24th June 2016 to discuss potential referrals under the EPBC Act. A presentation was given to outline the proposed Mt Dore Heap Leach Copper Project and the research findings from the Carpentarian Antechinus Project.

4.3 Department of Natural Resources and Mines (DNRM)

DNRM has been consulted about and involved in recent mining lease applications for the haul road and services corridor and other tenure related dealings. DNRM Mines Inspectors are regular visitors to site.

4.4 Department of State Development (DSD)

DSD in Mt Isa was briefed in June 2016 about the Project and the potential benefits to the North Queensland Region.

4.5 Cloncurry Shire Council (CSC)

Project infrastructure is all located within the CSC. Chinova Resources is in constant contact with CSC and is providing support for road projects in the area by way of joint submissions to state and federal government. Consultation will be required for Notifiable Road Use in relation to the proposed Mt Dore Heap Leach Copper Project.

4.6 Aboriginal Groups

The Cloncurry Project mining and exploration tenements cover land associated with three native title claimant groups (the Kalkadoon, Mitakoodi, and Yulluna groups). CRCM has an ongoing commitment to consult with these groups on both native title and cultural heritage matters. Land Access Agreements are negotiated with the respective native title claimant groups under the Native Title Act, 1993. Yulluna People have been granted Native Title over the Mt Dore Heap Leach Copper Project area in a Federal Court hearing that was held at Osborne mine site on 28th March 2014.
management of all sites and items of Aboriginal cultural heritage significance is facilitated by a separate Cultural Heritage Management Agreement with the Yulluna People. Local indigenous people will be targeted for employment and training opportunities in relation to the Heap Leach project effectively transferring the existing employees from the current Osborne Open Pit project. A meeting was held with Yulluna People on 22nd November 2016 to specifically discuss the proposed Mt Dore Heap Leach Copper Project. The Yulluna People strongly supported the development of the project and the associated employment and training benefits.

4.7 Land Owner

The project area is located entirely within Starcross Holding held by CRCM. A sub-lease agreement has been established with MDH Pty Limited (Bob McDonald). Bob McDonald has been consulted in regards to the proposed operation.

4.8 Local Community

As previously mentioned, Local’s Day at Osborne is used to inform local stakeholders of current and future operations. These days are well considered by the local community and will continue to inform on mine developments and exploration activities. In addition, there is regular informal contact throughout the year with local landholders during exploration and mine associated activities.

5 GENERAL ENVIRONMENTAL VALUES

5.1 Meteorology

5.1.1 Rainfall and Evaporation

The nearest BOM meteorological station to the Mt Dore Operation is approximately 37km south west at Chatsworth Station (Station 37013) with more than a hundred years of record. The Cloncurry McIlwraith Street (Station 29008) is located 105km north of Mt Dore and has been included for comparison. The semi-arid to arid Mount Isa area is described as having a tropical continental climate (Bureau of Meteorology, Australia - Köppen Australian climate classification scheme). Refer Table 3. Average annual rainfall at Chatsworth is 321.8mm with evaporation of 3,110mm (Mt Isa).
### Table 3: Rainfall and Evaporation

<table>
<thead>
<tr>
<th></th>
<th>Cloncurry</th>
<th>Chatsworth</th>
<th>Monthly Evaporation (mm)</th>
<th>Daily evaporation (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>122.5</td>
<td>69.9</td>
<td>303.8</td>
<td>9.8</td>
</tr>
<tr>
<td>Feb</td>
<td>114.8</td>
<td>69.9</td>
<td>252.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Mar</td>
<td>66.7</td>
<td>37.5</td>
<td>279.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Apr</td>
<td>18.3</td>
<td>15.8</td>
<td>252.0</td>
<td>8.4</td>
</tr>
<tr>
<td>May</td>
<td>13.5</td>
<td>13.9</td>
<td>201.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Jun</td>
<td>12.0</td>
<td>9.8</td>
<td>162.0</td>
<td>5.4</td>
</tr>
<tr>
<td>Jul</td>
<td>7.3</td>
<td>9.8</td>
<td>170.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Aug</td>
<td>3.8</td>
<td>3.8</td>
<td>213.9</td>
<td>6.9</td>
</tr>
<tr>
<td>Sep</td>
<td>7.0</td>
<td>5.8</td>
<td>270.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Oct</td>
<td>16.5</td>
<td>14.8</td>
<td>325.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Nov</td>
<td>30.1</td>
<td>21.2</td>
<td>345.0</td>
<td>11.5</td>
</tr>
<tr>
<td>Dec</td>
<td>69.0</td>
<td>48.6</td>
<td>334.8</td>
<td>10.8</td>
</tr>
<tr>
<td>Annual</td>
<td>480.5</td>
<td>321.8</td>
<td>3,110.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: BOM Climate Data (2016)

Rainfall events exceeding the average condition will need to be assessed to determine the design criteria for water management structures.

#### 5.1.2 Temperature

The highest average daily temperature for Cloncurry is 38.0°C in December with the lowest average minimum of 10.3°C in July. Temperatures in excess of 53°C have been recorded at Cloncurry. Figure 3 below shows the average monthly temperatures and extremes for Mt Isa.
5.1.3 Humidity

The highest relative humidity levels for Cloncurry rise to 57 – 59% for January and February (wet season) each year at 9am dropping to 39 – 40% at 3pm. Dry season humidity ranges from 26-48% at 9am and 16-30% at 3pm.

5.1.4 Wind Speed and Direction

Figure 4 shows a wind-rose created from the Mt Dore weather station using records from December 2009 to August 2014. The data correlates closely with Bureau of meteorology data from Cloncurry Airport.

The predominant wind direction over the year is south south-east with average wind speeds of 5-7km/hr.
5.2 Topography and Drainage

The Cloncurry Project is characterized by two sub-parallel (eastern and western ironstones), continuous ridges, of low to moderate relief, that extend above a flat plain. These ridges are formed by more resistant lithologies of the main geological formations of the area the Kuridala and Staveley Formations, with the Starra line located to the west and Merlin located on the eastern ridgeline.

The main water courses traverse the peneplain that has developed between the two main ridges. Most of these watercourses are shallowly incised and ephemeral – flowing for only short durations during and immediately after the wet season.

The watercourses are incised into the laminated near-surface rocks and there is little alluvial development associated with them.

5.3 Regional Geology

The geology of the Chinova Resources leases consists of Proterozoic formations of the Staveley Formation and Kuridala Group. The primary geological formations that comprise the area are the Kuridala Group and the Staveley Formation. These formations express at the surface as thinly laminated and quite steeply dipping siltstone, slate, and phyllite, with subsidiary quartzite and ironstone layers that often form steep remnant ridges.
Granitic sequences intrude the Kuridala and Staveley Formations in places. To the east and the south of the project, Mesozoic cover associated with the Carpentaria Basin onlaps the Proterozoic sequence.

ERA Maptec, 1994 provide the following summary of the Starra and Merlin areas.

The Selwyn deposits are located in a corridor of Staveley Formation rocks bounded by two ironstone ridges, the western (Starra Line) and eastern ironstones (Merlin Line). The Kuridala Formation lies to the east of the eastern ironstones. To the west of the western ironstones lie very strained schists, assumed by some previous workers to be equivalent of the Answer Slate, but mapped as an early ductile shear of uncertain affinity by others. The ironstones are sub parallel with gold copper mineralisation hosted in the western ironstones only. The main difference is that the western ironstone is magnetic and the eastern ironstone is not. The ‘hinge zone’ consists of a series of ironstone lenses, between the eastern and the western ironstones and is intermediate in magnetic character. The copper gold mineralisation consists of:

- quartz-magnetite-chalcopyrite-gold ironstone grading to
- quartz-feldspar-chlorite-hematite-magnetite-chalcopyrite-gold schists being part of a wider alteration halo of
- quartzo feldspathic footwall rocks (albite-quartz-hematite) and scapolitic and carbonaceous hanging wall rocks.

The area lies in a north south trending corridor of concentrated deformation between two granites. The area is structurally complex with the following events generally recognised:

1. Creation of major shears zones at the boundary of the principal units:
   a. The Starra Shear between the Staveley Formation and the Answer Slate and Gin Creek Granite.
   b. The Selwyn Shear at the boundary at the boundary between the Staveley and Kuridala Formations.
2. Ductile sinistral shearing producing steeply plunging folds at various scales. This is accompanied by the formation of a pervasive foliation. This is the most obvious macroscopic event but could be preceded by an earlier event which created large scale upright, tight to isoclinals folds, with doubly plunging axes and an axial planar slaty cleavage.
3. In the south - open to tight folds overprint an earlier foliation.
4. NE ductile to brittle faulting, coeval with regional kinking of the Starra structural corridor.

Figure 5 shows a geological map of the area with mining lease boundaries and prospect names. This large-scale mapping is useful for highlighting major structures and for understanding the relationships of the geological units.
Figure 5: Regional Geology
5.3.1 Mt Dore Geological Setting

Copper (Cu) and molybdenum-rhenium (Mo-Re) mineralisation at Mount Dore is hosted within a tectonised sequence of metashale, metasiltstone, schist and phyllite belonging to the Proterozoic Kuridala Group in the Eastern Fold Belt of the Mount Isa Inlier. This stratigraphic package lies to the west of the over-thrust Mount Dore Granite and extends north-south along strike for several kilometres and dips eastward underneath the granite, see Figure 6. A massive, easterly-dipping, intensely-silicified quartzite ridge on the western side of the area forms the footwall to the deposits.

5.4 Landforms and Soils

5.4.1 Landforms

Cloncurry Project Mining Leases are situated within two land systems (Perry et al. 1962). They are:

- Mt Elliott, which is comprised of immaturely dissected plateau and high plains of pre-mid Mesozoic age; and
- Kuridala, comprised of maturely dissected hill country with dissected pre-mid Mesozoic surface, with some early to mid-Tertiary elements and narrow late Tertiary to Quaternary plains.

The dominant topographical features on these leases is the Starra ridge which attains heights of RL440m, the very broken topography where the two tailings dams and the Merlin deposit are located, with ridges in the order of 410m. The area to the west of the Starra ridge has more gentle sloping topography but with peaks attaining heights of 390m.

The Mt Elliott Mining Leases are situated within two land systems. They are:

- Torwood, comprised of immaturely dissected plateau and high plains of early to mid-Tertiary age; and
- Kuridala, previously described above.

5.4.2 Soils

The soils of the project area were described within the original EIIS, 1987. There are four main soil types in the area:

- Skeletal soils;
- Brown soils of light texture;
- Coarse textured red earths; and
- Fine textured red earths.

