

## 10. MINOR FACTORS

### 10.1 ABORIGINAL HERITAGE

#### 10.1.1 Assessment criteria

##### **EPA objective**

The EPA objective for Aboriginal heritage is:

- *To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.*

##### **Aboriginal Heritage Act**

The Minister for Indigenous Affairs is responsible for the administration of the *Aboriginal Heritage Act 1972* (Aboriginal Heritage Act). Under section 17 of the Aboriginal Heritage Act, it is an offence to disturb any Aboriginal site without consent under section 18 of that Act.

The Minister considers recommendations from the Aboriginal Cultural Material Committee and the general interests of the community when making a decision on disturbance to a site and may also impose conditions on the approval.

The Registrar of Aboriginal Sites is responsible for maintaining the Register of Places and Objects. The Department of Indigenous Affairs (DIA) has a database of all recorded sites.

##### **EPA Guidance Statement No 41**

EPA Guidance Statement No. 41, "Assessment of Aboriginal Heritage" (EPA 2004c), provides guidance on the process for the assessment of Aboriginal heritage as an environmental factor. In its assessment of proposals the EPA will expect proponents to:

- report on the likelihood of the presence of matters of heritage significance to Aboriginal people
- analyse if the proposed biophysical changes will result in an impact on matters of heritage significance to Aboriginal people.

Based on this information, the EPA will make a determination on whether Aboriginal heritage is a relevant environmental factor. Where it is determined to be a relevant environmental factor, the EPA will expect the proponent to properly consider how to minimise any adverse impact of the proposal on heritage values.

This guidance statement also details those actions that may be pertinent to the factor of Aboriginal heritage, including:

- consultation with DIA staff and desktop review of sites
- undertaking an Aboriginal heritage and/or archaeological survey in consultation with relevant Aboriginal representatives
- inform relevant Aboriginal people of the proposal and conduct appropriate consultation

- demonstrate that any concerns raised by the Aboriginal people have been considered in the environmental management of the factor and that this is made known to the relevant Aboriginal people.

### **Native title**

Native title, or indigenous land rights, is a concept in the law of Australia that recognises the continued ownership of land by local Australian Aborigines or Torres Strait Islanders. The colonisation of Australia was conducted under the false assumption that the land was unoccupied (*terra nullius*) and could therefore be claimed for the Crown and distributed to colonists by the Government. The legal concept of Native Title as it applies in Australia was recognised by the judicial system in 1992, and the Keating government later enacted the *Native Title Act 1993* (Commonwealth) to clarify the legal position of landholders and the processes that must be followed for Native Title to be claimed, protected and recognised through the courts.

#### **10.1.2 Description of factor**

An archaeological and ethnographic survey of the project area was completed by McDonald Hales and Associates in March and April of 2001 (MHA 2001). Seven Aboriginal consultants from the Gnarla Karla Booja native title claim assisted in the ethnographical survey.

Aboriginal consultants reported that all of the creeks running through the project area have mythological significance due to their association with the Waugal. These locations were subsequently registered with the Department of Indigenous Affairs (DIA) (Location 18941- Gynudup Brook Ephemeral Creeks) following completion of the ethnographic survey (Figure 10-1).

#### **10.1.3 Assessment of potential impacts and mitigation**

##### ***Sources of potential impact***

##### Disturbance of creeks (registered sites)

Mining will come within 30 m of the creeks at Happy Valley South and 50 m from the creek at Happy Valley North. The creeks may be associated with artefacts and/or burials, as well as having mythological significance.

##### Uncovering of artefacts and/or burial sites

The proposed clearing and earthworks have the potential to uncover aboriginal artefacts of cultural significance and burial remains. The potential for this to occur is greatest in along the creeks (as above) and lower areas.

##### ***Management commitments***

##### Native Title agreement

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.

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### Section 18 approval

Bemax has received approval under Section 18(3) of the Aboriginal Heritage 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.

### Protection of 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 creeklines in the project area. The only disturbance in these areas will be for essential internal roads. This will retain much of the existing 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.

### Vegetation clearing protocols

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.

### Management protocols

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.

## 10.2 AIR QUALITY AND GREENHOUSE EMISSIONS

### 10.2.1 Assessment criteria

#### **EPA objective**

The EPA objective for dust and particulates is:

- *To ensure that air emissions to air do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.*

The EPA objective for greenhouse gases is:

- *To minimise levels to as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.*

#### **Environmental Protection Act 1986**

The *Environmental Protection Act 1986* includes requirements for the prevention of pollution to both subjective and prescriptive levels, the proper storage of waste materials that may result in pollution, and the licensing of prescribed premises, including mineral sands mining operations. Such licences may include conditions relating to quality of emissions, measures for minimising pollution, monitoring requirements and reporting requirements amongst others.

#### **EPA Guidance No 18**

EPA Guidance Statement No. 18: *Prevention of air quality impacts from land development sites* (EPA, 2000b) provides guidance for proposals with the potential to generate dust and smoke. It also provides information on possible mitigation measures and the use of management systems.

#### **National Environment Protection Measure for Ambient Air Quality (Air NEPM) 1997**

The Air NEPM establishes guidelines for air quality targets applying Australia-wide. Of relevance to this assessment is the target for particles (as PM10) of a maximum of 5 days a year exceeding 50 ug/m<sup>3</sup> (24 hour average).

#### **Energy Efficiency Opportunities Act 2006 (Cwth)**

The *Energy Efficiency Opportunities Act 2006* and its regulations require assessment of energy use and evaluation and reporting on opportunities for improvements in energy use efficiency. Participation is mandatory for corporations utilising more than 0.5 petajoules of energy per year. The Act is designed to improve the identification and uptake of cost-effective energy efficiency opportunities and improve productivity and reduce greenhouse gas emissions.

#### **National Greenhouse and Energy Reporting Act 2007 (Cwth)**

The National Greenhouse and Energy Reporting Act 2007 and its regulations establish a national system for the reporting of greenhouse gas emissions, energy consumption and production. It is intended that this data will be publicly available and in the long term form the basis of the Emissions Trading Scheme.

## Others

A guideline for the development and implementation of a dust management program (DEC 2008c) which identifies and discusses a range of considerations in deciding on appropriate management practices to minimise adverse impacts from dust generating activities.

The *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* establishes ambient standards and limits for total suspended particulates and sulphur dioxide in the Kwinana area. Whilst not directly applicable outside the Kwinana area, the particulate standards and limits can provide guidance on acceptable emissions for the Happy Valley assessment.

