YILGARN OPERATIONS
KOOLYANOBBING RANGE F DEPOSIT
FLORA AND VEGETATION MANAGEMENT PLAN
242-EN-PLN-0013

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<tr>
<th>Revision Number</th>
<th>Issue Date</th>
<th>Prepared By</th>
<th>Approved By</th>
<th>GM Signature</th>
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<td>0</td>
<td>2/04/2019</td>
<td>M. Flowers</td>
<td>N. Smith</td>
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1. **SUMMARY**

This Condition Environmental Management Plan (EMP) was prepared by Cliffs Asia Pacific Iron Ore Pty. Ltd (Cliffs) for Ministerial Statement 1054 (MS1054), in accordance with MS1054 Condition 6 for the Koolyanobbing Range F Deposit and approved in June 2017. Mineral Resources Limited (MRL) continues to implement the approved plan.

The table below presents the environmental criteria to measure achievement of the conditioned environmental outcome that must be met through implementation of this EMP.

**Table 1.1 – Environmental Criteria Used to Measure Environmental Outcomes**

<table>
<thead>
<tr>
<th>TITLE OF PROPOSAL</th>
<th>Yilgarn Operations, Koolyanobbing Range F Deposit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROONENT</td>
<td>Yilgarn Iron Pty Ltd</td>
</tr>
<tr>
<td>MINISTERIAL</td>
<td>1054</td>
</tr>
<tr>
<td>STATEMENT NUMBER</td>
<td></td>
</tr>
<tr>
<td>PURPOSE OF THIS</td>
<td>This Condition EMP (F Deposit Flora and Vegetation Management Plan) is submitted to fulfil the requirements of condition 6 of the above Statement.</td>
</tr>
<tr>
<td>CONDITION EMP</td>
<td></td>
</tr>
<tr>
<td>ENVIRONMENTAL</td>
<td>To maintain representation, diversity, viability and ecological function at the species, population and community level.</td>
</tr>
<tr>
<td>OBJECTIVE FOR THE</td>
<td></td>
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<tr>
<td>KEY ENVIRONMENTAL</td>
<td></td>
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<tr>
<td>FACTOR/S</td>
<td></td>
</tr>
<tr>
<td>CONDITION</td>
<td></td>
</tr>
<tr>
<td>ENVIRONMENTAL</td>
<td>1. No adverse effects on native flora and vegetation outside the Stage 1 and 2 development envelopes as shown in Figure 3.1 in Schedule 1 or within the Stage 2 development envelope until the requirements of condition 9 of Ministerial Statement 1054 have been met.</td>
</tr>
<tr>
<td>OUTCOME OR PROPOSED</td>
<td>2. No adverse effects on greater than 313 <em>Tetratheca erubescens</em> plants within the Stage 1 development envelope as shown in Figure 3.1 in Schedule 1 of Ministerial Statement 1054.</td>
</tr>
<tr>
<td>MEASURABLE OUTCOME</td>
<td>3. No adverse effects on greater than 652 <em>Tetratheca erubescens</em> plants within the Stage 2 development envelope as shown in Figure 3.1 in Schedule 1 of Ministerial Statement 1054 once the requirements of condition 9 have been met.</td>
</tr>
</tbody>
</table>

**Environmental criteria**

- Dust deposition at any (non-reference) dust monitoring site exceeds:
  - 80g/m²/month (Sₐ) during the first 12 months from commencement of mining;
  - 40g/m²/month (Sₐ) after 12 months from commencement of mining.

Monitoring of *Tetratheca erubescens* indicates a statistically significant relationship between condition (ICF and/or % live material) and dust deposition, distance from the proposal boundary or mine-related factor.
<table>
<thead>
<tr>
<th>Monitoring of Priority species indicates a statistically significant relationship between condition (ICF and/or % live material) and dust deposition, distance from the proposal boundary or mine-related causal factor.</th>
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</table>

**THRESHOLD CRITERIA**

<table>
<thead>
<tr>
<th>Monitoring of <em>Tetratheca erubescens</em> indicates a statistically significant relationship between mortality and dust deposition, distance from the proposal boundary or mine-related causal factor.</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Monitoring of <em>Tetratheca erubescens</em> indicates a statistically significant relationship between condition (ICF and/or % live material) and dust deposition, distance from the proposal boundary or mine-related causal factor for two consecutive two-monthly monitoring dates in year 1 or two consecutive quarterly monitoring dates in year 2.</th>
</tr>
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<table>
<thead>
<tr>
<th>Monitoring of Priority species and/or native vegetation indicates a statistically significant relationship between mortality, dust deposition, distance from the proposal boundary or mine-related causal factor.</th>
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</table>
2. CONTEXT, SCOPE AND RATIONALE

2.1 Project Background

The Yilgarn Iron ore Operations includes mining operations at the Koolyanobbing Range, Mt Jackson Range, Windarling Range, ore processing at Koolyanobbing and road and rail transport between these operations and the Port of Esperance. The general location of the operations is shown in Figure 2.1.

Mining has occurred at Koolyanobbing since the 1960’s. Formally known as Portman Iron Ore, Cliffs Asia Pacific Iron Ore Pty Ltd (Cliffs) recommissioned the operations following closure by BHP Pty Ltd in the early 1980’s and started operating the mine in 1994.

In July 2014 Cliffs submitted a proposal for assessment to the Environmental Protection Authority (EPA) to develop a new operation located at the Koolyanobbing Range F Deposit, approximately 50km north-north-east of Southern Cross in the Shire of Yilgarn.

In January 2017, the Minister for Environment granted approval of the Proposal through Ministerial Statement 1054 (MS 1054) in accordance with s45 (5) of the Environmental Protection Act 1986 (WA) (EP Act).

Cliffs ceased mining operations at Koolyanobbing in early 2018 and entered into an Asset Sale Agreement with Mineral Resources Limited (MRL) on 12 June 2018. The transaction was completed in August 2018 and included the transfer of legal title in Cliffs mining tenements to MRL and ownership of all remaining iron ore, fixed plant, equipment and non-process infrastructure in the Yilgarn and at the Port of Esperance. All assets were transferred to the wholly owned MRL subsidiary Yilgarn Iron Pty Ltd (YIPL).

Responsibility for the Proposal and other project approvals was transferred to YIPL in the third quarter of 2018. YIPL commenced mining at Koolyanobbing in September 2018.

2.2 F Deposit Flora and Vegetation Management Plan

A Yilgarn Operations Flora and Vegetation Management Plan applies to operations that were established prior to the development of the Koolyanobbing Range F Deposit; and addresses statutory obligations relating to flora and vegetation under Ministerial Statement 982 (Cliffs 2016a).

This Koolyanobbing Range F Deposit Flora and Vegetation Management Plan has been prepared to specifically address statutory obligations relating to flora and vegetation under Ministerial Statement 1054 applying to the proposed operations at Koolyanobbing Range F Deposit, shown in Figure 2.1.

2.3 Key Environmental Factors

This Koolyanobbing Range F Deposit Flora and Vegetation Management Plan addresses the Key Environmental Factor of ‘Flora and Vegetation’ (EPA 2016).

The final development envelope for the proposal is 203 ha, of which approximately 189 ha is covered in native vegetation. The condition of the majority of the vegetation in the survey study area is ranked as ‘Excellent’ condition (Woodman 2014). The Priority Ecological Community (PEC) Koolyanobbing Vegetation Complexes (Banded Iron Formation) – (Koolyanobbing PEC) coincides with the survey study area. PECs are listed by the Department of Biodiversity, Conservation and Attractions – Parks and Wildlife Service but are not listed under the Biodiversity Conservation Act 2016 (BC Act). The Koolyanobbing PEC is ranked as Priority 1, and covers the northern and southern sections of the Koolyanobbing Range. The Koolyanobbing PEC boundary corresponds with the boundary of the Koolyanobbing Range landform. Its values include threatened and Priority flora species and restricted vegetation units.
Figure 2.1 - YIPL’s Yilgarn Operations (Location of F Deposit)
Sixteen vegetation units were mapped in the survey study area, of which eight are potentially restricted to the southern Koolyanobbing Range. Two hundred and fifty flora taxa were identified in the survey study area, including 10 Priority flora species and one threatened flora species. The proposal would impact nine of the 16 mapped vegetation units. Four are potentially restricted vegetation units within the PEC. The proposal would impact less than 10 per cent of the extent of each vegetation unit occurrence on the southern Koolyanobbing Range.

The proposal would impact six of the 10 identified Priority flora species. Only one of the six species is a priority one species (P1); the others are priority three or four species. Beyeria rostellata (P1) is more restricted than the other species, occurring on the Koolyanobbing and Mt Jackson Ranges, plus a small population on the Helena-Aurora Range. Only 1.5% of Beyeria rostellata would be impacted by the proposal.