Samples were taken from the surface 200mm and 200-400mm intervals for chemical analyses from 56 locations and were bulked per the mapping units described.
The soil types were then broken into seven classes summarised in Table 4 below with their relative locations and occurrence.
Figure 6: Mt Dore Regional Geology
<table>
<thead>
<tr>
<th>Major Group</th>
<th>Class</th>
<th>Descriptor</th>
<th>Description</th>
<th>Location and Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniform texture profiles</td>
<td>Skeletal</td>
<td>Skeletal</td>
<td>Shallow (&lt;400mm), coarse textured red or brown soils dominated by rock fragments. Textures are sandy, sandy loams or clay loams.</td>
<td>Ridge tops, steep slopes and exposed rock 410ha Starra 48ha Mt Elliott 71ha Cobalt 17% total</td>
</tr>
<tr>
<td>Cockatoo</td>
<td>Brown</td>
<td>of light</td>
<td>&lt;400mm deep, dark reddish brown to brown sandy loam; up to 40% surface gravel; massive; slightly acid soil reaction.</td>
<td>Ridge tops extending to gently sloping valley floors 874ha Starra 6ha Cobalt 34% total</td>
</tr>
<tr>
<td>Manbulloo</td>
<td>Brown</td>
<td>of light</td>
<td>Shallow (200-500mm), dark reddish brown sands; approximately 30% gravel; massive; predominantly slightly acid pH.</td>
<td>Ridge slopes extending to gently sloping valley floors 643ha Starra 189ha Mt Elliott 43ha Cobalt 25% total</td>
</tr>
<tr>
<td>Sturgeon</td>
<td>Red</td>
<td>earth</td>
<td>&gt;400mm, dark reddish brown, sand clay loams; low pedality; soft consistence; approximately 30% gravel; neutral surface pH increasing to moderately alkaline with depth.</td>
<td>Undulating slopes 178ha Starra 6% total</td>
</tr>
<tr>
<td>Lang</td>
<td>Krasnozen</td>
<td></td>
<td>&gt;400mm deep, red to dark reddish brown loam; uniformly fine textured clays with some soils having a medium textured surface grading to clay; soft surface consistence grading to hard with depth; acid soil reaction in general but mildly alkaline sub-soils.</td>
<td>Undulating and low slopes 149ha Starra 5% of total</td>
</tr>
<tr>
<td>Gradational</td>
<td>Forsayth</td>
<td>Red earth</td>
<td>&gt;400mm deep, red to dark reddish brown; predominantly uniformly textured clay loams with some soils of sand or sandy loam texture grading to sandy loam; clay loam or clay; variable consistence; predominantly acid pH but neutral and alkaline lower horizons occur.</td>
<td>Undulating slopes and valley floors 334 ha Starra 24 ha Mt Elliott 12% total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt;400mm deep, reddish brown to brown sandy loam grading to sandy clay; clay loam; low pedality; soft consistence; alkaline soil reaction.</td>
<td>Undulating slopes and valley floors 26ha Starra &lt;1% total</td>
</tr>
</tbody>
</table>
In general the soils are slightly acid, the exceptions being some Munbulloo profiles which were strongly acid and Forsayth and Elliott classes which were mildly and moderately alkaline respectively. The pH either remained unchanged or increased with depth, the greatest change being in Forsayth, for which the subsurface material was strongly alkaline. The pH range detected in this survey was not sufficient to restrict the soils use for rehabilitation.

High salinity levels were detected throughout the profile of the Elliott soil class. The subsoil profiles of the Manbulloo were sodic and both the surface and sub-surface of the Forsayth and Elliott classes were strongly sodic. Phosphorus and nitrogen levels were low in all soils except for the skeletal soils where 17 ppm phosphorus was recorded.

6 GHOST BAT

The Ghost bat (*Macroderma gigas*) is the largest microchiropteran bat in Australia, with a head and body length of 10–13 cm and a forearm length of 10–11 cm. It is Australia’s only carnivorous bat. Its fur is light to dark grey above and paler below. It has long ears which are joined together, large eyes, a simple noseleaf and no tail (Richards, et al., 2008).

Fossil data show that the ghost bat was once distributed widely over much of Australia except Victoria and Tasmania, including the arid zone, but contracted northwards during the Holocene period (Molnar, et al., 1984; Churchill & Helman, 1990). A study that combined information from ancient DNA obtained from remains in extinct southern populations, newly-generated and existing genetic data from extant northern populations, and ecological niche modelling based on past and present climatic conditions (Thomson, et al., 2012), suggested that the ghost bat expanded southwards during periods of higher humidity (interglacial) and contracted northwards in response to increasing aridity (e.g. preceding the last glacial maximum). The combined analyses support previous statements that the ghost bat is a geographically relictual species in southern, arid landscapes, present only because caves provide suitable roost microclimates.

At the time of European settlement, arid zone subpopulations remained. Since the arrival of Europeans, ghost bats have contracted further northwards, with much of their arid zone distribution disappearing in the past few decades (Molnar, et al., 1984; Churchill & Helman, 1990). (Burbridge, et al., 2009) reported that western desert Aboriginal people stated that ghost bats only ever occurred in a few favourable areas and that they were still present. However, searches of several central Australian sites where they once occurred have since failed to locate any (Churchill & Helman, 1990). The last arid zone specimen was collected in 1961 (Butler, 1962). The major range contraction from central Australia happened more than three generations (24 years) ago.
The species’ current range is discontinuous, with geographically disjunct colonies occurring in the Pilbara (Armstrong & Anstee, 2000; McKenzie & Bullen, 2009), Kimberley (including several islands; McKenzie & Bullen, 2012)), Northern Territory (including Groote Eylandt), the Gulf of Carpentaria (Australian Wildlife Conservancy, 2010), coastal and near coastal eastern Queensland from Cape York to near Rockhampton (Richards, et al., 2008), and western Queensland (including Riversleigh and Camooweal districts; Bullen pers. comm., 2015). Burbidge, et al., (2009), using modern, historical and subfossil data, found that the ghost bat occurred in 37 of Australia’s 85 bioregions, and that it was extinct in 12. Only 14 breeding sites are currently known (Worthington Wilmer, 2012).

Populations are highly structured, being genetically distinct at both regional and local scales (Worthington Wilmer, et al., 1994; Worthington Wilmer, et al., 1999) Armstrong et al., in prep. Populations at the southern limits of the species’ range are geographically isolated and separated by a minimum distance of 300 km. This geographic isolation is reflected in the genetic data with populations at Mt Etna, Cape Hillsborough, and Camooweal in Queensland, and the Pilbara in Western Australia, being highly divergent genetically, and implies virtually no movement of individuals between these sites (Worthington Wilmer, et al., 1999). Populations within the Northern Territory and far north Queensland are also highly distinct from each other and other population centres (Worthington Wilmer, et al., 1999), while the Kimberley bats are distinct from all other Australian populations with genetic structure evident in the Kimberley populations (Worthington Wilmer, 1996).

Population genetic studies indicate a high degree of female philopatry (remaining in, or returning to, an individual's birthplace) at natal roosts based on mitochondrial DNA markers; gene flow within regions mediated by male movements was also suggested from nuclear microsatellite markers (Worthington Wilmer, et al., 1994; Worthington Wilmer, et al., 1999). Northern groups had higher heterozygosity and less marked phylogeographic structure than southern groups, which was interpreted to be a consequence of the limited availability and greater separation of roost sites with suitable microclimates in more arid areas. Recent studies that have built on the work by Worthington Wilmer et al., (1994, 1999), by adding individuals from the Pilbara and Kimberley regions, have also highlighted the distinctness of these two subpopulations, high female philopatry, and gene flow within regions arising from male movements (K. Armstrong et al., pers. comm., cited in Woinarski, et al., 2014). Losses of sites containing breeding females have the potential to reduce the area of occupancy and population size significantly.

Figure 7 below shows all recorded sightings of the Ghost Bat from a Wildnet search undertaken on 17th November 2016. The green sighting approximately 68 kilometres north of the proposed Mt Dore Heap Leach Copper Project and represents a sighting of a single male in September 2013 (pers comm Dr Kyle Armstrong University of Adelaide). This is the site of some historic mine workings (Dycotts Gully) which are likely used by the individual for roosting.
Figure 7: Sighting Data for *Macroderma gigas*
6.1 Targeted Species Survey Guidelines

The Targeted species survey guidelines: Ghost Bat (*Macroderma gigas*) (Hourigan, 2011) indicate the following:

- The Ghost Bat is distinctive and readily identifiable being the largest microbat in Australia.
- When free flying, calls are characterised by steep linear frequency modulated (FM) pulses at 45-56 kHz, of low intensity and short duration (0.8-2.3 ms) (Guppy, et al., 1985; Hourigan, 2011). When perched to forage, calls are of lower frequency 28.5-36.5 kHz (Hourigan, 2011). Calls have up to four harmonics but most of the strength is in the 2nd or 3rd harmonic (Guppy, et al., 1985).
- In Queensland, this species is currently distributed in only 4-5 highly disjunct populations along the coast and inland from the McIlwraith Range in Cape York to Rockhampton.
- Regional populations are centred on permanent maternity roosts that are genetically isolated from each other (Worthington Wilmer, et al., 1994).
- Roost sites are deep natural caves or disused mines with a specific microclimate, which is a relatively stable temperature (23°C to 28°C) with moderate to high (50-90 %) relative humidity, and the ceiling at least 2 m above the floor (Churchill & Helman, 1990). Individuals aggregate in these maternity roosts during spring and summer.
- Ghost Bats vary seasonally in the use of roosts, with individuals congregating in maternity roosts from September to April and dispersing in small groups over winter (Toop, 1985).
- Surveys targeting this species should be carried out between September and April, as the species may be easier to detect when individuals are more aggregated.
- However, as the Ghost Bat has the potential to be present in a wider range of areas during the winter months, surveys may need to be repeated between June and August, particularly if maternity roosts are not present within the project area.

The following survey effort is recommended in the guideline per 100ha of project area and detailed in Table 5.

<table>
<thead>
<tr>
<th>Survey Technique</th>
<th>Minimum Effort</th>
<th>Minimum Number of Nights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active monitoring</td>
<td>8 detector hours</td>
<td>4 nights</td>
</tr>
<tr>
<td>Harp traps</td>
<td>8 trap nights</td>
<td>4 nights</td>
</tr>
<tr>
<td>Mist nets (optional)</td>
<td>8 mist net hours</td>
<td>4 nights</td>
</tr>
<tr>
<td>Roost searches</td>
<td>2 hours per survey day</td>
<td></td>
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</tbody>
</table>
6.2 Survey Effort

6.2.1 Place 2010 Survey

Place Design Group undertook detailed fauna surveys in the period 15\textsuperscript{th}-23\textsuperscript{rd} September 2010 in relation to the proposed Merlin decline development (10ha) and a proposed haul road access (15 kilometres) and general assessments of all the Cloncurry Project mining lease areas (Place Design Group, 2010). The Merlin development is located on the western side of a ridgeline separating it from the Mt Dore Heap Leach Copper Project area on the eastern side of this ridgeline.

A broad selection of trapping and search techniques were employed to look for mammalian species within the Decline Area survey effort. These included: Elliot traps, cage traps, hair tubes, pitfall traps, diurnal searches for shelter habitat, call playback, bat echolocation recording (ANABAT), and nocturnal spotlight searches while traversing suitable habitat on foot. Incidental sightings and searches in high quality habitat were conducted throughout the Investigation Area. The following efforts were conducted relative to the identification of the Ghost Bat:

- Nocturnal spotlighting 6 person hours
- Infrared cameras 6 x 24hrs
- ANABAT echolocation surveys 6 x 12hrs

The general fauna assessments across all the Cloncurry Project mining leases included:

- Interpretation and review of aerial photography for each mining lease areas to gain an understanding of the vegetation densities and potential habitats within the ML;
- Detailed foot and vehicular traverse of the site by two ecologists to investigate and define all potential habitat types within the ML;
- Investigation of microhabitat to search for evidence of fauna inhabiting specific habitat types (i.e. caves). This included spotlighting and scat collection; and
- Documentation of all species encountered or potentially utilising habitats within the ML.

This report identified that the Ghost Bat may potentially occur in the region. The report also indicated that no cave habitats that would support populations of the Ghost Bat occurred in the investigation area (Merlin Decline), however older redundant mine workings outside of the investigation area may provide deep cave style habitat suitable for the species. This investigation also identified Taphozous troughtoni (Troughtons sheathtail bat) using ANABAT echolocation technology. At that stage Taphozous troughtoni was considered endangered under the Nature Conservation Act (Qld) 1992. Additionally, a population of microchiropteran bat was noted roosting within an abandoned copper/gold mine and smelter and was
tentatively identified as either *Taphozousroughtoni* (Troughton's sheathtail bat) or *Taphozous Geoffroyi* (Common sheathtail bat).