**Table 10-1. Kwinana EPP Ambient air quality standards and ambient air quality limits — total suspended particulates**

| Area        | Standard (µg/m <sup>3</sup> ) | Limit (µg/m <sup>3</sup> ) | Averaging period |
|-------------|-------------------------------|----------------------------|------------------|
| Policy Area | —                             | 1 000                      | 15 minutes       |
| Area A      | 150                           | 260                        | 24 hours         |
| Area B      | 90                            | 260                        | 24 hours         |
| Area C      | 90                            | 150                        | 24 hours         |

Area A is the area of land on which heavy industry is located;  
 Area B is a buffer area surrounding industry;  
 Area C is beyond Areas A and B, predominantly rural and residential.

## Assessment outline

To assess the potential environmental significance of the hazards posed by the proposal against the environmental objectives of the EPA and published air quality standards, the following issues will be examined:

**Determining what residences are present within the proposal area and its surrounds:** This issue has been addressed by a desktop review and community consultation to identify landowners in the vicinity of the proposal area.

**Determining local landowners concerns in relation to dust and greenhouse emissions:** Community consultation over the course of the approvals process and submissions received relating to the Happy Valley Environmental Scoping Document provided the primary source of information regarding concerns in relation to this issue.

**Determining the impact of dust emissions from the mining operation on local residences and vegetation:** Dust emissions were estimated utilising National Pollutant Inventory (NPI) methods and the risk of dust was assessed in comparison with the proponents current Gwindinup operation for comparison and verification.

**Examine the Proponents' previous performance in relation to dust and smoke:** Historical records were obtained from the company's incident recording database.

**Determine the impact of greenhouse emissions from the mining operation:** Estimations were made utilising Australian Greenhouse Office methodology based on predicted fuel and electricity usage and

land clearing areas. Estimations were compared to anticipated production of heavy mineral concentrate.

**Determining the influence of other threatening processes:** Information regarding other potential threats to air quality in the area has been reviewed. Measures for controlling or reducing the scope of these threats that can be implemented by the proponent are outlined.

**Identifying management options to avoid, minimise or mitigate the impacts of the Proposal:** The proposal has been extensively reviewed to avoid or minimise impacts to air quality. A review of Best Practice dust and greenhouse gas management measures has been undertaken and relevant management commitments are described.

**Comparing both worse-case and likely impact scenarios against State and Commonwealth criteria:** The relative regional and local impacts of the proposal are assessed against the criteria and described in terms of risk. The management commitments proposed by the proponent to address the risk levels are also assessed.

## 10.2.2 Description of factor

### **Identification of Sensitive Residences**

A review of residences in proximity to the Proposal area has identified six residences within 2 km of the site. The location of these residences is shown in Figure 10-3. Two of these residences are located on property owned by the Proponent. The nearest of these residences is approximately 50 m from the boundary of the mining lease, and 350 m from anticipated activity. During the drier months it is winds from the east which pose the biggest risk of excessive dust generation at these premises.

### **Community consultation**

To date community consultation has occurred primarily via the Happy Valley Working Party which has met four times since September 2007 to discuss the outcomes of studies conducted as part of the EIA process (Appendix C1). Dust was identified by members of the party as a key concern given the proximity of residences to the Happy Valley North sites and the proponents' performance at its current Gwindinup North operation.

### **Estimation of dust emissions**

Greenbase Pty Ltd have calculated estimated particulate emissions ( $PM_{10}$ ) from the Happy Valley Proposal over anticipated life of the mine, using National Pollutant Inventory (NPI) estimation techniques on behalf of the Proponent. Calculations included  $PM_{10}$  particulates generated from fuel combustion in vehicles, wind generated dust from open areas, and mechanically generated dust from vehicle wheels and materials loading and unloading. These calculations estimate the quantity of particulates generated on site rather than the quantity which leaves the premises boundary.

Average annual emissions of  $PM_{10}$  are estimated to be in the order of 212 tonnes per annum, which is in the lowest 2% of facilities reporting to the NPI. (ref. [www.npi.gov.au](http://www.npi.gov.au), 14/08/08). A complete breakdown of emission sources is provided in Appendix D1.

Emission estimates also provide a relative comparison with current and previous Bemax minesites. Results indicate that Happy Valley is expected to generate significantly less  $PM_{10}$  emissions than the

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nearby Gwindinup minesite for example. This is primarily due to the lower overburden removal requirements and a reduced heavy earthmoving fleet.

## **Estimate of greenhouse gas emissions**

Greenbase Pty Ltd have calculated estimated greenhouse gas emissions from the Happy Valley project over a six year mining period, to be followed by continuing rehabilitation. The estimations included emissions from burning fuels, electricity use and clearing and rehabilitation of native vegetation. Yearly calculations are provided in Appendix D1

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>63</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 10-2.

**Table 10-2 Annual Net Scope 1 and 2 Emissions of CO<sub>2</sub>-e for the Happy Valley project**

| Year | Annual Emissions of CO <sub>2</sub> -e<br>(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.

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<sup>63</sup> Based on modeling contained in the NCAS toolbox (<http://www.climatechange.gov.au/ncas/ncat/>), Scope 1 and 2 emissions.

## 10.2.3 Assessment of potential impacts and mitigation

### *Sources of potential impact*

#### Dust generation during materials handling

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).

Dust from mine sites is termed “Coarse Particulate Matter” (CPM), predominantly having a diameter larger than 10 microns<sup>64</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.

Previous mine experience suggests the greatest potential for dust generation is during the removal of vegetation and 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 problematic quantities of dust due to restricted airflow in the pit and higher soil moisture levels. Un-stabilised stockpiles and disturbed areas may also contribute to wind generated dust.

The Proposal 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 total suspended particulates (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.

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 Proposal area significantly addresses 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.

The location of residences within 2 km of the HVN and HVS deposits are shown in Figure 9-1. 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

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<sup>64</sup> NSW Minerals Council Technical Paper – Particulate Matter and Mining (undated)

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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 north-west of the HVN deposit.

### Smoke generation from controlled burning

Burning of felled timber and controlled burning during rehabilitation may lead to visible smoke (particulate) generation, as well as emission of greenhouse gases. The emission of smoke from the burning of woody debris may also impact on the health or amenity of nearby residences.

### Greenhouse gas emissions from fuel and electricity usage

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.

### Greenhouse gas emissions from land clearing

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.

