

Keysbrook Mineral Sands Mine

Olympia Resources Limited

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia
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Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
25/07/05	Level of assessment set (following any appeals upheld)	0
26/06/06	Proponent document released for public comment	48
21/08/06	Public comment period closed	8
28/09/07	Final proponent response to the issues raised	58
29/10/07	EPA report to the Minister for the Environment	4

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29 OCTOBER 2007.
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Assessment No. 1580

Summary and recommendations

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the proposal by Olympia Resources Limited to develop a mineral sands mine near the rural township of Keysbrook. The proposal involves the excavation and processing of a low-grade heavy mineral sands deposit to produce 920,000 tonnes of heavy mineral concentrate over 8 years. The concentrate would be trucked 117 kilometres (km) to Bunbury by road for further processing and export.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the outcome of its assessment of a proposal. The report must set out the:

- key environmental factors identified in the course of the assessment; and
- EPA's recommendations as to whether or not the proposal may be implemented, and if the EPA recommends that implementation be allowed, the conditions and procedures to which implementation should be subject.

The EPA may include in the report any other advice and recommendations as it sees fit.

The EPA is also required to have regard for the principles set out in section 4A of the *Environmental Protection Act 1986*.

Key environmental factors and principles

The EPA decided that the following key environmental factors relevant to the proposal required detailed evaluation in the report:

- (a) vegetation (includes fauna, wetlands and rehabilitation);
- (b) groundwater;
- (c) noise; and
- (d) dust.

There were a number of other factors which were relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

The following principles were considered by the EPA in relation to the proposal:

- (a) precautionary principle;
- (b) principle of intergenerational equity;
- (c) principle of the conservation of biological diversity and ecological integrity;
- (d) principles relating to improved valuation, pricing and incentive mechanisms; and
- (e) principle of waste minimisation.

Conclusion

The EPA has considered the proposal by Olympia Resources Limited to develop a mineral sands mine near the rural township of Keysbrook.

The Commonwealth Department of the Environment and Water Resources found the proposal to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* for the presence of Listed threatened species and communities, and Wetlands of international importance in the vicinity of the project area. The threatened species are *Calyptorhynchus baudinii* (Baudin's Black Cockatoo) and *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo). The wetlands of interest are the Peel-Yalgorup Ramsar site (20km downstream of the project area), Becher Point Wetlands (20km northwest of the project area), and the Forrestdale and Thomsons' Lakes (37km north of the project area). The EPA has assessed the proposal in accordance with the bilateral agreement between the Commonwealth and Western Australia relating to environmental impact assessment.

The proposed mine area has multiple owners, and comprises farmland not owned by the proponent. The minerals in the area are "minerals to owner".

The project area is within a dampland (seasonally waterlogged basin). On-ground assessment of wetlands by the Department of Environment and Conservation found that no mapped conservation category wetlands exist within the mine area.

Most of the project area is annual pasture grazed by cattle. During the assessment, the EPA established that the remnant native vegetation on Lot 56 and Lot 3 has the highest conservation value of the vegetation in the project area because it contains remnants that:

- are poorly represented on the eastern side of the Swan Coastal Plain;
- are in Good to Very Good condition, in an extensively cleared area; and
- comprise habitat for native fauna of conservation significance. The significant stands of mature trees provide feeding areas for endangered cockatoos and other conservation significant bird species.

For these reasons, the EPA advised the proponent that the proposal to clear remnant native vegetation on Lots 56 and 3 would not be supported. As a result, the proponent excised these areas from the mine plan.

The majority of the mine area is pasture with scattered native trees. The remnant native vegetation within the mine area consists of stands of mature trees with minimal or no understorey. The remnant vegetation, that covers about 13% of the proposed mine area in discrete pockets, has environmental value because it:

- is poorly represented on the eastern side of the Swan Coastal Plain;
- exists in an extensively cleared area; and
- provides resource value, in terms of food, breeding, roosting or shelter for endangered cockatoos and other conservation significant bird species.

Considering the significance of the vegetation and trees to be cleared as a result of mining, the EPA recommended that the proponent identify a consolidated area of remnant native vegetation on Lots 59 and/or 62, and excise this area from the mine plan. This area should be protected from grazing, enhanced through revegetation and weed control, and preferably secured in perpetuity for conservation purposes, by means of a conservation covenant. The EPA notes that the proponent is negotiating with the landowners of Lots 59 and 62 to provide compensation to place a conservation covenant over the excised area.

On-site monitoring and modelling indicated that groundwater drawdown associated with the proposal should not adversely affect the aquifers and surrounding bore users.

The EPA has recommended a daytime noise level of 50dB(A), evening noise limit of 40dB(A), and a night time noise limit of 35dB(A). This would preclude mining at night in the southern part of the project area, consistent with the proponent commitments. Overall, there would be a pre-disposition towards daytime operations.

The EPA considered that the generation of Total Suspended Particulate matter (which includes all particles up to 50 micrometres in diameter) requires management for the proposal.

The EPA considered that the proponent could have agreements with the surrounding landowners that may be adversely affected by noise and dust generated from the proposal.

The EPA has concluded that the proposal should proceed only if the proponent can ensure that mining operations meet the recommended noise limits, and there is satisfactory implementation of the recommended conditions set out in Appendix 4 of this report.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is the development of a mineral sands mine near the Keysbrook township. The proposal involves the excavation and processing of a low-grade heavy mineral sands deposit. Local roads would be upgraded to facilitate the transport of the heavy mineral concentrate to South Western Highway.
2. That the Minister considers the report on the key environmental factors and principles as set out in Section 3.
3. That the Minister notes that the EPA has concluded that mining operations should be allowed to proceed only when the recommended noise levels are met.
4. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Conditions

Having considered the proponent's management actions and commitments and information provided in this report, the EPA has developed a set of conditions that it recommends is imposed if the proposal by Olympia Resources Limited to develop a mineral sands mine near Keysbrook is approved for implementation. These conditions are presented in Appendix 4. Matters addressed in the conditions are outlined below.

- (a) Fulfillment of the commitments set out as an attachment to the recommended conditions in Appendix 4.
- (b) Rehabilitation.
- (c) Weed and dieback management.
- (d) Water management.
- (e) Acid sulfate soils management.
- (f) Performance bond.
- (g) Noise management.
- (h) Air quality and dust management.

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5. Summary of submissions and proponent's response to submissions

1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the key environmental factors and principles for the proposal by Olympia Resources Limited to develop a mineral sands mine 70 kilometres (km) south of Perth, between the rural townships of Keysbrook and North Dandalup (Figure 1). The project area is on the eastern edge of the Swan Coastal Plain (SCP) within the Shire of Serpentine-Jarrahdale and the Shire of Murray.

The land in the project area is held in pre-1898 title, where the private landowner, rather than the State has ownership of the minerals. Therefore the provisions of the *Mining Act 1978* do not apply to the proposal. The area to be mined is in private ownership, with multiple landowners. The proponent owns one of the sixteen lots to be mined (Lot 112). The full extent of the mineral sands deposit at Keysbrook is identified in Figure 2. The proponent proposes to partially mine the identified deposit based on obtaining land access agreements with the landowners.

The proposal was referred to the EPA in June 2005. The level of assessment was set at Public Environmental Review (PER) in July 2005. The PER document was made available for a public review period of eight weeks commencing on 26 June 2006, and ending on 21 August 2006.

The proposal was assessed bilaterally with the Department of the Environment and Water Resources (formerly the Department of the Environment and Heritage) due to the Commonwealth controlling provisions in relation to Listed threatened species and communities, and Wetlands of international importance.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses the environmental factors and principles for the proposal. The conditions and commitments to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides other advice by the EPA, Section 6 presents the EPA's conclusions and Section 7, the EPA's recommendations.

Appendix 5 contains a summary of submissions and the proponent's response to submissions, and is included as a matter of information only and does not form part of the EPA's report and recommendations. Issues arising from this process, and which have been taken into account by the EPA appear in the report itself.

2. The proposal

The proposal involves the excavation and processing of a low-grade (2.7%) heavy mineral sands deposit near Keysbrook to produce 920,000 tonnes of Heavy Mineral Concentrate (HMC) over 8 years. An area of 30 hectares (ha) would be progressively mined at any time. Topsoil would be removed and stockpiled for use in rehabilitation. The ore would be excavated and unloaded into a dump hopper located on the pit floor. The ore would be conveyed to a screening plant where oversize material would be removed and placed in the mined areas as backfill. The remaining sand and clay

would be mixed with water and pumped, as slurry, to a wet concentrator plant. Here, the clay would be removed and be fed into a clay fines thickener. A non-hazardous chemical flocculant would be added to remove the clay from the water in the thickener. The HMC would be removed from the sand and pumped to a stockpile. The residual sand would be mixed with the thickened clay and pumped from the wet concentrator plant into mined areas as backfill. The backfilled areas would be re-contoured and stabilised prior to topsoil replacement and return to pasture or native vegetation.

Dewatering would be required where the ore body extends below the watertable. This water would be used in the wet concentrator plant. Where there is insufficient dewater for processing, additional water would be abstracted from bores in the Leederville aquifer. This water would be pumped into the site dam for use in the wet concentrator plant and for dust suppression.

Several roads within the project area would be upgraded to facilitate the transport of the HMC in heavy vehicles to South Western Highway (Figure 2). The wet concentrator plant would be relocated three times throughout the life of mine (Figure 2). Support infrastructure, such as pipelines, offices and workshops would also be relocated with the wet concentrator plant. A site dam would be constructed at each of the three locations. A conceptual layout of the project operations, where the mine pit is close to the location of the processing plants, is provided in Figure 3. Where the mine pits are further away from the processing plants, the slurry and water pipelines would be longer.

Two high voltage powerlines traverse the project area (Figure 2). A 35-metre (m) radius mine exclusion zone would be established around each pylon. The properties are the project area where mining would occur and the transport route to South Western Hwy. The mine area is the area within the project area to be mined.

The main characteristics of the proposal are summarised in Table 1. A detailed description of the proposal is provided in Section 4 of the *Keysbrook Mineral Sand Project Public Environmental Review* (MBS, 2006).

Since release of the PER a number of modifications to the proposal have been made by the proponent. These are outlined below.

1. Increase to the mine area from 1,234ha to up to 1,366ha due to the addition of areas of pasture with scattered native trees.
2. Increase to the remnant native vegetation mine exclusion area from 49ha to 87ha. This includes 72ha and 15ha of remnant native vegetation on Lots 56 and 3 respectively. An additional consolidated area on Lots 59 and/or 62 would also be excluded from mining.
3. Change to the secondary processing location of the HMC from Picton to Cable Sands' plant in Bunbury.
4. Potential use of quieter primary mining equipment.

The potential impacts of the proposal initially predicted by the proponent in the PER (MBS, 2006) and their proposed management are summarised in Table 1 (Executive summary) of the proponent's document.

The anticipated stages of mining are:

Stage 1

- Lot 112 Westcott Rd, Keysbrook
- Part Lot 300 Westcott Rd, Keysbrook

Stage 2

- Eastern half Lot 59 Westcott Rd, North Dandalup

Stage 3

- Western half Lot 59 Westcott Rd, North Dandalup
- Part Lot 62 Hopeland Rd, North Dandalup

Stage 4

- Part Lot 63 Hopeland Rd, Keysbrook
- Lot 6 Westcott Rd, Keysbrook

Stage 5

- Lot 113 Westcott Rd, Keysbrook
- Part Lot 111 Westcott Rd, Keysbrook
- Part Lot 52 Westcott Rd, Keysbrook
- Part Lot 1 Elliott Rd, Keysbrook
- Eastern section Lot 57 Elliott Rd, Keysbrook

Stage 6

- Western section Lot 57 Elliott Rd, Keysbrook

Stage 7

- Part Lot 56 Westcott Rd, Keysbrook
- Part Lot 49 Readheads Rd, North Dandalup
- Part Lot 7 Readheads Rd, North Dandalup
- Part Lot 6 Readheads Rd, North Dandalup

Stage 8

- Part Lot 44 Readheads Rd, North Dandalup

Table 1: Summary of key proposal characteristics

Element	Description	
Land tenure over the mine area	Keysbrook	North Dandalup
	Part Lot 56 Westcott Rd Part Lot 57 Elliott Rd Part Lot 1 Elliott Rd Part Lot 52 Westcott Rd Part Lot 111 Westcott Rd Lot 112 Westcott Rd Lot 113 Westcott Rd Part Lot 6 Westcott Rd Part Lot 63 Hopeland Rd	Part Lot 62 Hopeland Rd Part Lot 59 Westcott Rd Part Lot 300 Westcott Rd Part Lot 49 Readheads Rd Part Lot 7 Readheads Rd Part Lot 6 Readheads Rd Part Lot 44 Readheads Rd
Life of mine	8 years	
Ore quantity	34 Million tonnes (to produce 920,000 tonnes of HMC)	
Pit depth	Average 2m below ground level, and up to 6m on sandy dunes	
Area of disturbance	Not more than 1,366ha (includes up to 182ha of remnant native vegetation and up to 1,184ha of pasture with scattered native trees)	
Dewatering	In-pit sumps to dewater the superficial Bassendean Sand aquifer at 0.2 gegalitres per year	
Bore abstraction	Up to 1.8 gegalitres per year from two bores into the deep Leederville aquifer	
Road upgrades	Upgrades of existing roads: Westcott Rd, Atkins Rd, Readheads Rd and intersection of Readheads Rd and South Western Hwy	



Figure 1: Regional location

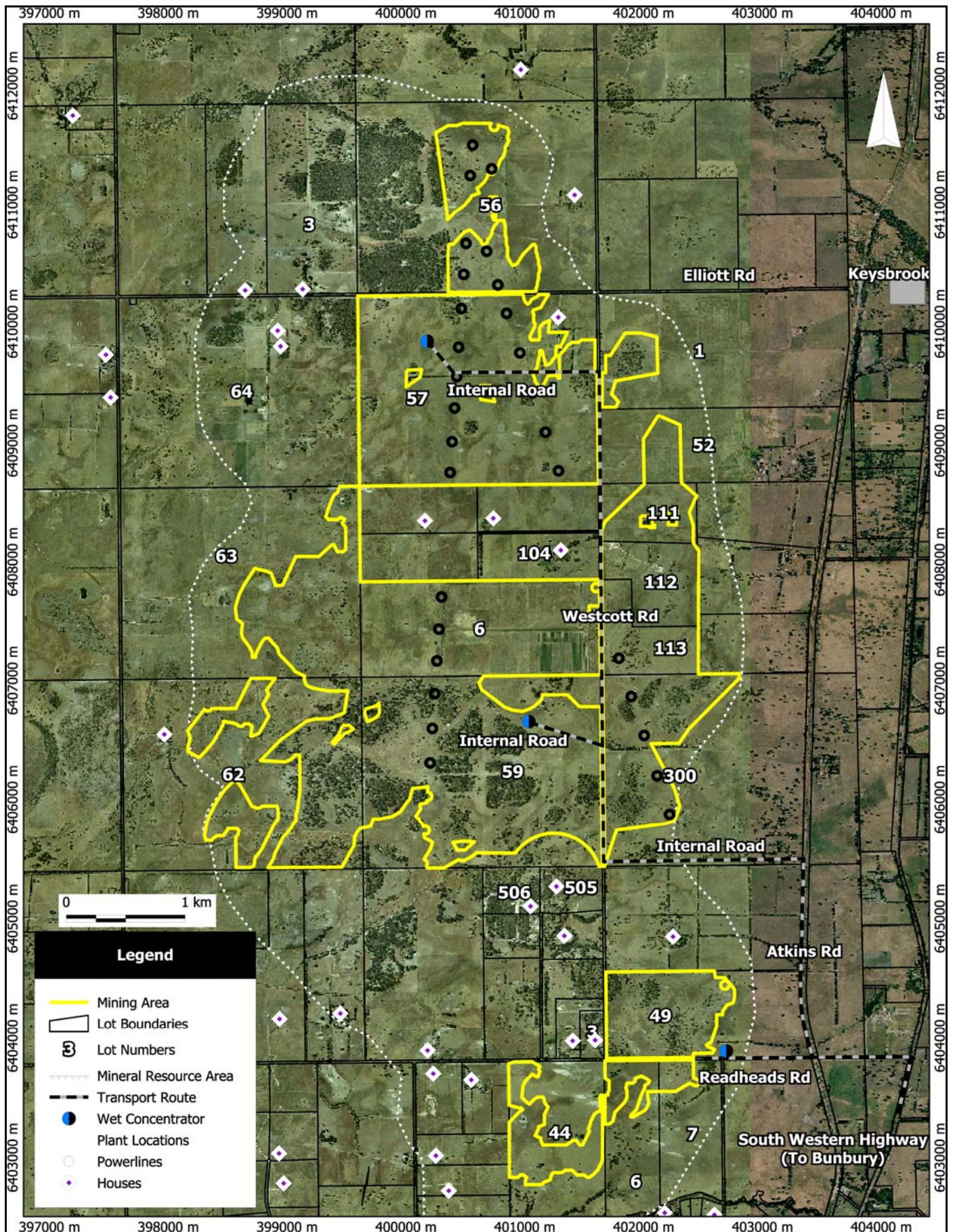


Figure 2: Project area

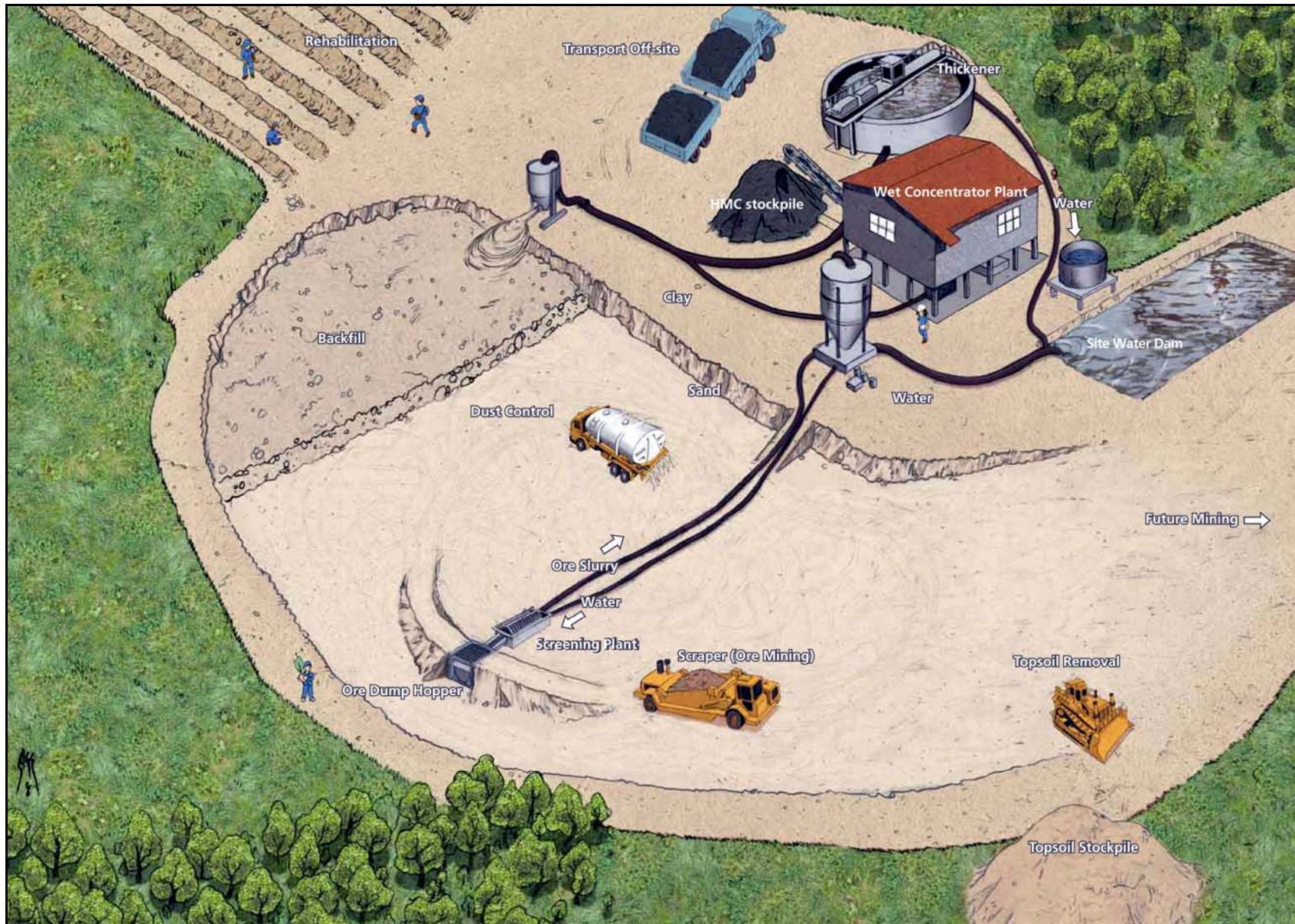


Figure 3: Project operations

3. Key environmental factors and principles

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the key environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the key environmental factors selected for detailed evaluation in this report is summarised in Appendix 3. The reader is referred to Appendix 3 for the evaluation of factors not discussed below. A number of these factors, such as liquid and solid waste and greenhouse gas emissions, are relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

It is the EPA's opinion that the following key environmental factors for the proposal require detailed evaluation in this report:

- (a) vegetation (includes fauna, wetlands and rehabilitation);
- (b) groundwater;
- (c) noise; and
- (d) dust.