The report identified generally the existence of large ranges traversing the Cloncurry Project mining leases in a north-south direction. These elongated rocky escarpments and smaller rocky knolls contain extensive small to large crevices and cave networks which may contain suitable roosting habitat for both the Ghost Bat and *Taphozousroughtoni*.

The listed Ghost Bat was not detected during any of detailed survey efforts within the Decline Area. This species is dependent on rocky outcrops containing deep caves for roosting habitat. Such habitat features were not present in rocky ridges within the Decline Area. This species may potentially utilise the site and surrounding locality for foraging purposes as a part of a broader home range, however it has been recognised that this species has undergone a contraction in its range and is now mostly restricted to tropical north Australia. Old mine shafts and large caves which exist throughout the locality may potentially provide suitable habitat for the Ghost Bat.

### 6.2.2 Place 2011 Survey

Place Design Group undertook supplementary wet season survey work from 20\textsuperscript{th}-24\textsuperscript{th} January 2011 (Place Design Group, 2011). The survey was undertaken through the same investigation area as the 2010 survey.

Targeted microbat assessments were undertaken throughout the disused 222 and 276 mine declines and Mt Elliot Copper Smelter to determine the extent of bat usage and confirm the potential presence of the endangered *Taphozousroughtoni* (Troughton’s sheathtail bat). To conduct these targeted surveys the following methodology was undertaken:

- Underground inspections of the declines to understand the inherent nature of microbat populations inhabiting the declines. A four-person team (two company staff and two PDG zoological staff) entered the declines and inspected each to a depth where little to no microbat activity occurred. This was gauged by the lack of individuals present in combination with the depth of the survey. This usually terminated at approximately 1 kilometre underground;
- The internal air supply vents were inspected to identify any potential roosting habitat, presence of microbats and exit points;
- A harp trap was assembled at the entry point of decline where large retractable shade cloth had been mounted to the roof to funnel exiting microbats into the harp trap. This process occurred at both 222 and 276 on separate nights over a four night period. To avoid the over-capture of bats exiting the declines, the harp trap was left in place for 15 minute intervals before inspection. At this point the harp trap was removed from the entry point and microbats captured were diagnostically identified, with all required
attributes recorded. Each individual was subsequently marked with xylene-free marker and released at the entry to the decline. This process was continued during the night until a minimum of 15 *Taphozous* species were captured and identified at each location. This process was conducted to ensure that enough individuals were captured to obtain sufficient data for comparative analysis, thus aiding the morphological comparisons between the species *troughtoni* and *georgianus*. The harp trap was not left out over the night and the shade cloth was retracted to allow normal exit and entry for microbat species;

- An ANABAT echolocation recording device was utilised during these trapping exercises. This technique was engaged to collect the calls of identified microbat species for reference against previously recorded data from the region. This device was left out over night to record further call data over the remaining period of the night.

- A previously encountered colony of *Taphozous* species inhabits the relict Mt Elliot Copper Smelter. Trapping was conducted within this smelter to aid in further collection of data. This was to aid in the determination of the species inhabiting the locality. A harp trap was set up in one of the tunnels associated with the smelter and observed until at least five individuals were captured. Diagnostic identification was undertaken and recorded to provide further clarification and comparison of individuals captured at other trapping localities.

- An ANABAT echolocation recording device was utilised during these trapping exercises. This technique was engaged to collect the calls of identified microbat species for reference against previously recorded data from the region. This device was left out over night to record further call data over the remaining period of the night.

Based on the results of the surveys undertaken in January 2011, it is concluded that large populations of *Taphozous troughtoni* (Troughton’s sheath-tail bat) occupy both 222 and 276 declines as well as the relict Mt Elliot Copper Smelter. Given the roosting ecology of this species, it is likely that individuals will roost in several caves and mining shafts within the region. It should be noted that there are several disused declines within the region and specifically within the Starra Range where both 222 and 276 are situated (see Figure 8).

The following is a summary of the survey efforts that were conducted relative to the potential identification of the Ghost Bat:

- Physical inspection of two mine declines and vent rises to the extent of microbat activity (generally 1 km).
- 2 nights selective harp trapping of two mine declines (not overnight).
- ANABAT recording of harp trapping sessions and overnight x 4 nights (minimum 8hrs).
- 1 night selective harp trapping of the Mt Elliot smelter.
• ANABAT recording of Mt Elliot harp trapping session and overnight x 1 nights (minimum 8hrs).

The listed Ghost Bat was not detected during any of these surveys.
Figure 8: Cloncurry Project Mine Locations
6.2.3 Place 2011 Microbat Management Plan

Place Design Group developed the microbat management plan to support the re-entry and development activities proposed for the Starra 276 and 222 mine declines (Place Design Group, 2011).

Harp trapping and ANABAT surveys undertaken in January 2011 identified several microbat species which utilise the Starra 222 and 276 declines. These species included *Vespadelus troughtoni* (Eastern cave bat), *Vespadelus finlaysoni* (Finlayson’s cave bat), *Scotorepens greyii* (Little broadnosed bat), *Nyctophilus geoffroyi* (Lesser long-eared bat), and *Chalinolobus gouldii* (Gould’s wattled bat). Current literature identifies that these species utilise multiple roost sites throughout their home-ranges (Churchill, 2008; Van Dyck & Strahan, 2008).

The immediate landscape and broader region provides an abundant supply of habitat for roosting and foraging for this species (Place Design Group, 2010). This is due to the high density of disused artificial habitats created by historic mining activities.

6.2.4 Place 2012

Place Design Group undertook detailed fauna assessments from 14-20th March 2012 over the mining leases specifically for the Mt Dore Heap Leach Copper Project (Place Design Group, 2012).

Habitat assessments and fauna field surveys were conducted using a variety of direct and indirect survey techniques. Methods used included:

- Elliot A and B Trapping;
- Mawbrey trapping;
- Pitfall trapping;
- Point and area counts for birds and herpetiles;
- Call playback for nocturnal bird species;
- Collection of scats and bone fragments;
- Analysis of tracks and scratches;
- Spotlighting;
- Motion cameras; and
- ANABAT call detection.

Due to equipment failure, the ANABAT survey was conducted later (3rd – 5th April 2012).

It should be noted that the ANABAT data captured was of low quality. It was considered that the original sequence files were initially downloaded at the incorrect division ratio and initially displayed at half the expected frequency. Furthermore, all files contained only weak call signals with most pulses poorly defined. The data file was reprocessed to display at the expected frequencies, the data quality however
remained very low, with weak signal strength and poorly defined pulse structures. The low data quality meant that none of the recorded calls could be reliably identified to species level. Consequently, calls were only identified to species groups based on similar pulse shapes and characteristic frequencies. The species groups identified during this survey included:

- *Chalinolobus gouldii*, *Scotorepens balstoni* and *Mormopterus*
- *Scotorepens greyii* and *Vespadelus baverstocki*
- *Nyctophilus* species
- *Vespadelus finlaysoni*
- *Chaerephon jobensis* and *Saccolaimus flaviventris*
- *Mormopterus beccarii* and *Taphozous* species

The author of the original ANABAT echolocation data interpretation summary report (Greg Ford, Balance Environmental pers.com 13th December 2016) has advised that it would be unlikely with the poor report quality data to have been able to identify Ghost Bat calls.

The Place report (2012) found that ‘There are a number of linear rocky escarpments and smaller rocky knolls containing a range of crevices. A distinct lack of cave habitat was noted within these MLs’ (section 2.6). In relation to *Taphozous troughtoni* it was noted that the species is found roosting in caves, cracks, and small solution pipes in rocky outcrops. ‘Whilst the study area did not provide any roosting habitat, the occurrence of the species would indicate that it forages in the area’ (Section 6.3).

Section 6.6.2 of the Place report (2012) however refers to the northern portion of the study area providing the highest quality habitat with vast ranging steep rocky peaks containing an abundance of large boulder piles, crevices and shallow to deep caves.

The following is a summary of the survey efforts that were conducted relative to the potential identification of the Ghost Bat:

- Intensive nocturnal searches 1hr at each site – 6 hours
- ANABAT recording (minimum 8hrs) – 4 nights – poor data quality
- Motion cameras 2 x 24hr period at two trap sites.

The listed Ghost Bat was not detected during these surveys.

### 6.3 Habitat values relevant to the Ghost Bat

The Ghost Bat currently occupies habitats ranging from the arid Pilbara to tropical savanna woodlands and rainforests. During the daytime, they roost in caves, rock crevices and old mines. Roost sites used permanently are generally deep natural caves or disused mines with a relatively stable temperature of 23°–28°C and a moderate to high relative humidity of 50–100 percent (Pettigrew, et al., 1986; Churchill & Helman, 1990; Armstrong & Anstee, 2000; Toop & Davies, (unpublished); Churchill, 1991).
The existence of large underground mine workings in the area surrounding the proposed project with groundwater generally encountered at 50 – 100 metres below the original ground surface, contributes to creating the ideal roosting environment for the Ghost Bat with relatively stable temperatures and consistent moderate to high humidity. It is reasonable to assume that these sites would be preferred by the species as permanent roosting or breeding sites.

The Place, 2012 report refers to the northern portion of the study area providing the highest quality habitat with vast ranging steep rocky peaks containing an abundance of large boulder piles, crevices and shallow to deep caves. This is consistent with *Eucalyptus leucophloia* low open woodland on granites and to a lesser extent *Eucalyptus leucophloia* low open woodland/*Corymbia terminalis* low open woodland on basic metamorphics reported in section 7.3 as the habitat values that are significant to the Carpentarian Antechinus. It should be noted that the Carpentarian Antechinus will utilise a broader range of rocky habitat than microbat species such as the Ghost Bat. This particular habitat will be specifically avoided by the proposed amendments to the placement of the northern and southern waste rock dumps. Impacts to 3.7 ha of mapped Carpentarian Antechinus habitat within the North and South Pit footprints will however not be avoidable.

The level of targeted bat surveys that have been completed in the area since 2010 is considered to have exceeded the targeted species survey guidelines for the Ghost Bat using several techniques, despite the apparent poor quality of the ANABAT recordings from the 2012 survey. In addition, the targeted surveys of existing mine workings which identified up to five microbat species, would reasonably have been expected to reveal the presence of the Ghost Bat in its preferred roosting environment.

As the proposed project will not disturb any significant areas of the highest quality potential natural habitat nor interact with any of the existing underground mine workings, it is considered with a high level of certainty that the proposed project will not impact on any individuals or populations of the Ghost Bat.

No further assessments will be included in this plan on the potential impacts to the Ghost Bat or assessments of any required controls. It should however be noted that the controls relevant to managing the impact to Carpentarian Antechinus habitat (Section 7.3) will be equally relevant to the habitat subset that applies to all microbat species including the Ghost Bat.

### 7 CARPENTARIAN ANTECHINUS

The Carpentarian Antechinus (*Pseudantechinus mimulus*) is a small marsupial, with a head and body length of 63-91 mm, tail length of 56-76 mm (Johnson, et al., 2008), and is currently listed as Vulnerable under the EPBC Act (1999). The main factor causing the species to remain eligible for listing in the Vulnerable category is a limited area of occupancy (AOO) and this may be due to inappropriate fire regimes and
predation by feral cats (Woinarski, et al., 2014). Estimation of the AOO is difficult, given the small number of records and limited sampling in suitable habitat. However, it is estimated that the mainland AOO may be >2,000km² (Woinarski, et al., 2014). It should also be noted that detectability success has increased substantially with the introduction of camera trapping since 2013.

