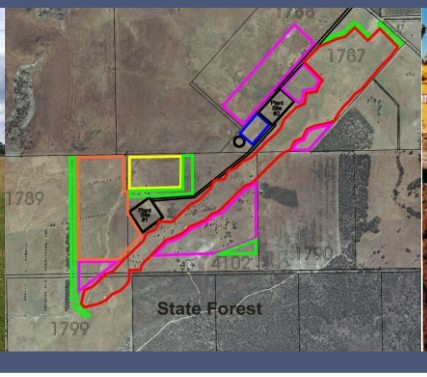
Tutunup Titanium Minerals Mine

Public Environmental Review



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INTERNATIONAL QUALITY MANAGEMENT SYSTEM ISO 9002 NATA CERTIFIED

INTERNATIONAL SAFETY MANAGEMENT SYSTEM NATA CERTIFIED

CABLE SANDS (WA) Pty Ltd

December 2001

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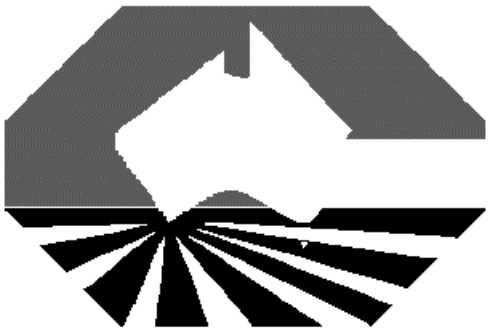

Cable Sands (WA) Pty Ltd

A.C.N. 009 137 142

December 2001

Invitation to make a submission.

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal. If you are able to, electronic submissions emailed to the DEP/EPA Project Assessment Officer would be most welcome.

Cable Sands (WA) Pty Ltd proposes to develop a mineral sands mine near Tutunup, approximately 14 km south of Capel. In accordance with the Environmental Protection Act 1986 and Environment Protection and Biodiversity Conservation Act 1999 (Cth) a PER has been prepared which describes this proposal and its likely effects on the environment. The PER is available for a public review period of 8 weeks from Monday 17th December 2001 closing on Monday 11th February 2002.

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable;
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the PER;
- if you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering;
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- address;
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: Monday 11th February 2002

Submissions should ideally be emailed to
ben.von.perger@environ.wa.gov.au

OR addressed to:

The Environmental Protection Authority
PO Box K822
PERTH
WA 6842
Attention: Ben von Perger

[Westralia Square
141 St George's Terrace
PERTH WA 6000]

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Cable Sands (WA) Pty Ltd (Cable Sands) Tutunup deposit is located at the southern end of the Swan Coastal Plain, approximately 14 km south of Capel.

The Tutunup deposit is estimated to contain 2.3 million tonnes of ore, which will be processed to extract titanium minerals, primarily ilmenite, with minor amounts of leucoxene, zircon and monazite. It is anticipated that overburden will be removed during 2002 and mineral production will commence in late 2002 or early 2003. Based on a 5 days-per-week operation, it is estimated that mineral production will be completed in approximately 25 months. Mining is expected to be completed during 2005, followed by completion of rehabilitation.

The operation will involve mining, preliminary concentration on site and transport of the heavy mineral concentrate (HMC) to Bunbury for separation.

The mining proposal includes:

- removal of the existing vegetation (pasture and scattered trees);
- topsoil stripping and stockpiling;
- removal and stockpiling of overburden;
- dry mining of the orebody using conventional earthmoving machinery;
- backfilling and recontouring of overburden, fines and tailings;
- respreading of topsoil, pasture re-establishment and shelterbelt planting.

HMC will be de-watered and stockpiled at the mine site prior to being trucked to Cable Sands' Secondary Separation Plant at North Shore, Bunbury. The preferred haulage route is to exit the minesite at the northern end onto Oates Rd, travel east to Tompsett Road, then north to Tutunup Road, west to Ludlow-Hithergreen Road, north to Bussell Highway, then north to Bunbury. In Bunbury, trucks travel along Robertson Drive and Koombana Drive to Cable Sands' North Shore Facility. At estimated production rates and truck payloads of 60 tonnes, there will be an average of around 13 return truck journeys per day during periods of haulage from this site.

The production bore is located central to the orebody and will be used to abstract up to 1.5 GL/yr of process water for the mining operations. A water storage dam with a capacity of approximately 45,000 kL will be constructed to service all phases of the operation. A thickener will be used to remove fine clay from the process water circuit. Fines will be pumped to dams constructed to allow settling and solar drying. Initially, approximately 18 ha of fines dams will be constructed on farm paddocks adjacent to the orebody. As the mine path progresses, and after the return of tails, fines dams will be located on mined areas where practical.

The key environmental issues associated with the proposed Tutunup mine are management of groundwater quality and quantity, the adjacent Threatened Ecological plant community, noise control, dust control and transport of HMC.

Management of these and other issues are summarised in the following table. Cable Sands has satisfactorily managed similar mine sites on the Swan Coastal Plain in the past. The proposed mine will operate in an environmentally responsible manner by continued implementation of Cable Sands' Environmental Management System.

SUMMARY OF ENVIRONMENTAL FACTORS AND MANAGEMENT

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
BIOPHYSICAL ENVIRONMENT					
Vegetation communities	Maintain the abundance and diversity of species, and geographic distribution and productivity of vegetation communities. Protect Threatened Ecological Communities consistent with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act).	An area of the Threatened Ecological Community "Busselton Wet Ironstone" (TEC) is located in State Forest adjacent to the proposed mine area. No communities are located within the proposed mine area.	The proposal could indirectly affect the adjacent TEC through drawdown of the water table, dust or spread of dieback or weeds.	Develop and implement groundwater management plan, control dust and access to this area Monitor health of TEC	Vegetation community will not be disturbed by proposed mine
Declared Rare Flora (DRF), Priority flora and other flora of conservation significance	Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950*, and provisions of the EPBC Act. Protect other flora species of conservation significance (eg undescribed taxa, range extensions).	No DRF within mine area. Many *Callothamnus* sp Whicher (P1) and 1 *Hakea oldfieldii* (P1) present in mine area. *Chamelaucium roycei* and 5 Priority Flora species present on Oates & Tompsett road verges. DRF and Priority Flora in adjacent State Forest (TEC).	No DRF or EPBC listed species removed during mining. Some (<5) *Chamelaucium roycei* may be disturbed during road upgrade. Approximately 500 plants of *Callothamnus* sp Whicher and one *Hakea oldfieldii* plant to be removed from mine area. Potential to disturb some Priority Flora plants during road upgrade. Indirect affects on TEC as above.	Mine plan and road upgrade designed to minimise disturbance of DRF and Priority Flora. Implement strategies for protection of TEC listed above.	No DRF or EPBC listed species disturbed. No significant impact on number or regional distribution of Priority Flora.
Native terrestrial fauna	Maintain the abundance, species diversity and geographical distribution of native terrestrial fauna.	Little remaining native fauna due to existing level of disturbance.	None likely	Maintain fencing around site	No impact on native fauna

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
Terrestrial fauna — Specially Protected (Threatened) Fauna	Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*, and provisions of the EPBC Act.	No protected species or habitat within site	None likely	None required	No impact
Watercourses	Maintain the integrity, functions and environmental values of watercourses.	No significant water courses in vicinity of deposit. Surface flows eventually discharge to Abba River.	No changes	Divert surface flows around minesite during mining. Create topography similar to pre-mining during landform reconstruction.	No impact
Groundwater quantity	Ensure that the beneficial uses of groundwater can be maintained.	Yarragadee, Leederville and Superficial aquifers used for agriculture, mining and domestic uses. Adjacent TEC assumed to rely on superficial groundwater for at least part of the year.	Drawdowns from pit could propagate into TEC area. Minor localised drawdown of Yarragadee due to abstraction. No impact on Leederville.	Develop and implement a Groundwater Management Plan and Operating Strategy.	No impact on beneficial uses of groundwater.
Mine planning, decommissioning and rehabilitation	Ensure that mine planning, decommissioning and rehabilitation are carried out in a planned sequential manner consistent with best practice. Ensure ecosystem function is maintained following mine closure. Avoid State liability.	Agricultural land in private ownership.	Short term change in land use	Landform reconstruction closely follows mining. Rehabilitation to pre-mining land use (agriculture).	No long term change in land use
Landform	Ensure that, as far as is practicable, the post-mining landform is, safe, stable, non-erodible, and is integrated into the surrounding environment.	Gently sloping down to north-west	Wind or water erosion from disturbed areas during mining	Minimise disturbed areas, control surface runoff, and rehabilitate as soon as practical. Return land contours similar to pre-mining.	Erosion controlled during mining. Landform will be returned similar to pre-mining.

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
POLLUTION MANAGEMENT					
Particulates / Dust	Ensure that particulate/dust emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or human health problem.	Generally low levels of dust, but some existing activities have potential to create elevated dust loads.	Potential for dust generation from earthmoving activities and exposed areas.	Use of water cart on unsealed roads and exposed areas. Minimise open areas, rehabilitate as soon as practical. Use of stabilisers/fines/vegetation to stabilise stockpiles.	Dust levels will be minimised and not cause concern to neighbours.
Noise & vibration	Protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet statutory requirements and acceptable standards.	Generally low baseline noise levels. 6 residences within 1 km of minesite.	Potential for noise to affect nearest residents to north, especially during overburden removal.	Implement Noise Management Plan	Mining operations will meet statutory requirements
Noise — road transport	Ensure that noise and vibration levels meet acceptable standards and that an adequate level of service, safety and public amenity is maintained.	Bussell Highway is a Main Road, used for heavy haulage. Ludlow-Hithergreen and Tutunup Roads are Shire managed and currently used for mineral sands haulage. Oates and Tompsett Roads have minimal heavy traffic.	Increased heavy traffic on Ludlow-Hithergreen, Tutunup, Tompsett and Oates Roads. 12 residences located along transport route	Restrict HMC transport to 6am to 8pm, Monday to Saturday. Speed restrictions. Seal Oates & Tompsett sections. Contributions to road maintenance	Noise managed to minimise annoyance to residents EPA objective met.
Groundwater quality	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the Australian and New Zealand Water Quality Guidelines (ANZECC, 2000).	Yarragadee and Superficial aquifers have low salinity and mildly acidic. In use for agricultural, domestic and mining purposes	Mixing of Yarragadee process water into superficial aquifer. No potential for development of acid sulphate soils.	Implement Groundwater Management Plan and Operating Strategy	No impact on groundwater quality.

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
Surface water quality	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the Australian and New Zealand Water Quality Guidelines (ANZECC, 2000).	No significant water courses in vicinity of deposit. Surface flows eventually discharge to Abba River.	Release of water with elevated turbidity.	Control and divert surface flows around minesite Water released from site only in emergencies as clear overflow from water storage dam.	No impact on surface water quality.
Solid waste	Ensure that wastes are contained and isolated from ground and surface water surrounds and treatment or collection does not result in long-term impacts on the natural environment.	Ground and surface waters of good quality.	Release of tailings or fines.	Appropriate handling and disposal of domestic waste and recyclables. Management of tailings and fines dams during operation and removal during rehabilitation.	No impact.
SOCIAL SURROUNDINGS					
Aboriginal culture and heritage	Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972; and Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.	No listed sites in project area.	High level of existing disturbance means discovery of previously unknown sites is unlikely.	If sites are discovered contact authorities and cease operations in vicinity pending investigation.	No impact.
Register of the National Estate	Comply with statutory requirements in relation to areas of cultural or historical significance.	No sites listed on Register of National Estate or Municipal Register within project area.	None	If sites are discovered contact authorities and cease operations in vicinity pending investigation.	No impact

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
Public health and safety — radiation	Radiological impacts to the public and the environment are kept as low as reasonably achievable and comply with acceptable standards. Ensure that solid wastes are handled and disposed of in an acceptable manner to avoid potential contamination of soil, surface and ground water, and to keep radiological impacts as low as reasonably achievable, by complying with statutory requirements.	Surface gamma radiation levels low and consistent with Swan Coastal Plain.	Exposure of low-level radioactive minerals.	Implement Radiation Management Plan	Post-mining surface gamma radiation levels similar to pre-mining.
Public health and safety — transport	Ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and MRWA requirements.	Bussell Highway is a Main Road, used for heavy haulage. Ludlow-Hithergreen and Tutunup Roads are Shire managed and currently used for mineral sands haulage. Oates and Tompsett Roads are gravel, minimal heavy traffic.	Increased heavy traffic on Ludlow-Hithergreen, Tutunup, Tompsett and Oates Roads. Safety concerns with School buses	Seal Oates & Tompsett sections. Restrict HMC transport to 6am to 8pm, Monday to Saturday. Speed restrictions. Avoid school bus times.	Positive benefit from road upgrade. EPA objective met.
Visual amenity	Visual amenity of the areas adjacent to the project should not be unduly affected by the proposal.	Not visible from major roads. Residences have views of farmland and/or bushland	Temporary views of mining area for 3 residences.	Vegetate topsoil stockpiles, retain maximum vegetation, return to similar landscape during rehabilitation.	No long term changes.

1 Introduction

1.1 PROPOSAL

Cable Sands (WA) Pty Ltd (Cable Sands) proposes to mine a heavy mineral deposit which has been identified at Tutunup, approximately 20 km east of Busselton and 14 km south of Capel (Figure 1.1). This deposit consists of approximately 2.3 million tonnes of ore and is estimated to contain 260,000 tonnes of heavy mineral concentrate (HMC). The HMC is composed primarily of ilmenite with minor amounts of leucoxene, zircon and monazite. As currently occurs at other Cable Sands mine sites, mining and preliminary concentration will take place on site with the HMC being transported to Bunbury for separation into component minerals.

It is anticipated that overburden will be removed during 2002 with mineral production to commence in late 2002 or early 2003. At a HMC production rate of up to 230,000 tonnes per annum, mineral production is expected to be completed during 2005, followed by remaining rehabilitation.

Table 1.1 . Key Characteristics of the Proposal.

ELEMENT	DESCRIPTION
Life of project ➢ Mineral production ➢ Mining (overburden and ore removal, backfilling)	(at 5 days/week) ➢ Approximately 25 months ➢ Approximately 3 years
Mine operation	24 hours/day, up to 7 days/week
Production ➢ Size of ore body ➢ Ore mining rate ➢ Overburden ➢ HMC produced	 ➢ Approximately 2 308 000 tonnes ➢ up to 2 000 000 tonnes per year ➢ Approximately 1 600 000 bcm ➢ Approximately 260 000 tonnes
Area of disturbance ➢ Mine pit ➢ Overburden stockpiles ➢ Fines dams ➢ Tailings dams ➢ Topsoil/subsoil stockpiles ➢ Infrastructure (water supply, roads, plant sites)	 ➢ 37 ha ➢ 27 ha ➢ 18 ha (outside mine path) ➢ 6 ha (outside mine path) ➢ 6 ha ➢ 6 ha
Depth of mine pit	Maximum 11 m
Water supply ➢ source ➢ average daily requirement ➢ maximum annual requirement	 ➢ Yarragadee aquifer, Capel-Ludlow subarea ➢ 4000 kL ➢ 1 500 000 kL
Fuel ➢ Maximum storage ➢ Maximum usage	 ➢ 50 000 L ➢ 1 700 000 L per annum

1.2 PROPONENT

The proponent for the project is Cable Sands (WA) Pty Ltd. Cable Sands is the oldest titanium minerals mining company in Western Australia. The company began mining in 1956 at Koombana Bay and has continued through a series of mineral deposits at Bunbury, Busselton, Capel, Waroona, Wonnerup and Minninup. Current operating minesites are located at Yarloop, Benger and Jangardup.

Cable Sands is a wholly owned subsidiary of Nissho Iwai Minerals Sands (Australia) Pty Ltd.

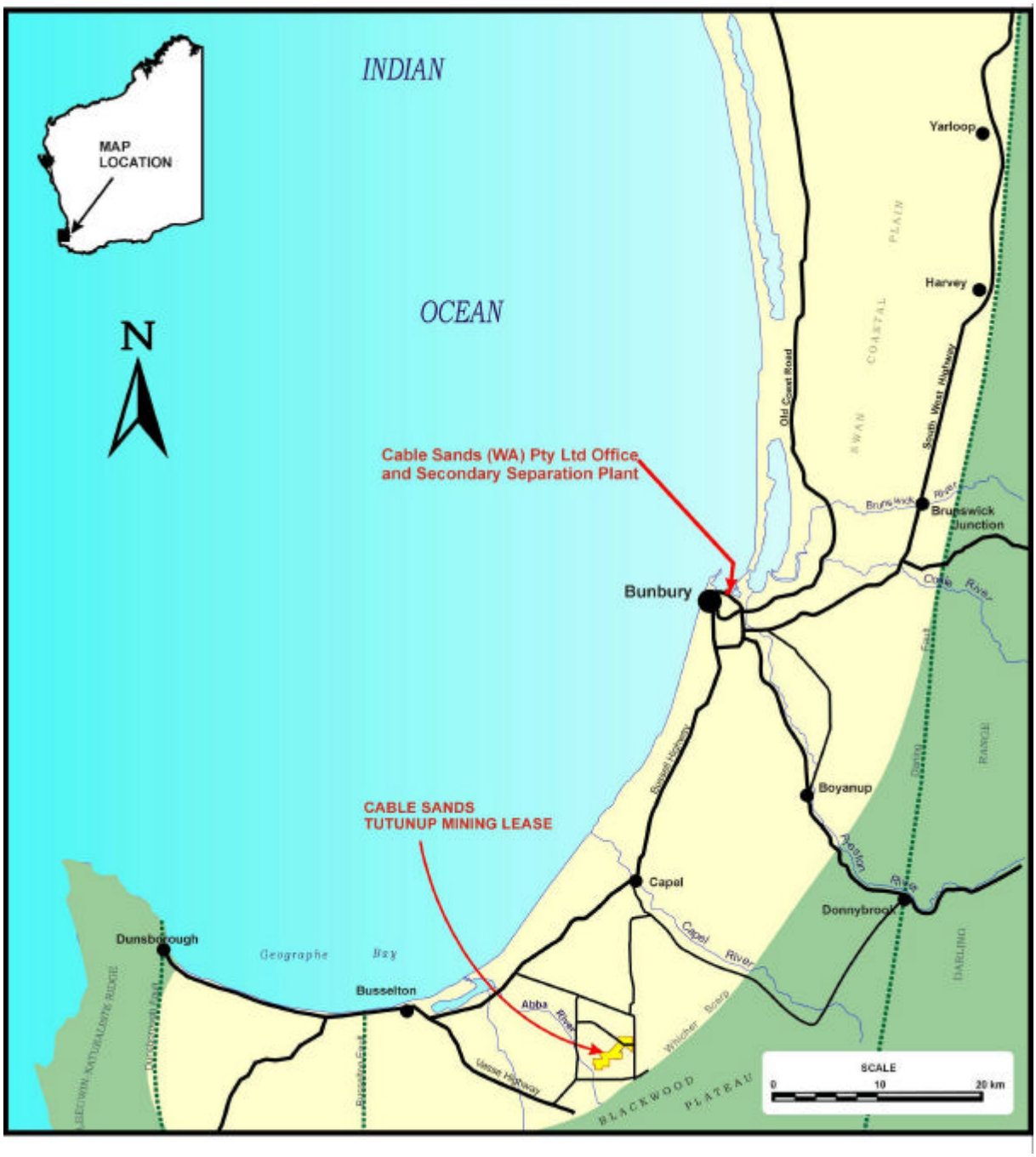


Figure 1.1. Location of Cable Sands' Tutunup deposit.

1.3 LOCATION & OWNERSHIP

The Tutunup deposit is covered by mining lease M70/1070, with the orebody and infrastructure restricted to Sussex locations 4102, 1787, 1790, 1788, 1789 and 1799 (see Figure 1.2). These locations are bounded by Oates Road to the north and Williamson Road to the south. Ownership of affected lots is shown in Table 1.2. Agreements have been negotiated with the landowners for access to mine in lots 1790, 1789 and 1799. Similar agreements are being finalised with the owners of lots 1787 and 1788.

Table 1.2. Tutunup deposit land ownership.

LOCATION NUMBER	VOLUME	FOLIO	TOTAL AREA (ha)	APPROX. MINE AREA (ha)	OWNER
Sussex Location 4102	1521	013	54.5	54.5	Cable Sands (WA) Pty Ltd
Sussex Location 1787	1260	664	40.5	40.5	Armstrong
Sussex Location 1790	1521	012	40.5	2	Lyle
Sussex Location 1788	1594	965	40.1	10	Gulberti
Sussex Location 1789	1402	959	55.6	23	O'Neill
Sussex Location 1799	1402	959	40.4	8.5	O'Neill

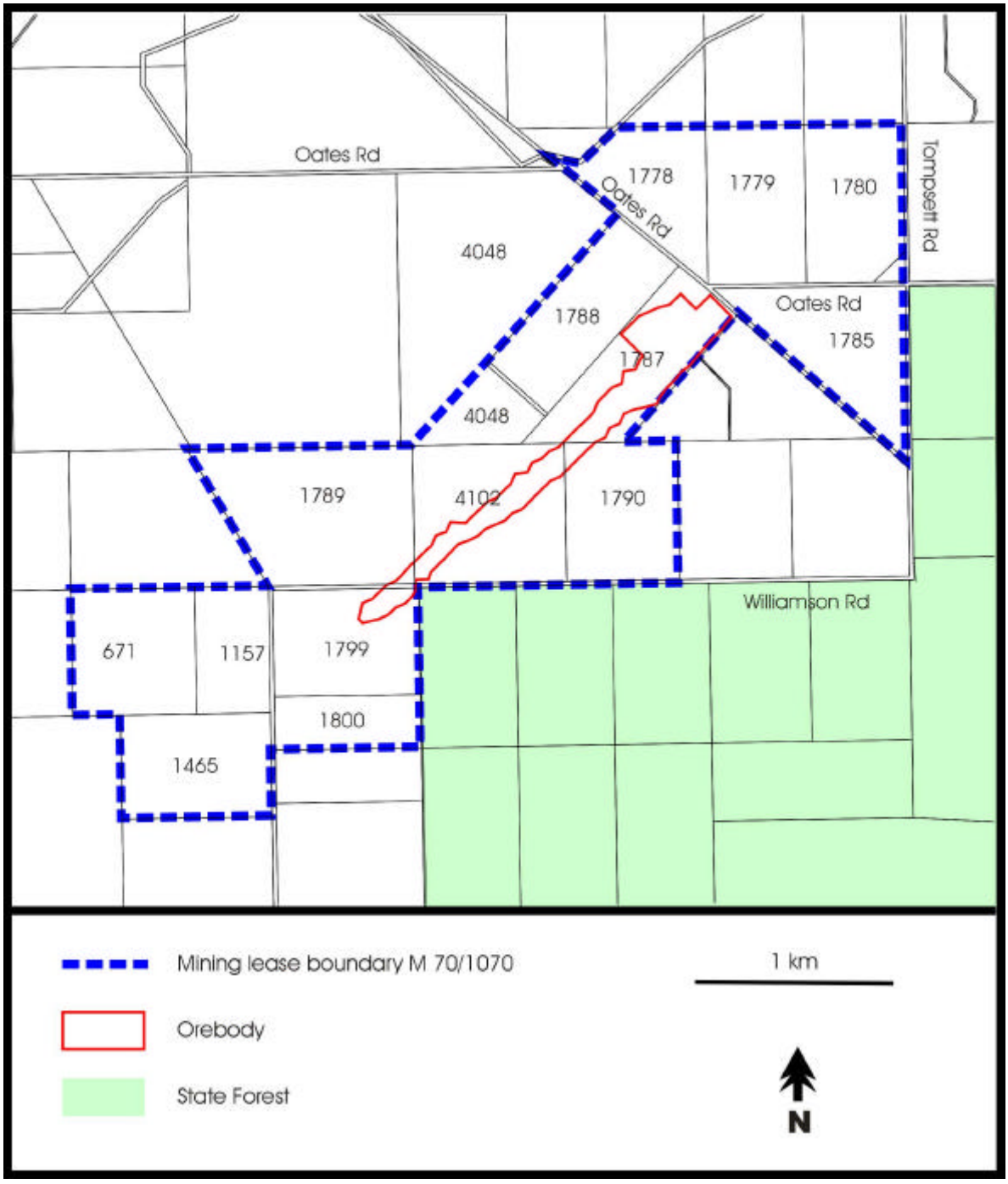


Figure 1.2. Location of freehold lots, lease boundaries and mineral sands deposit.

1.4 LEGAL FRAMEWORK

1.4.1 Commonwealth

The project is being assessed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Following referral in May 2001, the project was determined to be a controlled action under sections 18 and 18A (Listed threatened species and communities). The Western Australian Public Environmental Review (PER) process (this document) has been accredited as providing the assessment requirements of the EPBC Act (see Appendix C)

1.4.2 Western Australia

A range of state decision-making authorities and other authorities will be involved in assessment of this proposal, including:

- Environmental Protection Authority (EPA).
  The EPA will consider this PER under Part IV of the *Environmental Protection Act 1986* (the EP Act).
- Department of Environmental Protection (DEP).
  The DEP will licence the operations under Part V of the EP Act, and is responsible for ensuring that Cable Sands takes all reasonable and practicable measures to protect the environment.
- Department of Conservation and Land Management (CALM).
  CALM protects and manages native flora and fauna and their ecosystems through the provisions of the *Conservation and Land Management Act 1984* and the *Wildlife Conservation Act 1950*. CALM has provided advice on the management of flora and fauna and has the responsibility for managing the adjacent state forest.
- Department of Minerals and Petroleum Resources (DMPR).
  The DMPR controls the activities of mining industries under the provisions of several Acts, including the *Mining Act 1978*, the *Mines Safety and Inspection Act 1994*, *Petroleum Act 1967* and the *Explosives and Dangerous Goods Act 1961*, and various associated regulations. Additionally, the DMPR administers disturbance of land by mining operations through the *Soil and Land Conservation Act 1945* on behalf of Agriculture Western Australia. The DMPR will provide advice to the EPA on environmental and mining procedures.
- Water and Rivers Commission (WRC).
  The WRC protects and manages natural waterways and their catchments through the provisions of the *Water and Rivers Commission Act 1995*, *Water Agencies (Powers) Act 1984* ant the *Waterways Conservation Act, 1976*. The WRC has the responsibility for control of groundwater allocation under the *Rights in Water and Irrigation Act, 1914*, and will also provide advice to the EPA on surface and ground water protection.

The DEP and WRC are undergoing a process of amalgamation to form the Department of Environment, Water and Catchment Protection (DEWCP).

1.4.3 Local Government

The project is located in the Shire of Busselton, in an area zoned 'Rural'. Under the *Rural Strategy Outcomes Document* (Koltasz Smith & Partners, 1992) the project falls within Precinct 2 (Abba Plains) of Policy Area 1 (Busselton East). This Strategy recognises that Precinct 2 contains significant mineral sands deposits, and that significant expansion of mining activity can be expected, specifically within the Whicher band in the region of Tutunup. Subject to appropriate assessment, Council will support expansion of mineral sands mining and the rehabilitation of mine sites to productive agricultural use (Koltasz Smith & Partners, 1992).

1.5 ECONOMICS

Cable Sands is an important contributor to the regional economy. Development of mining operations at Tutunup will allow for continuity of employment for current personnel and help to ensure the long-term viability of Cable Sands with the intrinsic benefits to the country, state and local community. Royalties will also be paid to the State Government.

2 Project Description

2.1 MINING PROCESS

The Tutunup orebody will be dry mined using earthmoving equipment (eg. scrapers, dozers, loaders). This process is described briefly below and is the same as is currently used at Cable Sands Benger and Yarloop mines. A schematic flow chart of the mining and separation process is shown in Figure 2.1.

2.1.1 Vegetation and Topsoil Removal

The proposal includes the disturbance of 100 hectares of mainly cleared agricultural land. Remnant vegetation will first be cleared from areas to be disturbed. Any cleared vegetation debris that cannot be used in rehabilitation areas (eg as fauna habitat or mulching), or otherwise salvaged will be burnt in accordance with fire restrictions and relevant smoke guidelines.

Up to 20 cm of topsoil will be removed, where available. Topsoil removal will occur not only for areas directly affected by overburden and ore removal, but also in areas where only surface disturbance is required (eg. overburden stockpiles, fines dams, plant sites). Availability of topsoil is likely to range from nil where caprock is exposed, to less than 10 cm over most of the area.

Topsoil will be stripped using scrapers, with the upper 10 cm stripped separately from the 10-20 cm layer. These materials will be stored in separate stockpiles (maximum height of 4 m) stabilised with a grass cover. The location of topsoil stockpiles is shown in Figure 2.2.