## **Management commitments**

### Proposed Environmental Management and Monitoring Plan

The Proponent has developed a draft Happy Valley Environmental Management and Monitoring Plan (EMMP) which addresses issues associated with particulate and greenhouse gas management for the Happy Valley Proposal. The draft plan, which is provided in Volume 2, has the following objectives in regards to dust management:

- 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) and consider offsets to mitigate cumulative emissions (greenhouse)
- to respond effectively to complaints
- to minimise off-site impacts of dust from mining and transport activities on vegetation.

### Previous performance

A review of performance by the Proponent in relation to air quality found that in the past eleven years thirty complaints relating to dust have been received. In addition to these complaints a further eight air quality related incidents have been recorded. Complaints primarily relate to visible dust. Incidents reported by Bemax staff relate to monitoring results outside set air quality targets. Overall the review of performance identified approximately 2.7 complaints per year, and 0.7 incidents per year on average over the past eleven years. Several of these complaints have been associated with the current Gwindinup North minesite where there are 9 residences within approximately 500 m of the project boundary. The majority of complaints were received during the mine development phase of the project.

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Given the close and comparable geographical location, the Proponent has reviewed dust monitoring results taken from locations surrounding the current Gwindinup North mine since development commenced in mid 2007. Results for Total Suspended Particulates (TSP) as measured by a High Volume Air Sampler (HVA) over a 24hr period and PM10 measurements recorded continuously by a Dustrac are presented in Appendix D2.

Quarter 4 2007 and Quarter 1 2008 results for PM10 and 2008 results for TSP until 20<sup>th</sup> March 2008 cover the mine development phase. This included clearing, topsoil stripping and stockpiling, and overburden removal and stockpiling activities. Results for quarters 4 2008 and 1 2009 include mining and mine development phases.

The Gwindinup Operating Licence issued by DEC in March 2008, sets a TSP emission target of 150 ug/m<sup>3</sup> and a limit of 260ug/m<sup>3</sup>. A target of 50ug/m<sup>3</sup> has also been set for PM10 emissions based on a 24 hr average. On this basis results indicate that there was only one recorded exceedance of the PM10 target since monitoring commenced. This occurred early in the development phase of the operations and was related to smoke from local bushfires rather than dust. Whilst PM10 results are shown to fluctuate, particularly as a result of local weather conditions, it is evident that there are relatively low concentrations of PM10 dust emissions generated from a mineral sands operation.

TSP results show that the licence limit of 260ug/m<sup>3</sup> was exceeded on one occasion over the total period of monitoring. This occurred in January 2009 during a mining and mine development phase. In this instance a number of activities were occurring immediately adjacent to the HVA monitor, including mine void backfilling, removal of soil safety bund, movement of pipelines and HMC haulage. Whilst dust generation was localised and not observed to be leaving the premises boundary it indicated that several infrequent and relatively low impact activities could combine to create a high dust risk. In light of this incident further changes were made to site operating procedures consistent with an adaptive management approach.

Whilst monitoring results for PM10 and TSP largely remained within prescribed limits, further scrutiny of results in combination with dust complaints indicate that the development phase of the Gwindinup minesite generally resulted in the highest and/or more frequent dust generation events. During this phase the proponent trialled and progressively implemented new dust control strategies which have now become standard practise at the minesite and included where applicable within the draft Environmental Management and Monitoring Plan for the Happy Valley project. A summary of these strategies include:

- progressive capping of sandy stockpile batters with clay material during construction phase
- ongoing treatment of site access and HMC haulage roads, laydown areas and plant working areas with chemical dust suppressant.
- spraying of disturbed mine areas with fines material using specially designed watercart.
- removal of upper sandy material from mine void batters and replacement with clay material.

Having proven the effectiveness of the above dust control strategies at the Gwindinup minesite in combination with a range of standard control techniques, it is expected that satisfactory dust control will be achieved for the Happy Valley Project.

## 10.3 RADIATION

### 10.3.1 Assessment criteria

#### **EPA objective**

The EPA objective for radiation as an environmental factor is:

- *To ensure that radiological impacts to the public and the environment are kept as low as reasonably achievable and comply with acceptable standards.*

#### **Radiation Safety Act and regulations**

The keeping and use of radioactive substances in Western Australia is governed by the *Radiation Safety Act 1975* (RS Act) and the *Radiation Safety (General) Regulations 1983* (RS Regulations), which are administered by the Radiological Council, a statutory body set up under the RS Act.

#### **Mines Safety and Inspection Act and regulations**

Radiation safety in mine sites is also subject to the *Mines Safety and Inspection Act 1994* (MSI Act) and the *Mines Safety and Inspection Regulations 1995* (MSI Regulations). The MSI Act and MSI Regulations are administered by the State Mining Engineer (SME), but with technical advice provided by the Resources Safety Division of the Department of Consumer and Employment Protection (DOCEP).

Neither the MSI Regulations nor the Mining Code specifies an activity concentration for a material to be classed as a radioactive material. However, the Mineral Sands industry is deemed to fall under the provisions of Part 16 of the MSI Regulations and is thus required to have in place an approved Radiation Management Plan and a Radiation control Officer.

The Company's Radiation Management Plan is based upon NORM 2.2 (Preparation of a radiation management plan – mining and processing), issued by Resources Safety Section of the WA Department of Consumer and Employee Protection (DoCEP) and meets the requirements of the Code of Practice for Radiation Protection and Radioactive Waste management in Mining and Mineral Processing (Australia Government 2005). The Plan is reviewed biennially, with approval required from both DoCEP and the Radiological Council of WA.

#### **Disposal codes**

Radioactive substances containing uranium and/or thorium may be disposed of under the *Code of Practice for the Disposal of Radioactive Wastes by the User* (User Disposal Code) (NHMRC 1985) provided the individual activity concentrations of U238 or Th232 do not exceed 0.25 Bq/g (250 Bq/kg). Disposal of radioactive substances with higher activity concentrations must conform to the *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia* (Near Surface Disposal Code) (NHMRC 1992).

#### **Transport codes**

The transport of radioactive material is governed by the *Code of Practice for the Safe Transport of Radioactive Material 2001* (Transport Code) (ARPANSA 2001). In this Code of Practice a material containing naturally occurring uranium and/or naturally occurring thorium is classed as radioactive if

the aggregate activity concentration of U238 and Th232 is greater than 1 Bq/g (1000 Bq/kg). However, exemption from the Transport Code under section 107(e) occurs for natural materials containing naturally occurring uranium and thorium, which are not intended to be processed for use of these radionuclides, provided the aggregate activity concentration of U238 and Th232 does not exceed 10 Bq/g (10 000 Bq/kg), which is the case for HMC.