It is closely related to and superficially like other pseudantechinus species that typically occupy rocky areas in northern and central Australia, but is slightly smaller than these species (Woinarski, 2004). All five species have a somewhat flattened head and pointed muzzle, large ears, and are generally brown above and pale below. The Carpentarian antechinus has a distinguishing patch of reddish fur around the ears, and feeds on a variety of invertebrates and small vertebrates including termites, spiders, cockroaches, grasshoppers and small skinks (Burnett pers comm.). Pseudantechinus species can store fat in their tail, and the tail becomes carrot-shaped when food is plentiful (Woinarski, 2004). From the limited available records, it appears to be a seasonal breeder with young born in August and September (Woolley, 2011; Burnett, et al., 2014). It is understood based on the lifecycle of other pseudantechinus species, that following breeding some males and females survive to breed in at least a second year, while the remainder die after their first breeding season.

The EPBC Conservation Advice (1/10/2015) considered the Carpentarian antechinus is restricted to sandstone formations on some islands (Vanderlin, North, Centre and South-west in the Sir Edward Pellew group) in the Gulf of Carpentaria (Woinarski, et al., 2011), and on some ranges in the Gulf hinterland (near Mt Isa extending as far east as the Selwyn Ranges, and at Pungalina – Seven Emu) (Baker & Griffiths, 2005; Woolley, 2011; Lloyd, et al., 2013). The type locality (Alexandria Station, on the Barkly Tablelands) appears atypical, and the species has not been recorded at that site since; the original specimen is likely to have been collected from the Mittiebah Ranges to the north-east of Alexandria (Woolley, 2011). It has not been recorded in rocky areas to the north of Mt Isa (i.e. the Lawn Hill [Boodjamullah] area) despite considerable sampling (White & Mason, 2011). Other recent surveys within the Cloncurry shire have also identified the presence of the species (AARC, 2013; EcoSmart Ecology, 2015). There is currently no recovery plan in place for the species and has not been since 1/10/2015.

The northern known extent of the species in Queensland is in the Knapdale Range approximately 60km to the northwest of Cloncurry with other occurrences approximately 30km to the north and 15-70km east of Mt Isa (AARC, 2013).

The known occurrences of the Carpentarian Antechinus increased significantly in 2013 with CRCM undertaking a project with University of Sunshine Coast to identify regional occurrences in and around the company’s Cloncurry Project mining leases approximately 120 kilometres south of Cloncurry. This study using baited trail cameras in the detection of the Carpentarian Antechinus for the first time, and was able to considerably extend the known range of the species within the Selwyn Range.
in addition to increasing the number of sites at which the species occurs within that range.

### 7.1 Survey Effort

A total of two-hundred and eighteen sites, consisting of 362 camera survey points were surveyed from 09/05/2013 to the 25/10/2013. Cameras were set at each site for between five and 12 consecutive days/night. There was a total of 247 detections of the Carpentarian Antechinus at 44 sites, with no detections at the 39 non-rocky habitat sites. The study approximately quadrupled the number of sites from which the species was known at the time and revealed new information regarding its preferred habitats (Burnett, et al., 2014).

Elliot traps were also deployed between 10/09/2013 and 19/09/2013 at 20 sites from which the species had been detected during the preceding five months, for a comparison between the effectiveness of the two methods. Elliott traps were set on an approximately contour-hugging transect of 10 Elliot traps, spaced 10m apart. The traps were operated for 4 consecutive nights at each site with total Elliot trapping effort of 800 trap nights (10 traps x 20 sites x 4 nights) with a total of seven individuals captured. This <1% success rate is consistent with other studies involving live trapping. It is worthwhile to note that the Elliott trapping was done during the period of low detectability and the success of this method may improve during periods of higher detectability (May- July).

Results indicate the use of trail cameras in preference to Elliot traps for the detection of the Carpentarian Antechinus. At worst, an array of two trail cameras spaced 60-m-apart and operated for 4 consecutive nights are as effective as a transect of 10 Elliot traps spaced 10-m-apart and operated over 4 nights. Camera traps however require much lower effort to set and maintain.

### 7.2 Detailed Mapping of Potential Habitat

Following targeted field survey for the species which revealed that it uses rocky areas irrespective of geology (Burnett et al. 2014), mapping for the Carpentarian Antechinus was undertaken by CRCM to identify the extent and location of potential habitat areas across the Cloncurry Project mining lease area.

Previous records and recent studies (Burnett, et al., 2014) demonstrate that the species is absent from areas that have little or no rocks. As such, these areas have been identified as unsuitable habitat. Broad identification of potential habitat across the whole of the Mt Dore project mining leases has been conducted by CRCM using two categories: ‘little/no rock’, which represent areas of no habitat for the species; and ‘rock’, which represent areas of potential habitat for the species. Rocky habitats can be readily distinguished from non-rocky habitats based on aerial interpretation and topography. It should be noted that the maps produced through this work represent potential habitat. They have been produced at a desktop level using
previous field experience, satellite imagery and topographical data. They do however provide a high level of confidence that the areas identified are potentially suitable or unsuitable habitat.

Importantly, the habitat mapping is considered adequate for this assessment in providing a baseline understanding of habitat values across the project area where potential impacts can be analysed. The areas that have been mapped as potentially suitable for the Carpentarian Antechinus broadly occur throughout the Selwyn Ranges which traverse the mining tenements running in north to south direction and covers an area of approximately 1.7 million ha (Open Lines Environmental Consulting, 2015). Suitable mapped areas are associated with steep slopes, gullies, outcrops and ridges. The core mine processing and operating areas are situated on the flat plains that do not contain the necessary rocky features to support the species.

The area of high quality rocky habitat within the project area that was originally proposed to be disturbed was 5.5 ha (Referral Application, September 2016). Importantly CRCM have undertaken a review of their activities and have reduced the proposed disturbance area by 1.9 ha by redesigning the Northern waste rock dump and relocating the Southern waste rock dump. It should also be noted that there have been changes made to the South Pit and associated haul road footprint as a result of a geotechnical review and risk assessment. The currently proposed disturbance represents <2% of 251 ha of the mapped habitat on the Cloncurry Project mining leases.

The elements of the proposed action that remain within areas of potential habitat include the north and south pits and these areas have been ground checked. Proposed amendments have been made to both the northern and southern waste rock dumps avoid mapped rocky habitat areas.
Figure 9 and Figure 10 show the Carpentarian Antechinus camera trapping records and mapped habitat within the proposed Project area. Figure 11 shows mapped habitat for the whole of the Cloncurry Project mining leases.
Figure 9: Carpentarian Antechinus Camera Trap Records
Figure 10: Potential Carpentarian Antechinus Habitat Disturbance
Figure 11: Mapped Carpentarian Antechinus Potential Habitat
7.3 Habitat Values Relevant to Carpentarian Antechinus

The 2013 study undertaken for Chinova identifies that the Carpentarian Antechinus is confined to rocky habitats in the study area and has been associated with 15 different Regional Ecosystem (RE) types and subtypes (Burnett, et al., 2014). This is consistent with the findings of other studies. Despite this dependence on rock habitat, the presence/absence of Carpentarian Antechinus at a site is not predicted by any of the rock variables; lithology (metamorphic, sedimentary or igneous), landform (boulder, scarp, ridge etc.), % rock ground cover, or an index of cavity size and number (Burnett et al., 2014). Burnett also found that those rocky sites supporting low woodland to open forest of *Acacia shirleyi* (Lancewood) are significantly more likely to be occupied by Carpentarian Antechinus. Table 6 includes RE descriptions and images of sites where the Carpentarian Antechinus has been identified.

In general, there is little known about this species and particularly regarding population dynamics and spatial ecology of the species. This is likely a result of low live trapping success (~1%), with the species being more readily detected using camera traps (Woinarski, et al., 2011; Burnett, et al., 2014).

The presence of the Carpentarian Antechinus at 7 of 18 burnt sites during the 2013 survey, all of which had been virtually denuded of vegetation for greater than 6 months (and half of the sites greater than 2 years) suggests that the species may be able to tolerate low vegetative cover over an extended period and have some resistance to uncontrolled bushfires. It is possible that the physical structure of the rocks in which the Carpentarian Antechinus live buffers the effects of exposure to the elements and predators, that vegetation would otherwise provide to small mammals and importantly their invertebrate prey (Burnett et al., 2014). Burnett et al. (2014) also indicates that the Carpentarian Antechinus has been encountered in at least two mine waste rock dumps indicating that the species is either using or moving through these disturbed area.
Table 6: Sites where the Carpentarian Antechinus has been identified.

<table>
<thead>
<tr>
<th>Regional ecosystem description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Eucalyptus leucophloia</em> low open woodland on granites</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td><em>Eucalyptus leucophloia</em> low open woodland on granites</td>
<td><img src="image2.png" alt="Image" /></td>
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<tr>
<td>Regional ecosystem description</td>
<td>Image</td>
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</tr>
<tr>
<td><em>Eucalyptus leucophloia</em> low open woodland/<em>Corymbia terminalis</em> low open woodland on basic metamorphics</td>
<td><img src="image" alt="Image" /></td>
</tr>
</tbody>
</table>
### 7.4 Direct and Indirect Impacts

The Multispecies Recovery Plan for the Carpentarian Antechinus, Butler’s Dunnart and the Northern Hopping-mouse (Woinarski, 2004) and the Carpentarian Antechinus Conservation Advice have been reviewed in developing the following assessments.

The proposed project has the potential to impact the Carpentarian Antechinus and includes a combination of direct and indirect impacts including:

- mortality of individuals
- habitat loss
- loss of habitat connectivity
- noise and vibration
- human disturbance and artificial lighting
- spread of feral predators
- introduction and spread of weeds
- land contamination, and
• changes to fire regime.

The sections below provide an analysis of the relevance, extent and a risk ranking of the potential significance of these impacts is undertaken in section 7.6.

7.4.1 Mortality from Land Clearing

Mortality of individuals will occur during land clearing and the species is unlikely to be able to outpace clearing activities or rapidly relocate to other suitable habitat adjacent to the proposed disturbance area. Mortality of some individuals within disturbance areas is therefore considered to be an unavoidable impact. It is not possible to quantify the number of individuals which may be lost from the population because of the proposed disturbance. However, the area of habitat loss will not exceed 4 ha or 1.6% of habitat available within the project mining leases, suggesting that only a relatively small proportion of the local population will be potentially impacted. In relation to the total project mining lease area of 4,990.18 ha, 251 ha (5%) has been mapped as potential habitat.

7.4.1.1 Proposed Mitigation Measures

Trapping and relocation will be undertaken immediately prior to disturbance of suitable habitat where the Carpentarian Antechinus has been identified and known to occur. Individuals that are captured will provide an opportunity to gain a better understanding of their spatial ecology and translocation success. Relocation work will be undertaken by the Sunshine Coast University over a 14 day period using a minimum of 1,000 trap nights (expected success rate ~1%) during the currently known period of higher activity between May and July (Burnett, et al., 2014). Trapping effort will be dependent on the results of the camera trapping prior to disturbance and adjusted accordingly if required. Captured individuals will be relocated a minimum distance of 500 metres. Camera trapping will also be undertaken in the removal area after trapping is completed to determine the success of the relocation program. The success of the program will be evaluated using an occupancy modelling power analysis approach. This will be an adaptive approach in that we will utilise camera trap data from the pre-removal phase of the animal translocation to determine the amount of trapping effort required to be 80% certain that lack of detections on trail cameras reflects that there are no individuals remaining at the site. Given the near impossibility of capturing every individual of any species, let a sparse and difficult to trap species such the Carpentarian Antechinus, it is unreasonable to expect that every individual will be trapped and removed.

7.4.2 Habitat Loss

Loss of habitat because of the originally proposed project would occur through direct clearing of vegetation and land modification during construction of the north and south pits and associated northern and southern waste rock dumps. An area of 3.7 ha of potential habitat loss has been calculated on this basis.
7.4.2.1 Proposed Mitigation Measures

Adjustment of the position of both the northern and southern waste rock dumps has been approved by CRCM effectively reducing habitat loss by 1.8 ha. The north and south pit disturbance areas cannot be relocated due to the position of the orebody and therefore this disturbance is unavoidable. The total area of habitat loss is <2% of suitable available habitat on the Cloncurry Project mining leases.