2.1.2 Overburden and ore removal

Overburden is the material below the topsoil that must be removed to allow access to the orebody. Following topsoil removal, the overburden (mostly ironstone caprock) will be fractured by ripping with a large dozer (eg D11). The overburden will be picked up using front-end loaders/excavators and dump trucks, or scrapers, and stockpiled, used to fill areas already mined, or used for construction of mining infrastructure (eg. fines dams, roads, plant site and HMC pads). It is anticipated that approximately 1.6 million bcm ('bank' [*in situ*] cubic metres) of overburden will be removed.

The exposed ore will then be mined using loaders and fed into rotary trommels. The trommels, one with a 50 mm screen and a secondary trommel with a 4.5 mm screen, will be used to separate large rocks, roots and gravel from the ore. These trommels will be positioned as near to the pit floor as possible.

After the ore has been removed, the area will be recontoured to blend in with the existing landscape using the dried clay fines, overburden and tailing sand. A description of the strategy for landform reconstruction is given in Section 0.

2.1.3 Heavy mineral separation

The fine fraction from the trommels (<4.5 mm) will be pumped as a slurry to the Primary Separation Plant where HMC will be separated by conventional wet gravity methods. Throughput and production from the plant will vary with the nature and grade of the deposit in different areas.

The HMC will be de-watered and stockpiled at the minesite prior to being trucked to Cable Sands' Secondary Separation Plant at North Shore, Bunbury.

2.1.4 Tailings Management

Primary (mine) tailings will be produced in the wet separation plant after separation of the HMC from the other sandy material. Initially, it will be necessary to stockpile mine tailings (see Figure 2.2) until sufficient space is available in the pit behind the mining face. Tailings material will then be returned directly to the mine pit as backfill. Stockpiled tailings will be returned to the mine void as part of the rehabilitation process (see Section 0).

Some secondary (mill) tailings from the secondary separation plant at North Shore in Bunbury will be returned to the Tutunup minesite. The majority of this material consists of residual silica sand which remains in the HMC stream after initial processing at Cable Sands various minesite separation plants.

Some monazite tailings from the North Shore Mill will also be disposed of at Tutunup. This material consists of silica sands with approximately 20% of monazite mineral.

2.1.5 Fines Management

Clay and silt "fines" will be removed from the process water circuit using a thickener tank, pumped to fines dams and allowed to dry. Fines dams will initially be located off the mine path (see Figure 2.2). These dams will store fines produced during the first 10 months of active mining. After tailings have been returned to the mine pit, fines dams will then be located over mined areas.

Fines dams will be up to 5 m high, with the intent to fill to a maximum depth of 3 m, to ensure the period taken to dry is minimised. The dams will be constructed with a minimum of one metre freeboard. No fines will be discharged from the site.

The dried material from the fines dams will be incorporated with tails and overburden when the landscape is re-contoured (see Section 0).

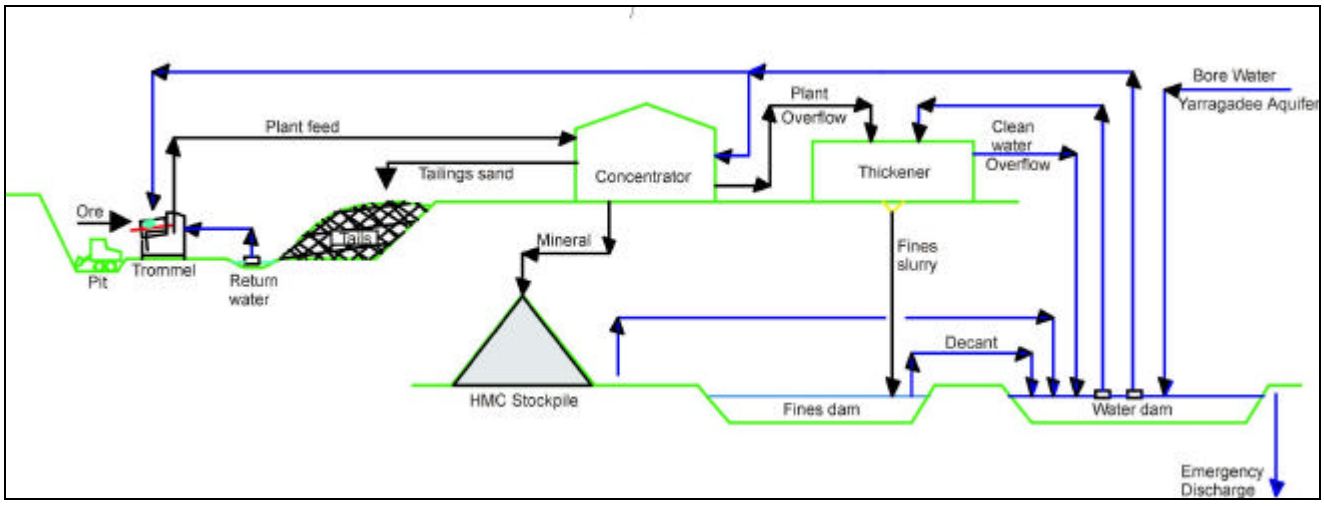


Figure 2.1. Process flow chart.

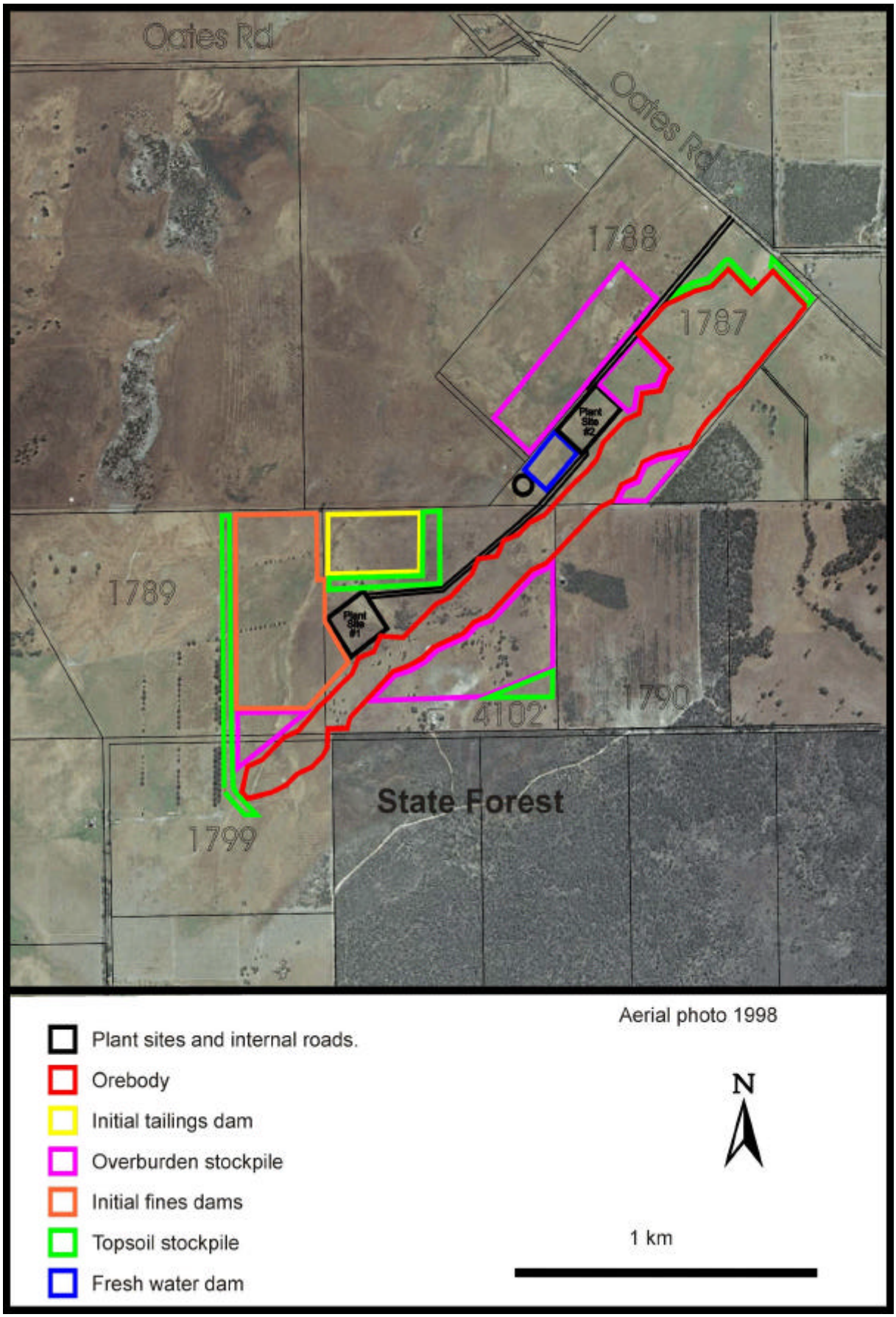


Figure 2.2. Proposed Tutunup mine plan.

2.2 INFRASTRUCTURE

The following plant and infrastructure will be required for the mining operation.

2.2.1 Water

A dam and bore will be used to provide process water for the mining operation. The dam will hold approximately 45,000 kL and will be located central to the orebody (Figure 2.2). Water will be required throughout the mining and separation processes, and will be recycled wherever practical. Stormwater harvested from within the site and seepage into the mine pit will be collected and used to supplement the bore water supply.

A bore has been drilled into the Yarragadee aquifer (screened over the interval 210 m to 310 m), under an exploratory Groundwater Well Licence from the WRC. This bore is located on the northern boundary of Lot 4102. Subject to negotiations with the WRC, it is anticipated that up to 1.5 GL/yr will be abstracted from the Yarragadee Formation. This is based on an average daily requirement for 4000 kL of water for the mining and processing operation, and water for artificial recharge of the superficial aquifer (see Section 5.1.4.2).

Potable water for domestic purposes will be collected in rainwater tanks if bore water is not suitable.

2.2.2 Power supply

Electricity will be supplied from the Western Power Grid via a new spur line to service the project. This spur line will be installed by Western Power and run from Ludlow-Hithergreen Road along the northern boundaries of Lots 1766 and 1789 to Lot 4102. Construction by Western Power and commissioning is likely to take place during the second quarter of 2002.

2.2.3 Thickener

A thickener tank will be used to remove fine clay and silt from the water circuit. The thickener uses a non-toxic commercial flocculant (eg. "Optimer 9965") to encourage settling of the fines. The thickener tank will be located adjacent to the water storage dam (see Figure 2.2).

2.2.4 Internal Roads

Internal roads will be constructed from gravel or limestone obtained from local quarries or from oversize material obtained on site. During the summer months these roads will be wetted down as needed to control dust. A water cart will be on site for this purpose.

2.2.5 Plant sites

The separation plant will be transferred from one of Cable Sands other minesites. Two plant sites will be used for the Tutunup mine (see Figure 2.2), with the primary separation plant being moved as mining progresses. Associated facilities including workshops, store, site office and amenities will be located at plant site 2 for the duration of the project. HMC stockpiles will be located adjacent to each plant site.

2.2.6 Noise bunding

Noise buffering will be provided by the strategic location of topsoil or overburden stockpiles.

2.2.7 Hydrocarbon storage

Hydrocarbon storage on site for fuelling earthmoving equipment will be in appropriately constructed, bunded areas conforming to AS/NZS 4452:1997 (Standards Australia, 1997), as required by the *Dangerous Goods Regulations 1992* and DEP guidelines.

Table 2.1. Summary of proposed areas of disturbance.

	AREA (HA)	HEIGHT (M)
Pit	37	
Overburden stockpiles	27	up to 10
Fines dams (off mine path)	18	5 (filled to 3)
Tails stockpiles	6	5
Topsoil stockpiles	6	up to 4
Infrastructure	6	
Total area of disturbance	100	
Total site	138	

2.3 MINING SCHEDULE

Site preparation for mining of the Tutunup deposit is planned to commence in the second quarter of 2002, with mineral production starting in late 2002 or early 2003. Mineral production is scheduled to continue for about 25 months, assuming a 5-day roster is used. The mining schedule (ie 5 or 7 days per week) is dependent on prevailing market and economic conditions.

Ore will be mined at an average rate of 1.5 million tonnes per annum, with a maximum of 2 million tonnes per annum. Production of HMC will vary between approximately 175,000 tonnes per annum in low-grade areas and 230,000 tonnes per annum in high-grade areas. At this rate, mining will be completed in early 2005. The rehabilitation phase, consisting of landform reconstruction and revegetation, will continue after completion of mining.

Overburden removal will occur up to 6 months in advance of mining of the ore. Progressive backfilling of the pit will occur about 3 to 4 months behind the mining face.

Three separate zones have been designated for mining of the orebody, based on different requirements for mining and landform restoration (see Figure 2.3).

- Central Zone (7300mN - 7900mN) - Mining of the orebody will commence within this zone and will be timed to facilitate the mining of the southern zone during winter. The exact start up location may be influenced by the timing of project approvals.
- Southern Zone (6600mN - 7300mN) - The aim is to mine this area in winter to minimise any potential for groundwater drawdown affect upon the State Forest (see Section 5.1.3). Backfilling will be accelerated through this zone.
- Northern Zone (7900mN - 8900mN) - this zone will be mined last.

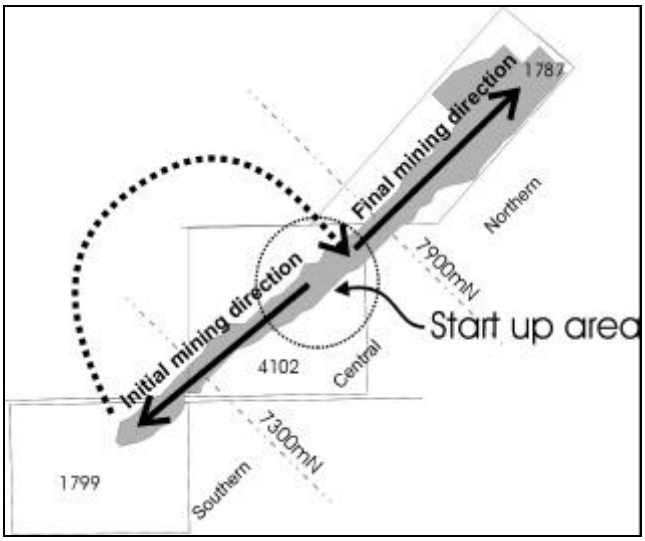


Figure 2.3. Conceptual mine path.

Rehabilitation will progressively follow the mine path as the final landform is redeveloped, with most activity occurring in the summer and autumn. As mining will be completed by early 2005, it is anticipated that the majority of rehabilitation will be completed by autumn of 2005, such that some preliminary grazing of pastures is possible by spring of the same year. Any areas of land not rehabilitated during 2005 will be sown to pasture the following year.

2.4 REHABILITATION AND DECOMMISSIONING

2.4.1 Post-mining land use

The proposed mining operation utilises agricultural land owned and managed by private landowners. The post-mining land use will be predominantly pasture production determined in consultation with these landowners. Any pre-existing infrastructure such as fences, watering points, farm shelterbelts and fencing will be re-established to the satisfaction of the landowner.

To ensure an acceptable post-mining land-use is achieved, Cable Sands will aim to return pastures of comparable productivity to pre-mining, based on monitoring of pasture production undertaken during 2001.

2.4.2 Physical and chemical properties of the pre-mining soil profile

Mining of the Tutunup orebody will include the removal and physical alteration of some of the pre-mining subsoils. To facilitate the development of a post-mining soil profile that will sustain pasture growth when under the influence of normal farm management practices, an understanding of the physical and chemical characteristics of the existing subsoil horizons is necessary.

A typical example of pre-mining subsoils that occur within the orebody are provided in Figure 2.4. Chemical characteristics of the different subsoil horizons depicted are provided in Table 2.2. The relevance of this information is discussed below.

- Root zone depth - The root zone depth to which it is important that a typical ryegrass/clover pasture has free access is 1 m. Most root proliferation is however likely to occur in the 0 to 50 cm depth, while some deep rooted pasture species (eg. Kikuyu) may send roots to depths of 1.5-2.0 m.

  Figure 2.4 indicates that the existing root zone depth tends to be variable along the orebody. In the northern zone 1 to 2 m of freely draining sands tend to be present, however in the central and southern zone the sands are either shallow or absent. Instead, the presence of a layer of ironstone caprock close to the surface limits the ability of pasture roots to optimise their distribution.

- Texture - During exploration drilling, samples are routinely tested for fines content (% clay and silt). This data is used primarily for mine planning purposes, however it also provides useful information on the textural properties of different soil horizons. As shown in Table 2.2, the upper sands and Yoganup sands tend to be of a similar texture, that being low levels of silt and clay. By contrast, the material described as clayey sand is more clayey, having approximately double the fines content of the other soil horizons. The more clayey nature of the clayey sands should be considered when investigating other factors such as sodicity (see below).

- Exchangeable cations - The cation exchange capacity (CEC) of a soil provides an indication of a soils ability to store nutrients. The CEC is affected by soil texture. Sandy soils tend to have very low CEC values, whereas soils high in clay or organic matter will have higher CEC values. Clays found on the Darling and Whicher scarps tend to be kaolinitic and have low CEC values (due to lower charge density) than other clays (eg. illite, montmorillonite, Sumner, 1993).

Due to the sandy nature of the subsoils, all of the materials tested had a low (<5 meq/100 g) CEC. The upper sand sample had a higher CEC than the other samples, and it is presumed that this is a result of better root penetration through this area and a resultant increase in organic matter (see organic carbon levels in Table 2.2).

Examination of the composition of exchangeable cations present also favours the upper sands as being most suitable for pasture production. This is due to the upper sands comprising a dominance of calcium, followed by magnesium, then potassium and sodium in smaller amounts (NSW Agriculture and Fisheries, 1989). By contrast, the other subsoils tend to be low in exchangeable calcium and high in exchangeable magnesium. High levels of exchangeable sodium indicate sodic soils, an issue that is discussed below.

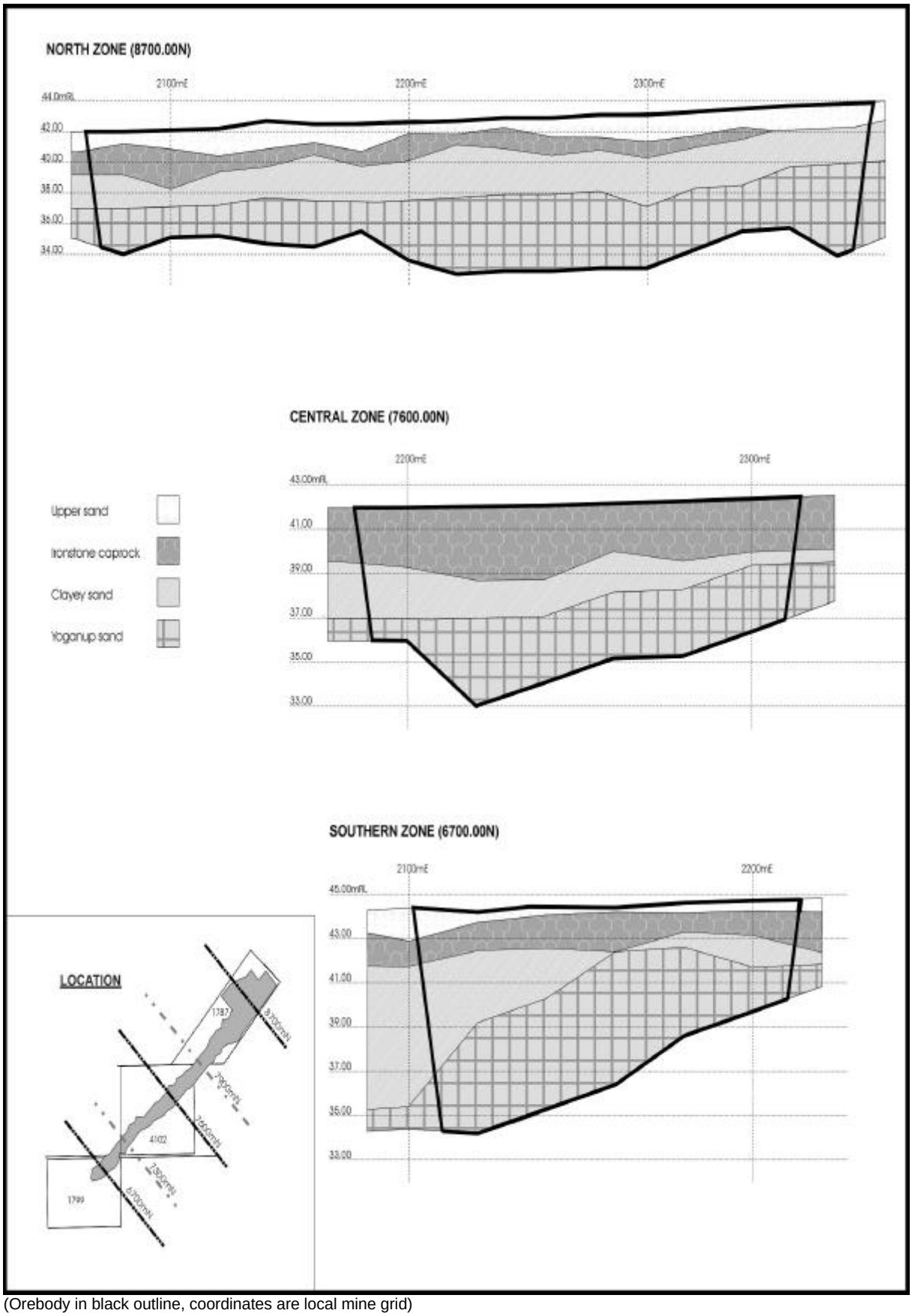
- Sodicity - Sodic soils are those having a high level of exchangeable sodium and displaying a tendency to disperse. This dispersiveness restricts the improvement of soil structure by limiting development of soil aggregates. Soil aggregation facilitates the penetration of plant roots, and the infiltration of water, into the soil. The lack of penetration of plant roots in sodic soils limits the plants ability to utilise stored moisture and nutrients, thus productivity is lowered. Reduction in infiltration will result in increased runoff and an increased risk of soil erosion.

  All the subsoils tested, apart from the upper sands are considered to be sodic. When of a sandy texture, these subsoils lack the clay content necessary to exhibit dispersive behaviour, however clay derived from these layers (eg. fines) should not be introduced into the surface 1 m of the soil profile unless suitably amended with a calcium ameliorant (eg. Gypsum).

- Salinity - The presence of high salt levels in the root zone of pastures can suppress growth due to disturbance of the plants osmotic balance and also due to accumulation of sodium and chloride ions at toxic levels. All samples taken were low in salt (EC[1:5] <0.2 dS/m), thus soil salinity is unlikely to be a factor requiring special management during landform reconstruction.

- Acidity - The ideal pH for plant growth varies according the species being considered, however fairly neutral conditions (pH ≈ 7) are generally preferred. pH values ranging between 5.5 and 7.0 are generally considered acceptable, while for values below 5.5, amelioration with lime may be required.

  The pH values shown in Table 2.2 demonstrate that acidity is unlikely to be a factor requiring special management during landform development. Only one value (southern zone, clayey sand) had a pH value below 5.5, however at a pH of 5.2, this acidity would be considered only mild.



(Orebody in black outline, coordinates are local mine grid)

Figure 2.4. Pre-mining subsoil profile cross-sections within the orebody.

Table 2.2. Chemical characteristics of pre-mining subsoil horizons within orebody.

FACTOR:	TEXTURE	ORGANIC MATTER	EXCANGEABLE CATIONS					SALINITY	ACIDITY
PARAMETER:	SILT & CLAY CONTENT	ORGANIC CARBON	CEC	Ca	Mg	K	Na (ESP)	EC (1:5)	pH
UNIT:	(%)	%	meq/100g	%CEC	%CEC	%CEC	%CEC	dS/m	
OPTIMAL RANGE:*	N/A	N/A	10	65-80	10-15	1-5	0-1	<0.2	>5.5
SITE:									
North Zone (8700mN)									
Upper sand	13.6	0.23	4.2	86%	10%	1%	2%	0.12	8.4
Clayey sand	39.6	0.08	2.22	18%	64%	4%	14%	0.06	6.3
Yoganup sand	13.6	0.09	0.55	42%	44%	7%	7%	0.02	6.6
Central Zone (7600mN)									
Clayey sand	18.6	0.07	1.61	20%	60%	9%	11%	0.03	6.2
Yoganup sand	7.6	0.07	0.55	47%	27%	13%	13%	0.02	6.5
South Zone (6700mN)									
Clayey sand	27.8	0.09	2.02	26%	54%	6%	13%	0.06	5.2
Yoganup sand	11.7	0.01	1.35	22%	32%	37%	9%	0.03	5.6

* (Hazelton and Murphy, 1992)

2.4.3 Landform restoration

As ore is progressively extracted, the mined areas will be re-contoured to blend in with the existing landscape using the dried fines, overburden and tailing sand. All available topsoil will be conserved and returned to the final landform.

The landform will be restored with the objective of providing 1 m of freely draining soil beneath the final land surface. Conceptual post-mining soil profiles are represented in Figure 2.5 to illustrate how overburden, tailings sands and fines are managed to achieve this criterion.

In the northern zone, the pre-existing subsoil (see 'upper sand' in Figure 2.4) is present in adequate depth to meet this criterion, thus this material will be returned to the same position in the soil profile as prior to mining.

In the central and southern zones, the upper sand overburden is not present in sufficient depth to provide 1 m of freely draining subsoil. To achieve a full metre depth, tailings sands (derived from Yoganup sand) will be placed beneath the upper sand overburden. Tailings sands will be used in preference to the blue sandy clay overburden as it has been shown to have a more favourable cation balance (see Section 2.4.2). All of the upper sand overburden removed from the southern zone will be returned to the same area.

Below 1 m depth, the composition of the soil profile will have little influence on pasture productivity. In this part of the soil profile the horizons indicated are based primarily on mining constraints. In the northern and central zones, fines material will be placed over the backfilled orebody. These fines will be kept one metre below the final surface level to limit their interaction with the pasture roots. In the southern zone, fines are not included as the drying of fines may otherwise limit Cable Sands ability to selectively mine and backfill this zone during winter.

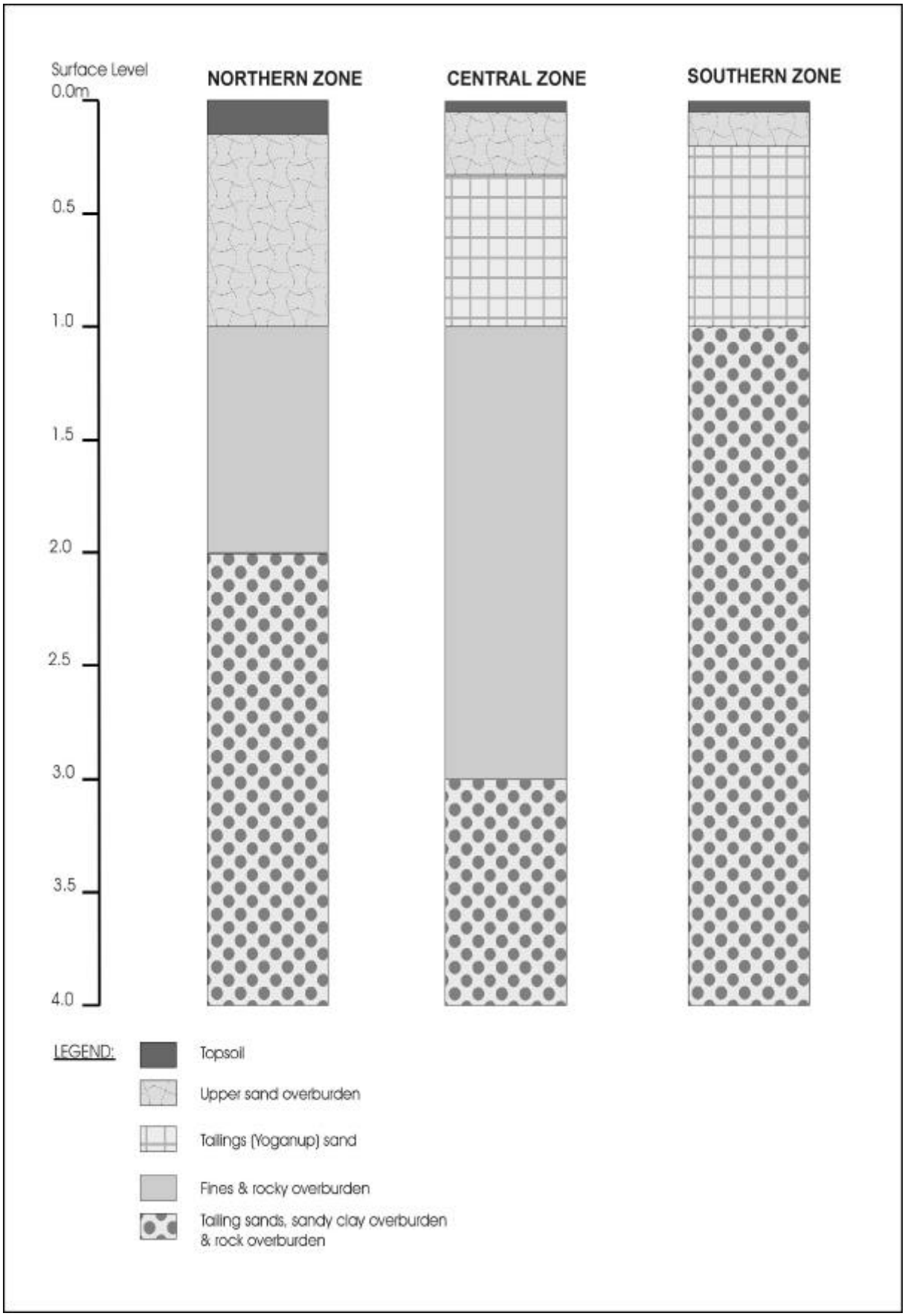


Figure 2.5. Conceptual representation of post-mining soil profiles.