The above key environmental factors were identified from the EPA's consideration and review of all environmental factors generated from the PER document and the submissions received, in conjunction with the proposal characteristics.

Details on the key environmental factors and their assessment are contained in Sections 3.1 – 3.4. The description of each factor shows why it is relevant to the proposal and how it would be affected by the proposal. The assessment of each factor is where the EPA decides whether or not the proposal meets the environmental objective(s) set for that factor.

The following principles were considered by the EPA in relation to the proposal:

- (a) precautionary principle;
- (b) principle of intergenerational equity;
- (c) principle of the conservation of biological diversity and ecological integrity;
- (d) principles relating to improved valuation, pricing and incentive mechanisms; and
- (e) principle of waste minimisation.

3.1 Vegetation (includes fauna, wetlands and rehabilitation)

Description

Vegetation

The majority of the project area is annual pasture with scattered native trees. The native vegetation in the mine area has been reduced to pockets of remnant vegetation and scattered trees due to the extensive clearing for agriculture. The majority of the

mine area is grazed by cattle. The vegetation complexes (as defined by Heddle *et al.* 1980) of Bassendean Central and South, Guildford and Southern River occur within the mine area. The proposal requires clearing of up to 1,366ha (Figure 4). This includes up to 182ha of remnant native vegetation, which includes stands of mature trees mainly subject to permanent or intermittent grazing by cattle, and having minimal or no understorey. There is about 1,184ha of pasture with scattered native trees in the mine area. Most clearing of remnant native vegetation would occur in the Bassendean Central and South complex.

The project area is within the System 6 region. The northern half of the project area is within the Bush Forever Study Area. No System 6 conservation areas and no Bush Forever site exists within this area.

The remnant vegetation in the mine area is Marri (*Corymbia calophylla*) woodland (MBS, 2006). Nine vegetation units were identified in a survey carried out by Bennett Environmental Consulting. The Floristic Community Types (FCTs) were inferred for the vegetation units, and three FCTs, 20b¹, 3a² and 3c³, were inferred to be Threatened Ecological Communities (TECs). PATN analysis (clustering analysis software) by Griffin and Associates concluded that FCT 20b more closely resembles other communities (21a or 21c), which are not TECs. The condition of FCTs 3a and 3c was considered to be Degraded⁴ to Completely Degraded⁵, and not worthy of conservation in the Bennett (2004) report. No Declared Rare Flora or Priority Flora was located during surveys of the project area.

The proponent considers that any drawdown in the aquifers as a result of the proposal would have a negligible impact on the root zone of the surrounding vegetation. Dewatering of the superficial aquifer would produce localised drawdown during winter to a level similar to the natural summer watertable. These levels are expected to recover after mining. Dewatering would not be required during summer.

The effect on the aquifers as a result of abstracting from the Leederville aquifer was measured through pumping on-site and modelling by Rockwater Proprietary Limited. The location of the bores is identified in Figure 5.

1. During the on-site pumping test of production bore KL3P, the impact on the superficial aquifer was measured at bore KWT3A, which is 24m from KL3P. The drawdown recorded at KWT3A was 0.04m after 44 hours, compared with 3.5m in the Leederville aquifer (at observation bore KL3Obs). For a pumping rate of 2,740 kilolitres per day (1.6 times that of the test) for 8 years, the drawdown at KWT3A was extrapolated to average 0.06 metres per year (m/yr).
2. The scenario modelled is that production bores KL2P and KL3P are pumped for 8 years at 2,466 kilolitres per day each to produce a total of 1.8 Gegalitres per year (GL/yr). In the Bassendean Sand Formation water levels would be reduced by 0.05 to 0.10m by the end of summer to the north and east of the

¹ FCT 20b is Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands.

² FCT 3a is *Eucalyptus calophylla* – *Kingia australis* woodlands on heavy soils.

³ FCT 3c is *Eucalyptus calophylla* – *Xanthorrhoea preisii* woodlands and shrublands.

⁴ The vegetation structure is severely impacted by disturbance (Government of WA, 2000).

⁵ The vegetation structure is no longer intact and the area is completely or almost completely without native species (Government of WA, 2000).

bores (average drawdown would be less than 0.013m/yr). In winter, drawdown would be reduced by additional recharge. At 3 to 4km east of the bores drawdown would be 0.2m. In the Guildford Formation, drawdown would be up to 0.6m 4km south-east of bore KL2P (average rate of drawdown would be less than 0.075m/yr). Drawdown in the Leederville aquifer would be less than 2m beyond about 2km from the bores, after 8 years of pumping, and up to 5m within 2km of the bores (Rockwater, 2007).

An aspect of the proposal that the EPA has considered is the potential to impact directly on vegetation through clearing. Vegetation adjacent to the mine area could be indirectly impacted through dust deposition and reduced water availability from bore abstraction.

The Bennett (2004) report identified the presence of 34 weed species, of which 28 are considered to be invasive, that is, able to invade natural bushland and waterways. Weeds of particular concern due to their ability to invade natural bushland and change the structure, composition and function of ecosystems are *Bromus diandrus* (Great brome), *Ehrharta calycina* (Perennial veldt grass), *Leptospermum laevigatum* (Victorian teatree), and *Romulea rosea* (Guildford grass).

Root and soil samples were taken from recently dead Banksias for the presence of *Phytophthora cinnamomi*⁶ at three locations in the project area; two on Lot 59 and one in the mine exclusion area on Lot 56. Results identified the presence of dieback in some upland vegetation on the eastern patch of remnant native vegetation on Lot 59.

The EPA will expect the proponent to manage its operations to ensure that neither weeds nor dieback are inadvertently spread to retained vegetation or watercourse buffers.

Fauna

Fauna surveys over the project area identified the presence of *Merops ornatus* (Rainbow Bee-eater), a migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo); and 15 bird species that are habitat specialists with a reduced distribution on the SCP, or wide-ranging species with reduced populations on the SCP (Government of WA, 2000), including *Calyptorhynchus baudinii* (Baudin's Black Cockatoo), *Phaps chalcoptera* (Common Bronzewing), *Malurus splendens* (Splendid Fairy-wren), *Smicrornis brevirostris* (Weebill), *Acanthiza apicalis* (Broad-tailed Thornbill), *Acanthiza chrysorrhoa* (Yellow-rumped Thornbill), *Petroica multicolor* (Scarlet Robin), *Pachycephala pectoralis* (Golden Whistler), *Manorina flavigula* (Yellow-throated Miner) and *Artamus cinereus* (Black-faced Woodswallow). Surveys also identified the potential presence of *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) and *Isodon obesulus fusciventer* (Quenda), a Priority listed species.

⁶ *Phytophthora cinnamomi* is a soil-borne water mould that kills a range of plants in the south west of WA by destroying their root systems. This slow moving epidemic of root disease in native vegetation is known as dieback (CALM, 2004).

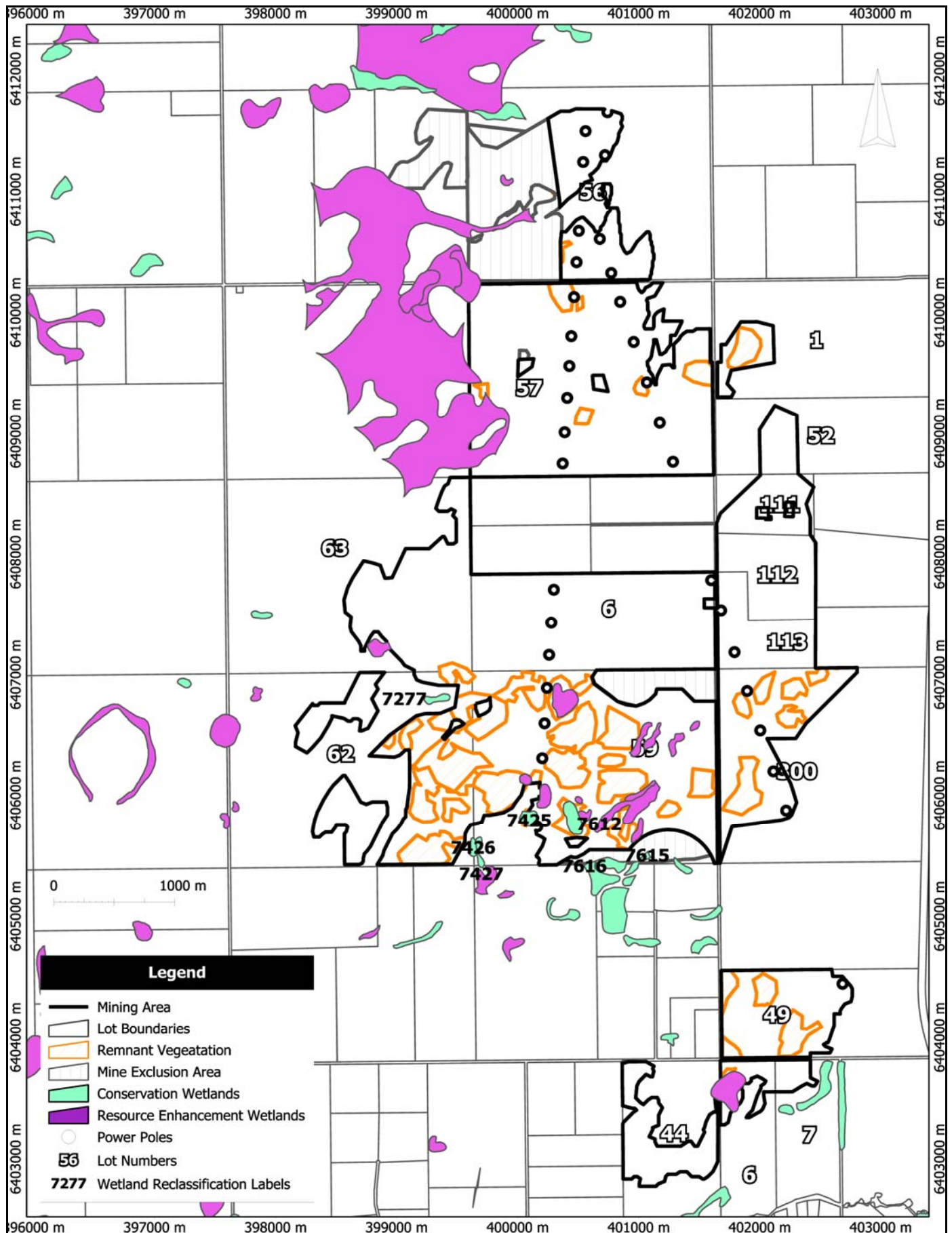


Figure 4: Mine area

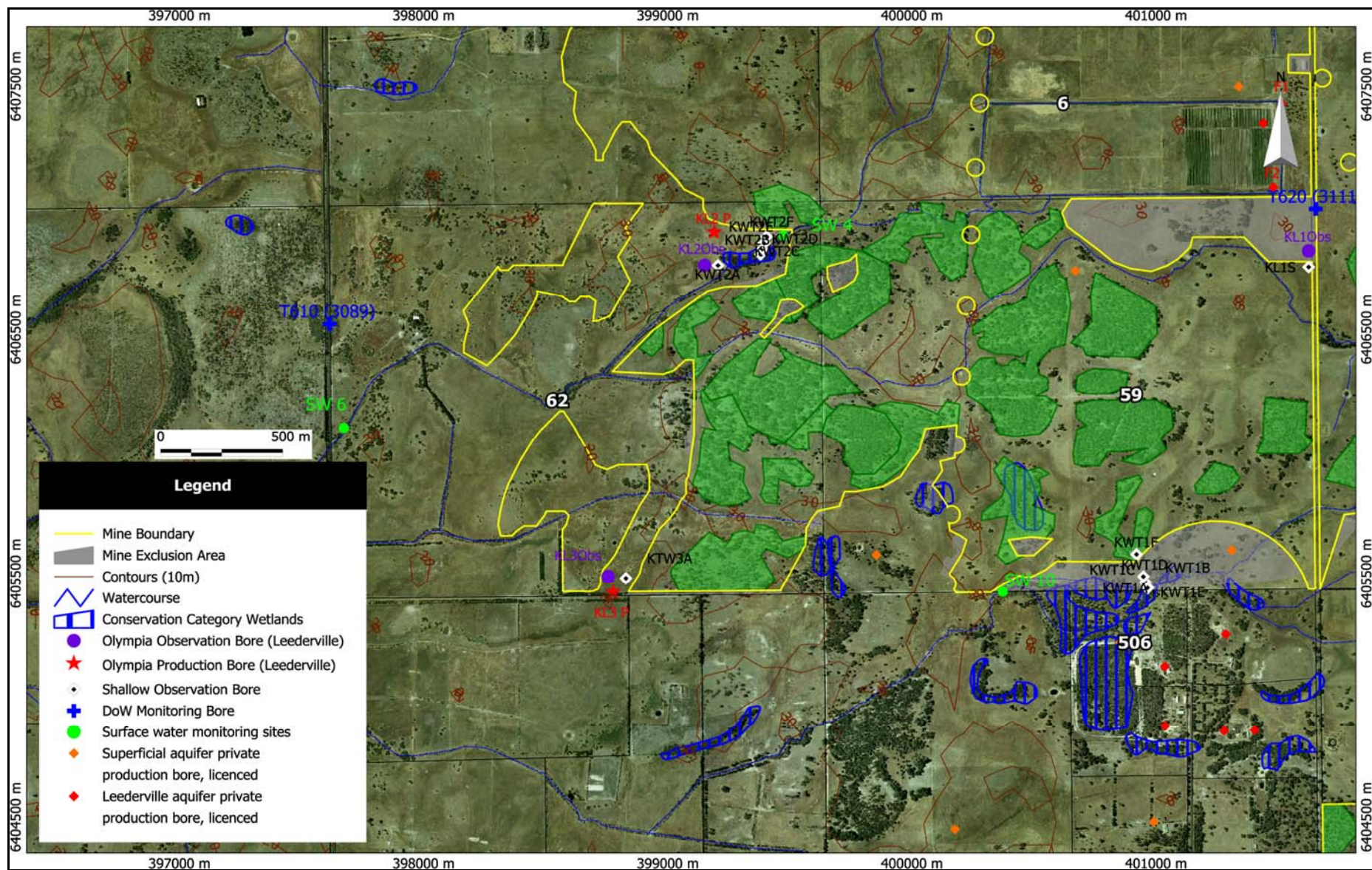


Figure 5: Groundwater production and monitoring bores

All three species of black cockatoo are listed in Schedule 1 of the *Wildlife Conservation Act 1950*. The Forest Red-tailed Black Cockatoo is extinct on the SCP portion of the Perth Metropolitan Region. Baudin's Black Cockatoo and Carnaby's Black Cockatoo are listed under the EPBC Act and have reduced populations on the SCP (Government of WA, 2000).

Western Wildlife conducted a survey of the remnant native vegetation on Lots 56, 59, 300 and 3 in October 2005 for nesting and feeding activity by black cockatoos. Western Wildlife (2005) reported that the vegetation is likely to provide feeding habitats for all three species of black cockatoo. Only a few potential nesting hollows were identified, but hollows are sometimes not visible from the ground. Most potential hollows identified were on Lot 56. It was noted that cockatoos may breed in the area.

Bamford Consulting Ecologists carried out a detailed fauna survey in winter/spring 2006. The following conclusions were made in the Bamford (2006) report: the project area does not have a natural pattern of rare, discontinuous habitats likely to have given rise to short-range endemic invertebrates, therefore the likelihood of such species being present is low; a high number of bird species were observed on Lots 300, 59, 56 and 62; it is likely that Red-tailed Black Cockatoos breed in the project area, based on a fresh but broken cockatoo egg that was found; additional surveys for bats, reptiles, Quendas and black cockatoos should be carried out; impact on cockatoo nesting sites should be minimised; native vegetation should be retained where possible; wetlands should not be affected; and rehabilitation should enhance wildlife habitat and corridors. In February 2007 Bamford Consulting Ecologists carried out a micro-bat survey. Two species were recorded in the project area; *Chalinolobus gouldii* (Gould's Wattled bat) and *Vespadelus regulus* (Southern Forest Bat). These species are not threatened.

The proposal has the potential to impact on fauna through loss of habitat from vegetation clearing, fragmentation of habitat and noise from mining and transport.

The proponent proposes to collect seeds of species used by the black cockatoos, such as Marri, Jarrah, Sheoak and Banksia from the project area for use in revegetation. These plants would provide suitable habitat for black cockatoos after many decades. The proponent considers that trees planted in the early stages of mining will provide a food source for fauna as the vegetation establishes. The proponent also considers that there are food supplies in the region, and cockatoos can travel 4 to 5km to these sites (which consist of the foothills and Darling Range forest).

Wetlands

The location of the wetlands listed in the Ramsar Convention⁷ in the vicinity of the project area are provided in Figure 1. The Becher Point Wetlands and Forrestdale and Thomsons' Lakes are about 20km and 37km, respectively from the project area, and are functionally separate. The Peel-Yalgorup System is about 20km downstream of the project area.

The proponent used wetland mapping from the Revised Draft *Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004* in the PER.

⁷ The Ramsar Convention on Wetlands is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (EPA, 2005).

On advice of the Department of Environment and Conservation (DEC), the proponent used the *Geomorphic Wetlands Swan Coastal Plain* dataset, as it displays the location, boundary, geomorphic classification and management category of wetlands on the SCP. The project area is within a dampland (seasonally waterlogged basin). According to the dataset, Conservation Category Wetland (CCW) Unique Feature Identifier (UFI) 7612 and twelve resource enhancement wetlands are mapped as occurring within the mine area. CCW UFI 7425 is mapped as partly within the mine area. Other CCWs and resource enhancement wetlands exist adjacent to the mine area.

The proponent applied to DEC to reclassify the two CCWs within the mine area to 'not a wetland', and downgrade seven other CCWs adjacent to the mine area to either multiple use wetlands or 'not a wetland' (MBS, 2007a). Preliminary advice from DEC is that the two CCWs mapped as occurring within the mine area are not conservation category, but resource enhancement wetlands. They do not have free water.

One of the issues considered by the EPA is the significance of the impact on resource enhancement wetlands within the mine area. Wetlands adjacent to the mine area have the potential to be impacted as a result of groundwater drawdown.

The aquifers in the proposal area are the superficial Bassendean Sand aquifer and the deep Leederville aquifer. In the project area, the soil formations in the superficial aquifer consist of the Bassendean Sand Formation, with a depth of 0 to 5m, and the underlying Guildford Formation, with a depth of 9 to 15m (Rockwater, 2007).