The endemic, threatened flora taxon Tetratheca erubescens occurs in the survey study area. The species is endemic to the Koolyanobbing Range, and is limited to approximately 1.6 km along the southern part of the range. It occupies small rock crevices on steep ironstone faces and upper rocky slopes. It is a geographically restricted species, with its extent of occurrence approximately 64 ha, and its area of occupancy is estimated at 3.5 ha due to its habitat preferences e.g. cliff faces. Tetratheca erubescens is specially protected under the BC Act as a threatened species, and is currently listed under Schedule 3 – Flora that are considered likely to become extinct or rare, as vulnerable flora.

The breeding system of the species is largely unknown but has been inferred from floral morphology and studies of close relatives nearby as being insect-pollinated, most likely via sonication (buzz pollination) by native bees. Seed dispersal vectors are also unknown, but the presence of a seed aril suggests it is likely to be ant dispersed (Bull 2007).

A census of Tetratheca erubescens was conducted in 2013, and additional opportunistic sightings were recorded by the proponent in 2014. The census and recent recordings identified a total of 6,333 individual plants in four main groupings (Figure 3.1).

The distribution of Tetratheca erubescens is confined to the area in and around the mining proposal. The Public Environmental Review document (Cliffs 2015) identified a direct impact of up to 1,383 individuals (22%) of the Tetratheca erubescens species. Subsequently modifications to the mine design were proposed by Cliffs to reduce the direct effect to Tetratheca erubescens. The change to the proposal was consented to by the Environmental Protection Authority (EPA) in July 2016. The modified proposal would result in the direct impact of up to 965 Tetratheca erubescens individuals (15%); 313 (5%) in Stage 1, and 652 (10%) in Stage 2. The EPA report and recommendations (EPA 2016) noted that the Proponent’s further modifications undertaken to reduce direct impact to Tetratheca erubescens allows a cautious staged approach with the approval to proceed with Stage 2 of the proposal being dependent on the successful establishment of at least 313 new Tetratheca erubescens individuals.

2.4 Requirements of the Condition

This environmental management plan (EMP) was prepared in accordance with Ministerial Statement 1054, Conditions 6-1 to 6-7 for the Koolyanobbing Range F Deposit Project. The requirements of these conditions are addressed in the following sections of the Condition EMP.
### Table 2.1 – Ministerial Statement 1054 Conditions 6.1 - 6.7

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>SECTION IN CONDITION EMP</th>
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<tr>
<td><strong>6.1</strong> Prior to the commencement of any ground disturbing activities, or as otherwise agreed in writing by the CEO, the proponent shall prepare and submit a Condition Environmental Management Plan to the satisfaction of the CEO, on advice of Parks and Wildlife, to demonstrate that the following environmental outcomes will be met:</td>
<td>Whole of document</td>
</tr>
<tr>
<td>1. No adverse effects on native flora and vegetation outside the Stage 1 and 2 development envelopes as shown in Figure 3.1 in Schedule 1 and delineated by coordinates in Schedule 2 or within the Stage 2 development envelope until the requirements of condition 9 have been met;</td>
<td>2.5.3, 2.6, 3.1, 3.2, 3.3, 3.4, 3.5, 6</td>
</tr>
<tr>
<td>2. No adverse effects on greater than 313 <em>Tetratheca erubescens</em> plants within Stage 1 development envelope as shown in Figure 3.1 in Schedule 1 and delineated by coordinates in Schedule 2; and</td>
<td></td>
</tr>
<tr>
<td>3. No adverse effects on greater than 652 <em>Tetratheca erubescens</em> plants within Stage 2 development envelope as shown in Figure 3.1 in Schedule 1 and delineated by coordinates in Schedule 2 once the requirements of condition 9 have been met.</td>
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</table>

**6.2** The plan required by condition 6-1 shall include provisions required by condition 6-3 to address indirect impacts on native flora and vegetation (including *Tetratheca erubescens* and Priority flora species) and vegetation health including from, but not limited to dust, weeds and fire as a result of implementation of the proposal. The plan shall be developed in consultation with an independent expert in the assessment and management of dust impacts on plants, to be endorsed by the CEO.

**6.3** The Condition Environmental Plan shall:

1. include the results of a suitable, contemporary baseline flora and vegetation survey to determine flora and vegetation health and condition pre-ground disturbance;
2. specify trigger criteria that will trigger the implementation of trigger level actions if exceeded;
3. specify threshold criteria that:
   a) provides a limit, which the proponent must not exceed, beyond which the environmental outcome specified in condition 6-1 is not achieved; and
   b) will trigger the implementation of threshold contingency actions if exceeded.
4. specify monitoring and analysis to determine if trigger and threshold criteria are exceeded;
5. specify trigger level actions to be implemented in the event that trigger criteria have been exceeded;
6. specify threshold contingency actions to be implemented in the event that threshold criteria are exceeded; | 2.5.1, 3.1, 3.1, 3.2 and Tables 3.3 and 3.5, 3.3 and Table 3.5, 3.4 and Tables 3.6 – Table 3.8 |
<table>
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<tr>
<th><strong>CONDITION</strong></th>
<th><strong>SECTION IN CONDITION EMP</strong></th>
</tr>
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<tr>
<td>7. provide the format and timing for the reporting of monitoring results and analysis against threshold criteria to demonstrate that condition 6-1 has been met over the reporting period in the Compliance Assessment Report required by condition 4; and</td>
<td>Tables 3.6 – Table 3.8 and Section 3.6</td>
</tr>
<tr>
<td>8. provide for reporting of exceedances of the threshold criteria.</td>
<td>Tables 3.6 – Table 3.8 and Section 3.6.3</td>
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6.4 After receiving notice in writing from the CEO that the Condition Environmental Management Plan satisfies the requirements of condition 6-3 for condition 6-1, prior to the commencement of ground disturbing activities, unless otherwise agreed by the CEO, the proponent shall:

1. commence implementation of the provisions of the Condition Environmental Management Plan;
2. monitor the health and condition of the remaining *Tetratheca erubescens* plants at the Koolyanobbing Range. Parameters to be monitored include, but are not limited to, mortality, recruitment, vegetation health and reproductive health;
3. monitor the health and condition of Priority 1 flora species and native vegetation adjacent to the Development Envelope for Stages 1 and 2; and
4. continue to implement the Condition Environmental Management Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the outcome specified in condition 6-1 has been met.

6.5 In the event that monitoring indicates exceedance of threshold criteria specified in the Condition Environmental Management Plan, the proponent shall:

1. report the exceedance in writing within seven (7) days of the exceedance being identified;
2. immediately implement the threshold contingency actions specified in the Condition Environmental Management Plan and continue implementation of those actions until the trigger criteria are being met, or until the CEO has confirmed by notice in writing that it has been demonstrated that the environmental outcome in conditions 6-1 is being met and implementation of the trigger level actions and/or threshold contingency actions are no longer required;
3. investigate to determine the cause of the threshold criteria being exceeded;
4. identify additional measures required to prevent the threshold criteria being exceeded in the future;
5. investigate to determine potential environmental harm or alteration of the environment that occurred due to threshold criteria being exceeded; and
6. provide a report to the CEO within ninety (90) days of the exceedance being reported. The report shall include:
   a) details of threshold contingency actions implemented;
   a) the effectiveness of the threshold contingency actions implemented, monitored and measured against trigger criteria and threshold criteria;
   b) the findings of the investigations required by condition 6-5(3) and 6-5(5);
   c) additional measures to prevent the threshold criteria being exceeded in the future; and
   d) measures to control or abate and mitigate the significant adverse environmental impacts which may have occurred.

6.6 The proponent:
   1. may review and revise the Condition Environmental Management Plan, or
   2. shall immediately review and revise the Condition Environmental Management Plan if the environmental outcomes in condition 6-1 are not being met or as and when directed by the CEO.

6.7 The proponent shall implement the latest revision of the Condition Environmental Management Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 6-3.

2.5 Rationale and Approach in Meeting the Environmental Outcome

2.5.1 Results of Baseline Surveys and Monitoring

Baseline Vegetation Surveys

A detailed flora and vegetation survey for a ‘study area’ covering approximately 1,714 hectares (within which the F Deposit proposal area of 203 hectares is located) was completed in August/September 2013 (Woodman 2014). A total of 199 20 x 20m non-permanent flora survey quadrats were established; 153 in the study area, and 46 quadrats within an adjacent area that had previously been mapped (Western Botanical 2009). Targeted searching for conservation significant flora taxa was also undertaken. The report incorporated the results of previous surveys undertaken at the Southern Koolyanobbing Range (Western Botanical, 2007-2008 unpublished data; Western Botanical 2009; Maia 2013) to provide distribution and abundance information for conservation significant taxa.

A total of 250 vascular flora taxa were recorded within the study area. These taxa represent 54 families and 137 genera. The most well-represented families were Fabaceae (33 taxa and 1 known hybrid), Asteraceae (29 taxa), Myrtaceae (19 taxa), Chenopodiaceae (17 taxa and 1 putative hybrid) and Scrophulariaceae (13 taxa).