2.4.4 Revegetation

Cable Sands has extensive experience in rehabilitating farmland on the Swan Coastal Plain. Revegetation procedures proposed for re-establishment of farmland at Tutunup will follow those currently used at Cable Sands' Yarloop and Benger minesites, and previously used successfully at Waroona.

The focus of the revegetation programme will be to rapidly stabilise restored landforms with agricultural pastures. After the final landform has been developed topsoil will be returned using scrapers. Lower topsoil will be returned first, followed by the upper topsoil. The surface will then be graded to ensure it is smooth enough to accommodate normal agricultural activities. Subject to landowner requirements, a clover-ryegrass mixture will then be sown and fertiliser spread, to ensure a vigorous re-establishment of the pasture.

To illustrate the methodology, pasture establishment at Cable Sands' Benger minesite during autumn of 2001 consisted of the following procedures:

- Seedbed preparation was undertaken using secondary tillage implements (scarifier and harrows).
- A seed mix was applied at 20 kg/ha using an "Aitchenson" seeder. The seed mix consisted of mixed sub clover and ryegrass varieties, the clover seed being inoculated via lime pelleting.
- After seeding, the area was rolled to provide a firm seed bed for pasture establishment.
- Fertiliser was applied at 400 kg/ha using a super-spreader. The fertiliser was comprised of superphosphate and potash with added trace elements of copper, zinc and molybdenum. In addition, lime was applied at 3 tonnes per hectare.

After pastures are established, they will be continually monitored and managed by Cable Sands' Agricultural Rehabilitation Officer until such time that the land is handed back to the landowner. In cooperation with the landowner, a short period of grazing may be applied in the first spring after sowing. This grazing is to promote a healthy component of clover amongst the ryegrass, and will also assist in discouraging any pasture weeds present (eg. capeweed) from attaining dominance. Any problem weeds (eg. blue lupins, cotton bush, rushes) will be controlled via herbicide application.

2.4.5 Decommissioning

All mining related infrastructure will be removed at the completion of the project. Services such as power and water supplies may remain according to landowner requirements.

2.5 WORKFORCE

The sequential nature of Cable Sands mining operations provides the opportunity for continuity of employment for current personnel. The operating minesite will directly employ about 30 people on a rotating shift basis.

2.6 TRANSPORT OF HEAVY MINERAL CONCENTRATE

Trucks used for the transportation of the HMC will be road-trains with a maximum 60 tonne payload. The preferred route that the trucks will take from the minesite will be to exit the minesite at the northern end, travel east along Oates Rd to Tompsett Road, then north to Tutunup Road, west to Ludlow-Hithergreen Road, north to the Bussell Highway, then north along Bussell Highway to Bunbury. In Bunbury, trucks will travel along Robertson Drive and Koombana Drive to Cable Sands' North Shore Facility. This route is indicated in Figure 2.6.

Cartage will be on a batch basis determined by the requirements of the Bunbury secondary separation plant, as occurs with current Cable Sands operations. That is, haulage will occur from one minesite for a period of time (eg. one to four weeks), and then from another site for a similar period. At estimated production rates and truck payloads of 60 tonnes, there will be an average of around 13 return truck journeys per day during periods of haulage from the Tutunup minesite.

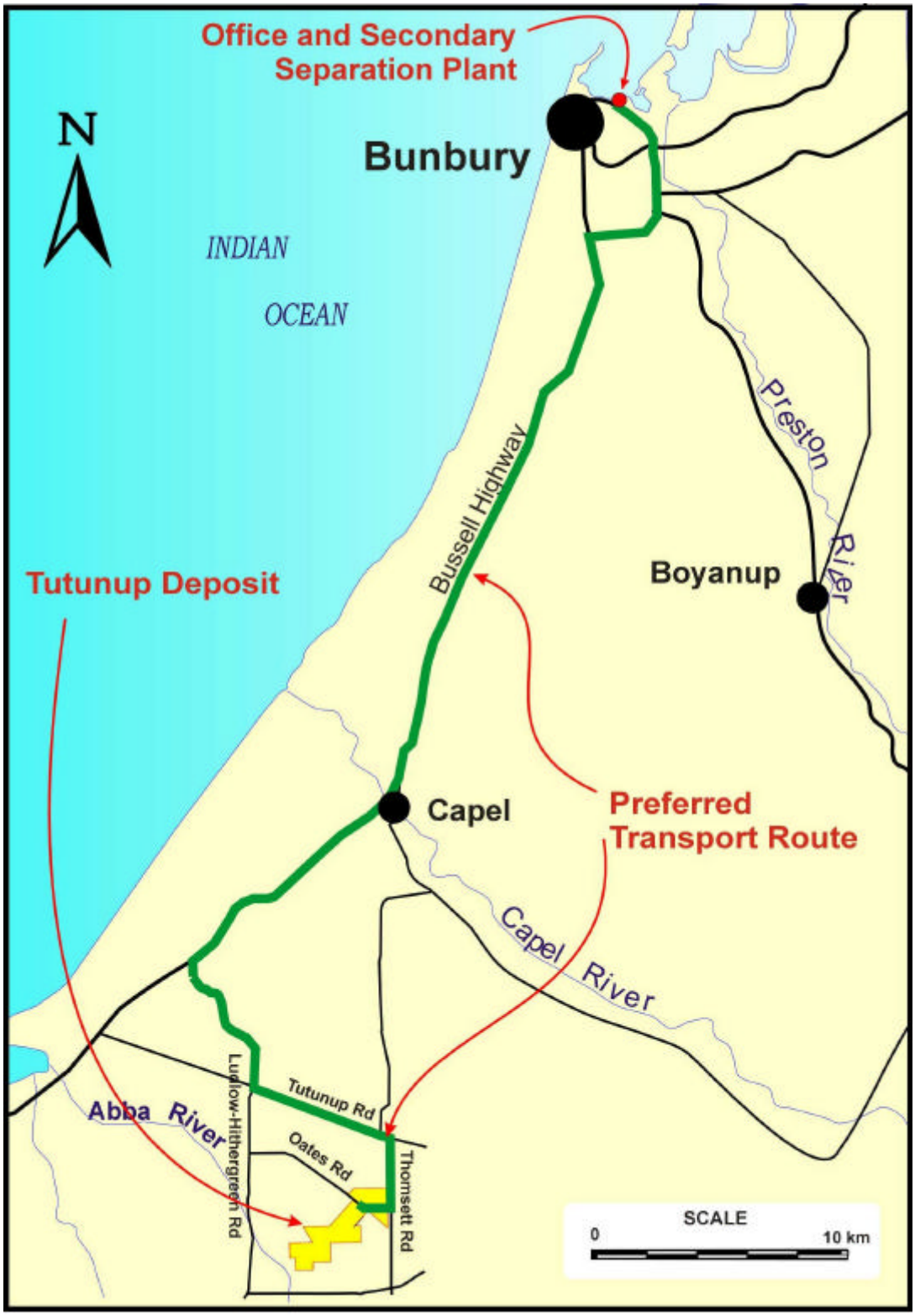


Figure 2.6. Proposed Heavy Mineral Concentrate Transport Route from Tutunup to North Shore, Bunbury.

3 Existing Environment

3.1 REGIONAL SETTING

The Southwest region of Western Australia is an important mining, processing, agricultural, manufacturing, timber and tourism region.

Mining and mineral processing is a $2.8 billion industry based largely around the alumina and titanium mineral industries. Bauxite mining on the Darling Plateau provides feed for alumina refineries located along the coastal plain and at Worsley, west of Collie. Titanium minerals (heavy mineral sand) continue to be mined at various locations along the coastal plains of the Southwest region. The region also includes Western Australia's main centres for the dairy, horticulture and timber industries.

Bunbury acts as a service city and port for the industries within the area. The greater Bunbury area has a population of over 50,000 people.

The coastal area south of Perth is dominated by three main landforms - the Swan Coastal Plain, the Darling Plateau and the Blackwood Plateau. Where the plain meets the Darling and Blackwood Plateaus, the Darling and Whicher Scarps, respectively, are formed. The Swan Coastal Plain extends for approximately 25 kilometres from the Darling and Whicher Scarps to the ocean. It is composed of a series of sedimentary materials of different ages deposited over millions of years. Titanium mineral resources are mined in areas where the sorting and deposition of heavy minerals provides sufficient concentrations to make mining economically viable.

3.2 CLIMATE

The project area experiences a Mediterranean climate with hot, dry summers and mild, wet winters. Median rainfall at the nearest major meteorological station, CALM's Jarrahwood plantation approximately 15 km ESE of the deposit, is 969 mm and approximately 85% of this is experienced between April and November.

Average maximum temperatures range from 16.3°C in July to 29.5°C in February. Average minimum temperatures range from 5.1°C in July to 13.3°C in February (see Figure 3.1).

Winter storms bring squally winds from the northwest to southwest. During summer, southwesterly sea breezes occur in the afternoon, while hot dry easterly winds of moderate strength occur at night and early in the day.

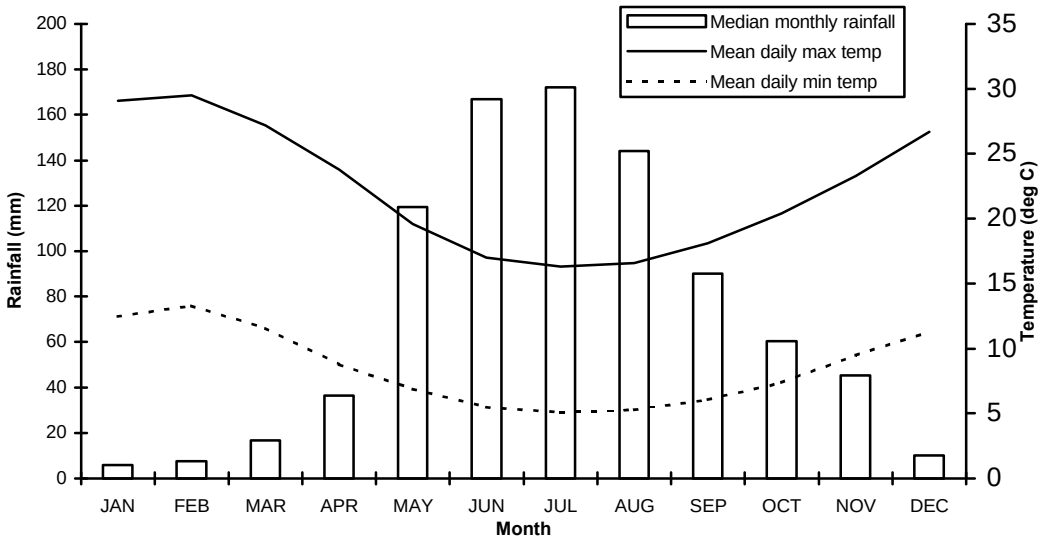


Figure 3.1. Summary of climatic data for the Busselton (Jarrahwood) Meteorological Station (No. 009842).

3.3 GEOLOGY

The geology of the Tutunup area has been described by Wharton (1981) and is summarised here. The area occurs within the Bunbury Trough, a deep graben defined by two north-south striking faults: the Busselton Fault to the west; and the Darling Fault to the east.

The Bunbury Trough contains at least 10,000m of Phanerozoic sediments, though only the uppermost (to 1100 m depth) formations have been described. Near the Tutunup deposit, these formations range in age from Jurassic to Holocene, as indicated below:

- Cockleshell Gully Formation - deposited in the early Jurassic and consists of approximately 1500 m of interbedded sandstone and grey shale.
- Yarragadee Formation - conformably overlies the Cockleshell Gully Formation and was developed in the late Jurassic. This formation may be up to 1500 m thick and consists of interbedded sandstone shale and minor siltstone.
- Leederville Formation - deposited in the early Cretaceous and unconformably overlies the Yarragadee Formation. This formation consists of interbedded sandstone, siltstone and shale and, near the Tutunup deposit, is likely to be 50-100 m thick.
- Superficial Formations - three Quaternary deposits are present in the proposed mining area, as indicated by Belford (1987):

    1. The Guildford Formation is a layer of alluvial silts and clays. Exposure of this formation corresponds with lower lying, more water logged areas immediately north west of the deposit.
    2. The Yoganup Formation is a Pleistocene shoreline deposit consisting of sand and lenticular clay beds with a basal conglomerate, and is likely to be up to 10 m deep and 10 m thick near the Tutunup deposit. This is the formation containing the heavy mineral resource.
    3. The Yoganup and Guildford formations are overlain by an outwash of pale brown colluvial sand. This sand has typically been cemented into a 2-4 m thick blanket of iron cemented sandstone (known commonly as "coffee rock" or "ironstone"), often exposed at the ground surface.

Exploratory drilling and test pits have confirmed this arrangement of the superficial layers over the Tutunup deposit.

3.4 SOILS AND LANDFORM

The Tutunup deposit lies on the southeastern margin of the Swan Coastal Plain, where the Whicher Scarp defines the gradation between the gently sloping plains and higher, more variable topography of the Blackwood Plateau (see Figure 1.1).

Soils and landform of the Tutunup area have been described and mapped by Bettenay *et.al.* (1960), Churchwood and McArthur (1980) and more recently by Tille and Lantzke (1990). The above mapping shows the deposit occurs within the Abba Plain, a sub-unit of the Swan Coastal Plain. The Abba Plain is a fluviatile deposit which generally consists of poorly drained yellow duplex soils as well as shallow sands over coffee rock. Exploratory drilling has confirmed that ironstone caprock (coffee rock) is present over most of the Tutunup deposit, averaging 2-3 m thick, and often exposed at the surface.

Where coffee rock is not encountered close to the surface, a typical soil profile consists of about 50 cm of grey sand, darkened by organic matter near the surface, followed by a yellow-grey sandy clay horizon containing ferruginous gravel and concretions. These soils tend to be of low fertility, and combined with their tendency for waterlogging, have limited agricultural value other than for pasture production.

3.5 SURFACE WATER

Surface drainage of the area of the deposit is by sheet flow, following the gentle slopes in a north-north-westerly direction, until an extensive area of flat waterlogged pastures is reached. Drainage in these areas is indistinct, but is assisted by numerous agricultural drains, which eventually lead to the Abba River. The Abba River flows in a north-north-westerly direction and is over 2 km south west of the deposit at its closest point (Figure 1.1). The Abba River discharges into the Vasse Inlet which, in turn, discharges to Geographe Bay.

3.6 GROUND WATER

Groundwater resources in the Tutunup area are contained within the Capel-Ludlow Subarea of the Busselton-Capel Groundwater Area, and are managed by the Water and Rivers Commission (WRC). The hydrogeology of the area has been described by Hirschberg (1989) and is summarised below.

3.6.1 Superficial Aquifer

Shallow groundwater (0.5-2 m below surface level) is held within an unconfined aquifer which comprises a variable succession of Cainozoic sediments known collectively as the superficial formations. In the vicinity of the Tutunup deposit these sediments are dominated by the Yoganup Formation (see Section 3.3).

Recharge of water within the superficial aquifer is dominated by infiltrating rainfall. Groundwater discharge occurs near the coast into existing streams and drains. Elsewhere, groundwater is utilised by transpirative draw of vegetation and also for domestic or farm water supplies, where soaks, wells or bores have been installed.

Groundwater salinity in the superficial aquifer gradually increases as it flows towards the coast. Salinity values range from less than 500 mg/L TDS (Total Dissolved Solids) near the Whicher Scarp, to over 7000 mg/L near the coast. TDS of the shallow groundwater near the Tutunup deposit (calculated from the electrical conductivity) is in the order of 160 to 450 mg/L.

Table 3.1 reveals that, as of April 2001, the majority of groundwater from the superficial aquifer remains unallocated.

3.6.2 Leederville aquifer

Recharge of the Leederville aquifer occurs in the Blackwood Plateau. Near the Whicher Scarp, some recharge also occurs by downward leakage from the superficial aquifer. Groundwater flow is towards the coast, where discharge occurs into the superficial aquifer.

Groundwater salinity in the Leederville aquifer tends to increase in the direction of flow, ranging from less than 300mg/L TDS near the Whicher Scarp, to over 1,000 mg/L TDS near the coast. As the Tutunup deposit is relatively close to the scarp, it is likely that groundwater salinity in this area will be low.

As of August 2001, about 35% of the Leederville aquifer was unallocated (Table 3.1). For management purposes, the WRC divides the Leederville aquifer into upper and lower regions, with the Upper Leederville currently oversubscribed, and the available resource being in the Lower Leederville aquifer.

3.6.3 Yarragadee aquifer

For the purpose of water resource management, the Yarragadee aquifer is considered to include water contained within both the Yarragadee and the Cockleshell Gully formations, as these flow systems are hydraulically connected.

Recharge to the Yarragadee aquifer generally occurs by downwards leakage from the Leederville aquifer, particularly in the northern half of the Blackwood Plateau. The flow pattern for groundwater within this aquifer is similar to the Leederville aquifer, generally trending towards the coast. Discharge from the formation is thought to occur offshore and also by upwards leakage into the Leederville aquifer near the coast.

Groundwater quality in the Yarragadee aquifer is closely related to the Leederville aquifer, thus salinity tends to increase towards the coast. Salinity measured in the Yarragadee bore drilled on the Tutunup lease is approximately 360 mg/L TDS.

As of April 2001, over one third of the available water resource in the Yarragadee aquifer was unallocated, however demand for this resource has now increased. As of August 2001, the quantity allocated, reserved and applications pending (including this and other Cable Sands projects) exceeded the estimated available supply by about 12% (Table 3.1).

Table 3.1. Groundwater throughflow, allocation and availability in the Capel-Ludlow Subarea

	AQUIFER (KL/YEAR)		
	SUPERFICIAL[#]	LEEDERVILLE	YARRAGADEE
Total availability:	11,200,000	4,400,000	14,500,000
Allocated:	827,500	2,492,395	6,886,500
Reserved	3,120,000	-	5,500,000
Applications pending		288,405	3,943,400 *
Unallocated:	7,252,500	1,619,200	- 1,829,900

[#] Superficial data: WRC, 3/4/01, Leederville/Yarragadee data: WRC, 15/8/01
* includes 1,500,000 kL/annum reserved for proposed Tutunup minesite.

3.7 NATIVE VEGETATION AND FLORA

3.7.1 Regional vegetation distribution

The project area is located within an area of the Swan Coastal Plain characterised by massive ironstone formations. The vegetation includes restricted, endemic taxa, with eleven species being restricted to the Busselton ironstones. Approximately 97% of the Busselton ironstone area has been cleared, resulting in many of these species being listed as Declared Rare Flora or Priority Flora (Gibson *et al*, 2000).

These areas have shallow groundwater and may be seasonally inundated (see Section 3.6). The plant communities are presumed to be dependent on this groundwater for at least part of the year. At other times the plants may be more reliant on rainfall and/or residual soil moisture or they may have strategies to reduce moisture requirements. The physiology and groundwater relations of the ironstone endemic species is the topic of current research at the University of WA.

3.7.2 Vegetation within the project area.

Most of the original vegetation in the vicinity of the Tutunup deposit has been cleared for agricultural purposes. Introduced pastures now dominate the vegetation, with scattered remnant vegetation. This area is illustrated in Plate 3.1 and Plate 3.2. Prior to clearing, a Jarrah (*Eucalyptus marginata*)/Marri (*Corymbia calophylla*) forest would have been present. Other ironstone endemic species are also likely to have been present.

Vegetation surveys of the project area were conducted in August 2001 (Bennett, 2001). The proposed areas of disturbance within Lots 1788, 1789, 1799, and 1790 contain only pasture species, with some planted Eucalypts in Lots 1788, 1789 and 1799. Lot 1737 is pasture with one *Nuytsia floribunda* and several *Melaleuca rhaphiophylla*, many of which are dead.

The remnant vegetation on Lot 4102 includes *Acacia stenoptera*, *Agonis parviceps*, *Astartea* affin. *fascicularis*, *Callothamnus* sp. Whicher (P1), *Calytrix acutifolia*, *Corymbia calophylla*, *Drosera glanduligera*, *Eucalyptus patens*, *Hakea oldfieldii* (P3), *Hypcalymma angustifolium*, *Kingia australis*, *Melaleuca incana* subsp. *incana*, *Melaleuca preissiana*, *Nuytsia floribunda* and *Xanthorrhoea preissii* (Bennett, 2001).

During the course of early vegetation surveys a group of plants were identified within Lot 4102 as possibly being either an unnamed *Calytrix* or *Darwinia* sp Williamson (DRF). Subsequent identification of flowering specimens has confirmed that these plants are the common *Calytrix acutifolia* (Lyn Craven, Australian National Herbarium, *pers. com*.).

The State Forest adjoining the project area (to the southeast) contains areas of the threatened Busselton Ironstone community, including populations of Declared Rare and Priority Flora. This area forms part of the "Shrublands on the southern Swan Coastal Plain ironstones", listed as a threatened ecological community under the EPBC Act.

A summary of the estimated number of individuals of the ironstone endemic flora within the Tutunup area is shown in Table 3.2. This also indicates the current conservation status of these species and health of the populations.

Table 3.2. Estimated number of individuals of Ironstone Endemic Flora in the area of the proposed Tutunup minesite.

TAXON	CONSERVATION STATUS[1]		WITHIN MINE AREA: LOTS 4102, 1787, PART LOTS 1790, 1789, 1799, 1788		ADJACENT STATE FOREST	TOTAL KNOWN NO.		CURRENT HEALTH
	STATE	EPBC	PROPOSED TO BE REMOVED	UNDISTURBED		POPULATIONS	INDIVIDUALS	
Brachysema papilio	DRF, C	E	–	–	100+	1	100+	good
Calothamnus sp. Whicher (BJK & NG 230)	P1	–	493[3]	361[3]	100+ (1200[3])	13	~2500 (5700[3])	good
Chamelaucium roycei ms	DRF, V	V	–	–	6	8	~800	good
Darwinia sp Williamson (GJK 12717)	DRF, C	E	–	–	~150	1	~150	good
Dryandra nivea subsp. *uliginosa*	DRF, E	E	–	–	100+	13	~850	moderate
Dryandra squarrosa subsp. *argillacea*	DRF, E	V	–	–	3	16	~3000	moderate
Grevillea elongata	DRF, E	V	–	–	3	~10	~1800	moderate
Grevillea maccutcheonii	DRF, C	E	–	–	–	1	15	moderate
Grevillea manglesioides subsp. *metaxa*	P2	–	–	–	present	unknown	unknown	unknown
Hakea oldfieldii (BJK & NG 226)	P1	–	1[2]	–	80	unknown	unknown	unknown
Hemigenia ramosissima	DRF	–	–	–	present	2	unknown	unknown
Isopogon formosus subsp. *dasylepis*	P3	–	–	–	present	21	unknown	unknown
Lambertia echinata subsp. *occidentalis*	DRF, C	E	–	–	20	1	20	poor
Petrophile latericola ms	DRF, E	E	–	–	100+	2	108	moderate
Ironstone Community	C	E	–	–	present	13		poor

1 DRF = Declared Rare Flora under *Wildlife Conservation Act 1950*
P1 = Priority 1 – Poorly known species, known from 1 or a few populations (generally <5), which are under threat
P2 = Priority 2 – Poorly known species, 1 or a few populations (generally <5), at least some are not under threat
P3 = Priority 3 – Poorly known species, several populations, at least some are not under threat
C = Critically endangered
E = Endangered
V = Vulnerable

2 Data from Bennett, 2001
3 Data from McCutcheon, 2001
Other data from Kim Williams, Program Leader Nature Conservation, South West Region CALM, *pers. com.*

Plate 3.1. View from NE corner of Lot 4102, looking NE along orebody through Lot 1787 (September 2000).

Plate 3.2. View from NE corner of Lot 4102 looking SW along orebody showing remnant clumps of *Callothamnus* sp Whicher and scattered *Eucalyptus patens* (September 2000.)

3.7.3 Vegetation along the proposed transport route.

The verges of the preferred haulage route, (Oates Rd and Tompsett Rd) have been surveyed by a consultant botanist, Eleanor Bennett (Bennett, 2001).

The survey along these roads identified five Priority Species. *Synaphea whicherensis* (previously P3) and *S. hians* (P3) were recorded from the corner of Oates and Tompsett Roads in a reserve on the northwest corner. Another plant of *S. hians* was also recorded on the northeast corner of the intersection of these roads. *S. whicherensis* was removed from the Priority list in August 2001.

Jacksonia sparsa (P4) was relatively abundant along both sides of Oates Road for about 400 m from the intersection with Tompsett Road and about 300 m north along Tompsett Road from the intersection with Oates Road. Most of the plants were recorded in the reserve.

Chamelaucium roycei, a Rare Species gazetted under the Western Australian *Wildlife Conservation Act (1950)* and Vulnerable under the EPBC Act was abundant in the Railway Reserve on the southwest corner of the Tompsett and Tutunup Roads intersection.

3.8 NATIVE FAUNA

The mining area was surveyed by Hart Simpson and Associates in October 2001 (HSA, 2001). They found that the site has almost no value for terrestrial fauna species because the remnant vegetation is so limited and scattered. Although some rare species may pass through, the value of the habitat is too small to be significant.

A considerable bird fauna is present, and 22 native species and one introduced species (the Kookaburra) were recorded on a single visit. Many other species would be recorded over a longer time. These bird species (Table 3.3) can be grouped into:

- Wetland species which will make use of any wet area including within pasture (Australian Wood Duck and White-faced Heron, and many others will be present at times).
- Species which are tolerant of and often favour highly disturbed environments (Emu, Kestrel, Crested Pigeon, Kookaburra, Singing Honeyeater, Magpie-lark, Willie Wagtail, Black-faced Woodswallow, Magpie, Raven, Pipit and Welcome Swallow). Some of these species such as the Crested Pigeon and probably the Magpie would not have been present at all before clearing since European settlement, and others would have been much less common.
- Species which occupy or feed in trees including those isolated in paddocks (Western Ring-neck, Red-capped Parrot, Horsfield‘s Bronze-cuckoo and Rufous Whistler).
- “Bush birds”, mainly the smaller species which make use of the shrub stratum and to a lesser extent trees (most of the honeyeaters, Grey Fantail and Silvereye, but many others could be present).

Some bird species with a classified conservation status would make use of the site at some time but the value of the habitat is very small and the site is not important to any of these species. In particular two rare cockatoo species would make occasional use of the site for feeding when they move through, but they would not nest on the site and the value of the site as feeding habitat is very small because of the limited number of native plants surviving. The impact on these species from development of the minesite is not significant locally or regionally.

Kangaroos (*Macropus fuliginosus*) are also known to visit the pastured areas, before returning to the adjacent State Forest.

Table 3.3. Bird species recorded on Location 4102.