Rockwater Proprietary Limited conducted monitoring and modelling of the superficial aquifer to identify potential impacts on wetlands as a result of pumping 1.8GL/yr from two bores into the Leederville aquifer and dewatering 0.2GL/yr from the superficial aquifer. Changes to groundwater levels around wetland UFI 7277 on Lot 62 were modelled for mining at the beginning of winter, in May (scenario 1), and mining after winter, in September (scenario 2). With winter mining the groundwater level at the wetland during and soon after mining will be lowered by 0.05 to 0.2m during winter. With mining after winter, the groundwater level at the wetland will be 0.1 to 0.26m lower than usual for four months. Once mining is complete backfilling of mined areas with slurry will recharge the superficial layer within the mined pit. This produces a water mound up to 0.2m above surrounding groundwater levels for scenario 1, and up to 0.5m for scenario 2, which disperses into the surrounding soil matrix (MBS, 2007a).

Modelling of water level changes in the Bassendean Sand Formation as a result of dewatering at selected locations near wetlands (Rockwater, 2007) found that:

1. Mining in the eastern section of Lot 59 would not produce groundwater level drawdown at the wetland to the south of it.
2. Mining in the southwest section of Lot 59 would result in drawdown of up to 0.2m at the wetland to the south. If the mine perimeter is drawn back about 200m to the north, there is indicated to be no drawdown at the wetland.
3. Mining in the northwest section of Lot 59 would result in drawdown of up to 0.37m at the eastern edge of the wetland. Mining would continue progressively into the southern section of Lot 63. The predicted drawdown at the edge of the wetland is 0.2m after about 2 months, and 0.04 m after about 5 months.

Superficial aquifer bores were drilled along two sections leading into wetlands (Figure 5). Section 1 consisted of monitoring bores (KWT1A-F) on Lot 59 near the mapped CCWs adjacent to the mine area. Here, the Bassendean Sand Formation is unsaturated in summer/autumn. Relative levels in the bores in May were between 29.69m Australian Height Datum (AHD) and 31.27mAHD. The base elevation of mining in this area is 29.8mAHD, so there would be no discernible lowering of the summer watertable at the wetlands. If this area was mined in winter/spring, and the watertable at the edge of the mine area was maintained at 30mAHD, the water level could not be lowered below 30mAHD at the edge of the wetlands. Negligible drawdown is expected at the wetland. Based on the measured water levels and allowing for a 1m rise in winter, the watertable would not reach ground surface in the wetland unless there was additional recharge from surface water (Rockwater, 2007).

Section 2 consisted of monitoring bores (KWT2B-F) near wetland UFI 7277 on Lot 62. Here, the Bassendean Sand Formation is dry in the southern half, and extends below the watertable elevation of up to 27mAHD in the northern half. Mining in the northern area will lower water levels at the mine edge to about 26mAHD, which is about 1m higher than the summer water level beneath the wetland. The wetland watertable would not be affected by mining in the dry season. Lowering of water levels in the mine area to 26mAHD in winter/spring would result in a very small groundwater flow from beneath the wetland towards the pit (Rockwater, 2007).

The proponent considers that the groundwater drawdown from pit dewatering is localised and temporary, returning to pre-mining levels within one year, and that these fluctuations are not expected to impact on adjacent vegetation, wetlands or the ability of neighbours outside the mine area to access the aquifer. The localised drawdown would have no effect on the Ramsar wetlands; the Peel-Yalgorup System, Becher Point Wetlands and Forrestdale and Thomsons' Lake (MBS, 2007a).

Rehabilitation

The topography of the project area is flat to gently undulating plain. The lowest elevations are in the western section at approximately 22mAHD, gradually sloping to approximately 40mAHD in the eastern section of the project area. The proponent intends to return the land to its pre-mining use of agriculture. The proposal involves mining of up to 1,366ha over 8 years. The mine area would be progressively returned to pasture with a small part rehabilitated to native vegetation.

Topsoil would be directly returned to the mined areas, except outside the vegetation rehabilitation season (April to August), when topsoil would be stockpiled. The stockpiling of topsoil for an extended period would occur on locations around the wet concentrator plant, where the facility is fixed for a number of years. Mining within each 30ha pit would take about three months. Pasture species would be seeded in May and August to stabilise the land. Return to pasture would involve two seeding years. Outside these months the land would be stabilised through the application of a layer of clay from the wet concentrator plant. Rehabilitation to native vegetation would include the establishment of understorey species.

The proponent has identified measures, outlined below, to minimise impacts on native vegetation, fauna and wetlands.

1. Implement a mine exclusion area (Figure 4) of 87ha of vegetation on Lots 56 and 3 that contain suitable habitat for all three species of black cockatoo and other birds. An additional consolidated area of vegetation on Lots 59 and/or 62 would also be excluded from mining.
2. Locate the wet concentrator plant and support infrastructure on existing cleared areas.
3. Implement dieback management measures identified in Table 40 of the PER including: isolation of remnant areas not to be impacted from mining; visual inspections of vegetation for symptoms of dieback; topsoil for upland areas to be sourced from dieback-free areas; dieback susceptible species to be planted and seeded in rehabilitation on upland areas; and phosphite fungicide to be used on susceptible species in rehabilitation.
4. Implement a Fauna Management Plan (MBS, 2007b) that identifies a programme for black cockatoo surveys and relocating cockatoo nest sites by remounting potential nest sites from trees to be cleared into remnant vegetation areas that would not be disturbed, by cutting the nest site out of the existing tree and remounting it in the replacement tree. Constructed wooden and plastic nest boxes for cockatoos would also be mounted in replacement trees.
5. Implement a Water Management Plan (MBS, 2007a) which outlines the results of modelling impacts from drawdown on wetlands. The Plan also provides a monitoring schedule to identify whether any significant impacts to surrounding wetlands occurs as a result of the project.
6. Implement a Vegetation and Rehabilitation Management Plan (MBS, 2007c).

Measures are identified in the Plan to control weeds by:

- applying herbicide in areas rehabilitated with native vegetation in the spring of the first year of planting to improve the establishment of planted trees, and application in the second year if required; and
- inspecting rehabilitated areas for declared weed species.

Measures are identified in the Plan to:

- plant native species in remnant vegetation areas outside the mine area;
- plant and seed with native species in pasture areas outside the mine area as part of an “early planting” programme to provide feeding sites for black cockatoos and other birds throughout the life of the mine;
- plant and seed with native species in areas that have been mined;
- transplant *Xanthorrhoea* and *Kingia australis* trees from areas to be mined into the above areas;
- fence areas to be planted or seeded with native vegetation; and
- remove mature trees within the mine area that contain potential cockatoo nesting sites during December to July (i.e. outside the breeding season) to avoid impact on hatchling birds.

The Plan also includes the following:

- return of mined areas to as close as possible to pre-mining levels;
- return of sand and clay from the wet concentrator into mined areas;
- temporary erosion control measures to minimise water erosion of restored landforms prior to establishment of a vegetative cover;
- shelter planting using fast growing tree species;
- sourcing seed from local provenance and germinating seedlings in nurseries to plant as tubestock;

- completion criteria;
- monitoring of rehabilitation;
- a conceptual rehabilitation plan; and
- a rehabilitation bond of \$10,000 per ha of native vegetation cleared, to be reduced after revegetation commences, based on the extent of works completed and achieving completion criteria.

Submissions

Many submissions made by the public expressed concern regarding the loss of native vegetation, particularly vegetation in good condition and mature trees, and the loss of fauna habitat and impact on local fauna. Submissions also noted that a survey of all of the trees in the project area (not just the remnant native vegetation) should be carried out to determine fauna habitat values of the trees. It was submitted that net environmental benefit is not demonstrated in the proposal as the removal of remnant native vegetation and trees in good condition cannot be replaced by a strip replanting with a limited number of species. The testing and mapping for dieback was considered inadequate in the submissions.

The submission from DEC was based on the proposal in the PER that 222ha of remnant native vegetation would be cleared. DEC stated that the remnant vegetation in the project area is likely to provide the only native habitat and food source for a number of fauna species, particularly birds. Vegetation within the project area provide ecological linkage for habitat sensitive bird species. Remnant vegetation of various sizes and scattered or clumped trees in paddocks facilitate movement for a range of fauna species. Further efforts should be made to conserve areas of remnant native vegetation. The placement of conservation covenants over areas of native vegetation to be excluded from mining or established as a result of the project would assist in securing the long-term protection of conservation values. Offsets should be provided for the loss of native vegetation and fauna habitat.

Submissions from the public and DEC expressed concern regarding the impact on CCWs, resource enhancement wetlands and Ramsar wetlands. Submissions highlighted the lack of detailed on-ground mapping and evaluation of wetlands in the area. It was submitted that the annual drawdown around wetlands should reflect the natural wet and dry cycles of the water bodies, and actions should be implemented if the watertable does not return to natural levels by the end of the mining process. The issue of contaminants and nutrients generated from the proposal entering the waterways and polluting the Peel-Harvey system was raised in the submissions.

Submissions from DEC and the Local Shires stated that the suite of plant species occurring within the original plant communities should be re-established in mined areas using seed of local provenance. The submissions also raised concern regarding the clearing of mature trees claimed to be hundreds of years old.

Submissions from the public raised concern regarding the lack of conservation covenants on revegetation, and maintenance of revegetation in the long-term by private landowners. It was submitted that the rehabilitation cannot replace the quality of the existing mature native trees, their value in providing fauna habitat, and their biodiversity values. The revegetation list is insufficient, does not include middle

storey or understorey species, does not replace the species diversity present in the project area, and contains dieback susceptible species. The bulk of the revegetation is a highly artificial set of straight lines, with no attempt to re-establish a natural bush setting. Wetland rehabilitation should be considered. Weed control and dieback management is required in rehabilitated areas.

Assessment

The remnant native vegetation in the proposed mine area is degraded through direct grazing, and faces inevitable demise.

The EPA's environmental objective for vegetation is to retain and enhance one or more protected areas, and to give these areas security.

The EPA's environmental objectives for rehabilitation are to: ensure that mine closure achieves stable, non-polluting and functioning landforms which are consistent with the surrounding landscape and other environmental values. Rehabilitation of native vegetation should use seed of local provenance.

The EPA notes advice from DEC that Floristic Community Types inferred to be TECs in the Bennett (2004) report are communities that were once TECs, but because of their Degraded condition, are not interpreted to contain intact TECs.

The remnant native vegetation within the mine area is degraded and deteriorating, but contains remnant vegetation in an extensively cleared area, and it comprises habitat for native fauna of conservation significance. Conservation significant fauna are those listed under the EPBC Act, the *Wildlife Conservation Act 1950*, as Priority by DEC, or have declining distributions or populations on the SCP.

The EPA recognises that the majority of the mine area is cleared, and the remnant native vegetation consists of mature stands of trees with minimal or no understorey. The EPA considers that due to the lack of protection and management of the vegetation, the condition of the vegetation is likely to decline over time due to grazing and weed and dieback infestations.

The EPA notes advice from DEC regarding the significance of the larger patches of remnant vegetation in the project area, and the linkage roles of these together with smaller patches and scattered trees. The EPA also notes advice from DEC that there is fauna living locally that exclusively rely on the remnant native vegetation and native trees within the project area for all or part of their resource requirements, including food, breeding, roosting and shelter. The EPA agrees with advice from DEC that it would take many decades for the proposed revegetation to mature adequately to provide hollows for fauna to that present in the existing vegetation.

During the assessment, the EPA established that the remnant native vegetation on Lots 56 and 3 is better than the rest in the project area because it contains remnants of vegetation that:

- is poorly represented on the eastern side of the SCP;
- is in Good to Very Good condition, in an extensively cleared area; and

- comprises habitat for native fauna of conservation significance. The significant stands of mature trees provide feeding areas for endangered cockatoos and other conservation significant bird species.

For these reasons, the EPA advised the proponent that the proposal to clear remnant native vegetation on Lots 56 and 3 would not be supported. As a result, the proponent excised these areas from the mine plan.

The EPA notes the proponent's efforts to avoid, minimise and rectify impacts on native vegetation and fauna. In particular, the EPA notes that 87ha of remnant native vegetation on Lots 56 and 3 would be excised from the mine area. However, a residual impact remains, as the proposed mine area contains native trees and vegetation that would be cleared. The remnant native vegetation within the mine area consists of stands of mature trees with minimal or no understorey. The remnant vegetation, that covers about 13% of the proposed mine area in discrete pockets, has environmental value because it:

- is poorly represented on the eastern side of the SCP;
- exists in an extensively cleared area; and
- provides resource value, in terms of food, breeding, roosting or shelter for endangered cockatoos and other conservation significant bird species.

The EPA notes advice from DEC (which was based on the initial proposal that 222ha of vegetation would be cleared) that the conceptual rehabilitation plan is lacking from a conservation perspective as the majority of the areas revegetated would be narrow linear corridors. The EPA agrees that a more suitable approach would be to retain larger intact areas of remnant vegetation and rehabilitate these areas so that they form a more resilient, consolidated vegetated area.

Considering the significance of the vegetation and trees to be cleared as a result of mining, the EPA recommends that the proponent identify a consolidated area of remnant native vegetation on Lots 59 and/or 62 to be excised from the current mine area (of 1,366ha). This area to be excised should preferably include vegetation that is dieback un-infested and mature trees that currently or would potentially provide hollows for black cockatoos.

This excised area should be protected from grazing, and enhanced through revegetation and weed control to improve the fauna habitat value of the area. The EPA notes the proponent's commitment to negotiate with the landowners to secure this excised area in perpetuity by means of a conservation covenant⁸. The EPA considers that this is a valuable undertaking, which would see the permanent security, of purpose and management, of an area of remnant native vegetation within the project area. The EPA recommends that should this area be secured through a conservation covenant, the area should be fenced to exclude grazing by cattle, managed for fauna and flora conservation purposes, and sign posted to notify significance of the area.

⁸ A conservation covenant is a voluntary agreement by the landowner to permanently protect the native vegetation and other environmental values on their land, and registering this on the property title.

The EPA notes that by retaining the remnant native vegetation on Lots 56 and 3, a source of habitat would be available to fauna potentially affected by the mining proposal. The EPA considers that the management of impacts associated with clearing of vegetation and trees in the mine area should include revegetation in the excised area on Lots 59 and/or 62 to improve the condition and function of the vegetation in this area, consistent with an Excised Area Management Plan (condition 7-3). This should include planting of understorey and middle storey species using local species, eradicating weeds, planting dieback resistant species, and enhancing fauna habitat value, through the placement of suitable tree hollows and nesting boxes.

The EPA notes that the majority of the mine area would be returned to pasture. The EPA considers that rehabilitation to native vegetation would be required where areas of remnant native vegetation and native trees are cleared for mining. The EPA acknowledges the proponent's intention to plant and seed with native species in pasture areas outside the mine area as part of an "early planting" programme, to use seeds from the project area for use in revegetation, and to transplant *Xanthorrhoea* and *Kingia australis* trees from areas to be mined into rehabilitated area. Mature trees to be transplanted should be managed for dieback.

The EPA notes that several watercourses that traverse the mine area, including Dirk Brook Tributary, Nambeelup Brook North Tributary, Balgobin Brook and Nambeelup Brook South Tributary, would have a buffer and would not be mined. The EPA considers that the vegetation along these watercourses should be enhanced consistent with a Watercourse Rehabilitation Plan (condition 7-3). This should include planting of understorey and middle storey species, eradicating weeds and planting dieback resistant species.

The EPA provides the following recommendation in regards to weed management for the Excised Area Management Plan and Watercourse Rehabilitation Plan: the proponent should map the distribution and abundance of weed species within the excised area; prioritise the weed species identified based on their ecological impact; describe measures to eradicate the weed species identified, based on their priority; identify a weed control monitoring programme; and identify hygiene practices for all vehicle and plant equipment entering the excised area.

The EPA notes that both weeds and dieback are present within the project area. The EPA considers that retaining and securing areas of remnant native vegetation would minimise the spread of weeds and dieback in the project area. The EPA also considers that hygiene and control measures should be implemented during the life of the mine to ensure that weeds are not spread within or outside the project area (condition 8). This would include cleaning all vehicles, equipment and footwear prior to entering the excised area and watercourse buffers; containing run-off from stockpiles and surface water that may contain dieback; using of the chemical phosphate to prevent dieback infection; and monitoring dieback infested and un-infested areas.

The EPA has recommended a condition for a performance bond (condition 11) to ensure adequate implementation of condition 7, which includes the return of functioning pasture, enhancement of the excised area on Lots 59 and/or 62, and implementation of the Watercourse Rehabilitation Plan.

The EPA notes that modelling indicated that bore abstraction would result in a reduction in the pressure head in the Leederville aquifer, and the average rate of drawdown in the Guildford Formation is predicted to be 0.075m/yr. The EPA considers that the reduction in the watertable per year as a result of the proposal is small, and should not adversely affect the surrounding native vegetation. The EPA notes that the estimation of the extent to which the aquifers would be affected by dewatering and bore abstraction was largely based on a numerical model. Therefore the EPA recommends that the proponent confirm model predictions and monitor the health and condition of retained native vegetation within the project area, and identify trigger levels and management actions, to ensure that vegetation is not adversely affected by groundwater drawdown associated with the proposal (condition 9).

The EPA notes that DEC is considering an application by the proponent to reclassify the two currently mapped CCWs within the mine area, and seven other CCWs adjacent to the mine area⁹. The EPA notes that on-ground assessment of wetlands by DEC in September 2007 found that no mapped CCWs exist within the mine area, and the closest CCW is at least 100m from the mine area. Assessment by DEC identified additional resource enhancement wetlands within the mine area. The EPA notes that approximately 15 resource enhancement wetlands would be cleared as a result of the mining proposal. The EPA considers that these wetlands have been significantly disturbed, and their conservation values are low. Therefore the EPA accepts that the proposal would result in the disturbance of these wetlands.

The EPA notes that CCWs would not be directly affected by mining. The EPA recommends that monitoring and management be carried out to ensure that CCWs adjacent to the mine area are not indirectly affected by the proposal (condition 9).

Summary

Having particular regard to the:

- (a) removal of 87ha of remnant native vegetation on Lots 56 and 3 from the mine area, which includes all Good and better condition vegetation;
- (b) recommended condition to excise a consolidated area of remnant native vegetation on Lot 59 and/or Lot 62 from the mine area;
- (c) recommended condition to enhance the vegetation along retained watercourses, and in the area to be excised from mining on Lots 59 and/or 62 through revegetation, weed control and fencing;
- (d) on-ground surveys by DEC identifying that mapped CCWs do not occur in the mine area;
- (e) groundwater modelling and monitoring that shows minimal impact on CCWs adjacent to the mine area; and
- (f) recommended condition for a performance bond,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for this factor.

⁹ The proponent's application is provided in Appendix 3 of the Water Management Plan (MBS, 2007a).

3.2 Groundwater

Description

The project area is located within the unproclaimed Karnup-Dandalup Underground Water Pollution Control Area, which has been identified as a Proposed Priority 2 Public Drinking Water Source Area (PDWSA). A Priority 2 classification has been proposed to ensure that there is no increased risk of pollution to the water source.

The aquifers affected by the proposal are the superficial Bassendean Sand aquifer and the deep Leederville aquifer. The project area is in a recharge zone to the superficial aquifer, Leederville aquifer and underlying Yarragadee aquifer. The superficial aquifer is about 10m deep, and the Leederville aquifer is about 130m deep. Water salinities in the superficial aquifer range from 200 to 1,000 mg/litre Total Dissolved Solids, while in the Leederville aquifer they are generally less than 1,000 mg/litre Total Dissolved Solids. Recharge to the superficial aquifer is from rainfall and runoff from watercourses, and recharge to the Leederville aquifer is from the superficial aquifer. The direction of the groundwater flow within the project area is westward (MBS, 2007a). In the project area, the soil formations in the superficial aquifer consist of the Bassendean Sand Formation, with a depth of 0 to 5m, and the underlying Guildford Formation, with a depth of 9 to 15m (Rockwater, 2007).

The Bassendean Sand Formation is in places fully unsaturated in summer/autumn, and partly saturated in winter/spring; water levels fluctuate about 1m annually. In other areas, the Bassendean Sand Formation extends below the summer watertable and is partly to fully saturated all year. The Guildford Formation lies mainly below water level, although its upper surface becomes unsaturated by up to 2m in dry seasons. The Bassendean Sand is low in clay content and has high permeability. The Guildford Formation varies from clay to sand and has generally low permeability (Rockwater, 2007). The mineral sands deposit is contained in the Bassendean Sand Formation, which would be dewatered to the base of the deposit.

