



**Environmental  
Monitoring and  
Management Plan-  
Happy Valley Titanium  
Minerals Project**

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**CD913**

**Happy Valley**

April 2009



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# Draft

## TABLE OF CONTENTS

<b>TABLE OF CONTENTS</b>	<b>I</b>
<b>LIST OF TABLES</b>	<b>IV</b>
<b>LIST OF FIGURES</b>	<b>IV</b>
<b>1. OVERVIEW</b>	<b>1</b>
1.1 PURPOSE	1
1.2 SCOPE	1
1.3 CONTENT	1
1.4 RELATIONSHIP TO OTHER DOCUMENTS	1
1.5 LEGAL STATUS	2
<b>2. ENVIRONMENTAL MANAGEMENT SYSTEM</b>	<b>2</b>
2.1 POLICY	2
2.2 RESPONSIBILITIES	2
2.3 HAZARD IDENTIFICATION	2
2.4 COMMUNICATION	3
2.5 COMMUNITY CONSULTATION AND COMPLAINT PROCEDURES	3
2.5.1 Community consultation	3
2.5.2 Complaint response procedures	3
2.5.3 Operating agreements	3
2.6 MONITORING	4
2.7 REVIEW AND REPORTING	4
<b>3. VEGETATION</b>	<b>5</b>
3.1 MANAGEMENT OBJECTIVE	5
3.2 DESCRIPTION	5
3.3 RISK AND RISK LEVEL	5
3.4 MANAGEMENT ACTIONS	6
3.4.1 Minimise clearing	6
3.4.2 Protection of vegetation	6
3.4.3 Enhancement of vegetation	7
3.5 PERFORMANCE MONITORING	7

# Draft

<b>TABLE 3-1 VEGETATION CONDITION RATING SCALE</b>	<b>7</b>
3.6    CONTINGENCY ACTIONS	8
<b>4.    AIR QUALITY – PARTICULATES</b>	<b>8</b>
4.1    MANAGEMENT OBJECTIVES	8
4.2    PERFORMANCE INDICATORS AND TARGETS	8
4.3    DESCRIPTION	9
4.4    RISK AND RISK LEVEL	9
4.5    MANAGEMENT ACTION	10
4.5.1    Work procedures and education	10
4.5.2    Clearing and burning	10
4.5.3    Timing of topsoil stripping	10
4.5.4    Transport management	11
4.5.5    Dust control and soil stabilisation	11
4.5.6    Site buffers and screens	11
4.5.7    Haulage controls	11
4.5.8    Rehabilitation	11
4.6    PERFORMANCE MONITORING	12
4.7    CONTINGENCIES	12
<b>5.    AIR QUALITY – GREENHOUSE GASES</b>	<b>13</b>
5.1    MANAGEMENT OBJECTIVE	13
5.2    PERFORMANCE INDICATORS AND TARGETS	13
5.3    DESCRIPTION	14
5.4    RISK AND RISK LEVEL	14
5.5    MANAGEMENT ACTION	15
5.5.1    Energy and fuel efficiency	15
5.5.2    Clearing controls	15
5.6    PERFORMANCE MONITORING	15
<b>6.    INDIGENOUS AND NON-INDIGENOUS CULTURES (HERITAGE)</b>	<b>15</b>
6.1    MANAGEMENT OBJECTIVE	15
6.2    PERFORMANCE INDICATORS AND TARGETS	16
6.3    DESCRIPTION	16
6.4    RISK AND RISK LEVEL	16
6.5    MANAGEMENT ACTIONS	17

# Draft

## Environmental Management and Monitoring Program

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6.5.1	Disturbance protocol	17
6.5.2	Creek lines	17
6.5.3	Clearing monitoring	17
6.6	PERFORMANCE MONITORING	17
<b>7.</b>	<b>VISUAL AMENITY</b>	<b>18</b>
7.1	MANAGEMENT OBJECTIVE	18
7.2	PERFORMANCE INDICATORS AND TARGETS	18
7.3	DESCRIPTION	18
7.4	RISK AND RISK LEVEL	18
7.5	MANAGEMENT ACTION	19
7.5.1	Installation	19
7.5.2	Vegetation and stockpile screening	19
7.5.3	Reduction of disturbance timeframes	19
7.6	PERFORMANCE MONITORING	19
<b>8.</b>	<b>RECREATION AND SAFETY</b>	<b>19</b>
8.1	MANAGEMENT OBJECTIVE	19
8.2	PERFORMANCE INDICATORS AND TARGETS	20
8.3	DESCRIPTION	20
8.4	RISK AND RISK LEVEL	20
8.5	MANAGEMENT ACTION	20
8.5.1	Site security	20
8.5.2	Traffic management	21
8.5.3	Site safety	21
8.6	PERFORMANCE MONITORING	21
<b>9.</b>	<b>RADIATION</b>	<b>21</b>
9.1	MANAGEMENT OBJECTIVE	21
9.2	PERFORMANCE INDICATORS AND TARGETS	21
9.3	DESCRIPTION	22
9.4	RISK AND RISK LEVEL	22
9.5	MANAGEMENT ACTION	22
9.5.1	Radiation Management Plan	22
9.6	PERFORMANCE MONITORING	22

# Draft

<b>10. MONITORING AND REVIEW</b>	<b>23</b>
10.1 PERFORMANCE MONITORING	23
10.2 PERFORMANCE REVIEW	23
10.3 COMPLIANCE AUDITING	23
10.4 NON-COMPLIANCES	23
10.5 REPORTING	23
<b>11. REFERENCES</b>	<b>27</b>
11.1 EXTERNAL DOCUMENTS	27
11.2 INTERNAL DOCUMENTS	27
<b>12. MANAGEMENT AND MONITORING COMMITMENTS</b>	<b>29</b>
<b>TABLE 12-1 SUMMARY OF MANAGEMENT COMMITMENTS</b>	<b>29</b>
<b>TABLE 12-2 SUMMARY OF MONITORING MEASURES</b>	<b>35</b>

## LIST OF TABLES

1. Responsibilities prescribed by the EMS	2
2. Vegetation condition rating scale	7
3. Annual Net Scope 1 & 2 Emissions of CO <sub>2</sub> -e for the Happy Valley project	14
4. Summary of management commitments	29
5. Summary of monitoring measures	35

## LIST OF FIGURES

1. Location of residences within 2km of Happy Valley.	25
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## 1. OVERVIEW

### 1.1 PURPOSE

The purpose of this Environmental Management and Monitoring Program (EMMP) is to describe the management actions to be implemented prior to and during the mining phase, as well as during rehabilitation that have been identified as necessary to avoid, minimise and/or mitigate the effects of mining and related activities on the surrounding environment.

The EMMP includes a monitoring program to assess the effectiveness of the management actions and to ensure that determinable changes to the surrounding environment are detected, reported and, if appropriate, acted upon.

### 1.2 SCOPE

This EMMP applies to the Happy Valley mining project during the phases of mine planning, construction, commissioning, operation and rehabilitation.

### 1.3 CONTENT

This EMMP includes the following management components:

- vegetation protection
- air quality (particulates)
- greenhouse gas emissions reduction strategy
- heritage
- radiation
- public safety and recreation
- visual amenity.

### 1.4 RELATIONSHIP TO OTHER DOCUMENTS

Significant environmental factors are managed through specific site Environmental Management Plans (EMPs). These EMPs are:

- Happy Valley Integrated Mining and Rehabilitation Plan CD915
- Happy Valley Noise Management Plan CD914
- Happy Valley Water Resources Management Plan CD916
- Happy Valley Fauna and Habitat Management Plan CD911
- Happy Valley Decommissioning and Closure Plan CD912.

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Management of common procedures and mine activities are generally defined within Work Instructions and System Procedures that form part of the Company's Environmental Management System as described in Section 2 below. Relevant Procedures and Instructions are referenced in this Plan but not appended.

## 1.5 LEGAL STATUS

This management plan has been prepared as part of the Happy Valley Environmental Review and Management Program.

## 2. ENVIRONMENTAL MANAGEMENT SYSTEM

### 2.1 POLICY

Bemax operates a certified ISO 14001 Environmental Management System (EMS) as part of its Integrated Management System (IMS). The core of the EMS is the company's Environmental Policy, which has been approved and signed by the Managing Director.

The Environmental Policy requires that Bemax monitors its performance and aims to continually improve both environmental performance and management.

### 2.2 RESPONSIBILITIES

The EMS designates the following responsibilities to the various staff positions and/or levels.