Emu	*Dromaius novaehollandiae*
Australian Wood Duck	*Chenonetta jubata*
White-faced Heron	*Ardea novaehollandiae*
Kestrel	*Falco cenchroides*
Crested Pigeon	*Ocyphaps lophotes*
Western Ringneck	*Barnardius zonarius*
Red-capped Parrot	*Purpureicephalus spurius*
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*
* Laughing Kookaburra	** Dacelo novaeguineae*
Red Wattlebird	*Anthochaera carunculata*
Brown Honeyeater	*Lichmera indistincta*
Singing Honeyeater	*Lichenostomus virescens*
New Holland Honeyeater	*Phylidonyris novaehollandiae*
Rufous Whistler	*Pachycephala rufiventris*
Magpie-lark	*Grallina cyanoleuca*
Grey Fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
Black-faced Woodswallow	*Artamus cinereus*
Australian Magpie	*Gymnorhina tibicen*
Australian Raven	*Corvus coronoides*
Richard's Pipit	*Anthus novaeseelandiae*
Welcome Swallow	*Hirundo neoxena*
Silvereye	*Zosterops lateralis*

* Introduced species

3.9 LAND USE

The area of the proposed minesite is currently cleared and used for grazing cattle and sheep. There are also areas of vineyards (table and wine grapes) established recently in surrounding properties.

There are 6 residences within a 1 km radius of the proposed mining operations, however, at least two of these will be vacant during the mining period.

4 Environmental Management System

Cable Sands has an Environmental Management System certified to ISO 14001. Certification was confirmed in July 1997 making Cable Sands the first titanium minerals company in the world and the first Australian mining company to have mining operations certified to that standard. Recertification for a further three years was approved in September 2000 (see Appendix B)

Australian Standard 14001 is identical with the International Standard (ISO) 14001 (Standards Australia, 1996). It is based on the risk management principles of AS/NZS 4360 (Standards Australia, 1999) and uses the organisation's Environmental Policy (see Appendix B) as the criteria for decision-making.

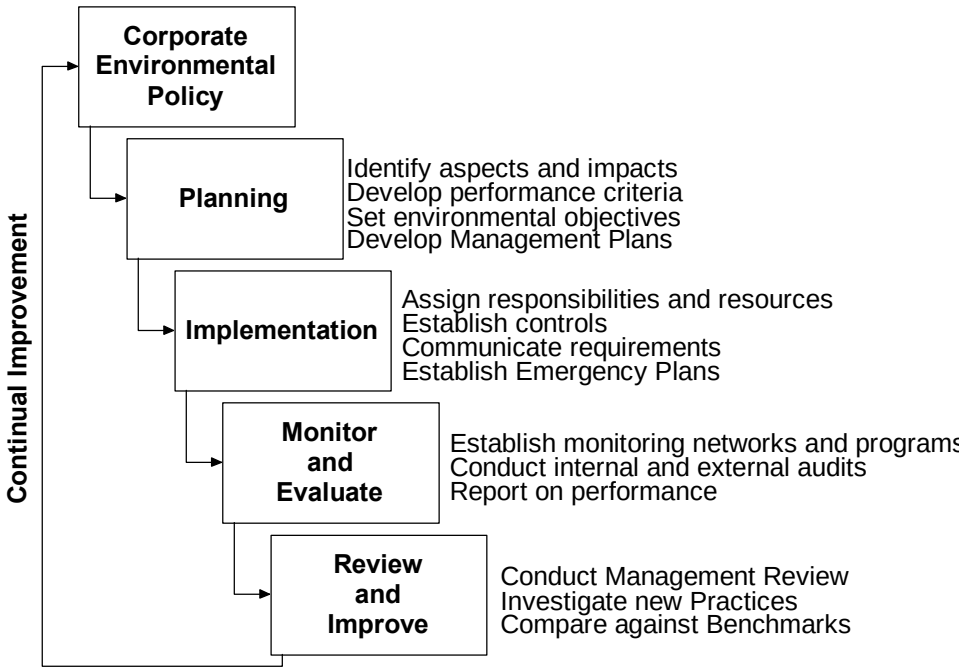


Figure 4.1. ISO 14001 Environmental Management System model.

The Environmental Policy must include commitments to:

- continual improvement
- pollution prevention
- full legal compliance
- effective communication.

The Standard requires that the EMS include a framework for identifying significant environmental aspects and applying environmental management practices and procedures.

The EMS also contains programmes for achieving the company's environmental objectives and targets, and updating these as required for new projects. Workforce training, system documentation and record keeping, emergency preparedness, monitoring and review are also included in the standard.

The EMS is audited internally and by external auditors every six months to ensure ongoing compliance with the requirements of the ISO 14001 standard and Company Environmental Policy.

Cable Sands' Environmental Management System will help ensure that best practice environmental management is implemented at the Tutunup Minesite during all phases of the project, including construction, operation, decommissioning and rehabilitation.

The EMS is complemented by a certified Quality Management System (AS/NZS ISO 9002:1994), and a certified Safety Management System (AS 4801:2000).

4.1 RISK ASSESSMENT

One of the first stages of implementation of the EMS is to conduct an assessment of Environmental Risk. A risk assessment was completed for the Tutunup project, following the principles of AS4360:1999 Risk Management (Standards Australia, 1999). This assessment identified several areas of potentially high environmental risk, principally during the development and mining phases and during HMC haulage from the site. These areas include:

- DRF and Priority Flora
- Vegetation Communities
- Groundwater quantity
- Noise
- Dust
- Transport routes
- Visual amenity

4.2 ENVIRONMENTAL MANAGEMENT PROGRAMME

As part of the EMS, an Environmental Management Program (EMP) will be developed for the Tutunup minesite. This will comprise several key documents addressing the areas of identified significant risk, as well as associated Work Instructions and System Procedures.

The key documents for the Tutunup project will include:

- Groundwater Management Plan and Operating Strategy; and
- Noise Management Plan

Draft versions of the Groundwater Management Plan and Operating Strategy and Noise Management Plan are provided in Appendix D and Appendix E.

In addition to these plans, the EMP will address a range of issues such as:

- Site rehabilitation;
- Site decommissioning;
- Monitoring requirements;
- Dust control
- Transport management

The potential risks identified and associated elements of the Environmental Management Programme are described further in the following sections.

Commitment 1.

Develop an Environmental Management Program for the Tutunup minesite. Among other issues the EMP will address:

1. Groundwater management
2. Noise management
3. Dust management
4. Transport management
5. Site rehabilitation
6. Decommissioning and closure

5 Biophysical Environment: Impacts & Management

5.1 GROUNDWATER QUANTITY

5.1.1 EPA Objective

- Ensure that the beneficial uses of groundwater can be maintained.

5.1.2 Relevant Standards

Use of groundwater is controlled under the *Rights in Water and Irrigation Act 1914*, administered by the Water and Rivers Commission.

5.1.3 Potential Impacts

5.1.3.1 Drawdowns due to groundwater abstraction

Groundwater is currently used by landowners in the area for domestic and agricultural purposes. Domestic bores are generally shallow (Superficial formation, 10-20 m below surface), with stock water and grape irrigation supplies being obtained from deeper bores (Leederville formation, 60-85 m below surface). Some properties utilise water from dams dug into the near surface groundwater. Bores into the deep Yarragadee aquifer are in use more distant from the proposed minesite, for mining and irrigation. A summary of the licensed users of groundwater in the vicinity of the Tutunup deposit is shown in Table 5.1. Water supplies need to be maintained to all of these other users during and after mining.

Table 5.1. Summary of Groundwater Well Licence Allocations as at November 2000.

AQUIFER	APPROXIMATE DISTANCE TO TUTUNUP DEPOSIT (LOT 4102)							
	WITHIN 2.5 KM		BETWEEN 2.5 & 5 KM		BETWEEN 5 & 10 KM		BETWEEN 10 & 15 KM	
	NO. OF GWLS	TOTAL ALLOCATION (kL/annum)	NO. OF GWLS	TOTAL ALLOCATION (kL/annum)	NO. OF GWLS	TOTAL ALLOCATION (kL/annum)	NO. OF GWLS	TOTAL ALLOCATION (kL/annum)
Superficial formations	2	1600	2	7500	1	1500	6	377 050
Leederville Formation								
Upper	7	241 700	9	170 380	11	654 250	42	595 690
Lower	0	0	1	39 100	3	82 500	1	1500
Yarragadee formation	0	0	0	0	7	5 533 000	6	1 851 500

Data provided by WRC Bunbury Regional Office, indicative totals only (URS, 2001a).

Cable Sands has drilled a production bore into the Yarragadee aquifer, under the terms of an exploratory Groundwater Well Licence from the WRC (No 99016). Performance of this bore and potential impacts from the proposed draw have been reviewed by consultants (URS 2001a). Due to the isolation between the aquifers, any drawdown will be limited to the Yarragadee Formation and will not propagate to the overlying Leederville or Superficial formations.

The nearest licensed bore in the Yarragadee aquifer is 6 km from the Tutunup production bore. Based on hydrogeological assessments, the maximum calculated drawdown at the Tutunup production bore will be 41 m (Table 5.2). These estimates are based on worst case conditions, and URS concluded that actual impacts are likely to be minor and insignificant due to:

- The absence of close, nearby groundwater users.
- The short duration of the planned mining operations and period of abstraction.
- Forecast abstraction (1 500 000 kL/annum) is conservative and actual abstraction may only be in the order of 1 000 000 kL/annum.
- Reduced operation of downgradient, former large-scale users of the Yarragadee Formation, in particular the Ruabon Minesite and South Capel Plant operated by Iluka Resources Limited, which is likely to result in progressive recovery of the potentiometric levels in the Yarragadee Formation both on a local and regional scale.
- Difference between screened intervals at the Tutunup Deposit and those of the closest users of the Yarragadee Formation.

Table 5.2. Predicted drawdown impacts - Yarragadee Formation.

GWL NO.	BORE LICENCE INFORMATION							
		97328	62596	61975	48520	50230	98241	84296
Use	Tutunup deposit	Pasture	Domestic / stock / pasture	Mining	Domestic / garden / protea	Pasture / stock	Wine grapes / horticulture	Wine grapes
Distance from Tutunup (km)	0	6	8.5	8.8	9	9.2	10.7	10.7
Allocation (kL/annum)	1 500 000	487 500	364 000	3 100 000	13 500	48 000	120 000	16 500
Screen interval (mAHD)	-172 to -272	to -209	to -215	-204 to -295 -180 to -260	to -287	to -188	unknown	to -152
MINING MONTH	**CALCULATED DRAWDOWNS (m)**							
3	38.7	2.8	1.9	1.8	1.8	1.7	1.4	1.4
6	39.6	3.7	2.8	2.7	2.6	2.6	2.2	2.2
9	40.1	4.3	3.3	3.2	3.2	3.1	2.7	2.7
12	40.5	4.7	3.7	3.6	3.6	3.5	3.1	3.1
15	40.9	5.0	4.1	4.0	3.9	3.8	3.4	3.4

Note: Calculated drawdowns are based on demand for Tutunup of 4000 kL/day, 7 days/week (URS, 2001a)

5.1.3.2 Drawdowns due to mine pit.

The ironstone plant communities in the adjacent State Forest (see Section 3.7.2) are endemic in areas of shallow groundwater, and may be seasonally inundated. They are presumed to be dependent on this shallow groundwater for at least part of the year. Any disturbance to the superficial groundwater levels may therefore impact on the health of this vegetation.

The potential for drawdowns associated with the mine pit propagating into the area of State Forest was assessed by URS (URS, 2001b). The local stratigraphy and aquifer systems were defined, based on information from a series of multipiezometers installed in early 2001 (Figure 5.1). This information was then used to develop a 3D groundwater flow model. The model was used to define predictive worst-case outcomes in terms of spatial and transient impacts due to mining.

From the 3D modelling it is concluded that:

- In the worst case, with no active management, drawdown of the superficial groundwater due to mining would propagate up to 450 m from the eastern crest of the pit and consequently extend under most areas of the threatened ecological community.
- Artificial recharge of the superficial water table, in areas between those mined and the State Forest, will limit the magnitude of drawdown of the water table beneath the State Forest to a maximum of 0.5 m. The drawdowns will be restricted to an area within 100 m from the pit (Figure 5.2).
- Artificial recharge will accelerate the recovery of the water table after the completion of mining, reducing the recovery period by at least four years.
- The superficial water table beneath the State Forest will recover to within 0.1 m of the initial pre-mining elevations within 9 months of backfilling of the southern area of the mine pit (Figure 5.2).
- Predicted drawdowns and subsequent recoveries of the water table are not sensitive to changes to the hydraulic characteristics of the backfill material types or clay capping within the backfill.

5.1.4 Management

5.1.4.1 Yarragadee and Leederville aquifers

The minesite will operate with a recirculating water system, which maximises the potential for recycling. Water will be returned to the water storage dam from various sources including:

- Overflow from the thickener tank;
- Collection from pit sump pumps;
- Decanting from tailings and fines dams and drainage from HMC stockpiles;
- Collection of stormwater from within the site, after passing through settling ponds.

This recycled water will reduce the amount of fresh water required to be taken from the bore to maintain water levels in the water storage dam. Experience from similar Cable Sands minesites indicates that in an average or better rainfall year, the bore may not be used for extended periods during the winter months, allowing for some recovery of the aquifer..

An Operating Strategy has been proposed for monitoring and management of groundwater abstraction (URS, 2001a). This includes pre- and post-commissioning monitoring of:

- The Tutunup production bore.
- A Yarragadee multipiezometer bore owned by Iluka Resources and located approximately 3.8 km to the northeast of the production bore.
- Three Leederville multipiezometers owned by WRC and located between 3.9 km and 5.1 km from the production bore.

The pre-commissioning monitoring outlined in this Operating Strategy commenced in May 2001. These actions will be incorporated into the Groundwater Management Plan and Operating Strategy (see Appendix D)

Existing nearby domestic and agricultural bores and dams will be surveyed for water quality and quantity prior to mining commencing, to provide a baseline for assessing any changes relating to the mining operations. Cable Sands will commit to maintaining adequate water supplies to nearby residents, should any adverse changes due to mining be detected.

5.1.4.2 Superficial aquifer.

A range of management strategies will be implemented to limit the drawdown impacts due to mining and reduce the recovery period, including:

Artificial recharge of the superficial aquifer.

Artificial recharge will be applied through buried, slotted pipes, located along the boundaries of the State Forest. Details of the artificial recharge system are provided in the Draft Groundwater Management Plan and Operating Strategy (Appendix D).

Rates of artificial recharge will vary over time depending on the drawdown stress applied to the water table due to mine dewatering. Simulated rates of artificial recharge predominantly range from 100 to 200 kL/day during overburden removal, mining and backfilling and subsequently progressively decline to less than 50 kL/day.

To ensure the artificial recharge system is adequately robust and fail-safe, it will also incorporate a standby direct watering system that would be able to apply additional water into perimeter areas of the forest. This backup system would only be used in the event that the artificial recharge system was not able to adequately maintain groundwater levels. It is likely it will never be used.

Reducing the period of mining in areas adjacent to the State Forest.

This will be achieved by:

- Completing the pre-stripping of the area in proximity to the State Forest immediately prior to commencement of the mining of ore; and
- Rapid backfilling of the mined void in proximity to the State Forest. Backfilling is scheduled to occur within 3 to 4 months of mining this area.

Monitoring

- A routine monitoring programme will measure groundwater levels in the multipiezometer bores (Figure 5.1). This programme commenced in April 2001, and will continue throughout the period of mining and after completion of mining.
- The frequency of monitoring will be increased during the period of highest stress on the water table, with minimum water table levels set to trigger operation of the back-up direct watering system.

Commitment 2.

Develop a Groundwater Management Plan and Operating Strategy to address:
1. Yarragadee abstraction and monitoring
2. Superficial aquifer artificial recharge system design and implementation
3. Monitoring of superficial groundwater in vicinity of Threatened Ecological Community
4. Monitoring of groundwater levels in other areas surrounding Tutunup project.
5. Actions to be taken in the event that adverse changes in groundwater levels or quality are detected.

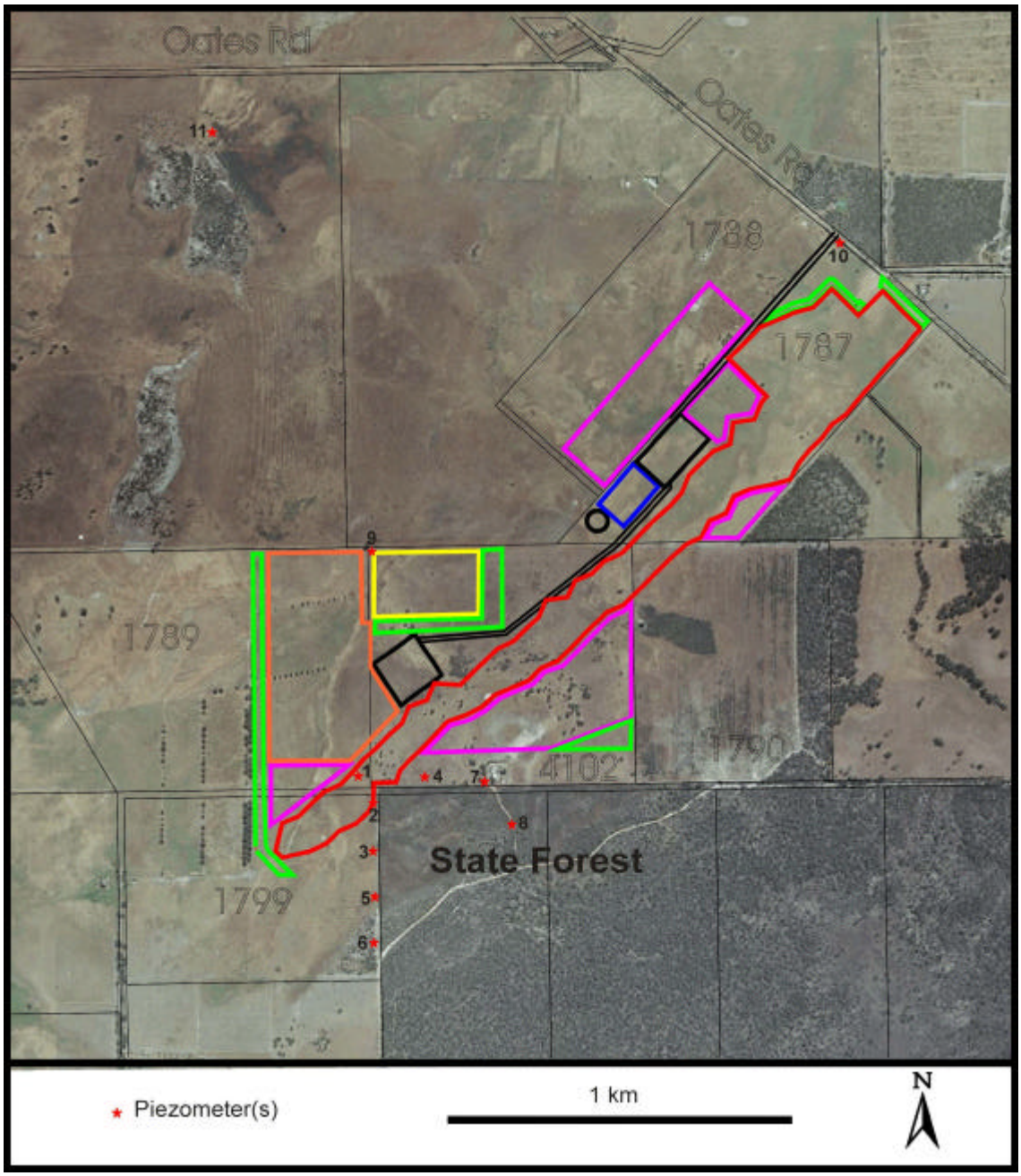
A draft of this plan is provided in Appendix D.

Commitment 3.

Implement the Groundwater Management Plan and Operating Strategy referred to in Commitment 2.

5.1.5 Predicted Outcome

The management strategies will lead to groundwater supplies being protected and the EPA's objectives being met.



BORE NUMBER	INSTALLATION DATE	INDIVIDUAL STANDPIPE SCREEN INTERVALS (m)				COMMENTS
1	February 2001	0.5-1.7	2.5-5.0	7.5-10.0	11.0-14.0	Installed for groundwater modelling programme.
2		0.5-2.5	3.0-4.0	4.5-6.5	7.5-12.0	
3		0.5-2.4	3.0-4.0	4.5-7.0	8.0-12.0	
4		0.5-2.5	3.0-5.0	5.5-7.0	8.0-12.0	
5		0.5-3.0	3.0-8.0			
6		0.5-4.0	6.0-12.0			
7		0.5-3.4	4.0-8.0			
8		0.5-4.8	5.0-8.0			
9	October 2001	0.5-2.5	3.0-6.0			Installed to provide additional downstream information.
10		0.5-2.7	4.7-7.7			
11		0.5-3.0	3.0-6.0			

Figure 5.1. Location and construction details of multipiezometer bores.

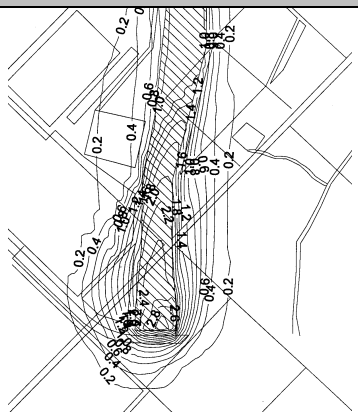
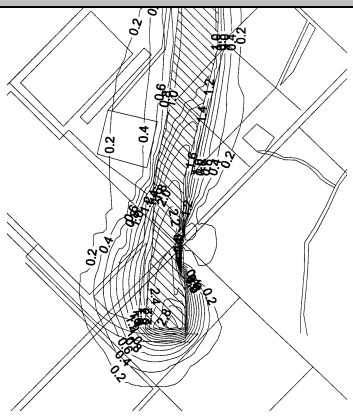
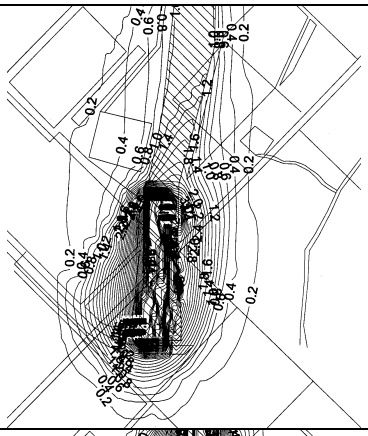
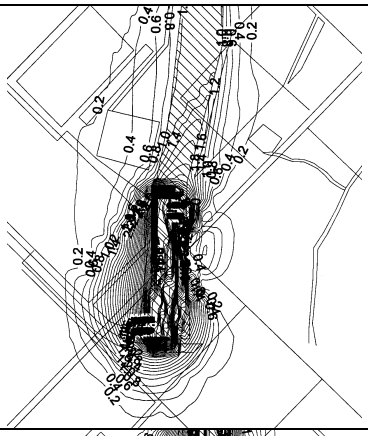
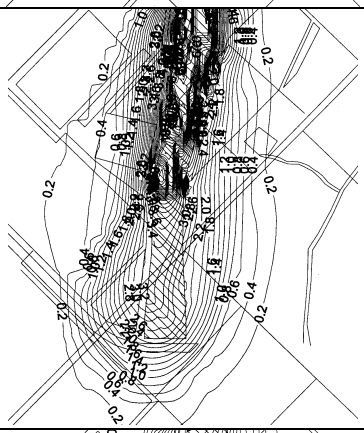
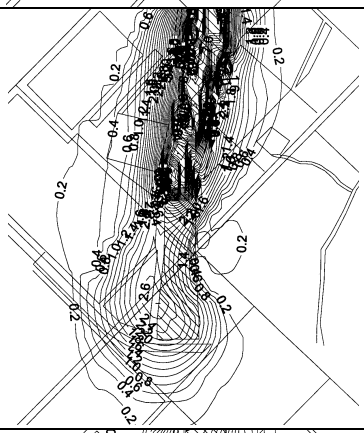
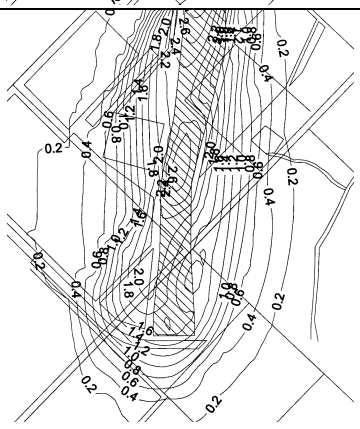
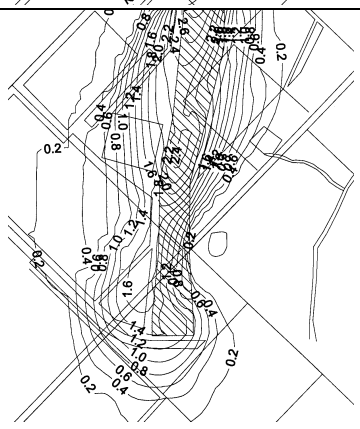
	WITHOUT ARTIFICIAL RECHARGE	WITH ARTIFICIAL RECHARGE
Overburden (caprock) removed		
Pit open		
Pit adjacent to State Forest backfilled, open further north.		
Backfill progressing north		

Figure 5.2. Groundwater drawdown modelling contours (m) at approximately 3-monthly intervals, with and without artificial recharge (URS, 2001b).

5.2 WATERCOURSES

5.2.1 EPA Objective

- Maintain the integrity, functions and environmental values of watercourses.

5.2.2 Relevant Standards

Protection of the environmental values of lakes and wetlands on the Swan Coastal Plain is addressed in the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*.

5.2.3 Potential Impacts

There are no significant streams in the vicinity of the Tutunup deposit, with drainage from this area tending to enter agricultural drains after following indistinct routes over waterlogged farmland. This drainage eventually discharges to the Abba River.

The topography of the site indicates that diffuse surface flow, if any, will move from the south east towards the north west, that is directly across the minesite.

5.2.4 Management

Any surface water flowing into the upstream side of the minesite will be controlled using earth bunding and directed around the minesite. This will then be allowed to disperse into existing diffuse surface flows on the downstream side of the minesite.

Following mining, the surface topography will be returned to similar levels to the pre-mining situation, allowing diffuse surface water flows to return to the pre-mining state.

Commitment 4.

Install erosion control structures (earth bunds and detention basins) as required around the mining area to control surface water runoff during mining.

5.2.5 Predicted Outcome

There will be no long-term changes to watercourses or surface flows, and the EPA objective will be achieved.

5.3 VEGETATION AND FLORA

5.3.1 EPA Objectives

- Maintain the abundance and diversity of species, and geographic distribution and productivity of vegetation communities.
- Protect Threatened Ecological Communities consistent with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act).
- Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950*, and provisions of the EPBC Act.
- Protect other flora species of conservation significance (eg undescribed taxa, range extensions).

5.3.2 Relevant Standards

Native flora, including Declared Rare Flora are protected under the provisions of the *Wildlife Conservation Act 1950*. Threatened flora and communities are also protected under provisions of the EPBC Act.

5.3.3 Potential Impacts

5.3.3.1 Impacts from mining

The native vegetation in the vicinity of the Tutunup deposit has been extensively cleared for agriculture. The vegetation that will be directly affected by mining consists mostly of introduced pasture and weed species. However, some scattered remnant vegetation is located on Lot 4102, including Priority flora (see Section 3.7.2).

Some of this remnant vegetation, including 2 species of Priority flora, is located within the mine path and infrastructure areas and will be removed during mining (Table 3.2). The Priority Flora to be removed includes approximately 490 *Callothamnus* sp Whicher (P1) and one *Hakea oldfieldii* (P1). Removal of these plants will not significantly change the regional distribution of these species. No Declared Rare or EPBC listed species occur in the mine path or infrastructure areas.

The adjoining State Forest (to the southeast) contains populations of Declared Rare Flora, Priority Flora, and areas of a Threatened Ecological Community (TEC, refer Section 3.7). Some of these species are only known from this location, while others are also present in other areas of remnant vegetation in the general Tutunup area. Disturbance of these restricted species could significantly impact on their regional distribution.

Potential disturbance to this nearby vegetation has been considered in developing this proposal, in particular through groundwater drawdown due to excavation of the mine pit. Potential groundwater drawdown is described in Section 5.1.3.2. The groundwater management strategies outlined result in minimal residual risk of drawdown impacting on this vegetation.

Other potential impact mechanisms considered include spread of dieback fungus and weeds through activities associated with the minesite. Spread of dieback and weeds are closely linked to activity (including existing activities) within and immediately adjacent to the area of interest.

Some of the TEC species are susceptible to dieback and have already been impacted by the presence of the fungus in the adjoining State Forest. Dieback is being controlled in this area by CALM through application of phosphite (Kim Williams, CALM, *pers. com.*). A public road passes along the southeast boundary of the TEC.

The standby direct watering system (see Section 5.1.4.2), if required, could create soil conditions conducive to the spread of the dieback fungus (ie warm, moist soil), particularly if used in summer. The preferred method of application (drip irrigation, see Appendix D) was selected following discussions with CALM (Kim Williams, Bunbury). This system minimises the area of moist soil and hence minimises the potential for further spread of dieback.