Rockwater Proprietary Limited evaluated the hydrogeological conditions in the project area, and modelled the dewatering requirements and drawdown effects of pumping the Leederville aquifer based on hydrogeological publications (Rockwater, 2006) and field measurements within the project area (Rockwater, 2007). This information was used to predict impacts on the aquifers and surrounding users as a result of pumping 1.8GL/yr from two bores (KL2P and KL3P) into the Leederville aquifer and dewatering 0.2GL/yr from the superficial aquifer.

The Rockwater (2007) report indicated that most dewatering would be during winter when the groundwater levels are highest. Dewater would be used in the wet concentrator plant and any excess water would be stored in the site dam. Where there is insufficient dewater for processing, additional water would be abstracted from bores into the Leederville aquifer. This additional water would be pumped to the site dam and used in the wet concentrator plant and for dust suppression. Where there is excess water in the site dam, water would be discharged from the dam into a natural drainage channel.

The site dam would be about 150m by 100m by 5m deep. The dam would be constructed by excavating to the base of the Bassendean Sand Formation, and using the excavated material to construct a 3m high dam wall. The dam will have a plastic liner.

The proponent would be required to obtain a licence from the Department of Water (DoW) under the *Rights in Water and Irrigation Act 1914* to abstract water from the Leederville and superficial aquifers. The proponent would also need to develop an Operating Strategy to supplement the licence conditions. An Operating Strategy outlines the proponent's commitments and responsibilities in managing the impacts of taking and using the water on the environment and other water users.

Production bores KL2P and KL3P (Figure 5) were constructed to the base of the Leederville Formation, and three observation bores (KL1Obs, KL2Obs and KL3Obs) were constructed in the Leederville aquifer. The effects of abstracting from the Leederville aquifer on the superficial aquifer was measured at bore KWT3A, during the pumping test of bore KL3P. The drawdown recorded at KWT3A was 0.04m after 44 hours, compared with 3.5m in the Leederville aquifer (at KL3Obs). For a pumping rate of 2,740 kilolitres per day (1.6 times that of the test) for 8 years, the drawdown at KWT3A was extrapolated to average 0.06m/yr, not including recharge.

The scenario modelled is that production bores KL2P and KL3P are pumped for 8 years at an average rate of 2,466 kilolitres per day each to produce a total of 1.8GL/yr. In the Bassendean Sand Formation water levels would be reduced by 0.05 to 0.10m by the end of summer to the north and east of the bores. In winter, drawdown would be reduced by additional recharge. The average drawdown rate would be less than 0.013m/yr. At 3 to 4km east of the bores there would be 0.2m drawdown. In the Guildford Formation, drawdown would be up to 0.6m 4km south-east of bore KL2P. The average rate of drawdown would be less than 0.075m/yr. Drawdown in the Leederville aquifer would be less than 2m beyond about 2km from the bores, after 8 years of pumping, and up to 5m within 2km of the bores. In this area the productive sandstone aquifers lie at 50 to 150 metres below ground level (mbgl) while standing water levels are 0 to 4mbgl. Given the available drawdown exceeding 45m, the operation of any other Leederville bores in the area would not be significantly affected (Rockwater, 2007).

The proponent considers that during winter, mining operations would lower groundwater levels to the base of the Bassendean Sand Formation in and around each mine pit. Water levels will start recovering as mining moves to new pits, excavated pits are backfilled, and rainfall recharges the reconstituted aquifer (MBS, 2007f).

The sand and clay tails are pumped back into the mine pit at approximately 45% density. Some of the water would segregate out of the tails, would be collected in in-pit drainage and taken to a collection sump and pumped to the site dam for reuse. The remaining water is held in the tails matrix and would seep out to recharge the superficial aquifer (MBS, 2007f).

DoW has advised that the proponent has collected sufficient data to support the hydrogeological assessment. DoW also advised that the proponent has conducted a sensitivity analysis, during modelling, to predict the level of risk of water required for the proposal on other users to the satisfaction of DoW.

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulfide). When undisturbed below the watertable these soils are not acidic (Potential ASS). However, if the soils are drained, excavated or exposed by lowering of the watertable, the sulfides would react with oxygen to form sulfuric acid (EPA, 2005).

According to the WAPC Planning Bulletin No. 64 *Acid Sulfate Soils*, the majority of the project area is classified as “moderate to low risk”, where ASS layers are predicted at depths greater than 3mbgl, with two areas classified as “high risk” within Lot 57. Mining is proposed to an average depth of 2mbgl, with a maximum depth of 6mbgl when mining in sandy dunes. The ore body extends below the seasonal watertable in some areas, where dewatering of the soils would be required.

The ore body is confined to the Bassendean Sand Formation. The sampling programme identified that the areas sampled, which included the two high risk areas, are of moderate to low risk of ASS. Sampling was concentrated in the low-lying and central part of the project area where the first stages of mining would commence. Other areas would be sampled in advance of mining. The soil profile where Potential ASS is likely to occur is in the underlying Guildford Formation, which would not be disturbed through excavation or dewatering. Dewatering would be via drains on the pit floor directing water to collection sumps (MBS, 2007f).

Hazardous material such as fuels and oils, and the release of nutrients contained in the soil from excavation could enter the groundwater system through infiltration.

The processing plant site would be located on a layer of hardstand. The HMC minerals are insoluble, so they do not contribute soluble nutrient or saline elements to the water. No chemicals are used in processing that adds soluble nutrients or possible toxins to the water. As the water draining from the HMC stockpile is the same as that used throughout the process, the quality of water draining from the HMC stockpile is expected to be the same as from other sources. The water draining from the HMC stockpile would be directed to collection sumps and recycled back into the process circuit; it would not be discharged to the environment (MBS, 2007f).

One aspect of the proposal that the EPA has considered is the potential to impact on the quantity of groundwater from dewatering the superficial aquifer and abstracting from the Leederville aquifer. Groundwater drawdown may impact on groundwater dependant ecosystems, such as vegetation and wetlands, on the aquifers, and on surrounding users. Groundwater drawdown impacts on vegetation and wetlands are considered in Section 3.1 of this report. The proposal has the potential to impact on the quality of the groundwater from exposure of ASS material as a result of dewatering and excavation. Pollutants from the mining operation could enter the groundwater system and the proposal has the potential to pollute the Proposed PDWSA.

The proponent has identified measures, outlined below, to minimise impacts on groundwater.

1. Implement a Water Management Plan (MBS, 2007a) which outlines the results of modelling and testing of drawdown on the aquifers. The Plan also includes measures to minimise contamination of groundwater, a water balance for the

operations, and a groundwater monitoring programme. The Plan includes trigger levels for water quality parameters, and actions to be implemented where there is an exceedence of a trigger level.

2. Prepare and implement a Water Operating Strategy in accordance with DoW licensing requirements.
3. Prepare and implement a Hydrocarbon Management Procedure.
4. Locate fuel storage areas and workshop facilities on elevated ground to ensure a minimum 2m separation distance to the highest watertable level.
5. Implement an Acid Sulfate Soils Management Plan (MBS, 2007d). The Plan outlines the staged field sampling programme to be undertaken in each mine area 12 months in advance of mining, and management actions to be implemented as a result of the sampling. A monitoring programme to detect any changes in water quality and trigger levels for Titratable Actual Acidity and pH are also identified in the Plan.

Submissions

Submissions made by the public highlighted concern regarding the perceived large water requirement from the proposal, and subsequent impact on the aquifers, the water available from surrounding bores, and on groundwater dependant ecosystems. Submissions noted that recharge to the Leederville aquifer would be reduced through dewatering the superficial Bassendean Sand aquifer. It was submitted that local bores that may be impacted by the proposal should be monitored, and impacts managed where water in the bores is significantly reduced. No information is provided as to the quality of the water draining from the HMC stockpile, which could leach into the soil and groundwater. The proposal should not impact on the future availability and quality of the proposed Karnup-Dandalup Underground Water Pollution Control Area. Submissions also raised concern regarding the generation of ASS and lack of a contingency plan for ASS contamination.

Assessment

The area considered for assessment of this factor is the groundwater aquifers within the project area.

The EPA's environmental objective for this factor is to maintain the quantity and quality of groundwater so that the superficial Bassendean Sand and Leederville aquifers, and surrounding users, are not adversely affected by groundwater drawdown or potential leaching of ASS associated with the proposal.

The EPA notes that 0.2GL/yr would be dewatered from the superficial aquifer, and 1.8GL/yr would be abstracted from the Leederville aquifer. The EPA notes that some of the water used in processing would be included in the backfill material, which would recharge the superficial aquifer.

The EPA notes advice of DoW, that based on field measurements obtained by the proponent after release of the PER and analysis, the quantity of water in the surrounding bores and the superficial aquifer should not be significantly affected as a result of groundwater abstraction associated with the proposal. DoW also advised that subsequent modelling has indicated that pumping of the Leederville aquifer would not have a significant impact on the superficial aquifer.

The EPA considers that the proponent should revise the Water Management Plan and identify a groundwater monitoring programme, including monitoring at the downstream project boundary (condition 9). The programme should include monitoring of groundwater levels within the project area and in surrounding bores. In the event that monitoring indicates that groundwater levels in surrounding bores are significantly declining, as a result of the proposal, the proponent should provide the supply of water to these surrounding groundwater users. The Plan should also identify trigger values to ensure there is no adverse impact on the environment, and mitigation measures should the trigger values be reached. The Plan should also identify measures to ensure that there is no long-term adverse effect on the quantity or quality of groundwater as a result of the proposal.

The EPA notes advice from DEC that although the ASS sampling results indicate low sulfide content, there are indications that some soil profiles have both Titratable Actual Acidity and Titratable Peroxide Acidity. This is likely derived from organic sources including metal hydrolysis. From the information provided, the risk of ASS disturbance in the first stage investigation was considered low. Background values of the receiving environment should be established to prevent acidification that may not be derived from sulfide oxidation.

The EPA notes that the sampling was targeted at the low-lying, central part of the project area, and identified that the risk of the presence of ASS to be moderate to low. The EPA also notes that the risk of impacting ASS is low because the soil profile where Potential ASS is likely to occur (the Guildford Formation) would not be disturbed through excavation or dewatering. The EPA recommends that the proponent should implement the Acid Sulphate Soils Management Plan (condition 10).

Summary

Having particular regard to the:

- (a) information in the hydrogeological assessment (Rockwater, 2007);
- (b) advice from DoW;
- (c) DoW groundwater licensing and permitting requirements; and
- (d) recommended condition for Water and Acid Sulfate Soils Management Plans,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

3.3 Noise

Description

The southern part of the project area is located 500m from the North Dandalup township and 120 to 500m from local residences (Figure 2). The proposal has the potential to generate noise from land clearing, excavation, processing and vehicle movement. Noise generated from the proposal has the potential to impact on the amenity of the local residents.

A Noise Impact Assessment carried out by Lloyd Acoustics in February 2006 indicated that in order to comply with the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations), the wet concentrator plant must be 1km from residences, the hopper/screen and pump should be located 2 metres below ground level (mbgl) within a 2m high bund and 215m from residences, and the booster pumps¹⁰ should be at least 200m from residences.

The assigned noise levels in the Noise Regulations for day time is 45dB(A)¹¹, 40dB(A) for evening, and 35dB(A) for night time. The assigned noise levels may be penalised 5 to 10dB if the nature of the noise is annoying. The EPA has analysed the likely noise impacts that could be generated if mining was conducted as proposed in the proponent's documents.

The following is based on the noise from the scraper in the original proposal. The scraper would have the highest noise emission of all equipment. Contours calculated for worst case wind conditions and calm conditions found that:

- under calm conditions a distance of 1km is required to achieve 30dB(A), the penalised value for night time; and
- under calm conditions a distance of 300m is required to achieve 45dB(A), the non-penalised value for daytime.

The proponent proposes mining during the daytime and night time to ensure continuous operation of the scraper and wet concentrator plant. Based on analysis by the EPA, and the proximity of residences, it would be likely that mining in the southern project area i.e. on Lots 6 (Readheads Road), 7, 44 and 49, would be subject to daytime mining only. The proponent has made a commitment in the PER to only mine in these areas during the daytime.

Additional modelling to examine the noise impact from haul trucks on the internal roads found that the predicted noise levels are less than the assigned noise levels.

The proponent has prepared a Noise Management Plan (MBS, 2007e) to minimise noise emissions. Management measures identified in the Plan include: using meteorological forecasts to schedule operations; fitting all mining equipment with mufflers to reduce noise levels; undertaking periodic noise measurements from site activities when operations are within 500m of sensitive premises; monitoring noise at the receiving premises; and implementing a noise complaint system.

Submissions

Concern was raised in the public submissions regarding the impact of noise on the local community from clearing, excavation, processing and transport, and from operating 24 hours a day, 7 days a week. It was submitted that the noise model failed to include: the use of at least two scrapers and beeping from mine vehicles; all residences in the vicinity of the mine area; all mobile vehicles; and cumulative noise

¹⁰ Booster pumps would be required if the wet concentrator plant is more than 750m from the hopper.

¹¹ An A-weighted noise level has been filtered to represent the way in which the human ear perceives sound, and is described as L_AdB or dB(A) (Lloyd Acoustics, 2006).

impacts from all equipment operating at one time. The submissions considered that the measures outlined in the PER would not adequately manage noise impacts.

Assessment

The area considered for assessment of this factor is the project area, and the residences adjacent to the project area.

The EPA's environmental objective for this factor is to protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring the noise levels meet acceptable standards.

The EPA notes advice from DEC that there are limitations, outlined below, in the modelling and Noise Management Plan.

1. Management measures were not provided for dealing with other sources when the scraper is not operating.
2. Only the closest residences were included in the Lloyd Acoustics (2006) noise assessment report. However, there are residences 400m from the mine area that were not included in the assessment.
3. No background data was provided to support the assertion in the Lloyd Acoustics (2006) report that ambient noise during the day should mask tonality, thus making a 5dB reduction unnecessary. Rural areas often have low ambient noise levels during the day, and if tonality was included, further constraints on mining would occur.
4. As night time operations could be unacceptable at distances of less than 1km to residences, the proponent identified that mining in the southern part of the project area would be restricted to daytime only. There are at least 19 residences within 1km of areas to be mined (Figure 2), and other areas across the mine area would be similarly affected and have restrictions in night time mining.

The EPA notes that the proponent is investigating the use of quieter mine equipment. These have not been included in the EPA analysis, as the degree of improvement is uncertain.

When noise levels do not meet the Noise Regulations there are various options to consider setting different levels. One option is through a variation with regulation 17 of the Noise Regulations. This is sometimes used for major developments with continuing noise issues. The operator is required to meet reasonable and practicable means to minimise noise emissions, and this sets the allowable decibel limit.

Another option is for the Minister for the Environment to set limits as part of the approvals process. The EPA has suggested that this option is appropriate for the proposal, so that all decision makers have certainty.

The EPA recommends that there be no change to the night time and evening noise levels identified in the Noise Regulations, 35dB(A) and 40dB(A) respectively. The EPA recommends that there be no penalty for annoying characteristics, instead the proponent be required to identify and minimise annoying characteristics. Likewise, the

EPA recommends that no penalty should be applied during the daytime, with an increase of the allowable limit from 45 to 50dB(A).

Based on the information provided to the EPA, using the above noise levels, and the proximity to houses; night time mining could be unacceptable.

The EPA notes that the proposed mining is a mobile operation; the mineral sand deposit is shallow, and the proponent anticipates mining across the site quickly. Therefore noise impacts on local residences would be temporary, and there is potential to relocate mine equipment over a pit area where necessary to minimise impact. The EPA expects that the recommended noise levels would predispose towards daytime operations only.

The EPA also considered the 5dB allowance for night time mining, and found that the allowable mining areas, based on wind direction, was largely the same as without the 5dB allowance. The EPA considered that due to the numerous residences in the vicinity of the mine area, it would be extremely difficult to manage the operation for wind direction to avoid significant impact on the residents during the night time.

The EPA considers that the recommended noise levels be the maximum allowable measured at the nearest occupied residence. Furthermore, where the proponent can demonstrate an agreement with the nearest occupied resident that relieves the noise limitations, the relevant site for measurement would become the next nearest occupied residence.

Summary

Having particular regard to the:

- (a) rapid rate of mining over a particular area; and
- (b) daytime noise limits of 50dB(A), evening limits of 40dB(A) and night time limits of 35dB(A), and a requirement to identify and minimise annoying characteristics,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

3.4 Dust

Description

The southern part of the project area is located 500m from the North Dandalup township and 120 to 500m from local residences (Figure 2). The proposal has the potential to generate dust from land clearing, topsoil stripping, excavation, movement of vehicles along haul roads and wind erosion of exposed surfaces. Dust generated from the proposal has the potential to impact on the health, welfare and amenity of local residents, impact on the health of the stock and deposit on surrounding native vegetation.

The National Environment Protection Measures (NEPM) standard for PM₁₀ is 50 micrograms per cubic metre (ug/m³) under certain conditions. PM₁₀ refers to particles with aerodynamic diameter of less than 10 microns. This standard allows up to 5

exceedances per year to accommodate dust from natural events such as fires. The standard is designed to protect human health as particles smaller than PM₁₀ can penetrate the respiratory tract.

The proponent carried out dust monitoring from February 2007 to March 2007 to obtain baseline PM₁₀ concentrations, and to determine the relationship between wind speed and direction and dust concentrations. Due to the occurrence of high speed easterly winds in the region during the summer months, the monitoring programme would resume over summer 2007/2008 to obtain comprehensive background dust data.

In the PER the proponent considered that the wind data available at the Perth airport was representative of the Keysbrook area. After release of the PER the proponent commissioned Sinclair Knight Merz to model particulate emissions generated from the development. Wind speed and wind direction data from the meteorological station at Mundijong (30km north of Keysbrook) operated by Iluka from 1991 to 2001, was compared to the meteorology at Perth airport. SKM reported that wind speed recorded at Perth airport is a suitable surrogate for wind speed at the project area, but wind direction data for Perth Airport is not a suitable indicator for wind direction at the project site due to the influence of local topography (SKM, 2007).

The SKM (2007) report stated that the project area is likely to experience localised wind impacts due to the proximity to the Darling Escarpment, including:

- the generation of very strong easterly winds, of particular concern during summer from early evening to several hours after sunrise;
- the creation of rotating winds where the wind direction reverses under moderate to strong easterly winds, and has the potential to carry particles aloft, occurring during summer from early evening to several hours after sunrise;
- wind channelling of westerly winds (north westerlies through to south westerlies) such that the localised wind direction is more northerly or southerly, respectively, and usually occurring under evening conditions; and
- night time winds under calm conditions would tend to become easterly.

The SKM (2007) report noted that dominant winds are from an easterly to south easterly direction, and correspond to the high wind speed direction. Seasonal variation in wind behaviour is evident. The SKM (2007) report concluded that the high frequency of easterly wind would increase the wind erosion potential from open and active mine areas, and there is the potential within this locality for extended periods of high wind speeds which would result in high dust emissions from the operations. These high emissions have the potential to impact on sensitive receptors.

Estimated dust emissions from the removal of topsoil and ore by scrapers, unloading of material onto stockpiles or the dump hopper, and wind erosion from product stockpiles and unsealed areas was used in the model. Worst case scenario modelling revealed the potential to impact upon some residences located close to the mine area at different stages of operations. The estimated distance for concern is when operations are approaching within 300m of a residence. Exceedances of NEPM were predicted at the residence on Lot 104 Westcott Rd when mining occurs on Lot 6 Westcott Rd and at the residence on Lot 3 Readheads Rd when mining occurs on Lot 49 Readheads Rd.

Recommendations of the SKM (2007) report are:

- Particulate emissions from wind erosion due to easterly winds is an issue, and wind erosion emissions would need to be reduced.
- Some residences are relatively close to operations, so the proponent should investigate the use of a monitoring network between the operations and the receptor to alert of high dust concentrations so that dust control procedures can be implemented. Some of the procedures that can be used include: increase use of watering; reducing the speed of vehicles; or briefly ceasing operations until the dust concentrations at the dust monitors have decreased then recommencing operations with an increased use of watering.