The area of all disturbance including mapped Carpentarian Antechinus habitat will be monitored and reported through CRCM’s Permit to Disturb system.

Rehabilitation of waste rock dumps will include:

- Establishment of rocky outer batters for erosion resistance and habitat development for the Carpentarian Antechinus and Purple Necked Rock Wallaby.
- Placement of rock areas across a minimum of 20% of the waste rock dump upper surface by way of rock infiltration basins and regularly placed low shaped coarse rock dumps.
- Cleared vegetation and soil will also be stockpiled for replacement during rehabilitation to provide initial habitat for invertebrate species.
- *Acacia shirleyi* (Lancewood) will be used in the seeding mix applied to the rehabilitated site.
- The existing Cloncurry Project Closure Plan includes revegetation criteria with the aim to:
  - establish a vegetation systems that contains species tolerant to drought and fire conditions;
  - has demonstrated resilience and recovery to drought and/or fire conditions;
  - has demonstrated secondary recruitment and progression towards the analogue condition;
  - has a foliage projective cover >50% of the analogue sites;
  - has a species diversity >50% of the analogue sites.
- Camera trapping of the new habitat will be undertaken to demonstrate usage by the Carpentarian Antechinus.

It is estimated that the rehabilitated waste rock dumps will provide a minimum of 10.6 ha of potential new rocky habitat suitable for the species. Rehabilitation monitoring is likely to extend at least 5 years beyond the completion of rehabilitation to achieve all relevant completion criteria.

7.4.3 Loss of Habitat Connectivity

Connectivity of suitable habitat is not expected to be impacted by the proposed project. The habitat of the north pit footprint lies within a small valley that has connectivity to suitable habitat further to the north and east. The habitat within the
The south pit footprint is adjacent to habitat further to the north east. The closest habitat in relation to the north pit where the species has also been found is approximately 400m to the east. The habitat in between these two locations is open woodland and this suggests that the species may move through less rocky habitat up to at least this distance. The presence of the species in isolated rock outcrops surrounded by non-habitat (Burnett et al. 2014) suggests that the species is able to disperse through non-optimal habitat. It is speculated that when conditions are favourable, population growth and competition forces individuals into less suitable habitat areas that have lower occupancy. Likewise, when conditions are unfavourable populations may retract to higher quality habitat.

There will be no physical barriers and the proposed Haul Road is not expected to significantly disrupt the movement of the species. Burnett et al., (2014) indicates that the Carpentarian Antechinus has been encountered in at least two mine waste rock dumps indicating that the species is either using or moving through these disturbed area.

7.4.3.1 Proposed Mitigation Measures:
No mitigation measures proposed.

7.4.4 Noise and Vibration

Several activities will produce noise and vibration including:

- blasting
- light and heavy vehicles on the project site and accessing the project site
- hauling and dumping operations
- generators, and
- ore processing.

It would be expected that the Carpentarian Antechinus would express a temporary change in behaviour because of increased noise/vibration, despite no published studies to confirm this. The levels expected will be high compared to background and most noise and vibration will be generated by blasting and heavy vehicle operations. Blasting will be intermittent events that only last for a short period (<10 seconds), whereas hauling and dumping operations will be more persistent (24/7). However, hauling and dumping operations will be expected to create less noise and vibration than blasting despite operations occurring closer to suitable habitat. Much of the noise and vibration generated from the proposed project will not be located adjacent to suitable habitat, except for the south pit and the northern waste rock dump.

It is expected that noise and vibration will not cause a significant impact on the species as there has been extensive blasting and hauling operations conducted historically along the Starra ridgeline and the species is still present in this location. More recently similar mining operations (eg. Exco Resources, Mt Colin and MMG, Dugald River) have been conducted within proximity to other populations which are known to persist. It
is also expected that noise/vibrations generated during the initial clearing phase may cause individuals within proximity to the proposed project to relocate.

Generators will operate while the power line corridor to Osborne is under construction and as a backup after the power lines are operational. Noise from generators will occur throughout the night, but noise levels will be low and continuous and likely to be tolerated by the species. Previously generators have been used to power the Mt Dore camp, dewatering pumps at Mt Dore and the Starra 276 mine with the species recorded around these locations.

7.4.4.1 Proposed Mitigation Measures

No mitigation measures proposed.

7.4.5 Human Disturbance and Artificial Lighting

Because the Carpentarian Antechinus is a mostly nocturnal species which inhabits rocky outcrops, human disturbance to the species is likely negligible as there is expected to be no human activity near rocky outcrops outside of daylight hours. The only potential for human disturbance is by undertaking monitoring of the species, which, will occur during daylight hours when the species is expected to reside down deep rock crevices and are unlikely to respond to minor surface activity (such as that from human movement). Therefore, human activities during daylight hours are not expected to impact on the species.

Most operations for the proposed project will be restricted to areas which do not contain suitable habitat. Therefore, lighting sources in these areas will be of no consequence to the species. The only expected lighting sources that are in proximity to suitable habitat could include those associated with south pit and north waste rock dump. The effect of lighting on the behaviour and ecology of the Carpentarian Antechinus is unknown. However, given that the species is often active during daylight hours in the cooler months (Burnet et al. 2014), it is unlikely that artificial light will impact on the species.

It would be expected that the Carpentarian Antechinus would express a temporary change in behaviour because of increased lighting in near proximity to habitat, despite no published studies to confirm this. It is expected that lighting will not cause a significant impact on the species as there has been extensive mining operations conducted historically along the Starra ridgeline and the species is still persists in this location. More recently similar mining operations (eg. Exco Resources, Mt Colin and MMG, Dugald River) have been conducted within proximity to other populations which are known to persist.

7.4.5.1 Proposed Mitigation Measures

No mitigation measures proposed.
7.4.6 Proliferation of Feral Predators

Several exotic pest species are known to occur within and surrounding the Selwyn Range including feral pigs, dingo/wild dog, and feral cats. CRCM has had existing feral animal monitoring and control procedures for pest species during the operation of Starra 276 and the development of Merlin, which, included appropriate waste management practices and actively trapping feral cats. These measures, which are inherent to CRCM mining activity, will reduce the risk of feral animal proliferation in these locations and may confer a net benefit to small vertebrates inhabiting the area.

Feral Pigs

Feral Pigs are predominantly restricted to the waterways, plains and stock watering locations throughout the Selwyn Range they can cause considerable damage to vegetation and habitat while foraging and in these areas. However, the Selwyn Range has hard skeletal soils with abundant rock and these features inhibit pig foraging. As such, they are highly unlikely to occur with any frequency in suitable rocky habitat. Feral pigs are therefore unlikely to be a threat to the Carpentarian Antechinus and no additional control or monitoring of this species is required.

Dingo/Wild Dogs

Dingos/wild dogs have been recorded in a variety of habitats throughout the Selwyn Range. While dingos/wild dogs prey on a wide variety of native fauna, they are unlikely to prey on elusive species such as the Carpentarian Antechinus and may in fact benefit the species by limiting feral cat numbers through direct predation and competition (Johnson, et al., 2007; Wang & Fisher, 2011; Kennedy, et al., 2012). As such, dingos/wild dogs are unlikely to have a significant negative effect on Carpentarian Antechinus populations.

Feral Cats

Feral cats are a major predator of small native mammals and are a listed threatening process. High numbers of feral cats are likely to increase predatory pressure on small mammals of the Selwyn Range, including the Carpentarian Antechinus. The severity of this threat will vary, influenced by feral cat and alternative prey abundance (e.g., Common Rock-rats, small lizards, birds etc.) and associated environmental factors such as rainfall. Feral cats can also benefit from human activity, most notably through an increase in prey or food associated with inappropriate disposal of food waste. Mine sites also provide shelter and hiding areas and can lead to an increase in feral cat numbers.

7.4.6.1 Proposed Mitigation Measures

CRCM has existing waste management practices (dump cages) to ensure food waste is disposed of appropriately, and as such it is not anticipated that feral cat abundance will substantially increase because of the proposed project. CRCM will undertake
monitoring and control of feral cats to ensure any potential impacts are avoided or minimised in the vicinity of operations.

7.4.7 Introduction and Spread of Weeds

Declared weed species are not prolific in the dry skeletal soils associated with the Mount Isa/Cloncurry region, and the risk of declared weeds being accidentally introduced from mining related activities into Carpentarian Antechinus habitat is low. There are currently no known declared weed species, within the proposed project area.

Buffel Grass (*Cenchrus ciliaris*) is a non-native grass species which is considered an environmental weed and favoured by pastoralists. It has however, been demonstrated to negatively influence biodiversity and potentially lead to altered fire regimes (Smyth, et al., 2009; Marshall, et al., 2012). The impact of Buffel grass on arid ecosystem function is significant. Anecdotal evidence indicates that Buffel grass thrives along creek lines in dry environments (Miller, 2003) effectively promoting and spreading fire along what would previously have been considered a barrier to fire. Where it occurs, buffel grass is also filling in much of the usual bare-ground spacing between native grasses, shrubs and trees. This bare-ground spacing is a feature of most arid and semi-arid Australian ecosystems, in most years, and helps to stop most wildfires from becoming too extensive and from occurring too often. Buffel grass is significantly altering this ecosystem feature and enabling more catastrophic fires to occur.

Buffel Grass is currently present within the project mining leases where it is typically associated with creek lines and plains with a deeper soil profile and (probably) higher moisture content. It is generally not present within rocky habitats, and while there remains a minor risk that some plants may become established where soil disturbance occurs it is unlikely that buffel grass will become established within Carpentarian Antechinus habitat. Buffel Grass may however provide paths for wildfire to be introduced. Once established there is no single control method available for the successful management of Buffel Grass over extensive areas (Tu, 2002). The impacts of Buffel Grass on the Carpentarian Antechinus are therefore best managed by reducing the potential for Buffel Grass to provide paths for wildfire to areas of habitat.

Despite the low risk of impacts from weeds on suitable rocky habitats within the proposed project area, weeds are broadly recognised as a relevant threat to the environment and will be managed by an existing Weed Washdown Procedure.

7.4.7.1 Proposed Mitigation Measures

General weed introduction will be managed by the existing Weed Washdown Procedure. Buffel grass will not be used in the rehabilitation program and will be actively managed to ensure it does not provide paths for wildfire to areas of Carpentarian Antechinus habitat in the project disturbance area.
7.4.8 Land Contamination

The potential for land contamination to have localised impacts on Carpentarian Antechinus habitat is extremely low. The risk of contamination impacts is from the heap leach pad and associated process ponds, processing area, fuel and chemical storage areas. These areas are located on the flats well away from suitable rocky habitat. The risk of any substantive impacts from contamination is therefore considered extremely low and well mitigated.

Potentially acid forming waste rock is a relatively minor issue for this proposed operation and is managed by selective handling and disposal into existing open pits away from suitable rocky habitat, in accordance with a Waste Rock Management Plan.

7.4.8.1 Proposed Mitigation Measures

Managed by a Waste Rock Management Plan and Environmental Authority conditions required by the State Government approvals.

7.4.9 Changes to the Fire Regime

Inappropriate fire regimes are listed as a severe threat to the species (Woinarski, et al., 2014). There are currently no fire regimes for the proposed project area and bushfires are common throughout the summer with several occurring in the region since 2011. The 2013 study found the Carpentarian Antechinus at sites that had been burnt 6 months and approximately two years respectively, prior to the survey. These results provide some evidence that the species may tolerate infrequent fire regimes. The fuel load associated with the Carpentarian Antechinus habitat in the proposed project area is low which reduces the likelihood of severe fires. CRCM will develop a Bushfire Management Plan for the project. Key elements of the plan will include:

- actively managing increased fire risk to known habitat from dispersal of buffel grass in disturbance areas;
- use of fire breaks;
- identification and management of ignition sources;
- identification of fire risk areas; and
- bushfire management training.