There is already the potential for introduction of pasture species from adjoining paddocks. The risk of the mining proposal resulting in further spread of dieback or weeds is considered to be minimal because:

- No mining activities are proposed within the State Forest, and access is not expected for any other production requirement. (Monitoring and/or direct watering may require limited access on foot.)
- No stockpiles will be located adjacent to the forest
- Any surface water flows will move from the forest towards the minesite.

5.3.3.2 Impacts from road upgrading

Between the mine site and the Ludlow Hithergreen Road, two routes are available. These routes are indicated in Figure 5.4 and are:

Route 1

- 1 km east on Oates Rd to Tompsett Road;
- 2.6 km north on Tompsett Rd to Tutunup Rd;
- 5.4 km west on Tutunup Rd to Ludlow-Hithergreen Rd.

Route 2

- 4.6 km west on Oates Rd to Ludlow-Hithergreen Rd (3.9 km south of Route 1).

Both routes have been assessed with regard to road surface upgrade requirements, environmental and social impacts. Cable Sands' preferred route for trucks to haul from the minesite is via Route 1. This route has been chosen following consultation with the Busselton Shire and consideration of potential impacts of upgrade requirements for both routes.

The major issue associated with upgrading is clearing of the roadside vegetation to allow for widening the road to 9 m. This clearing will be minimal in most areas of Route 1 as the existing clearing is approximately 8 m wide. The requirement for clearing along the alternate route would be greater as the existing clearing width along much of Oates Rd is only 6 m, and additional clearing would have the potential to impact on Rare Flora present on the road verges.

Widening of Tompsett Road is required at the intersection with Tutunup Road to address safety requirements for haulage trucks to negotiate the turn. *Chamelaucium roycei* (DRF) is abundant in the Railway Reserve on the southwest corner of this intersection. One *C. roycei* plant has been located on the east side of Tompsett Road.

The upgrading of this intersection will be restricted to the east side of Tompsett Road and a small area on the south-west of the intersection. There is already an area on the south-west of the intersection which does not contain any native vegetation (see Figure 5.3). Disturbance of this one individual would not be regionally significant (refer Table 3.2).

No other Rare Species were recorded along the road verges.

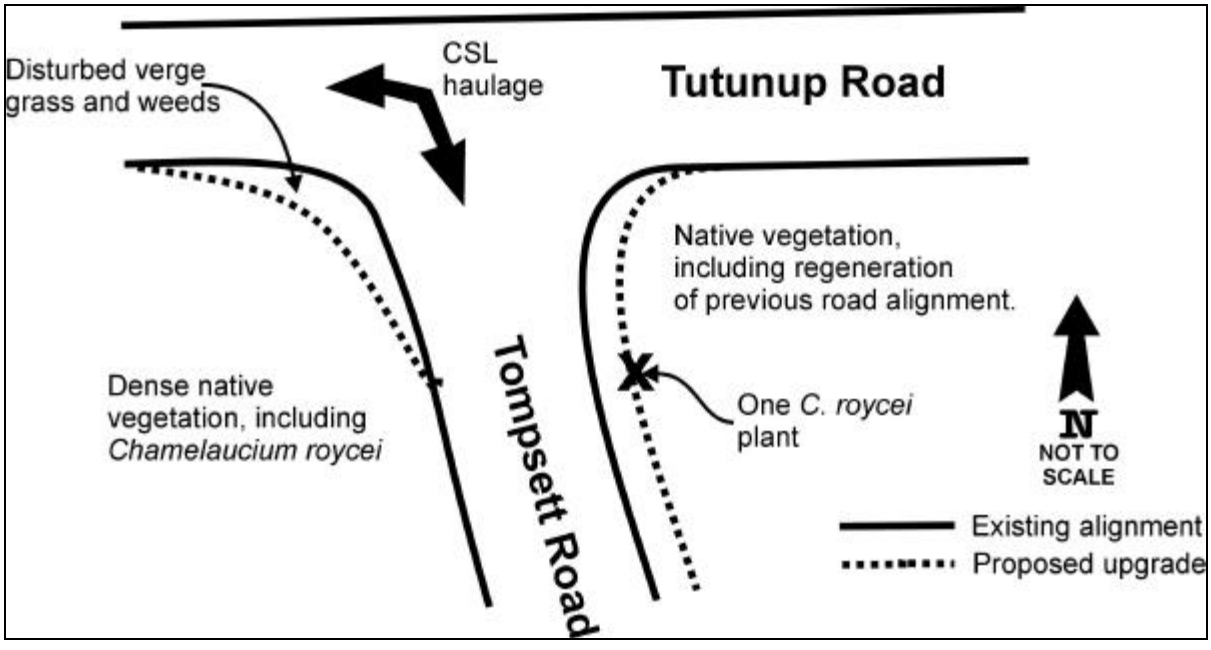


Figure 5.3. Tutunup Road - Tompsett Road intersection.

5.3.4 Management

5.3.4.1 Within mine disturbance area

Due to the existing amount of clearing that has occurred on site there will be no direct impact on native flora over most of the minesite area. Infrastructure and stockpile locations have been selected to minimise impacts on remnant vegetation in Lot 4102.

Clumps of *Callothamnus* sp Whicher have been retained to the east of plant site number 1 and on the eastern side of the tailings dam. The area to the east of the tailings dam also contains many *Calytrix acutifolia* plants.

Areas that are disturbed by mining will be returned to pasture, with shelterbelts as determined in consultation with landowners. Rehabilitation of Lot 4102 will include a buffer of native vegetation along the northern boundary of the State Forest to provide further protection of the TEC from adjacent agricultural activities.

5.3.4.2 Outside mine disturbance area.

Native flora in adjacent State Forest areas will not be directly disturbed by mining activities. The groundwater management strategies outlined in Section 5.1.4.2 and Commitment 2 will protect the State Forest area from impacts associated with drawdown of the superficial groundwater. The direct watering system would only be used as a backup in the event that the artificial recharge system was unable to adequately maintain water levels, and may never be used.

Dust control measures outlined in Section 6.1.4 will also provide protection for flora.

The health of the adjacent threatened ecological community (TEC) will be monitored to ensure that any adverse changes are detected and appropriate actions taken. Preliminary discussions have been held with Nature Conservation Officers from CALM in order to develop a monitoring system which is complementary to that already in place.

During rehabilitation of the site a "buffer zone" of native vegetation will be created along the southern boundary of Lot 4102, providing additional long-term protection of the State Forest from potential agricultural impacts.

5.3.4.3 Road upgrading.

Where possible, the widening of the existing road as part of the upgrade will be restricted to the side where the vegetation is in poor condition. The design of the upgrade will minimise disturbance to the reserve to the northwest of the Oates Rd – Tompsett Rd corner, and to the population of *C. roycei* in the railway reserve on the south side of Tutunup Road.

In consultation with CALM, an attempt will be made to translocate the single *C. roycei* plant located within the road upgrade area at the Tutunup Road – Tompsett Road intersection to a new location within the immediate vicinity. Should any further plants of this species be located following final survey they will also be translocated.

Commitment 5.

Develop a Vegetation Monitoring Programme, in consultation with CALM, to assess the health of the adjacent Threatened Ecological Community.

Commitment 6.

Implement the Vegetation Monitoring Programme developed through Commitment 5.

5.3.5 Predicted Outcome

There will be no significant impact from the proposed mining or road upgrading on the number or regional distribution of DRF, EPBC listed species or Priority Flora. Adjacent vegetation communities will be protected during mining by the management strategies outlined above, and the EPA's objectives will be met.

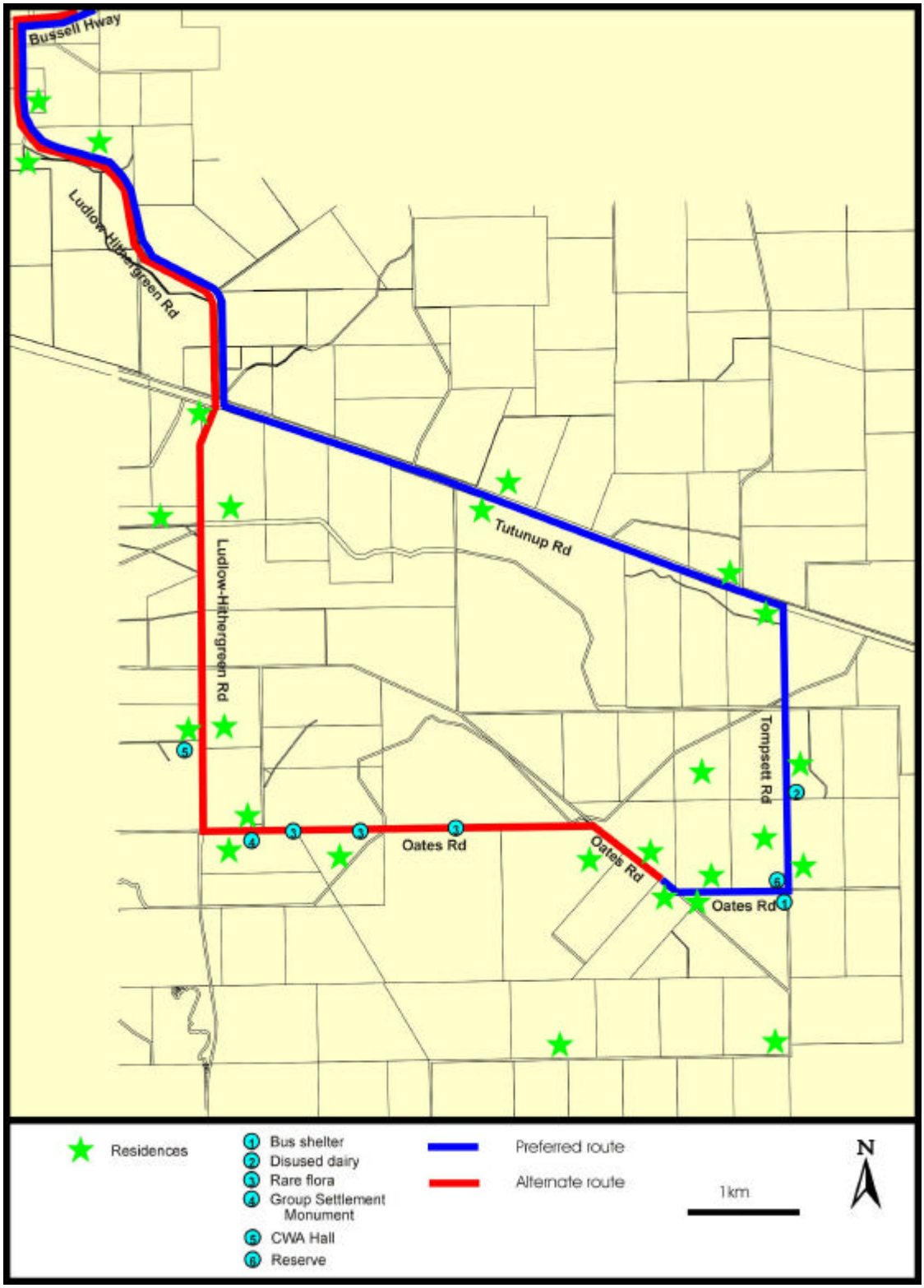


Figure 5.4. Heavy Mineral Concentrate Transport Route Options from proposed Tutunup minesite.

5.4 FAUNA

5.4.1 EPA Objective

- Maintain the abundance, species diversity and geographical distribution of native terrestrial fauna.
- Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*, and provisions of the EPBC Act.

5.4.2 Relevant Standards

Threatened fauna are protected by CALM under the provisions of the *Wildlife Conservation Act 1950* (WC Act). Threatened and migratory fauna are also protected under the provisions of the EPBC Act

5.4.3 Potential Impacts

A search of the EPBC listings found one migratory bird and five threatened species or species habitat likely to occur within the general area:

- *Haliaeetus leucogaster* White-bellied Sea Eagle
- *Calyptorhynchus baudinii* Baudin's Black Cockatoo, Long-billed Black Cockatoo
- *Calyptorhynchus latirostris* Carnaby's Black Cockatoo, Short-billed Black Cockatoo
- *Dasyurus geoffroii* Chuditch, Western Quoll
- *Pseudocheirus occidentalis* Western Ringtail Possum
- *Setonix brachyurus* Quokka

The mining area was surveyed by Hart Simpson and Associates in October 2001, with particular reference to the EPBC listed species and other threatened species (HSA, 2001). The following review is taken from this report.

The site has almost no value for terrestrial fauna species because the few native plants remaining are so scattered. A few species which are tolerant of pasture areas may be present in small numbers (such as some frogs, skinks and snakes), and other species may pass through at times. None of the species tolerant of such degraded areas are of conservation interest because they are common and widespread in such environments. The value of the habitat for the terrestrial species which simply move through occasionally is very small and not significant on a local or regional scale. Although some rare species would be included in this category, such as the Chuditch and Ring-tailed Possum, these species do not need to be considered further because the impact on them is so small.

The bird fauna is dominated by wetland species which require only the presence of water and species which tolerate highly disturbed environments. A few tree-dwelling species are present, but the small species favouring the shrub stratum are largely missing. These include the Thornbills and Fairy-wrens. Some of the smaller species recorded on the site may only be present because of the large area of intact vegetation very close by in the State Forest. They probably feed on the site but are unable to nest there.

All bird species which might occur on the site were considered to identify any rare species which might be present. The following species with some classified conservation status may be present:

- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*). This species is gazetted under the WC Act as a Schedule 1 species which means "Rare or likely to become extinct". This means that it must be given special protection. This species breeds primarily in the northern and eastern parts of its range and tends to move to the coastal belt when not breeding where

it feeds on native shrubs and trees (particularly proteaceous species) as well as pine trees. It is threatened primarily by loss of tree hollows for breeding, particularly in the wheatbelt (Johnstone and Storr, 1998). This species is scarce this far south but would be present at times when feeding. The site is not prime habitat and the birds would not breed on the site.

- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*). This species is gazetted under the WC Act as a Schedule 1 species which means "Rare or likely to become extinct". This means that it must be given special protection. This species is primarily a forest dwelling species which eats the seeds of Marri and other eucalypts. It is not common and has declined greatly due to destruction as a pest in orchards, but appears to be secure since much of its forest habitat is still available as native vegetation. This species would be a regular visitor to the site, but it would not breed because there are no trees large enough.
- The Peregrine Falcon (*Falco peregrinus*). This species is gazetted under Schedule 4 of the WC Act as "In need of special protection". This is a widespread although uncommon species. It is seen occasionally throughout the South-West, but prefers hills, cliffs, river edges and tall trees. This species was previously regarded as threatened by egg-shell thinning due to pesticides, illegal hunting as a pest, and capture for falconry and the cage trade (Kennedy, 1990, Garnett, 1992), but has now been deleted from the latest national Action Plan for Australian birds (Garnett and Crowley, 2000). In Western Australia this species is regarded as uncommon but secure, and it is mainly gazetted to protect it from illegal capture. It could be recorded on the site but only as an occasional visitor when hunting other birds from the taller trees, and would not breed. It is surprisingly tolerant of disturbed environments.
- The Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*). This is a "Priority 3" species listed by CALM, which is defined as "Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna". It is regarded as a nuisance in orchards, and although it has declined it is not endangered in total because much of its habitat is still available. It occurs primarily in the forest country to the east but would make regular use of the site for feeding and was recorded nearby in a similar highly disturbed environment with Marri trees. It would not breed because there are no trees large enough.
- The Square-tailed Kite (*Lophoictinia isura*). This is a "Priority 4" species listed by CALM, defined as "Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands". This species is a scarce but widespread species favouring woodlands and heath. It is most common in the lower South-West in summer (Johnstone and Storr, 1998), but is also recorded more widely (Blakers *et al*. 1984). It would be an occasional visitor to the site considered here, as passing individuals hunting overhead. It is often overlooked or mistaken for similar more common species.

Only two of these species are listed under the EPBC Act. These are the Carnaby's and Baudin's Black-Cockatoos, which are listed as Endangered and Vulnerable respectively.

Two species which may be present (Rainbow Bee-eater which is likely to occur and the Fork-tailed Swift which is less likely, see Storr, 1991) are protected under international treaties and therefore the EPBC Act. Both are migrants, but both are common and widespread in Australia and require no specific management.

The impact of the proposed mining on the two bird species which are Schedule 1 species under state laws and triggers under the EPBC Act is very small and the proposed mining will not have

a significant impact on either of these species on a local or regional scale. On this basis no specific actions are required to manage these species.

5.4.4 Management

No specific management plans are required due to the lack of native fauna utilising the site.

Site boundary fencing and the amount of activity on-site will discourage ingress of kangaroos from the State Forest.

5.4.5 Predicted Outcome

The EPA's objectives will be met.

5.5 LANDFORM

5.5.1 EPA Objective

- Ensure that, as far as is practicable, the post-mining landform is, safe, stable, non-erodible, and is integrated into the surrounding environment.

5.5.2 Relevant Standards

The relevant standard is the EPA objective for this factor.

5.5.3 Potential Impacts

All disturbance areas lie between the 40 m and 46 m contour lines, gently sloping down to the northwest, over a distance of 800-1000 m. Hence, the risk of erosion caused by surface runoff is low because of the gentle slopes.

Post-mining contours, following landform reconstruction and rehabilitation will be similar to the pre-mining environment.

5.5.4 Management

The risk of water erosion will be further reduced by the installation of diversion bunds to prevent surface runoff from affecting disturbed soils within the mining area. These bunds will incorporate sedimentation basins (see Commitment 4 above).

Following mining, landforms will be re-instated which are stable, non-eroding and compatible with the surrounding environment (see Section 2.4.3). Rehabilitation will follow as soon as practical after mining (see 2.4.4). Cable Sands will plant trees for shade, shelter and land stabilisation in the rehabilitated land in a manner consistent with its pre-mining land use as predominantly grazing, and in consultation with the landowners.

Cable Sands has extensive experience in rehabilitation of agricultural land (eg Waroona, Capel, Busselton, Yarloop and Jangardup). In these cases, landforms have been re-developed which are stable and not prone to erosion.

5.5.5 Predicted Outcome

The EPA's objective will be met.

5.6 MINE PLANNING, DECOMMISSIONING & REHABILITATION

5.6.1 EPA Objective

- Ensure that mine planning, decommissioning and rehabilitation are carried out in a planned sequential manner consistent with best practice.
- Ensure ecosystem function is maintained following mine closure.
- Avoid State liability.

5.6.2 Relevant Standards

The *ANZMEC/Minerals Council of Australia Strategic Framework for Mine Closure 2000* is relevant to this factor. The Framework outlines a range of objectives and principles including stakeholder involvement, planning, financial provisioning, implementation, standards and relinquishment (ANZMEC, 2000).

5.6.3 Potential Impacts

Mining will be a temporary change in the land use of the project site. Due to the short term of the project, some of the rehabilitation will occur after the completion of mining to accommodate seasonal requirements.

Rehabilitation will alleviate impacts on factors such as landform, surface water and visual amenity.

5.6.4 Management

Rehabilitation and decommissioning of the site will be managed as outlined in Section 2.4. This section provides details of the strategies to address:

- Mine planning to integrate restoration of landforms, allowing progressive rehabilitation.
- Landform reconstruction including selective placement of substrate materials.
- Separate strategies for areas where adequate topsoil and subsoil is present pre-mining, versus those where caprock is exposed and little or no soil is available.
- Completion criteria for pasture re-establishment, based on pre-mining monitoring of existing pastures.
- Removal of mining infrastructure at the completion of the project. Services such as power and bore may remain according to landowner requirements.

Rehabilitation, decommissioning and closure will be managed through working plans within the site EMP and controlled under the EMS (see Section 4.2).

Completion criteria for groundwater monitoring, and decommissioning of monitoring piezometers and artificial recharge system will be included in the Groundwater Management Plan and Operating Strategy.

The DMPR will hold performance bonds, pending satisfactory completion of rehabilitation and site decommissioning.

Commitment 7.

Include progressive rehabilitation and decommissioning plans within the site Environmental Management Programme.

5.6.5 Predicted Outcome

The mining operation will not change the long-term land use. Mining related infrastructure will be removed at the completion of mining, and the EPA's objectives will be met.

6 Pollution Management

6.1 DUST

6.1.1 EPA Objective

- Ensure that particulate/dust emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or human health problem.

6.1.2 Relevant Standards

At minesites currently operated by Cable Sands the DEP set a licence limit of 1000 $\mu g/m^3$ of total suspended particulates (TSP), when measured as the difference between levels upwind and downwind of the mining operations.

The National Environmental Protection Measure for air quality lists a standard for particulates with an aerodynamic diameter less than 10 μm (PM_{10}) of 50 $\mu g/m^3$ averaged over 1 day. This level should not be exceeded on more than 5 days per year.

6.1.3 Potential Impacts

Experience at other Cable Sands mining operations has shown that problems with dust generation are most likely to occur during the transportation of HMC on internal gravel roads, and during topsoil and overburden stripping campaigns.

Existing dust levels were monitored at surrounding locations in April 2001 using a High Volume Air Sampler (HVA) (Table 6.1). Results were generally low, but did indicate that specific existing activities have the potential to generate elevated dust levels, for example, site 3 was influenced by a road grader operating on the adjacent gravel road.

Dust monitoring undertaken at other Cable Sands minesites indicates that, on average, mining operations contribute around 100 $\mu g/m^3$ to the background dust loading at the minesite boundary. This is less than the measured increase due to the road grader noted above.

Table 6.1. Baseline dust monitoring results, April 2001.

SITE	LOCATION RELATIVE TO PROPOSED MINESITE	SAMPLING PERIOD (HRS)	DUST CONCENTRATION ($\mu g/m^3$)
1	250 m north west	53	95
2	1.5 km south east	64	32
3	200 m north west	49	246

Analysis of mining dust shows that, unlike combustion processes, the abrasive mechanical forces that create particles are unable to create very fine particles, so the fraction of very fine particles emitted during mining is small compared with that associated with particles generated from vehicle exhausts and combustion processes (NSW Minerals Council, undated). Less than 5% of mining dust is comprised of very fine particles ($PM_{2.5}$), and less than 40% is PM_{10}. The very fine particles ($PM_{2.5}$) are the main health concern, while coarser particles (larger than PM_{10}) generally fall out within a few metres or tens of metres from the source.

Neighbouring grape-growers have expressed concerns with dust contamination of their crops in the lead-up to, and during, harvesting (November to May). The closest vineyards to the

proposed minesite are approximately 1.2 km to the southeast and 0.5 km to the northeast, with areas of bushland between both locations and the minesite. Another vineyard is located approximately 0.7 km to the southwest. Analysis of wind data for the Bureau of Meteorology's Jarrahwood site shows:

- Winds are generally less than 10 km/hr.
- Morning prevailing winds are southwesterly in early summer, shifting to southeasterly later in summer.
- Afternoon prevailing winds are southwesterly early in summer, and southwesterly to southeasterly later in summer.
- Strong winds occur less than 10% of the time during summer.
- Strong winds early in the day are south/south-westerly in early summer, shifting to east/south-easterly later in summer.
- Strong winds late in the day are south/south-westerly early in summer, and southerly to northwesterly later in summer.

Given the distance, intervening bushland and prevailing winds, it is unlikely that significant amounts of minesite dust will travel to surrounding vineyards.

6.1.4 Management

The impact of dust from mining sources will be minimised through a "wetting down" dust control programme involving the use of an appropriate water cart on internal, unsealed roads and exposed, active areas during susceptible periods.

Dust generation from other mining sources will be reduced by minimising the areas disturbed, restricting dust generating activities on excessively windy days and rehabilitating as soon as practical after mining has passed. Topsoil stockpiles will be vegetated where possible and clay fines used as a seal on tailings areas to reduce the potential for dust lift off.

Commitment 8.

Control dust generation from the minesite by:

1. Use of a water cart on unsealed internal roads and disturbed areas when required.
2. Stabilising stockpiles as required through the use of fines/sealants/vegetation.
3. Mine planning to keep disturbed areas to a minimum, retain maximum vegetation and rehabilitate as soon as practical following mining.

6.1.5 Predicted Outcome

These steps have proved effective in minimising dust at other Cable Sands minesites. It is not anticipated that there will be any major problems with dust during mining of the Tutunup deposit. The EPA objective will be met.

6.2 NOISE & VIBRATION

6.2.1 EPA Objective

- Protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet statutory requirements and acceptable standards.

6.2.2 Relevant Standards

Noise limits are set out in the *Environmental Protection (Noise) Regulations 1997*. EPA Guidance Note No. 8 provides guidance on the assessment of environmental noise, including identification of potentially significant noise emissions and demonstration of compliance with the Noise Regulations (EPA, 1998a).

6.2.3 Potential Impacts

A survey of background noise was conducted during April 2001 to provide baseline information for the mining operation. This was done using a calibrated noise data logger set up in the open near various residences around the area over a period of 9 days. The sites were chosen to represent residences near the proposed minesite and haulage route. The instrument recorded sound level information over 10 minute intervals.

Whilst the levels were generally low, a significant number of measurements exceeded the corresponding Noise Regulation limits for locations within 15 m of a noise sensitive premises.

Sources of noise included:

- Traffic – light vehicles, heavy traffic (No. 7)
- Machinery – agricultural, pumps, road grader (No. 3)
- Environmental noise – birds, insects, wind in trees etc

Table 6.2. Baseline noise level monitoring results, April 2001.

RESIDENCE NO (REF. FIGURE 6.1)	TIME OF DAY	AVERAGE L_{10} (dB)	AVERAGE L_1 (dB)	MAXIMUM L_{MAX} (dB)	AVERAGE L_{90} (dB)
3	Day	38	49	84	29
	Evening	28	32	63	27
	Night	36	39	81	31
7	Day	44	56	88	32
	Evening	36	43	80	32
	Night	35	43	84	29
9	Day	39	46	81	31
	Evening	38	42	80	34
	Night	35	38	76	31
11	Day	46	54	83	36
	Sunday	39	49	84	30
	Evening	41	45	68	35
	Night	35	39	78	30

Note Day = 7am to 7pm, Monday to Saturday
Sunday = 9am to 7pm, Sunday & public holidays
Evening = 7pm to 10pm, every day
Night = 10pm to 7am, Monday to Saturday, to 9am Sunday & public holidays

6.2.3.1 Construction phase.

The major potential for noise impact is during the "construction phase" (*Environmental Protection (Noise) Regulations, 1997*) before and after productive mining takes place. This involves the removal and return of topsoil and overburden with conventional earth moving equipment (dozers, loaders, trucks, scrapers). At these times the equipment is working at or above normal ground level, and without the benefit of screening stockpiles. During these periods noise levels may, at times, be above levels otherwise specified by the Noise Regulations.

Removal of the ironstone layer overlying the deposit will require ripping with large dozers (eg D11) to break up the rock. Noise and vibration monitoring was conducted during the construction of several small "test pits" to assess the potential for this activity to cause an impact on nearby residents (ABT, 2001).

Noise levels were measured during ripping of the caprock, reversing pass-by, and pushing up of ripped material. Noise levels are presented in Table 6.3, with frequency analysis of the higher levels in Table 6.4. The highest levels were encountered during the hard ripping cycles, and were in the relatively low frequency range. Preliminary calculations indicate that:

- Noise levels will be in the order of 47 dB(A) at a distance of 150 m from the dozer when operating on the caprock surface with no intervening bunds.
- Noise levels will be in the order of 35 dB(A) at a distance of 150 m from the dozer when operating on the caprock surface with an effective barrier of 10 m height.

Table 6.3. Measured noise levels during ripping trials.

NOISE MEASURE	NOISE LEVEL dB(A) FAST	DOZER ACTIVITY
Max Peak	108	Ripping caprock
$L_{Aeq, 60\ secs}$	92	Ripping caprock
$L_{Aeq, Ti}$	80 – 84	Ripping, reversing, other
$L_{Aeq, 30\ mins}$	83	Ripping, reversing, other
$L_{Aeq, 5\ mins}$	82	Ripping, reversing, other

Source: ABT, 2001

Table 6.4. Frequency spectra of highest noise levels - hard ripping of caprock (dB).

MEASUREMENT	125 HZ	250 HZ	500 HZ	1000 HZ
1	109	95	100	93
2	95	93	94	91
3	94	89	94	93
4	99	91	95	89

Source: ABT, 2001

A summary of the vibration monitoring results is presented in Table 6.5. The peak particle velocities (PPV's) measured were low and decreased rapidly with distance from the dozer. When compared to the Australian Standard recommended damage criterion for residential houses (AS:2187:1993, Standards Australia, 1993) of 10 mm/sec, it shows that it is highly unlikely to cause any structural damage to nearby residences.