The proponent has committed to wash down roofs of residences that rely on rainwater collection at the end of summer, to ensure that winter rain collected would be clean (MBS, 2007f).

The proponent has prepared an Air Quality and Dust Management Plan (MBS, 2007g) to minimise dust generated from the proposal. Management actions identified in the Plan include:

1. Minimising clearing and open areas;
2. Not stripping topsoil during periods of high winds. Visual monitoring of topsoil stripping, and ceasing activity if dust crosses the project boundary.
3. Watering of internal roads and dust generating disturbed areas as required.
4. Growing of temporary 'stubble' crops to bind soil and decrease wind velocity at ground level.
5. Using mulch, chemical or polymer suppressants where suitable and surface spraying of clay to control dust prior to rehabilitation.
6. Re-establishing pasture and vegetation as soon as possible after mining has been completed.
7. Using sprinkler systems around high activity infrastructure areas.
8. Installing a high wind warning system to enable the site to initiate dust control mechanisms in a timely manner.
9. Using continuous real time weather monitoring linked to an alarm when the wind speed threshold value of 45km per hour is reached.
10. Installing continuous particle monitors along the boundary to the closest residences when operations are within 500m.
11. Regularly reviewing monitoring data and investigating high results, with corrective actions to eliminate the causal factors.
12. Implementing a complaints management system.
13. Covering loads of HMC on trucks prior to leaving the stockpile area.
14. Restricting vehicle speeds on unsealed surfaces.
15. Using weather forecasts as a proactive management tool to schedule tasks and implement dust reduction activities.

Submissions

Submissions from the Local Shires recommended that the Dust Management Plan should address impacts from active mine areas on nearby residents, and relatively high wind speeds are experienced in the area, and appropriate dust management should be employed during mining and rehabilitation on-site.

Submissions from the public raised concern regarding the difficulty in controlling the large amount of dust that would be generated. The need for separate night and day pits and different mining locations based on the prevailing winds would mean a larger area of excavated land is exposed. It was submitted that water sprays would not adequately control dust generation under high easterly winds during the summer months. Clearing of tall and dense remnant vegetation would increase the likelihood of sand dune blowouts and dust storms from katabatic winds descending the Scarp and hitting the SCP at high velocities. This would be further exacerbated by removing the soil profile by scrapers during such high wind conditions. The proponent should do site-specific measurements and base any wind erosion predictions and management plans on these. The proponent's claim to only mine on the down wind side of residences is not possible, with houses surrounding the mine, and summer winds changing 180 degrees in a day.

Assessment

The area considered for assessment of this factor is the project area, and the residences adjacent to the project area.

The EPA's environmental objectives for this factor are to reduce dust emissions as far as practicable, and ensure that dust emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses.

The EPA notes the proponent has modelled the expected dust emissions from the proposal, and that modelling has indicated that PM₁₀ concentrations at some residences would exceed the NEPM standard. The EPA considers that the generation of Total Suspended Particulate matter (which includes all particles up to 50 micrometres in diameter) requires management for the proposal.

The EPA acknowledges the proponent's intention to use weather forecasts as a proactive management tool to schedule tasks and implement dust reduction activities. The EPA notes that mining is a mobile operation, and the equipment can be moved depending on the weather conditions. The EPA notes the proponent's intention to monitor at the project boundary, and use continuous real time weather monitoring linked to an alarm when the wind speed threshold value of 45km per hour is reached.

The EPA recommends that the proponent should revise the Air Quality and Dust Management Plan (condition 13) to include: dust management according to predictions (i.e. weather forecasts); management according to actual winds experienced at the site; measures to minimise open areas; a plan for each pit, with the times of day and weather conditions under which parts of the pit could be mined (i.e. no mining upstream of an occupied residence when an easterly wind is blowing). The Plan should also include dust management measures negotiated between the proponent and

the landowners when mining in close proximity to their residences and high dust levels are experienced at the residence for a period of time.

Summary

Having particular regard to the:

- (a) rapid rate of mining over a particular area;
- (b) recommended condition for an Air Quality and Dust Management Plan; and
- (c) agreement with landowners when mining in close proximity to their residence,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

3.5 Key environmental principles

In preparing this report and recommendations, the EPA has had regard for the object and principles contained in section 4A of the *Environmental Protection Act 1986*. Appendix 3 contains a summary of the EPA's consideration of the principles.

4. Conditions and commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Having considered the proponent's management actions, commitments and the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Olympia Resources Limited to develop the Keysbrook Mineral Sands Mine was to proceed.

These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

- (a) Fulfillment of the commitments set out as an attachment to the recommended conditions in Appendix 4.
- (b) Rehabilitation.
- (c) Weed and dieback management.
- (d) Water management.
- (e) Acid sulfate soils management.
- (f) Performance bond.
- (g) Noise management.
- (h) Air quality and dust management.

5. Other advice

Protection of vegetation on Lot 56 and Lot 3

During the assessment the EPA established that the remnant native vegetation on Lot 56 and Lot 3 has high conservation value because it contains remnants of vegetation that:

- is poorly represented on the eastern side of the SCP;
- is in Good to Very Good condition, in an extensively cleared area;
- comprises habitat for native fauna of conservation significance. The significant stands of mature trees provide feeding areas for endangered cockatoos and other conservation significant bird species.

For these reasons, the EPA considered that the remnant native vegetation on Lot 56 and Lot 3 should not be cleared for mining. Furthermore, the EPA recognises that the removal of any threatening processes, such as grazing and land development, is important to ensure that the vegetation is protected in the long-term. The EPA advises that any subsequent proposal to clear this vegetation would need to be carefully scrutinised by DEC and assessed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. The EPA encourages the landowners to place a conservation covenant over this bushland to ensure the security, of purpose and management, of the vegetation in perpetuity.

Other approvals processes

Other regulatory mechanisms relevant to the Keysbrook Mineral Sands Mine are:

- works approval and licensing by DEC under Part V of the *Environmental Protection Act 1986*;
- permits and water licensing by DoW under the *Rights in Water and Irrigation Act 1914*;
- planning approval, extractive industries licence and traffic safety assessment by the Local Shires.

Community involvement

The EPA is aware that the local community has many environmental and social concerns about the proposal. The EPA considers that the proponent should continue to undertake effective community consultation (commitment 2).

The proponent stated that “A range of appropriate local programmes would be supported during the project” in the PER (MBS, 2006). Furthermore, the proponent stated that “Olympia sponsorship of local groups: \$25,000 per year” in the Response to Submissions document (MBS, 2007f). In accordance with commitment 2, the proponent should identify community development programmes that would be initiated or supported by the proponent.

6. Conclusions

The EPA has considered the proposal by Olympia Resources Limited to develop a mineral sands mine near the rural township of Keysbrook.

The Commonwealth Department of the Environment and Water Resources found the proposal to be a controlled action under the EPBC Act for the presence of Listed threatened species and communities, and Wetlands of international importance in the vicinity of the project area. The threatened species are Baudin's Black Cockatoo and Carnaby's Black Cockatoo. The wetlands of interest are the Peel-Yalgorup Ramsar site (20km downstream of the project area), Becher Point Wetlands (20km northwest of the project area), and the Forrestdale and Thomsons' Lakes (37km north of the project area). The EPA has assessed the proposal in accordance with the bilateral agreement between the Commonwealth and Western Australia relating to environmental impact assessment.

The project area is within a dampland (seasonally waterlogged basin). On-ground assessment of wetlands by DEC found that no mapped conservation category wetlands exist within the mine area.

Most of the project area is annual pasture grazed by cattle. During the assessment, the EPA established that the remnant native vegetation on Lot 56 and Lot 3 has the highest conservation value in the project area because it contains remnants of vegetation that:

- is poorly represented on the eastern side of the Swan Coastal Plain;
- is in Good to Very Good condition, in an extensively cleared area; and
- comprises habitat for native fauna of conservation significance. The significant stands of mature trees provide feeding areas for endangered cockatoos and other conservation significant bird species.

For these reasons, the EPA advised the proponent that the proposal to clear remnant native vegetation on Lots 56 and 3 would not be supported. As a result, the proponent excised these areas from the mine plan. The proponent has committed to excise an additional consolidated area of vegetation on Lots 59 and/or 62 from the mine area. The EPA notes that the proponent is negotiating with the landowners of Lots 59 and 62 to provide compensation to place a conservation covenant over the excised area in order to secure the vegetation in perpetuity for conservation purposes.

The majority of the mine area is pasture with scattered native trees. The remnant native vegetation within the mine area consists of stands of mature trees with minimal or no understorey. The remnant vegetation, that covers about 13% of the proposed mine area in discrete pockets, has environmental value because it:

- is poorly represented on the eastern side of the Swan Coastal Plain;
- exists in an extensively cleared area; and
- provides resource value, in terms of food, breeding, roosting or shelter for endangered cockatoos and other conservation significant bird species.

Considering the significance of the vegetation and trees to be cleared as a result of mining, the EPA recommended that the proponent identify a consolidated area of remnant native vegetation on Lots 59 and/or 62, and excise this area from the mine plan. This area should be protected from grazing, enhanced through revegetation and weed control, and preferably secured in perpetuity for conservation purposes, by means of a conservation covenant.

On-site monitoring and modelling indicated that groundwater drawdown associated with the proposal should not adversely affect the aquifers and surrounding bore users.

The EPA has recommended a daytime noise level of 50dB(A), evening noise limit of 40dB(A), and a night time noise limit of 35dB(A). This would preclude mining at night in the southern part of the project area, consistent with the proponent commitments. Overall, there would be a pre-disposition towards daytime operations.

The EPA considered that the generation of Total Suspended Particulate matter (which includes all particles up to 50 micrometres in diameter) requires management for the proposal.

The EPA considered that the proponent could have agreements with the surrounding landowners that may be adversely affected by noise and dust generated from the proposal.

The EPA has concluded that the proposal should only proceed if the proponent can ensure that mining operations meet the recommended noise limits, and there is satisfactory implementation of the recommended conditions set out in Appendix 4 of this report.

7. Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is the development of a mineral sands mine near the Keysbrook township. The proposal involves the excavation and processing of a low-grade heavy mineral sand deposit. Local roads would be upgraded to facilitate the transport of the heavy mineral concentrate to South Western Highway.
2. That the Minister considers the report on the key environmental factors and principles as set out in Section 3.
3. That the Minister notes that the EPA has concluded that mining operations should be allowed to proceed only when the recommended noise levels are met.
4. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Appendix 1

List of submitters

Organisations:

Conservation Council of Western Australia
Department of Environment and Conservation
Department of Indigenous Affairs
Department of Industry and Resources
Department of Water
Greenacres Turf Farm
Keysbrook North Dandalup Action Group
Landcare Serpentine-Jarrahdale Inc
North Dandalup Primary School P&C Association
Peel Harvey Catchment Council Inc
Radiological Council
Shire of Murray
Shire of Serpentine-Jarrahdale
Water Corporation
Wildflower Society of Western Australia Inc
3 anonymous organisations (confidential)

Individuals:

Brenda and Mervyn Beacham
Brian and June Bowman
Brian Buck
Monika Cameron
Bruce Campbell
Tina Edwards
Alan Elliott
Colby Elliott
Graham Elliott
Harrison Elliott
Kathleen Elliott
Luke Elliott
Marrion Elliott
Jessica Harrison
R. F. and S.F. Hickson
Robert Shane Hickson
Samantha Hickson
Brian Higgs
Denise Honeybone
Jean B. Horner
Lewis W. Horner
Tom Hoyer
Faye Llewellyn
Rod Lukatelich
Denyse Needham
Greg and Leanne O'Neil
David Royans
Leanne Stacey
Maddison Weston
Sierra Weston
92 anonymous individuals (confidential)

Appendix 2

References

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- MBS (2007c) *Keysbrook Mineral Sand Project. Vegetation and Rehabilitation Management Plan.* (Unpub) Prepared for Olympia Resources Limited by MBS Environmental. May 2007.
- MBS (2007d) *Keysbrook Mineral Sand Project. Acid Sulfate Soils Management Plan.* (Unpub) Prepared for Olympia Resources Limited by MBS Environmental. May 2007.
- MBS (2007e) *Keysbrook Mineral Sand Project. Noise Management Plan.* (Unpub) Prepared for Olympia Resources Limited by MBS Environmental. May 2007.
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SKM (2007) *Keysbrook Mineral Sand. Dust modelling.* (Unpub) Sinclair Knight Merz Pty Ltd. May 2007.

Western Wildlife (2005) *The value of remnant vegetation in the Keysbrook area to three species of threatened cockatoo.* (Unpub) Prepared for MBS Environmental by Western Wildlife. November 2005.

Appendix 3

Summary of identification of key environmental factors and principles

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
BIOPHYSICAL			
Vegetation	<p>The proposal would require clearing of up to 1,366 hectares (ha). This includes up to 182ha of remnant native vegetation and 1,184ha of pasture with scattered native trees. The vegetation in Good or better condition has been removed from the mine area. The vegetation in the mine area consists of stands of mature trees with minimal or no understorey.</p> <p>The vegetation complexes of Bassendean Central and South, Guildford and Southern River occur within the project area. Most clearing would take place in the Bassendean Central and South complex. The vegetation remaining within these complexes is below 30% of the total extent pre-1750. Therefore the native vegetation within the mine area is considered to be regionally significant.</p> <p>Nine vegetation communities exist within the project area, of which three Floristic Communities Types (FCTs), 20b, 3a and 3c, were inferred to be Threatened Ecological Communities (TECs). PATN analysis concluded that FCT 20b more closely resembles other communities (21a or 21c), which are not TECs. The condition of FCTs 3a and 3c was considered to be Degraded to Completely Degraded, and not worthy of conservation.</p> <p>The northern half of the project area is within the Bush Forever study area. No Bush Forever sites exist within this area.</p> <p>No Declared Rare Flora (DRF) or Priority flora was identified during surveys of the project area.</p>	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> • Remnant native vegetation within the project area is important in maintaining diversity in agricultural environments. • The condition of the original plant communities inferred as TECs are Degraded and cannot be interpreted to contain intact TECs. • Offsets should be provided to compensate for the loss of the vegetation within the complexes that are currently under the 30% biodiversity threshold. • All vegetation identified as Good or better condition should be retained. • Vegetation to be excised from mining should be fenced to exclude grazing. • The placement of conservation covenants over areas of native vegetation to be excluded from mining or established as a result of the project would assist in securing the long-term protection of conservation values. <p><u>Public</u></p> <ul style="list-style-type: none"> • Concern regarding the loss of native vegetation, particularly vegetation in Good condition and mature trees. • The proposal is not consistent with the Native Vegetation Clearing Principle e). • Remnant native vegetation in the project area is significant because it comprises vegetation in an area that has been extensively cleared i.e. the eastern side of the Swan Coastal Plain (SCP). A reduction in the number of remnant blocks of native vegetation tends to reduce the value of remaining remnant blocks. Therefore remnant vegetation should be excised from mining. • Vegetation to be protected should be permanently fenced. • Vegetation classed as Good should be excised from the mine area. • Remnant vegetation in the project area should receive permanent protection, including fencing to prevent stock grazing and the application of conservation covenants. Rehabilitation of the areas mined should include the establishment of linkages between these remnants. • FCTs 3a and 3c, inferred as TECs, are worthy of conservation. • Net environmental benefit is not demonstrated in the proposal. The removal of remnant vegetation communities and many trees in good health cannot be replaced by a strip replanting with a limited number of species. • The project area has not been adequately surveyed for flora. • Further flora surveys should be carried out to verify the extent of the presence 	<p>Considered to be a key environmental factor and is discussed in section 3.1 “Vegetation”.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	The proposal would impact on native vegetation through direct land clearing. Surrounding native vegetation has the potential to be impacted through dust deposition and reduced water availability from groundwater drawdown.	<p>of DRF and Priority flora within the project area.</p> <ul style="list-style-type: none"> The flora and vegetation survey did not assess the values of the trees in the parkland cleared areas. Lowering of the water table will adversely impact on the vegetation in the area. The diversion of watercourses would impact on the wetland vegetation. 	
Weeds	<p>34 weed species exist within the mine area, of which 28 are invasive. Weeds of particular concern are Great brome, Perennial veldt grass, Victorian teatree, and Guildford grass.</p> <p>The proposal has the potential to increase the spread of weeds both within and outside the project area.</p>	<p><u>Department of Environment and Conservation</u></p> <ul style="list-style-type: none"> Vegetation to be excised from the mine area should be fenced to exclude grazing and minimise the spread of weeds into the area. <p><u>Public</u></p> <ul style="list-style-type: none"> Weed control should be undertaken more frequently than only during spring, and according to optimum time for control of individual species. 	Considered to be a key environmental factor and is discussed in section 3.1 “Vegetation”.
Dieback	<p>Root and soil samples were taken from recently dead Banksias for the presence of <i>Phytophthora cinnamomi</i> at three locations in the project area. Results identified the presence of dieback in some upland vegetation on the eastern patch of remnant native vegetation on Lot 59.</p> <p>The proposal has the potential to increase the spread of dieback both within and outside the project area.</p>	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> A Dieback Management Plan should be prepared. Dieback areas should be identified through further testing and on-site mapping. Vegetation to be excised from the mine area should be fenced to exclude grazing and minimise the spread of dieback into the area. <p><u>Public</u></p> <ul style="list-style-type: none"> No quantitative information or mapping of dieback affected areas is provided. All mobile equipment and vehicles must be washed down before entering and exiting the mine area to eliminate the spread of dieback to unaffected areas. Dieback infected material will be placed in low-lying areas prone to sheetwash. Without buffering minor watercourses dieback would enter the wetland chain. A Dieback Management Plan should be prepared. 	Considered to be a key environmental factor and is discussed in section 3.1 “Vegetation”.
Fauna	<p>Fauna surveys over the project area identified the presence and potential presence of the following conservation significant species:</p> <ul style="list-style-type: none"> at least 15 bird species that are habitat specialists with a reduced distribution on the SCP, or wide-ranging species with reduced populations on the SCP according to Bush Forever; <i>Calyptrorhynchus latirostris</i> (Carnaby’s Black 	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> Remnant native vegetation within the project area is important in providing habitat for fauna. The project area represents one of the larger areas of mature vegetation and fauna habitat remaining on the eastern side of the SCP. It would take many years for the rehabilitation to provide suitable habitat for fauna of conservation significance. Remnant vegetation with habitat values should therefore be retained as much as possible. Conservation offsets should be investigated for the loss of fauna habitat and local biodiversity, and the difficulties associated with rehabilitation. 	Considered to be a key environmental factor and is discussed in section 3.1 “Vegetation”.