Table 2-1 Responsibilities prescribed by the EMS

Party	Responsibility
Operations Manager	Responsibilities include ensuring that all Bemax's activities conform to the Environmental Policy.
Environmental Manager	Responsibilities include taking immediate action where necessary on the receipt of communications and/or complaints regarding environmental issues.
Mining Manager	Responsibilities include implementing on-site management strategies to minimise environmental impact in accordance with all site licences, Company policy and procedures.
Senior Environmental Officer – Operations & Compliance	Responsibilities include ensuring compliance with relevant environmental legislation and regulations. Managing the EMS, maintaining documents and records to demonstrate conformance, and identification of non-conformances with the EMS.
All employees	Responsibilities include ensuring that all operations are carried out in accordance with specified procedures and work practices.

### 2.3 HAZARD IDENTIFICATION

Environmental aspects, which are at risk of being impacted upon by the mining operations, are identified using the procedures set out in SP03 *Identification and Management of Environmental Risk*.

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### 2.4 COMMUNICATION

The EMS contains procedures for managing internal and external communications of environmental matters. Environmental hazards and incidents are reported using an incident report (CD018).

All external complaints automatically generate an incident report that is forwarded to and dealt with by the Environment Department under the EMS.

### 2.5 COMMUNITY CONSULTATION AND COMPLAINT PROCEDURES

Bemax has a commitment, under its Environmental Policy, to involve the community in aspects of impact management.

#### 2.5.1 Community consultation

To establish an open line of communication with stakeholders, Bemax established the Happy Valley working party. Members of the Working Party consist of neighbours of the project as well as representatives of relevant government agencies and community groups. The aim of the working party was to actively involve the community in the environmental impact assessment process. The continuation of the Happy Valley working party past the commencement of mining operations will be dependent on the wishes of the members.

As a means of keeping the broader stakeholder group apprised of the status of the Happy Valley project Bemax distributes a community update on a regular basis. Bemax will continue to update the community as to the progress of the project by this manner throughout the life of the mining operations. In addition to these measures, Bemax will continue to liaise with residents and other interested stakeholders as required to address specific concerns or to obtain direct feedback and attitudes towards its operations and performance.

#### 2.5.2 Complaint response procedures

Bemax has contacted neighbouring residents to discuss environmental issues and continues to liaise with them on a regular basis via the previously mentioned mechanisms. These residents are aware of the environmental management requirements of the company and have been informed of whom to contact in the event of an environmental incident.

In addition to the minesite response, environmental complaints will be formally processed through the EMS. Responsibility for action lies with the relevant Area Manager. The Environment Department reports complaints and other non-conformances to the appropriate government regulator.

#### 2.5.3 Operating agreements

In the event that the mining operations, despite all attempts at control, continues to have an impact on any neighbouring resident, Bemax will consider actively seeking a legal agreement with the resident as a means of resolving the issue.

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The establishment and content of operating agreements is dependent on a number of factors and will be reviewed as the situation arises. An independent third party may be consulted with before an offer of agreement is extended, or if agreement cannot be reached.

### 2.6 MONITORING

A monitoring program for each component of the EMMP will be conducted to assess the reliability of risk forecasts and the effectiveness of management measures. Monitoring will be coordinated by the Senior Environmental Officer - Operations & Compliance, and will be conducted in accordance with the appropriate procedures.

Bemax routinely conducts internal audits according to SP15 *Internal Audits* to assess the compliance with, and effectiveness of the various components of its EMS, including the EMMP. In addition, the entire EMS is audited externally every six months, with a full re-certification audit every three years.

Audit findings are reviewed by the Integrated Management Systems Committee, including the Operations Manager, and acted upon by the Senior Environmental Officer, through the EMS.

### 2.7 REVIEW AND REPORTING

Monitoring results and performance and compliance assessments are reported each March to the relevant government agencies via Bemax's Annual Environmental Report and will be made available to relevant stakeholders on request.

### 3. VEGETATION

#### 3.1 MANAGEMENT OBJECTIVE

Consistent with the Environmental Policy, the specific objective in managing this aspect for the Happy Valley project is to maintain abundance, diversity, distribution and productivity of flora within the project area, through the avoidance or management of adverse impacts.

This is a principal objective for the project, as achievement of the objectives for fauna, conservation and landscape connectivity is strongly reliant on achieving the management objective for flora and vegetation.

#### 3.2 DESCRIPTION

The project area occurs on the lower to mid slopes of the Whicher Scarp along the interface between the Blackwood Plateau and the Swan Coastal Plain and as such it includes areas of cleared agricultural land, State Forest and remnant native vegetation. Mining activities are proposed to take place in both private land and State Forest.

The State Forest consists of forest complexes in relatively good condition. Some of the private land is currently used for grazing, whereas other areas have previously been used for bluegum plantations, although there are still large areas of remnant native vegetation throughout the private land. A dieback survey undertaken in 2008 (Glevan Consulting 2008) indicates that a lot of the project area is infected by *Phytophthora cinnamomi*.

#### 3.3 RISK AND RISK LEVEL

Impacts on the forest ecosystem will arise from the initial land disturbance for mining and potentially from ongoing operational activities. The major impact is clearing activities and the resultant loss in biodiversity and significant flora. Of the 155 ha of native vegetation clearing, 90 ha is required for the mine pit, with the remainder required for associated infrastructure. 93 ha of associated infrastructure will not disturb remnant vegetation.

In addition to clearing, mine operations may impact on vegetation health through effects such as dewatering. This risk is considered low as studies show that none of the vegetation within the project and nearby surrounds are groundwater dependent and baseline water monitoring has indicated that the mine pit will not intersect the water table. The riparian vegetation along the creeklines may be dependent on seasonal flows. The project is not expected to interfere significantly with these flows.

On-site activities may impact on remnant vegetation, mainly through the risk of mobile equipment causing damage to vegetation and spreading disease and weeds. The risk of this occurring is considered moderate and can be managed through the implementation of well established work practices. A similar risk occurs where grazing activities take place in areas where remnant vegetation occurs within agricultural land.

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Fire, either naturally occurring or through prescribed burning, poses a risk to the remnant vegetation if not properly managed. It is not proposed for any prescribed burns to take place within the project area during the mining phase. Prescribed burning occurs within the adjacent state forest and is co-ordinated by DEC.

The dieback survey indicated that a large proportion of the project area was infected by dieback. The spread of this disease occurs when infected soil is transported to uninfected soil. The transport of this soil has the potential to be aided through minesite activities such as vehicle movements and uncontrolled runoff.

### 3.4 MANAGEMENT ACTIONS

#### 3.4.1 Minimise clearing

The main management action for protection of vegetation is to minimise clearing. Detailed mine planning has been undertaken to minimise the amount of native vegetation clearing required and to avoid clearing in areas of high conservation value.

To minimise the risk of unauthorised or accidental clearing, areas to be cleared will be demarcated prior to clearing occurring. Clearing activities will be conducted according to the procedure in the IMRP (CD915).

#### 3.4.2 Protection of vegetation

Riparian vegetation along the creeks and streams within the project area will be protected by a buffer in which no activity will be carried out. This buffer will extend a minimum of 30 metres on either side of the creek centreline. Corridors will have to be established at each creek to allow for vehicle movements and infrastructure. Clearing for these corridors will be minimised to the area required for construction only.

Remnant vegetation within the project area that is not required to be cleared according to the mine plan will be protected and maintained to retain landscape values. This will involve:

- fencing of areas of vegetation where there is a risk from grazing.
- prior to each clearing stage remnant vegetation will be demarcated and signposted. Access to these areas will then be restricted to environmental monitoring and rehabilitation purposes
- managing each clearing stage according to the IMRP
- noxious weed control will be undertaken across the site on an annual basis
- firebreaks will be installed and/or maintained where required and a schedule of controlled burns will be developed in conjunction with the DEC (See IMRP)
- implementing an appropriate *Phytophthora* dieback hygiene strategy (as outlined in IMRP)
- implementing a site drainage plan (as per the WRMP).

### 3.4.3 Enhancement of vegetation

Whilst the majority of remnant vegetation is in good condition opportunities exist to enhance vegetation within the project area. Activities to enhance the vegetation may include:

- rehabilitation of tracks
- infill planting in riparian zones
- infill planting in areas affected by *Phytophthora* dieback
- rehabilitation of previously disturbed areas within the project area.

### 3.5 PERFORMANCE MONITORING

Monitoring of the vegetation health will be conducted on a quarterly basis. To ensure adequate replication and hence statistical validity of data, a minimum of 10 strategically placed belt transects will be established across the project areas. Placement of transects will focus on “at risk” areas of each broad vegetation complex within the project area. Transects will be situated adjacent to proposed mine activities to maximise the likelihood of recording vegetation decline at the site.

Each assessment transect will comprise of 20 contiguous 1 m<sup>2</sup> quadrats (20 m by 1 m). The corners of each transect will be permanently marked by four star pickets. Within individual 1 m<sup>2</sup> quadrats, plant frequency, % ground cover and maximum plant height will be recorded for each plant species present including weeds. Transects will initially be sampled in early spring prior to mine excavation commencing, and will continue on an annual basis until 12 months following the completion of backfilling of the mining excavation. Data will be summarised for each 20 m transect to provide mean plant density, mean % ground cover, and mean maximum plant height for each species including an assessment of weeds. Annual data will be compared using one way analysis of variance testing ( $\alpha=0.05$ ) to elucidate statistically significant differences.