Analysis of the measured frequencies of vibrations allows calculation of a threshold PPV for human annoyance between 0.2 and 0.4 mm/sec (based on AS 2670:1990 Part 2, Standards Australia, 1990). The results in Table 6.5 indicate that while vibrations may be perceptible at the closest residence (No. 1 in Figure 6.1), ripping is unlikely to cause annoyance. Under the terms of a mining agreement, this residence will be vacant during mining.

Table 6.5. Summary of vibration monitoring of dozer operations.

DISTANCE FROM MONITOR TO DOZER (m)	PEAK PARTICLE VELOCITY (PPV) (mm/sec)			
	DEEP RIPPING CYCLE		TRANSVERSE CROSS RIPPING	
	MAX PPV	MIN PPV	MAX PPV	MIN PPV
26 – 36	2.43	1.61	0.56	0.38
28 – 35	2.00	1.55	N/A	N/A
38 – 45	0.52	<0.1	N/A	N/A
50 – 58	<0.1	<0.1	<0.1	<0.1

Source: ABT, 2001

6.2.3.2 Operating phase

During the operating phase, the major source of noise is from the rotary trommels and loaders. However, being within the pit, this noise does not carry to the same extent as noise generated above ground. HMC separation produces limited noise due to the predominance of electrically driven machinery within the plant.

6.2.4 Management

A Noise Management Plan (NMP) will be developed for Tutunup in consultation with the DEP. A draft of this plan is provided in Appendix E. As is the normal practice with Cable Sands operations, the NMP will include:

- As far as possible, night time earthmoving operations will be restricted to within the pit. Construction activities (eg caprock) ripping will only be carried out during daytime hours.
- Substitution of flashing lights instead of reversing beepers at night time.
- Noise control "at source" eg. fitting of acoustic exhaust mufflers to all Cable Sands' earthmoving machinery working outside daylight hours (as referred to in the *Environmental Protection (Noise) Regulations, 1997*).
- Noise control through mine planning eg. the strategic location of topsoil and overburden stockpiles and fines dams to provide noise-buffering effect.
- Public consultation eg. advising neighbouring residents when construction noise may affect their properties, including the likely duration of these activities.
- Complaint resolution procedures.
- Monitoring requirements.

It is expected that some of the nearby residences will be vacant during mining - No. 1 (under the terms of a mining agreement) and No. 10 (owned by Cable Sands).

Commitment 9.

Develop a Noise Management Plan, in consultation with the DEP addressing:

1. Noise control – mine planning and control at source;
2. Community relations;
3. Complaint resolution procedures; and
4. Monitoring and reporting

Commitment 10.

Implement the Noise Management Plan developed under Commitment 9.

6.2.5 Predicted Outcome

The mining operations will meet statutory noise requirements and the EPA objective will be achieved.

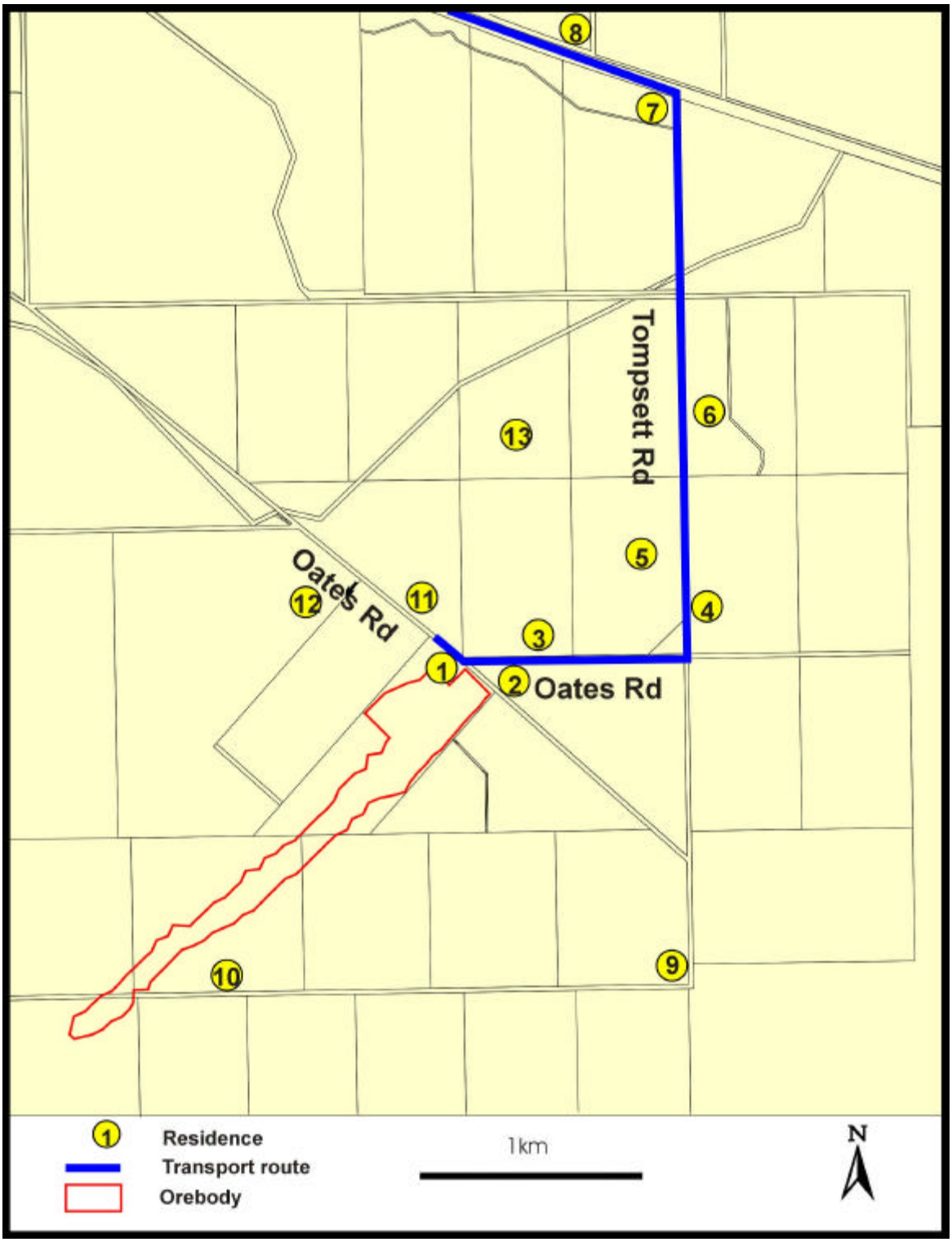


Figure 6.1. Residences in proximity to the proposed Tutunup minesite and HMC haulage route.

6.3 NOISE – ROAD TRANSPORT

6.3.1 EPA Objective

- Ensure that noise and vibration levels meet acceptable standards and that an adequate level of service, safety and public amenity is maintained.

6.3.2 Relevant Standards

The EPA's Draft Guidance for the Assessment of Environmental Factors No. 14, Road and Rail Transportation Noise is relevant to this factor. For proposed increases in road or rail traffic the environmental objectives are:

- that the noise emissions of the vehicles associated with the proposal should comply with "best practice"; and
- that the noise levels inside noise-sensitive premises associated with the proposed traffic should meet acceptable levels. (EPA, 1998b)

6.3.3 Potential Impacts

There are a total of 12 residences located close to the road along the preferred transport route from the minesite to Bussell Highway (see Figure 5.4). Three of the houses along Ludlow-Hithergreen Road, three along Tutunup Road and one at the northern end of Tompsett Road are already exposed to heavy vehicle traffic along these roads. Residents from the northern end of Ludlow-Hithergreen Road have raised concerns with the level of noise and vibration from this existing traffic. Those residents along the southern portion of Tompsett Road (3 homes) and Oates Road (2 homes) are not currently exposed to this traffic.

HMC haulage from the proposed Tutunup minesite will increase the number of truck movements on Ludlow-Hithergreen and Tutunup Roads by an average of 30 to 35% (see Section 7.4.3), from the current 40 per day to around 53 per day.

In addition to general engine noise, some particular characteristic noises have the potential to cause annoyance to residents of homes very close to the road, for example:

- Engine brakes
- Trucks accelerating eg. away from corners.
- Empty truck bodies bouncing over uneven parts of the road
- Inappropriate use of horns

The period of potential impact on residents is limited due to the short mine life of the project (around 25 months).

6.3.4 Management

Transport related noise will be minimised through a range of strategies, many of which also relate to safety aspects discussed in Section 7.4, including:

- Restricting trucking to 6 am to 8 pm Monday to Saturday. This avoids those times of the day when noise is most likely to cause annoyance (at night and on Sundays);
- Voluntary speed restrictions which reduce the need for engine-braking in the approaches to corners (eg at the northern end of Ludlow Hithergreen Road, and the Tutunup Road – Tompsett Road intersection.
- Upgrading of Oates and Tompsett Roads to a sealed standard and contributions to road maintenance for Tutunup and Ludlow-Hithergreen Roads to ensure the surface remains as smooth as possible, thereby reducing vibration and impulsive noise from empty truck bodies.

- Requiring trucking contractors to adequately maintain their vehicles.
- Education of truck drivers
- Community consultation
- Monitoring and reporting of results. Discussions will be held with affected residents with respect to possible monitoring within homes before and during Cable Sands haulage.

These strategies will enable Cable Sands to meet the objectives outlined in the EPA Policy. In addition, most of the contractors truck fleet meet the suggested vehicle specifications for power rating, suspension and noise levels listed in the Policy (EPA, 1998b).

Commitment 11.

Include management of transport noise in Noise Management Plan prepared under Commitment 9.

6.3.5 Predicted Outcome

Noise due to transport from the Tutunup site will be adequately managed to minimise annoyance to residents along the route. Thus the EPA objective will be met.

6.4 GROUNDWATER QUALITY

6.4.1 EPA Objective

- Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the *Australian and New Zealand Water Quality Guidelines* (ANZECC, 2000).

6.4.2 Relevant Standards

Whilst not specifically addressing groundwater quality, the principles outlined in the *Australian and New Zealand Water Quality Guidelines* are relevant to the assessment and management of this factor.

6.4.3 Potential Impacts

Minesite water requirements are detailed in Section 2.2.1, with discussion of potential impacts due to abstraction in Section 5.1.3. No significant impacts are predicted from groundwater abstraction.

Water from the deep Yarragadee bore to be used for mine supplies is of comparable quality to the superficial aquifers (Table 6.6). Mineral separation onsite will not result in any effluent streams with elevated levels of any contaminants. Consequently, any seepage from process water held in surface dams will not impact on the quality of the superficial groundwater.

Assessment of the soil chemistry at Tutunup indicates that there are only low levels of sulphur present, and hence no potential for the generation of acid sulphate soils.

6.4.4 Management

Groundwater quality will be managed through the implementation of the Groundwater Management Plan and Operating Strategy (see Appendix D).

6.4.5 Predicted Outcome

The EPA objective will be achieved.

Table 6.6. Comparison of water quality in Yarragadee and Superficial Aquifers.

PARAMETER	UNITS	YARRAGADEE BORE	SUPERFICIAL AQUIFER
pH	pH Units	6.4	5.6 – 5.9
Electrical Conductivity @ 25ºC	µS/cm	560	240 – 350
Total Dissolved Solids (calc)	mg/L	360	160 – 230
Iron, Fe (soluble)	mg/L	<0.05	2.5 – 9.3
Sodium, Na	mg/L	59	38 – 56
Potassium, K	mg/L	14	3.2 – 8.2
Calcium, Ca	mg/L	17	5.5 – 10
Magnesium, Mg	mg/L	11	3.9 – 5.8
Chloride, Cl	mg/L	100	55 – 90
Carbonate, CO_3	mg/L	<1	<1
Bicarbonate, HCO_3	mg/L	75	25 – 35
Sulphate, SO_4	mg/L	20	<10 – 45
Nitrate, NO_3	mg/L	<0.2	<0.2
Cation/Anion balance	%	4.9	-3.90 – 3.15
Sum of Ions (calc.)	mg/L	297	183 – 225

Data: Yarragadee – URS, 2001a, Superficial – URS, 2001b

6.5 SURFACE WATER QUALITY

6.5.1 EPA Objective

- Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the *Australian and New Zealand Water Quality Guidelines* (ANZECC, 2000).

6.5.2 Relevant Standards

The EPA *Draft Guidance No. 26 Management of Surface Run-off from Industrial and Commercial Sites* is relevant to the assessment and management of this factor. The objective of this guidance statement is to ensure that receiving water bodies are protected from contamination through management of surface runoff. (EPA, 1999)

The principles of the *Australian and New Zealand Water Quality Guidelines* are also relevant. These guidelines provide a guide for setting water quality objectives required to sustain current or likely future environmental values for natural and semi-natural water resources.

6.5.3 Potential Impacts

The risk of contamination of the Abba River, as a result of turbid water being discharged from the mine site into the surrounding environment, is considered to be low because:

- Discharges of water from the minesite will normally only occur as a result of accumulation of excess stormwater following periods of heavy rainfall. Such discharge, if required at all, will be in the form of clear overflow from water storage dams.
- Discharges of water from the minesite are only likely to occur in winter and thus will be highly diluted by contributions from other parts of the catchment.
- Overland flow of any discharges across agricultural pastures will tend to filter out suspended solids and any adsorbed nutrients.

Flocculant will be stored on site and added to the thickener tank to aid settling of the clay fines. Flocculants are ionic polymers (usually polyacrylamide or latex-based) used to coalesce fine particles in suspension, causing them to settle. They usually have a (light) hydrocarbon carrier, and are toxic to aquatic organisms at sufficient concentrations. Advice from NALCO Australia, suppliers of the flocculants, is that:

- Polymer toxicity only relates to free (surplus) polymer, as polymers bound to the surface of particles are not bioavailable.
- Studies by NALCO in conjunction with Curtin University show that bacteria rapidly break down polymers and polymers do not adversely affect plant growth

In order to impact on aquatic organisms, the flocculant would need to be carried to natural water bodies in sufficiently high concentrations. Monitoring conducted at Cable Sands existing sites has not detected any of the hydrocarbon carrier in surrounding waters.

6.5.4 Management

To limit uncontrolled runoff into the mining areas, earth bunds will be constructed to divert any surface flows. These bunds will be integrated with detention basins, which will attenuate surface water flow and reduce sediment loads (see Section 5.2.4).

The process water circuit will be designed to accommodate water from most winter storms within the water storage dam and fines dams. Offsite discharge of excess water will only be required following prolonged or extreme rainfall events.

As occurs at other Cable Sands operations, offsite discharge of water from the mining and processing of mineral sands will be restricted to clear overflow from water storage dams during winter. The water quality and sediment load of any water discharged from the site will be monitored on a daily basis during any period of discharge.

Bulk fuel and oils stored on site will be located in low permeability bunds, designed to contain at least 110% of the storage volume. Procedures are in place under Cable Sands EMS to monitor and maintain the integrity and capacity of storage bunds. Drainage from the vehicle washdown facilities will pass through interceptor traps to remove any hydrocarbon residues before release to the site drainage system.

Flocculant will be stored and mixed in bunded areas. Containment of drainage within the site, as detailed above will also prevent discharge of any significant quantity of flocculant off-site.

A septic system will be installed to Shire of Busselton and Health Department requirements to service the site office and ablutions.

6.5.5 Predicted Outcome

As a consequence of the above management practices, it is considered that there will be negligible affect on the quality and quantity of surface water, and the EPA's objective will be met.

6.6 SOLID WASTE

6.6.1 EPA Objective

- Ensure that wastes are contained and isolated from ground and surface water surrounds and treatment or collection does not result in long-term impacts on the natural environment.

6.6.2 Relevant Standards

The EPA objective provides the assessment standard for this factor.

6.6.3 Potential Impacts

Wastes generated on-site, and their potential to impact on the environment are described in Table 6.7.

Table 6.7. Waste inventory.

WASTE	COMPOSITION	POTENTIAL TO IMPACT
Domestic waste	Office, cribroom waste	May become wind-blown if not contained
Recyclables	Steel, waste oil, tyres, batteries	Require suitable storage and regular removal
Contaminated soil	Soil, hydrocarbons	Potential to leach into groundwater if not contained
Mine tailings	Fresh water, sand	No chemicals are required in the separation process, hence tailings pose no risk through seepage to groundwater. Release of tailings off-site could increase the sediment load of surface water.
Fines	Fresh water, clay, flocculant	Flocculant is rapidly broken down, and carriers have not been detected in groundwater at existing sites (see Section 6.5.3 above). Release of fines off-site could increase the sediment load of surface water.

6.6.4 Management

Domestic and workshop refuse will be collected in bins for disposal at a licensed landfill site. Recyclable materials will be stored in appropriate bins, containers or lay-down areas before removal from site. Any contaminated soil from leaks or spills, or collected from the washdown facility will be stored in drums in designated areas pending disposal off-site to approved facilities.

Tailings and fines dams will be constructed in accordance with DMPR guidelines and managed to minimise risks of wall failures. The site drainage system will be designed to contain any leaks of fines or tailings within the site. Tailings and fines materials will be incorporated into the landform during rehabilitation, and no storage facilities will remain at completion of the project.

6.6.5 Predicted Outcome

The EPA objective will be achieved.

7 Social Environment: Impacts & Management

7.1 ABORIGINAL CULTURE & HERITAGE

7.1.1 EPA Objectives

- Ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*; and
- Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.

7.1.2 Relevant Standards

The assessment standard for Aboriginal heritage is the requirements of the *Aboriginal Heritage Act 1972*. The EPA will give consideration to Aboriginal heritage matters to the extent that they may be affected by impacts of the proposal on the physical or biological surroundings (EPA, 2001).

7.1.3 Potential Impacts

A search of the Department of Indigenous Affairs (DIA) Register of Aboriginal Sites conducted on 10/9/01 found no sites within the project area (DIA, 2001).

Previous communication with the DIA has indicated that the likelihood of sites occurring is usually influenced by factors such as availability of water, access to raw materials (eg. quartz or chert), the presence of prominent features and level of prior disturbance or development of the land. Based on the following, it is unlikely that there are unrecorded sites in the project area:

- High level of disturbance from existing agricultural practices;
- Lack of prominent features;
- Lack of any water courses through the area; and
- Solid, near surface caprock limits the ability to dig or bury material on the site

The existing land use also means that it is unlikely that there are any modern Aboriginal uses of the land which would be compromised by the proposal.

7.1.4 Management

In the event that mining operations unearth skeletal remains or discover Aboriginal sites the Police Department and the DIA will be informed immediately. Operations in the immediate vicinity will cease while the site is investigated.

If any Aboriginal heritage sites are located, they will be avoided where practical. If disturbance of an Aboriginal site is unavoidable, an application to disturb the site will be made to the Aboriginal Cultural Material Committee under Section 18 of the Act.

7.1.5 Predicted Outcome

The EPA's objectives will be achieved.

7.2 REGISTER OF THE NATIONAL ESTATE

7.2.1 EPA Objective

- Comply with statutory requirements in relation to areas of cultural or historical significance.

7.2.2 Relevant Standards

Management of heritage sites is controlled by the *Heritage of Western Australia Act 1990*.

7.2.3 Potential Impacts

A search of the Australian Heritage Commission's Register of the National Estate for the Local Government area of Busselton located 47 records, none of which were in the project area (AHC, 2001).

A similar search of the Heritage Council of WA Register of Heritage places located 182 records in the Shire of Busselton, but none were within the project area (HCWA, 2001).

7.2.4 Management

If any sites of European heritage significance are identified during site development or operation, the Heritage Council, the National Trust and local stakeholders will be consulted prior to disturbance to ensure such sites were evaluated and appropriate management actions developed.

7.2.5 Predicted Outcome

The EPA's objective will be achieved.

7.3 PUBLIC HEALTH AND SAFETY – RADIATION

7.3.1 EPA Objective

- Radiological impacts to the public and the environment are kept as low as reasonably achievable and comply with acceptable standards.
- Ensure that solid wastes are handled and disposed of in an acceptable manner to avoid potential contamination of soil, surface and ground water, and to keep radiological impacts as low as reasonably achievable, by complying with statutory requirements.

7.3.2 Relevant Standards

Management of radioactive materials is managed by the DMPR under Regulation 16.7 of the *Mines Safety and Inspection Regulations 1995*. The DMPR has published a series of Radiation Safety Guidelines to assist in management of radioactive materials.

7.3.3 Potential Impacts

The mineral suite present in titanium mineral deposits generally contains a small quantity of the mineral monazite. At Tutunup this averages less than 1% of the heavy mineral concentrate. The monazite contains Uranium and Thorium, which are radioactive elements.

A pre-mining gamma radiation survey of the southern part of the deposit was completed in January 2001. Results are shown in Figure 7.1 and summarised in Table 7.1. These levels are low and typical of the Swan Coastal Plain and do not represent a safety hazard. Layers of overburden that overlie the mineral deposit naturally insulate and reduce the gamma radiation experienced at ground level.

Table 7.1. Summary of pre-mining gamma radiation survey.

	GAMMA DOSE RATE (mGy/hr IN AIR)
Minimum	0.05
Maximum	0.16
Average	0.09
Standard deviation	0.014

n =267

During primary separation at the minesite, the monazite will follow the heavy mineral stream to the HMC stockpile, for transport to the secondary processing plant in Bunbury. The primary (mine) tailings will have a reduced level of radioactive content.

Secondary (mill) tailings that are returned to the mine pit (see Section 2.1.4) will be of comparable radioactivity to the mined materials. Return of these tailings to the mine pit will not increase the existing surface radiation levels in the area, thus no special management procedures are required.

The small volumes of monazite tailings being returned to the mined areas will be diluted with the mine tailings, resulting in surface radiation levels of the rehabilitated minesite being similar to pre-mining levels.

7.3.4 Management

Cable Sands maintains and implements a *Radiation Management Plan* (RMP), which is reviewed and approved by the DMPR (CSL, 1999). The RMP documents standard radiation management procedures for mining, stockpiling and mineral transport for protection of the environment, public and employee health. Procedures in the plan include:

- Controls to minimise radiation exposures to the workforce – engineered dust control, work procedures, training, spillage management;
- Radiation monitoring programme – environmental, process materials, personnel;
- Waste management;
- Transport of radioactive materials;
- Decommissioning and rehabilitation; and
- Record keeping.

An addendum to the RMP (CSL, 2001) documents procedures and approvals for the disposal of monazite tailings through dilution with mine tailings.

Commitment 12.

Implement the approved Radiation Management Plan at the Tutunup minesite.

7.3.5 Predicted Outcome

Experience with similar mining operations indicates that post-mining gamma radiation levels are likely to be similar to, or below pre-mining levels. Thus, the EPA objective will be met.

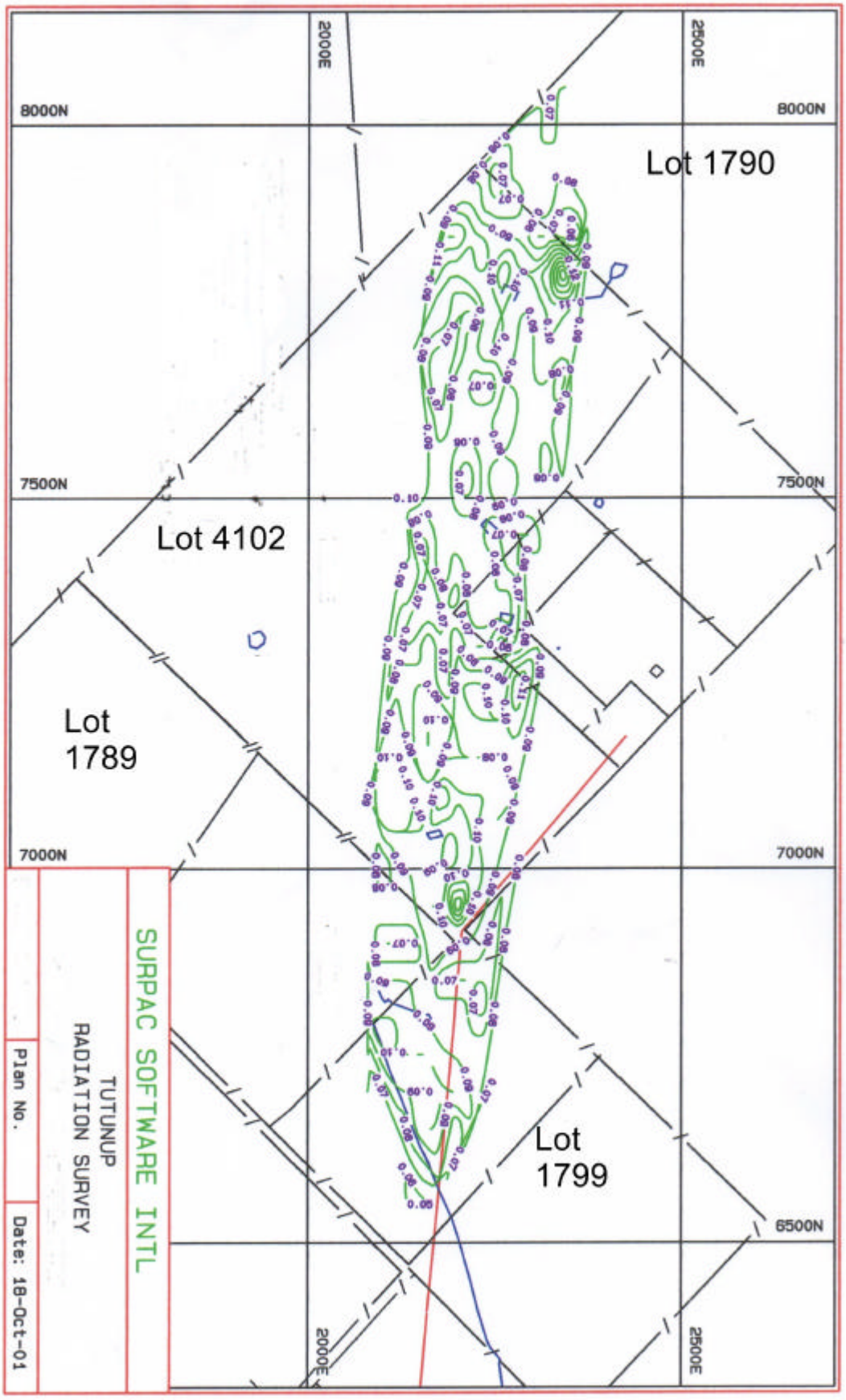


Figure 7.1. Pre-mining gamma radiation survey, January 2001.

7.4 PUBLIC HEALTH AND SAFETY – TRANSPORT

7.4.1 EPA Objective

- Ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and MRWA requirements.

7.4.2 Relevant Standards

Major roads are managed to MRWA standards, while minor roads in the Tutunup area are managed by the Shire of Busselton.

7.4.3 Potential Impacts

Various materials will be transported to and from the Tutunup minesite, the most significant being heavy mineral concentrate.

Trucks used for the transportation of the HMC will be road-trains with a maximum 60 tonne payload. Trucks will be similar to that shown in Plate 7.1. Given this payload, a total of approximately 4,300 return trips between Bunbury and the minesite would be required over the life of the mine.

As per current operations, cartage will be on a batch basis determined by the requirements of the Bunbury processing plant. At estimated production rates and truck payloads there will be an average of around 25 truck movements per day during periods of haulage (approximately half the time) over the 25 months of mine production. This equates to about 13 movements per day averaged over the mining period.

The preferred HMC transportation route is shown in Figure 5.4. Bussell Highway is an acknowledged heavy haulage route managed by Main Roads WA, with road trains requiring extra-mass permits.

Ludlow-Hithergreen and Tutunup Roads are local roads managed by the Shire of Busselton, and currently used for mineral sands haulage using similar road trains. Oates and Tompsett Roads are also managed by the Shire but currently carry much lower volumes of heavy traffic. Approval will be required from the Shire for Cable Sands to haul along these roads.

Discussions with the residents along the Tutunup Rd and Ludlow-Hithergreen Rd sections of the route have raised several concerns, including noise, vibration, livestock crossing and safety associated with extra heavy vehicles travelling past their homes. Estimated increases in road train movements are shown in Table 7.2. Haulage from the Tutunup minesite will increase the number of mineral sands trucks on these roads by an average of around 30%. If other existing heavy truck movements are also considered (eg livestock trucks, milk tankers) then the increase in heavy traffic volume is less than 30%.

Table 7.2. Estimated change in number of road trains hauling HMC along Tutunup and Ludlow Hithergreen Roads.

	AVERAGE NO. TRUCK MOVEMENTS PER DAY	% INCREASE FROM TUTUNUP PROPOSAL
Existing mineral sands haulage	40	-
From proposed Tutunup Minesite	12-14	30-35%

Each truckload of HMC equals two truck movements – one empty truck entering, one loaded truck leaving.