One Rare Flora taxon listed under the BC Act was recorded from the study area, being Tetratheca erubescens. No flora taxa listed as Threatened Species of flora under the Environment Protection and Biodiversity Conservation Act 1999 (C’th) (EPBC Act) were recorded.
Six flora taxa classified by the Department of Biodiversity, Conservation and Attractions (DBCA) as ‘Priority’ are present within the proposal area:

- Beyeria rostellata (P1);
- Acacia dissona var. indoloria (P3);
- Hibbertia lepidocalyx subsp. tuberculata (P3);
- Lepidosperma ferricola (P3);
- Stenanthemum newbeyi (P3); and
- Banksia arboarea (P4).

Twelve weed species were recorded in the study area; none of the weed species found within or adjacent to the study area are Declared Pests under the Biosecurity and Agriculture Management Act 2007 (WA) or listed as Weeds of National Significance. Appendix 1 provides a map of the weeds recorded in the general project area.

A total of 16 vegetation units were mapped based upon statistical analysis of data collected from 199 vegetation quadrats. The diversity of vegetation units in the study area is considered to be relatively high, as there is a relatively high variety of habitat types owing to the varied topography in the study area. The condition of the majority of the vegetation in the study area was ranked as ‘Excellent’, indicating a pristine condition with no signs of significant disturbance and weed taxa (if any) not considered serious environmental weeds and present at low levels. The only areas of vegetation not considered pristine were several small areas that had been disturbed by previous mining activities.

No Threatened Ecological Communities (TECs) listed under the EPBC Act, or classified by DBCA, were recorded as coinciding with the study area. The DBCA-classified Priority Ecological Community (PEC) “Koolyanobbing vegetation complexes (banded ironstone formation) (Priority 1)” coincides with the study area. The boundary of this PEC generally corresponds with the boundary of the Koolyanobbing Range landform, rather than coinciding with the vegetation units present.

**Baseline Census of Tetratheca erubescens**

A detailed survey and census of Tetratheca erubescens at the southern Koolyanobbing Range was undertaken in June/July 2013 (Maia 2013). The purpose of the census was to develop an understanding of the population size, distribution and health condition of Tetratheca erubescens on the southern Koolyanobbing Range. Information was also obtained on the habitat and vegetation associations, foliar cover, life stage and reproductive status.

The baseline census located a total of 6,321 Tetratheca erubescens, of which 131 were dead. (The total figure was revised to 6,333 after additional individuals were located by subsequent opportunistic recordings.) The population was found to be distributed in four essentially spatially-separate groupings (Figure 3.1). One group is located on the northern side of the range and three groups occur on the southern side. It was found that Tetratheca erubescens occurs on cliff faces, rocky slopes, at the base of cliffs, on boulders and in rock cavities, with the majority (89%) occurring on cliff faces. Tetratheca erubescens was found to occur on both ironstone and non-ironstone substrates. The condition and foliar width of Tetratheca erubescens was lowest for plants located on the northern side of the range. It was surmised that this may be due to relatively higher solar radiation.

The population was found to be strongly dominated by the adult age class (98%), and approximately 15% of the total population had flowers and/or fruit at the time of the census.
Baseline Monitoring of *Tetratheca erubescens*

**Annual Monitoring**

Annual monitoring was undertaken in November 2015 and November 2016, providing two years of pre-mining baseline data.

The design and methods for the annual monitoring of *Tetratheca erubescens* are described in Section 3.2, and the results are summarised in Appendix 2. A detailed presentation of the results of the 2015 and 2016 annual monitoring is contained in the respective annual monitoring reports (Cliffs 2016b and 2017b).

**Monthly Monitoring**

Baseline monitoring of *Tetratheca erubescens* was undertaken at monthly intervals from October 2016 to March 2017.

The design and methods for the monitoring of *Tetratheca erubescens* are described in Section 3.2. *Tetratheca erubescens* in 10 plots were monitored in October 2016. Additional plots were added in November 2016 (Plot 26) and December 2016 (Plot 13). A summary of the results is provided in Appendix 3.

**Baseline Monitoring of Priority Species and Native Vegetation**

Baseline monitoring of the Priority species *Beyeria rostellata* (P1) and *Stenanthemum newbeyi* (P3) was undertaken in November and December 2016 and February 2017. Baseline monitoring of native vegetation was undertaken in April 2017, prior to the commencement of mining at F Deposit.

The design and methods for the monitoring of Priority species and native vegetation are described in Section 3.2. A summary of the results of the priority species monitoring is provided in Appendix 3.

**Baseline Monitoring of Dust Deposition**

Baseline monthly dust deposition monitoring commenced in November 2016. The methods for the dust deposition monitoring are described in Section 3.2. Results are provided in Appendix 3.

Appendix 3 also includes historical dust data recorded during mine pit development at Windarling Range. Monthly dust deposition data at Windarling was obtained at three locations approximately 20m from the W5 West Pit from the commencement of mining in 2010. The data demonstrated a clear pattern of highest dust deposition during the first six months (i.e. during land clearing and near-surface mining), followed by a steady decline over time. The pattern of declining dust deposition was correlated with increasing mine pit depth (RL), and was relatively independent of the volume of material being mined. The reduction in dust deposition over time is likely to be a reflection of (a) increasing pit depth resulting in an increasing spatial separation of mining from the pit crest, (b) the material being mined changing from weathered surface material compared to more competent rock at depth, and (c) increasing moisture levels of the deeper material. A similar pattern is expected for F Deposit, where the mining methods and characteristics of the material to be handled during are similar.

The Windarling dust data has been used to assist in setting the dust trigger criteria proposed in this EMP.

### 2.5.2 Key Assumptions and Uncertainties

The spatial extent of the F Deposit proposal footprint has been clearly defined (Figure 3.1). There is a high degree of certainty that the direct effects of the proposal on flora and vegetation will be as
planned given that the demarcation and clearing process is subject to well-established methods of control.

The main area of uncertainty, as identified by the EPA, is in regard to potential indirect effects of the proposal on *Tetratheca erubescens* (EPA 2016). The EPA considered that population fragmentation, disruption of pollinators, instability of landforms and dust deposition were the key potential indirect effects. The EPA noted that effects of the proposal on genetic variation and structuring of the *Tetratheca erubescens* population is minimal, and is further improved by the modified proposal. Likewise, the incorporation of ecological corridors in the modified proposal is expected to assist in maintaining pollinator connectivity. The EPA considered that landform stability could be effectively managed in accordance with requirements specified by the Department of Mines, Industry Regulation and Safety (now Department of Mines, Industry Regulation and Safety). With regard to dust deposition, the EPA was of the view that there “is some uncertainty in regard to the consequences of dust impacts on *Tetratheca* species”. Consequently, the EPA recommended a condition that requires the proponent to “prepare and implement a Condition Environmental Management Plan which is to be developed in consultation with an independent expert in the assessment and management of dust impacts on plants”. In addition, the EPA considered that triggers for contingency management actions for dust should be conservative in order “to predict any impacts early”. This condition EMP therefore has a particular focus on addressing potential impacts of dust on flora and vegetation.

### 2.5.3 Management Approach

**Direct Effects**

The management approach to control direct effects on native flora and vegetation outside the development envelope involves the application of management controls to ensure that land disturbance is confined to the areas approved for disturbance. The relevant management controls include:

- An approvals implementation process to ensure that approvals requirements are communicated internally and entered into relevant site systems and databases;

- A site disturbance permit process to ensure checking and management sign-off prior to clearing;

- A clearing procedure that includes pre-clearing survey and demarcation of clearing boundaries, and post-clearing verification and sign-off;

- Controls on blasting and surface mining near the pit crest to minimise rock overspill and blast vibration; and

- Inductions and awareness training for site-based personnel and contractors.

**Indirect Effects**

The management approach to addressing potential indirect effects on native flora and vegetation from dust will be to closely monitor and manage dust emissions, particularly during the early stages of development when clearing and near-surface mining is expected to generate peak levels of dust. Other potential indirect factors, e.g. changes to wind or solar exposure or substrate water retention, are considered to be of low risk but, if encountered, would be expected to be related to proximity to the mine footprint. Hence the monitoring program has been designed to detect spatial differences in vegetation health with regard to proximity to the mine.

The monitoring program is designed to detect short-term (two-monthly or quarterly) and long-term (annual) variation in the health of flora and vegetation. For the Rare Flora *Tetratheca erubescens* and priority species, annual monitoring will involve the measurement of condition status, reproductive status, recruitment and mortality of the population. Annual monitoring of native
vegetation will record numbers of individuals of all species present in monitoring plots. The short-term monitoring of *Tetratheca erubescens* will assess stem surface dust, presence of soft tips, condition status, reproductive status and mortality.

### 2.6 Rationale for the Choice of Environmental Criteria

The environmental criteria to be used will function to demonstrate that the environmental outcomes specified in Ministerial Statement 1054 are being met. The environmental outcomes to be met are ‘no adverse effects’ on flora and vegetation outside the development envelope. The definition adopted for ‘no adverse effect’ for the purposes of this management plan is: *No statistically significant adverse effect on native flora and vegetation outside the development envelope.*

The environmental criteria proposed to be used for trigger and threshold criteria are relevant measures of vegetation condition and dust deposition.