In addition, a quarterly assessment of vegetation condition will be made along each of the 20 x 1 m transects. Transects will be photographed from the north side, and a vegetation condition rating assigned based on the scale outlined in Table 3-1. Data will be summarised for each 20 m transect to provide a mean condition rating. Quarterly data will be compared using one way analysis of variance testing ( $\alpha=0.05$ ) to elucidate statistically significant differences.

Table 3-1 Vegetation condition rating scale

Score	Observation
0	No evidence of stress
1	Odd plant showing signs of stress
2	One or two plants usually under severe stress, near death
3	Scattered stressed and dead plants around plot
4	Susceptible plants dead or dying
5	Graveyard death, most plants dead

In addition to vegetation monitoring, standing groundwater levels will be monitored on a monthly basis, as outlined in the WRMP.

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Table 12-2 provides a summary of the monitoring actions commitments.

### 3.6 CONTINGENCY ACTIONS

In the event that monitoring of vegetation indicates a significant decline in health, an investigation into the decline will be undertaken and appropriate management actions will be implemented. This will be tracked and documented through the Bemax EMS. Additionally, the frequency of monitoring will be increased until an improvement in vegetation condition is noted.

## 4. AIR QUALITY – PARTICULATES

### 4.1 MANAGEMENT OBJECTIVES

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Happy Valley project are:

- to ensure that particulate emissions do not adversely affect environmental values or the health, welfare or amenity of people and land uses by meeting statutory requirements and acceptable standards
- to minimise emissions to levels as low as practicable on an on-going basis (i.e. continuous improvement)
- to respond effectively to complaints
- to minimise off-site impacts of dust from mining and transport activities on vegetation.

### 4.2 PERFORMANCE INDICATORS AND TARGETS

The following performance indicators and targets apply to the Happy Valley minesite:

- Bemax will not cause an increase in the level of dust across the boundary of the premises, greater than  $1000 \mu\text{g}/\text{m}^3$  (15 min average) or  $260 \mu\text{g}/\text{m}^3$  (24 hr average)<sup>1</sup>
- Bemax will prevent visible dust attributable to its operations from crossing the premises boundary by taking the dust control measures specified in this plan
- Bemax will not cause an increase in the  $\text{PM}_{10}$  levels across the boundary of the premises, greater than  $50 \mu\text{g}/\text{m}^3$  (24 hr average).

In this document, 'dust' refers to total suspended particulate matter (TSP), as defined by AS/NZS3580.9.3:2003.

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<sup>1</sup> This emission limit has been imposed by the DEC on past and current Cable Sands minesites.

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### 4.3 DESCRIPTION

Mining and other major land development activities are often associated with the emission of windborne particulates, or dust. While usually quickly dispersed, dust impacts tend to be cumulative in that dust may build up over time on surfaces in or around residences and other sensitive areas (including vegetation) and can result in nuisance or health impacts. A particulate layer (dust) may hinder plant functions by reducing light penetration or the exchange of gases by the leaves (ICMM 2006). The emission of smoke from the burning of woody debris may also impact on the health or amenity of nearby residences.

Dust from minesites is termed “Coarse Particulate Matter” (CPM), predominantly having a diameter larger than 10 microns<sup>2</sup>. Particles over this size range are not considered to pose a significant health or environmental threat, but are viewed mainly as a nuisance and aesthetic problem.

The project area is slightly elevated on the scarp, and is surrounded by State Forest to the south and east and a rural setting to the north and west. Ambient levels of TSP at Happy Valley are strongly influenced by the following:

- adsorption of particulates by leafy vegetation
- neighbouring farming activities e.g. ploughing
- unsealed roads
- smoke from burns/fires.

In summer, the typical wind pattern for the area is dry easterly winds of moderate strength in the mornings and overnight followed by afternoon seabreezes of moderate strength ranging from the west to the south. In winter, the typical wind pattern is light/calm winds in the morning, followed by westerly winds of moderate strength in the afternoon.

The location of residences within 2 km of the HVN and HVS deposits are shown in Figure 1. While the 2 km assessment area is based on an arbitrary number, it is considered to be very conservative as previous mining experience indicates that significant nuisance impacts are rarely experienced beyond 500 m from operations. The combination of predominant wind vectors and premises locations increases the potential for dust to affect residences to the west and northwest of the HVN deposit.

### 4.4 RISK AND RISK LEVEL

Previous mine experience suggests the greatest potential for dust generation is during the removal of vegetation and the removal and replacement of topsoil and overburden. Vehicle movements on unsealed internal mine roads also pose a high risk. Removal of the ore is not expected to generate

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<sup>2</sup> NSW Minerals Council Technical Paper – Particulate Matter and Mining (undated)

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problematic quantities of dust due to restricted airflow in the pit and higher soil moisture levels. Other potential problems may be associated with the burning of felled timber, controlled burning during rehabilitation, and unstabilised stockpiles and disturbed areas.

As the minesite is located in a rural setting, approximately 6 km from the nearest town, sensitive receptors are limited to several farm residences located predominantly to the north, northwest and west of the Happy Valley project area. (see Figure 1). Experience shows that one of the predominant winds for dust issues in the South West is the dry northwest winds that often precede the passing of a frontal system. The absence of dwellings to the southeast of the project area significantly reduces potential impacts in this area. Additionally, the other wind vector associated with dust problems is the easterly wind, which prevails in the drier summer and autumn months. There are two residences located west of Happy Valley North which are at risk from dust carried by easterly winds. These properties will be separated from operations by mature native vegetation which will assist in reducing airborne dust levels.

### 4.5 MANAGEMENT ACTION

#### 4.5.1 Work procedures and education

As a part of the site induction process, all employees and contractors on-site will undergo awareness training highlighting the importance of on-site dust management. The training will cover dust management and monitoring strategies as well as provide employees with strategies to minimise their impact. Inductions are conducted when an employee first arrives on-site or if an employee or contractor has been absent from site for a period of 7 weeks or more. Monthly toolbox talk meetings will also be used to reinforce requirements, highlight issues and management strategies.

A number of work instructions apply to management of activities that may result in dust or smoke emissions. If necessary, these Work Instructions will be developed and/or modified as new or improved practices are identified. Work Instructions and specific management practices will be reinforced to employees through monthly Toolbox Talks, Enviro-Updates and inductions.

#### 4.5.2 Clearing and burning

Cleared areas open at any one time will be minimised through mine planning initiatives, in order to minimise potential dust impacts.

The quantity of material to be burnt will be minimised through mine and rehabilitation planning initiatives. Climatic conditions will be assessed by the Site Supervisor prior to and during burning operations and burning will only be conducted if the conditions are assessed as being favourable. Adjacent landowners will be notified prior to any burning off activities.

#### 4.5.3 Timing of topsoil stripping

Where possible, soil (particularly topsoil) shall be stripped outside of summer months. The preference for topsoil stripping will be late autumn as this will provide the greatest benefits when direct returning the topsoil (seed germination etc) and have a high soil moisture from rainfall. The mine supervisor will be responsible for assessing soil moisture to ensure an adequate level of moisture is present to bind particles. If necessary, the soil will be wetted down through the use of water carts. Similarly

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climatic conditions including wind direction and speed shall be considered before any stripping takes place.

### 4.5.4 Transport management

A speed limit of 30 km/h will apply to the main access road and any unformed tracks for light vehicles and haulage trucks. Dust generation from the movement of heavy vehicles will be managed through the use of well formed, sealed roads (e.g. gravel capped) and regular use of water carts when needed. Speed limits are available as a contingency during adverse conditions, based on the assessment of the site supervisor.

### 4.5.5 Dust control and soil stabilisation

Dust generation occurring on soils that have been exposed or disturbed will be managed using stabilisation treatments. These treatments can include:

- capping with clay/fines material
- applying mulch/hydromulch
- commercial applications (e.g. Dustex)
- seeding the area with a cover crop such as cereal rye to form a vegetative cover
- stabilisation with gravel (e.g. on haulage roads).

The effectiveness of these treatments depends on the level of activity occurring on the surfaces and application rates. Where appropriate, access to stabilised areas will be restricted. Areas which are unable to be stabilised using the treatments above will be stabilised by wetting down the surface using water carts or sprinkler systems.

### 4.5.6 Site buffers and screens

Buffers and screening around the boundary of the site, especially on boundaries adjoining neighbours, will be maintained wherever possible and erected in areas where deemed necessary. Potential buffers include vegetation screens and strategic location of stockpiles or the use of “shadecloth” fencing.