Six houses are located in the Oates Rd/Tompsett Rd section of the preferred route, five of which are close to the road (see Figure 6.1). Issues raised during consultation with these residents included dust, noise, safety with school buses, road drainage and potential injuries to fauna. Haulage noise concerns have been discussed in Section 6.3 above.

Plate 7.1. Truck similar to those to be used for HMC haulage from proposed Tutunup Minesite.

Other transport requirements for the Tutunup minesite have been estimated from similar Cable Sands sites, and include:

- Diesel and oils – deliveries by supplier's truck, average about once per month.
- Flocculant – deliveries by supplier's truck, average about once per month.
- Mill tailings – return of mill tailings for backfill into the mine pit (see Section 2.1.4) will be delivered by HMC haulage trucks and will not result in any additional traffic.
- Contractors equipment – delivery and removal of contractors earthmoving equipment on an irregular basis, depending on site activities.
- Site infrastructure – delivery of plant, equipment and transportable offices during development of the site and removal during decommissioning.
- Light vehicles associated with employees and contractors travelling to and from site, and daily courier deliveries of small stores items.

All of the larger vehicles will travel on the same route as the HMC trucks from Bussell Highway to the minesite.

7.4.4 Management

Upgrading of the preferred route between the minesite and Tutunup Rd will be required to make it suitable for roadtrains and two-way operation. Along Oates Rd and the southern part of Tompsett Rd this will include widening and sealing. The northern 0.85 km section of Tompsett Rd will require more substantial upgrading to raise the road level through a low-lying area and manage drainage. An existing concrete plank bridge may require widening to allow two-way traffic flow.

Management to minimise or reduce transport impacts includes:

- Sealing of the Oates Rd and Tompsett Rd sections of the route will eliminate concerns with dust, and significantly reduce concerns with noise and road maintenance.

- Restricting hours of transport to 6am to 8pm Monday to Saturday.
- Speed restrictions along Oates Rd, Tompsett Rd and Ludlow-Hithergreen Rd sections of route, where most of the access points to the residences are located.
- Awareness training for truck drivers on the school bus routes and stopping places, and avoiding truck movements during these times.

Commitment 13.

Manage transport impacts through:

1. Upgrading Oates Rd and Tompsett Rd sections of the haulage route to a sealed standard.
2. Restricting hours of transport to 6am to 8pm Monday to Saturday.
3. Applying voluntary speed restrictions along Oates Rd, Tompsett Rd and Ludlow-Hithergreen Rd sections of route.
4. Providing awareness training for truck drivers on the school bus routes and stopping places, and avoiding truck movements during these times.

7.4.5 Predicted Outcome

The project will result in upgrading of Oates and Tompsett Roads, providing an ongoing benefit to residents of these areas. While some residents may notice a short term increase in heavy vehicle traffic, the strategies outlined above will ensure an adequate level of service and safety will be maintained. Thus the EPA objective will be met.

7.5 VISUAL AMENITY

7.5.1 EPA Objective

- Visual amenity of the areas adjacent to the project should not be unduly affected by the proposal.

7.5.2 Relevant Standards

The assessment standard for this factor is the EPA objective.

7.5.3 Potential Impacts

The mining operation is located some distance from significant transport and tourist routes, the nearest being Vasse Highway about 5 km to the south west and Bussell Highway about 10 km to the north west. Hence the mining operations will not affect the visual amenity as viewed from these roads.

The minesite may be visible from 5 nearby residences, mainly along Oates Rd (Nos. 1, 2, 10, 11 & 12 in Figure 6.1), but at least 2 of these will be vacant during mining (Nos. 1 & 10). All others are effectively screened by existing intervening bushland. Views from the three occupied residences towards the proposed mine area are shown in the following photographs.

This photograph shows the view from the bend in Oates Road, immediately north of Residence No. 12 (visible in trees on RHS). This residence is currently vacant and may remain so during mining. The minesite will be located at the base of the Whicher Scarp (visible in the background). An overburden stockpile and tailings/fines dams will be visible from this location across the open paddocks.

Plate 7.2. View from Oates Rd south towards proposed mine area.

This photograph shows the current view from the entrance to Residence No. 11 from Oates Road (behind photographer). The house itself is screened from the road by trees and shrubs. An overburden stockpile will be visible in the middle ground, in front of the row of trees.

Plate 7.3. View from entrance to Lot 1778, SSW towards proposed mine area.

This photograph shows the current view from the entrance to Residence No. 2 from Oates Road (to left of photographer). A topsoil stockpile will be visible in the middle ground, behind the row of trees. Residence No. 1 is visible on RHS behind trees.

Plate 7.4. View from entrance to Lot 1785, east towards proposed mine area.

The plant sites will be effectively screened from occupied residences by intervening stockpiles, minimising the chance of light spill during night time operations.

7.5.4 Management

Existing vegetation will be maintained wherever possible to help screen neighbouring residences from the mining operations. Topsoil stockpiles will be vegetated where possible, which will assist in blending with the existing pastures.

Lighting will be positioned to reduce light spill towards neighbouring residences.

Rehabilitation will return the landscape to similar to that existing prior to mining.

Commitment 14.

Minimise the visual impact of the minesite on nearby residents through:

1. Retaining existing vegetation where possible to screen the minesite.
2. Vegetating topsoil stockpiles where possible to blend with landscape.
3. Directing lights to minimise light spill to neighbouring residences.

7.5.5 Predicted Outcome

The short term nature of the operation, removal of all infrastructure at the conclusion of mining, and return of the ground surface to similar levels to the pre-mining state, mean that there will be no long term impact on the visual amenity of the area. Thus, the EPA objective will be achieved.

7.6 COMMUNITY CONSULTATION

Commercial agreements have been negotiated with two of the four owners of the properties directly affected by the mining operations, and are being finalised with the remaining two. Cable Sands has purchased Lot 4102.

Individual discussions have been held with residents of neighbouring properties (No.s 1, 2, 3, 9 and 11 in Figure 6.1) and along the preferred transport route (No.s 4-8, 13, and along Tutunup and Ludlow-Hithergreen Roads). These residents were provided with an information package in October 2000, giving details of the proposed mine and transport route. Issues discussed included:

- Noise – from both mining and transport operations. This issue and its management is discussed in Sections 6.2 and 6.3.
- Dust – from both mining and transport operations. Discussions included the possibility of dust being deposited on grapes as harvest time. Impacts and management of dust from mining are discussed in Section 6.1. Subsequently, a decision has been made to upgrade Oates and Tompsett Roads to a sealed standard, avoiding earlier concerns with dust from a gravel road.
- Traffic – impacts and management of this issue are discussed in Section 7.4. Potential impacts on native fauna were also discussed.
- Domestic and horticultural bores – homes and vineyards adjacent to the proposed mine will have their bores tested for quality, quantity and pressure. This will assist in determining the current water supply situation for each household and facilitate a commitment to maintaining a suitable supply during and after mining. Further detail is provided in Section 5.1.
- Power supply – some residents were concerned that mining operations would increase the existing problem with power surges. Similar complaints from residents of rural areas near other Cable Sands sites have been investigated by Western Power, and found not to be

related to minesite operations. A new 3-phase supply will be constructed for the mining operations (refer Section 2.2.2)

- Mine methodology – information on the timing and scale of dry mining operations was provided to the residents. Their response was cautious but favourable provided there were no ongoing extensions to the proposal.

Discussions have also been held with representatives of the Shire of Busselton including:

- Evelyn Brand – East Rural Ward Councillor
- Jon Bettink – Director, Technical Services
- Rob Paull – Director, Planning and Building Services
- Tim Koroveshi – Manager, Strategic Planning
- Aaron Bell – Planning Officer
- Kirrily White – Environmental Officer

The issues discussed have included:

- Road upgrade requirements
- Residents concerns with traffic
- Environmental assessment of potential impacts on DRF
- Council planning for gravel pits on Tompsett Rd and potential landfill sites.

Ongoing discussions have also been held with representatives of CALM (Bunbury, Busselton and Perth Offices) and WRC (Bunbury and Perth Offices) regarding protection of the adjacent TEC, assessment of groundwater modelling and proposed management.

8 Environmental Management Commitments

Cable Sands is committed to manage impacts associated with the proposal so that there will be no net adverse impact on the environment. Commitments relating to the biophysical environment, pollution management and social surroundings are summarised in Table 8.1 following.

Table 8.1. Proponent's Environmental Management Commitments – Tutunup Titanium Minerals Mine.

TOPIC	ACTIONS	OBJECTIVES	TIMING	ADVICE FROM
Environmental Management	1 Develop an Environmental Management Program for the Tutunup minesite. Among other issues the EMP will address: 1. Groundwater management 2. Noise management 3. Dust management 4. Transport management 5. Site rehabilitation 6. Decommissioning and closure	Provide a systematic framework for environmental management at the Tutunup minesite consistent with the Cable Sands Environmental Policy	Before mining	
Groundwater	2. Develop a Groundwater Management Plan and Operating Strategy to address: 1. Yarragadee abstraction and monitoring 2. Superficial aquifer artificial recharge system design and implementation 3. Monitoring of superficial groundwater in vicinity of Threatened Ecological Community 4. Monitoring of groundwater levels in other areas surrounding Tutunup project. 5. Actions to be taken in the event that adverse changes in groundwater levels or quality are detected.	To have no discernible impact on groundwater quality or quantity.	Before mining.	WRC
	3. Implement the Groundwater Management Plan and Operating Strategy referred to in Commitment 2	Achieve the objectives of Commitment 2.	Before and during mining.	WRC
Surface water	4. Install erosion control structures (earth bunds and detention basins) as required around the mining area to control surface water runoff during mining.	To have no discernible impact on surface water quantity or quality.	Before mining	WRC
Vegetation	5. Develop a Vegetation Monitoring Programme, in consultation with CALM, to assess the health of the adjacent Threatened Ecological Community.	To maintain the abundance and distribution of pre-mining vegetation	Before mining	CALM
	6. Implement the Vegetation Monitoring Programme developed through Commitment 5.	Achieve the objectives of Commitment 5	Before, during and after mining	CALM

TOPIC	ACTIONS	OBJECTIVES	TIMING	ADVICE FROM
Mine planning, rehabilitation & decommissioning	7 Include progressive rehabilitation and decommissioning plans within the site Environmental Management Programme.	To rehabilitate site to agreed agricultural land use.	Before, during and after mining	DMPR
Dust	8. Control dust generation from the minesite by: 1. Use of a water cart on unsealed internal roads and disturbed areas when required. 2. Stabilising stockpiles as required through the use of fines/sealants/vegetation. 3. Mine planning to keep disturbed areas to a minimum, retain maximum vegetation and rehabilitate as soon as practical following mining.	To minimise dust impacts associated with earthmoving, stockpiling and rehabilitation	Before, during and after mining	
Noise	9. Develop a Noise Management Plan, in consultation with the DEP addressing: 1. Noise control – mine planning and control at source; 2. Community relations; 3. Complaint resolution procedures; and 4. Monitoring and reporting	To minimise noise impacts on neighbouring properties. To comply with statutory noise requirements.	Before mining	
	10. Implement the Noise Management Plan developed under Commitment 9.	Achieve the objectives of Commitment 9.	During mining	
	11 Include management of transport noise in Noise Management Plan prepared under Commitment 9	To minimise noise impacts on residents along transport route.	During mining	
Public Health & Safety – Radiation	12. Implement the approved Radiation Management Plan at the Tutunup minesite.	To keep post-mining surface radiation similar to pre-mining levels.	Before, during and after mining	DMPR
Public Health & Safety – Transport	13. Manage transport impacts through: 1. Upgrading Oates Rd and Tompsett Rd sections of the haulage route to a sealed standard. 2. Restricting hours of transport to 6am to 8pm Monday to Saturday. 3. Applying voluntary speed restrictions along Oates Rd, Tompsett Rd and Ludlow-Hithergreen Rd sections of route. 4. Providing awareness training for truck drivers on the school bus routes and stopping places, and avoiding truck movements during these times.	To minimise transport impacts on residents adjoining transport route	During mining	Shire
Visual amenity	14. Minimise the visual impact of the minesite on nearby residents through: 1. Retaining existing vegetation where possible to screen the minesite. 2. Vegetating topsoil stockpiles where possible to blend with landscape. 3. Directing lights to minimise light spill to neighbouring residences.	To reduce the visual impact of the minesite	During mining	

DMPR = Department of Mineral and Petroleum Resources
Shire = Shire of Busselton
WRC = Water and Rivers Commission
AgWA = Agriculture Western Australia
CALM = Department of Conservation and Land Management
DEP = Department of Environmental Protection

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Appendix A

EPA GUIDELINES FOR PER

Environmental Protection Authority
Guidelines for preparation of a PER

TUTUNUP TITANIUM MINERALS MINE, 14 KM SOUTH OF CAPEL, WESTERN AUSTRALIA

(CABLE SANDS (WA) PTY LTD)

(WA EPA Assessment Number 1384)

1. **Overview**
2. **Objectives of the environmental review**
3. **Preparation of the environmental review document**
4. **Contents of the environmental review document**
5. **Public consultation**
6. **Other information**

These guidelines are provided for the preparation of the proponent's environmental review document. The specific environmental factors to be addressed are identified in Section 4.2.

The environmental review document must address all elements of these guidelines prior to approval being given to commence the public review.

The environmental review document must also address any requirements of the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999.*

The EPA expects the proponent to fully consult with interested members of the public and relevant stakeholders, and to take due care in ensuring any other relevant environmental factors, which may be of interest to the public and stakeholders, are addressed. The environmental review should document the results of all consultation undertaken.

Guidelines for the preparation of the PER document

1. Overview

All environmental reviews have the objective of protecting the environment. Environmental impact assessment is deliberately a public process in order to obtain broad ranging advice. The review requires the proponent to:

- describe the proposal;
- describe the receiving environment;
- outline the potential impacts of the proposal on factors of the environment;
- identify the proposed management strategies to ensure those environmental factors are appropriately protected; and
- demonstrate that the proposal should be judged by the EPA to be environmentally acceptable.

Throughout the assessment process it is the objective of the Environmental Protection Authority (EPA) to help the proponent to design the proposal to improve the protection to the environment. The Department of Environmental Protection (DEP) administers the environmental impact assessment process on behalf of the EPA.

The primary purpose of the environmental review is to provide information to the EPA and the public on the proposal within the local and regional framework, with the aim of emphasising how the proposal may impact the relevant environmental factors and how those impacts may be mitigated and managed so as to be environmentally acceptable.

The language used in the body of the environmental review should be kept simple and concise, considering the audience includes non-technical people, and any extensive, technical detail should either be referenced or appended to the environmental review. The environmental review will form the legal basis of the Minister for the Environment and Heritage's approval of the proposal and therefore the environmental review should include a description of all the main and ancillary components of the proposal.

Information used to reach conclusions should be properly referenced, including personal communications. Such information should not be misleading or presented in a way that could be construed to mislead readers. Assessments of the significance of an impact should be soundly based rather than unsubstantiated opinion, and each assessment should lead to a discussion of the management of the environmental factor.

2. Objectives of the environmental review

The objectives of the environmental review are to:

- place this proposal in the context of the local and regional environment;
- adequately describe all components of the proposal, so that the Minister for the Environment and Heritage can consider approval of a well-defined project;
- provide the basis of the proponent's environmental management program, which shows that the environmental impacts resulting from the proposal, including cumulative impact, can be acceptably managed;
- communicate clearly with the public (including government agencies), so that the EPA can obtain informed public comment to assist in providing advice to government; and
- provide a document which clearly sets out the reasons why the proposal should be judged by the EPA to be environmentally acceptable.

3. Preparation of the environmental review document

Proponents are encouraged to maintain close contact with the DEP/EPA officer during the preparation of the environmental review. The environmental review should be provided to the DEP/EPA officer for comment. At this stage the document should have all figures produced in the final format and colours.

The proponent and DEP/EPA officer/Manager should agree on the time to be taken to review the draft, taking into account the level of consultation during the environmental review preparation, DEP/EPA officer's availability and the need for external review. Revision of the document may be requested to ensure that it addresses all topics and issues in these guidelines, can be read by the educated lay-person, contains no significant error of science and meets the required format.

When the EPA is satisfied with the standard of the environmental review document it will provide a written sign-off to the proponent, giving approval to advertise the document for public review. The review document may not be advertised for release before written approval is received.

Following approval to release the review for public comment, the final environmental review document should also be provided to the DEP/EPA project officer as an electronic copy, in PC Microsoft Word 2000 format, and any scanned figures. Where possible, these figures should be legible and meaningful in a black and white format.

4. Contents of the environmental review document

The environmental review document should include an executive summary, introduction and at least the following:

4.1 The proposal

General requirements

The environmental review document should provide a comprehensive description of the proposal including its location (address and certificate of title details where relevant). Specific matters requiring attention are:

- justification and objectives for the proposed development;
- the legal framework, including existing zoning and environmental approvals, and decision making authorities and involved agencies; and
- consideration of alternative options.

Brief description of the proposal which is the subject of these guidelines

Cable Sands (WA) Pty Ltd proposes to develop a mineral sands mine at Tutunup, located approximately 20 kilometres east of Busselton and 14 kilometres south of Capel. The proposal involves:

- disturbance of 110 hectares of mainly cleared agricultural land within Mining Lease 70/1070;
- mining, using dry mining techniques, for a period of 15 to 20 months, at an average rate of 1.5 million tonnes per annum;
- production of heavy mineral concentrate (HMC) at the approximate rate of 170,000 to 230,000 tonnes per annum;
- construction of fines dams and a water dam, and topsoil, tails and overburden stockpiles;
- abstraction of groundwater for process use from the Yarragadee aquifer; and
- haulage of the HMC in road-trains (carrying a maximum of 60 tonnes per truck) to the proponent's North Shore facility in Bunbury.

Key characteristics of the proposal

The Minister's statement will bind the proponent to implementing the proposal in accordance with any technical specifications and key characteristics[1] in the environmental review document. It is important therefore, that the level of technical detail in the environmental review, while sufficient for environmental assessment, does not bind the proponent in areas where the project is likely to change in ways that have no environmental significance.

Include a description of the components of the proposal, including the nature and extent of works proposed. This information must be summarised in the form of a table, an example of which follows:

Table 1: Key characteristics (example only)

Element	Description
Life of project (mine production)	< 5 yrs (continual operation)
Size of ore body	682 000 tonnes (upper limit)
Depth of mine pit	less than 30m
Water table depth	50m below ground surface
Area of disturbance (including access)	100 hectares
Mine operation	Daylight hours only, Monday to Friday
List of major components • pit • waste dump • infrastructure (water supply, roads, etc)	refer 'Plans, specifications, charts' section immediately below for details of map requirements
Ore mining rate • maximum	 • 200,000 tonnes per year
Solid waste materials • maximum	 • 800,000 tonnes per year
Water supply • source • maximum hourly requirement • maximum annual requirement	 • XYZ borefield, ABC aquifer • 180 cubic metres • 1 000 000 cubic metres
Fuel storage capacity and quantity used	litres; litres per year

Plans, specifications, charts

Provide adequately dimensioned plans showing clearly the location and elements of the proposal that are significant from the point of view of environmental protection. Locate and show dimensions (for progressive stages of development, if relevant) of plant, amenities buildings, access ways, stockpile areas, dredge areas, waste product disposal and treatment areas, all dams and water storage areas, mining areas, storage areas including fuel storage, landscaped areas etc.

Only those elements of plans, specifications and charts that are significant from the point of view of environmental protection are of relevance here.

Always include:

- a map showing the proposal in the local context - an overlay of the proposal on a base map of the main environmental constraints;

[1] Changes to the key characteristics of the proposal following final approval would require assessment of the change and can be treated as non-substantial and approved by the Minister, if the environmental impacts are not significant. If the change is significant, it would require assessment under section 38 or section 46. Changes to other aspects of the proposal are generally inconsequential and can be implemented without further assessment. It is prudent to consult with the Department of Environmental Protection about changes to the proposal.

- a map showing the proposal in the regional context; and, if appropriate,
- a process chart / mass balance diagram showing inputs, outputs and waste streams.

The plan/s should include contours, north arrow, scale bar, legend, grid coordinates, the source of the data, and a title. The dates of any aerial photos should be shown.

Other logistics

- timing and staging of project; and
- ownership and liability for waste during transport, disposal operations and long-term disposal (where appropriate to the proposal).

4.2 Environmental factors

The environmental review should focus on the relevant environmental factors for the proposal, and these should be agreed in consultation with the EPA and DEP and relevant public and government agencies.

At this preliminary stage, the EPA believes the specific relevant environmental factors, objectives and work required for this proposal are as detailed in the table below.

CONTENT	SCOPE OF WORK	
Factor	**EPA objective(s)**	**Work required for the environmental review**
BIOPHYSICAL		
Vegetation communities	Maintain the abundance and diversity of species, and geographic distribution and productivity of vegetation communities. Protect Threatened Ecological Communities consistent with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act).	Identification of the abundance, species diversity and geographic distribution of vegetation communities in the project area. Assessment of the potential impacts (direct and indirect) of the proposal on vegetation communities within and adjacent to the project area, in particular, the adjacent Busselton Wet Ironstone Community, listed as the Endangered Ecological Community 'Shrublands on the southern Swan Coastal Plain ironstones' under the EPBC Act. The impacts assessed should include those associated with weed invasion, dieback fungus and changes to hydrology. Analyse the significance of these potential impacts at a local and regional level. Proposed measures to manage and/or mitigate impacts, including a detailed discussion of the proposed Artificial Storage Recovery method. *(Refer also to EPA Position Statement No. 2, Environmental Protection of Native Vegetation in Western Australia.)*

CONTENT	SCOPE OF WORK	
Factor	**EPA objective(s)**	**Work required for the environmental review**
Declared Rare Flora (DRF), Priority flora and other flora of conservation significance	Protect Declared Rare Flora consistent with the provisions of the *Wildlife Conservation Act 1950,* and listed threatened flora species consistent with the provisions of the EPBC Act. Protect other flora species of conservation significance (e.g. undescribed taxa, range extensions).	Baseline studies, at appropriate seasons, to identify DRF, Priority Flora, EPBC Act-listed flora species or other flora of conservation significance (including location and number of individuals), particularly of the DRF *Grevillea elongata*, *Chamelaucium roycei, Darwinia* sp. *Williamson, Grevillea maccutcheonii* (all of which are listed under the EPBC Act), *Lambertia echinata* subsp.*occidentalis*, *Brachysema papilio*, *Petrophile latericola* ms *Dryandra nivea* subsp. *uliginosa*, *Dryandra squarrosa* subsp. *argillacea* and, Priority 1 *Calothamnus* sp *Whicher*. Assessment of potential impacts (direct, and indirect such as hydrological change) on such species as a result of mining activities and infrastructure development. Analysis of the significance of these potential impacts at a regional level. Consultation with the Department of Conservation and Land Management on impacts to, and management of, DRF, Priority flora, other flora of conservation significance, and Threatened Ecological Communities. Proposed measures to manage and/or mitigate impacts.
Native terrestrial fauna	Maintain the abundance, species diversity and geographical distribution of native terrestrial fauna.	Baseline studies to identify existing native terrestrial fauna throughout the Project Area. Assessment of potential impacts (direct and indirect) on native terrestrial fauna, including impacts on fauna habitat, as a result of mining and associated activities. Analysis of the significance of these potential impacts at a regional level. Proposed measures to manage and/or mitigate impacts including identification of proposed fauna translocation areas if required.
Terrestrial fauna — Specially Protected (Threatened) Fauna	Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act 1950*, and provisions of the EPBC Act.	Baseline studies to identify Specially Protected (Threatened) Fauna that may be found within the Project Area, including species under EPBC Act. Assessment of potential impacts (direct and indirect) on terrestrial fauna as a result of mining and associated activities. Analysis of the significance of these potential impacts at a regional level. Consultation with the Department of Conservation and Land Management on any impacts to, and management of, threatened fauna species. Proposed measures to manage and/or mitigate impacts.
Watercourses	Maintain the integrity, functions and environmental values of watercourses.	Identify watercourses, surface lakes and types of surface water flow throughout the areas to be affected by the project. Assessment of the potential impacts on any lakes, surface water flow rates, drainage patterns, sediment transport, and riparian vegetation and any dependent vegetation as a result of mining, processing and project infrastructure. Proposed measures to manage and/or mitigate impacts.

CONTENT	SCOPE OF WORK	
Factor	**EPA objective(s)**	**Work required for the environmental review**
Groundwater quantity	Ensure that the beneficial uses of groundwater can be maintained.	Details and justification of water requirements for mining, processing, and other associated operations. Details of the hydrogeological systems of affected areas, existing and potential future uses of groundwater, and groundwater dependent environmental systems, particularly the adjacent Busselton Wet Ironstone Community, listed as the Endangered Ecological Community 'Shrublands on the southern Swan Coastal Plain ironstones' under the EPBC Act. Assessment of implications of planned abstraction on groundwater systems, existing and potential future uses of groundwater, and any groundwater dependent environmental systems. Also address the potential for water recyling. Consultation with the Water and Rivers Commission regarding groundwater allocation in the area and effects of groundwater drawdown from the proposal. Proposed measures to manage and/or mitigate impacts, including any drawdown associated with the mine pit and over-abstraction.
Mine planning, decommissioning and rehabilitation	Ensure that mine planning, decommissioning and rehabilitation are carried out in a planned sequential manner consistent with best practice. Ensure ecosystem function is maintained following mine closure. Avoid State liability.	Present, as part of the review document: • an integrated mining, decommissioning, and rehabilitation strategy (which includes progressive rehabilitation of disturbed areas); • a close-out strategy to ensure ecosystem function will be maintained following project closure; and • appropriate final land uses for all areas affected by the proposal. *(Refer to ANZMEC/Minerals Council of Australia Strategic Framework for Mine Closure, 2000.)*
Landform	Ensure that, as far as is practicable, the post-mining landform is, safe, stable, non-erodible, and is integrated into the surrounding environment.	Assessment of potential impacts of the proposal on existing landforms, including from erosion. Evaluation of the landscape values in the project area and how these will be affected by the proposal and any measures to manage such impacts. Details of measures proposed to rehabilitate the impacted areas to an acceptable standard, and that will integrate the post-mining landform with the surrounding environment.
POLLUTION MANAGEMENT		
Particulates / Dust	Ensure that particulate/dust emissions, both individually and cumulatively, meet appropriate criteria and do not cause an environmental or human health problem.	Identification of sources of particulates/dust and estimates of project-wide emissions. Analysis of the significance of these emissions with regard to human health and environmental impacts, in particular, impacts on vegetation. Proposed measures to manage and/or mitigate impacts. *(Refer also to the Air Quality and Air Pollution Modelling Guidelines contained in Attachment 5.)*

CONTENT	SCOPE OF WORK	
Factor	**EPA objective(s)**	**Work required for the environmental review**
Noise	Protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet statutory requirements and acceptable standards.	Estimation of the potential increase in noise resulting from the construction and operation of the mine and separation plant. Comparison of the estimates with relevant standards and limits set out in the *Environmental Protection (Noise) Regulations 1997*. Proposed measures to manage and/or mitigate impacts.
Noise — road transport	Ensure that noise and vibration levels meet acceptable standards and that an adequate level of service, safety and public amenity is maintained.	Estimation of the noise and vibration levels at sensitive premises arising from road/rail transport. In consultation with the DEP, establish best practicable measures to manage and/or mitigate noise emissions. Proposed measures to manage and/or mitigate impacts. *(Refer to EPA Draft Guidance for the Assessment of Environmental Factors No. 14, Road and Rail Transportation Noise.)*
Groundwater quality	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the *Australian and New Zealand Water Quality Guidelines* (ANZECC, 2000).	Describe water requirements for any on-site processing and mine operations. Describe baseline monitoring of bores, licensing requirements, drainage and fate of water used in any on-site processing and mine operations. Assessment of impact from any change in groundwater quality, including acid sulphate soils, on the surrounding environment. Assessment of potential impacts on other users of the groundwater resource. Proposed measures to manage and/or mitigate impacts, including over-abstraction.
Surface water quality	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the *Australian and New Zealand Water Quality Guidelines* (ANZECC, 2000).	Details of site drainage, hydrocarbon use, disposal of plant site waste (including sewage), dewatering, and fate of water used/pumped. Assessment of the implications the proposal may have on local surface water quality, in particular Abba River. Proposed measures to manage and/or mitigate impacts. *(Refer to EPA Draft Guidance for the Assessment of Environmental Factors No. 26, Management of Surface Run-off from Industrial and Commercial Sites.)*
Solid waste	Ensure that wastes are contained and isolated from ground and surface water surrounds and treatment or collection does not result in long-term impacts on the natural environment.	Detail of the composition and storage of all solid wastes, in particular, any tailings streams from the separation plant. Assessment of the implications this may have on groundwater quality. Proposed measures to manage and/or mitigate impacts.