#### 2.6.1 Trigger Criteria

Dust deposition was selected as a trigger criterion as it was identified by the EPA during the F Deposit environmental assessment process as a potential risk factor to flora and vegetation health. It was not known at what levels dust could affect vegetation health but, in order to provide a conservative approach, Cliffs proposed to use multiple trigger criteria using measures of dust deposition and vegetation condition. The rationale for including a trigger based on dust deposition was to ensure that triggers for contingency management actions for dust were conservative, i.e. if high dust deposition levels occur they will trigger management actions, regardless of whether there are any accompanying signs of an effect on vegetation condition. The trigger criteria for dust deposition were set based on the levels recorded during initial pit development and mining in a comparable setting at W5 West Pit at Windarling Range (see section 2.5.1 above). The trigger levels for dust deposition at F Deposit were selected on the basis that they are below the peak dust levels recorded at W5 West Pit.

The rationale for applying measures of flora condition as trigger criteria is to provide a means of detecting and responding to possible early signs of indirect effects on vegetation. Seasonal and annual decline and recovery in vegetation condition is normal in natural populations. However, if the pattern of condition shows a correlation with proximity to the mine or levels of dust deposition, and the pattern persists over time, then factors associated with mining may be implicated. Thus the proposed trigger criteria were designed to detect early signs of possible effects based on the spatial pattern. The trigger criteria are conservative in that a trigger event will occur prior to determining whether the pattern persists over time i.e. the trigger criteria are based on a single monitoring event. A further level of conservatism is applied by using two independent methods for measuring *Tetratheca erubescens* condition (% live material and index of chlorophyll fluorescence).

#### 2.6.2 Threshold Criteria

In contrast to the trigger criteria, which are intended to provide an indication of possible or potential effects in advance of a significant effect occurring, the threshold criteria are intended to represent a situation where it is concluded, with a high degree of confidence, that a negative effect on flora and vegetation outside the proposal area has occurred as a result of implementing the project.

The threshold criteria for *Tetratheca erubescens* relate to measures of condition and mortality. In the case of plant condition, the criteria specify a decrease in condition that is ‘persisting’, i.e. continues beyond one sampling event and therefore has the potential to reduce the long-term survival and/or reproductive capacity of the flora. Persistence over two consecutive two-monthly sampling periods in the first year from commencement of mining (and two quarterly sampling periods in year 2) were adopted as the criteria. Two independent methods of measuring *Tetratheca*
erubescens condition (% live material and index of chlorophyll fluorescence) have been adopted and operate as independent threshold criteria.

3. **CONDITION EMP PROVISIONS**

3.1 **Environmental Criteria**

**Table 3.1 – Environmental Criteria**

<table>
<thead>
<tr>
<th>TRIGGER CRITERIA</th>
<th>Environmental Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust deposition (g/m²/month (S₁₁))</td>
<td>Dust deposition at any (non-reference) dust monitoring site exceeds:</td>
</tr>
<tr>
<td></td>
<td>• 80g/m²/month (S₁₁) during the first 12 months from commencement of mining;</td>
</tr>
<tr>
<td></td>
<td>• 40g/m²/month (S₁₁) after 12 months from commencement of mining.</td>
</tr>
<tr>
<td><strong>Tetratheca erubescens</strong> condition (Index of Chlorophyll Fluorescence (ICF) and/or % live material)</td>
<td>Monitoring of Tetratheca erubescens indicates a statistically significant relationship between condition (ICF and/or % live material) and dust deposition, distance from the proposal boundary or mine-related factor.</td>
</tr>
<tr>
<td><strong>Priority species</strong> condition (Index of Chlorophyll Fluorescence (ICF) and/or % live material)</td>
<td>Monitoring of Priority species indicates a statistically significant relationship between condition (ICF and/or % live material) and dust deposition, distance from the proposal boundary or mine-related causal factor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THRESHOLD CRITERIA</th>
<th>Environmental Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tetratheca erubescens</strong> mortality (deaths among the sample of monitored individuals)</td>
<td>Monitoring of Tetratheca erubescens indicates a statistically significant relationship between mortality and dust deposition, distance from the proposal boundary or mine-related causal factor.</td>
</tr>
<tr>
<td><strong>Tetratheca erubescens</strong> condition (Index of Chlorophyll Fluorescence and/or % live material)</td>
<td>Monitoring of Tetratheca erubescens indicates a statistically significant relationship between condition (ICF and/or % live material) and dust deposition, distance from the proposal boundary or mine-related causal factor for two consecutive two-monthly monitoring dates in year 1 or two consecutive quarterly monitoring dates in year 2.</td>
</tr>
<tr>
<td><strong>Priority species and native vegetation mortality</strong> (deaths among the sample of monitored individuals)</td>
<td>Monitoring of Priority species and/or native vegetation indicates a statistically significant relationship between mortality, dust deposition, distance from the proposal boundary or mine-related causal factor.</td>
</tr>
</tbody>
</table>

3.2 **Monitoring**

The purpose of monitoring is to inform, through the environmental criteria, if the condition environmental outcome is being achieved and when trigger level actions or threshold contingency actions will be implemented. This section describes how YIPL will undertake monitoring to determine the performance against the environmental criteria. Refer to Table 3.5 for a summary of the proposed monitoring methods and associated trigger actions. As per Ministerial Statement 1054...
condition 6-4, the monitoring will continue until it is demonstrated that the outcomes specified in condition 6-1 (refer to Section 2.4) have been met.

Monitoring of flora and vegetation will be undertaken in accordance with a sampling framework and associated data analysis methods developed in consultation with specialist statisticians Data Analysis Australia (DAA 2015, 2016, 2017a and 2017b). The monitoring program is described in detail in Cliffs (2017a). Modifications to the sampling design for *Tetratheca erubescens* were adopted following consultation with the Office of the Environmental Protection Authority (OEPA) (now EPA Services) and Parks and Wildlife (now DBCA). The modifications involved the inclusion of two additional monitoring plots, increasing the number of monitored plants at distances closer to the proposal boundary, and a reduction in the frequency of monitoring of *Tetratheca erubescens* from monthly to two-monthly during the first year of mining. Additional monitoring plots were also established for Priority species and native vegetation.

### 3.2.1 Tetratheca erubescens

The monitoring program has been designed to provide a means of detecting change in *Tetratheca erubescens* condition, reproductive output and population numbers over time and space, particularly in relation to mining activity and levels of dust deposition. Monitoring utilises fixed area plots (Figure 3.1) to measure a representative subsample of the population of *Tetratheca erubescens*. The number of *Tetratheca erubescens* contained within the monitoring plots is approximately 50% of the total population of *Tetratheca erubescens* occurring outside the mine proposal area, although the steep terrain of the habitat limits the number of *Tetratheca erubescens* that are accessible for individual assessment.

#### Annual Monitoring

All accessible individuals of *Tetratheca erubescens* within the monitoring plots will be monitored annually. Annual monitoring will be undertaken in late spring to coincide with the normal flowering and fruiting period.

Data will be obtained annually for:

- Reproductive status (vegetative, flowering and/or fruiting);
- Condition by Chlorophyll Fluorescence (Fv/Fm);
- Condition by % live material;
- Mortality (no. individuals);
- Recruitment (no. individuals); and
- Life stage (seedling, juvenile or adult).

*Seedling = less than one-year-old; juvenile = 1-3 years old and not yet reproductive; adult = more than 3 years old and/or reached reproductive status.*

#### Two-Monthly/Quarterly Monitoring

A sampling interval of two-months will apply for the first 12 months from commencement of mining, reducing to quarterly in the second year and thereafter to annually, provided no trigger event occurs. YIPL will notify the Department of Water, Environment and Regulation (DWER) and DBCA when the monitoring frequency changes from quarterly to annually. If a trigger event occurs, the sampling interval will change only after a period of 12 months has elapsed without a trigger event. Should Stage 2 of the proposal proceed, the monitoring will revert to two-monthly, then quarterly and annually for monitoring sites within 500m of the Stage 2 boundary.
Figure 3.1 – Location of the Proposal and Monitoring Sites in Relation to the Distribution of *Tetrapheca erubescens*. 
Two-monthly (year 1) and quarterly (year 2) monitoring of *Tetratheca erubescens* will obtain data on:

- Reproductive status (vegetative, flowering and/or fruiting);
- Condition by Chlorophyll Fluorescence (Fv/Fm);
- Condition by % live material;
- Mortality (no. individuals);
- Soft tips (new growth); and

Leaf surface dust (% quartile visual estimate).

