Section 2
Description of the Proposal

PREAMBLE

This section describes the proposed Ardlethan Rehabilitation and Tailings Retreatment and Rehabilitation Project including:

- the objectives of the Proposal;
- an overview of the Proposal and the approvals required;
- the infrastructure that would be established;
- the site preparation that would be undertaken;
- the proposed tailings extraction, reprocessing and placement operations;
- ancillary activities that would be undertaken; and
- the proposed rehabilitation of the areas that would be disturbed throughout the life of the Proposal.

The Proposal is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of the activities proposed, how the various activities would be undertaken and to enable an assessment of the potential impacts on the surrounding environment. The boundaries and dimensions of the various components described throughout this section are indicative only.

Details of the safeguards and management measures that the Applicant proposes to implement to minimise or negate the potential impacts on components of the surrounding environment are provided in Section 4 of this document.
2.1 INTRODUCTION

2.1.1 Objectives of the Proposal

The objectives of the Proposal would be as follows:

- To extract and reprocess tin tailings to produce a tin concentrate suitable for sale to international tin processing facilities.
- To rehabilitate and remEDIATE disturbed sections of the Mine Site and to enable areas of contaminated lands to be considerably reduced and returned to native vegetation.
- To operate the Proposal in a manner that would minimise surface disturbance and impacts on surrounding residents and the local environment.
- To implement appropriate design, operational control and mitigation measures that ensures compliance with appropriate environmental criteria and reasonable community expectations.
- To develop and operate the Proposal in compliance with all relevant statutory requirements.
- To create a final landform that is suitable for a post-mining land use of nature conservation and water storage.
- To continue to develop trust within the local community through a transparent and accountable approach to all activities and through maintaining an open and honest relationship.
- To achieve the above objectives in a cost-effective manner to ensure security of employment and the continued economic viability of the Applicant.

2.1.2 Overview of the Proposal

The Applicant proposes to seek development consent for the following (Figure 2.1).

- Extraction of approximately 10 million tonnes (Mt) of tailings from the Main and Spring Valley Tailings Storage Facilities.
- Transportation of approximately 9.5Mt of pre-flotation tailings to the run-of-mine (ROM) Pad.
- Transportation of approximately 0.5Mt of post-flotation tailings to the White Crystal Open Cut which has previously been used for placement of post-flotation tailings.
- Reprocessing of the extracted tailings using a gravity separation reprocessing plant to produce a tin concentrate suitable for sale to international customers.
- Transportation of the tin concentrate from the Mine Site to port via road.
- Placement of the reprocessed tailings into the Ardwest/Wild Cherry Open Cut.
2.1.3 Approvals Required

The Proposal would require development consent from Coolamon Shire Council under Part 4 of the Environmental Planning and Assessment Act 1979. In addition, the following licences, leases, permits, agreements and approvals would be required to allow commencement of the Proposal.


2. Water Supply Works and Use Approval and Water Access Licence issued by the DPI – Water under the Water Management Act 2000 for:
   - groundwater extracted from the Ardwest/Wild Cherry Open Cut; and
   - for makeup water sourced to be sourced from the licenced surface water sources.

3. A Section 138 Permit issued by the Coolamon Shire Council under the Roads Act 1993, for upgrades to Tin Mines Road and the intersection of that road with Bygoo Road.

The Applicant holds mineral authorities for the majority of the Mine Site (see Section 1.4.1 and Figure 1.3). These authorities include:

- 23 Mining Leases (ML);
- 4 Mining Purpose leases (MPL);
- 16 Private Lands Leases (PLL);
- 5 Private Lands (Mining Purpose) Leases (PL(MP)L); and
- 1 Special (Crown and Private Lands) Lease.

It is noted that a number of these authorities are for “Mining Purposes”. While such leases typically do not permit mining of ore, the Department of Industry – Division of Resources and Energy has advised the Applicant that extraction and processing of previously stockpiled material does not constitute “mining” under the Mining Act 1992. The Instruments of Agreement for each of the Mining Purposes Leases specifically allow the activities which are the subject of this Application.

Furthermore, the Applicant notes that those sections of the Mine Site that are not the subject of a mineral authority are held under EL8260 by Riverston Tin Pty Ltd. The Applicant would ensure that no mining related activities are undertaken on that land without the consent of the holder of EL8260. As a result, no further mineral authorities are required for the Proposal. However, it is noted that an updated Mining Operations Plan will be required for the Proposal prior to the commencement of activities under this application.
2.2 SITE ESTABLISHMENT AND CONSTRUCTION

2.2.1 Introduction

As identified in Section 1.4.4, the Applicant holds approval under the Mining Act 1992 for extraction of a bulk sample of 20 000t to be processed on site using a pilot plant. That pilot plant would form the initial module of the proposed processing plant. As a result, a substantial portion of the proposed site establishment activities have been or would be completed under that approval. However, in the interests of preparing a comprehensive application for development consent, the following subsections provide a description of the site establishment activities that would be undertaken as part of the Proposal.

Site establishment would comprise the following activities.

- Site mark out and preparation.
- Construction of the Site Access Road.
- Installation of site infrastructure.

2.2.2 Site Mark Out and Preparation

The Applicant would initially mark out the areas of proposed disturbance using pegs. This would include:

- the initial extraction areas;
- haul roads;
- ROM Pad and stockpile areas;
- processing plant area.

Following site mark out, the Applicant would prepare all work areas, including:

- ensuring safe and efficient access for light and heavy vehicles;
- removal of unwanted infrastructure where necessary to establish the required infrastructure for the Proposal; and
- minor earthworks to level working areas and establish safety bunds.

2.2.3 Preparation of the Site Access Road

Concurrently with the site mark out and preparation activities, the Applicant would prepare the Site Access Road. The original Site Access Road that served the Mine Site was removed during alluvial tin mining operations. Access to the Mine Site is currently obtained via a track on the Main Waste Rock Emplacement. That access road is not convenient nor safe for ongoing access the Mine Site once it is operational.
As a result, the Applicant proposes to re-establish the Site Access Road from the western end of Tin Mines Road to the processing plant area via the eastern side of the Ardwest/Wild Cherry Open Cut (Figure 2.1). The Site Access Road would be an all-weather, unsealed two lane road suitable for use by light and heavy vehicles. A small section of the road would, however, be constructed as a single lane. The Applicant would implement a one-way traffic management procedure in that section of the road where in-bound traffic would be required to give way to out-bound traffic.

Road side drainage would be constructed in accordance with the requirements of Managing Urban Stormwater – Soils and Construction – Volume 2C Unsealed Roads published by the Department of Environment and Climate Change in 2008 (DECC, 2008).

The Site Access Road would be sheeted with suitable material to minimise dust generation as a result of vehicle movements and would be watered using a water truck as required.

A lockable agricultural-type gate would be erected at the site entrance to control access to the Mine Site and would be locked when the site is not occupied.

2.2.4 Installation of Site Infrastructure

Once the Site Access Road has been constructed, the Applicant would install the following site infrastructure.

- Surface water controls, including dirty water diversion structures in the vicinity of the ROM Pad and the proposed processing plant to divert all potentially sediment-laden surface water to the Processing Plant Detention Pond (Figures 2.1 and 2.6).
- Site office, crib room and ablutions as described in Section 2.9.1.
- Water and reprocessed tailings pipelines to permit transfer of water from the Mill Reclaim Dam, Ardwest/Wild Cherry Open Cut and the Spring Valley Fresh Water Dam.

2.3 EXTRACTION OPERATIONS

2.3.1 Introduction

Development consent is sought for the extraction of tailings from the Main and the Spring Valley Tailings Storage Facilities. The history of placement of tailings into these facilities and the estimated grade tonnage of material contained within the facilities is described in Sections 1.4.2 and 1.4.3. The following subsections describe the proposed extraction areas, sequence and methods, the proposed haul routes and the anticipated mining equipment that would be used during extraction campaigns. Extraction operations within the Borrow Pit are described in Section 2.13.5.4.
2.3.2 Tailings Extraction Areas

Figure 2.2 presents the proposed tailings extraction areas. In summary, tailings extraction would be undertaken within the Main and Spring Valley Tailings Storage Facilities. The Main Tailings Storage Facility comprises four separate storage facilities, namely the Horseshoe Dam, Lower Dam, No. 1 Dam and Sulphide Dam.

With the exception of small volumes of tailings discharged to the Sulphide Dam from the former Mill during maintenance operations, the Main Tailings Storage Facility ceased to receive tailings with the construction of the Spring Valley Tailings Storage Facility in 1977. The Spring Valley Tailings Storage Facility was active from that date until 1983, with the uppermost tailings deposited in the facility produced following the introduction of flotation processing in 1981.

Following the closure of the Spring Valley Tailings Storage Facility in 1983, tailings were deposited into the White Crystal Open Cut until closure of the mine in 1986. Tailings from the White Crystal Open Cut are not proposed to be extracted under this Proposal.

Each of the tailings storage facilities include an embankment wall, typically constructed of waste rock sourced either directly from open cut mining operations or extracted from the Main Waste Rock Emplacement. In addition, the upper surface of the facilities have, in places, been sheeted with waste rock, sourced either from the Main Waste Rock Emplacement or from the former quarry area. The former quarry area was used to extract non-mineralised cover material for the Tailings Storage Facility.

2.3.3 Tailings Extraction Sequence

Figures 2.3 to 2.5 present the indicative staging sequence for the Proposal. In summary, tailings extraction would proceed as follows.

- Stage 1 – tailings would be extracted from the western section of the No. 1 Dam and transported to the ROM Pad via the existing haul road to the north of the Main Tailings Storage Facility.

- Stage 2 – tailings would be extracted from the eastern section of the No. 1 Dam and transported to the ROM Pad via the above haul road.

- Stage 3 – tailings would be extracted from the Lower Dam, Sulphide Dam and Horseshoe Dam and transported to the ROM Pad. It is noted that some tailings within these storages have substantially higher grades than other storages. As a result, the Applicant may undertake extraction within these areas concurrently with earlier or later stages to ensure appropriate blending of feed stock for the processing plant.

Post-flotation tailings would also be pre-stripped from the upper sections of the Spring Valley Tailings Storage Facility during Stage 3 and transported to the White Crystal Open Cut via the existing haul road to the south of the Main Tailings Storage Facility and to the east of the former processing plant and via the Site Access Road.
Section 2 – Description of the Proposal

Ardlethan Tin Mine

Figure 2.2
Tailings Extraction Areas and Borrow Pit

Figure 2.14
Proposed Borrow Pit

Note: All plans are subject to change and are for illustration purposes only.

Scale: 1:17,500

R.W. CORKERY & CO. PTY. LIMITED

EOE (NO.75) PTY LIMITED
Ardlethan Tin Mine
Report No. 754/08
Figure 2.3
PROPOSED STAGING
SEQUENCE - STAGES 1 AND 2
Figure 2.4
PROPOSED STAGING SEQUENCE - STAGES 3 AND 4
Figure 2.5
PROPOSED STAGING SEQUENCE - STAGES 5 AND 6

REFERENCE
- Mine Site Boundary
- Domain Boundary
- Haul Road
- Site Access Road (unpaved)
- Internal Road

Activity
- Tailings (Pre-flotation) Extraction
- Tailings (Post-flotation) Extraction
- Tailings Processing
- Reprocessed Tailings Deposition
- Direct Tailings Deposition
- Growth Medium Extraction
- Removal of Mine and Demolition Waste
- Removal / Treatment of Contaminated Material and Growth Medium / Ecosystem Establishment
- Cover Establishment
- Rehabilitation Monitoring / Maintenance
- No Activity
• Stage 4 – tailings would be extracted from the Spring Valley Tailings Storage Facility and transported to the ROM Pad via the existing haul road to the south of the Main Tailings Storage Facility and to the east of the former processing plant.