7.4.9.1 Proposed Mitigation Measures

Implementation of the Bushfire Management Plan is considered adequate to manage this potential risk to the species.

7.5 Avoidance, Safeguards and Mitigation Measures

The Mt Dore Mine is a proposed mine which will incorporate the existing health, safety and environmental management system currently in use 48 kilometres south at the Osborne Project. The Mt Dore Heap Leach Copper Project will be conditioned to operate under a range of measures to manage potential environmental impacts. These measures address issues relating to weed, fire, feral animals, land
contamination, land clearing, rehabilitation and changes to ground and surface water. This section of the Plan considers the avoidance, safeguards and mitigation measures for the significant impacting activities identified within the context of these existing controls. Additional management measures are defined where they are considered necessary or prudent for the protection of the local Carpentarian Antechinus population.

7.5.1 Mortality from Land Clearing

- Land disturbance activities will be managed by the existing Permit to Disturb process with avoidable disturbance to mapped habitat not permitted.
- Land disturbance will be tracked in the existing Land Disturbance Register and mapped by satellite imagery in MapInfo.
- The area of habitat to be disturbed will be minimised by adjustment of the location of infrastructure such as haul-roads and waste rock dumps to avoid known mapped habitat.
- Land clearing activities that have not been conducted in accordance with the issued Permit to Disturb will trigger an incident report and internal investigation process.
- The area of mapped habitat to be disturbed will be intensively trapped with the effort based on results of the camera trapping prior to disturbance and all encountered species including Carpentarian Antechinus will be relocated to mapped high quality habitat, a minimum distance of 500 metres distant from the proposed disturbance.
- Trapping will be undertaken in the period May to July when the species is known to be most detectable.
- Camera trapping will be undertaken after individuals have been removed to determine the effectiveness of this management strategy.
- The trapped area will be cleared immediately following the trapping program to reduce the potential for recolonization.

7.5.2 Habitat Loss

- Habitat loss will be managed by the existing Permit to Disturb process with avoidable disturbance to mapped habitat not permitted.
- Land disturbance will be tracked in the existing Land Disturbance Register and mapped by satellite imagery in MapInfo.
- The area of habitat to be disturbed will be minimised by adjustment of the location of infrastructure such as haul-roads and waste rock dumps to avoid mapped habitat.
- Habitat loss will be recorded and reported.
- Land clearing activities that have not been conducted in accordance with the issued Permit to Disturb will trigger an incident report and internal investigation process.
• Waste rock dump rehabilitation will include creating rocky environments and associated micro-habitat with the aim of establishing suitable habitat favoured by the Carpentarian Antechinus. At the completion of rehabilitation efforts, it is expected that there will be a net gain in potential habitat of 6.6 ha.

• Cleared vegetation and soil will also be stockpiled for replacement during rehabilitation to provide initial habitat for invertebrate species.

• *Acacia shirleyi* (Lancewood) will be used in the seeding mix applied to the rehabilitated site.

• The existing Cloncurry Project Closure Plan includes revegetation criteria with the aim to:
  o establish a vegetation systems that contains species tolerant to drought and fire conditions;
  o has demonstrated resilience and recovery to drought and/or fire conditions;
  o has demonstrated secondary recruitment and progression towards the analogue condition;
  o has a foliage projective cover >50% of the analogue sites;
  o has a species diversity >50% of the analogue sites.

• Camera trapping of the new habitat will be undertaken to demonstrate usage by the Carpentarian Antechinus.

• It is considered that there will be no significant residual impacts to mapped habitat that will require a conservation offset.

**7.5.3 Proliferation of Feral Predators**

• Feral cats will be actively trapped and removed from the area during development and operational phases.

• The general waste disposal facility will be protected by an existing dump cage to prevent access by feral and native animals.

• Feral cat activity will be recorded and noted on camera traps.

• CRCM staff will be prevented from feeding feral or native animals.

**7.5.4 Changes to the Fire Regime**

• A Bushfire Management Plan will be developed primarily for asset protection in the project area. This plan will be applicable to the increased risk of fire to the Carpentarian Antechinus by:
  o Actively managing increased fire risk to known habitat from dispersal of buffel grass in disturbance areas;
  o Use of fire breaks;
  o Identification and management of excessive fuel loads by regular low intensity burns;
  o General fire risk identification; and
  o Emergency response training.
• Maintaining a map of fire affected areas in relation to Carpentarian Antechinus habitat.
• Camera trapping in bushfire affected Carpentarian Antechinus habitat to determine any impacts to resident populations.

7.6 Risk Assessment

Risks have been assessed according to the framework set out in the Department of Environment’s Environmental Management Plan Guidelines. Risks are categorised by qualitative measures of likelihood and the severity of their consequences. These qualitative measures are used to assign a risk rating to each risk before and after mitigation. Each environmental risk is given a rating in terms of likelihood and consequence using the criteria in the Table 7 and Table 8 below. These ratings are then combined using Table 9 to generate a risk rating of low, medium, high or severe. The risk rating generated using Table 9 will be used as a guide to the amount of time and resources that will be required to manage each risk. Risks with ‘medium’, ‘high’ and ‘severe’ risks will require mitigation measures (Table 10).

### Table 7: Qualitative measure of likelihood

<table>
<thead>
<tr>
<th>Qualitative measure of likelihood (how likely is it that this event/issue will occur after control strategies have been put in place)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly likely</td>
<td>Is expected to occur in most circumstances</td>
</tr>
<tr>
<td>Likely</td>
<td>Will probably occur during the life of the project</td>
</tr>
<tr>
<td>Possible</td>
<td>Might occur during the life of the project</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Could occur but considered unlikely or doubtful</td>
</tr>
<tr>
<td>Rare</td>
<td>May occur in exceptional circumstances</td>
</tr>
</tbody>
</table>

### Table 8: Qualitative measure of consequences

<table>
<thead>
<tr>
<th>Qualitative measure of consequences (what will be the consequence/result if this issue does occur rating)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>Minor incident of environmental damage that can be reversed</td>
</tr>
<tr>
<td>Moderate</td>
<td>Isolated but substantial instances of environmental damage that could be reversed with intensive efforts</td>
</tr>
<tr>
<td>High</td>
<td>Substantial instances of environmental damage that could be reversed with intensive efforts</td>
</tr>
<tr>
<td>Major</td>
<td>Major loss of environmental amenity and real danger of continuing</td>
</tr>
<tr>
<td>Critical</td>
<td>Severe widespread loss of environmental amenity and irrecoverable environmental damage</td>
</tr>
</tbody>
</table>
Table 9: Risk Rating Scores

<table>
<thead>
<tr>
<th></th>
<th>Minor</th>
<th>Moderate</th>
<th>High</th>
<th>Major</th>
<th>Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highly Likely</strong></td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Severe</td>
<td>Severe</td>
</tr>
<tr>
<td><strong>Likely</strong></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Severe</td>
</tr>
<tr>
<td><strong>Possible</strong></td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>Severe</td>
</tr>
<tr>
<td><strong>Unlikely</strong></td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td><strong>Rare</strong></td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>
Table 10: Risk Rankings and Mitigation Measures

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Description</th>
<th>Initial Risk</th>
<th>Proposed Control Measures</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>Direct loss of individuals through clearing of known habitat during construction</td>
<td>Moderate x Likely = Medium</td>
<td>Undertake a relocation program. Realign northern and southern waste rock dumps.</td>
<td>Minor x Possible = Low</td>
</tr>
<tr>
<td>Habitat Loss</td>
<td>Direct loss of habitat</td>
<td>Highly Likely x Moderate = High</td>
<td>Relocate northern and southern waste rock dumps. Control and report disturbance through a permit system. Create rocky environments and associated micro-habitat with the aim of establishing suitable habitat</td>
<td>Highly Likely x Minor = Medium</td>
</tr>
<tr>
<td>Habitat Connectivity</td>
<td>Loss of connecting habitat.</td>
<td>Minor x Unlikely = Low</td>
<td>No mitigation proposed.</td>
<td></td>
</tr>
<tr>
<td>Noise and Vibration</td>
<td>Noise and vibration from mining activity.</td>
<td>Minor x Unlikely = Low</td>
<td>No mitigation proposed.</td>
<td></td>
</tr>
<tr>
<td>Activity and Lighting</td>
<td>Lighting and activity from night operations.</td>
<td>Minor x Unlikely = Low</td>
<td>No mitigation proposed.</td>
<td></td>
</tr>
<tr>
<td>Feral Animals</td>
<td>Feral cat activity increasing as a results of the project activity.</td>
<td>Moderate x Likely = Medium</td>
<td>Dump cages to restrict feral animals. Active trapping program to remove feral cats.</td>
<td>Minor x Possible = Low</td>
</tr>
<tr>
<td>Weeds</td>
<td>Potential for weed incursions as a result of the project activity.</td>
<td>Minor x Unlikely = Low</td>
<td>CRCM has a Weed Washdown Procedure in place. Buffel grass will not be used in rehabilitation programs and will be actively managed to avoid creation of wildfire paths to Antechinus habitat.</td>
<td></td>
</tr>
<tr>
<td>Land Contamination</td>
<td>Potential for impact on habitat by ore processing, fuel and chemical storage.</td>
<td>Minor x Unlikely = Low</td>
<td>A Waste Rock Management Plan will manage potentially acid producing waste rock for disposal away from habitat areas.</td>
<td></td>
</tr>
<tr>
<td>Bushfires</td>
<td>Impacts from uncontrolled bushfires.</td>
<td>Moderate x Possible = Medium</td>
<td>Establish a Bushfire Management Plan</td>
<td>Minor x Unlikely = Low</td>
</tr>
</tbody>
</table>
7.7 Outcome Based Conditions

Identifying the outcome for the protected matter is the first step to determine how an action will affect the protected matter and the conditions that should apply to the approval in order to avoid and mitigate its impacts, including consistency with the objectives of a relevant Recovery Plan (Outcome-based conditions guidance, March 2016).

7.7.1 Proposed Outcomes and Performance Measures

The following outcomes and associated performance measures are proposed to manage the impact to the Carpentarian Antechinus in relation to the highlighted significant risks:

**Outcome 1:**
Direct impact to identified Carpentarian Antechinus habitat will be limited to less than 1.6% or 4ha of the available mapped habitat measured within the Cloncurry Project mining lease areas.

**Performance Measures:**
- Measured mapped Carpentarian Antechinus habitat within mining lease numbers 2454, 2566, 2688, 2689, 2690, 2691, 2692, 2693, 2694, 2732, 2733, 2734, 2736, 2737, 2738, 2745, 2746, 90043, 90061, 90215 & 90217.
- Measured disturbance to mapped Carpentarian Antechinus habitat within mining lease numbers 2454, 2566, 2688, 2689, 2690, 2691, 2692, 2693, 2694, 2732, 2733, 2734, 2736, 2737, 2738, 2745, 2746, 90043, 90061, 90215 & 90217.

**Purpose of Condition:**
- To ensure that the loss of identified Carpentarian Antechinus habitat will be effectively limited in relation to the proposed action.

**Outcome 2:**
Direct impact to individuals of Carpentarian Antechinus will be limited to the minimum extent practicable by active trapping and removal of individuals from areas to be disturbed.