### 10.3.2 Description of factor

#### ***Radiation in mineral sands***

Mineral sands typically contain low-level traces of radiation, attributable to the naturally-occurring radioactive elements uranium and thorium that are associated with the crystalline heavy minerals, in particular with monazite. Monazite typically represents less than one percent of the total volume of mineral sands processed. The uranium and thorium are embedded in the crystal matrix and are not readily leached from the heavy minerals and thus follow the mineral stream during the separation process (Cooper 2005).

#### ***Processing and storage***

Primary separation concentrates the heavy mineral fraction from roughly 10% in the ore to more than 90% of the HMC that is transferred from the minesite to the secondary separation plant (North Shore). HMC from the Happy Valley orebody will contain approximately 170 ppm of thorium and uranium combined.

#### ***Zircon Tails***

The North Shore operations separate the concentrate into its individual components, with a by-product produced which includes monazite-bearing material referred to as Zircon Tails. There has been no chemical treatment during the separation process, so the monazite-bearing material (approximately 30% monazite) is in the same chemical and physical form as in the natural environment. This material typically contains approximately 11,300 ppm of Thorium and 540 ppm of Uranium.

Once separated, the material is stored and managed in accordance with the Company's Radiation Management Plan. Standard procedures defined in the Plan require the material to be stored within an enclosed storage shed. The shed is then deemed to be a controlled area whereby access by Company employees is regulated and radiation exposure rates monitored.

Since 2004 BEMAX has been exporting this material into Asia at a rate of approximately 20,000 tonnes per annum. The Zircon and Leucoxene fractions are removed initially and the remaining material reprocessed to produce rare earth chlorides. Approximately 60% of the rare earth chlorides are exported to USA, Japan and Austria, whilst the remaining 40% is consumed by the domestic (Asian) market for use in battery and gas mantle production.

Export occurs under licence from the Federal Department of Resources, Energy and Trade. The proponent's current permit is for 24 months, valid until 31<sup>st</sup> December 2010. A further application will be made for a new permit prior to the expiry date.

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## Previous incidents

The performance of Bemax and the mineral sands industry to date has been sufficient to ensure that there have been no significant incidences or legacies, further de-prioritising radiation as an important environmental factor. Additionally, a review of previous EPA advice on the impacts and management of radiation during mineral sands mining confirms that the EPA is satisfied that the risk is manageable under the current framework (Table 10-3).

**Table 10-3 Summary of radiation considerations in EPA Bulletins for mineral sand mining proposals in the last 6 years**

| EPA Bulletin                          | Advice to the Minister re radiation   |
|---------------------------------------|---|
| B1085 Cable Sands Tutunup (EPA 2002d) | No comments received. EPA advised that management of radioactive materials is DoIR responsibility under Mines Safety Inspection Act, that a Radiation Management Plan would be prepared and implemented to the satisfaction of DoIR and that post-mining radiation levels would be similar to, or below, pre-mining levels. EPA considered not to be a relevant environmental factor for further evaluation by EPA. |
| B1098 Cable Sands Ludlow (EPA 2003d)  | EPA considered factor did not require further evaluation. Radiation is managed by other responsible agencies and the return of radioactive materials to the minesite (at controlled rates) only represents a return of material already in the soil on the site.  |
| B1146 Iluka Gingin (EPA 2004f)        | EPA considered radiation to be a relevant environmental factor, however, EPA does not provide specific advice on the factor. Standard commitments to prepare and implement a Radiation Safety Plan to satisfaction of Radiological Council and DoIR.  |
| B1185 Bemax Gwindinup (EPA 2005b)     | EPA advised that radiation did not require further EPA evaluation. One public submission regarding disposal of radioactive mine tails (monazite) on site.   |
| B1211 Gunson Coburn (EPA 2005c)       | Not considered to be a relevant environmental factor: radiation management plan must be to satisfaction of Radiological Council and State Mining Engineer (DoIR).   |
| B1233 Iluka Cloverdale (EPA 2006d)    | No mention of radiation.  |

### 10.3.3 Assessment of potential impacts and mitigation

#### Sources of potential impact

The Happy Valley Proposal is a continuation of the Gwindinup mining operations and thus does not introduce additional radiation safety hazards or risks to public health, other than those that already exist which are recognised as being minor.

#### Management commitments

The Bemax mining and processing operations have in place a Radiation Management Plan which addresses, amongst other things:

- sources and pathways of radiation exposure, and their management
- equipment and facilities for controlling radiation sources
- institutional controls, safety personnel and workforce training
- waste disposal and transport
- a radiation monitoring program.

The Radiation Management Plan will be updated to include the proposed mining areas, as required by the MSI Regulations.

## 10.4 VISUAL AMENITY

### 10.4.1 Assessment criteria

#### **EPA objective**

The EPA management objectives for visual amenity are:

- *To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable*
- *To maintain the integrity, ecological functions and environmental values of landscapes and landforms.*

#### **EPA Guidance Statement No. 33**

EPA Guidance Statement No. 33 (EPA 2008b) provides guidance on land use planning and development processes to achieve environmentally sound outcomes. Part B of the Guidance Statement (*'Biophysical factors'*) provides advice in relation to 'landscape and landforms' and Part D (*'Social surrounds'*) provides advice in relation to 'visual amenity'. The Guidance Statement provides checklists for considering both of these factors during local area planning. Checklist criteria relevant to the Proposal are as follows:

#### Visual amenity

- retain natural landforms and vegetation in visually prominent places, as well as other parts of a site, in order to maintain local landscape character
- avoid locating development where it would be visually obtrusive
- adopt appropriate building design
- rehabilitate disturbed natural areas
- carry out landscaping works to meet completion criteria.

#### Landscape and landforms

- consider any guidance and principles that have been developed for the broader area
- carry out studies to describe and evaluate the existing landscape, landforms and visual resource
- describe the potential impacts that a proposed development may have with respect to landscape and landforms and their associated values
- consult with stakeholders and demonstrate how this has been incorporated into the project
- employ sound design measures and propose management measures that mitigate as far as possible the potential adverse impacts of the development of the landscape
- consider whether the location, design and management measures proposed are consistent with relevant objectives and pursue improvements where possible

- ensure implementation of approved design and management measures.