The Applicant anticipates that there would be some overlap between each of the extraction stages.

2.3.4 Tailings Extraction Method

Tailings would be extracted using conventional free dig techniques using an excavator and off-road haul trucks. In summary, extraction would typically proceed as follows.

• Capping material placed on the upper surface of the tailings to limit dust lift-off would, where present, be removed initially. This material would be placed within the cover and embankment material storage area (Figure 2.1).

• The excavator would then establish a working face up to approximately 4m high. The excavator would top load one or more haul trucks which would transport the extracted tailings to the ROM Pad (see Section 2.3.5).

• Where the tailings thickness is more than 4m thick, multiple extraction faces would be established, with ramps constructed from one bench to the next to permit movement of vehicles between benches. Each working face would be temporarily bunded for safe vehicle operation.

• Following extraction of the full thickness of the tailings, the underlying clay material would be stabilised using a polymer-based product to prevent dust lift off. Inactive sections of the intermediate benches would be similarly treated and movement of vehicles in treated areas would be restricted.

The Applicant notes that each of the tailings extraction areas includes embankments and internal structures constructed from waste rock and other materials. This material would be extracted and managed in a manner similar to the capping material, namely it would be placed within cover and embankment material storage area. Based on the length, height and width of each of the tailings embankments, the Applicant estimates that approximately 230 000 loose cubic metres (lcm) of capping and embankment material would be placed within the cover and embankment material storage area for subsequent reuse to cap the reprocessed tailings placed within the Ardwest/Wild Cherry Open Cut. The Applicant would, during extraction Stage 3, also transfer non-contaminated material from the embankment of the Spring Valley Tailings Storage Facility to the White Crystal Open Cut to cover post-flotation tailings placed within that Open Cut. Management of the transported cover and embankment material and eventual reuse of during rehabilitation operations is described in Section 2.13.5.2.

2.3.5 Tailings Transportation

Extracted tailings would be transported to the ROM Pad via proposed haul road around the perimeter of the Main Tailings Storage Facility (Figure 2.2 to 2.5). The proposed haul road would be constructed progressively as tailings extraction progresses and would be an all-
weather unsealed road suitable for two haul trucks to pass. Road-side drainage would be constructed in accordance with the requirements of *Managing Urban Stormwater – Soils and Construction – Volume 2C Unsealed Roads* (DECC, 2008). Internal haul roads within the footprint of the tailings storage facility would be constructed as required and would be demarcated using posts or similar to ensure that vehicle movements are limited to defined areas.

All trafficked areas, including the haul road and working areas, would be watered as required using a water truck to limit the potential for dust lift off. Alternatively, less commonly used areas may be treated with a polymer-based binding agent.

### 2.3.6 Mining Equipment

Table 2.1 presents the indicative list of equipment that would operate during tailings extraction operations. It is noted that the listed equipment is indicative only and that different equipment may be used depending on production rates and ground conditions.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Capacity/Size</th>
<th>Number</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
<td>25t to 60t</td>
<td>1 to 2</td>
<td>Tailings extraction</td>
</tr>
<tr>
<td>Bulldozer / Grader</td>
<td>D8 / 120M</td>
<td>1</td>
<td>Pushing of tailings, maintenance of extraction areas and haul roads, excavator support. Intermittent use only.</td>
</tr>
<tr>
<td>Haul truck</td>
<td>20t to 40t</td>
<td>1 to 2</td>
<td>Transportation tailings from the extraction area to the ROM Pad or the White Crystal Open Cut</td>
</tr>
<tr>
<td>Front-end Loader</td>
<td>10t to 15t</td>
<td>1 to 2</td>
<td>Excavator support, stockpile management, feeding of the processing plant.</td>
</tr>
<tr>
<td>Water Cart</td>
<td>15t</td>
<td>1</td>
<td>Dust suppression throughout disturbed sections of the Mine Site.</td>
</tr>
</tbody>
</table>

*Source: EOE (No.75) Pty Limited*

### 2.4 PROCESSING OPERATIONS

#### 2.4.1 Introduction

Extracted tailings would be processed within the on-site Processing Plant which has been designed by Mineral Technologies to be modular, semi-transportable and capable of being progressively scaled up through the addition of further modules. In summary, the Processing Plant would comprise the following modules. Each module would be transportable in sections by low loader for on-site assembly.

- Dump hopper module.
- Scrubber Module.
- Desliming / screening module.
- Grinding module.
- Spiral module.
- Shaker table module.
Figure 2.6 presents the conceptual layout of the Processing Plant Area, Figure 2.7 presents a conceptual process flow diagram for the Processing Plant and Figure 2.8 presents an isometric view of the desliming / screening, spiral and shaker table modules.

The following subsections describe the design and operation of the ROM Pad each module.

### 2.4.2 ROM Pad

The ROM Pad would be constructed in an elevated area to the west of the Processing Plant. Extracted tailings material would be transported to the ROM Pad and stockpiled separately according to the material characteristics. The material stockpiled within the ROM Pad would be managed using a front-end loader which would selectively blend material from the various stockpiles to ensure consistent feed for the Processing Plant.

The ROM Pad would include a safety bund to prevent access to the adjacent steep face, as well as clean water diversions to divert water around the ROM Pad and the Processing Plant Area (Figure 2.6).

A water cart would be used to manage dust lift off within the ROM Pad area. Where stockpiles would not be used for an extended period, they would be stabilised using a polymer-based product or covered with tarpaulins.

### 2.4.3 Dump Hopper Module

The Applicant would establish a dump hopper loading area on the eastern margin of the ROM Pad using precast concrete panels, used haul truck or loader tyres or sea containers filled with waste rock (Figure 2.6). This would provide a near vertical wall for the dump hopper to be abutted against.

The dump hopper would comprise a hopper with a grizzly. The grizzly would remove oversize material, including capping or embankment material that may have become entrained in the tailings. The hopper would have a belt feeder at the base to transfer tailings to the scrubber module.

Stockpiled tailings material would be blended using a front-end loader and placed directly into the hopper.

### 2.4.4 Scrubber Module

The scrubber module (Figure 2.6) would consist of a slurrying chute, fitted with water sprays for wetting the tailings material and a rotating drum scrubber fitted with a trommel section to screen and remove material larger than 2mm. Oversize material from the trommel would be stockpiled and, with oversize material from the grizzly, would be placed within the cover and embankment material storage area (Figure 2.1)
Figure 2.6 Indicative Processing Plant Layout

INDICATIVE PROCESSING PLANT LAYOUT

REFERENCE
- Red: Mine Site Boundary
- Blue: Existing Track
- Purple: Existing Power Pole
- Green: Watercourse/Drainage Line
- Orange: Existing Building (to be removed)
- Purple: Desliming/Screening Module
- Purple: Grinding Module
- Green: Table Circuit
- Pink: Spiral Module
- Blue: Diversion Drain

SCALE 1:2 000 (A4)

20 0 20 40 60 80 100 m

To Main Tailing Storage Facility

Existing Processing Plant Detention Pond

ROM Pad

Safety Bund

Scrubber

Dump Hopper

Oversize Stockpile

Dump Hopper

Loading Area

Processing Plant

Office, Laboratory, Amenities, Storage & Dispatch Area

Y:Jobs 531 to 1000/754_E_D_SilReports75409_EIS - 201610S712W7198Z05.dwg 2.6 Indicative Processing Plant Layout-13.12.2016-1:55 PM

Figure 2.6 Indicative Processing Plant Layout-13.12.2016-1:55 PM
Section 2 – Description of the Proposal

Figure 2.7
PROCESS FLOW DIAGRAM

Source: Mineral Technologies (2016) - After Figure 2.1

Figure 2.8
PROCESSING PLANT - ISOMETRIC VIEW

Source: Mineral Technologies Pty Ltd
2.4.5 Desliming / Screening Module

The desliming / screening module (Figures 2.6, 2.7 and 2.8) would comprise a series of desliming cyclones that would separate tailings material greater than 500µm from material smaller than that size. The undersize material would be pumped directly to the spiral module, while the oversize material would be pumped to the grinding module.

2.4.6 Grinding Module

The grinding module would comprise a small rod or ball mill. Material passed to the grinding module would be reduced in size and passed back to the desliming / screening module for further size classification.

2.4.7 Spiral Module

The spiral module (Figures 2.6, 2.7 and 2.8) would consist of a 3-stage spiral circuit comprising rougher, scavenger and cleaner spirals, as well as a base module that would include the pumps and pipework required for the spirals. The spirals would progressively separate the denser tin-bearing Cassiterite (SnO\(_2\)) from the less dense gangue (non-economic minerals). No processing chemicals would be used in this process which would rely on gravity alone to concentrate the Cassiterite.

The concentrate would be passed to the shaker table module, with the gangue or reprocessed tailings passed to the Ardwest/Wild Cherry Open Cut.

2.4.8 Shaker Table Module

The shaker table module (Figures 2.6, 2.7 and 2.8) would comprise two stages of wet shaking tables. These tables operate by oscillating the material over a sloped, textured surface. Less dense material tends to move towards the long edge of the table, with the denser, Cassiterite-bearing fraction moving towards the short edge of the table. The less dense fraction would either be pumped with the reprocessed tailings to the Ardwest/Wild Cherry Open Cut or recirculated to the spiral module. The denser fraction would be placed into containers for transportation off site to the Applicants customers. The Applicant anticipates that concentrate would have tin grades of 40% to 50%, suitable for sale to a range of international customers.

2.4.9 Proposed Rate and Maximum Volume of Tailings to be Processed

The Applicant proposes to gradually increase the rate at which the tailings is processed from 30t per hour (tph) or 250 000t per annum (tpa) to 180tph or 1.5Mtpa. The dump hopper, scrubber and grinding modules would be designed to cater for the maximum proposed processing rate. However, the remaining modules would indicatively each process up to 30tph. As a result, the Applicant proposes a four stage ramp up of production as follows.

- Phase 1 – One module or 30tph or 250 000tpa.
- Phase 2 – Two modules or 60tph or 500 000tpa.
- Phase 3 – Four modules or 120tph or 1Mtpa.
- Phase 4 – Six modules or 180tph or 1.5Mtpa.
No timeframe has been set for the proposed ramp up in production. Rather installation of new modules would be initiated when market conditions are conducive.

Finally, the Applicant anticipates that approximately 9.5Mt of tailings would be reprocessed, namely all pre-1981 tailings. In the event that the Applicant is able to reprocess the post-1981 tailings, a subsequent application for a modified or new development consent would be prepared.

2.4.10 Management of Chemicals

Lime may potentially be used to raise the pH of process water to be sourced from the Ardwest/Wild Cherry Open Cut and the Mill Reclaim Dam. The Applicant anticipates that no other chemicals would be required for processing operations.

Hydrocarbons would be stored on site for use in mobile plant and for power generation (see Section 2.9.2.3). All hydrocarbons, including diesel and oils, would be stored within covered and bunded areas or within self bunded tanks. A concrete-sealed refuelling area with an oil-water separator would be constructed and all mobile plant, with the exception of excavators and bulldozers, would be refuelled within the refuelling area.