**Chlorophyll Fluorescence Method as a Measure of Vegetation Condition**

Chlorophyll fluorescence is a technology that is increasingly being used as an indicator of stress levels in vegetation. It has been widely applied in forestry and agricultural studies and tested on a diverse array of vascular plants. A comprehensive technical review of chlorophyll fluorescence technology, including its application to field surveys is provided by Kalaji *et al.* (2014). Fv/Fm (index of chlorophyll fluorescence) has a normal range of 0.7 to 0.8 across a broad range of different vascular plan taxa. The ratio declines when plants are under conditions of stress. The method directly measures physiological function and thus offers significant advantages over the more traditional measures of vegetation condition that use indirect indicators such as dead/live leaf material or leaf colour. The recent availability of hand-held instruments capable of measuring Fv/Fm in the field has contributed to the attractiveness of this method.

There appears to conflicting opinion in the literature about what is an appropriate value of Fv/Fm to use as an indicator of stress, but generally a value of <0.6 adopted. However, this becomes less relevant where relative measures of Fv/Fm are being used to compare the level of stress of a population of plants either spatially or over time (as is proposed in this management plan). There also appears to be some debate about whether Fv/Fm is diurnally and seasonally stable (Murchie *et al.* 1999; Richie 2006), although this potential source of error can be managed by applying a fixed sequence of undertaking the monitoring of plots and hence standardising time of day of the monitoring.

Baseline data for chlorophyll fluorescence has been collected for *Tetratheca erubescens* and Priority flora (Appendices 2 and 3). The results are within the expected range for unstressed vegetation with the exception of some unexpectedly low readings for a few individuals of *Tetratheca erubescens* in January 2017 (Figure A3.3). The low readings coincided with very high temperatures on the day they were monitored (over 40°C). It is not known whether high temperature was the causal factor. Literature suggests that heat induced changes to Chlorophyll Fluorescence vary from species as well as the thermal environment these species are propagated in (Schreiber & Berry 1977). Currently there is insufficient data to indicate unequivocally that this is the case with *Tetratheca erubescens*. Further monitoring and data are required to assess if there is possibly a causal relationship. It is noteworthy that all of the *Tetratheca erubescens* had recovered at the February 2017 monitoring date.

**Monitoring Sample Size and Distribution in Relation to Distance from the Proposal Boundary**

The two-monthly/quarterly monitoring will utilise a fixed sample of 15 randomly selected mature *Tetratheca erubescens* within each sampling plot for plots located beyond 50m of the proposal boundary. For each plot located within 50m of the proposal boundary, 15 plants located within 20m of the proposal boundary and 5-12 plants located at distances of 20-50m from the boundary will be included in the monitored sample (Table 3.2).
Table 3.2 – Number of Monitored *Tetratheca erubescens* Located in Monitoring Plots <20m, 20-50m and >50m from the Proposal Boundary

<table>
<thead>
<tr>
<th>DISTANCE FROM BOUNDARY</th>
<th>PLOT NUMBER</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 5 7 9 10 11 13 14 16 18 21 25 26</td>
<td></td>
</tr>
<tr>
<td>&lt;20m</td>
<td>19 13 15 21 15</td>
<td>83</td>
</tr>
<tr>
<td>20-50m</td>
<td>6 12 12 5 12</td>
<td>47</td>
</tr>
<tr>
<td>&gt;50m</td>
<td>15 15 15 15 15</td>
<td>120</td>
</tr>
<tr>
<td>Plot totals</td>
<td>15 15 25 25 15 27 26 27 15 15 15 15 15</td>
<td>250</td>
</tr>
</tbody>
</table>

**Monitoring of Plants that Appear Dead**

Experience with the related species *Tetratheca paynterae* subsp. *paynterae* has shown that individuals that appear to be dead can sometimes re-sprout from the base. Any individuals of *Tetratheca erubescens* found to have no live (green) above-ground material present at the time of monitoring will be classified as ‘dead’ for the purpose of assessing mortality within the monitored sample. However, the ‘dead’ plant will continue to be checked for at least 12 months and reinstated in the monitored sample if it is found to re-sprout. It will not be replaced in the monitored sample by another live plant.

**Power Analysis to Confirm Adequacy of the Sample Size**

A ‘power analysis’ of the baseline data has been undertaken by Data Analysis Australia to determine whether a sample size of 15 individuals per plot is adequate to reliably detect changes in plant condition (DAA 2017a). The power analysis confirmed that this sample size is adequate for detecting small changes (in the order of 5%) in condition for both chlorophyll fluorescence and % live material. Should a higher level of sensitivity and confidence in the result be desirable (e.g. following a trigger event), the sample size can be readily increased. Cliffs obtained baseline data for additional plants in each plot in order to allow for comparison with a larger sample size if required in future.

**Data Analysis and Detection of Trigger and Threshold Events**

The proposed data analysis methods, as recommended by DAA (DAA 2017a), involve the use of linear mixed models to test for the effects of proximity to the mine and dust deposition on index of chlorophyll fluorescence, % live material and mortality as per the BACI (Before/After/Control/Impact) approach. Time and proximity are also included as interacting factors.

Following each collection of monitoring data, analysis will be undertaken using a linear mixed model to produce t-test values for the factors indicated in Table 3.3.

The test of whether trigger or threshold criteria are met will be based on detecting a significant adverse effect of Before and after mining commencement, Dust deposition and/or Proximity on ICF, % live material and/or mortality (P < 0.05 in a one-tailed test).
Table 3.3 – Linear Mixed Model Design

<table>
<thead>
<tr>
<th>MONITORING PARAMETER (DEPENDENT VARIABLE)</th>
<th>PREDICTORS (FIXED EFFECTS)</th>
<th>RANDOM EFFECTS</th>
</tr>
</thead>
</table>
| Chlorophyll Fluorescence (ICF) % Live Material | **Main effects**  
  • Before and after mining commencement  
  • Proximity (distance from proposal boundary)  
  • Dust deposition  
  • Reproductive status  
  • Soft stem tips  
  **Interactions**  
  • Time*Proximity | • Plot number  
  • Plant number  
  • [Time]^  
  ^If there is no interaction between Time and Proximity, then Time will be included as a random effect.

| Mortality | **Main effects**  
  • Before and after mining commencement  
  • Proximity (distance from proposal boundary)  
  • Dust deposition  
  **Interactions**  
  • Time*Proximity | • Plot number  
  • Plant number  
  • [Time]^  
  ^If there is no interaction between Time and Proximity, then Time will be included as a random effect.

3.2.2 Priority Species, Native Vegetation and Weeds

Because the distribution of Priority species does not generally coincide with the distribution of *Tetratheca erubescens*, separate, additional monitoring plots have been established. The monitoring program for Priority species utilises 12 fixed area plots (Figure 3.2) located at a range of distances from the proposal boundary. These plots will also be utilised to monitor all native vegetation present within the plots.

Monitoring will occur annually in spring, commencing in spring 2017.

Priority Species

The Priority species, *Beyeria rostellata* (P1), *Stenanthemum newbeyi* (P3), *Lepidosperma ferricola* (P3), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3) and *Banksia arborea* (P4) will be monitored. The rationale for selecting *Beyeria rostellata* is that this species has the highest conservation significance (Priority 1) of the six Priority species to be impacted by the F Deposit proposal. A second Priority 1 species, *Acacia haematites*, occurs in the general area but is not impacted by the proposal and is located at greater distance from the proposal boundary. *Stenanthemum newbeyi*, *Lepidosperma ferricola* and *Hibbertia lepidocalyx* subsp. *tuberculata* were selected as species that are abundant and co-occurring with *Beyeria rostellata* in the near vicinity of the proposed mine pits (Figure 3.2). All are perennial species. *Beyeria rostellata* and *Stenanthemum newbeyi* are shrubs, but have quite different leaf forms; *Beyeria rostellata* has narrow viscous leaves and *Stenanthemum newbeyi* has broad waxy leaves that are hairy on the underside. *Lepidosperma ferricola* is tufted sedge with long leaves. *Banksia arborea* is included as it is widespread and is a tree.
Figure 3.2 – Location of the Proposal and Monitoring Sites for Priority Species and Native Vegetation
For *Beyeria rostellata*, *Stenanthemum newbeyi*, *Lepidosperma ferricola* and *Hibbertia lepidocalyx ssp. tuberculata* data will be obtained annually for:

- Reproductive status (vegetative, flowering and/or fruiting)
- Condition by Chlorophyll Fluorescence (Fv/Fm)
- Condition by % live material
- Mortality (no. individuals)
- Recruitment (no. individuals)
- Leaf surface dust (% quartile visual estimate)

The methods of data analysis will be the same as described above for *Tetratheca erubescens*.

The numbers of *Banksia arborea* to be monitored are lower because of its lower abundance and the use of a different monitoring method (photographic) for this species. Photographic monitoring from fixed photographic points will be undertaken to provide a qualitative check for any decline in the general health and condition of this species, and any recruitment of new individuals will be recorded.