### 4.5.7 Haulage controls

To manage dust associated with haulage of the heavy mineral concentrate (HMC) from the minesites, a sealed apron will be installed at the entrance to the minesite. Cattle grids or conveyor belt will be installed prior to the site exit to assist the removal of soil from the trucks tyres and undercarriage by vibration. All trucks carting HMC must have their load covered before leaving the minesite. HMC will be stockpiled and loaded in a moist state.

### 4.5.8 Rehabilitation

To control dust from rehabilitated areas, windbreaks, mulch or chemical suppressants may be used if soil is to be left exposed through the drier months or before sufficient vegetated ground cover has been established.

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### 4.6 PERFORMANCE MONITORING

The site supervisor will be responsible for assessing the on-site conditions and potential sources of dust on at least a daily basis. Daily minesite inspections of the operating areas and premises boundary will be undertaken. These inspections will focus on the effectiveness of dust management, and identify areas of stabilisation that need re-application.

Monitoring for TSP will be conducted using a High Volume Air Sampler (HVA), and will be conducted according to AS3580.9.3:2003 which provides information and requirements for preparation, calibration, reporting and Quality Assurance. Monitoring will be conducted once per month during construction activities (Works Approval period) and at least four times between September and May during the mining phase (license period).

Monitoring using the HVA is subject to the availability of a continuous power 240 V power supply. Locations will be progressively established close to the site boundary between site operation and surrounding residences. The determination of these locations and the siting of the HVA will be determined according to AS3580.1.1:2007 – *Guide to siting air monitoring equipment*.

In addition to TSP monitoring using the HVA, an E-Sampler will also be used. This is a real time dual technology piece of equipment that use light scatter technology and gravimetric sampling to determine TSP levels. By providing real-time results, the E-Sampler is useful as a management tool. Use of the E-Sampler will be focussed on areas without access to power and locations close to sensitive receptors.

Monitoring for PM<sub>10</sub> will be conducted using a TSI “DustTrak”. This unit uses light scatter to measure particulate matter less than 10µm in diameter (PM10). The unit will be calibrated, operated, and maintained in accordance with the manufacturer’s instructions.

Public complaints of excessive dust crossing the minesite boundary will be reported as an Environmental Incident under the EMS and investigated immediately.

Monitoring commitments are also outlined in Table 12-2.

### 4.7 CONTINGENCIES

In the event that dust or smoke emissions from the site become, or could be expected to become, unacceptable or exceed specified levels, immediate action will be taken to suppress the source of emissions. The following steps will be taken:

- identification of the cause, or potential cause of dust generation
- review of the current site wind and weather conditions and any monitoring data available
- determine if there is an actual dust nuisance, or the potential for a dust nuisance to occur

If it is determined that on-site activities are generating excessive dust, or that weather conditions have the potential to worsen dust generation then one or more of the following short term contingency measures will take place:

- ensure appropriate management actions are taking place

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- implement additional dust control measures such as increasing water cart frequency and operating hours
- divert activities away from the areas where dust is originating to less susceptible areas, or reduce the level of activity in the affected areas
- reduce the total amount of dust generating activity across the site (e.g. reduce the total amount of activity on-site so that only essential activities are taking place)
- if the dust is being generated by an activity that can be scheduled to occur in more favourable conditions (e.g. topsoil removal, vegetation disposal), cease the activity until more suitable conditions occur.

After implementing the above actions, conduct an assessment on whether the mitigation of the dust emissions was successful. This assessment will include the consideration of additional management action, either short or long term that may be required to mitigate future dust generation.

In the event of an exceedence of a target or limit, the cause/s of the emissions will be reviewed and appropriate measures will be implemented to minimise the likelihood of a repeat of the event.

## 5. AIR QUALITY – GREENHOUSE GASES

### 5.1 MANAGEMENT OBJECTIVE

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Happy Valley project are:

- to ensure that greenhouse gas emissions do not adversely affect environmental values or the health, welfare or amenity of people and land uses by meeting statutory requirements and acceptable standards
- to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.

### 5.2 PERFORMANCE INDICATORS AND TARGETS

Performance indicators and targets will be defined through the *Energy Efficiencies Opportunity Act 2006* and the National Greenhouse Energy Reductions Scheme.

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### 5.3 DESCRIPTION

The Happy Valley project is expected to generate approximately 149,963 tonnes CO<sub>2</sub>-e throughout the 6 year operating life of the mine<sup>3</sup>. This represents approximately 0.2 tonne CO<sub>2</sub>-e generated per tonne of HMC produced. . An annual breakdown of estimated emissions is presented in Table 5-1

Table 5-1 Annual Net Scope 1 & 2 Emissions of CO<sub>2</sub>-e for the Happy Valley project

Year	Annual Emissions of CO <sub>2</sub> -e (tonnes/annum)
1	30,807
2	23,029
3	25,417
4	25,635
5	22,789
6	22,286

Approximately 45% of the total emissions are due to activities that require the burning of hydrocarbons, such as transport and earthmoving and, in particular, using heavy machinery (Scope 1 emissions). The wet plant, pumps and lights will require electricity, and greenhouse gas emissions created from producing this electricity can be attributed to the operations (Scope 2 emissions).

The clearing and removal of 155 ha of native vegetation will also significantly contribute to greenhouse gas emissions. This clearing will eventually be offset by rehabilitation activities which will return the same area to native vegetation. Net annual emissions from land use change (emissions from clearing minus sequestration in rehabilitation) are estimated to reduce to zero in year 9/10, thereafter becoming net sequestration into rehabilitation areas.

### 5.4 RISK AND RISK LEVEL

In principle, the Happy Valley proposal represents a continuation of the existing operational minesite at Gwindinup. On this basis, the proposal does not constitute an increase in greenhouse gas emissions, but instead represents ongoing emissions.

The clearing of native vegetation will be offset by the rehabilitation undertaken on-site. Whilst it will take some years for vegetation to reach the same sequestration capacity, it will ultimately result in only a small loss of carbon sequestration capacity.

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<sup>3</sup> Based on modeling contained in the NCAS toolbox (<http://www.climatechange.gov.au/ncas/ncat/>), Scope 1 & 2 emissions.

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### 5.5 MANAGEMENT ACTION

#### 5.5.1 Energy and fuel efficiency

The main focus of management is the pursuit of gains in energy and fuel efficiency. This objective is also driven by dramatic increases in the cost of both of these commodities. Energy efficiency programs are ongoing as part of continual improvement. Management of energy and fuel efficiency will be driven through the company requirements under the *Energy Efficiency Opportunities Act 2006*.

#### 5.5.2 Clearing controls

Clearing of native vegetation has been minimised by detailed mine planning and strict control of clearing activities. Via these methods, the requirement for clearing of native vegetation has been reduced from 216 ha to 155 ha. In addition to planning initiatives, strict control during clearing operations is instigated via Work Instructions 410 (Clearing of Native Vegetation) and 224 (Native Vegetation Pre-clearing Checklist) to ensure clearing of native vegetation occurs according to mine planning. All timber with a commercial value will be provided to local sawmills to reduce burning requirements and provide an additional sink for carbon dioxide.

### 5.6 PERFORMANCE MONITORING

Minesite fuel consumption figures are provided each year to the Commonwealth and State Governments as part of the National Pollutant Inventory.

In addition, the newly proclaimed *National Greenhouse and Energy Reporting Act (NGER Act) 2007* requires the reporting of greenhouse gas emissions, abatement actions and energy consumption and production by corporations. The first reporting year occurs from 1/7/08 til 30/6/09. It is anticipated that Bemax will be required to report as per the requirements of the NGER Act 2007, which will include emissions from the Happy Valley project.

The newly established *Energy Efficiencies Opportunity Act 2006* applies to corporations with energy consumption of greater than 0.5 petajoules. Bemax triggered reporting under this act in the 2006/07 reporting period and will monitor and report as per the requirements of the act.

## 6. INDIGENOUS AND NON-INDIGENOUS CULTURES (HERITAGE)

### 6.1 MANAGEMENT OBJECTIVE

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Happy Valley project are:

- to ensure the mine operations comply with the requirements of the *Aboriginal Heritage Act 1972*
- to ensure changes to the biophysical environment do not adversely affect historical and cultural associations
- to comply with relevant heritage legislation.

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Disturbance of historical aboriginal sites can not only impinge on cultural associations with the area, but can also irreversibly spoil its ethnographic record by altering the soil strata and damaging artefacts. Because of the shortage of definitive information on the aboriginal ethnographic background of the area and the small number of archaeological sites, any risk of irreversible damage to these *in situ* records must be assessed prior to the commencement of ground disturbing activities. This is a requirement of the *Aboriginal Heritage Act 1972* (AH Act) and also of EPA Guidance No. 41 (EPA 2004).