2.5 REPROCESSED TAILINGS MANAGEMENT

2.5.1 Introduction

Reprocessed tailings would be placed within the Ardwest/Wild Cherry Open Cut (Figure 2.9). In addition, tailings produced after the commencement of flotation operations within the Mine Site in 1981 and placed into the upper sections of the Spring Valley Tailings Storage Facility would be directly transferred to the White Crystal Open Cut and placed with the previously placed post-flotation tailings (Figure 2.9). Management of these tailings are described in Section 2.6.

The following subsections describe the characteristics of the reprocessed and post flotation tailings and the capacity of the Ardwest/Wild Cherry Open Cut and White Crystal Open Cut. A description of the hydrological setting of the Ardwest/Wild Cherry Open Cut is presented in Section 4.2.

2.5.2 Tailings Characteristics

Mineral Technologies Pty Ltd prepared a report entitled Metallurgical Report for Characterisation and Flowsheet Processing Test Work of 500kg Sample from TD51 in February 2016. That report described the characterisation test work undertaken on a stockpile referred to as TD51. Stockpile TD51 forms part of the No. 1 Dam at a location considered by Aberfoyle geologists to be representative of the tailings stored within the Mine Site and it has been this stockpile that has been the subject of all subsequent test work and analysis.
Section 2 – Description of the Proposal

Figure 2.9: Tailings Placement Areas

Ardlethan Tin Mine
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The Applicant notes that the test work relates to the tailings feedstock for the processing plant, not the reprocessed tailings that would be placed within the Ardwest/Wild Cherry Open Cut. However, as the concentrate to be produced would comprise only 0.25% of the processed tailings and the majority of that would be Cassiterite, the Applicant contends that the test work undertaken is representative of the reprocessed tailings that would be deposited into the Ardwest/Wild Cherry Open Cut.

Table 2.2 presents the particle size distribution and analysis for the tailings material. In summary, the tailings may be classified as a silty sand, with a high proportion (20.4%) of the sample being very fine grained (<20µm in size). The tin-bearing Cassiterite primarily occurs in the fine grained portion of the sample.

<table>
<thead>
<tr>
<th>Size Fraction (µm)</th>
<th>Mass Percentage</th>
<th>Analysis Results (%)</th>
<th>SnO₂</th>
<th>Fe₂O₃</th>
<th>SiO₂</th>
<th>Al₂O₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;150</td>
<td>28.1</td>
<td>0.07</td>
<td>4.43</td>
<td>80.5</td>
<td>9.74</td>
<td></td>
</tr>
<tr>
<td>63-150</td>
<td>29.1</td>
<td>0.10</td>
<td>5.09</td>
<td>77.5</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>20-63</td>
<td>22.4</td>
<td>0.36</td>
<td>6.95</td>
<td>72.0</td>
<td>12.8</td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>0.8</td>
<td>1.94</td>
<td>9.58</td>
<td>58.7</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>7-11</td>
<td>2.7</td>
<td>0.08</td>
<td>9.33</td>
<td>68.6</td>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td>5-11</td>
<td>2.2</td>
<td>0.34</td>
<td>11.80</td>
<td>62.5</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>&lt;5</td>
<td>14.7</td>
<td>0.29</td>
<td>13.50</td>
<td>47.2</td>
<td>23.8</td>
<td></td>
</tr>
<tr>
<td>Weighted Average</td>
<td></td>
<td>0.19</td>
<td>6.86</td>
<td>71.9</td>
<td>13.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: Mineral Technologies (2016) – after Table 1

In addition to the work undertaken by Mineral Technologies, the tailings are acid forming with a low pH leachate currently reporting to the Mill Reclaim Dam and leaking from the base of the Spring Valley TSF. Indeed, one of the principal objectives of the Proposal is to relocate the acid generating tailings to the Ardwest/Wild Cherry Open Cut where they can be more appropriately managed.

2.5.3 Volume and Capacity of the Ardwest/Wild Cherry Open Cut

The Applicant, in estimating the volume of the Ardwest/Wild Cherry Open Cut, notes that survey information of the final open cut is not available and that the current water level within the open cut was approximately 198m AHD or approximately 74m above the deepest section of the open cut. In addition, an unknown volume of tailings from the alluvial tin mining operations undertaken between 2000 and 2003 by Telminex NL were placed into the open cut. As a result, a definitive estimate of the available volume of the open cut cannot be made. However, for the purposes of estimating the volume available for the placement of tailings, the Applicant has utilised a range of methods, including past mining and survey records and photogrammetry for the section of the open cut above the water level to determine a maximum and minimum volume of the Ardwest/Wild Cherry Open Cut below the low point of the crest of the open cut at approximately 260m AHD. Table 2.3 presents the results of that analysis.
It is noted that the open cut comprises two open cuts, with the Ardwest Open cut located to the southwest and the Wild Cherry Open Cut located to the northeast. These open cuts merge to form a single, larger open cut, with the bridge between the open cuts at approximately 205m AHD.

### Table 2.3

**Ardwest/Wild Cherry Open Cut Volume Estimate**

<table>
<thead>
<tr>
<th>Bench elevation (m AHD)</th>
<th>Maximum Volume (m³)</th>
<th>Minimum Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ardwest Open Cut</td>
<td>Wild Cherry Open Cut</td>
</tr>
<tr>
<td>124-130</td>
<td>57 750</td>
<td>-</td>
</tr>
<tr>
<td>130-145</td>
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<td>310 500</td>
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<td>472 500</td>
<td>384 750</td>
</tr>
<tr>
<td>205-220</td>
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<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>250-260</td>
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<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7 876 000</strong></td>
<td></td>
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</table>

Source: EOE (No.75) Pty Limited

In summary, the estimated volume of the open cuts below 260m AHD is estimated to be between 6.5Mm³ and 7.9Mm³.

The Applicant proposes to reprocess approximately 9.5Mt of tailings. Based on an assumed average density of 1.5t/m³, the Proposal would produce approximately 5.9Mm³ of reprocessed tailings. However, the Applicant notes that estimates of final tailings density are difficult to accurately determine, particularly in relation to the subaqueous emplacement procedures proposed and the thickness of the tailings pile that would accumulate. As a result, **Table 2.4** presents the anticipated volume of tailings that would accumulate based on a range of average densities. In summary, the Ardwest/Wild Cherry Open Cut has sufficient capacity to store all reprocessed tailings at a density of 1.5t/m³ based on the minimum volume estimate presented in **Table 2.3**. Based on the maximum volume estimate, the open cut would have adequate capacity should the average tailings density be as low as 1.3t/m³.

### Table 2.4

**Anticipated Volume of Reprocessed Tailings**

<table>
<thead>
<tr>
<th>Assumed Reprocessed Tailings Tonnage (Mt)</th>
<th>Assumed Average Density (t/m³)</th>
<th>Estimated volume (Mm³)</th>
<th>Adequate capacity</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td></td>
<td>1.2</td>
<td>7.9</td>
<td>No</td>
</tr>
</tbody>
</table>

In summary, the estimated volume of the open cuts below 260m AHD is estimated to be between 6.5Mm³ and 7.9Mm³.
In light of the uncertainties in relation to the volume of the open cut and the density of the reprocessed tailings, the Applicant would ensure that a minimum freeboard of 10m is maintained between the level of the tailings and the open cut invert. Figure 2.10 presents the design of the maximum tailings filling level with the open cut. This commitment would ensure that all tailings are adequately contained within the open cut.

2.5.4 Deposition of Reprocessed Tailings

Reprocessed would be transported to the Ardwest/Wild Cherry Open Cut via a bunded pipeline. As the elevation of the Ardwest/Wild Cherry Open Cut is substantially lower than the elevation of the processing plant, the Applicant anticipates that the pipeline would operate at low pressure, resulting in limited potential for breaks or leaks in the line.

Reprocessed tailings would be placed initially below the surface of the water currently within the open cut. The tailings would be delivered via a pipeline on the western wall of the open cut, with the outlet of the pipeline below the surface of the water. This would permit optimal distribution of the tailings within the Ardwest Open Cut.

Once the reprocessed tailings have accumulated to the level of the invert between Ardwest and Wild Cherry Open Cuts, tailings discharge would move to the northern side of the open cut, with reprocessed tailings once again placed below the water level.

When the tailings surface rises above the water level within the open cut the Applicant would implement a system where the tailings discharge pipe would be installed around the western and northern crests of the open cut, with spigots or discharge valves at regular intervals. These spigots would be connected to pipes that would pass reprocessed tailings down the wall of the open cut and deposit the material close to the surface of the tailings beach. This would ensure that tailings are not deposited on the wall of the open cut, limiting the potential for ongoing wind-generated dust emissions. The discharge locations would be varied to ensure that the decant location remained at the ramp, permitting safe and convenient access to a decant pump on the ramp.

2.5.5 Decant and Water Return

The Ardwest/Wild Cherry Open Cut, together with the Processing Plant Detention Pond, would form the principal sources of water for reprocessing during the initial stages of the life of the Proposal. As indicated in Section 2.5.3 the Applicant estimates the open cut and associated underground workings contain between 2.7GL and 2.9GL of water.

The Applicant would establish a pump on the existing access ramp and would use the recovered water for processing-related purposes. The decant water pipeline would run up the haul ramp and within the bunded trench for the tailings line. The pipelines would be inspected daily and, in the event of a leak or break in the line, the pump would be immediately shutdown.

Water from the Ardwest/Wild Cherry Open Cut would be pumped to the Processing Plant Detention Pond. Management of water within that Pond is described in Section 2.7.2.3.
REFERENCE

- Mine Site Boundary
- Proposed Cover and Embankment Material Storage Area
- Existing Contour (m AHD) (interval=5m)
- Design Contour (m AHD)
- Stackpool Open Cut Surface Water Channel

SCALE 1:6 000 (A4)

Figure 2.10
TAILINGS PLACEMENT AREAS - INDICATIVE FILL LEVELS

Base Photo Source: Google Earth (11 July 2015)
2.6 TRANSPORTED TAILINGS MANAGEMENT

2.6.1 Introduction

As indicated in Section 2.3.3, post-1981 tailings within the Spring Valley Tailings Storage Facility would be extracted and transported directly to the White Crystal Open Cut (Figure 2.9). The White Crystal Open Cut has previously been used for storage of post-1981 tailings, with approximately 0.76Mt of tailings currently stored within the Open Cut. Approximately 0.48Mt of additional tailings would be transferred from the Spring Valley Tailings Storage Facility to the White Crystal Open Cut.

The following subsections describe the transportation and placement of the post-1981 tailings.

2.6.2 Transportation

The post-1981 tailings would be extracted during Stage 3 extraction operations (see Section 2.3.3). These materials would be loaded into off road haul trucks or road-registerable trucks and transported directly to the White Crystal Open Cut via the internal haul road network and the Site Access Road.

In the event that the Applicant elects to use off-road haul trucks, it would ensure:

- that the Site Access Road is adequate to convey the class of vehicles proposed to be used; and
- that controls are implemented to ensure that non-Mine vehicles are not permitted to access the Site Access Road unaccompanied during transportation operations.

2.6.3 Placement

Transported tailings would be paddocked dumped within the White Crystal Open Cut. A bulldozer would be used to level the transported tailings, permitting the next layer of tailings to be placed.