The number of *Beyeria rostellata*, *Stenanthemum newbeyi*, *Lepidosperma ferricola* and *Hibbertia lepidocalyx* subsp. *tuberculata* to be monitored in each plot will be 15 individuals wherever possible. The numbers per plot are shown in Table 3.4. The sample size was guided by the results of a ‘power analysis’ of the baseline data for *Beyeria rostellata* and *Stenanthemum newbeyi* undertaken by Data Analysis Australia to the minimum sample size adequate to reliably detect changes in plant condition (DAA 2017a). The power analysis confirmed that a sample size of 15 was adequate for detecting small changes (in the order of 5-10%) in condition for both chlorophyll fluorescence and % live material. Should a higher level of sensitivity and confidence in the result be desirable (e.g. following a trigger event), the sample size can be increased. Due to the low number of plots where ≥15 individuals of *Hibbertia lepidocalyx* subsp. *tuberculata* are present, this species will not be used in assessing whether trigger and threshold criteria are met.

**Table 3.4 – Number of Individuals of Priority Species in each Monitoring Plot. Monitoring will Occur Where Numbers of a Species in a Plot are >15. Refer to Figure 3.2 for Plot Locations.**

<table>
<thead>
<tr>
<th>PLOT NUMBER</th>
<th>NUMBER OF INDIVIDUALS PER MONITORING PLOT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>Beyeria rostellata</em></td>
</tr>
<tr>
<td>PS1</td>
<td>&gt;15</td>
</tr>
<tr>
<td>PS2</td>
<td>&gt;15</td>
</tr>
<tr>
<td>PS3</td>
<td>&gt;15</td>
</tr>
<tr>
<td>PS4</td>
<td>&gt;15</td>
</tr>
<tr>
<td>PS5</td>
<td>3</td>
</tr>
<tr>
<td>PS6</td>
<td>2</td>
</tr>
<tr>
<td>PS7</td>
<td>&gt;15</td>
</tr>
<tr>
<td>PS8</td>
<td>0</td>
</tr>
<tr>
<td>PS9</td>
<td>0</td>
</tr>
<tr>
<td>PS10</td>
<td>5</td>
</tr>
<tr>
<td>PS11</td>
<td>&gt;15</td>
</tr>
<tr>
<td>PS12</td>
<td>13</td>
</tr>
</tbody>
</table>

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Native Vegetation and Weeds

Monitoring of native vegetation and weeds will utilise the same plots as for the Priority species. Monitoring will obtain data on:

- Number of native species;
- Number of individuals each native species;
- Keighery scale condition assessment;
- Number of weed species; and
- Number of individuals of each weed species.

The method of data analysis will use PERMANOVA to test for change in number of species and numbers of individuals. The condition data for obtained for Priority species will also provide a surrogate for general native vegetation health.

In addition to the regular monitoring of weeds within all flora and vegetation monitoring plots (bi-monthly, quarterly and annual), the general management and control of weeds in the F Deposit project area will be addressed in accordance with YIPL’s Yilgarn Operations weed management procedures.

All earthmoving, drilling and construction machinery and associated equipment intended for use in the project area will be thoroughly cleaned prior to travelling to site. Machinery and equipment will be subject to inspection, and issued with a Weed Hygiene Certificate before entering the F Deposit project area.

Weed occurrences noted within the project area will be recorded, entered into the YIPL Weed Register and subject to weed control measures annually as a minimum.

3.2.3 Dust Deposition

Two-monthly monitoring of dust deposition is undertaken using standard dust deposition gauges located within flora monitoring plots and at two remote sites located to the west and east and approximately 1km from the proposal boundary (Figure 3.3). Dust monitoring commenced in October 2016.

Elevated dust levels at locations close to the mine pits are expected to occur during the initial clearing and mining of the upper benches. Based on dust monitoring results at Windarling, dust deposition is expected to decline significantly as the pit depth increases. It is proposed to reduce the dust deposition sampling frequency to quarterly once dust levels have consistently decreased. The frequency of monitoring of dust deposition will be changed to quarterly after the first year from the commencement of mining if dust deposition at monitoring sites is below 10g/m²/month (S₀) for two consecutive two-monthly sampling periods. Should dust deposition at any non-reference site subsequently increase to above 10g/m²/month (S₀), two-monthly monitoring will be reinstated at that site until it returns to below 10g/m²/month (S₀) for two consecutive two-monthly sampling periods.

3.2.4 Short-Term Ambient Dust

Three real-time ambient dust monitors were established in the near vicinity of the mine pits to obtain short-term information on ambient dust levels. The real-time ambient dust monitors provide telemetry alerts for high short-term dust levels and act as management aids to enable rapid response to high dust emission events as and when they occur.
Figure 3.3 - Location of the Proposal and Dust Deposition Gauge Monitoring Sites
3.3 Implementation of Trigger Level Actions

Trigger level actions will be implemented if the associated trigger criterion signals the need for increased mitigation or protection (Table 3.5). These trigger level actions will be implemented by YIPL to mitigate and manage impacts so that they return to below trigger criteria.

The specific actions to be undertaken by YIPL in response to trigger events would be dependent on the particular causal factors that were found to be contributing to trigger events. However, the management response is likely to include the modification of practices, or potentially the suspension or relocation of particular operational activities if found to be contributing to the trigger event. YIPL will ensure that options are available within the mining plan and schedule to accommodate a level of flexibility.

In the case of a trigger event being due to an exceedance of the dust deposition trigger criteria (or internal YIPL management alert levels using real-time dust monitors), the management actions are likely to include the following:

- Focused and more intensive dust control treatments for areas and activities identified as the main sources of dust emissions. In the first instance this would involve increased frequency of watering of trafficable surfaces by water carts and the watering of non-trafficable surfaces by truck-mounted water cannons;
- Blasting, if found to be a significant source of dust (as measured by real-time dust monitors), will be avoided during unfavourable wind conditions, i.e. where wind conditions are likely to transport blast-generated dust in the direction of *Tetratheca erubescens*;
- The switching of mining activities to alternative locations should conditions at scheduled mining locations be unfavourable in terms of wind and weather conditions; and
- Monitoring the effectiveness of the dust control treatments using real-time dust monitors located near the boundary of the mining operations.

3.4 Implementation of Threshold Contingency Actions

Threshold contingency actions will be implemented if the associated threshold criterion signals that the environmental outcome is exceeded (Table 3.6). The threshold contingency actions will be implemented to manage aspects of the proposal and achieve the condition environmental outcome and manage impacts so that they return to below threshold and trigger criteria.

The comments relating to specific trigger level management actions above also apply for threshold contingency actions.
### Table 3.5 – Monitoring to Measure the Environmental Outcome Against Trigger Criteria

<table>
<thead>
<tr>
<th>Trigger Criterion 1 – Dust Deposition</th>
<th>Trigger Criterion 2 – <em>Tetratheca erubescens</em> Condition</th>
<th>Trigger Criterion 3 – Priority Species Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INDICATOR</strong></td>
<td>Dust deposition</td>
<td>Priority species condition</td>
</tr>
<tr>
<td><strong>METHOD</strong></td>
<td>Dust deposition gauges (AS/NZS 3580.10.1:2003)</td>
<td>Field measurement of index of chlorophyll fluorescence and % live material</td>
</tr>
<tr>
<td><strong>LOCATION</strong></td>
<td>Refer Figure 3.3</td>
<td>Refer Figure 3.1</td>
</tr>
<tr>
<td><strong>FREQUENCY</strong></td>
<td>Year 1 – <em>Two-monthly</em></td>
<td>Year 1 – <em>Two-monthly</em></td>
</tr>
<tr>
<td></td>
<td>Year 2 – <em>Quarterly</em></td>
<td>Year 2 – <em>Quarterly</em></td>
</tr>
<tr>
<td></td>
<td>(if &lt;10g/m²/month (Sₐ) for two consecutive sampling periods and stays below this level)</td>
<td>Year 3 + – <em>Annually</em> (if no trigger event occurs)</td>
</tr>
<tr>
<td><strong>TRIGGER ACTIONS AND TIMING</strong></td>
<td>Interrogate real-time dust monitoring records and wind data, mining activity records and shift supervisor dust control checklists to identify the main contributing dust sources. Based on the results of investigations, modify mining activities and/or implement additional targeted dust control measures as necessary to reduce dust emissions to below trigger levels.</td>
<td>Modify mining activities and/or implement additional targeted measures as necessary to reduce dust or mitigate other identified mine-related factor.</td>
</tr>
</tbody>
</table>

*Note: *The FREQUENCY for Trigger Criterion 1 and 2 includes options for annual or more frequent monitoring based on the results of investigations.*
Table 3.6 - Monitoring to Measure the Environmental Outcome Against the Threshold Criteria