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>Cockatoo) and <i>Calyptorhynchus baudinii</i> (Baudin's Black Cockatoo) listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) and <i>Wildlife Conservation Act 1950</i>;</p> <ul style="list-style-type: none"> • <i>Calyptorhynchus banksii naso</i> (Forest Red-tailed Black Cockatoo), listed under the <i>Wildlife Conservation Act 1950</i>; • <i>Merops ornatus</i> (Rainbow Bee-eater) a migratory species under the EPBC Act; and • <i>Isododon obesulus fusciventer</i> (Quenda), a Priority listed species. <p>A survey of the remnant vegetation for the three species of black cockatoo found that the vegetation is likely to provide feeding habitats for all three species. Although only a few potential nesting hollows were identified in the survey, it was noted that hollows are sometimes not visible from the ground. Most of the potential hollows identified were on Lot 56.</p> <p>A detailed fauna survey in 2006 found that: the likelihood of short-range endemic invertebrate species being present is low; a high number of bird species were observed on Lots 300, 59, 56 and 62; surveys for bats, reptiles, Quendas and black cockatoos should be carried out; the proposal impact on cockatoo nesting sites should minimise, retain native vegetation where possible and not affect wetlands; and rehabilitation should enhance wildlife habitat and corridors.</p> <p>The proposal has the potential to impact on fauna through loss of habitat from vegetation clearing, fragmentation of habitat and noise from mining operations and transport.</p>	<ul style="list-style-type: none"> • The limited areas of remnant vegetation are likely to provide the only native habitat and food source for a number of fauna species across the site. • Corridor linkages are not defined. Remnants of various sizes and scattered or clumped trees in paddocks facilitate movement for a range of species. • Remnant vegetation on Lots 3 and 56 represent excellent habitat for habitat sensitive bird species listed as significant on the SCP. Cockatoo nesting sites on Lot 56 should be excised from the mine area. • Remnants on Lots 62 and 59 and the adjoining vegetation on properties that will not be mined contain ecological linkage for habitat sensitive bird species. • A survey of the faunal values of the project area should be undertaken to determine their regional significance. Areas determined as regionally significant habitat should be removed from the mine area. <p><u>Public</u></p> <ul style="list-style-type: none"> • Concern regarding the loss of fauna habitat and impacts of the proposal on local fauna, many of regional conservation significance. • The project area has not been adequately surveyed for fauna. • An assessment of all of the trees in the project area (not just the remnants) should be carried out to determine fauna habitat values. • Clearing of all mature trees (except for the mine exclusion area) means that there will be no nesting hollows for hundreds of years across a 1,200ha area. The cockatoos that use these hollows will be displaced. • The Baudin's Black Cockatoo and Carnaby's Black Cockatoo sightings and nesting hollows identified in the PER is an underestimate. • Remnants containing Marri tress are significant feeding and breeding areas for Forest Red-tailed Black Cockatoos. • A more in-depth assessment of trees that are currently or will be suitable feeding and nesting habitat for all three black cockatoos should be undertaken. • The impact on the other 32 bird species of conservation significance identified in the PER has not been addressed • The potential impact on bats should be assessed through surveys. • The numbers of kangaroos identified in the area is an underestimate. • Many kangaroos use the vegetation within the project area for habitat, and would be forced into neighbouring properties. • Clearing of remnant vegetation will lead to a further loss of fauna species in the SCP. Therefore remnant vegetation within the project area should be retained. 	

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
Soil and landform	<p>The project area lies within the major geomorphological system of Bassendean Dunes/Pinjarra Plains. The soil formations within this system consist of the Bassendean Sand Formation and the underlying Guildford Formation. The mineral sands deposit is contained in the Bassendean Sand Formation.</p> <p>The proposal would result in alterations to the local topography and landforms within the project area.</p>	<p><u>Shire of Murray</u></p> <ul style="list-style-type: none"> Measures to ensure that current ground levels across the site are maintained or enhanced to reduce the potential for inundation should be provided. <p><u>Public</u></p> <ul style="list-style-type: none"> The cause and extent of salinity within the project area has not been addressed. Mobilisation and release of nutrients from excavation could affect the soil and landscape. A Nutrient and Drainage Management Plan should be prepared including on-site testing and modelling. Removal of remnant vegetation will raise the groundwater table and increase salinity of the agricultural land in the surrounds of the project area. Land clearing and mining should not occur during the spring and summer months due to the risk of east wind erosion. Concern regarding the disturbance of the natural landform of the area. There is no digital terrain model for the area. Therefore it is not possible to re-establish existing landforms if they are not initially understood. 	<p>The post-mining landform would be returned as close as possible to the pre-mining state. Pre-existing drainage patterns (that are not proposed to be diverted) would be maintained. Post mining ground level would re-establish the pre-mining regional surface drainage.</p> <p>Erosion control measures would be implemented during the life of the mine. All landforms would be stabilised with either pasture or native vegetation.</p> <p>Not considered to be a key environmental factor.</p>
Groundwater	<p>The project area is located within the unproclaimed Karnup-Dandalup Underground Water Pollution Control Area, which has been identified as a Proposed Priority 2 Public Drinking Water Source Area (PDWSA). The project area is in a recharge zone to the superficial Bassendean Sand aquifer, the Leederville aquifer and underlying Yarragadee aquifer.</p> <p>The two aquifers affected by the proposal are the superficial Bassendean Sand aquifer, which ranges from 10 to 15 metres (m) depth, and the deep Leederville aquifer, which extends to about 100m depth. Water salinities in the superficial aquifer range from 200 to 1,000 mg/litre Total Dissolved Solids, while in the Leederville aquifer they are generally less than 1,000 mg/litre Total Dissolved Solids. Recharge to the superficial aquifer is from rainfall and local stream runoff.</p>	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> More information on the impact of dewatering the superficial aquifer and extraction from the Leederville aquifer on the Leederville aquifer is required. The impact on water levels in the Leederville aquifer as a result of the reduction in recharge has not been adequately addressed. It is stated in the PER that dewatering would affect other users and the natural system. However, very little information is provided on the affect of these impacts and the proposed mitigation measures. Further information should be provided regarding localised impacts on the groundwater table as a result of dewatering, particularly with respect to the duration and extent of these impacts. Impacts from groundwater table elevation (mounding) associated with the tailings deposition areas should be determined. Pump test data and on-site measurements are required to validate the model used in the Rockwater (2006) report to predict changes in groundwater levels. The cumulative impacts of local bores abstracting from the superficial and Leederville aquifers, in addition to the mining operation was not considered. Baseline groundwater levels and water quality should be provided. 	<p>Considered to be a key environmental factor and is discussed in section 3.2 “Groundwater”.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>Recharge to the Leederville aquifer is from the superficial aquifer. The direction of the groundwater flow within the project area is westward.</p> <p>In the project area the soil formations in the superficial aquifer consists of the Bassendean Sand Formation and the underlying Guildford Formation.</p> <p>0.2 gigalitres per year (GL/yr) would be dewatered from the superficial aquifer, and used in the wet concentrator plant. About 20% of the water required for the proposal would be sourced from dewater. The balance would be sourced from bores into the Leederville aquifer, at a maximum rate of 1.8 GL/yr.</p> <p>After release of the PER, the proponent carried out modelling of the dewatering requirements and drawdown effects, based on field measurements of hydrogeological parameters.</p> <p>The proposal has the potential to impact on the quantity of groundwater from dewatering the superficial aquifer and abstracting from bores into the Leederville aquifer.</p> <p>The proponent would be required to obtain a licence from the Department of Water to abstract water from the Leederville and superficial aquifers.</p> <p>The proponent has prepared a Water Management Plan which outlines the results of modelling and testing of drawdown on the aquifers. The Plan also includes measures to minimise contamination of groundwater, a water balance for the operations, and a groundwater monitoring</p>	<ul style="list-style-type: none"> • Insufficient information is provided to demonstrate that water levels and quality of surrounding water users will not be impacted. Bore depths, screen intervals, water levels and water quality should be identified in surrounding bores. • All nearby groundwater users should be identified and consulted with. A plan should be developed to deal with groundwater licences within the project area. • Estimates of the processing water requirements should be refined. • A risk analysis of potential impacts on the local bores in the event that the drawdowns estimated by the model are underestimated should be conducted. • As part of obtaining a groundwater licence, a rigorous groundwater monitoring programme will be required due to the volume of water required for the proposal, the density of local bores in the area and the proximity to wetlands. • A Water Management Plan should be prepared defining groundwater monitoring locations, frequency and parameters. • Monitoring would be required beyond the life of the mine. • Concern regarding impact on the Proposed PDWSA. • The minimum 2m separation to the groundwater table will not be achieved. • Fuel storage tanks need to be installed above ground. • A Hydrocarbon Management Procedure should be prepared to prevent any surface water or groundwater pollution in the proposed PDWSA. <p><u>Water Corporation</u></p> <ul style="list-style-type: none"> • The project area is within a proposed Priority 2 source protection area, where protection of public water supplies is a high priority. <p><u>Public</u></p> <ul style="list-style-type: none"> • The amount of water required for the proposal is very large, underestimated, and will severely deplete the resource. • The quantity and quality of water in the Leederville aquifer should not be adversely impacted by the proposal. • The groundwater aquifers could be contaminated from release of nutrients and pollutants from the mining operation. • Investigations undertaken to ensure that the proposal will not lead to the mobilisation of the nutrients (and salts) stored in the soil being released into the groundwater should be outlined. • What disposal system will be in place to protect the groundwater from pollutants generated by the mining operation? 	

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	programme. The Plan includes trigger levels for water quality parameters, and actions to be implemented where there is an exceedence of a trigger level.	<ul style="list-style-type: none"> • Recharge to the Leederville aquifer will be reduced through dewatering the superficial Bassendean Sand aquifer. • Pit dewatering and groundwater abstraction will adversely affect the quantity and quality of the water available from neighbouring bores. The proponent should monitor local bores that may be impacted by the proposal. • What will happen if groundwater abstraction and dewatering significantly reduces the water available in the bores of the surrounding landowners? • Impacts on the superficial aquifer as a result of dewatering should not extend beyond the boundary of the mine area. • The model (Rockwater, 2006) did not consider the future developments and agricultural production in the area adjacent to the mine, and their subsequent demand for water; declining rainfall and run-off reducing the recharge to the aquifers; bores that show a decline in water levels; local borehole data; and the effects on the Leederville aquifer. • Modelling should be repeated using hydraulic parameters that are calculated from field-testing of the project area. • No information is provided as to the quality of the water draining from the HMC stockpile, which could leach into the soil and groundwater. • There are no calculations on how the annual drawdown of the Leederville aquifer will affect the watertable in the immediate area of the mine bore field. • An understanding of the interaction of the Leederville aquifer with other aquifers, groundwater dependent ecosystems and wetlands in the local area, supported by groundwater drawdown pumping trials, should be demonstrated • Evidence that water abstraction will be sustainable and will not impact on the environment is not provided. • Dewatering will be required during summer. • Reclaiming slurry water for re-use should be investigated. • Timing of dewatering should reflect the natural fluctuations of the watertable. • The three site dams should be designed so as not to draw water from the aquifers or release nutrients and sediments to the aquifers. • The proposal should not impact on the future availability and quality of the proposed Karnup-Dandalup Underground Water Pollution Control Area. 	
Wetlands	The Ramsar listed Becher Point Wetlands and Forrestdale and Thomsons' Lakes are about 20km and 37km, respectively from the project area.	<u>Local and State Government agencies</u> <ul style="list-style-type: none"> • Dewatering could affect the ephemeral hydrological regime resulting in vegetation death and degradation of wetlands. 	Considered to be a key environmental factor and is discussed in section 3.1

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>The Peel-Yalgorup System is about 20km downstream of the project area.</p> <p>The proponent used wetland mapping from the Revised Draft <i>Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004</i> in the PER. On advice of DEC, the proponent used the <i>Geomorphic Wetlands Swan Coastal Plain</i> dataset. The project area is within a dampland. According to the dataset, Conservation Category Wetland (CCW) UFI 7612 and twelve resource enhancement wetlands are mapped as occurring within the mine area. CCW UFI 7425 is mapped as partly within the mine area. Other CCWs and resource enhancement wetlands exist adjacent to the mine area.</p> <p>The proponent applied to DEC to reclassify the two CCWs within the mine area to 'not a wetland', and downgrade seven other CCWs adjacent to the mine area to either multiple use wetlands or 'not a wetland'. Preliminary advice from DEC is that the two CCWs mapped as occurring within the mine area are not conservation category, but resource enhancement wetlands.</p> <p>The proposal has the potential to impact on resource enhancement wetlands within the mine area through direct clearing. Wetlands adjacent to the mine area have the potential to be impacted as a result of groundwater drawdown.</p> <p>Rockwater Proprietary Limited conducted monitoring and modelling of the superficial aquifer to identify potential impacts on wetlands as a result of bore abstraction and dewatering.</p>	<ul style="list-style-type: none"> • It has not been clearly demonstrated that dewatering will not impact on wetlands. • Geomorphic wetland mapping, available from DEC, shows CCWs within the mine area that has not been reflected in the PER. The project area should be revised to avoid impact on CCWs and resource enhancement wetlands. • The proposed buffers to wetlands are inadequate. • The environmental water requirements and conservation values of the wetlands should be determined prior to any site works. • The model (Rockwater, 2006) does not provide an indication of the drawdowns in the wetlands adjacent to the mine areas. • Dewatering should be sufficiently far away from protected wetlands to ensure there is no hydrological impact. • The current hydrological state of the wetlands has not been accurately determined to state whether the wetlands are wholly dependant on creek flow, or if the wetlands have a groundwater inflow component. <p><u>Public</u></p> <ul style="list-style-type: none"> • The PER did not consider the presence of and impact on CCWs, resource enhancement wetlands and multiple use wetlands. • The buffers between the mine area and wetlands should be determined according to the WAPC's <i>Guideline for the Determination of Wetland Buffer Requirements (Draft)</i>. • There has been no detailed on-ground mapping of wetlands in the area. • The lack of a detailed digital terrain model prevents the identification of wetlands. This will lead to unrecoverable areas after mining. • The annual drawdowns around wetlands should reflect the natural wet and dry cycles of the water bodies. • Impacts drawdown may have on the wetlands or what actions will be implemented should the water table not return to natural levels by the end of the mining process has not been addressed. • Concern regarding impacts on the Ramsar listed sites and the Peel-Harvey system, particularly from mobilisation of fertilizers trapped in the soil. • Ramsar listed wetlands should not be adversely impacted by the proposal. • Management of impacts on the wetlands from dewatering is not addressed. • Wetland areas should be permanently protected by fencing and the application of conservation covenants on the titles of the properties. 	<p>“Vegetation”.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
Surface water	<p>The Major watercourses that traverse the project area are Balgobin Brook and North Dandalup River Tributary. The Medium watercourses are Dirk Brook Tributary, Nambeelup Brook North Tributary, Balgobin Brook South Tributary and Nambeelup Brook South Tributary. The Minor watercourses are generally shallow and poorly defined. Many of the existing drainage lines have been modified into agricultural drains, and stock has access to most of the drainage lines within the project area (MBS, 2006).</p> <p>Rates of groundwater contribution to stream flow for the Medium watercourses before and during dewatering were estimated using a numerical model. From the model it was calculated that stream flow would decrease in the range of zero to 250m³/day and are mainly less than 60m³/day. The proponent considers that these are very minor amounts in the hydrology of the area (MBS, 2007f). Excess water would flow over a lined spillway on the dam to these nearby watercourses. If considered necessary, additional sediment sumps would be installed between the dam and the creek line to further decrease turbidity of discharge water (MBS, 2007a).</p> <p>In the event that water available from dewatering and in the site dam exceeds that required for processing and dust suppression, surplus water is proposed to be discharged along an existing drainage channel. Discharge water would be released from the site dam via a sediment settlement pond before discharge to the environment. Testing of nutrient levels in the Bassendean subsoils by the proponent has shown low levels of the major nutrients, nitrogen,</p>	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> • Dewatering impact on groundwater contribution to streams has not been demonstrated. • The Nambeelup Catchment is one of the most nutrient enriched catchments in the Peel-Harvey. • All watercourses within the project area should be fenced and revegetated. • The proposed buffers to watercourses are inadequate. • The disturbance of the Minor watercourses is not supported. Should this disturbance be permitted then detailed management plans should be prepared. • Stream flow, nitrogen and phosphorus loads should be calculated and regularly monitored during the life of the mine and after closure. • A Water Management Plan should be prepared defining surface water monitoring locations, frequency and parameters and baseline information. • The model (Rockwater, 2006) does not provide an indication of the drawdowns in the watercourses. • The potential impacts of the use of flocculants during processing on water disposal and storage should be addressed. • All surface watercourses eventually drain to the Peel-Harvey estuary. Appropriate controls should be put in place to ensure that the estuary is not impacted upon by the mining operations. • Given that the site is located within the Peel-Harvey Catchment, any overflow from the mining operations will need to be appropriately monitored and managed to minimise potential downstream impacts. • During the peak of the wet season, discharge of excess water into drainage channels may have significant impacts in regard to flooding and water quality. The impacts on downstream users in regard to water quantity and quality have not been adequately addressed. • Change in topography as a result of excavation impacting on the surface flow regime across the project area should be addressed. <p><u>Water Corporation</u></p> <ul style="list-style-type: none"> • Outflows from the project area should be kept to existing levels. • Management procedures should be in place to prevent unacceptable impacts on the drainage system associated with the disturbance of ASS. 	<p>The proponent has identified measures, outlined below, to minimise impacts on the watercourses.</p> <ol style="list-style-type: none"> 1. Maintain a 10m buffer each side of the Major and Medium watercourses crossing the mine area to ensure no direct physical disturbance on the watercourses. 2. Bund mine pits to prevent surface water runoff to the pit or from the pit, while mining occurs. 3. Capture and treat waters from potentially contaminated catchments prior to release to natural catchments. 4. Prepare and implement a Hydrocarbon Management Procedure. 5. Monitor discharge water for acidity. 6. Construct sediment sumps and silt and oil traps to remove sediments or pollutants from runoff before water enters local drainage. 7. Clean up any spills of contaminants such as oils and fuels immediately. 8. Monitor surface water quality around the active mine area. 9. Construct diversion drains so that water re-enters natural