Based on an estimated 0.46Mt of tailings to be transported and an average density of 1.7t/m³, approximately 270 000m³ of tailing would be placed within the open cut. Figure 2.10 presents the anticipated constructed landform within the White Crystal Open Cut. In summary, the White Crystal Open Cut is currently internally draining. However, the adjacent White Crystal Waste Rock Emplacement drains via a channel to the Stackpool Open Cut and from there, via an inclined drill hole, to the underground workings. This system is a passive system and does not require day-to-day management by site personnel. The proposed placement of post-flotation tailings into the White Crystal Open Cut would result in the open cut becoming free draining. The Applicant would ensure that surface water flows from the placed tailings are directed to the existing passive Stackpool Open Cut surface water channel, thereby ensuring that potentially contaminated surface water is contained within the existing contaminated water circuit.

Once placement operations have been completed, the Applicant would cover the tailings with non-mineralised cover material sourced from the embankment of the Spring Valley Tailings Storage Facility as described in Section 2.13.5.3.
2.7 SITE WATER MANAGEMENT

2.7.1 Introduction

The nature of the historic disturbance on the Mine Site has required disturbed and sediment laden runoff to be captured and stored to prevent discharge and subsequent impacts to downstream (receiving) surface water systems. Figure 2.11 displays the general arrangement of the Mine Site catchments, water management infrastructure and site water storages and the following subsections describe the site water storages, requirements and water balance. The information presented in this subsection has been drawn from a Surface Water Impact Assessment prepared by R.W. Corkery & Co. Pty Limited. That report is presented as Appendix 4 and is referred to hereafter as RWC (2016).

2.7.2 Site Water Storages and Catchments

2.7.2.1 Spring Valley Freshwater Dam

The Spring Valley Freshwater Dam is an engineered structure, constructed by Aberfoyle to capture runoff from the Spring Valley catchment as well as act as balance storage for externally supplied process water. This structure is situated at the downstream end of the Spring Valley Catchment and intercepts all overland flow from Spring Valley Tailings Storage Facility and surrounding undisturbed areas. The Applicant is not aware of this structure ever discharging.

2.7.2.2 Mill Reclaim Dam

The Mill Reclaim Dam is an engineered, lined structure constructed by Aberfoyle. This storage is situated at the downstream extent of the Mill Reclaim catchment and intercepts all overland flow from the Main Tailings Storage Facility. Water quality within this storage is poor, with low pH leachate from the Main Tailings Storage Facility resulting in a pH of between 2.5 and 2.8. Historically, this structure was hydraulically connected to the Ardwest/Wild Cherry Open Cut via an open drain and surge dam. However, a 0.3m diameter pipe was installed by the Derelict Mines Unit during rehabilitation operations for the alluvial mining operations. That pipe discharges directly to the Ardwest/Wild Cherry Open Cut.

2.7.2.3 Processing Plant Detention Pond

Runoff generated from the Processing Plant catchment would drain via overland flow into the Processing Plant Detention Pond. This pond would also be utilised as part of the process water \\ decant water return circuit and would be actively managed as such with a pump and pipeline. In addition, an open channel would be cut from the base of the embankment, below the spillway of this storage, to the Ardwest/Wild Cherry Open Cut to return any spillway discharge and avoid uncontrolled discharge to downstream systems.

The Processing Plant Detention Pond would also be used to treat the process water, with lime to be added as required to raise the pH to a level suitable for the processing plant. The amount of lime required would vary based on the volume and pH of the make up water. Any precipitates that accumulate during treatment would be managed as contaminated material and would be placed into the Ardwest/Wild Cherry Open Cut with the reprocessed tailings.
Section 2 – Description of the Proposal

Ardlethan Tin Mine
Report No. 754/08

Figure 2.11
MINE SITE CATCHMENTS

REFERENCE
- Mine Site Boundary
- Existing Track
- Site Access Road
- Perimeter Drain
- Watercourse/Drainage Line
- Catchment Boundary
- Mine Water Storage
- Drainage Direction / Overland Flow
- Mill Reclaim Dam Pipeline (indicative only)

SCALE 1:20 000 (A4)
2.7.2.4 Ardwest/Wild Cherry Open Cut

Runoff generated within the contributing catchment internally drains via overland flow to the open cut void and interconnected underground workings. However in the northeastern section of the catchment, a perimeter drain was previously constructed to direct runoff from an adjacent waste rock emplacement into the excavated mining void (Ardwest/Wild Cherry Open Cut). The Mill Reclaim Dam and Stackpool Open Cut (under certain conditions) also discharge into void/workings.

2.7.2.5 White Crystal Open Cut

Runoff generated within the contributing catchment internally drains via overland flow to this void that has been partially filled with tailings. An earthen bund, approximately 5m in height has been placed across the haul road into the open cut to prevent surface water flows from the Site Access Road entering the open cut.

2.7.2.6 Stackpool Open Cut

Runoff generated within this catchment internally drains to an open channel perimeter drain which discharges into the Stackpool Open Cut excavated mining void. The Stackpool Open Cut is hydraulically connected to the Ardwest/Wild Cherry Open Cut via existing exploration drill holes located in the walls of the Stackpool Open Cut at an elevation of approximately 251m AHD.

2.7.2.7 Eastern Evaporation Pond Catchment

Runoff generated within this catchment drains to the Eastern Evaporation Pond via overland flow. The Applicant is not aware of this catchment discharging to natural drainage.

2.7.2.8 Northern Evaporation Pond Catchment

Runoff generated within this catchment from a former quarry area used to provide non-mineralised cover material, as well as the northern face of the Main Waste Rock Emplacement drains to the Northern Evaporation Ponds via overland flow. The Applicant is not aware of this catchment discharging to natural drainage.

2.7.3 Site Water Requirements and Distribution

2.7.3.1 Introduction

Operational water would be required for processing and dust suppression. This subsection describes the sources of the operational water required for the Proposal, as well as the site water distribution system employed to capture, collect and transfer water around the Mine Site during operations. Figure 2.12 presents a schematic of the system.
Transfer of water around the Mine Site would be facilitated by a pump and pipe system that would involve the following. Numbered references relate to those identified in Figure 2.12.

1. Transfer of reprocessed tailings to the Ardwest/Wild Cherry Open Cut via pump and pipe.
2. Return transfer of decant water from the Ardwest/Wild Cherry Open Cut via pump and pipe to the process water detention pond.
3. Supply of process water to the processing plant from the process water detention pond via pump and pipe.
4. Transfer of water from the Spring Valley Freshwater Dam via pump and pipe to the Mill Reclaim Dam (for direct discharge to the Ardwest/Wild Cherry Open Cut).
5. Transfer of water from the external sources to meet process water demand should climatic conditions require.

2.7.3.2 Processing Operations

The volume of water required to meet processing demand is 4,000L per tonne of reprocessed tailings (4m³/t). Process water demand would therefore vary dependent upon the production, with water demand expected to vary between 1GL and 6GL per year. It is conservatively...
estimated that, due to the sub-aqueous deposition of tailings, recovery of approximately 60% of the process water would be achieved for reuse in the processing circuit. As a result, demand for makeup water would be between 0.4GL and 2.4GL per year. Section 2.7.4 presents the water balance for the Proposal.

Priority for the supply of process water would be given to the volumes of water held in site storages as a consequence of the capture of Mine Site runoff to prevent off-site discharge. Should these volumes be insufficient due to climatic factors or rates of production, additional make up water would be sourced from an external licenced supply. Previously, the Mine relied on an existing pipeline from Grong Grong. The Applicant would recommence use of that pipeline and would obtain the required licenced water allocation under the Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012.

### 2.7.3.3 Dust Suppression

The volume of water required to meet dust suppression requirements would vary based upon the rate of production, area disturbed and rainfall. Priority for the supply of dust suppression water would be given to water within the least contaminated site storages, primarily the Spring Valley Fresh Water Dam.

### 2.7.4 Water Balance

#### 2.7.4.1 Introduction

A water balance model was developed for the Proposal to establish the capacity of Mine Site water management infrastructure to meet the water demands across a range of production scenarios representing reprocessing rates of 30tph, 60tph, 120tph and 180tph (see Appendix 4). The key inputs and outputs of the site water balance are presented in Figure 2.12 with a description of each key element and how each is represented in the model is discussed below.

#### 2.7.4.2 Inputs

**Rainfall**

Rainfall data for the Mine Site was sourced from the Scientific Information for Land Owners (SILO) database, managed by the Queensland Department of Science, Information Technology and Innovation (DSITI). The program uses historic Bureau of Meteorology datasets and interpolation techniques to generate continuous daily time step synthetic rainfall and other climate data for any given location in Australia. The SILO dataset for the period 1 January 1889 to 9 October 2016 was generated for the Mine Site (Latitude -34.35, Longitude 146.85) on 10 October 2016.

The data was then processed using Cunnane’s plotting position formula (Cunnane, 1979) and Log Pearson Type 3 (LPIII) interpolation (AR&R 1987 and 2016) to establish rainfall events with a range of Annual Exceedance Probability (AEP) values to enable the selection of representative rainfall years in the daily time step model.
External Supply

Arbitrary base volumes were set for the two primary site water storages (Ardwest/Wild Cherry Open Cut and Spring Valley Freshwater Dam) in the model. Once the model reached these base volumes, external supply was triggered in order to identify the volumes of water required to supplement site water in meeting process water demand.

2.7.4.3 Throughputs

As noted in Section 2.7.3.2 the recovery of process water from the sub aqueous deposition of reprocessed tailings was estimated to be approximately 60% of the total volume required for reprocessing.

2.7.4.4 Outputs

Evaporation

Morton’s shallow lake evaporation is a calculated climate variable provided with the SILO dataset on a daily time step that reflects evaporation rates from shallow water bodies such as dams and water storages. This variable was extracted from the SILO dataset for the identified representative rainfall years and used in the daily time step water balance modelling.

Dust Suppression

The volumes of site water used to manage dust generated as a consequence of the Project were calculated based on the traffic volume (dependent upon production), evaporation rates and desired efficiency.

Process Water Demand

The volume of water required to meet processing demand was fixed at 4 000L per tonne of reprocessed tailings (4m^3/t) in accordance with guidance from the reprocessing plant manufacturer. Process water demand in the model therefore varies dependent upon the production scenario modelled.

2.7.4.5 Assumptions

The modelling was based on the following assumptions.

- During years of below average rainfall (>50% AEP) the following assumptions were made.
  - No discharge to the Ardwest/Wild Cherry Open Cut occurs from the Stackpool Open Cut; and
  - The coefficient of runoff from disturbed catchments is 0.2. This coefficient was compared to the coefficient (0.126) calculated using the regression equations presented in Boughton and Chiew (2006) for natural catchments in the Murray Darling Basin and is considered reasonable for highly disturbed catchments essentially devoid of vegetation.
• The coefficient of runoff for the naturally vegetated areas of the Spring Valley
  Catchment of 0.126 was that established using the regression equations presented

• During years of above average rainfall (<50% AEP) the following assumptions
  were made.
  – Discharge to the Ardwest/Wild Cherry Open Cut occurs from the Stackpool
    Open Cut.
  – The coefficient of runoff from disturbed catchments is 0.3. This is considered
    reasonable for a saturated catchment and was estimated using changes in pit
    lake levels and rainfall over the period 5 July 2016 to 10 November 2016.

2.7.4.6 Modelled Scenarios

Two model run series for the full range of AEP and production scenarios were completed as
follows

• Scenario 1 – was commenced with initial storage volumes of 1 630 600m$^3$
  (1.6GL) in Ardwest/Wild Cherry, representing the observed pit water level after
  three years of below average rainfall and 83 000m$^3$ in Spring Valley Freshwater
  Dam, which is representative of the 50% AEP modelled catchment inflows from
  rainfall. The Applicant anticipates that between 1.8GL and 2.0GL of water is
  currently available within the Ardwest/Wild Cherry Open Cut. This scenario is
  considered to be a conservative representation of a start-up scenario, when
  operations would commence with water storages close to the current observed
  water levels.