<table>
<thead>
<tr>
<th>Threshold Criterion 1 – <em>Tetratheca erubescens</em> Mortality</th>
<th>Threshold Criterion 2 – <em>Tetratheca erubescens</em> Condition</th>
<th>Threshold Criterion 3 – Priority Species and Native Vegetation Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INDICATOR</strong></td>
<td><strong>METHOD</strong></td>
<td><strong>LOCATION</strong></td>
</tr>
<tr>
<td><em>Tetratheca erubescens</em> mortality</td>
<td>Mortality data obtained from field monitoring</td>
<td>Refer Figure 3.1</td>
</tr>
<tr>
<td><em>Tetratheca erubescens</em> condition</td>
<td>Field measurement of index of chlorophyll fluorescence and % live material</td>
<td>Refer Figure 3.1</td>
</tr>
<tr>
<td>Priority species and native vegetation mortality</td>
<td>Mortality data obtained from field monitoring</td>
<td>Refer Figure 3.2</td>
</tr>
<tr>
<td><strong>FREQUENCY</strong></td>
<td><strong>FREQUENCY</strong></td>
<td><strong>FREQUENCY</strong></td>
</tr>
<tr>
<td>Year 1 – <em>Two-monthly</em></td>
<td>Year 1 – <em>Two-monthly</em></td>
<td>Annually</td>
</tr>
<tr>
<td>Year 2 – <em>Quarterly</em></td>
<td>Year 2 – <em>Quarterly</em></td>
<td></td>
</tr>
<tr>
<td>Year 3 + – <em>Annually</em> (if no trigger events)</td>
<td>Year 3 + – <em>Annually</em> (if no trigger events)</td>
<td></td>
</tr>
</tbody>
</table>

**THRESHOLD CONTINGENCY ACTIONS AND TIMING**

1. Within 7 days of identifying the threshold criteria being exceeded, report to DWER and DBCA – Parks and Wildlife.
2. Within 30 days of identifying the threshold criteria being exceeded, complete an investigation of causes and potential environmental harm or alteration to the environment that occurred due to threshold criteria being exceeded and provide a report and mitigation plan to DWER and Parks and Wildlife.
3. Implement the mitigation plan as soon as practicable following consultation with DWER.
4. Within 90 days of the threshold exceedance being reported, provide a report to the DWER to include:
   - Details of the threshold contingency actions implemented.
   - The effectiveness of the threshold contingency actions implemented, monitored and measured against trigger criteria and threshold criteria.
   - Additional measures to prevent the threshold criteria being exceeded in the future.
   - Measures to control or abate the significant adverse environmental impacts which may have occurred.
3.5 General Management Controls

YIPL has a range of management controls and actions for its Yilgarn Operations to minimise the potential for project activities to adversely affect flora and vegetation. Table 3.7 summarises the relevant Yilgarn Operations management controls that will apply to YIPL’s F Deposit Operations.

Table 3.7 – Environmental Aspects and Management Controls Applicable to Flora and Vegetation

<table>
<thead>
<tr>
<th>ASPECT</th>
<th>RISK/POTENTIAL IMPACT</th>
<th>MANAGEMENT CONTROLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline water</td>
<td>Decline or loss of flora due to uncontrolled release of saline water or spray drift.</td>
<td>• Inductions and awareness training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Incident reporting and corrective action process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spill/leak containment infrastructure (V drains, bunding, shut-off valves)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Daily saline water infrastructure inspections</td>
</tr>
<tr>
<td>Unauthorised disturbance</td>
<td>Decline or loss of flora due to physical disturbance.</td>
<td>• Site disturbance permit process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inductions and awareness training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Incident reporting and corrective action process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clearing procedures including boundary demarcation and control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Approvals implementation process</td>
</tr>
<tr>
<td>Weeds</td>
<td>Decline or loss of flora due to weed invasion.</td>
<td>• Weed register</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Weed control program</td>
</tr>
<tr>
<td>Fire</td>
<td>Decline or loss of flora due to wildfire.</td>
<td>• Inductions and awareness training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Incident reporting and corrective action process</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fire breaks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fire fighting vehicles and equipment</td>
</tr>
<tr>
<td>Dust</td>
<td>Decline or loss of flora due to smothering by dust.</td>
<td>• Dust control procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dust monitoring</td>
</tr>
<tr>
<td>Feral fauna</td>
<td>Decline or loss of flora due to grazing or trampling by feral fauna.</td>
<td>• Fauna sightings and interaction register</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Feral fauna control program</td>
</tr>
<tr>
<td>Altered surface water flow</td>
<td>Decline or loss of flora due to altered surface water flow.</td>
<td>• Clearing procedures including boundary demarcation and control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Blasting vibration limits and monitoring of all blasts</td>
</tr>
<tr>
<td>Altered micro-habitat characteristics</td>
<td>Decline or loss of flora due to altered micro-habitat characteristics.</td>
<td>• Clearing procedures to ensure correct boundary demarcation and control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Blasting vibration limits and monitoring of all blasts</td>
</tr>
</tbody>
</table>
3.6 Reporting Provisions

3.6.1 Reporting Frequency and Timing

Timing and Commencement
YIPL will report to DWER and DBCA – Parks and Wildlife on the results of the monitoring program six months from the commencement of mining. The monitoring data, monitoring methods and trigger levels will be reviewed for effectiveness and, if areas for improvement are identified, recommendations will be submitted for consideration by DWER and DBCA – Parks and Wildlife.

Annual Reporting
The environmental outcome will be reported against trigger and threshold criteria in the Compliance Assessment Report by 30 April each year addressing compliance in the previous calendar year. In the event that the trigger criteria or threshold criteria were exceeded during the reporting period, the annual report will include a description of the effectiveness of trigger level actions and threshold contingency actions that have been implemented to manage the impact. The annual report will also be provided to DBCA – Parks and Wildlife.

Change from Quarterly to Annual Monitoring Frequency
YIPL will notify the DWER when the monitoring frequency for Tetratheca erubescens changes from quarterly to annual.

3.6.2 Reporting Format

The following information will be provided in reports:

- Data obtained for each of the monitoring parameters (as specified in sections 3.2.1, 3.2.2 and 3.2.3);
- Data obtained at each monitoring event (two monthly, quarterly and annually);
- Cumulative summary data (plot averages) through time, including baseline results;
- Results of the data analysis; and
- Compliance with trigger and threshold criteria.

The monitoring data will be provided in the following form:

- Raw data;
- Summary data (mean and standard deviation) for each monitoring plot (tables);
- Summary data (plot mean and standard deviation) in relation to distance from; the proposal boundary (graphs); and
- Summary data for condition, mortality and recruitment for each monitoring plot shown visually on a map.

3.6.3 Reporting on Exceedance of Threshold Criteria

In the event of an exceedance of any threshold criteria, YIPL will notify the DWER and DBCA – Parks and Wildlife in writing within seven days of the exceedance being identified. The relevant monitoring data and data analysis results will be provided.
Within ninety (90) days of the exceedance being reported, YIPL will provide a report to the Executive Director – EPA Services (DWER) to include:

- Details of threshold contingency actions implemented;
- The effectiveness of the threshold contingency actions implemented, monitored and measured against trigger criteria and threshold criteria;
- The findings of the investigations required by condition 6-5(3) and 6-5(5);
- Additional measures to prevent the threshold criteria being exceeded in the future; and
- Measures to control or abate and mitigate the significant adverse environmental impacts which may have occurred.

4. **ADAPTIVE MANAGEMENT AND REVIEW OF THE CONDITION EMP**

YIPL will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against trigger and threshold criteria, to more effectively meet the condition environmental outcome.

The monitoring data, monitoring methods and trigger levels will be reviewed annually for effectiveness and, if areas for improvement are identified, recommendations will be submitted for consideration by DWER and DBCA – Parks and Wildlife Service.

The annual monitoring will continue for a period of at least five years from the commencement of mining, at which time it is proposed to undertake a review of the F Deposit Flora and Management Plan. The review will be undertaken in consultation with DWER and DBCA – Parks and Wildlife Service.

5. **STAKEHOLDER CONSULTATION**

A summary of the consultation undertaken in developing this condition EMP is provided below.