## **Visual Landscape Planning in Western Australia**

The *Visual Landscape Planning in Western Australia* guidance document (DPI 2007) provides guidance on land use planning, visual impact assessment and management.

The broad management objectives for visual amenity are to protect and maintain visual landscape character, restore and enhance degraded visual landscape character and undertake best practice for siting and design.

## **Shire of Capel Town Planning Scheme**

The Shire of Capel Town Planning Scheme No.7 contains no specific requirements for visual amenity for general industry, extractive industries or rural use areas.

### **10.4.2 Description of factor**

Visual amenity relates to the visual quality of a site or area as experienced by visitors and incorporates the collective impact of visual components that contribute to the visual pleasantness and character of localities. Landscape values include a wide range of human-related values that stem from relationships between people and places.

#### **Visual landscape character**

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 (Figure 10-1). The surrounding features of hills, Jarrah/Marri forest, cleared pasture and existing mines are located within private and State owned land.

The landscape character units for the Proposal area and surrounds are described below and as shown in Figure 10-2:

- **hills natural** includes elevated areas of the Whicher Scarp surrounding the proposal area. The Whicher Scarp consists of the escarpment, eroded ridges and plateau, dominated largely by vegetation
- **low foothills natural** located along the western boundary of the proposal area provide a distinct transition area between the flats and the escarpments; dominated by vegetation except for roads, tracks or power lines
- **low foothills disturbed** include the existing mineral sands operations located north and south of the proposal area consisting largely of cleared areas. The existing Gwindinup and Yoganup mines consist of exposed soil, mine pits, haul roads, stockpiles and earth bunds
- **low foothills farming** includes where agricultural activities dominate the land use character. These areas consist largely of cleared open paddocks with some pockets of remnant vegetation

- **plains farming** includes the topographically flat area of the Swan Coastal Plain near the proposal area that are largely cleared open paddocks used for agricultural activities (mainly animal agistment).

## **Community use**

An assessment of community use provides an indication of how people use an area and the likely importance of landscape values for that use. 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.

## **Community perceptions**

Areas of high scenic amenity are those highly regarded by the community and have good views compared with other parts of the region. The area surrounding and incorporating the proposal area can be considered a 'valued' landscape as it contains a number of landscapes and features that are highly valued by the community (EPA 2008a). People generally prefer areas of high scenic amenity including (DPI 2007):

- natural landscapes
- panoramic views
- expansive landforms
- dramatic topography (relief, ruggedness, ridgelines)
- ephemeral water features (flooding, creeks) and associated riparian vegetation
- areas of diverse patterns of vegetation
- recreational use (including access roads, four-wheel drive tracks and trails).

The area surrounding the proposal area also contains landscapes that are not potentially valued by the community, such as the existing disturbance of current mineral sand mining operations.

## **Landscape significance**

Landscape significance identifies the characteristics or features of the study area that are most important to the experience and enjoyment of people.

- elevated areas along the Whicher Scarp
- areas of diverse patterns of vegetation (eg. crops, pastures and natural vegetation)
- steep vegetated slopes of the Whicher Scarp and intersecting valleys and ridges
- rural dams
- State forest.

## **Sensitivity levels**

Sensitivity levels have been assigned to use areas based on established criteria identified by Cleary (2007). These sensitivity level criteria are based on the volume of use and the type of use (Table 10-4).

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**Table 10-4 Sensitivity level criteria - source (Cleary 2007)**

| Classification                 | Type of use – existing or formally proposed                        |   |   |
|--------------------------------|--|---|---|
|                                | Non-recreational use rural and forest roads                        | Recreation and tourism  | Settlement  |
| High sensitivity – Level 1     | National and State Highways. Links between cities and major towns. | Designated tourist roads. Major recreation site recognised formally or informally at a national or state level, including walking tracks and lookouts. Primary access to these recreation sites or multiple level 2 use areas. Travel routes or sites through or adjacent to scenic or historic areas with recognised or assessed values or national or state importance. | Places with recognised or assessed scenic or historic values or national or state importance. |
| Moderate sensitivity – Level 2 | Main link roads between towns and highways.                        | Important but undesignated tourist and recreation roads. Recreation sites of regional importance, including walking tracks and lookouts. Primary access to these recreation sites or multiple level 3 use areas. Travel routes or sites through or adjacent to scenic or historic areas with recognised or assessed values of regional importance.                        | Places developed to capitalise on views or attractions.                                       |
| Low sensitivity – Level 3      | Minor link roads.  | Local recreation use.   | Residential areas other than Level 1 or 2.  |
| Very low sensitivity – Level 4 | Roads receiving local non-recreation use.                          |   | Industrial areas.   |

## Views

The Gwindinup and Yoganup extended mine on the Whicher Scarp are already visible to several residences located on the Swan Coastal Plain and Whicher Scarp. The Gwindinup mine site is also intermittently visible to people utilising the roads located on the Swan Coastal Plain area adjoining to the Whicher Scarp. Examples of these views and views of the proposal area are contained in Plates 1 to 3 in Appendix L1.

### 10.4.3 Assessment of potential impacts and mitigation

#### *Sources of potential impact*

Activities or environmental aspects of the proposal that may potentially affect landscape values and visual amenity include:

- landform modification may reduce the aesthetic value and visual quality of the area due to the change in landscape (for example, removal of native vegetation and loss of rural character)
- mining pit and infrastructure may be visible to the public thereby detracting from the visual quality of the area
- dust emissions may detract from the visual quality of the area
- light spill.

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## Impacts at key visual receptors

The areas potentially visually affected by ‘line of sight’ include all areas that are within the lower and mid-slopes of the Whicher Scarp. The key visual receptors were identified as Receptors 1 to 4 (Figure 10-3). A series of baseline photographs facing the proposal area were taken at each identified key visual receptor. Computer graphic simulations of predicted future landscapes in year 2011 to 2012 were produced for the most significant visual Receptors 1 to 4 and are shown in Appendix L1. Receptors A to D (Figure 10-3) are not considered key visual receptors due to significant levels of vegetative screening.

The proposal will result in temporary additional modification of an already highly modified landscape. The top ridgeline of the Whicher Scarp is expected to be visible from all of the sensitive visual receptors and is unlikely to be obscured by the proposal.