• Scenario 2 – was commenced with initial storage volumes of 199 000m$^3$
  in Ardwest/Wild Cherry Open Cut, and 83 000m$^3$ in Spring Valley Freshwater Dam,
  which are representative of the 50% AEP modelled catchment inflows from
  rainfall, assuming that both storages have been emptied. This represents a worst-
  case water balance scenario where previous processing operations have resulted in
  drawdown of the water levels within each of the water storages.

2.7.4.7 Results

Table 2.5 presents the results of the water balance model for a range of AEP and production
scenarios. In summary, the results of the water balance modelling indicate the following.

Scenario 1

Site water demand is met by rainfall and existing water stored on site at all production levels up
to 120tph under all rainfall scenarios, with the exception of a nominal 6ML of makeup water
that would be required at 120tpa under a 1 in 100 dry (99% AEP) year. At a maximum
production rate of 180tph, makeup water would be required under all rainfall scenarios, varying
between 380ML under a 1 in 100 wet (1% AEP) year and 830ML under a 1 in 100 dry (99%
AEP) year.
Table 2.5
Water Balance Modelling Results

<table>
<thead>
<tr>
<th>AEP (%)</th>
<th>Representative year</th>
<th>Annual Rainfall (mm/yr)</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
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</thead>
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<td></td>
<td></td>
<td></td>
<td>Demand (ML/yr)</td>
<td>Deficit (ML/yr)</td>
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<td><strong>Production rate = 180tph / 1.5Mtpa</strong></td>
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<td>185</td>
<td>2 626</td>
<td>830</td>
</tr>
</tbody>
</table>
Scenario 2

At a production level of 30tph, site water demand is met by rainfall up to a 1 in 40 dry (80% AEP) year, with makeup water demand up to 129ML under a 1 in 100 dry (99% AEP) year.

Under all other production rates, makeup water would be required under all rainfall scenarios, varying between:

- 96ML at a production rate of 60tph under a 1 in 100 wet (1% AEP) year; to
- 2.2GL at a production rate of 180tph under a 1 in 100 dry (99% AEP) year.

Discussion and Commitment

Whilst the water balance model indicates that a supplementary water supply of up to approximately 2.2GL would need to be obtained from external sources, this is considered to be a worst case scenario. Scenario 1 is considered to be a more realistic representation of site conditions as the initial volume has been derived from observations of the pit water level over three consecutive years of below average rainfall. Therefore it is anticipated that supplementary supply would be required in average rainfall years (50% AEP) once production levels reached 180tph (1.5Mtpa).

Supplementary supply would be secured through purchase of appropriate entitlements under the Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012, with that water to be transferred to the Mine Site via the existing Grong Grong Pipeline. The Applicant would ensure that the required entitlements are obtained prior to increasing the proposed production rate above 120tpa or 1Mtpa. In the event that makeup water is required at production rates below this level, the Applicant would either source the required entitlement or would reduce production rates to that required to ensure that all water requirements can be met by existing, onsite supplies.

2.8 TRANSPORTATION

2.8.1 Introduction

This section describes the proposed transportation both within and surrounding the Mine Site. An assessment of traffic and transportation-related impacts has been undertaken by Barnson Pty Ltd. That report is summarised in Section 4.6, is presented as Part 4 of the Specialist Consultant Studies Compendium and is hereafter referred to as Barnsons (2016).

2.8.2 Transportation Routes

Figure 2.13 presents the road network surrounding the Project Site. In summary, vehicles travelling to and from the Project Site would do so via:

- Tin Mines and Bygoo Roads and Ariah and Mirrool Streets (Local Roads);
- Burley Griffin Way (Regional Road); and
- the Newell Highway (State Road).
Section 2 – Description of the Proposal

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Figure 2.13

HEAVY VEHICLE TRANSPORTATION ROUTE

SCALE 1:50 000 (44)

Source: OS Topographic Map

 rio

Short Term

Long Term

DETAIL SCALE: 1:250 000 (2)
The Applicant has been advised that Coolamon Shire Council proposes to construct a realignment of Bygoo Road to permit direct access to Mirrool Street (Figure 2.13).

The vast majority of heavy vehicles accessing the Mine Site would do so from Burley Griffin Way, with only very occasional, local heavy vehicle traffic accessing the Mine Site from the north via Bygoo Road.

Light vehicles would principally transport personnel to and from the Mine Site and would also principally access the Mine Site from the south from the village of Ardlethan or Burley Griffin Way. However, some personnel may access the Mine Site from the north via Bygoo Road depending on their place of residence.

### 2.8.3 Traffic Types

Traffic types associated with the Proposal would include the following.

- Light vehicles – including passenger vehicles and light trucks.
- Heavy vehicles – including rigid trucks, and semi-trailers and B-doubles delivering consumables and supplies.
- Oversize and overweight vehicles – delivering components of the Processing Plant and mobile fleet. The Applicant would ensure that all oversize and overweight vehicles would have the appropriate permits and approvals and would be appropriately escorted, when required.

### 2.8.4 Traffic Levels

The Applicant anticipated that the maximum traffic levels accessing the Mine Site during operations would be as follows.

- Light vehicles – 56 movements or 28 return trips per day.
- Heavy vehicles – 4 vehicle movements or 2 return trips per day.

However, during construction or addition of further processing streams or decommission and rehabilitation of the Mine Site, the Applicant anticipates that between 12 to 20 heavy vehicle loads (24 to 30 movements) may be required over a period of up to three months. These would be additional to the proposed operational traffic movements.

### 2.9 FACILITIES AND SERVICES

#### 2.9.1 Facilities

The following facilities would be installed within the Mine Site to support the proposed tailings extraction and reprocessing operations. The Applicant does not propose to utilise the former facilities within the Mine Site as these have largely been vandalised and destroyed.

- A transportable office, crib / training room and ablutions building.
- A small workshop comprising a Colorbond shed, store room and oil store. The workshop would be likely to utilise an existing concrete pad.
- An unsealed carpark for employee and visitors vehicles.
- A hardstand area for parking of mobile plant.

2.9.2 Services

2.9.2.1 Electricity Supply

The power was previously supplied to the Mine Site via a high voltage power line from a substation near the intersection of Tin Mines Road and Bygoo Road. That line has been vandalised and the power line has been removed.

The Applicant notes that the processing plant will require approximately 300kW at 30tph and 1 440kW at 180tph. This includes electricity requirements for:

- the office and crib / training room;
- lighting;
- communication system.

As a result, the Applicant does not propose to re-establish mains power to the Mine Site. Rather, power would be obtained from one or more silenced generators. In the event that it became cost effective to re-establish mains power, the Applicant notes that those works would be exempt development under Clauses 20 and 43 of the State Environmental Planning Policy (Infrastructure) 2007.

2.9.2.2 Communications

External communications for site data and phone service would be provided via wireless connection. If required, equipment to improve signal quality would be installed.

Within the Mine Site, communications would be via UHF radio.

2.9.2.3 Hydrocarbons

All diesel fuel for the mobile equipment would be stored in above ground, self-bunded tanks. Bunding, if required, would be sized to meet the containment requirements identified in AS 1940:2004 – Safe storage & handling of flammable & combustible liquids.

A sealed refuelling area would be located adjacent to the diesel store, with all drainage directed to oil/water separators. More mobile plant (haul trucks, graders, front-end loaders) would utilise the refuelling areas while less mobile plant (excavators, bulldozers and generators) would be refuelled at their work site using a mobile fuel tanker.

Bulk oils, greases and waste oils would also be stored within a covered and bunded area.
2.9.2.4 Potable and Ablutions Water

Potable water would be transported to site in 20L containers or similar.

Water for ablutions would be sourced from rainwater tanks located adjacent to the office and crib/training room. In the event that rainwater does not provide adequate supply, water would be transported in bulk to the Mine Site. Process water would not be used for ablutions.

2.9.2.5 Sewage and Waste Water

Waste water from ablutions facilities would be treated through an appropriately licenced waste water treatment system. Alternatively, chemical or pump out toilet facilities would be provided. In either case, the waste water system would comply with the requirements of Coolamon Shire Council and would be serviced by a licensed waste collection and disposal contractor, as required.

2.10 NON-PRODUCTION WASTE MANAGEMENT

2.10.1 Introduction

Two classes of non-production wastes are present within the Mine Site or would be generated, namely existing demolition and mine waste and operational non-production waste.

2.10.2 Existing Mine and Demolition Waste

Following cessation of previous mining operations in 2003, the operator of the operator was placed into receivership and the processing plant and other infrastructure sold for scrap. During removal, substantial quantities of non-putrescible waste were left on site. Since 2003, there has also been substantial vandalism within the Mine Site, with previously useable buildings now destroyed, with the resulting waste remaining on site. Plates 2.1 to 2.4 present views of the existing mine and demolition wastes within the Mine Site.

Management of this waste was a matter for discussion during the Planning Focus Meeting, with Coolamon Shire Council requesting that the material not be placed within the Ardlethan Waste and Resource Recovery Facility. As a result, the Applicant proposes to establish a non-putrescible waste disposal area within the Mine Site. This subsection describes the management of the existing mine and demolition waste and the non-putrescible waste disposal area.

Figure 2.14 and Plate 2.1 present the location of the non-putrescible waste disposal area. In summary, the area is located in a disturbed area in the vicinity of the former Processing Plant. The Applicant would initially remove small quantities of tailings that have been placed in this area and would establish surface water diversions to divert surface water away from the disposal area. In addition, the disposal area would be prepared by removing unconsolidated material for later use in covering the placed waste material.
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Plate 2.1: Former Processing Plant area and proposed Mine and Demolition Waste Disposal Area

Plate 2.2: Former Workshop showing Mine Waste

Plate 2.3: Vandalised building requiring demolition

Plate 2.4: Vandalised building requiring remediation
Figure 2.14
FORMER INFRASTRUCTURE AREA

REFERENCE
- Limit of EOE Land Ownership
- Existing Track
- Former Building (to be removed)
- Tailings Extraction Area
- Water Management Dams
- Watercourse/Drainage Line
- Contour (mAHD)(Interval = 1m)
- Plate Number & Direction

SCALE 1:2 500 (A4)

Base Photo Source: QASCO 14 December 2007
Once the disposal area has been prepared, the Applicant would progressively place non-putrescible material only within the disposal area. This would indicatively include:

- polypipe and fittings;
- broken concrete;
- timber and building waste; and
- other non-putrescible waste as defined under the NSW *Waste Classification Guidelines*.

Liquid, asbestos, hazardous or putrescible waste would not be placed within the non-putrescible waste disposal area and no waste would be imported to the Mine Site. Any wastes that are not classified as non-putrescible would be removed from the Mine Site by a suitably licenced contractor or the Applicant and disposed of at a waste facility licenced to accept such waste.

In addition, the Applicant would, where practicable, recycle as much of the existing mine and demolition waste as possible, including steel and other metals.

### 2.10.3 Operational Non-production Waste Management

The underlying principle for all operational non-production waste management would be to minimise waste generation, to recover, reuse and to recycle waste materials as much as possible, and to reduce environmental harm in accordance with the principles of ecologically sustainable development.

Table 2.6 lists the non-production wastes that would be generated throughout the life of the Proposal and briefly describes how each class of waste would be stored or managed on site and subsequently removed from the Project Site.