**Performance Measures:**
- A minimum trapping effort of 1,000 Elliott Trap nights will be expected to capture ~10 individuals.
- Trapping effort will be guided by camera trapping results conducted immediately prior to disturbance.
- Camera trapping after removal will be used to identify any remaining individuals and to determine effectiveness of the removal campaign.
• Maintain records of the number of individuals trapped and removed.
• Records of capture (number) and release (location) to be maintained.

Purpose of Condition:
• To ensure all practicable efforts are made to effectively translocate affected individuals and to monitor their capture to improve the understanding of the effectiveness of current removal options.

Outcome 3:
Actively trap and remove feral cats from the project area during development and operational phases.

Performance Measures:
• Maintain records of traps numbers, locations and success.
• Maintain record of feral cats identified in camera trapping locations.

Purpose of Condition:
• To effectively reduce the pressures of predation by feral cats in the project area.

Outcome 4:
A Bushfire Management Plan will be established before project activities commence to limit the impact of uncontrolled end of dry season fires on Carpentarian Antechinus habitat in the project area.

Performance Measures:
• Bushfire Management Plan developed and in place before development activity commences.
• Maintain records of bushfires, any burnt areas and dates of the fires within the project area.
• Maintain records of any controlled burns, the areas burnt and date within the Cloncurry Project mining lease areas.
• Where fire interacts with Carpentarian Antechinus habitat carry out camera trapping surveys and record individual survivals.

Purpose of Condition:
• To effectively reduce the frequency and intensity of uncontrolled end of dry season fires which may cause stress to existing populations of the Carpentarian Antechinus and to identify impacts of fire on individuals in known habitat.
7.7.2 Surrogate Outcomes:

A surrogate outcomes-based condition is one that specifies an outcome (or a level of performance to be achieved) for something which directly supports the protected matter.

**Surrogate Outcome 1:**
Create rocky environments and associated micro-habitat with the aim of establishing suitable habitat for Carpentarian Antechinus on all waste dump slopes to encourage use of the area for foraging and shelter.

**Performance Measures:**
- A minimum of 20% or 10.6 ha of the waste rock dump surface area will be covered with clean rocky material with a nominal size range of 0.25-1.0 metres to a minimum 2 metres depth.
- Cleared vegetation and soil will also be stockpiled for replacement during rehabilitation to provide initial habitat for invertebrate species.
- *Acacia shirleyi* (Lancewood) will be used in the seeding mix applied to the rehabilitated site.
- The revegetation criteria will be to:
  - establish a vegetation systems that contains species tolerant to drought and fire conditions;
  - has demonstrated resilience and recovery to drought and/or fire conditions;
  - has demonstrated secondary recruitment and progression towards the analogue condition;
  - has a foliage projective cover >50% of the analogue sites;
  - has a species diversity >50% of the analogue sites.
- Camera trapping will identify Carpentarian Antechinus usage of the area.

**Purpose of Condition:**
- To effectively provide a net increase in potential habitat area for Carpentarian Antechinus as a beneficial outcome of the project.

**Surrogate Outcome 2:**
Support a defined project for two monthly monitoring for one year of Carpentarian Antechinus at known habitat locations in the Selwyn Ranges to gain an understanding of variations in detectability and life cycle (joint project with Sunshine Coast University and MMG).

**Performance Measures:**
- Records of two monthly monitoring.
- Report on the findings.
Purpose of Condition:

- To improve detection surveys and the level of knowledge of the Carpentarian Antechinus lifecycle to inform future management plans.

7.7.3 Adaptive Management

An adaptive management system is key to achieving recognised best practice for achieving continual improvement. This Plan and associated actions will be reviewed on an annual basis commencing July 2018 and updated accordingly to adjust for any identified issues.

7.7.4 Environmental Monitoring

Environmental monitoring activities relevant to this Plan include recording:

- Land clearing activities approved by the Permit to Disturb system within the Project mining leases.
- The quantity of mapped Carpentarian Antechinus habitat impacted by the proposed action within the Project mining leases.
- The relative trapping effort in Elliot trap hours to relocate affected individuals of Carpentarian Antechinus.
- The number of relocated individuals and the release locations of Carpentarian Antechinus.
- Relevant tracking information for relocated individuals of Carpentarian Antechinus.
- The effort (trap hours), trap locations and numbers of feral cats removed from the Project mining leases.
- Bushfire impacts on the project mining leases including area burnt, date of burn and any impact to Carpentarian Antechinus habitat.
- Camera trapping of Carpentarian Antechinus habitat affected by bushfire to determine survival.
- Rehabilitation of waste rock dumps including the area of habitat developed for Carpentarian Antechinus.
- Bimonthly monitoring of Carpentarian Antechinus for one year in the Selwyn Ranges (joint project with Sunshine Coast University and MMG).
- Incidents or non-compliance with conditions.

7.7.5 Record Keeping and Reporting

All records required to be kept by this Plan will be made publicly available on the Chinova Resources website www.chinovaresources.com

A report summarising the achievement of outcomes and monitoring of the performance measures will be produced annually commencing in July 2018,
with a review of this Plan. The report and Plan update will be also made publicly available on the Chinova Resources website.

7.7.6 Independent Audits of Outcomes

An independent audit of outcomes and monitoring of the performance measures will be conducted every two years from project commencement (July 2017) with the reports made publicly available on the Chinova Resources website (July 2019 & 2021).

7.8 Significance of Potential Impacts

Direct and indirect impacts associated with the proposed action that could potentially impact the Carpentarian Antechinus have been considered. Based on the analysis above, many these impacts pose a low risk and can be expected to have a negligible impact on the species. The mine will be subject to a range of controls and approval conditions which will likely be adequate in managing many of these potential impacts in addition to proposing suitable mitigation measures and outcome based conditions.

The key residual impact relevant to the species during the mine life will be the unavoidable loss of habitat due to the construction of the north and south pits. CRCM have committed to a total disturbance limit of 4 ha of Carpentarian Antechinus habitat. This area of habitat loss represents <2% of mapped habitat available within CRCM Cloncurry Project mining leases. Further areas of highly suitable habitat are known to occur in the local region with very extensive rock habitats becoming common place further to the east and north. One of the proposed mitigation measures is to recreate 10.6 ha of rocky habitat by the targeted rehabilitation of waste rock dumps resulting ultimately in a net gain in potential habitat of 6.6 ha. Thus, the loss of habitat because of the proposed action is not expected to reduce the overall availability of habitat to the extent that the species is likely to decline. Based on the limits to habitat loss and measures to manage indirect impacts, it is considered unlikely that significant impacts to the species will occur. Table 11 outlines the EPBC Act significant impact criteria and their relevance.

<table>
<thead>
<tr>
<th>EPBC Act Significant Impact Criteria</th>
<th>Project Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead to a long-term decrease in the size of an important population of a species.</td>
<td>Unlikely given the small amount of habitat loss and the remaining extensive habitat.</td>
</tr>
<tr>
<td>Reduce the area of occupancy of an important population.</td>
<td>No significant reduction in area of occupancy because of the project. Rehabilitation of waste rock dumps will effectively increase the area of potential habitat by 10.6 ha.</td>
</tr>
</tbody>
</table>
**Fragment an existing important population into two or more populations.**
Connectivity will be maintained within and around the project area.

**Adversely affect habitat critical to the survival of a species.**
The proposed action will impact on <2% of the mapped habitat available on the Cloncurry Project mining leases. Rehabilitation of waste rock dumps will result in a nett increase in the area of potential habitat of 6.6 ha.

**Disrupt the breeding cycle of an important population.**
No significant impact is expected to an important population and clearing works will be undertaken outside of the breeding season. Individuals will be removed from the affected area by Elliot trapping in the period May – August.

**Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.**
The amount of habitat to be removed is not expected to cause the species to decline. Rehabilitation of waste rock dumps will result in a nett increase in the area of potential habitat of 6.6 ha. The quality of the rehabilitated habitat is expected to improve over time.

**Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat.**
Unlikely as weed and pest management programs will be in effect. Buffel grass will be actively managed to reduce the potential for wildfire paths to Antechinus habitat close to disturbed areas.

**Introduce disease that may cause the species to decline.**
Not considered likely. There are no currently known disease threats to the Carpentarian Antechinus.

**Interfere substantially with the recovery of the species.**
Considered unlikely as major threats within the project area will be managed.

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### 8 OFFSETS

The term ‘environmental offsets’ refers to measures that compensate for the residual adverse impacts of an action on the environment. Offsets provide environmental benefits to counterbalance the impacts that remain after avoidance and mitigation measures. These remaining, unavoidable impacts are termed ‘residual impacts’. For
assessments under the EPBC Act, offsets are only required if residual impacts are significant. It is considered based on the assessments in section 7.8 that residual impacts to the Carpentarian Antechinus will not be significant and an environmental offset will not be relevant.

9 ALTERNATIVES TO THE PROPOSAL

There are no feasible alternatives to taking the proposed action. The type of activities and location of the proposed action are driven by the presence of a significant mineral resource. The only alternative would be a ‘do-nothing’ scenario which would have negative economic and employment outcomes.

There are however opportunities to manage disturbance areas for ancillary activities such as waste rock dumps, access and processing areas to limit the potential impact on the identified Carpentarian Antechinus habitat. Replacement of suitable habitat is also proposed and supported by records of Carpentarian Antechinus within previously disturbed mined areas (Burnett, et al., 2014). The actions of limiting impacts and developing suitable replacement habitat are inherent in this plan.

10 CUMULATIVE IMPACTS

The following discussions consider the impacts of the predominant regional land uses of grazing and mining as well as cumulative impacts on the Carpentarian Antechinus from historic mining activities specific to the Cloncurry Project mining leases.

10.1 History of Settlement Cloncurry District

Pastoral occupation of the Cloncurry district began in the 1860s, leading to violent clashes with the Kalkadoon Aboriginal population. It was mining, however, on which Cloncurry was founded. A remote inland settlement, the Cloncurry district was explored in 1866 by an unsuccessful pastoralist, Ernest Henry, chiefly with mineral exploration in mind. His first find proved to be silicated iron, but in May 1867 he found the 'Great Australian' copper ore body south of present day Cloncurry. He made further ore discoveries at Kajabbi, north-west of Cloncurry. Later that year gold was found south of Cloncurry. A semi-permanent mining community developed, and in 1876 the Cloncurry Township was surveyed.

10.2 Grazing Impacts

The region is characterised by its poor fertility and very low carrying capacity and in many ways has a lot in common with less fertile areas of the Cape York and Kimberley regions. There are a great variety of soil types in the region and as a result the quality of the grazing country is highly variable throughout. Good country tends to be used for fattening while poorer areas are utilized for breeding. On the whole though this region is considered fairly poor grazing country and stocking rates are therefore maintained at a low level. The climate is also highly variable ranging from extended
drought conditions which may last from 3-5 years with some exceptionally wet periods often resulting from the remnants of tropical cyclones moving inland from coastal regions.

Grazing pressure is a complex issue involving the introduction of non-native grazers and non-native pasture. In relation to the Carpentarian Antechinus, the direct impacts are considered relatively minor as cattle do not graze to any significant extent in the rocky ridgeline habitat areas known to be preferred by the species. The introduction of Buffel Grass (*Cenchrus ciliaris*) is favored by pastoralists and is now considered to be a significant impact on ecosystem function. This is largely due to the fact that where it occurs, buffel grass is filling in much of the usual bare-ground spacing between native grasses, shrubs and trees. The Carpentarian Antechinus persists in these areas and has shown a level of tolerance to fire incursions with the indirect impact of buffel grass on their rocky ridgeline habitat not likely to be significant.

The impacts of grazing on the Carpentarian Antechinus can be best summarised as widespread low levels of impact which is difficult to quantify.