The greatest change to existing views is expected to occur at Receptor 1, a rural residence located on the Whicher Scarp near the northern extent of the proposal area. This location presently has views of open farmland pastures and the natural hills of the Whicher Scarp. Simulated views of the proposed noise bund at appear close and prominent from areas within this property, including Receptor 1a (farm gate entrance), and Receptor 1b (dwelling). Views of the proposal area from Receptor 1b could not be fully determined during the current visual assessment, however, they may be partially screened by topography and screened by vegetation located immediately south of the house. Further visual investigations at this receptor may be required before any proposed ground disturbing activities.

A summary of visual impacts to all key visual receptors is provided in Table 10-5 and described in Appendix L1.

## Landscape impacts

Of the landscape units identified earlier, only the **hills natural** and **low foothills natural** units are potentially impacted by the proposal as a result of clearing and visual exposure to the noise bund and mine pits. During the course of the proposal, the mine pit and noise bund (which will differ in topography and colour from the more natural landform) will be sited within the vegetated areas of the scarp, thereby affecting the surrounding natural landscape. However, the vegetation below the proposal area on the lower scarp will provide significant screening and the overall impact is expected to be low.

**Table 10-5 Summary of key receptor locations and potential sensitivity levels**

| Visual Receptor location | Description  | Distance to the proposal area | Level of public use | Potential views   | Perceivable change                            | Potential sensitivity |
|--------------------------|--|-------------------------------|---------------------|---|---|-----------------------|
| 1a                       | Brilliant Road - rural residential driveway access | 0.8 km                        | Low                 | South-easterly panoramic views towards the scarp and proposal area  | Moderate - partial views of the northern bund | Moderate              |
| 1b                       | Brilliant Road - rural residential dwelling        | 0.5 km                        | Low                 | Site access restrictions (simulated assessment only). Views south towards the proposal area may be potentially screened by vegetation | Moderate – partial views of the northern bund | Moderate              |
| 2                        | Brilliant Road - rural residential dwelling        | 0.4 km                        | Low                 | South-easterly views towards the proposal   | Minor for the driveway                        | Low                   |

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| Visual Receptor location | Description                         | Distance to the proposal area | Level of public use | Potential views   | Perceivable change  | Potential sensitivity |
|--------------------------|-------------------------------------|-------------------------------|---------------------|---|---|-----------------------|
|                          | and driveway access                 |                               |                     | area and scarp screened by trees, shed and water tank   | access – proposal screened by remnant trees<br>None for the dwelling                  |                       |
| 3                        | Lowrie Road                         | ~2 km                         | Low                 | South-easterly intermittent views of the Gwindinup mine and towards the proposal area. Roadside views largely obstructed by roadside vegetation and vegetation screening on the scarp | Minor – existing roadside vegetation provides intermittent views of the proposal area | Low                   |
| 4                        | Boundary Road - views from roadside | ~2.5 km                       | Low                 | South-easterly unobscured panoramic views of the scarp and ridgelines. Views to Proposal area and Gwindinup mine are diminished by vegetation in the middleground.                    | Minor – large distance to proposal area   | Low                   |

## Management commitments

Existing visual amenity and landscape values within and surrounding the proposal area will be maintained as far as practicable through the implementation of the following measures:

- minimise unnecessary clearing of vegetation
- minimise disturbance timeframe by conducting staged clearing and prioritise rehabilitation in areas causing most visual impact to visual receptors
- utilising local provenance species and matching local relative plant densities in rehabilitation areas
- revegetation of disturbed areas with the aim of achieving safe, stable and self sustaining landforms that are compatible with surrounding areas
- locating infrastructure in, or near previously disturbed areas as far as practicable
- selecting colour schemes for buildings and infrastructure that blend in with the surrounding landscape
- install lighting as per the Australian Standard AS4282-1997 *Control of the obtrusive effects of outdoor lighting* (eg. minimise use, light orientation).

The low relief of the access roads and visual receptors on the Swan Coastal Plan provides significant opportunity for screening the proposal area with low to moderately high vegetation. Where feasible, vegetation screening along roadsides and rural residences can minimise the impact to visual sensitive receptor locations. Vegetation screening using fast growing species along the roadside at these close to the visual receptors view points will enable staged screening with each year of vegetative growth.

### 10.5 RECREATION AND PUBLIC SAFETY

#### 10.5.1 Assessment criteria

##### ***EPA objective***

The EPA management objective for recreation is:

- *To ensure that existing and planned recreational uses are not compromised.*

#### 10.5.2 Description of factor

Currently, the State Forest portion of the proposal area is open to public access for the purposes of recreation, under the Lands Act. For public safety reasons, the active mining areas, including an appropriate set-back, will require to be restricted, using fences and signs. However, consultation with the Working Party and local DEC officers gives a strong indication that there are no there are no areas of specific or elevated recreational value within the proposal grounds. It has been previously reported that, the public open space and vegetated landscape values of the proposal area are widespread along the Whicher Scarp (Strategen 2007a). Additionally, the restrictions on public access are for the short-to-medium term only, during which the revegetation of old gravel pits within the State Forest and the increase in local extent of State Forest as proposed offsets, should result in a net benefit to this environmental factor.

Accordingly, the Happy Valley proposal is not considered to be inconsistent with the EPA objective for recreation, i.e. to ensure that existing and planned recreational uses are not compromised.

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**Table 10-6 EIA Summary table – Minor factors**

| Management Objective  | Potential Impact  | Proposed Management   |
|---|---|---|
| To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation                                | Disturb registered sites, without permission.                                     | Ensure activities are consistent with Section 18 approvals.<br>Retain creek buffers.  |
|   | Uncover artefacts or burial sites.  | Develop clearing protocols, including the presence of an Aboriginal monitor during initial ground disturbance.<br>Develop management protocols (EMMP) for dealing with artefacts and other remains.   |
| To ensure that air emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards | Create unacceptable dust emissions during materials handling.                     | Assess weather conditions and dust risk prior to and during earthmoving activities<br>Use water carts to manage dust, if appropriate.   |
|   | Create unacceptable dust emissions during haulage.                                | Install sealed apron at mine site entrance and water down internal roads and work areas.<br>Cover HMC during haulage.<br>Restrict internal speeds.  |
|   | Increase risk of unacceptable dust emissions from open disturbed areas and roads. | Stabilise open areas with high dust risk and restrict access to such areas.<br>Minimise the area open at any one time.  |
|   | Fail to take all reasonable and practicable measures to limit dust emissions.     | Inspect dust risk daily, including weather conditions, as part of EMMP.<br>Install and maintain buffers and screens along risk areas.<br>Keep amount of material burnt to a minimum and consider weather conditions before burning.<br>Respond effectively to complaints. |
| To minimise greenhouse gas emissions to as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions  | Increase greenhouse intensity.  | Comply with relevant legislation.<br>Implement reduction and efficiency programs as per the EMMP.   |
| To ensure that radiological impacts to the public and the environment are kept as low as reasonably achievable and comply with acceptable standards   | Radiation levels after mining may exceed pre-mining levels.                       | Implement Radiation Management Plan, approved by Radiological Council of WA.  |
|   | Radiation may build up along haulage routes.                                      |   |
| To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable  | Impact on visual amenity .  | Ensure disturbances are minimised and rehabilitation is completed as soon as possible.  |
|   | Impact on neighbourhood amenity by poor management of outdoor lighting.           | Implement EMMP, including management of outdoor lighting as per AS.   |