### 2.11 PROPOSAL LIFE AND HOURS OF OPERATION

#### 2.11.1 Proposal Life

Based upon an annual throughput of 250 000tpa progressively rising to 1.5Mtpa, the Proposal would be completed within approximately 13 to 15 years. More than 15 years may be required to complete mining operations in the event that production rates increase more slowly than currently anticipated. Rehabilitation of disturbed areas would require a further 2 years.

#### 2.11.2 Hours of Operation

Table 2.7 presents the proposed hours of operation for each of the relevant components of the Proposal.
### Table 2.6
Non-Production Waste Management

<table>
<thead>
<tr>
<th>Waste Type</th>
<th>Storage</th>
<th>Removal Method</th>
<th>Anticipated Volume and Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>General solid waste (putrescible), including food scraps</td>
<td>Covered bins located within the crib room, office and elsewhere as required. Where these bins would be located in open areas, they would be fitted with animal-proof lids.</td>
<td>Collected on a regular basis by licensed waste contractor and transported to a licensed waste disposal facility or transported by the applicant.</td>
<td>1 to 2 x 240L bin per week to the Ardlethan Waste and Resource Recovery Facility.</td>
</tr>
<tr>
<td>General solid waste (non-putrescible), including non-recyclable packaging and other materials</td>
<td>Placed into the non-putrescible waste disposal area.</td>
<td></td>
<td>1 to 2 x 240L bin per week.</td>
</tr>
<tr>
<td>General Recyclables</td>
<td>Covered bins located within the crib room, office and elsewhere as required. Where these bins would be located in open areas, they would be fitted with animal-proof lids.</td>
<td>Collected on a regular basis by licensed waste contractor and transported to a licensed waste disposal facility or transported by the applicant.</td>
<td>1 to 2 x 240L bin per week to the Ardlethan Waste and Resource Recovery Facility.</td>
</tr>
<tr>
<td>Waste oils and greases</td>
<td>Placed within bunded area(s) within or in the vicinity of the workshop areas.</td>
<td>Collected on a regular basis by a licensed waste contractor and or transported to an appropriately licensed facility by the Applicant.</td>
<td>100L to 200L per week to a licenced recycling facility.</td>
</tr>
<tr>
<td>Batteries</td>
<td>To be removed from site by the supplier.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyres</td>
<td>To be removed from site by the supplier.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scrap Steel /Metal</td>
<td>Stored in a specified areas within the workshop area or elsewhere such as the laydown area, as required.</td>
<td>Collected as necessary by a scrap metal recycler.</td>
<td>Variable volume to be removed by a scrap metal recycler.</td>
</tr>
</tbody>
</table>

Source: EOE (No.75) Pty Limited

### Table 2.7
Proposed Hours of Operation

<table>
<thead>
<tr>
<th>Activity</th>
<th>Proposed Days of Operation</th>
<th>Proposed Hours of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land preparation</td>
<td>7 days per week</td>
<td>7:00am to 7:00pm</td>
</tr>
<tr>
<td>Plant assembly operations</td>
<td>7 days per week</td>
<td>7:00am to 7:00pm</td>
</tr>
<tr>
<td>Tailings extraction operations</td>
<td>7 days per week</td>
<td>7:00am to 7:00pm</td>
</tr>
<tr>
<td>Processing operations</td>
<td>7 days per week</td>
<td>24 hours per day</td>
</tr>
<tr>
<td>Transportation operations</td>
<td>7 days per week</td>
<td>7:00am to 7:00pm</td>
</tr>
<tr>
<td>Maintenance operations</td>
<td>7 days per week</td>
<td>24 hours per day</td>
</tr>
<tr>
<td>Rehabilitation operations</td>
<td>7 days per week</td>
<td>7:00am to 7:00pm</td>
</tr>
</tbody>
</table>

Note 1: The pilot plant (30tph) would operate between 7:00am to 7:00pm. 24-hour production would not commence until the pilot plant has demonstrated the success of the proposed processing operations.

Source: EOE (No.75) Pty Limited
2.12 EMPLOYMENT, CAPITAL COST AND ECONOMIC CONTRIBUTIONS

2.12.1 Employment

The Applicant anticipates that limited onsite construction positions would be produced because the processing plant modules would be prefabricated off site and transported to the Mine Site for assembly. Approximately 10 people would be required on site for up to 4 weeks for the installation of the Pilot Plant.

Table 2.8 presents the anticipated operational full time equivalent (FTE) employment figures for the Proposal. In summary, the Applicant expects that employment will increase in stages from 7 FTE positions when the pilot plant only is operational to approximately 28 FTE positions once production increases to more than 60tph.

<table>
<thead>
<tr>
<th>Position</th>
<th>Production Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pilot Plant</td>
</tr>
<tr>
<td>Manager</td>
<td>1</td>
</tr>
<tr>
<td>Admin/Assay/Purchasing</td>
<td>1</td>
</tr>
<tr>
<td>Shift Supervisors</td>
<td>1</td>
</tr>
<tr>
<td>Excavation and Haulage</td>
<td>1</td>
</tr>
<tr>
<td>Plant Operators</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

All positions would be offered on a residential basis, with the majority of workers of employees and other workers expected to reside in Ardlethan and surrounding towns. The Applicant is aware of numerous former employees of the Mine who still reside in surrounding areas and has been contacted by a range of individuals interested in seeking employment once the Proposal is approved. In addition, the Applicant would provide training for potential local employees to obtain the skills necessary to gain employment with the Proposal.

The Applicant anticipates that managerial, administration and excavation and haulage personnel would work dayshift only, indicatively 7:00am to 7:00pm five to six days per week. Shift supervisors and plant operators would be divided into four panels, with each panel working an even-time roster (e.g., 7 days on – 7 days off, 12-hour shifts). Shift change times would be expected to be 7:00am and 7:00pm.

2.12.2 Capital Cost

The Applicant anticipates the capital cost for the Pilot Plant including all mobile plant, spares, transportable buildings and other infrastructure would be approximately $3.5 million. The remaining processing plant modules would have a cost of approximately $7.5 million. This component, for the purpose of calculating the Capital Investment Value (CIV) would be funded as an operational cost.
2.12.3 Economic Contributions

Table 2.9 presents the economic contribution of the Proposal to the local, regional and NSW economies.

Table 2.9
Economic Contribution Attributable to the Proposal

<table>
<thead>
<tr>
<th>Annual Contribution (A$)</th>
<th>Pilot Plant</th>
<th>30-60tph</th>
<th>&gt; 60tph</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local and Regional Economy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wages and salaries.</td>
<td>1 670 000</td>
<td>2 190 000</td>
<td>2 450 000</td>
</tr>
<tr>
<td>Local services and suppliers (local deliveries, local earthmoving, maintenance, etc.).</td>
<td>590 000</td>
<td>860 000</td>
<td>1 760 000</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>2 260 000</td>
<td>3 050 000</td>
<td>4 210 000</td>
</tr>
<tr>
<td><strong>State and National Economy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilities (power, water, communications).</td>
<td>50 000</td>
<td>420 000</td>
<td>790 000</td>
</tr>
<tr>
<td>State and National services and suppliers (long distance deliveries, supplies other than local supplies).</td>
<td>50 000</td>
<td>100 000</td>
<td>200 000</td>
</tr>
<tr>
<td>NSW government royalty.</td>
<td>80 000</td>
<td>170 000</td>
<td>340 000</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>180 000</td>
<td>690 000</td>
<td>1 330 000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2 440 000</td>
<td>3 740 000</td>
<td>5 540 000</td>
</tr>
</tbody>
</table>

Source: EOE (No.75) Pty Limited

In addition, the Applicant will negotiate a Voluntary Planning Agreement (VPA) with Coolamon Shire Council. The Applicant anticipates that that agreement will include the following components and that it will be required to be considered and exhibited by Council prior to being finalised.

- Upgrade of Tin Mines Road from the Mine Site entrance to the sub-station once production levels exceed 500 000tpa.
- Maintain Tin Mines Road from the Mine Site entrance to the intersection with Bygoo Road.
- Contribute on a pro rata basis to the maintenance of the local road network from the intersection of Tin Mines Road and Bygoo Road to the intersection of Mirrool Street and Burley Griffin Way. The relevant contribution would be based on the proportion of heavy vehicles associated with the Proposal compared with the total number of heavy vehicles that use that road.

In addition, the Applicant would contribute to community groups and events in consultation with its workforce and the wider community at a rate commensurate with the size and scale of the Proposal.
2.13 SITE REHABILITATION AND REMEDIATION

2.13.1 Introduction

The Applicant notes that one of the objectives of the Proposal is to rehabilitate and remediate disturbed sections of the Mine Site and to enable areas of contaminated lands to be considerably reduced and returned to native vegetation. As a result, rehabilitation and remediation forms a central component of the Proposal.

It is noted, however, that substantial sections of the Mine Site would not be modified as a result of this Proposal. When the Applicant initially assumed control of the Mine Site, extensive discussions with the Division of Resources and Energy and its predecessors in relation to rehabilitation of the Mine Site were entered into. The results of those discussions were embodied in a document entitled *Ardlethan Hard Rock Tin Mine Preliminary Mine Closure Plan*, hereafter referred to as RWC (2010). That Plan described the agreed rehabilitation activities that would be undertaken by the Applicant in all areas that were not disturbed by its activities. The Applicant proposes to implement that Plan in sections of the Mine Site that would not be disturbed by the Applicant.

The following subsections provide an overview of the proposed rehabilitation and remediation activities throughout the life of the Proposal, with particular focus on areas that would be disturbed by the proposed activities.

2.13.2 Rehabilitation Objectives

In the short term, the Applicant’s rehabilitation and remediation objectives are to:

- monitor and manage all surface water management structures to ensure that potentially contaminated water is not permitted to flow from the Mine Site;
- clean up and appropriately remediate the former infrastructure area;
- progressively relocate tailings from disturbed sections of the Mine Site to more appropriate storage locations;
- test and treat and/or remove contaminated material from disturbed sections of the Mine Site; and
- revegetated formerly contaminated sections of the Mine Site to re-establish vegetation communities similar to those surrounding the Mine Site.

The Applicant’s longer term rehabilitation objectives are to ensure that:

- the rehabilitated landform is safe, stable, non-polluting and suitable for the identified long-term final land uses;
- suitable vegetation is established on the final landform, taking into account the proposed final land use;
- the rehabilitated landform requires levels of maintenance commensurate with surrounding land;
• rehabilitation is undertaken in an efficient and economically sustainable manner;
• the mining lease(s) over the rehabilitated landform can be relinquished and the security progressively returned.

2.13.3 Final Landform

Figures 2.15 and 2.16 presents the proposed final landform. In summary, the final landform would comprise the following. In all cases the final landform would be safe, stable, secure and non-polluting as a minimum.

• A reconstructed, free draining landform in the footprint of the Main Tailings Storage Facility, with the Mill Reclaim Dam removed once monitoring indicates surface water is not contaminated.
• A reconstructed, free draining landform in the footprint of the Spring Valley Tailings Storage Facility.
• A reconstructed, free draining borrow pit.
• Spring Valley Fresh Water Dam.
• A reshaped and free draining former infrastructure area and processing plant area.
• A covered, internally draining tailings storage facility within the Ardwest/Wild Cherry Open Cut, including a shaped landform within the cover material stockpile area that would drain to the Ardwest/Wild Cherry Open Cut.
• A covered free draining tailings storage facility within the White Crystal Open Cut that would drain to the Stackpool Open Cut.