### 6.2 PERFORMANCE INDICATORS AND TARGETS

Company performance in this aspect will be assessed through compliance with the relevant heritage legislation, namely that approval under section 18 of the AH Act is obtained and its conditions complied with.

### 6.3 DESCRIPTION

The Department of Indigenous Affairs (DIA) advises that no recorded Aboriginal heritage sites are listed for the Happy Valley area, and indicate that the likelihood of sites occurring is usually influenced by factors such as availability of water, access to raw materials (eg. quartz or chert), the presence of prominent features and level of prior disturbance or development of the land. Based on these considerations, it is unlikely that there are unrecorded sites in the project area.

Following consultation with the Noongar Land Council and Gnaala Karla Boojah native title claimants, an Aboriginal heritage survey was conducted over the mining leases (MHA 2001).

The survey identified that all of the creeks running through the proposed development area have mythological significance due to their association with the *Waugal*, although no specific information regarding this association was provided. The Aboriginal consultants that took part in the survey also reported the potential for burial sites to exist along the creek banks.

Bemax has a Native Title agreement in place for the Happy Valley deposits, with several of the commitments already fulfilled and those remaining to be provided to the claimants following approval of the project.

Bemax has received approval under Section 18(3) of the AH Act to conduct mineral sands mining operations at the sites. This approval is subject to an approved archaeologist and/or Aboriginal monitors being available during vegetation clearing and excavations, particularly in creek areas.

### 6.4 RISK AND RISK LEVEL

Risk is associated with disturbance, so the assessment area is limited to the disturbance area, including roads, tracks, fence lines and firebreaks. The area of highest risk is associated with creek areas where the potential for burial sites exists, and the association with the *Waugal* has been identified.

## **6.5 MANAGEMENT ACTIONS**

### **6.5.1 Disturbance protocol**

The proponent has developed a response procedure in the event of unearthing potential Aboriginal artefacts or remains (WI045 – Aboriginal Heritage Monitoring and Contingency Plan), which is managed and updated under the proponent's EMS. This procedure has been in effect since commissioning of the proponent's Ludlow operations and was endorsed by the DIA during approval of the Ludlow project. The work instruction details the procedure in the event of a discovery and includes cessation of work, demarcation of area and procedure for notification of Bemax's Environmental Department, DIA and, in the event of skeletal remains, the Police Department. This Work Instruction will be reviewed and amended for the Happy Valley project.

### **6.5.2 Creek lines**

In order to minimise impacts on areas that are of significance in relation to both Aboriginal heritage and the surface water environment, a minimum buffer of 30 metres will be in place around all creek lines in the project area. The only disturbance in these areas will be for essential access tracks. Existing tracks will be utilised as much as possible, which will enable the retention of the maximum amount of remnant vegetation around the creek lines and preserve the soil profile in these areas minimising the risk of impacting possible burial sites and retaining the ethnographic significance of these creek lines.

In addition to this, stormwater will be collected within the mining areas and returned to the process water circuit for re-use. In this way, any water potentially contaminated by mining operations will be collected and reused, whilst any uncontaminated water will follow its natural drainage pattern to maintain existing flow regimes as much as possible and thus minimise the potential to impact upon the ethnographic values of the creeks.

Further details on the management of surface water flow and quality are provided in CD916 Happy Valley Water Resources Management Plan.

### **6.5.3 Clearing monitoring**

As per Bemax's Section 18 approval, an approved archaeologist and/or Aboriginal monitors will be present on-site during vegetation clearing and topsoil removal activities, especially those in proximity to creek areas. The monitors will examine the clearing areas progressively during clearing and topsoil removal events looking for artefacts or skeletal remains.

## **6.6 PERFORMANCE MONITORING**

Management will focus on adherence to the Section 18 permit requirements, namely that a Section 16 permit is obtained by a qualified archaeologist and/or Aboriginal representative to monitor vegetation clearance and excavations during the development, especially in creek areas.

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Tempus Archaeology will be responsible for the Section 16 permit, subject to approval from the DIA. Monitoring of operations will involve nominated representatives from the Gnaala Karla Boojah native title claim.

### 7. VISUAL AMENITY

#### 7.1 MANAGEMENT OBJECTIVE

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Happy Valley project are:

- to ensure that the visual amenity of the area adjacent to the project is not unduly affected by the mining activities

#### 7.2 PERFORMANCE INDICATORS AND TARGETS

Although there are no measurable performance targets for this aspect, performance will be gauged against complaints and comments received via local stakeholders. Communication received from stakeholders regarding this aspect will be logged through the EMS.

#### 7.3 DESCRIPTION

The visual landscape character is classified and described in terms of broad patterns of environmental characteristics according to their relevance to human interaction. Typically, this classification focuses on natural and land use character.

The proposal area is located on the midslopes of the Whicher Scarp overlooking the Swan Coastal Plain. The surrounding features of hills, Jarrah/Marri forest, cleared pasture and existing mines are located within private and State owned land.

The main users affected by the potential impact to visual amenity by the proposal are residents living on the Whicher Scarp and Swan Coastal Plain, and people using roads bounded by Lowrie Road, Boundary Road and Gavins Road (all sealed roads) used to access the local rural residences, industries and state forest.

The Gwindinup and Yoganup extended mines on the Whicher Scarp are already visible to several residences located on the Swan Coastal Plain and Whicher Scarp and members of the public using local roads in the area.

#### 7.4 RISK AND RISK LEVEL

Two types of impacts arise from mining activities that impact on visual amenity. These are light spill and impacts directly on visual amenity (aesthetics) such as loss of vegetation buffers. Light spill from large outdoor lights used to light the pit and infrastructure can impact on nearby residences. If the end land use is inconsistent with expectations then visual amenity may be impacted upon.

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Night-time lighting is mainly associated with the wet separation plant and HMC towers. Such lighting is usually relatively low intensity. Lighting of a higher intensity is used around the active areas of the pit and the primary screens. Light spill from these lights can impact on nearby residences.

Preliminary assessment indicates that the HVN plant site is moderately screened from positions down on the flats, whereas the HVS plant site is nestled amongst native vegetation which will largely screen positions on the plain.

Because the active pit area and the primary screens are located inside the pit, direct light outside the pit from these activities is minimal.

### 7.5 MANAGEMENT ACTION

#### 7.5.1 Installation

Lighting will be installed as per Australian Standard AS4282-1997 *Control of the obtrusive effects of outdoor lighting* in order to minimise the impact of lighting on surrounding residents and fauna utilising the adjacent vegetation.

#### 7.5.2 Vegetation and stockpile screening

Where possible vegetation will be retained to act as a screen, this will be managed according to WI224 – *Native Vegetation Pre-Clearing Checklist*. Stockpiles will be utilised as visual screens where possible and revegetated if practicable.

#### 7.5.3 Reduction of disturbance timeframes

Minimisation of the disturbance timeframe and staged rehabilitation will occur in order to re-instate aesthetic values as soon as possible following the completion of mining.

### 7.6 PERFORMANCE MONITORING

Routine visual inspections of the mine area from points of expected impact will be undertaken along with regular consultation with adjoining landowners.

## 8. RECREATION AND SAFETY

### 8.1 MANAGEMENT OBJECTIVE

Consistent with the Environmental Policy, the specific objectives in managing this aspect for the Happy Valley project are:

- to ensure that existing and planned recreational uses of the area are not compromised
- to ensure that risk from the proposal is as low as reasonably achievable.

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### **8.2 PERFORMANCE INDICATORS AND TARGETS**

Performance for this aspect will be assessed through the Environmental Management System. Incidents involving public safety and unauthorised access will be logged as incidents in the EMS. These incidents are reviewed and, where appropriate, investigated and then reported internally in the monthly objectives and targets.

### **8.3 DESCRIPTION**

The majority of the Happy Valley project site lies on private land; however, some mining will occur in public land in the State Forest and a portion of Gavins Road. Although there are no known legitimate groups that regularly use the State Forest, it is accessed by members of the public for recreational activities.

A diversion road will be made before mining occurs on Gavins Road so that traffic flow along Gavins Road is not significantly affected by mining activities. There will be an increase in vehicle activity in the area associated with the minesite, due to both private and company vehicles accessing the site and heavy machinery working on the minesites. In addition to this, increased traffic due to haulage of HMC will occur.

### **8.4 RISK AND RISK LEVEL**

The primary potential risk associated with public safety is mining in areas that have previously been used by the public. This will include areas of the State Forest where mining is to occur and a section of Gavins Road. This risk has been identified as low by members of the Happy Valley Working Party who have indicated that no legitimate local groups regularly use the area and that recreational usage of the area is minimal.

Gavins Road will need to be diverted to allow mining within the road reserve. In addition to this, minesite vehicles and machinery will need to cross the road and possibly carry out works on the road verge during mining operations. This causes further risk in addition to the risks that road users are exposed to, through an unfamiliar road layout and higher traffic loading.