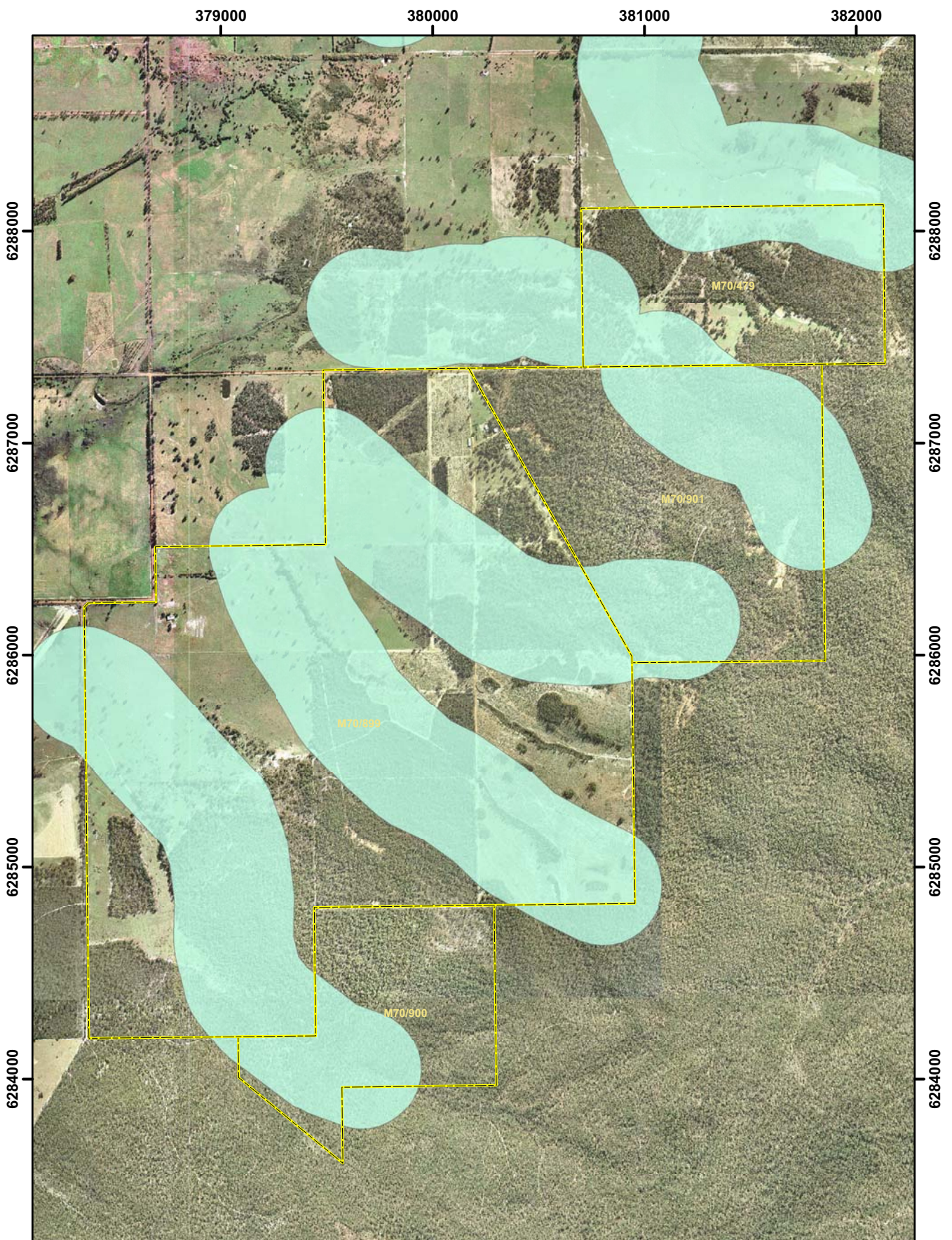
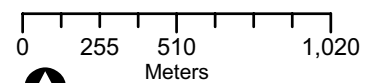


Figure 10-1  
Locations of registered sites under the  
Aboriginal Heritage Act 1972