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>phosphorus and potassium. The proponent expects that the discharge water would not contain high levels of nutrients (MBS, 2006).</p> <p>DoW advised that a licence to discharge into a natural drainage channel is not required because the project area is not located within a Management Area identified under the <i>Waterways Conservation Act 1976</i>.</p> <p>The proponent used stream flow data from a DoW stream gauging station located 10km southwest of the project area. The majority of the project area is located within the catchment for the gauging station (Nambeelup Brook Catchment). The average annual flow volume recorded is 24,920 megalitres, and a mean peak annual discharge of 15.7 cubic metres per second (m³/sec). Annual average runoff depth is 216 millimetres. There are generally no flows from January to April, and high flows occur from June to October. Analysis using a hand held water quality metre to measure conductivity of water at 15 locations within the project area in October 2005 found that the surface water is fresh (MBS, 2006).</p> <p>Minor watercourses that traverse the mine area would be diverted around the mine pits. The diverted watercourses would be constructed so that water re-enters the natural drainage line downstream of the mine pit at a velocity and depth similar to the original drainage channel. These diversions would be temporary, in that the pre-mining surface drainage would be re-instated after mining (MBS, 2006).</p> <p>The proponent will be required to apply for a</p>	<p><u>Public</u></p> <ul style="list-style-type: none"> • The lack of a detailed digital terrain model prevents the identification of the smaller drainage patterns. This will lead to unrecoverable areas after mining. • The annual drawdowns around watercourses should reflect the natural wet and dry cycles of the water bodies. • Impacts drawdown may have on the waterways or what actions will be implemented should the water table not return to natural levels by the end of the mining process has not been addressed. • Concern regarding the impact on the natural drainage of the area, and the lack of detailed investigations into water drainage from the mine area. • Concern regarding impacts on the quantity and quality of water in the watercourses, and impacts on the Ramsar listed sites and the Peel-Harvey system, particularly from mobilisation of fertilizers trapped in the soil. • Drainage areas should be permanently protected by fencing and the application of conservation covenants on the titles of the properties. • Pit dewatering in highly permeable sand and tailings in the mine pits will allow nutrients from the mine to enter Nambeelup Creek, which flows to the Peel-Harvey estuary catchment area. • Pit dewatering has the potential to contaminate Nambeelup Creek and impact on the wetlands. • Pollutants from the mine site including flocculants, and sediments and nutrients suspended from excavation could contaminate the wetlands and watercourses and be transported to downstream watercourses and to the Peel-Harvey estuary. • During the wet season it will be difficult to contain contaminated surface water, resulting in polluted water entering creeks, drains and flat areas. • There should be no net loss of nutrients to the catchment. • An assessment of when and how the Minor watercourses will be diverted, and the impacts associated with the diversions (on the watercourse itself, surrounding properties, and the adjoining wetlands) should be identified, as well as the management of the impacts. • During excavation and processing salt mineralisation held within the soil profile will be released into the water, and when returned to the mine pits or into the drainage system, what will occur with this potentially salty water? • At times the watertable is at the ground level. Nearby residences could be subject to inundation through any addition of water into the drainage system. 	<p>drainage lines at a velocity and depth that can be accommodated by the natural steam line without increasing scouring.</p> <p>10. Construct sedimentation basins in areas of exposed land to reduce turbidity before release to the environment.</p> <p>11. Implement a Water Management Plan which identifies measures to manage impacts on surface water quality by implementing the following actions:</p> <ul style="list-style-type: none"> • Isolate infrastructure areas that have the potential to contaminate surface water by directing all surface water from these locations to contained basins. • Construct sediment sumps, silt and oil traps where necessary to remove sediments or pollutants from runoff before water enters local drainage. • Any spills of contaminants such as oil or fuel will be cleaned up immediately. • Monitor surface water quality around the active mine area. <p>Not considered to be a key environmental factor.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>permit to DoW to interfere with creek bed and banks under the <i>Rights in Water and Irrigation Act 1914</i>. The application would need to include information on how the potential impacts on the creeks and the surrounding environment, from the creek diversions, will be minimised and managed.</p> <p>The proposal has the potential to impact on the integrity of the Minor watercourses through diversions. Runoff and erosion from disturbed areas, and pollutants such as fuels and oils, could enter the watercourses. The watercourses may also be impacted from the discharge of excess water into drainage lines, particularly where the water is contaminated with ASS.</p>	<ul style="list-style-type: none"> • It should be demonstrated that the proposed buffers to the Major and Medium watercourses will ensure no adverse impacts on the watercourses. • Pit dewatering in highly permeable sand in an area subject to sheet wash during wet winters will mean that mine waste water will carry nutrients remobilised by mining into the Nambeelup drainage system. • The project has a high risk of polluting the local surface water systems which drain into the Peel-Harvey system. • Given the vigorous washing action associated with the separation of heavy minerals from quartz sand, most of the nutrients will dissolve in the water and eventually pollute the Peel-Harvey system, unless contained. • The issue of nutrient release and pollution of water quality is not addressed in the PER, despite recognition in the <i>Surface Hydrology Report</i> (MBS, 2006) that “The major water quality issue for the area is the high level of nutrients.” • The use of ASS samples to determine soil nutrient levels is not appropriate. 	
Rehabilitation	<p>The topography of the project area is flat to gently undulating plain. The lowest elevations are in the western section at approximately 22mAHD, gradually sloping to approximately 40mAHD in the eastern section of the project area. The proponent intends to return the land to its pre-mining use of agriculture. The proposal involves mining of up to 1,366ha over 8 years. The mine area will be progressively returned to pasture or rehabilitated to native vegetation.</p> <p>Topsoil will be directly returned to the mined areas, except outside the vegetation rehabilitation season (April to August), when topsoil will be stockpiled. The stockpiling of topsoil for an extended period will occur on locations around the wet concentrator plant, where the facility is fixed for a number of years.</p> <p>Mining within each 30ha pit will take about three months. Pasture species will be seeded in May and August to stabilise the land. Return to pasture will involve two seeding years. Outside</p>	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> • The suite of plant species occurring within the original plant communities should be re-established in rehabilitation areas using seed of local provenance. • The use of mulched material in rehabilitation should be clarified with DEC. • Completion criteria should be developed. • Trees to be cleared should be relocated where possible. • Seed collection and propagation from vegetation on-site and endemic to the area should be used. • Revegetation should commence soon after the completion of mining. • Measures should be identified to ensure that the current ground levels across the site are maintained or enhanced to reduce the potential for inundation. • Dieback resistant species should be used in rehabilitation. <p><u>Public</u></p> <ul style="list-style-type: none"> • Concern regarding the lack of conservation covenants on revegetation and the maintenance of revegetation in the long-term by private landowners. • The proponent should manage revegetated areas until self-sustaining ecosystems are established, which reflect similar natural ecosystems. • The revegetation list is insufficient, includes species locally regarded as weeds, does not include middle storey or understorey species, does not replace the species diversity present in the project area, and contains dieback susceptible 	<p>Considered to be a key environmental factor and is discussed in section 3.1 “Vegetation”.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>these months the land will be stabilised through the application of a layer of clay from the wet concentrator plant. Rehabilitation to native vegetation will include the establishment of understorey species.</p> <p>The proponent has prepared a Vegetation and Rehabilitation Management Plan.</p>	<p>species. A larger and more diverse revegetation list is required.</p> <ul style="list-style-type: none"> • Revegetation of the project area would be at the expense of older established trees that provide nesting hollows or could provide hollows in the future. • The ecological value of planted vegetation will be much lower than that of the original flora, therefore the area of revegetation should be sufficiently large to compensate for this difference. • The bulk of the revegetation is a highly artificial set of straight lines, with no attempt to re-establish a natural bush setting. • Cleared trees should be used in rehabilitation rather than burnt. • Rehabilitation of the Beenup Mineral Sands Mine found that the clay could not consolidate, and as a result ASS entered the groundwater. • The PER does not define any rehabilitation bonds in the event that the proponent does not meet its rehabilitation commitments. • Mitigating past impacts through wetland rehabilitation should be considered. • The PER needs to demonstrate how the rehabilitation completion criteria will be met and what measures will be put in place to ensure the revegetation can be maintained in the long-term. • Full weed control following germination and prior to planting should be carried out. Selective weed control may then be needed in spring and/or the following year but initial weed control is vital to success. • The impact of removing minerals on water and nutrient uptake of native plants in revegetated areas should be determined. • Revegetated areas should be permanently fenced to prevent grazing from livestock and minimise the spread of dieback and weeds. • The proposed two year post mining monitoring programme is not sufficient. • The area should be returned to a better condition than before mining. This should include a larger area to be permanently revegetated to prevent salinity. • There is no commitment to monitor the spread of salinity, ASS, radiation levels and nutrient discharge post mining. • The land should be returned to a stable landform. • What modelling and testing has been done to demonstrate that the mixing of various strata of the soil profile will work on Bassendean soils? What impacts will this have on infiltration rates to the groundwater aquifers? • There is no digital terrain model for the area. Therefore it is not possible to re-establish existing landforms if they are not initially understood. 	

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
POLLUTION			
Acid sulfate soils	<p>According to the WAPC Planning Bulletin No. 64 <i>Acid Sulfate Soils</i>, the majority of the project area is classified as “moderate to low risk”, where ASS layers are predicted at depths greater than 3m below ground level, with two areas classified as “high risk” within Lot 57. Mining is proposed to a depth of 2m below ground level, and up to 6m below ground on sandy dunes. The ore body extends below the seasonal water table in some areas, where dewatering of the soils will be required.</p> <p>The ore body is confined to the Bassendean Sand Formation. The sampling programme identified that the areas sampled, which included the two high risk areas, are of moderate to low risk of ASS. Sampling was concentrated in the low-lying and central part of the project area where the first stages of mining will commence. Other areas will be sampled in advance of mining. The soil profile where Potential ASS is likely to occur is in the underlying Guildford Formation, which will not be disturbed through excavation or dewatering. Dewatering will be via drains on the pit floor directing water to collection sumps (MBS, 2007f).</p> <p>The proposal has the potential to impact on the quality of the groundwater and the soil from exposure of ASS material as a result of dewatering. The discharge of acidified water from dewatering and processing could impact on the surrounding environment.</p>	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> • The approach undertaken to assess ASS risk for the proposal is limited. • Without conducting a comprehensive site investigation, commencement of site excavation and dewatering may represent a risk to groundwater quality and the receiving environment. • Contingencies should be identified and implemented to ensure acidification of the groundwater does not occur. • An ASS Management Plan should be prepared prior to any site works. <p><u>Water Corporation</u></p> <ul style="list-style-type: none"> • The proponent should have management procedures in place to prevent the potential unacceptable impacts associated with the disturbance of the ASS. <p><u>Public</u></p> <ul style="list-style-type: none"> • Concern regarding the disturbance of ASS and the related impacts on water quality, aquatic communities, CCWs and Ramsar listed wetland systems. • The ASS assessment is limited in inadequate to guarantee minimisation of the risk of ASS development due to the design of the sampling programme, relatively small number of sampling sites and limited depth of coring. • A comprehensive grid pattern drilling programme should be undertaken over the project area to identify risk of ASS. • There is no contingency plan for ASS contamination. • The possibility of a plume of acidic water moving from the mine area via groundwater or surface water streams to the Peel-Harvey system is a high priority impact requiring management on this project. • Acidified soils will be spread over a large area from the mixing of soils, air and water associated with backfilling. Disturbance of the lower clay layers of the soil profile will reduce the acid buffering capacity of the soil, and create the conditions for acidic groundwater, and facilitate the rapid infiltration and transport of the plume to receiving environments. • An ASS Management Plan should be provided with identified trigger levels and management actions, and include groundwater and surface water quality monitoring bores through the soil profile and across the project area and downstream. 	<p>Considered to be a key environmental factor and is discussed in section 3.2 “Groundwater”.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
Noise	<p>The project area is located 500m from the North Dandalup township and 120 to 500m from local residences. The proposal has the potential to generate noise from land clearing, excavation, processing and vehicle movement. Noise generated from the proposal has the potential to impact on the amenity of the local residents.</p> <p>A Noise Impact Assessment carried out by Lloyd Acoustics in February 2006 found that in order to comply with the <i>Environmental Protection (Noise) Regulations 1997</i> (Noise Regulations), the wet concentrator plant must be 1km from residences, the hopper/screen and pump should be located 2 metres below ground level (mbgl) within a 2m high bund and 215m from residences, and the booster pumps should be at least 200m from residences.</p> <p>The scraper will have the highest noise emission of all equipment. Modelling indicated that:</p> <ol style="list-style-type: none"> 1. under downwind conditions, a distance of 2.1km is required to achieve 30dB(A) (the night time threshold level); 2. under downwind conditions a distance of 640m is required to achieve 45dB(A) (the day time threshold level); 3. under calm conditions a distance of 1km is required to achieve 30dB(A); and 4. under calm conditions a distance of 300m is required to achieve 45dB(A). 	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> • A Noise Management Plan should be prepared and identify all noise sources and associated noise control measures; monitoring regime for noise emissions; management of transport noise; model refining/verification; reporting of noise emissions; review and continuous improvement programme; commitment to “buy quiet”; and complaint management procedure. • The Noise Management Plan should address construction noise management. • The value used in the acoustic model for ground absorption may be excessively attenuating the predicted noise levels by approximately 2-3dB. • The Noise Management Plan should address the movement of heavy haulage vehicles on local roads, restricting this activity between 7pm to 7am Monday to Saturday and not at all on Sunday. <p><u>Public</u></p> <ul style="list-style-type: none"> • Concern regarding the impact of noise on the local community from clearing, excavation, processing and transport associated with the mining proposal, and from operating 24 hours a day, 7 days a week. • The noise model failed to include: the use of at least 2 scrapers and beeping from mine vehicles; all residences in the vicinity of the mine area; all mobile vehicles (e.g. the water truck and haulage trucks were not included); and cumulative noise impacts from all equipment operating at one time. • The location of the wet concentrator plant in the southern part of the project area is in a creek. • The noise model suggests that scrapers cannot operate at night for much of the project area. • There appears to be no allowance for noise reduction during the day. • The sound travels further in the area, as it is flat land. • Mining should be restricted during night time. • The measures outlined in the PER will not adequately manage noise impacts. 	<p>Considered to be a key environmental factor and is discussed in section 3.3 “Noise”.</p>
Dust	<p>The project area is located 500m from the North Dandalup township and 120 to 500m from local residences. The proposal has the potential to generate dust from land clearing, topsoil stripping, excavation, movement of vehicles along haul roads and wind erosion of exposed</p>	<p><u>Local Government agencies</u></p> <ul style="list-style-type: none"> • The Dust Management Plan should address impacts from active mine areas on nearby residents. • Relatively high wind speeds are experienced in the area and appropriate dust management should be employed during mining and rehabilitation on-site. 	<p>Considered to be a key environmental factor and is discussed in section 3.4 “Dust”.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>surfaces. Dust generated from the proposal has the potential to impact on the health, welfare and amenity of local residents, impact on the health of the stock and deposit on surrounding native vegetation.</p> <p>Estimated dust emissions from the removal of topsoil and ore by scrapers, unloading of material onto stockpiles or the dump hopper, and wind erosion from product stockpiles and unsealed areas was used in the model. Worst case scenario modelling revealed the potential to impact upon some residences located close to the mine area at different stages of operations. The estimated distance for concern is when operations are approaching within 300m of a residence. Exceedances of NEPM were predicted at the residence on Lot 104 Westcott Rd when mining occurs on Lot 6 Westcott Rd and at the residence on Lot 3 Readheads Rd when mining occurs on Lot 49 Readheads Rd.</p> <p>The proponent has prepared an Air Quality and Dust Management Plan.</p>	<p><u>Public</u></p> <ul style="list-style-type: none"> • The need for separate night and day pits and different mining locations based on the prevailing winds will mean a larger area of excavated land is exposed. • The proposal will create a large amount of dust that will be difficult to control and will impact on the health of local residents and affect rain water tanks. • Water sprays will not adequately control dust generation under high easterly winds during the summer months. • The proponent has not demonstrated that Perth airport has similar wind conditions to the project area in order to justify the use of Perth airport data. • Clearing of tall and dense remnant vegetation will increase the likelihood of sand dune blowouts and dust storms from katabatic winds descending the Scarp and hitting the SCP at high velocities. This will be further exacerbated by removing the soil profile by scrapers during such high wind conditions. The proponent should do site-specific measurements and base any wind erosion predictions and management plans on these. • The absence of local wind monitoring fails to address the severe wind velocities of the area (especially during summer), enhanced by local topography. • Further study of the local katabatic winds and assessment of impacts on soil erosion, vegetation removal (and establishment) should be undertaken. • Will the proponent set up a weather monitoring station? • The proponent's claim to only mine on the down wind side of residences is not possible, with houses surrounding the mine, and summer winds changing 180 degrees in a day. • The dunes that act as wind breaks from the strong easterlies will be cleared. • The timing of land clearing is important to minimise wind erosion during summer. • Land clearing and mining should not occur during the spring and summer months due to the risk of east wind erosion. 	
Greenhouse gas emissions	<p>Emission data for diesel combustion from mobile equipment for:</p> <ul style="list-style-type: none"> • VOCs is 4,608 Kilograms per year. • NO_x is 51,199 Kilograms per year. • NO₁₀ is 4,739 Kilograms per year. • CO is 17,168 Kilograms per year. • Formaldehyde is 1,330 Kilograms per year. 	<p><u>Public</u></p> <ul style="list-style-type: none"> • No assessment was made of the quantities of greenhouse gas emissions over the life of the project. • Greenhouse gas emissions generated from the proposed mining operation should be quantified. • No information was provided as to how the proponent will offset greenhouse emissions generated by the proposed mine. 	<p>Indirect fossil fuel consumption (i.e. WA SWIS grid electricity consumption) for electrically driven items is 25,200 tonnes of CO₂-e.</p> <p>The emissions from the</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<ul style="list-style-type: none"> SO₂ is 5,247 Kilograms per year. 	<ul style="list-style-type: none"> Information on how the proponent will operate as carbon-neutral should be provided. 	<p>extraction, production and transport of fuels used in the production of purchased electricity and emissions associated with the electricity lost in transmission and distribution on the way to the consumer is 28,080 tonnes of CO₂-e.</p> <p>Not considered to be a key environmental factor.</p>
Hazardous material	<p>There is potential for hazardous material to leak or spill and contaminate the soil, surface water and groundwater. Hazardous material includes fuels, grease and radioactive material in the mineral sands.</p> <p>Measures to minimise risk to the environment from hydrocarbons includes:</p> <ul style="list-style-type: none"> Hydrocarbon storage areas and workshops will be located in bunded areas, at least 2m above the groundwater. Runoff from the workshop and office areas potentially contaminated with hydrocarbons will be directed to containment sumps prior to discharge. Hazardous wastes generated by the operation will be transported off-site to licenced waste disposal facilities. Hydrocarbon spills will be cleaned up, contaminated soil removed from site, and be reported in the incident report procedure. <p>One of the main potential sources of radiation emission is airborne dust.</p>	<p><u>Radiological Council</u></p> <ul style="list-style-type: none"> No radiation monitoring results are presented in the PER to confirm the proponent's claim that testing conducted in the ore body detected no monazite. The PER does not reflect the legislative requirements for registration and licensing under the <i>Radiation Safety Act 1975</i>. If the site is registered, the Radiological Council will require compliance with a Radiation Management Plan and Radiation Waste Management Plan. The objectives of the radiation management, rehabilitation and closure plans should make reference to approvals required from the Radiological Council. Once mining ceases, the site will remain registered until the Radiological Council approves the release of the site and terminates the registration. <p><u>Public</u></p> <ul style="list-style-type: none"> No baseline levels of radiation are provided. Monazite is a mineral sands by-product that contains the radioactive material thorium. The proponent proposes to dispose of the monazite with the tailings into the mine void. The shallow depth of the mine void and close proximity to the groundwater means that there is potential for the groundwater to be contaminated with this radioactive waste material. Monazite should be disposed of in a regulated waste management site. A radiation assessment should be carried out. 	<p>A baseline gamma radiation survey over the area comprising the first three years of mining (Lots 112, 300, 59 and 62) was conducted. Subsequent surveys will be conducted in other areas in advance of mining.</p> <p>The proponent has prepared a Radiation Management Plan.</p> <p>The proponent has prepared an Air Quality and Dust Management Plan.</p> <p>Radiation can be managed under the <i>Radiation Safety Act 1975</i>, which may require registration and licensing of the site.</p> <p>The proponent will prepare and implement a Hydrocarbon Management Procedure.</p> <p>Not considered to be a key environmental factor.</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
Liquid and solid waste	<p>There will be no on-site disposal of waste. Hazardous waste material will be stored in a bunded area. Wastes will be recycled where possible. Contractors will be engaged to remove all rubbish and waste from the site.</p> <p>Potential impacts if wastes are not managed properly include contamination of the soil, surface water and groundwater.</p>	<p><u>Local and State Government agencies</u></p> <ul style="list-style-type: none"> The numbers, locations, types and proposed usage rates of effluent disposal systems should be provided. The nature of the flocculant to be used and whether it poses a potential risk to the environment if released should be investigated. <p><u>Public</u></p> <ul style="list-style-type: none"> All recyclable materials should be recycled locally. 	Not considered to be a key environmental factor.
SOCIAL SURROUNDINGS			
Aboriginal heritage and culture	<p>A desktop Aboriginal Heritage Assessment carried out by Australian Interaction Consultants identified the potential for three sites to be impacted by the proposal.</p> <p>After release of the PER, the proponent carried out an on-site archaeological survey of the project area, and consulted with the local Aboriginal people to identify any ethnographic sites in the area.</p>	<p><u>Department of Indigenous Affairs</u></p> <ul style="list-style-type: none"> Archaeological field inspections and consultation with relevant Aboriginal people should be conducted prior to any developments in the project area. Suitably qualified consultants should be engaged to conduct ethnographic and archaeological surveys of the area. Aboriginal interest groups should be consulted so that all sites in the project area are identified or avoided. Surveys should include archival research, consultations and on-ground inspections. <p><u>Public</u></p> <ul style="list-style-type: none"> An on-ground Aboriginal heritage assessment and consultation with local Aboriginal elders should be conducted. The PER does not address management of aboriginal heritage for the proposal. 	<p>The proponent will be required to comply with the requirements of the <i>Aboriginal Heritage Act 1972</i>.</p> <p>Not considered to be a key environmental factor.</p>
Public health and safety	<p>The route to transport the Heavy Mineral Concentrate (HMC) utilises Westcott Rd (through the mine area), a private road through Lot 300, Atkins Rd, south to Readheads Rd and east to South Western Highway. Trucks will travel approximately 117km for secondary processing at Cable Sands' plant in Bunbury.</p> <p>Truck movements to and from the mine site to Bunbury will be 12 to 14 per day, and all loads will be covered. In addition to the haulage of the HMC, there will be truck movements associated with the delivery (about one per week) of supplies</p>	<p><u>Public</u></p> <ul style="list-style-type: none"> Air emissions from the proposal will impact on the health of local residents, some of whom already have health problems. Noise generated from the proposal will exacerbate migraine headaches experienced by a local resident. Due to air quality issues the burning of cleared vegetation is not supported. The PER does not explain how the water pipelines will cross properties and roads to reach the processing plants at various locations. The haul roads are along narrow country roads used by cyclists, horse riders and walkers, school bus routes and an overcrowded South Western Highway. The increased truck haulage will make it dangerous for other road users. The South Western Highway will experience greater traffic pressure from the 	<p>The proponent has negotiated with the person suffering from migraine headaches to re-locate the family when mining is close to their property.</p> <p>The proponent will consult with the Local Shires regarding upgrading and maintaining local roads used as haulage roads. The proponent will consult with Main Roads to ensure the safe movement of vehicles along the</p>