There will be an increase in traffic in the area associated not only with haulage of HMC but also traffic to and from the minesite. Consultants have been engaged to assess the proposed transport routes and determine the associated impact.

### **8.5 MANAGEMENT ACTION**

#### **8.5.1 Site security**

In order to minimise risk to the public, and to prevent unauthorised access to the minesite, the premises boundary will be fenced and sign posted, notifying members of the public of the activities and safety hazards within the area.

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### 8.5.2 Traffic management

Vehicle access to and from the minesite and public areas will be from designated entry/exit points only. Internal minesite roads will be appropriately signposted where they intersect public roads.

Should any work be required to be undertaken within the road reserve, it will be clearly signposted, notifying road users of the hazard. Designated heavy vehicle crossings across Gavins Road will also be signposted.

The diversion of Gavins road will be signposted to make users aware of modifications to the road layout for the duration of the diversion.

Haulage will be undertaken on a defined route (to be determined). Roads identified for haulage use will be upgraded to the requirements of the vested agency. Site specific safety awareness training will be provided to truck operators as a part of the site induction.

### 8.5.3 Site safety

All activities on-site will comply with Mines Safety Regulations.

## 8.6 PERFORMANCE MONITORING

Daily inspections of the minesite will assess the premises boundary, including signage, fence conditions, and unauthorised access.

## 9. RADIATION

### 9.1 MANAGEMENT OBJECTIVE

Consistent with Environmental Policy, the specific objectives in managing this aspect for the Happy Valley Project are:

- to ensure that radiation levels at neighbouring premises are not affected by the mine
- to ensure that post-mining radiation levels are consistent with, or below, pre-mining (background) levels.

### 9.2 PERFORMANCE INDICATORS AND TARGETS

State legislation regulates occupational radiation dose limits. These limits are currently:

- for members of the public: an average dose of 1 mSv/year over 5 years
- for Radiation Workers: an average dose of 20 mSv/year over 5 years or 50 mSv in 12 months.

Bemax is committed to the ALARA principle which aims to keep radiation exposure levels “*As Low As Reasonably Achievable (ALARA), taking into account social and economic considerations.*”

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Pre-mining gamma levels will be used as the limit for gamma surveys post-mining.

### 9.3 DESCRIPTION

Mining of heavy mineral concentrate will remove the majority of the elements contributing to the current background levels of gamma radiation. Preliminary gamma radiation surveys indicate surface radiation levels within the project area are very low ranging from 0.03 – 0.3  $\mu\text{Gy}/\text{Hr}$ . These levels are typical of the Swan Coastal plain and do not represent a safety hazard. Extensive volumes of overburden that overlay the mineral deposit naturally insulate and reduce natural gamma radiation experienced at ground level.

The mining and concentration process removes the majority of mineral containing radioactive elements from the soil. This material is concentrated in the HMC; and although concentrated, radiation levels of the HMC are relatively low. Heavy mineral concentrate is removed from site to Bemax's North Shore Mineral Separation Plant for further processing. Whilst some tails from the mineral separation plant are returned to the minesite for disposal in the pit, the primary radioactive component is retained in the product streams. Hence material returned to the pit which makes up the final landform tends to be of equivalent or lower radioactivity than that which was originally present.

### 9.4 RISK AND RISK LEVEL

The titanium mineral contains a small amount of radioactive elements. The mining and consequent concentrating of this mineral also concentrates these radioactive elements. The predominant risks are those to employees and general public safety. Extensive precautions are in place to minimise risk from spillage or release of dust from the radioactive monazite tailings at the North Shore mineral separation plant. Monazite tailings are not returned to the minesite. The potential risk of increased irradiation of the site due to replacement of other tails also needs to be considered.

### 9.5 MANAGEMENT ACTION

#### 9.5.1 Radiation Management Plan

The Radiation Management Plan (CD669), which is approved by the Department of Mines & Petroleum (DMP) and the Radiological Council of Western Australia, will be fully implemented at Happy Valley.

The objective with regard to this environmental factor is to ensure that radiological impacts to the public and the environment are kept As Low As Reasonably Achievable and compliant with acceptable legislation, codes of practice and guidelines.

### 9.6 PERFORMANCE MONITORING

The area in which radiation levels must be controlled to meet acceptable standards is the total minesite area and the transport haulage routes. Gamma surveys of the project area will be conducted prior to ground disturbing activities in accordance with WI052 *Operation of Gamma Survey Meters*. These

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levels will be deemed background levels and be used as the upper limit for gamma levels following the completion of mining.

During operations, gamma surveys will be conducted around the site to ensure that levels remain within safe limits.

Post-mining gamma surveys will be conducted after topsoil replacement. The levels obtained in these surveys will be compared with the pre-mining data. If there are areas where the levels have increased by more than 20% of the original background levels, cleanup will be required to lower radiation levels to an acceptable point.

Monitoring results will be reported in the Annual Environmental Radiation Report.

## **10. MONITORING AND REVIEW**

### **10.1 PERFORMANCE MONITORING**

The performance monitoring programme is described in Table 12-2. All monitoring records will be collected as per any relevant standards or EMS procedures and will be stored at the Bemax North Shore Administration Centre.

### **10.2 PERFORMANCE REVIEW**

Monitoring results will be reviewed by Bemax environmental staff as they are recorded, to enable a response to be implemented if required. The results of the entire monitoring programme will be reviewed internally every three months as part of the EMS procedures.

### **10.3 COMPLIANCE AUDITING**

The auditing of conformance with this management plan and any conditions or commitments related to environmental management will be conducted on a 12-monthly basis throughout the life of the project. The auditing will be conducted as part of the Annual Environmental Report and is the responsibility of the Senior Environmental Officer – Compliance/Operations.

### **10.4 NON-COMPLIANCES**

Non-compliances identified during the auditing process or through the EMS will be brought to the attention of the Operations Manager and an incident report will be completed. Non-compliances will be reported to the DEC (as per Section 10.5), along with any measures that will be or have been taken to prevent recurrence of the conditions leading to the non-compliance.

### **10.5 REPORTING**

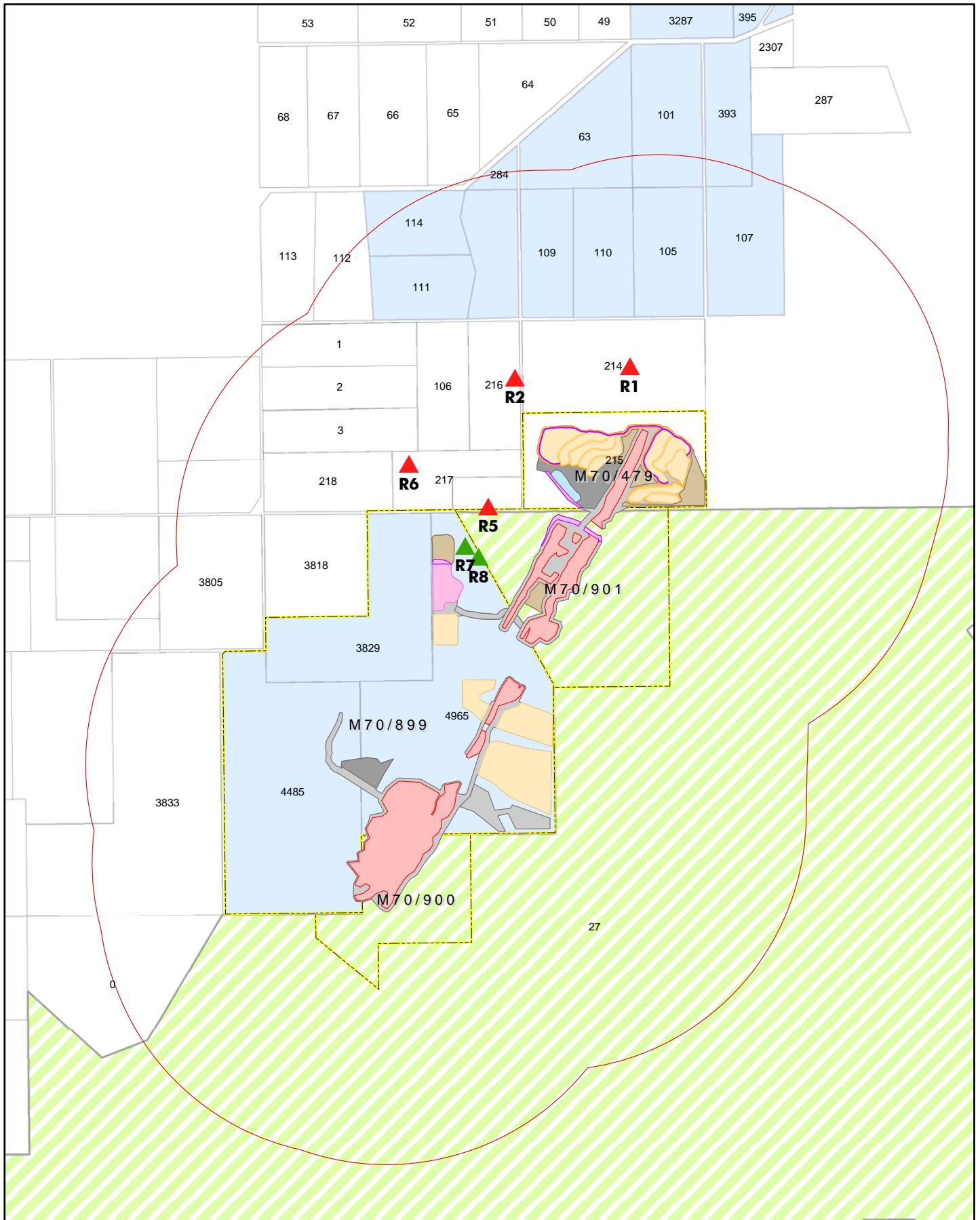
A report describing the performance of the EMMP in working towards its objectives, based on monitoring results, and the extent to which it has been complied with, will be submitted to the DEC by