**Legend**

- Tenement Boundaries
- Gynudup Brook Ephemeral Creeks



Datum: GDA 1994 MGA Zone 50  
Drawn: DH  
Date: 25/8/08



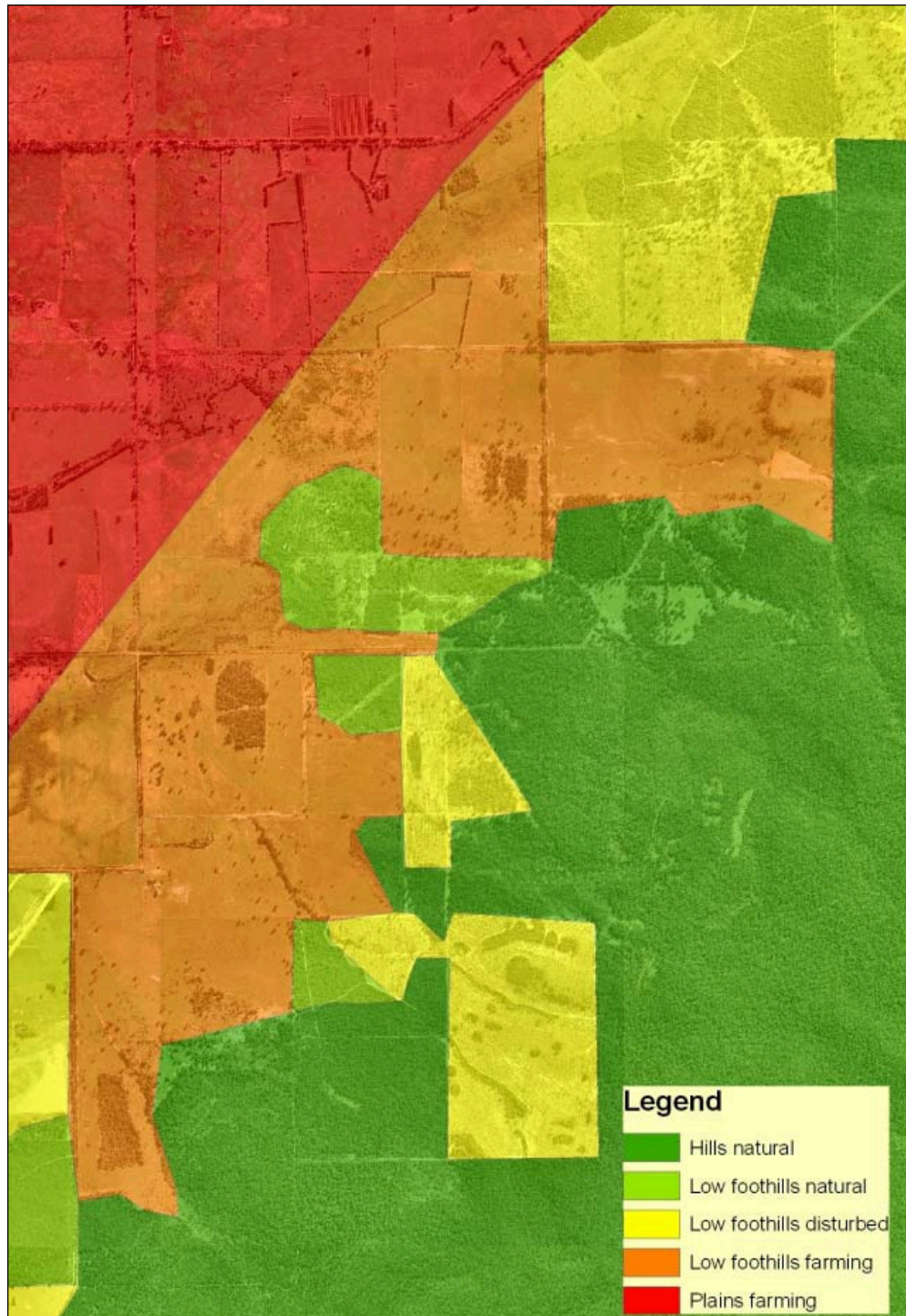


Figure 10-2 Landscape character units of the Proposal area and surrounds

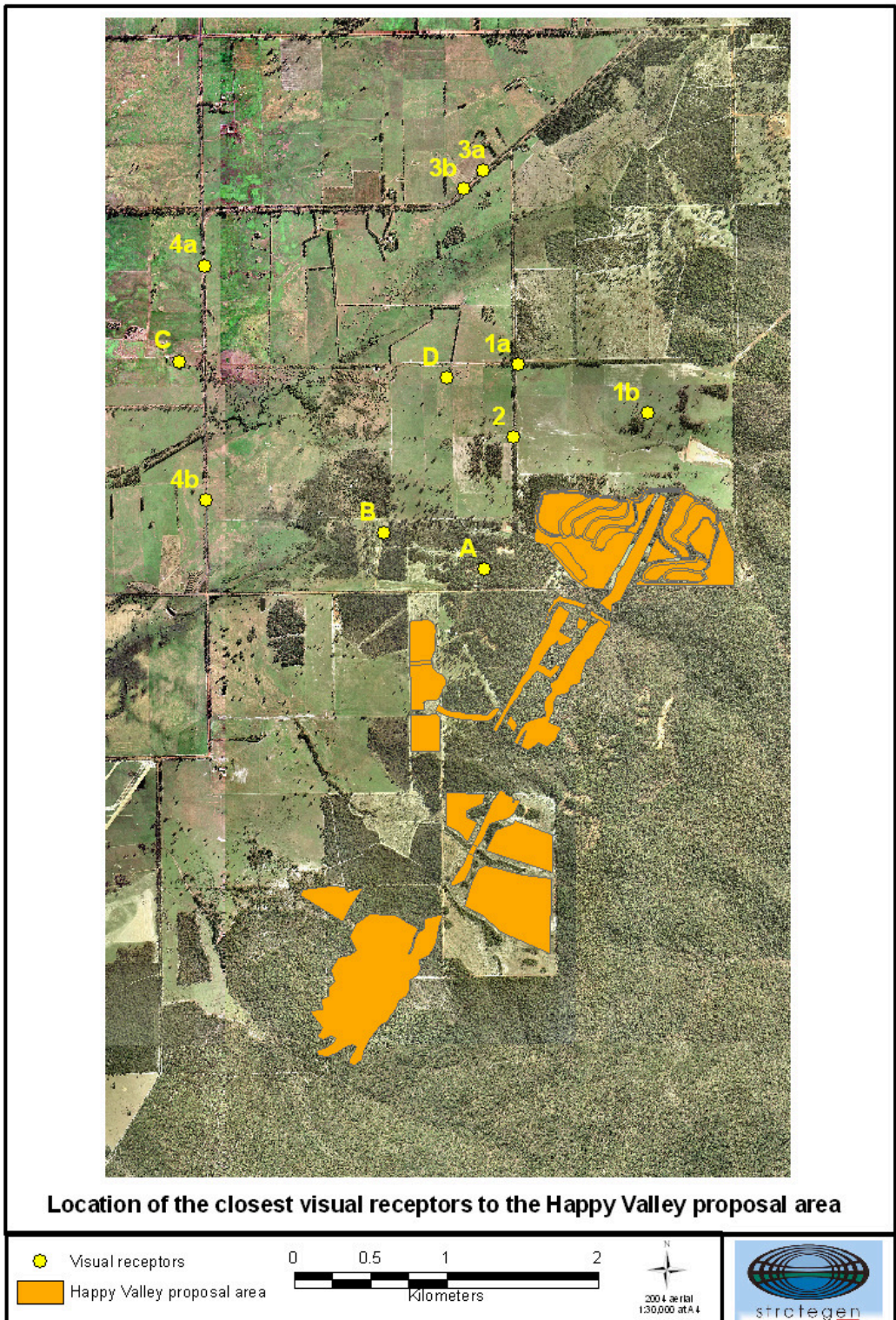


Figure 10-3 Sensitive receptor locations