Preliminary environmental factors	Proposal characteristics	Government agency and public comments	Identification of key environmental factors
	<p>to the site, particularly diesel fuel.</p> <p>A resident 400m from the mine area has health problems that can be exacerbated by pollutants, such as diesel emissions generated by the proposal. The proponent will employ selective mining near the residence to mine only when prevailing wind blows away from the property.</p> <p>The proponent will maintain a complaints register, and respond to all issues raised.</p>	<p>proposal.</p> <ul style="list-style-type: none"> • 12 to 14 movements of 50 tonne trucks, plus additional light vehicles, is not a minimal traffic increase. • The HMC should be transported off-site by constructing a siding to the existing railway line to minimise impacts from transportation via trucks on the road. • Concern regarding noise and safety impacts from the trucks passing the school. • Safety concern regarding the use of Readheads Road as a haul road because it is a narrow school bus route. 	<p>South Western Highway.</p> <p>The proponent considered that the costs associated with establishing a rail siding at the existing railway line was not viable for the proposal.</p> <p>Not considered to be a key environmental factor.</p>
Visual amenity	<p>The mine area would be visible from some local roads and residences.</p> <p>The active mine area will move relatively quickly through the landscape. Progressive rehabilitation will re-instate the visual amenity soon after the completion of mining.</p> <p>The proposed 'early planting' programme would assist in retaining visual amenity for local residents and visitors.</p>	<p><u>Shire of Serpentine-Jarrahdale</u></p> <ul style="list-style-type: none"> • The topography of the landscape lends itself to the operations being visible from the surrounding region, creating a visual impact of the mining operation. <p><u>Public</u></p> <ul style="list-style-type: none"> • The crude and unnatural revegetation plan to plant an artificial looking series of straight lines will be a visible scar. • The mine and processing plants will be a visual impact to the natural beauty of the area enjoyed by visitors and local residents. • Mining will occur within 500m of the North Dandalup township and 200m within local residences. 	<p>Not considered to be a key environmental factor.</p>

PRINCIPLES		
Principle	Relevant Yes / No	If yes, consideration
1. The precautionary principle <i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In application of this precautionary principle, decisions should be guided by –</i> <i>(a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i> <i>(b) an assessment of the risk-weighted consequences of various options.</i>	Yes	The proposal has the potential to affect groundwater dependant ecosystems through groundwater drawdown. Monitoring and contingency measures will need to be implemented to avoid and manage any adverse impacts. This matter is discussed in the key environmental factors of vegetation and groundwater.
2. The principle of intergenerational equity <i>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</i>	Yes	The proposal would permanently decrease the resource in the area, and has the potential to reduce the productivity of the land if not managed and rehabilitated properly. Vegetation (including fauna, wetlands and rehabilitation) is a key environmental factor discussed in this report.
3. The principle of the conservation of biological diversity and ecological integrity <i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i>	Yes	The proposal has the potential to impact on the biological diversity of fauna and flora. Vegetation (including fauna, wetlands and rehabilitation) is a key environmental factor discussed in this report.
4. Principles relating to improved valuation, pricing and incentive mechanisms <i>(1) Environmental factors should be included in the valuation of assets and services.</i> <i>(2) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</i> <i>(3) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.</i> <i>(4) Environmental goals, having been established, should be</i>	Yes	<p>The proponent should bear the cost of avoiding or abating pollution. Potential impacts of pollution and their mitigation are discussed in the key environmental factors of groundwater, noise and dust.</p> <p>Where environmental assets are lost, the proponent should bear the cost of rectifying these losses. Rehabilitation is discussed in the key environmental factor of vegetation.</p>

PRINCIPLES		
Principle	Relevant Yes / No	If yes, consideration
<i>pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximize benefits and/or minimize costs to develop their own solution and responses to environmental problems.</i>		
5. The principle of waste minimisation <i>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</i>	Yes	The proposal will require the appropriate management of waste products such as tailings.

Appendix 4

**Recommended environmental conditions and
proponent's consolidated commitments**

**STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
PURSUANT TO THE PROVISIONS OF THE
ENVIRONMENTAL PROTECTION ACT 1986**

**KEYSBROOK MINERAL SANDS MINE
SHIRE OF SERPENTINE-JARRAHDALE AND SHIRE OF MURRAY**

Proposal: To develop a mineral sands mine near the Keysbrook township. The proposal involves the excavation and processing of a low-grade heavy mineral sands deposit. The proposal is described further in schedule 1 of this document.

Proponent: Olympia Resources Limited

Proponent Address: Level 4, 25 Walters Drive HERDSMAN WA 6016

Assessment Number: 1580

Report of the Environmental Protection Authority: Bulletin 1269

The proposal referred to in the report of the Environmental Protection Authority may be implemented subject to the following conditions and procedures:

1 Proposal Implementation

- 1-1 The proponent shall implement the proposal as documented and described in schedule 1 of this statement subject to the condition and procedures of this statement.

2 Proponent Environmental Management Commitments

- 2-1 The proponent shall fulfil the environmental management commitment contained in schedule 2 of this statement.

3 Proponent Nomination and Contact Details

- 3-1 The proponent for the time being nominated by the Minister for the Environment under sections 38(6) or 38(7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal.
- 3-2 The proponent shall notify the Chief Executive Officer of the Department of Environment and Conservation (CEO) of any change of the name and address of the proponent for the serving of a notice or other correspondence within 30 days of such change.

4 Time Limit of Authorisation

- 4-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void within five years after the date of this statement if the proposal to which this statement relates is not substantially commenced.

- 4-2 The proponent shall provide the CEO with written evidence which demonstrates that the proposal has substantially commenced on or before the expiration of five years from the date of this statement.

5 Compliance Reporting

- 5-1 The proponent shall submit to the CEO environmental compliance reports annually reporting on the previous twelve-month period, unless required by the CEO to report more frequently.

- 5-2 The environmental compliance reports shall address each element of an audit program approved by the CEO and shall be prepared and submitted in a format acceptable to the CEO.

- 5-3 The environmental compliance reports shall:

1. be endorsed by signature of the proponent's chief executive officer or a person, approved in writing by the CEO, delegated to sign on behalf of the proponent's chief executive officer;
2. state whether the proponent has complied with each condition and procedure contained in this statement;
3. provide verifiable evidence of compliance with each condition and procedure contained in this statement;
4. state whether the proponent has complied with each key action contained in any environmental management plan or program required by this statement;
5. provide verifiable evidence of conformance with each key action contained in any environmental management plan or program required by this statement;
6. identify all non-compliances and non-conformances and describe the corrective and preventative actions taken in relation to each non-compliance or non-conformance;
7. provide an assessment of the effectiveness of all corrective and preventative actions taken; and
8. describe the state of implementation of the proposal.

- 5-4 The proponent shall make the environmental compliance reports required by condition 5-1 publicly available in a manner approved by the CEO.

6 Performance Review

- 6-1 The proponent shall submit a Performance Review report every two years after the start of production to the Environmental Protection Authority, which addresses:

1. the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve

these; and the key indicators of environmental performance measured against those objectives;

2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;
 3. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and
 4. the proposed environmental objectives over the next two years, including improvements management processes and practices.
- 6-2 The proponent shall make the Performance Review reports required by condition 6-1 publicly available in a manner approved by the CEO.

7 Rehabilitation

- 7-1 The proponent shall reinstate areas of functioning annual pasture after mining, unless otherwise agreed to by the landowner.
- 7-2 Prior to the commencement of ground-disturbing activities, the proponent shall prepare a Rehabilitation Programme to the requirements of the Department of Environment and Conservation.

The Programme shall include the following Plans:

1. Excised Area Management Plan

The objective of the Plan is to excise a consolidated area of remnant native vegetation on Lots 59 and/or 62 from the mine area, provide protection and security to this area and enhance the condition of the vegetation to provide fauna habitat.

2. Watercourse Rehabilitation Management Plan

The objective of the Plan is to enhance the condition of the vegetation along the watercourses in the project area.

The Excised Area Management Plan shall:

1. identify a consolidated area of remnant native vegetation on Lot 59 and/or 62 that will be excised from mining, and protected from mine related disturbance;
2. describe the condition of the vegetation in the excised area, and habitat values; and
3. identify measures to establish nest boxes for black cockatoos and other bird species of conservation significance into the excised area;

The Excised Area Management Plan and Watercourse Rehabilitation Management Plan shall:

1. describe measures to protect the areas to be revegetated from access, including grazing by stock;
 2. identify measures to translocate native plant species cleared for mining into revegetated areas;
 3. identify measures to eradicate weeds in the revegetated areas;
 4. identify measures to use dieback un-infested topsoil and dieback resistant species in the revegetated areas;
 5. describe a strategy to revegetate areas, including the use of local species of local provenance, and establishment of middle storey and understorey species;
 6. identify completion criteria for revegetation; and
 7. outline a revegetation monitoring programme.
- 7-3 The proponent shall implement the Rehabilitation Programme required by condition 7-2.
- 7-4 The proponent shall review and revise the Rehabilitation Programme required by condition 7-2 as and when directed by the CEO.
- 7-5 The proponent shall implement revisions of the Rehabilitation Programme required by condition 7-4.
- 7-6 The proponent shall make the Rehabilitation Programme required by condition 7-2 and revisions required by condition 7-4 publicly available in a manner approved by the CEO.

8 Weed and Dieback Management

- 8-1 The proponent shall manage its operations to ensure that neither weeds nor dieback are spread as a result of project activities.

9 Water Management

- 9-1 Prior to the commencement of ground-disturbing activities, the proponent shall revise the Water Management Plan to the requirements of the Department of Water.

The objective of the Plan is to maintain the quantity and quality of groundwater so that the aquifers, and surrounding users are not adversely affected by groundwater drawdown associated with the proposal.

The Plan shall:

1. outline a programme to monitor groundwater quality and quantity, including monitoring of bores located on surrounding properties, and at the downstream boundary of the project area;
 2. monitor the health and condition of retained remnant native vegetation within the project area to ensure that it is not affected by groundwater drawdown associated with the proposal;
 3. identify groundwater trigger levels and management actions should a trigger level be reached;
 4. identify measures to provide an alternative source of water, particularly to surrounding groundwater users, where monitoring in item 1 indicates that mining activities has adversely affected water quality to the point where it cannot be used for its intended purpose or ecosystem maintenance;
 5. identify measures to ensure that the quality and quantity of groundwater is maintained post-mining;
 6. identify measures to minimise impacts associated with the discharge of excess water;
 7. outline a monitoring programme to detect any adverse impacts to the water quality, water levels or vegetation health of the conservation category wetlands adjacent to the mine area; and
 8. identify management measures in the event that monitoring in point 7 detects adverse impacts to conservation category wetlands adjacent to the mine area as a result of the proposal.
- 9-2 The proponent shall implement the Water Management Plan required by condition 9-1.
- 9-3 The proponent shall review and revise the Water Management Plan required by condition 9-1 as and when directed by the CEO.
- 9-4 The proponent shall implement revisions of the Water Management Plan required by condition 9-3.
- 9-5 The proponent shall make the Water Management Plan required by condition 9-1 and revisions required by condition 9-3 publicly available in a manner approved by the CEO.

10 Acid Sulfate Soils Management

- 10-1 The proponent shall not lower the depth of the watertable below that required for accessing the orebody.
- 10-2 The proponent shall implement the Acid Sulfate Soils Management Plan dated May 2007.

11 Performance Bond

- 11-1 As security for the due and punctual observance and performance by the proponent to meet the requirements of condition 7, the proponent shall lodge with the CEO on demand prior to commencement of construction of the mine, an unconditional and irrevocable bank guarantee, from a guarantor acceptable to the CEO in his sole unfettered discretion to a cash value and in a form acceptable to the CEO (“the Security”) which Security at the hereof being \$12,000 per hectare of land disturbed.

After two years of return to pasture or revegetation post mining, the Security may be reduced to \$5,000 per hectare of land disturbed based on the achievement of condition 7-2 and completion criteria identified in condition 7-3.

After five years of return to pasture or revegetation post mining, the Security may be returned on the achievement of condition 7-2 and completion criteria identified in condition 7-3.

- 11-2 The CEO may review the Security required by condition 11-1 at any time or times and if, on such review, the CEO considers that a security has ceased to be acceptable to the CEO, then the CEO may, with the approval of the Minister for the Environment, require the proponent to furnish replacement or additional security for performance by the proponent of its obligations under condition 7.
- 11-3 The proponent shall within fourteen days after written request by the CEO furnish replacement or additional security in such sum as the CEO shall nominate, in a form and upon terms and conditions approved by the CEO, which approval shall not be unreasonably withheld. On receipt of approved replacement security the CEO shall release and discharge the original security.

Note: In the preparation of advice to the CEO in relation to condition 7, the Environmental Protection Authority expects that the advice of the Department of Environment and Conservation would be obtained.

12 Noise Management

- 12-1 The proponent shall not undertake any mining operations where and when measurements at the nearest occupied residence exceeds the noise levels identified in condition 12-3. A residence will assumed to be occupied unless the proponent has written confirmation from the resident to the contrary.
- 12-2 Where the proponent has an agreement with a resident that the noise levels identified in condition 12-3 is not to apply, written evidence of that agreement shall be provided by the proponent.
- 12-3 Noise emissions from mineral excavation activities, carried out in accordance with conditions 12-1 and 12-2, when received on a noise-sensitive premises at locations within 15 metres of a building that is directly associated with a noise-sensitive use, shall not exceed the following daytime, evening and night time noise levels:

Daytime (between 0700 hours and 1900 hours)

- $L_{A\ 10}$ of 50 dB(A);
- $L_{A\ 1}$ of 60 dB(A); and
- $L_{A\ max}$ of 70 dB(A).

Evening (between 1900 hours and 2200 hours)

- $L_{A\ 10}$ of 40 dB(A);
- $L_{A\ 1}$ of 50 dB(A); and
- $L_{A\ max}$ of 55 dB(A).

Night time (between 2200 hours and 0700 hours)

- $L_{A\ 10}$ of 35 dB(A);
- $L_{A\ 1}$ of 45 dB(A); and
- $L_{A\ max}$ of 55 dB(A).

Note: For the purpose of these Conditions the level of a noise emission shall be determined in accordance with Part 3 of the *Environmental Protection (Noise) Regulations 1997*; and the terms $L_{A\ 10}$, $L_{A\ 1}$ and $L_{A\ max}$ have the meaning given in those regulations.

- 12-4 There shall be no penalty of noise levels ascribed to tonality, modulation and impulsiveness. The proponent shall identify and minimise any such sources.
- 12-5 The proponent shall have publicly available, rolling three month plans for operations showing predicted levels of noise impacts.
- 12-6 The proponent shall have continuous monitoring of noise levels at the nearest occupied residence (except where there is an agreement otherwise).
- 12-7 Measurements and locations for $L_{A\ 10}$, $L_{A\ 1}$ and $L_{A\ max}$ shall be made public each week, in the week after measurements.

13 Air Quality And Dust Management

- 13-1 Prior to the commencement of ground-disturbing activities, the proponent shall revise the Air Quality and Dust Management Plan to the requirements of the Department of Environment and Conservation.

The objective of the Plan is to reduce dust emissions as far as practicable, and ensure that dust emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses.

The Plan shall:

1. outline the results of on-site baseline dust monitoring and modelling;
 2. identify dust management measures for a range of predicted weather forecasts, including avoiding, ameliorating and protecting from dust impacts;
 3. identify dust management measures according to actual winds experienced at the site;
 4. identify a plan for each pit, which details the times of day and weather conditions under which parts of the pit could be mined;
 5. identify a monitoring programme;
 6. identify a complaint management procedure; and
 7. describe the outcomes of landowner agreements when mining in close proximity to occupied residences.
- 13-2 The proponent shall implement the Air Quality and Dust Management Plan required by condition 13-1.
- 13-3 The proponent shall review and revise the Air Quality and Dust Management Plan required by condition 13-1 as and when directed by the CEO.
- 13-4 The proponent shall implement revisions of the Air Quality and Dust Management Plan required by condition 13-3.
- 13-5 The proponent shall make the Air Quality and Dust Management Plan required by condition 13-1 and revisions required by condition 13-3 publicly available in a manner approved by the CEO.

Notes

1. Where a condition for a Management Plan states "to the requirements of the Department of Environment and Conservation", the proponent shall consult with the Department during preparation of the Management Plans.
2. The Minister for the Environment will determine any dispute between the proponent and the Department of Environment and Conservation over the fulfilment of the requirements of the conditions.
3. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act 1986*.

Schedule 1

Keysbrook Mineral Sands Mine (Assessment No. 1580)

The proposal is to develop a mineral sands mine near the Keysbrook township. The proposal involves the excavation and processing of a low-grade heavy mineral sands deposit. Local roads would be upgraded to facilitate the transport of the heavy mineral concentrate to South Western Highway.

An area of 30 hectares will be progressively mined at any time. Waste from the processing will be used as backfill in the mined areas. Backfilled areas will be progressively re-contoured and stabilised prior to topsoil replacement and return to pasture or native vegetation. The wet concentrator plant will be relocated three times throughout the life of mine. Support infrastructure, such as pipelines, offices and workshops will also be relocated with the wet concentrator plant. A site dam will be constructed at each of the three locations.

The main characteristics of the proposal are summarised in Table 1 below.

Table 1 - Key Proposal Characteristics (Assessment No. 1580)

Element	Description	
Land tenure over the mining area	Keysbrook	North Dandalup
	Part Lot 56 Westcott Rd Part Lot 57 Elliott Rd Part Lot 1 Elliott Rd Part Lot 52 Westcott Rd Part Lot 111 Westcott Rd Lot 112 Westcott Rd Lot 113 Westcott Rd Part Lot 6 Westcott Rd Part Lot 63 Hopeland Rd	Part Lot 62 Hopeland Rd Part Lot 59 Westcott Rd Part Lot 300 Westcott Rd Part Lot 49 Readheads Rd Part Lot 7 Readheads Rd Part Lot 6 Readheads Rd Part Lot 44 Readheads Rd
Life of mine	8 years	
Product quantity	approximately 920,000 tonnes of heavy mineral concentrate	
Pit depth	average 2 metres below ground level, and up to 6 metres on sandy dunes	
Area of disturbance	not more than 1,366 hectares. This area would be reduced as a result of implementation of the excised area on Lot 62 and/or Lot 59, to be confirmed in condition 7.	
Dewatering	in-pit sumps to dewater the superficial Bassendean Sand aquifer at 0.2 gicalitres per annum	
Bore abstraction	up to 1.8 gicalitres per annum from two bores into the deep Leederville aquifer	
Road upgrades	upgrades of existing roads; Westcott Rd, Atkins Rd, Readheads Rd and intersection of Readheads Rd and South Western Hwy	

Figures

Figure 1 - Regional location. See Figure 1, page 4 above

Figure 2 - Project area. See Figure 2 page 5 above

Figure 3 - Mine area. See Figure 4 page 10 above.

Schedule 2

**Proponent's Environmental Management Commitments – OCTOBER 2007
KEYSBROOK MINERAL SANDS MINE (ASSESSMENT NO. 1580)**

No	Topic	Objective	Action	Timing	Advice
1	Security of remnant native vegetation	To secure areas of remnant native vegetation within the mine area by means of a conservation covenant	The proponent shall negotiate with the landowners of Lot 62 and Lot 59 to provide compensation for the security, in perpetuity, of areas of remnant native vegetation by means of a conservation covenant.	Life of the mine	Department of Environment and Conservation
2	Community consultation	To engage with the local community	The proponent shall continue to undertake community consultation and identify community development programmes to be initiated or supported by the proponent to the value of at least \$25,000 per year.	Life of the mine	Department of Environment and Conservation

Appendix 5

**Summary of submissions and
proponent's response to submissions**