### 10.3 Mining Impacts

When considering a general assessment of the potential for mining to impact on the Carpentarian Antechinus in the Mt Isa Region it is important to note that the total current mining lease area is measured at 46,730ha within a known Queensland extent of the Carpentarian Antechinus measured at 1,699,000ha (see Figure 12). Mining therefore currently represents a potential land use area of 2.8%. To put this further into perspective the vast majority of the mining leases currently have no current mining activity occurring on them and merely represent resources secured for potential future development. Within the mining leases where activity is currently occurring or proposed, only a minor proportion of the mining lease areas will generally be disturbed. The following are recent examples:

- MMG Dugald River mining lease area – 3,607ha with disturbance of 270.35ha (7.5%);
- Mt Colin mining lease area - 130ha with disturbance of 43ha (33%);
- Cloncurry Project mining lease area - 4,990ha with current and proposed disturbance - 594 ha (12%)

Based on the above assessment and assuming that Carpentarian Antechinus habitat is relatively evenly distributed throughout the landscape, mining leases have the potential to impact on approximately 2.8% of the currently known Carpentarian Antechinus habitat in the Mt Isa region, however the probable impact from mining activity is considered to be <1%.

It has been demonstrated that the Carpentarian Antechinus has occurred within disturbed mining habitat (Burnett, et al., 2014) and it is therefore reasonable to assume that recreation of suitable habitat through mine rehabilitation activities, has the potential to offset at least some of the potential habitat losses.
The impact of mining on the Carpentarian Antechinus can be summarised as localised high impact activity generally limited by the extent of economically recoverable mineralisation within the area of occurrence. It is also relevant to note that mining is a highly regulated activity requiring high levels of environmental management and rehabilitation that also has the potential to provide suitable habitat replacement.
Figure 12: Regional Mining Lease Areas
10.4 Cloncurry Project Impacts
The Cloncurry Project includes historical impacts such as the Mt Elliot Mine and Smelter Complex from the early 1900’s as well as impact from open cut and underground mining operations on the current mining leases dating back to 1987.

An assessment of the impacts of all historical and past mining activity has measured approximately 3ha of disturbance to mapped Carpentarian Antechinus habitat on all Cloncurry Project mining leases to date (refer Figure 11). The current proposed action (Mt Dore Heap Leach Copper Project) proposes to add an additional maximum of 4 ha of disturbance to mapped Carpentarian Antechinus habitat. The cumulative impact of all mining activities including the proposed action will amount to 7 ha or ~2.8% of the 251 ha of mapped Carpentarian Antechinus habitat within the Cloncurry Project mining leases.

11 DOCUMENT REVIEW
Sections 7 – 7.7.2 have been reviewed by Dr Scott Burnett Lecturer in Animal Ecology, School of Science and Engineering, University of the Sunshine Coast as a relevant species expert to ensure the proposed mitigation measures proposed are appropriate for the project and best practice based on the current level of available information.

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12 COMPANY COMMITMENT AND ENVIRONMENTAL RECORD
Chinova Resources is committed to minimising the impact of its activities on the environment and will work proactively with the regulators and other stakeholders to achieve this outcome. Measures proposed to achieve this goal include:

• Application of high standards of health, safety and environment management in all company activities;
• Line management accepts responsibility for providing adequate resources and effective training to enable people to work to recognised standards of compliance for safety and environmental management;
• A work culture and systems that encourage incident reporting and investigation that identifies root causes for incidents, including systemic failures and provides for remedial actions; and
• Regular communications within the organisation on health, safety and environmental issues and the effectiveness of their management.
Chinova Resources currently receives the maximum 30% financial assurance discounts for both the Osborne and Cloncurry Projects with the Queensland Department of Environment and Heritage Protection. This represents a recognition that the company has had no relevant compliance actions in addition to having carried out proactive management of high risk mine wastes and significant rehabilitation works.

The company maintains a core expertise in environmental management with two project based environmental staff and contracts specialist skills as required to meet and exceed their statutory responsibilities.

Chinova Resources has Project Closure Plans in place and has expended in excess of $13M in the past two years rehabilitating inherited legacy mining related disturbances.

Chinova Resources maintains strong and open communication with the local community, indigenous groups and other stakeholders.

13 ENVIRONMENTAL MANAGEMENT ROLES AND RESPONSIBILITIES

13.1 Site Manager

The Site Senior Executive maintains the overall responsibility for the management of health, safety and environmental risks on site including the proposed avoidance, safeguards and mitigation measures proposed in this plan.

13.2 Environment Superintendent

The Environment Superintendent is responsible for the maintenance of this plan and monitoring compliance with this plan.

13.3 Site Personnel

All site personnel will be required to adhere to this plan and the associated procedures and standard work instructions.

14 TRAINING

All personnel seeking to access or to conduct work on an active mine site are required to complete the site induction. The induction outlines the roles and responsibilities of individuals in the management of environmental risk associated with site activities including the protection of the Carpentarian Antechinus. The site induction further includes procedures for incident notification and consequences for non-compliance with site procedures.

Records of all training conducted are maintained and include:

- the person receiving the training;
- the date the training was received; and
- the name of the person conducting the training.
Secondary methods for communication of general awareness of environmental matters are via pre-start meetings and site bulletins.

15 EMERGENCY PROCEDURES

CRCM has an established Crisis and Emergency Management Procedure designed to respond to and recover from significant events of consequence that threaten people, environment, assets, or reputation. The plan contains emergency related processes, organisation structures, duty cards, support tools, and resources that will support an effective site-wide response to significant events of consequence.

16 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Australia's National Strategy for Ecologically Sustainable Development (1992) defines ecologically sustainable development as: ‘using, conserving and enhancing the community’s resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased’.

Part 2 of the strategy sets several sectoral objectives for the mining industry as follows:

- Objective 5.1 - to ensure mine-sites are rehabilitated to sound environmental and safety standards, and to a level at least consistent with the condition of surrounding land;
- Objective 5.2 - to provide appropriate community returns for using mineral resources and achieve better environmental protection and management in the mining sector; and
- Objective 5.3 - to improve community consultation and information, improve performance in occupational health and safety and achieve social equity objectives.

Chinova Resources performance relevant to the above objectives includes:

- The Cloncurry and Osborne Projects have detailed Closure Plans established to identify and manage both future mining projects and legacy sites which have been inherited.
- In 2015 rehabilitation activities included expenditure of $1.8M.
- In 2016 rehabilitation activities included expenditure of $11M.
- The rehabilitation of waste rock dumps for the Mt Dore Project is intended specifically to recreate rocky habitat suitable for both the Carpentarian Antechinus and the Purple Necked Rock Wallaby (Petrogale purpureicollis).
- The project is required to identify and lodge a suitable financial assurance with the Queensland Department of Environment and Heritage Protection to ensure rehabilitation activities are fully costed.
• The proposed project will generate a net income of $120.9M from the production of copper cathode with $199.15M expected to be injected into the North Queensland regional economy by way of wages, goods and services.

• The proposed project will generate employment for approximately 150 workers during construction, reverting to 100 for the proposed 5 year period of operations.

• Local and indigenous employment will be favoured. Chinova is proposing to team with the same technical partner who has assisted at the Osborne open pit. At the peak, 28% of the operational workforce has been sourced from local indigenous groups. Chinova and its technical partner intend to run this project along similar lines.

• Chinova currently has a high level of consultation with annual Locals’ Day meetings for surrounding landholders on Melbourne Cup Day and 6-monthly meetings with the Yulluna People as the determined Native Title holder.

• It should be noted that the Yulluna People strongly supported the proposed Mt Dore Project at a meeting held on 22nd November 2016 and in particular the continuing employment, training and development opportunities for indigenous people.

• Chinova Resources currently operates the Osborne Project 48 kilometres south of the proposed Mt Dore Project. The Osborne Project includes a Health and Safety Management System that has applied progressive improvements to health and safety performance. The 2016 targets for injuries and incidents is 75% of the 2015 calendar year actuals. These targets are currently being comfortably achieved with only 1 lost time injury, 2 medical treatment injuries and 25 first aid injuries recorded up to the 30th November.

The proposed project has undertaken a high level of ecological investigation and has taken steps to minimise impacts to matters of national and state environmental significance. Where disturbance to significant habitat is to be undertaken it has been initially proposed to limit the disturbance and environmental offsets have been identified where impacts cannot be avoided.

17 ECONOMIC AND SOCIAL MATTERS

The cost/benefit analysis has been prepared by Chinova with assistance from its technical partner. A financial model has been developed from first principles to replicate the expected financial impacts of the technical performance of the project and the influence of the external factors such as the international copper price and exchange rate. As a risk mitigation, the project has an initial short life of 5 years to ensure repayment of capital and meet environmental requirements, resulting in a fully funded centrally located heap leach SXEW operation for future development of copper oxide deposits in the region. The economic performance on this basis, expressed in Australian dollars, is as follows:

Revenue from copper sales = $378.2m
Less: Cash costs = $235.95m  
Less: Queensland Government Royalties = $11.35m  
Less: Rehabilitation Costs = $10m  
= EBITDA = $120.9m

These figures are derived using a copper price of US$2.16/lb (AUD$3.08/lb) and an exchange rate of AUD$1.00 = US$0.70.

Note: As of 30th January the copper price was US$2.68 with an exchange rate of AUD$1.00 = US$0.76 or AUD$3.53/lb.

Breaking these figures down to identify the benefits:
- Royalties payable to the Queensland Government = $11.35m
- Payroll paid into North Queensland = $45.98m
- Payments to local suppliers = $153.17m

The modelling indicates the project is expected to employ 158 people during construction. Once operations commence it is estimated this number will reduce to 104. Chinova and its technical partner currently operate a similar sized operation at the Osborne mine. In this case 100% of the operations workforce are sourced from North Queensland. At the peak 28% of the operations workforce was from indigenous groups. Chinova intends to maintain a similar or better level of Indigenous employment for its workforce with this new project.

18 GLOSSARY

**agglomerator** – process to form crushed ore into a rounded mass

**BOM** – Bureau of Meteorology

**CSC** – Cloncurry Shire Council

**DEE** – Federal Department of Environment and Energy

**DEHP** – Queensland Department of Environment and Heritage Protection

**DNRM** – Queensland Department of Natural Resources and Mines

**DSD** – Queensland Department of State Development

**EA** – environmental authority

**EBITDA** – earning before tax, depreciation and amortization
EIS – environmental impact statement

electrowinning (EW) - the recovery of metals from solutions by electrolysis.

heap leach - Heap leaching is an industrial mining process to extract precious metals, copper, uranium, and other compounds from ore via a series of chemical reactions that absorb specific minerals and then re-separates them after their division from other earth materials.

heterozygosity - having dissimilar pairs of genes for any hereditary characteristic

ILS - intermediate leach solution

microchiropteran bat - microbat

NAF – non-acid forming

PAF – potentially acid forming

philopatry - remaining in, or returning to, an individual's birthplace

phylogeographic - the study of the historical processes that may be responsible for the contemporary geographic distributions of individuals

PLC – programmable logic control

PLS – pregnant leach solution

raffinate – barren liquor

RO – reverse osmosis

ROM – run of mine

solvent extraction (SX) - A technique, also called liquid extraction, for separating the components of a liquid solution. This technique depends upon the selective dissolving of one or more constituents of the solution into a suitable immiscible liquid solvent.

SXEW – solvent extraction and electrowinning
REFERENCES


20 APPENDIX A

- Decision on referral (EPBC 2016/7773)
- Decision notice
- Additional Information required for preliminary documentation (and checklist)
- EPBC Additional Information Request
21 APPENDIX B

- Place Baseline Ecological Assessment 2010
- Place Post Wet Season Assessment 2011
- Place Taphozous Management Plan 2011
- Place Mt Dore Ecological Assessment 2012
- Burnett et al *Pseudantechinus mimulus* Report 2014
- RBC Environmental *Pseudantechinus mimulus* Report 2016