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Environmental Management and Monitoring Program

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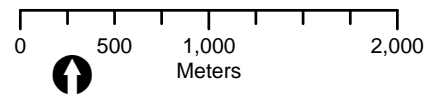
31<sup>st</sup> March each year. The report will be provided to relevant government authorities and will be publicly available on request.



**Figure 1:**  
**Location of sensitive premises relative to the project.**

**Legend**

- |                    |                       |                |              |
|--------------------|-----------------------|----------------|--------------|
| ▲ Bemax owned      | □ 2km buffer          | ■ Fines        | ■ OB         |
| ▲ Private          | □ Tenement Boundaries | ■ Fines (Wall) | ■ Pit        |
| ■ Bemax Properties | ■ Disturbance         | ■ Noise Bund   | ■ Plant Site |
| ■ State Forest     |                       | ■ TS           | ■ Water Dam  |



Datum: GDA 1994 MGA Zone 50  
 Drawn: DH  
 Date: 9/4/09





## 11. REFERENCES

### 11.1 EXTERNAL DOCUMENTS

DEC 2006, *Compliance Monitoring – Guidelines for Proponents (Draft)*. Environmental Management Division, Department of Environment, Perth.

EPA 2004, *EPA Guidance No 41 – Assessment of Aboriginal Heritage*. Environmental Protection Authority, Perth.

Glevan Consulting 2008, *Phytophthora Occurrence Assessment – Bemax Happy Valley Project Area*. Unpublished report prepared for Bemax Resources Pty Ltd, Perth.

Department of Climate Change (11 December 2008), *National Carbon Accounting Toolbox*, [Online], Commonwealth of Australia, Available from <http://www.climatechange.gov.au/ncas/ncat/> [21 January 2009].

International Council on Mining and Metals (ICMM) 2006, *Good Practice Guidance for Mining and Biodiversity*, International Council on Mining and Metals, London.

McDonald Hales & Associates (MHA) 2001, *Report of the Aboriginal Heritage Survey of the Proposed Mineral Sands Mining of the Gwindinup Projects, Western Australia*. Unpublished report prepared for Bemax Resources Pty Ltd, Perth.

Standards Australia 2003, *AS/NZS3580.9.3:2003 Methods for sampling and analysis of ambient air – Determination of Suspended Particulate Matter – Total Suspended Particulate Matter (TSP) - High Volume Sampler Gravimetric Method*. SAI Global, Sydney.

Standards Australia 2007, *AS/NZS3580.1.1:2007 Methods for sampling and analysis of ambient air – Guide to Siting Air Monitoring Equipment*. SAI Global, Sydney.

### 11.2 INTERNAL DOCUMENTS

Reference	Title	Type
CD018	Hazards and Incidents Reporting form	Controlled Document
CD669	Radiation Management Plan	Controlled Document
CD911	Happy Valley Fauna and Habitat Management Plan	Controlled Document
CD912	Happy Valley Decommissioning and Closure Plan	Controlled Document
CD914	Happy Valley Noise Management Plan	Controlled Document
CD915	Happy Valley Integrated Mining and Rehabilitation Plan	Controlled Document
CD916	Happy Valley Water Resources Management Plan	Controlled Document
SP015	Internal Audits	System Procedure
SP03	Identification and Management of Environmental Risk	System Procedure
WI224	Native Vegetation Pre-clearing Checklist	Work Instruction
WI410	Clearing of Native Vegetation	Work Instruction

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Environmental Management and Monitoring Program

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<b>Reference</b>	<b>Title</b>	<b>Type</b>
WI045	Aboriginal Heritage Monitoring and Contingency Plan	Work Instruction
WI047	Determination of Water Quality and Standing Water Level	Work Instruction
WI052	Operation of Gamma Survey Meters	Work Instruction

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## 12. MANAGEMENT AND MONITORING COMMITMENTS

Table 12-1 Summary of management commitments

Aspect	Number	Management Commitment	Monitoring Objective	Record/Evidence	Timing	Contingency	KPI
Vegetation	1.1	Minimise clearing of vegetation	To assess compliance	Survey & demarcate areas to be cleared according to mine plan	Prior to clearing	N/A	Number of incidents involving unauthorised clearing
	1.2	Maintain a buffer of at least 30 metres along creeklines	To assess compliance	Survey and demarcate 30 m buffer	Prior to clearing	N/A	Non-compliances
	1.3	Protect remnant vegetation within the project area from grazing	To assess compliance	Retain records (photographs, invoices of work) of installation	Ongoing	N/A	N/A
	1.4	Demarcate remnant vegetation as 'exclusion zones' and restrict access	To assess compliance	Retain photographs of demarcated zones and induction material	Prior to clearing & ongoing	N/A	Incidents of unauthorised access
	1.5	Install and maintain firebreaks in risk areas	Protection of existing remnant vegetation	Retain records (photographs, invoices of work) of installation and maintenance	Ongoing	N/A	N/A
	1.6	Control noxious weeds in remnant vegetation	Keep areas free of noxious weeds	Spray records	At least annually in appropriate season	N/A	Remnant areas of native vegetation free of noxious weeds
	1.7	Monitor vegetation health of remnant vegetation within project area	To assess vegetation health	As per Section 3.5	Prior to ground disturbing activities and ongoing	As per section 3.6	Mean plant density, mean % ground cover, mean maximum plant height and condition rating

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### Environmental Management and Monitoring Program

Air quality (particulates)	2.1	All employees will undergo dust awareness training as a part of the induction process	To assess compliance	Retain induction records	Prior to an employee commencing work on-site, or following an absence exceeding 7 months from site	N/A	100% of site employees inducted and trained
	2.2	Minimise cleared areas open at any one time through mine planning initiatives	To assess compliance	Mine plan, demarcate staged clearing	Prior to each clearing stage	N/A	Area of disturbance (ha)
	2.3	Minimise the quantity of material burnt through mine planning and rehabilitation initiatives	To assess compliance	Mine plan and clearing strategy	Prior to each clearing campaign	N/A	Quantity of material burnt
	2.4	Assess climatic conditions prior to burning operations and only conduct burning if conditions are favourable	To assess compliance	Retain on-site data used to assess current and predicted (Bureau of Meteorology) wind speed and direction as well as soil moisture levels	Prior to burning operations	Cease burning operations  As per Section 3.6	Number of complaints related to smoke
	2.5	Notify adjacent landowners prior to any burning off	To assess compliance	Retain records of notification	Prior to burning operations	N/A	N/A
	2.6	Strip topsoil outside of summer months; if this is not possible, wet down soil prior to movement	To minimise dust emissions	Retain records of topsoil stripping activities and water carts activities during stripping	Ongoing	Cease topsoil stripping until conditions are more favourable  As per Section 3.6	Dust complaints related to topsoil stripping activities
	2.7	Assess climatic conditions prior to undertaking topsoil stripping activities	To assess compliance	Records of on-site climatic conditions	Daily, during topsoil stripping operations	If possible reschedule stripping, otherwise deploy water carts to wet down topsoil  As per Section 3.6	Number of complaints related to dust generation as a result of topsoil stripping

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### Environmental Management and Monitoring Program