All other landforms would be as described in the Preliminary Mine Closure Plan (RWC, 2010) and would comprise the following (Figure 2.15).

• Domain 9 – Construction Materials Domain – an internally draining landform that would remain available for extraction of non-mineralised rock if required for rehabilitation or an alternative lawful purpose.
• Domain 10 – Ardwest/Wild Cherry Waste Rock Emplacement – a stable landform that would continue to drain to a series of evaporation ponds.
• Domain 13 – Carpathia Domain – a bunded domain to prevent access to an existing collapse zone, with heritage areas protected.
• Domain 14 – Stackpool Open Cut Domain – an internally draining, bunded and fenced open cut.
• Domain 16 – White Crystal Waste Rock Emplacement Domain – a stable landform that would continue to drain to the Stackpool Open Cut.
• Domain 17 – White Crystal Alluvial Domain – an internally draining domain.
• Domain 18 – Northern Evaporation Pond and Drainage Structures – Internally draining domain that receives but does not discharge surface water from the Ardwest/Wild Cherry Waste Rock Emplacement.
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Figure 2.15
FINAL LANDFORM AND LAND USE OVERVIEW
Figure 2.16
FINAL LANDFORM AND LAND USE DETAIL

REFERENCE
- Mine Site Boundary
- Limit of EOE Land Ownership
- Proposed Tailings Extraction Area
- Proposed Tailings Placement Area
- Proposed Borrow Pit
- Existing Contour (m AHD) (interval = 1m)
- Indicative Final Contour (m AHD)
  (interval = 1m)

Final Land use
- Track
- Site Access Road
- Watercourse/Drainage Line
- Water Storage Dam
- Nature Conservation
- Covered Tailings
- Prior Disturbance Area Rehabilitation
- Domain and Identifier RWC (2010)
2.13.4 Final Land Use

**Figures 2.15 and 2.16** present the final land use for those sections of the Mine Site that would be disturbed by the Applicant. In summary, these would include the following.

- Nature conservation.
- Covered, non-polluting tailings placement areas within the Ardwest/Wild Cherry and White Crystal Open Cuts.

Those sections of the Mine Site that would not be disturbed by the Applicant would retain a final land use that would be consistent with that identified in Section 3.3 of RWC (2010), namely a safe, stable, secure, non-polluting landform with all contaminated surface water contained on site, no significant dust emissions and with established vegetation appropriate to the landform.

2.13.5 Rehabilitation Methods, Procedures and Scheduling

2.13.5.1 Former Infrastructure Area

As described in Section 2.10.2, the Mine Site includes numerous dilapidated buildings, mine and demolition waste and concrete foundations, slabs and plinths remaining from a failure to remove all infrastructure after the former operator was placed into receivership (**Figure 2.14** and **Plates 2.1 to 2.4**). The Applicant proposes, as a matter of priority, to remove and clean up that material during the initial stages of the Proposal. The rehabilitation methods and procedures to be employed would include the following. Disposal of mine and demolition waste within the Non-putrescible Waste Disposal Area is described in Section 2.10.2.

- All remaining buildings would be inspected by a suitably qualified or experienced person and all identified asbestos or other hazardous material would be removed from the Mine Site.
- Recyclable material, principally corrugated iron and other metal, where practicable, would be placed into scrap steel bins and removed from site by a metal recycling contractor for recycling.
- The Non-putrescible Waste Disposal Area would be prepared, with friable material scraped from the surface and stockpiled for subsequent use as cover material and surface water diversion structures installed.
- Remaining non-putrescible waste would be progressively collected and placed within the prepared Non-putrescible Waste Disposal Area, including pipe work, building materials and other waste.
- Remaining concrete pads would be assessed for use by the Applicant for storage areas or construction of the workshop. Where no subsequent use can be identified, the concrete pads and all other concrete footings and plinths would be removed to the Non-putrescible Waste Disposal Area or buried *in situ*.
- An assessment of the former infrastructure area for contamination would be undertaken and any contaminated material would be remediated or removed to the Ardwest/Wild Cherry Open Cut.
The former infrastructure area would be reshaped to establish a final landform with slopes of less than 1:3 (V:H). Figure 2.16 presents the indicative final landform.

The reshaped landform would then be covered by growth medium sourced from the borrow pit and revegetated with native species consistent with the surrounding vegetation communities.

### 2.13.5.2 Tailings Extraction Areas

Section 2.3.3 presents the proposed tailings extraction sequence. In summary, the Applicant would progressively extract the full thickness of tailings within the tailings extraction area and expose the underlying basin material. As a result, rehabilitation of the tailings extraction areas would be undertaken progressively as each extraction area is completed. In summary, rehabilitation of each completed extraction area would be as follows.

- Remove all tailings material and establish temporary surface water controls to ensure that potentially sediment-laden or contaminated water is not permitted to flow from the Mine Site.
- Engage a suitably qualified and experienced contamination expert to undertake a contamination assessment of the underlying basin material to determine the nature, extent and depth of contamination. Based on the results of that assessment, the expert would prepare a range of recommendations in relation to management of the contaminated material, including:
  - material that is best managed through removal to the Ardwest/Wild Cherry Open Cut; or
  - material that is best managed through *in situ* remediation and/or amelioration.
- Implement the recommendations of the contamination expert and, following completion, ensure that the works are inspected and signed off by the expert.
- Once signed off, the reshaped landform would, if required, be covered by growth medium sourced from the borrow pit and revegetated with native species consistent with the surrounding vegetation communities.

### 2.13.5.3 Tailings Placement Areas

#### White Crystal Open Cut

Post-flotation tailings would be transported from the Spring Valley Tailings Storage Facility and placed directly within the White Crystal Open Cut. This material would be shaped to form a free draining landform within the footprint of the open cut and surface water drainage would be directed to the existing Stackpool Open Cut surface water containment structure. The placed tailings would then be covered with embankment material from the Spring Valley Tailings Storage Facility to prevent dust lift off and erosion of the tailings material.
The Applicant does not propose to construct an impermeable cover over the placed tailings for the following reasons.

- The post-flotation tailings represent a likely future resource and would, following receipt of modified or new development consent, be likely to be reprocessed.

- The tailings would be placed within the existing open cut, with surface water drainage directed to the existing contaminated water circuit. In addition, any surface water that infiltrated the tailings pile would be contained within the White Crystal Open Cut.

Ardwest/Wild Cherry Open Cut

Tailings emplaced within the Ardwest/Wild Cherry Open Cut would, unlike those emplaced within the White Crystal Open Cut, be emplaced as a slurry, initially sub-aqueously and, towards the end of the life of the Proposal, sub-aerially. Rehabilitation of these materials would be undertaken as follows.

- The placed tailings would be allowed to settle and dewater. To facilitate this process, the Applicant would implement the following.
  - Isolate the open cut from sections of the Mine Site where rehabilitation has been completed, including the Main Tailings Storage Facility.
  - Install measures including sprays and foggers, if required, to maximise evaporation.
  - In the event that the rate of dewatering and consolidation of the tailings is too slow, the Applicant would install dewatering wicks or similar devices to facilitate removal of water from the tailings pile.

- Once adequately consolidated, the Applicant would shape the final tailings surface to facilitate surface water drainage to a location adjacent to the haul ramp to permit convenient access for sampling and pumping as required.

- The Applicant would then push previously placed material from the cover and embankment material storage area over the tailings using a bulldozer. The thickness of placed cover material would depend on the volume of material available. However, the Applicant would ensure that the entire surface of the reprocessed tailings is covered to prevent wind erosion and emission of particulate material.

The Applicant does not propose to construct an impermeable cover over the placed tailings for the following reasons.

- The tailings would continue to settle and move for a considerable period of time following the completion of placement operations. As a result, any impermeable cover would be likely to be compromised within a short period of being placed.

- The Applicant has committed to ensuring that the tailings within the Ardwest/Wild Cherry Open Cut would be no higher than 10m from the open cut invert or approximately 250m AHD. As a result, the open cut would remain internally draining and any impermeable cover would not facilitate shedding of water from the tailings surface.
2.13.5.4 Borrow Pit

Extraction of Growth Medium

Section 2.1.1 identifies that an objective of the Proposal is:

“To rehabilitate and remediate disturbed sections of the Mine Site and to enable areas of contaminated lands to be considerably reduced and returned to native vegetation.”

In order to achieve this objective the Applicant would progressively extract and reprocess previously placed tailings and expose, test and treat or remove contaminated material. In order to facilitate reestablishment of native vegetation, suitable growth medium would be required. To this end, the Applicant proposes to establish a borrow pit to the south of the Spring Valley Tailings Storage Facility (Figure 2.2). The location and extent of the borrow pit has been determined based on the following.

- Minimising disturbance to both native vegetation and productive agricultural land.
- Ensuring that known objects of Aboriginal heritage significance are not disturbed.
- Ensuring that existing drainage lines are not disturbed.

Soils within the borrow pit were previously assessed by Global Soil Systems (GSS, 1999). The results of that assessment are presented in Section 4.10. In summary, GSS (1999) determined the following.

- The soils of the Borrow Pit may be classified as “Brown Gradational” soils, grading from dark brown loam at surface to sandy clay at depth.
- The soils are suitable for use in rehabilitation operations.

The borrow pit occupies an area of approximately 5.8ha. Growth medium would be extracted to a maximum depth of 3m below the existing surface, with the final landform to be free draining.

Based on the above, approximately 174,000m$^3$ of growth medium would be available for use during rehabilitation operations. The actual volume of growth medium that would be required cannot be determined until the initial contamination assessment programs within the tailings extraction areas are complete. However, in the event that the volume of growth medium required exceeds the volume available within the borrow pit, the Applicant would seek a modification to any development consent that is granted to permit additional or an enlarged borrow pit. The Applicant notes that it owns a range of potential alternate borrow pit locations, including to the west of the Main Tailings Storage Facility and east of the White Crystal Open Cut.

Growth medium extraction operations would be undertaken on a campaign basis using a scraper and/or small bulldozer, front-end loader and small truck. Surface water controls to divert clean water around the extraction area would be installed prior to each extraction campaign and potentially sediment-laden water would be retained within the extraction area. Following the completion of each extraction campaign, the extraction area would be treated to stabilise the exposed material prior to the next campaign.

Rehabilitation of the Borrow Pit

Following the completion of extraction of growth medium, the borrow pit would be shaped to form a free draining landform with slopes of 1:3 (V:H) or less (Figure 2.16). The final landform would be ripped and rehabilitated as described in Section 2.13.5.2.
2.13.5.5 Other Areas to be Disturbed by the Applicant

A range of other areas would be disturbed by the Applicant. These include the following.

- Proposed ROM Pad and Processing Plant area.
- Infrastructure and other areas used for Proposal-related activities.

These areas would, following completion of all processing operations, be rehabilitated as follows.

- All infrastructure, including processing equipment, transportable buildings, workshops, storage sheds and waste water treatment plants would be removed from site unless a lawful final use for that infrastructure has been identified.
- Remaining concrete pads and foundations would be removed to the Non-putrescible Waste Disposal Area or buried in situ.
- A contamination assessment would be undertaken and any contaminated material would be remediated or removed to the Ardwest/Wild Cherry Open Cut.
- The former infrastructure area would be reshaped to establish a final landform with slopes of less than 1:3 (V:H). Figure 2.16 presents the indicative final landform.
- The reshaped landform would then be covered by growth medium sourced from the borrow pit and revegetated with native species consistent with the surrounding vegetation communities.