**Table 5.1 – Summary of Stakeholder Consultation**

<table>
<thead>
<tr>
<th>CONSULTATION</th>
<th>STAKEHOLDERS INVOLVED</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation of outline first draft flora and vegetation management plan including proposed monitoring and trigger and threshold criteria.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>25.10.2016</td>
</tr>
<tr>
<td>Notes on 25/10/2016 meeting circulated by Cliffs.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>01.11.2016</td>
</tr>
<tr>
<td>Comments received from OEPA and Parks and Wildlife on outline management plan presentation.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>11.11.2016</td>
</tr>
<tr>
<td>Additional information supplied on separation distances between flora and pit walls (C Pit and F Deposit), proposed <em>T. erubescens</em> monitoring program, monitoring design advice, proposed Priority species monitoring sites, and comparative chlorophyll fluorescence and % live stems condition data.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>16.11.2016</td>
</tr>
<tr>
<td>CONSULTATION</td>
<td>STAKEHOLDERS INVOLVED</td>
<td>DATE</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Responses to OEPA and Parks and Wildlife comments on outline management plan provided by Cliffs.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>25.11.2016</td>
</tr>
<tr>
<td>Draft flora and vegetation management plan (Revision B) provided for comment.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>25.11.2016</td>
</tr>
<tr>
<td>Comments received from OEPA and Parks and Wildlife on draft management plan (Revision B).</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>22.12.2016</td>
</tr>
<tr>
<td>Responses to OEPA and Parks and Wildlife comments on draft management plan (Revision B) provided by Cliffs.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>27.01.2017</td>
</tr>
<tr>
<td>Revised flora and vegetation management plan (Revision C) provided.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>20.02.2017</td>
</tr>
<tr>
<td>Comments received from OEPA draft management plan (Revision C).</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>10.03.2017</td>
</tr>
<tr>
<td>Meeting with OEPA and DPaW to discuss monitoring design aspects of the draft management plan. Attended by Dr John Henstridge of Data Analysis Australia (DAA).</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>15.03.2017</td>
</tr>
<tr>
<td>DAA modified monitoring design recommendations report provided by Cliffs.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>30.03.2017</td>
</tr>
<tr>
<td>Revised flora and vegetation management plan (Revision D) provided.</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>02.04.2017</td>
</tr>
<tr>
<td>Comments received from OEPA on draft management plan (Revision D).</td>
<td>Office of the Environmental Protection Authority; Parks and Wildlife</td>
<td>28.04.2017</td>
</tr>
<tr>
<td>Responses to OEPA and Parks and Wildlife comments on draft management plan (Revision D) provided by Cliffs.</td>
<td>Office of the Environmental Protection Authority</td>
<td>5.05.2017</td>
</tr>
<tr>
<td>Revised flora and vegetation management plan (Revision E) provided.</td>
<td>Office of the Environmental Protection Authority</td>
<td>5.05.2017</td>
</tr>
<tr>
<td>Notice received from OEPA of approval of the flora and vegetation management plan (Revision E) and request for some minor modifications.</td>
<td>Office of the Environmental Protection Authority</td>
<td>5.05.2017</td>
</tr>
<tr>
<td>Final version of the flora and vegetation management plan (Revision 0) provided.</td>
<td>Office of the Environmental Protection Authority</td>
<td>14.06.2017</td>
</tr>
</tbody>
</table>
6. INDEPENDENT EXPERT CONSULTATION

Condition 6-2 of ministerial Statement 1054 requires that the condition EMP be developed “in consultation with an independent expert in the assessment and management of dust impacts on plants, to be endorsed in writing by the CEO”. The independent expert nominated for this role was Dr Eddie van Etten, Senior Lecturer in Ecology at Edith Cowan University. Dr van Etten has extensive research and teaching experience in terrestrial plant ecology and the management of arid zone ecosystems. Dr van Etten was endorsed by the then CEO of the OEPA to undertake this role. Dr van Etten was involved in the process of reviewing and refining the management plan since early November 2016. He provided comment and input regarding the monitoring design, monitoring methods and trigger and threshold criteria. A summary of the consultation with Dr van Etten during the development of this condition EMP is provided in Table 6.1.
### Table 6.1 – Summary of Consultation with Independent Expert

<table>
<thead>
<tr>
<th>NATURE OF THE CONSULTATION WITH INDEPENDENT EXPERT</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent expert undertook Koolyanobbing site visit. Familiarisation with F Deposit development proposal and associated flora and vegetation issues, including proposed flora and dust monitoring methods.</td>
<td>01.11.2016 – 03.11.2016</td>
</tr>
<tr>
<td>Follow-up information supplied to independent expert including <em>Tetratheca paynterae</em> subsp. <em>paynterae</em> research reports, monitoring methods and results; <em>Tetratheca erubescens</em> preliminary monitoring plan; chlorophyll fluorescence literature and early draft F Deposit Flora and Vegetation Management Plan.</td>
<td>04.11.2016</td>
</tr>
<tr>
<td>Copy of draft F Deposit Flora and Vegetation Management Plan (Revision A) provided to independent expert. Technical information supplied regarding chlorophyll fluorescence condition assessment method and baseline <em>Tetratheca erubescens</em> data comparing chlorophyll fluorescence and % live stems data.</td>
<td>14.11.2016</td>
</tr>
<tr>
<td>Follow-up meeting with Independent expert to discuss draft F Deposit Flora and Vegetation Management Plan.</td>
<td>16.11.2016</td>
</tr>
<tr>
<td>Independent expert provided with copies of information sent to OEPA and Parks and Wildlife including Data Analysis Australia reports, proposed <em>T. erubescens</em> and Priority flora monitoring sites and flora separation distances from the proposed F Deposit pit.</td>
<td>16.11.2016</td>
</tr>
<tr>
<td>Independent expert provided with copy of OEPA and Parks and Wildlife comments on draft EMP outline and draft Cliffs’ response. Copy provided of (draft) revised F Deposit Flora and Vegetation Management Plan (Revision B).</td>
<td>21.11.2016</td>
</tr>
<tr>
<td>Meeting with independent expert to discuss revised F Deposit Flora and Vegetation Management Plan (Revision B) and OEPA and Parks and Wildlife comments.</td>
<td>23.11.2016</td>
</tr>
<tr>
<td>Independent expert provided copies of literature related to chlorophyll fluorescence method for measuring vegetation condition.</td>
<td>24.11.2016</td>
</tr>
<tr>
<td>Meeting with independent expert to discuss revisions to the F Deposit Flora and Vegetation Management Plan, OEPA/Parks and Wildlife comments on Revision B and Cliffs’ responses.</td>
<td>13.01.2017</td>
</tr>
<tr>
<td>Independent expert attended meeting with Data Analysis Australia and Cliffs to discuss the F deposit flora monitoring design and data analysis.</td>
<td>20.01.2017</td>
</tr>
<tr>
<td>Independent expert provided with copies of Cliffs’ responses to OEPA and Parks and Wildlife comments F Deposit Flora and Vegetation Management Plan (Revision B)</td>
<td>27.01.2017</td>
</tr>
<tr>
<td>Independent expert provided with copies of revised F Deposit Flora and Vegetation Management Plan (Revision C) and Data Analysis Australia report on <em>T. erubescens</em> baseline data power analysis and data analysis methods.</td>
<td>20.02.2017</td>
</tr>
</tbody>
</table>
7. REFERENCES


APPENDIX 1 – BASELINE WEED MAPPING

Figure A1.1  Recorded Locations of Introduced Flora Taxa in the Project Area
Figure A1.1 – Recorded Locations of Introduced Flora Taxa in the Project Area. Data Source: Woodman (2014); Cliffs (2016 2017 unpublished)
APPENDIX 2 – BASELINE ANNUAL TETRATHECA ERUBESCENS MONITORING RESULTS

Figure A2.1  Tetrapheca erubescens Life Stage 2015-2016
Figure A2.2  Tetrapheca erubescens Reproductive Status 2015-2016 (% with flowers, fruits or buds)
Figure A2.3  Tetrapheca erubescens Live Material 2015-2016 (% live stems)
Figure A2.4  Tetrapheca erubescens Chlorophyll Fluorescence 2016 (Fv/Fm)
Figure A2.1 – *Tetratheca erubescens* Life Stage 2015-2016
Figure A2.2 – *Tetratheca erubescens* Reproductive Status 2015-2016
Figure A2.3 – *Tetratheca erubescens* Live Material 2015-2016
Figure A2.4 – *Tetrathea erubescens* Index of Chlorophyll Fluorescence 2016
APPENDIX 3 – BASELINE MONTHLY FLORA AND DUST MONITORING RESULTS

*Tetratheca erubescens*

Figure A3.1  *Tetratheca erubescens* Reproductive Status (% with flowers, fruits or buds)

Figure A3.2  *Tetratheca erubescens* Live Material (% live stems)

Figure A3.3  *Tetratheca erubescens* Chlorophyll Fluorescence (Fv/Fm)

*Beyeria rostellata*

Figure A3.4  *Beyeria rostellata* Live Material (% live material)

Figure A3.5  *Beyeria rostellata* Chlorophyll Fluorescence (Fv/Fm)

*Stenanthemum newbeyi*

Figure A3.6  *Stenanthemum newbeyi* Live Material (% live material)

Figure A3.7  *Stenanthemum newbeyi* Chlorophyll Fluorescence (Fv/Fm)

*Dust Deposition*

Figure A3.8  Dust Deposition (Sa g/m2/month)

Figure A3.9  Near-mine dust deposition monitoring results, mining volumes and pit depth at the Windarling Range W5 Deposit mine pit from commencement of mining in late 2010
**Figure A3.1** – *Tetratheca erubescens* Reproductive Status
Figure A3.2 – *Tetratheca erubescens* Live Material
Figure A3.3 – *Tetrapheca erubescens* Chlorophyll Fluorescence
Figure A3.4 – Beyeria rostellata Live Material
Figure A3.5 – Beyeria rostellata Chlorophyll Fluorescence

**Beyeria rostellata** Chlorophyll Fluorescence
Figure A3.6 – *Stenanthemum newbeyi* Live Material
Figure A3.7 – *Stenanthemum newbeyi* Chlorophyll Fluorescence
Dust Deposition

Figure A3.8 – Dust Deposition
Figure A3.9 – Near-mine dust deposition monitoring results, mining volumes and pit depth at the Windarling Range W5 Deposit mine pit from commencement of mining in late 2010. The dust deposition gauges are located approximately 20m from the pit crest.