	2.8	Treat exposed or disturbed areas through the use of stabilisation treatments, water carts and/or sprinkler systems	To minimise dust emissions	Minesite inspections of treated areas noting the effectiveness of treatments and identifying areas requiring re-treatment	Treatment: <ul style="list-style-type: none"> <li>•spring/summer – at the start of spring, or within two weeks of fresh disturbance, then ongoing</li> <li>•autumn/winter – as required based on weather conditions</li> </ul> Inspections: daily	As per Section 3.6 Investigate alternative techniques for stabilisation	Number of dust complaints related to exposed areas
	2.9	Restrict access to stabilised areas	To minimise dust emissions	Retain records of signage or demarcation restricting access to stabilised areas	Ongoing	N/A	N/A
	2.10	Where possible maintain vegetation buffers or install screening around the premise boundary	To minimise dust emissions	Inspections/audit prior to clearing identifying vegetation that can be retained	Prior to clearing.	N/A	N/A
				Inspections/audits identifying areas to be screened	Ongoing.		
	2.11	Install a sealed apron to the entrance of the minesite prior to HMC haulage commencing	To minimise dust emissions	Retain photographs of sealed apron	Prior to haulage commencing	N/A	N/A
	2.12	Restrict vehicle speed to 30 km/h on main internal haulage road, and unformed tracks	To minimise dust emissions	Retain photographs of signage indicating speed limits and induction material	Ongoing	As per section 4.5.4	N/A
	2.13	Manage dust from heavy earth moving equipment by using well formed, stabilised roads, and utilising water carts as needed	To minimise dust emissions	Retain records from daily Site Inspections	Ongoing	Apply speed limits during adverse conditions  As per Section 3.6	Dust complaints relating to heavy earth moving equipment

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### Environmental Management and Monitoring Program

Air quality – greenhouse gases	3.1	Comply with the requirements of the <i>Energy Efficiency Opportunities Act 2006</i>	To assess compliance and monitor effectiveness	Report as required under the <i>Energy Efficiency Opportunities Act 2006</i>	Ongoing	N/A	Compliance with regulations
	3.2	Seek out energy and fuel efficiency initiatives	To assess compliance, monitor effectiveness and identify opportunities in efficiency	Records of energy and fuel use Public Report of identified opportunities.	Ongoing	N/A	Energy and fuel consumed/tonne ore processed
	3.3	Minimise native vegetation clearing through mine planning	To minimise emissions	Survey & demarcate areas to be cleared according to mine plan	Prior to clearing	N/A	Number of incidents involving unauthorised clearing.
	3.4	Provide timber of commercial value to local sawmills, rather than burning	To minimise emissions	Retain records of delivery to sawmills	At the completion of each clearing stage	N/A	Number of trees sent to sawmills
	3.5	Comply with the NGER Act	To assess compliance and monitor effectiveness	Report, as required, under the NGER Act	Ongoing	N/A	Compliance with regulations
Indigenous and non-Indigenous cultures (heritage)	4.1	Maintain a buffer of at least 30 m around all creek lines	To assess compliance	Surveyed buffer	Prior to clearing	N/A	Non-compliances
	4.2	Obtain a Section 18 permit	To assess compliance	Section 18 permit	Prior to ground disturbance	N/A	N/A
Visual amenity	5.1	Install lighting as per AS4282 – Control of the obtrusive effects of outdoor lighting	To assess compliance	Inspections and audits	Ongoing	N/A	Non-compliances
	5.2	Where possible retain native vegetation as a screen	To assess compliance	Inspection/audit identifying vegetation to be retained	Prior to each clearing stage	N/A	N/A

## Draft

### Environmental Management and Monitoring Program

	5.3	Utilise stockpiles as visual screens and revegetate if practicable	To assess compliance	Photographic records of stockpiles	Ongoing	Installation of visual screens	N/A
	5.4	Minimise disturbance timeframe and stage rehabilitation to reinstate aesthetic values as soon as possible	To assess compliance	Mine plan, clearing schedule and rehabilitation schedule	Ongoing	N/A	As per IMRP
Recreation and Safety	6.1	Fence the premise boundary and install signage along it	To assess compliance	Retain records of installation and inspections of premises	Install prior to mining, then inspect daily	Repair damage as soon as practical	N/A
	6.2	Restrict access between the minesite and public areas to designated entry/exit points	To assess compliance	Retain records of inspections of premise boundaries	Ongoing	N/A	Incidents reported
	6.3	Signpost internal roads where they intersect public roads	To assess compliance	Retain records (e.g. photographs) of installed signage, log employees non-complying as part of EMS	Ongoing	N/A	Incidents reported
	6.4	Clearly signpost and notify road users of any work being undertaken within the public road reserve	To assess compliance	Retain records (e.g. photographs) of installed signage	Ongoing	N/A	Incidents reported
	6.5	Signpost public roads where heavy vehicles cross Gavins Road	To assess compliance	Retain records (e.g. photographs) of installed signage	Ongoing	N/A	Incidents reported
	6.6	Upgrade roads along haulage route to the requirements of the vested agency	To assess compliance	Retain records of communication with vested agency regarding requirements for upgrade	Prior to haulage commencing	N/A	N/A

## Draft

### Environmental Management and Monitoring Program

	6.7	Induct all haulage operators with site specific safety awareness training	To assess compliance	Retain records of inductions and examples of induction materials	Prior to employee commencing work on-site	N/A	Non-compliances
	6.8	All activities on-site are to comply with Mines Safety Regulations	To assess compliance	Internal and external audits	Ongoing	N/A	Non-compliances
Radiation	7.1	Implement the Radiation Management Plan	To assess compliance	Annual Radiation Report	As per IRMP	N/A	Non-compliances
	7.2	Ensure radiological impacts are kept as low as reasonably achievable	To assess compliance	Monitoring records	Prior to ground disturbance and after topsoil replacement  Quarterly during the operating phase	N/A	No increase in post-mining gamma levels  Gamma levels are below legal and acceptable standards

## Draft

Environmental Management and Monitoring Program

**Table 12-2 Summary of monitoring measures**

Aspect	Monitoring Action	Responsible Person	Method	Timing	Contingency	KPI
Vegetation	Monitor vegetation health of remnant vegetation within project area	Rehab Advisor	As per Section 3.5	Prior to ground disturbing activities, then quarterly	As per section 3.6	Condition rating
	Survey vegetation health of remnant vegetation within project area	Rehab Advisor	As per Section 3.5	Prior to ground disturbing activities, then annually, in early spring	As per section 3.6	Mean plant density, mean % ground cover, mean maximum plant height
	Monitor the standing water level in bores	Environmental Technician	WI047 – Determination of Water Quality and Standing Water Level.	Monthly		Standing water level
Air quality (particulates)	Assess climatic conditions prior to burning operations and only conduct burning if conditions are favourable	Minesite Supervisor	Assess current on-site and predicted (Bureau of Meteorology) wind speed and direction as well as soil moisture	Prior to burning operations	Cease burning operations. As per Section 3.6	Number of complaints related to smoke
	Assess climatic conditions prior to undertaking topsoil stripping activities	Minesite Supervisor	Assess current on-site and predicted (Bureau of Meteorology) wind speed and direction as well as soil moisture	Daily, during topsoil stripping operations	If possible reschedule stripping, otherwise deploy water carts to wet down topsoil As per Section 3.6	Number of complaints related to dust generation as a result of topsoil stripping
	Daily inspection of the minesite area focussing on stabilised areas and dust generation	Minesite Supervisor	Minesite inspections of treated areas noting the effectiveness of treatments and identifying areas requiring re-treatment	Inspections - daily.	Investigate alternative techniques for stabilisation	Number of dust complaints related to exposed areas
Air quality – greenhouse gases	Estimate greenhouse gas emissions as per the NGER requirements	Senior Environmental Officer - Compliance	NGER Report	Annually	N/A	N/A

## Draft

### Environmental Management and Monitoring Program

Aspect	Monitoring Action	Responsible Person	Method	Timing	Contingency	KPI
Indigenous and non-Indigenous cultures (heritage)	Monitoring topsoil stripping activities, by a Section 16 permit holder or nominated Aboriginal representative	Environmental Officer	As per Section 16 and Section 18 permit conditions	During clearing activities	As per WI045	Non-compliances
Visual amenity	Inspect lighting and ensure it is installed as per AS4282 – Control of the obtrusive effects of outdoor lighting	Minesite Supervisor	Inspections and audits	Upon commencement of operations, upon plant or trommel relocation.	Adjust lighting if safe to do so	Complaints relating to lighting
Recreation and safety	Premise boundary inspection	Minesite Supervisor	Inspect minesite boundary, noting integrity of fences, site access and sign posting	Daily	Repair damage to fence and signage as soon as practical	N/A
Radiation	Operating area gamma survey	Environmental Technician	WI052 – Operation of Gamma Survey Meters	Quarterly	N/A	N/A
	Pre-mining gamma survey	Environmental Technician	WI052 – Operation of Gamma Survey Meters	Prior to ground disturbance	N/A	N/A
	Post mining gamma survey	Environmental Technician	WI052 – Operation of Gamma Survey Meters	After replacement of topsoil	N/A	Pre-mining gamma levels