2.13.5.6 Prior Disturbance Areas

Figure 2.15 identifies prior disturbance areas that would not be disturbed by the Applicant. As identified in Section 2.13.1, the Applicant would implement the agreed rehabilitation activities identified in Section 7 of RWC (2010). For the sake of completeness, Table 2.10 reproduces the agreed rehabilitation actions. Domains referred to in Table 2.10 are shown on Figure 2.15.

<table>
<thead>
<tr>
<th>Task</th>
<th>Activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain 9 – Construction Materials Domain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure Objectives</td>
<td>• Safe, stable landform.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Non-polluting.</td>
<td></td>
</tr>
<tr>
<td>Completion Criteria</td>
<td>• No significant erosion or geotechnical failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All potentially sediment-laden surface water is directed to the Mill Reclaim Dam Domain or a suitable sedimentation pond.</td>
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<tr>
<td></td>
<td>• Surface is not the subject of dust generation through wind erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Area remains available for extraction of construction materials.</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Reprofile walls to a safe angle.</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Nil</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2.10 (Cont’d)
#### Agreed Closure Actions – Prior Disturbance Areas

<table>
<thead>
<tr>
<th>Task</th>
<th>Activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain 10 – Ardwest/Wild Cherry Waste Rock Emplacement Domain</strong></td>
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</tr>
<tr>
<td>Closure Objectives</td>
<td>• Safe, stable landform.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Non-polluting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Development of sustainable vegetative cover.</td>
<td></td>
</tr>
<tr>
<td>Completion Criteria</td>
<td>• No significant erosion or geotechnical failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All potentially sediment-laden surface water is directed a suitable sedimentation pond.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Surface is not the subject of dust generation through wind erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Suitable vegetation established.</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>Spread topsoil or other fine material as required on the outer toe of the waste rock emplacement and revegetate domain with appropriate tree species sourced from locally collected seed.</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Visual inspection and photographic record annually for remainder of lease term.</td>
<td>Photographic locations should be marked with a painted concrete block and photographs should be taken at the same time of day, same direction and using the same focal length or zoom.</td>
</tr>
<tr>
<td><strong>Domain 13 – Carpathia Domain</strong></td>
<td></td>
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</tr>
<tr>
<td>Closure Objectives</td>
<td>• Safe, stable landform.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Non-polluting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Development of sustainable vegetative cover.</td>
<td></td>
</tr>
<tr>
<td>Completion Criteria</td>
<td>• No significant erosion or geotechnical failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All potentially sediment-laden surface water is directed a suitable sedimentation pond of the underground workings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Surface is not the subject of dust generation through wind erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Suitable vegetation established.</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>• Retain historic stone walls and mining equipment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Repair and upgrade bunding and fencing around potential collapse zone as appropriate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Plug drill holes and reprofile domain.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Deep rip, spread appropriate soil material or other growth medium and revegetate with appropriate species sourced from locally collected seed.</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Visual inspection and photographic record annually for remainder of lease term.</td>
<td>Photographic locations should be marked with a painted concrete block and photographs should be taken at the same time of day, same direction and using the same focal length or zoom.</td>
</tr>
</tbody>
</table>
### Table 2.10 (Cont’d)
#### Agreed Closure Actions – Prior Disturbance Areas

<table>
<thead>
<tr>
<th>Task</th>
<th>Activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain 14 – Stackpool Open Cut Domain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure Objectives</td>
<td>• Safe, stable landform.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Non-polluting.</td>
<td></td>
</tr>
<tr>
<td>Completion Criteria</td>
<td>• No significant erosion or geotechnical failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All potentially contaminated surface water directed to the Ardwest/Wild Cherry Open Cut.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Surface is not the subject of dust generation through wind erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Suitable fences and/or bunds exist to prevent unauthorised/ inadvertent access.</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>• Repair and upgrade perimeter bunding and fencing as appropriate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ensure that drain holes remain open and are not subject to blockage.</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Visual inspection and photographic record annually for remainder of lease term.</td>
<td>Photographic locations should be marked with a painted concrete block and photographs should be taken at the same time of day, same direction and using the same focal length or zoom.</td>
</tr>
<tr>
<td></td>
<td>Undertake annual water quality analysis (pH, electrical conductivity) and report results to I&amp;I NSW.</td>
<td>It is likely that the pH will decrease and electrical conductivity of water within the Spring Valley Dam will decrease and increase respectively with addition leachate inflow and evaporative loss.</td>
</tr>
<tr>
<td><strong>Domain 16 – White Crystal Waste Rock Emplacement Domain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure Objectives</td>
<td>• Safe, stable landform.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Non-polluting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Development of sustainable vegetative cover.</td>
<td></td>
</tr>
<tr>
<td>Completion Criteria</td>
<td>• No significant erosion or geotechnical failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All potentially sediment-laden surface water is directed a suitable sedimentation pond.</td>
<td></td>
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<tr>
<td></td>
<td>• Surface is not the subject of dust generation through wind erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Suitable vegetation established.</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>• Clean out perimeter drain on northern and eastern sides of the waste rock emplacement.</td>
<td>Photographic locations should be marked with a painted concrete block and photographs should be taken at the same time of day, same direction and using the same focal length or zoom.</td>
</tr>
<tr>
<td></td>
<td>• Plant screening vegetation at the toe of the emplacement.</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Visual inspection and photographic record annually for remainder of lease term.</td>
<td>Photographic locations should be marked with a painted concrete block and photographs should be taken at the same time of day, same direction and using the same focal length or zoom.</td>
</tr>
</tbody>
</table>
### Table 2.10 (Cont’d)
**Agreed Closure Actions – Prior Disturbance Areas**

<table>
<thead>
<tr>
<th>Task</th>
<th>Activity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain 17 – White Crystal Alluvial Domain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure Objectives</td>
<td>• Safe, stable landform.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Non-polluting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Development of sustainable vegetative cover.</td>
<td></td>
</tr>
<tr>
<td>Completion Criteria</td>
<td>• No significant erosion or geotechnical failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All potentially sediment-laden surface water is directed a suitable sedimentation pond.</td>
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<tr>
<td></td>
<td>• Surface is not the subject of dust generation through wind erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Suitable vegetation established.</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>• Install appropriate surface water drainage to ensure that domain remains internally draining.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reprofile, deep rip and revegetate domain with appropriate tree species sourced from locally collected seed.</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Visual inspection and photographic record annually for remainder of lease term.</td>
<td>Photographic locations should be marked with a painted concrete block and photographs should be taken at the same time of day, same direction and using the same focal length or zoom.</td>
</tr>
<tr>
<td><strong>Domain 18 – Northern Evaporation Pond and Drainage Structures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closure Objectives</td>
<td>• Safe, stable landform.</td>
<td></td>
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<tr>
<td></td>
<td>• Non-polluting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Development of sustainable vegetative cover.</td>
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</tr>
<tr>
<td>Completion Criteria</td>
<td>• No significant erosion or geotechnical failure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All potentially sediment-laden surface water is directed a suitable sedimentation pond.</td>
<td></td>
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<tr>
<td></td>
<td>• Surface is not the subject of dust generation through wind erosion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Suitable vegetation established.</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>• Review the design of the dams and confirm that they are capable of containing a 1 in 100 year rainfall event.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Remove sediment from drainage structures as required.</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td>Visual inspection and photographic record annually for remainder of lease term.</td>
<td>Photographic locations should be marked with a painted concrete block and photographs should be taken at the same time of day, same direction and using the same focal length or zoom.</td>
</tr>
</tbody>
</table>

Source: RWC (2010) – After Table 5
2.13.5.7 Rehabilitation Schedule

The Applicant acknowledges that rehabilitation of the Mine Site is a matter of considerable importance for both the surrounding community and the relevant regulators. As a result, the Applicant proposes to undertake all rehabilitation progressively throughout the life of the Proposal. Table 2.11 and Figures 2.3 to 2.5 present the indicative rehabilitation schedule throughout the life of the Proposal.

Table 2.11
Indicative Rehabilitation Schedule

<table>
<thead>
<tr>
<th>Proposed Disturbance Areas</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
<th>Stage 5</th>
<th>Stage 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure Area</td>
<td></td>
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<tr>
<td>No. 1 Dam – West</td>
<td></td>
<td></td>
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<tr>
<td>No. 1 Dam – East</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Lower and Horseshoe dam</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Valley Tailings Storage Facility</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ardwest/Wild Cherry Open Cut</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>White Crystal Open Cut</td>
<td></td>
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<tr>
<td>Processing Plant Area and Remaining Disturbance Areas</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Borrow Pit</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Prior Disturbance Areas</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domain 9 – Construction Materials Domain</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Domain 10 – Ardwest/Wild Cherry Waste Rock Emplacement Domain</td>
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<tr>
<td>Domain 13 – Carpathia Domain</td>
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<tr>
<td>Domain 14 – Stackpool Open Cut Domain</td>
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<td></td>
</tr>
<tr>
<td>Domain 16 – White Crystal Waste Rock Emplacement Domain</td>
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<td></td>
</tr>
<tr>
<td>Domain 17 – White Crystal Alluvial Domain</td>
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<td></td>
</tr>
<tr>
<td>Domain 18 – Northern Evaporation Pond and Drainage Structures</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note 1:
- Tailings (pre-flotation) extraction
- Tailings (post-flotation) extraction
- Tailings processing
- Reprocessed tailings deposition
- Direct tailings deposition
- Growth medium extraction
- Removal of mine and demolition waste
- Removal/treatment of contaminated material and growth medium/ecosystem establishment
- Cover establishment
- Rehabilitation monitoring/maintenance
- No activity

Source: EOE (No.75) Pty Limited
2.14 PROJECT RATIONALE AND ALTERNATIVES CONSIDERED

2.14.1 Introduction

This sub-section identifies the feasible alternatives considered and rejected during the design and planning phase of the Proposal. The alternative of not proceeding with the Proposal is considered in Section 5.2.3.5 and an evaluation of the Proposal in terms of Ecologically Sustainable Development and biophysical, socio-economic and planning considerations is provided in Sections 5.2.2 and 5.2.3.

2.14.2 Alternative Plant Design

The Applicant has, since assuming control of the Mine Site, undertaken numerous reviews of different methods to reprocess the tailings within the Mine Site. These included installation of a flotation plant and a range of gravity separation methodologies. In all cases either the capital cost or the recovery of Cassiterite from the tailings resulted in the Proposal not being economically viable.

2.14.3 Processing of Mineralised Waste Rock

The Applicant has considered processing of the mineralised waste rock within the Mine Site. This material would require installation of a crushing and grinding circuit. Installation of such a circuit would result in additional noise and air quality emissions associated, as well as additional capital cost. Processing of this material would, however, result in removal of material that is currently generating a low pH leachate.

At this stage, the Applicant does not believe that sufficient resources exist to justify installation of the required plant, nor the imposition of the additional noise and air quality emissions. However, this alternative would be reviewed throughout the life of the Proposal and an application to modify the development consent would be submitted if reprocessing of this material proves feasible.

2.14.4 Mining and Processing of Primary Ore

The Applicant considered mining and reprocessing of the primary ore remaining within the Mine Site. This option would, as a result of the water stored within the Ardwest/Wild Cherry Open Cut, require installation of a new box cut, decline and underground mine, as well as a different processing plant.

At this stage, the Applicant does not believe that sufficient resources exist to justify the establishment of the required infrastructure. However, this alternative would be reviewed throughout the life of the Proposal and an application to modify the development consent would be submitted if recommencement of mining operations proves feasible.