CONTENT	SCOPE OF WORK	
Factor	**EPA objective(s)**	**Work required for the environmental review**
SOCIAL SURROUNDINGS		
Aboriginal culture and heritage	Ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*; and Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.	Identify Aboriginal cultural and heritage sites of significance, through archaeological and ethnographic surveys of the project area if required, and through consultation with local Aboriginal groups and/or the Department of Indigenous Affairs. Consult with the Aboriginal people of the area to determine potential impacts of the proposal on cultural associations with the project area. Proposed measures to manage and/or mitigate impacts. *(Refer to EPA Draft Guidance for the Assessment of Environmental Factors No. 41, Assessment of Aboriginal Heritage.)*
Register of the National Estate	Comply with statutory requirements in relation to areas of cultural or historical significance.	Identify any places listed on the Register of the National Estate (or the Interim List of the Register) that may be adversely impacted by the proposal. Proposed measures to manage impacts.
Public health and safety — radiation	Radiological impacts to the public and the environment are kept as low as reasonably achievable and comply with acceptable standards. Ensure that solid wastes are handled and disposed of in an acceptable manner to avoid potential contamination of soil, surface and ground water, and to keep radiological impacts as low as reasonably achievable, by complying with statutory requirements.	Assessment of baseline radiation levels. Proposed measures to manage and/or mitigate impacts.
Public health and safety — transport	Ensure that roads are maintained or improved and road traffic managed to meet an adequate standard of level of service and safety and MRWA requirements.	Describe the types, quantities, and methods of transport for various inputs (including reagents) and products of the processing plant, in particular, any hazardous goods. Describe the transport requirements for the mine and plant. Assessment of transport heavy haulage routes, and the implications these may have on public health and safety. Proposed measures to manage and/or mitigate impacts.
Visual amenity	Visual amenity of the areas adjacent to the project should not be unduly affected by the proposal.	Describe, with both text and appropriate figures, the impact of the proposal on visual amenity. Proposed measures to manage and/or mitigate impacts.

These factors should be addressed within the PER document for the public to consider and make comment to the EPA. The EPA expects to address these factors in its report to the Minister for the Environment and Heritage.

The EPA expects the proponent to fully consult with interested members of the public and take due care in ensuring all other relevant environmental factors, which may be of interest to the public, are addressed.

Further environmental factors may be identified during the preparation of the environmental review, therefore on-going consultation with the EPA, DEP and other relevant agencies is recommended. The DEP/EPA can advise on the recommended EPA objective for any new environmental factors raised. Minor matters which can be readily managed as part of normal operations for the existing operations or similar projects may be briefly described.

For discussion under each environmental factor:

- a description of where this factor fits into the broader environmental / ecological context (only if relevant - may not be applicable to all factors);
- a clear definition of the area of assessment for this factor;
- the EPA objective for this factor;
- a description of what is being affected - why this factor is relevant to the proposal;
- a description of how this factor is being affected by the proposal - the predicted extent of impact;
- a straightforward description or explanation of any relevant standards / regulations / policy;
- environmental evaluation - does the proposal meet the EPA's objective as defined above;
- if not, environmental management proposed to ensure the EPA's objective is met; and
- predicted outcome.

The proponent should provide a summary table of the above information for all environmental factors, under the three categories of biophysical, pollution management and social surroundings as shown below:

Table 2: Environmental factors and management (example only)

Environ-mental Factor	EPA Objective	Existing environment	Potential impact	Environmental management	Predicted outcome
BIOPHYSICAL					
Vegetation community types 3b and 20b	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation community types 3b and 20b	Reserve 34587 contains 45 ha of community type 20b and 34 ha of community type 3b	Proposal avoids all areas of community types 20b and 3b	Surrounding area will be fully rehabilitated following construction	Community types 20b and 3b will remain untouched Area surrounding will be revegetated with seed stock of 20b and 3b community types
POLLUTION MANAGEMENT					
Dust	Ensure that the dust levels generated by the proposal do not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards	Light industrial area - three other dust producing industries in close vicinity Nearest residential area is 800 metres	Proposal may generate dust on two days of each working week.	Dust Control Plan will be implemented	Dust can be managed to meet EPA's objective
SOCIAL SURROUNDINGS					
Visual amenity	Visual amenity of the area adjacent to the project should not be unduly affected by the proposal	Area already built-up	This proposal will contribute negligibly to the overall visual amenity of the area	Main building will be in 'forest colours' and screening trees will be planted on road	Proposal will blend well with existing visual amenity and the EPA's objective can be met

4.3. Environmental management

The EPA expects the proponent to have in place an environmental management system (EMS) appropriate to the scale and impacts of the proposal, including provisions for performance review and a commitment to continuous improvement.

The system may be integrated with quality and health and safety systems and should include the following elements:

- environmental policy and commitment;
- planning of environmental requirements;
- implementation of environmental requirements;
- measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes.

A description of the environmental management system should be included in the environmental review documentation. If appropriate, the documentation can be incorporated into a formal environmental management system (such as AS/NZS ISO 14001). Public accountability should be incorporated into the approach on environmental management.

The environmental management program (EMP) is the key document of an environmental management system. The EMP should provide plans to manage the relevant environmental factors, define the performance objectives, describe the resources to be used, outline the operational procedures and outline the monitoring and reporting procedures which would demonstrate the achievement of the objectives.

4.4. Environmental management commitments

The final stage of the Environmental Impact Assessment (EIA) process is reached when the Minister for the Environment and Heritage issues the Ministerial Statement for the project, which is a set of legally enforceable conditions and procedures for the implementation of the project. One of the standard procedural conditions is a requirement for the proponent to implement the key commitments which have been made during the EIA process and which the EPA and the proponent wish to become legally enforceable.

It is accepted practice for a list of the proponent's key commitments to be attached to the Minister's statement, however, it is not compulsory for the proponent to make any legally enforceable commitments. The EPA will recommend conditions to address environmental matters that the implementation of the proposal should be subject to. The EPA expects proponents to implement all the commitments, which are made as part of the public review of the proposal, as part of their commitment to good environmental management.

Commitments that are to be made legally enforceable should not be made lightly and should focus on the important, on-going, high-risk issues that will need a higher level of environmental management in terms of achieving a satisfactory outcome. They would be key components within the proponent's environmental management system and would be subject to both internal (company) and external (regulator) audit processes to ensure both compliance as well as outcome.

Smaller-scale, generalised, overly-specific and/or non-controversial management actions, objectives and policies that the proponent intends to undertake in implementing the proposal (e.g. return 150 mm of topsoil, avoid coral reefs, minimise clearing of vegetation) do not need to be included in the list of legally enforceable commitments.

Ideally, management actions, etc, should be separated from the commitments in the public review document and they would not become specifically legally binding as would the commitments. However, the proponent would still be expected to implement these management actions as part of responsible environmental management as this is what the EPA will base its recommendations of acceptability upon.

It is important to ensure the commitments are auditable and, therefore, proponents are advised to follow a tabular format as explained below.

4.4.1. Commitment components

The commitments need to be framed in a format similar to that of the environmental conditions so that they have clarity and enforceability and, therefore, can be readily implemented by the proponent and audited efficiently by the DEP. The required standard format for all commitments comprises a number of components as follows:

The proponent will, for a specific topic (environmental issue), undertake an action (**what, how, where)** to meet an environmental objective (**why**) to a time frame (**when)**, and on advice from a relevant advisory agency (**from whom**, eg. government agencies such as Department of CALM, Department of Mineral and Petroleum Resources, Shire Council). With regard to 'advice from

whom', this need only be included if the expertise and/or statutory responsibilities of the third party is relevant to implementing the commitment.

It is important for the consolidated list of commitments to be numbered correctly for easy reference in the implementation and auditing stages of the project. These should therefore be sequentially numbered 1, 2, 3, ... without use of subgroups such as 1.1, 1.2 or 2(i) or 2(a), 2(b).

4.4.2. Paragraph format

In applying the standard components (topic what, why, when, from whom) an example of a commitment in paragraph form is as follows:

Prepare and implement a Dust Control Plan that will minimise dust generation on-site and aim to prevent dust emission from construction of the foreshore extension in order to protect the amenity of nearby land users. The Plan will be prepared during the design (project planning) phase and will include measures that ensure dust levels do not exceed EPA dust control criteria (EPA, 1996). The Plan will be prepared and implemented on advice from the Shire of Widgie. The approved Plan will be implemented during the construction phase.

However, writing the commitment in paragraph form can result in a confusing or clumsy sentence structure that may be difficult to interpret for future auditing purposes. Hence, a paragraph format is not acceptable and a tabular format is now required.

4.4.3. Tabular format

It is recommended that the table column headings be titled: 'commitment number', 'topic', 'actions', 'objectives', 'timing' and 'advice from'. The example in paragraph format above can be written in tabular form as per example 1 below. Note that the tabular format also overcomes the sometimes long-winded sentence structure where there are multiple specific actions for the plan to address. Also, it is desirable to create a separate commitment for the preparation and implementation parts of the commitment. Finally, the tabular format provides an immediate audit framework for use both by the proponent and the DEP, which enables efficient administration of environmental approvals. An example of the three most common formats is given below and Example 4 shows how to rewrite a management strategy into a commitment.

Example 1. Prepare and Implement format

This is the most common format and will apply most of the time where there is an on-going need to address the issue.

No.	Topic	Actions	Objectives	Timing	Advice from*
1.	Dust management	Prepare a Dust Control Plan for the foreshore construction site which addresses: 1) prevention of dust generation; 2) prevention of dust emissions off-site; and 3) monitoring and compensatory measures to address accidental emissions off-site.	1) Maintain the amenity of nearby residents. 2) Dust levels at nearest critical premise are within EPA dust control criteria (EPA, 1996).	Design phase (prior to the start of construct-ion)	Shire of Widgie
2.	Dust management	Implement the approved Dust Control Plan referred to in commitment 1.	Achieve the objectives of Commitment 1.	During construction	Shire of Widgie

* this may be left blank if no advisory local or state government agency is relevant; note that the DEP or the EPA or the Minister for the Environment and Heritage are never noted in this column. They are the regulators and the commitments are to their requirements, not advice.

Example 2. Once-off Action format

This format is for actions that have a clear completion time.

No.	Topic	Action	Objectives	Timing	Advice from
3.	Fauna protection	Undertake a trapping programme, approved by CALM, for capturing and relocating the Southern Brown Bandicoots from the area to be cleared.	Relocate the Southern Brown bandicoots to an area and in a manner where the population will be protected	Design (prior to the start of ground disturbance)	CALM

Example 3. Prepare, Implement and Upgrade format

This format is for circumstances when there is a clear need to modify a plan based on a study that is yet to be completed.

No.	Topic	Action	Objectives	Timing	Advice from
4.	Waste Rock Dump	Prepare a Waste Rock Dump Management Plan that: 1) ensures natural drainage is reinstated; 2) identifies rehabilitation options and techniques; 3) achieves a visual quality objective of level 3; 4) etc.	Construct a waste rock dump that: 1) blends with local landscape; 2) is stable in the long-term; and 3) will not produce leachate that would pollute the nearby wetlands.	Prior to the start of construction of the mine	Dept. Minerals and Energy
5.	Waste Rock Dump	Implement the WRDM Plan referred to in commitments 4 and 6.	As for commitment 4.	During construction and operations	DME
6.	Waste Rock Dump	Modify the WRDM Plan referred to in commitment 4 after the Acid Mine Drainage study referred to in commitment 9 is completed and the study findings approved by the EPA.	Ensure that drainage, including subsurface leachate, does not exceed water quality criteria (NHMRC, 1999).	During operations	DME

Example 4. How to rewrite a management action, etc, into a commitment

No.	Topic	Action	Objectives	Timing	Advice from
1.	Waste material	Remove waste material which cannot be accommodated on-site due to potential changes in final design levels to an acceptable landfill. **this is a management action and is rewritten below**	To prevent contaminated material removed from the western part of the site being relocated inconsistent with the final plans for the development.	During remedial works	Shire of Widgie
1.	Excess waste material	Prepare a Waste Material Plan for any excess contaminated material that: 1) identifies the quantity and location of the material; 2) specifies the methods of removal and transport of the material; and 3) identifies the landfill site for disposal and the monitoring methods for the landfill disposal operation.	Ensure that contaminated material that cannot be contained on-site is disposed of at an acceptable landfill site.	During the remedial stage (prior to the validation stage)	Shire of Widgie
2.	Excess waste material	Implement the approved Waste Material Plan referred to in commitment 1.	Achieve the objectives of commitment 1.	After plan is approved by the DEP (during remedial stage)	Shire of Widgie

5. Public consultation

A description of the public participation and consultation activities undertaken by the proponent in preparing the environmental review should be provided. It should describe the activities undertaken, the dates, the groups/individuals involved and the objectives of the activities. Cross-reference should be made with the description of environmental management of the factors that should clearly indicate how community concerns have been addressed. Those concerns that are dealt with outside the EPA process can be noted and referenced.

5.1. Availability of the environmental review

Copies for distribution free of charge

Supplied to the Department of Environmental Protection (DEP):

- Library Information Centre 9
- EPA members 6
- Officers of the EPA/DEP 6

Distributed by the proponent to:

Government departments	•	Environment Australia 4
	•	DEP, South West Region Office 2
	•	Department of Conservation and Land Management 2
	•	Department of Mineral and Petroleum Resources 2
	•	Department of Indigenous Affairs 1
	•	Office of Major Projects 1
	•	Main Roads Western Australia 1
	•	Water and Rivers Commission 2
	•	Water Corporation 1
Local government authorities	•	Shire of Busselton 1
	•	Shire of Capel 1
Libraries	•	J S Battye Library 3
	•	The Environment Centre 2
Other	•	Conservation Council of WA 1
	•	Wildflower Society of WA 1

5.2 Available for public viewing

- J S Battye Library
- Department of Environmental Protection, Library Information Centre, Perth
- Department of Environmental Protection, South West Region Office
- Environment Australia Library;
- Shire of Busselton and Shire of Capel Public Libraries; and
- on Cable Sands (WA) Pty Ltd's website

6. Other information

Additional detail and description of the proposal, if provided, should go in a separate section.

Appendix B

ENVIRONMENTAL POLICY & ISO14001 CERTIFICATE

CABLE SANDS (WA) PTY LTD

ENVIRONMENTAL *Policy*

GENERAL POLICY

Cable Sands (WA) Pty Ltd is committed to efficient production of Titanium Minerals in a manner that protects the values of the natural and social environments in which it operates.

IN FULFILLING THIS COMMITMENT, CABLE SANDS:

- Operates in compliance with an Environmental Manual prepared in accordance with AS/NZS ISO 14001: 1996.
- Operates in compliance with applicable legislation, regulations and Codes of Practice.
- Commits to pollution prevention and waste minimisation.
- Recognises that operations will have a localised, short term impact on the environment and aims to reduce this impact wherever practicable.
- Regularly audits and monitors environmental performance.
- Aims to continually improve environmental management practices and performance.
- Works with the community with the aim of achieving mutually acceptable outcomes from all areas of operation.
- Conducts mining in a manner that ensures that rehabilitation to the agreed end land use can be achieved at the earliest practical time.
- Ensures that all employees, including contractors, are aware of their role in implementing Company environmental responsibilities, policies and commitments.

SCOPE

All aspects of Cable Sands operations including exploration, mining, processing, transport, shipping and site rehabilitation are encompassed by the Environmental Policy.

Gary Crockford
General Manager

7/5/01
Date

INTERNATIONAL ENVIRONMENTAL MANAGEMENT SYSTEM

REVISION 3

CD119

SCOPE OF CERTIFICATION

NCS
NATA Certification Services
International

Certification Number: 7755

Cable Sands (WA) Pty Ltd

Koombana Drive
North Shore
BUNBURY WA 6230

Phone: (08) 9721 0200 Fax: (08) 9791 1249

Certification Standard:

AS/NZS ISO 14001:1996

Capability Statement:

Environmental management system associated with exploration, planning, development, mining, transport, storage and processing of titanium minerals in the south-west of Western Australia, including post mining rehabilitation of disturbed areas to specified land uses.

Issue Date: 1 September 2000
Valid Until: 31 August 2003

on behalf of the
Board of Directors

JAS-ANZ

"The use of this mark indicates the accreditation of NCS International Pty Limited by the Joint Accreditation System of Australia and New Zealand for those activities covered by JAS-ANZ Certificate Number E1510196AS"

Appendix C

EPBC ACT NOTIFICATIONS

COMMONWEALTH OF AUSTRALIA

ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

DECISION ON CONTROLLED ACTION, CONTROLLING PROVISIONS AND DESIGNATION OF PROPONENT

Pursuant to section 75 of the *Environment Protection and Biodiversity Conservation Act 1999*, I, STEPHANIE ROSE MARTIN, Assistant Secretary, Policy and Compliance Branch, Environment Australia, having taken into account the relevant matters specified in section 75, decide that the proposed action, set out in the Schedule, is a controlled action; that the controlling provisions for the action are those set out in the Schedule; and designate Cable Sands (WA) Pty Ltd as proponent of the action.

SCHEDULE

The proposed action to mine and rehabilitate a titanium minerals deposit near Tutunup, Western Australia, and as described in the referral received under the Act on 10 May 2001 (EPBC 2001/279).

The Part 3, Division 1, controlling provisions are:

- sections 18 and 18A (Listed threatened species and communities).

Dated this 23rd day of May 2001

Stephanie Martin

ASSISTANT SECRETARY
POLICY AND COMPLIANCE BRANCH
ENVIRONMENT AUSTRALIA

RECEIVED
16 JUL 2001

Environment Australia

Department of the Environment and Heritage

Mr Gary Crockford
General Manager
Cable Sands (WA) Pty Ltd
PO Box 133
BUNBURY WA 6231

Dear Mr Crockford

Cable Sands (WA) Pty Ltd/Mining – Sand/Tutunup/WA/Titanium Mineral Deposit (Our Reference: EPBC 2001/279)

On 23 May 2001 the Delegate of the Minister made a decision that approval was required for the above action. Preliminary information for the action was received under section 86 on 4 June 2001 for decision on assessment approach under Part 8 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The assessment approach for the action has now been considered under the EPBC Act and I have decided, as delegate for the Minister that assessment by an accredited process must be conducted.

The accredited process is the Public Environmental Review (PER) under the Western Australian *Environmental Protection Act 1986*. The next step in the assessment process is for you to contact the Western Australian Department of Environmental Protection (WADEP) to discuss requirements under the WA *Environmental Protection Act*. Once assessment under PER is complete, the WADEP will provide me with an assessment report on the impacts of the action in order for the decision on approval process to commence.

Yours sincerely

Cathy Parsons
Assistant Secretary
Environment Assessment and Approvals Branch

// July 2001

Date 16.7.01	No 5994
GM - Operations (WA)	
Environmental Supt	
Mining Supt Nth	
Mining Supt Sth	
Mill Supt	
Admin Supt	
Maintenance Supt	
Human Resources Supt	
Tech Servcies Supt	
Exploration Supt	
Development Supt	
Copy TJ01	File GC

BJV

GREENHOUSE CHALLENGE MEMBER

GPO Box 787 Canberra ACT 2601 Telephone 02 6274 1111 Facsimile 02 6274 1666
Internet: www.environment.gov.au

INTERNATIONAL ENVIRONMENTAL MANAGEMENT SYSTEM

Appendix D

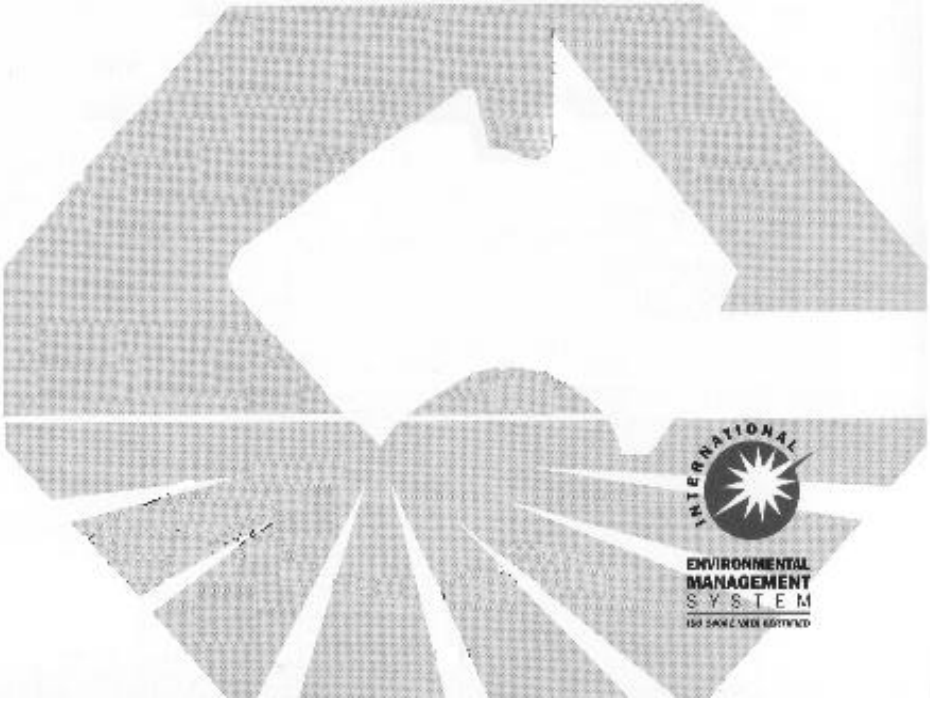
DRAFT GROUNDWATER MANAGEMENT PLAN AND OPERATING STRATEGY

CABLE SANDS (WA) PTY LTD

CD621
Groundwater Management Plan and Operating Strategy
TUTUNUP MINE

Revision 0

November 2001



Contents

Related Documents.

Procedures

SP01. Environmental Reporting

SP03. Identification and Management of Environmental Issues

SP07. Structure and Responsibility

SP13. Non-conformance & Preventative Action

SP15. Internal Audits

SP16. Formal Management Review

SP27. Control of Inspection, Testing and Measuring Equipment

SP32. Training

Work Instructions

WI045 Conductivity Calibration

WI047 Determination of water quality and standing water level.

WI049 pH Calibration

Reference Documents

AS 5667.1:1998 Water Quality - Sampling

AS 4360:2000 Risk Management

AS/NZS ISO 14001:1996 Environmental Management Systems

URS 2001a. *Tutunup Deposit – Groundwater Supply Development*. Prepared for Cable Sands (WA) Pty Ltd.

URS 2001b. *Tutunup Deposit – Superficial Formations Hydrogeological Investigations*. Prepared for Cable Sands (WA) Pty Ltd.

1. PURPOSE OF THIS DOCUMENT

General.

This Groundwater Management Plan and Operating Strategy (GMPOS) is part of the Cable Sands (WA) Pty Ltd (Cable Sands) ISO14001 certified Environmental Management System (EMS) and is consistent with the company's Environmental Policy. It contains the objectives and strategies for groundwater management at the Tutunup minesite.

Work Instructions referred to in the GMPOS are not provided in this document.

Cable Sands recognises that operations at its Tutunup minesite have the potential to affect other beneficial uses of groundwater in the area. As such, the issue has a HIGH impact rating[1] and thus requires an appropriate management strategy.

[1] SP03 Identification and Management of Environmental Issues.

2. CABLE SANDS' POLICY ON GROUNDWATER MANAGEMENT

General.

Cable Sands operates a certified ISO 14001 Environmental Management System (EMS). The core of the EMS is the company's Environmental Policy. This policy has been approved and signed by the company's General Manager.

Primarily, Cable Sands' policy on groundwater management is to operate in compliance with legislation, with the principle objective of causing no impact on other users (including the environment) of the resource.

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

Responsibilities[1].

General Manager: includes ensuring that all Cable Sands' activities conform to the Environmental Policy.

Environmental Superintendent: includes taking immediate action where necessary on the receipt of communications and/or complaints regarding environmental issues.

Senior Environmental Officer: includes ensuring compliance with relevant environmental legislation and regulations.

Environmental Officer: includes managing the EMS, maintaining documents and records to demonstrate conformance, and identification of non-conformances with the EMS.

All employees: includes ensuring that all operations are carried out in accordance with specified procedures and work practices.

Training[2].

Under general environmental training and awareness, groundwater management issues and the responsibilities of individual employees are discussed via monthly minesite staff meetings. This follows on from initial induction courses where employees and principal contractors are made aware of the importance of their environmental performance

A copy of this Groundwater Management Plan and Operating Strategy is to be appended to the site Environmental Management Plan, a copy of which is kept at the minesite.

[1] SP07 Structure and Responsibility

[2] SP32 Training

Community Consultation

Cable Sands has a commitment, under its Environmental Policy, to involve the community in aspects of impact management. This reflects the company's belief that a positive community attitude towards its activities in the area not only has immediate benefits, but makes future proposals more favourable to the wider community.

Cable Sands will, at its discretion, continue to conduct or coordinate public forums with the purpose of informing the community about environmental issues, including groundwater management, or to obtain community feedback and attitudes towards its operations and performance. These forums will supplement Cable Sands' practice of liaising with residents directly.

Complaint Response Procedures

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

All external complaints automatically generate an incident report that is forwarded to and dealt with by the Environment Department[1].

To establish an open line of communication, Cable Sands has contacted neighbouring residents to discuss groundwater and other issues and continues to liaise with them on a regular basis. These residents have been informed of the GMPOS for the minesite and are aware of whom to contact in the event of concerns arising.

In addition to the minesite response, any complaints will also be formally processed through Cable Sands' ISO14001 certified EMS system. Responsibility for action lies with the Environmental Superintendent. The Environment Department reports complaints and other non-conformances to the Department of Environmental Protection (DEP).

[1] SP13 Non-Conformance and Preventative Action.

3. IDENTIFICATION OF RISKS[1]

General.

As part of the EMS a risk assessment has been completed for the Tutunup site. This assessment follows the principle of AS4360:2000[2] to identify areas of potential environmental risk.

Impacts from abstraction

Groundwater is currently used by landowners in the area for domestic and agricultural purposes. Domestic bores are generally shallow (superficial aquifer), with stock and irrigation supplies being obtained from deeper bores (Leederville aquifer). Bores into the deep Yarragadee aquifer are in use for mining and large scale irrigation more distant from the minesite.

The Tutunup production bore is drilled into the Yarragadee aquifer. Due to the isolation between the aquifers, any drawdown will be limited to the Yarragadee formation and will not propagate to the overlying Leederville or Superficial formations.

Hydrological assessments have indicated that any drawdowns in the Yarragadee aquifer are likely to be minor and not significant. This is due primarily to the distance to the nearest other bores, and the expectation that the forecast abstraction of 1 500 000 kL per annum is conservatively high.

Drawdown from mine pit

Drawdowns associated with the mine pit have been modelled and assessed. Under worst-case conditions, with no active management, drawdowns could propagate up to 450 m from the crest of the pit. Such drawdowns could have the potential to impact on native vegetation in the adjacent State Forest, which includes rare flora.

The modelling has shown that an artificial recharge system will limit the magnitude of the drawdown to less than 0.5 m, within 100 m of the pit crest. The water table will return to pre-mining levels following backfilling of the pit.

This potential impact has been designated a risk level in the EMS of HIGH. This Groundwater Management Plan and Operating Strategy is primarily aimed at addressing this risk.

---

[1] SP03 Identification and Management of Environmental Issues.

[2] AS4360:2000 Risk Management

4. CONTROL OF GROUNDWATER ABSTRACTION

General.

Management to reduce the risk of over-abstraction is split into two components:

1. Control of abstraction; and
2. Water recycling.

Control of Groundwater Abstraction.

Process water for the minesite will be drawn from a production bore drilled into the Yarragadee aquifer. This bore is screened over the interval 210 m to 310 m below ground level.

Abstraction from the production bore will be controlled to minimise water consumption. Abstraction will be limited to:

- Maximum annual abstraction 1 500 000 kL
- Maximum daily abstraction 4 500 kL

Water Recycling.

The water supply for the minesite will operate on a closed, recirculating system to ensure maximum recycling of process water. Central to the water circulation system will be the water supply dam, capable of holding about 45,000 kL (see Figure 1). This dam will be fed from:

- Water decanted from fines, tails and HMC storage areas;
- Thickener overflow
- Collection of seepage from mine pit;
- Harvesting of stormwater within the operating area
- The Yarragadee bore, as required to maintain dam level.

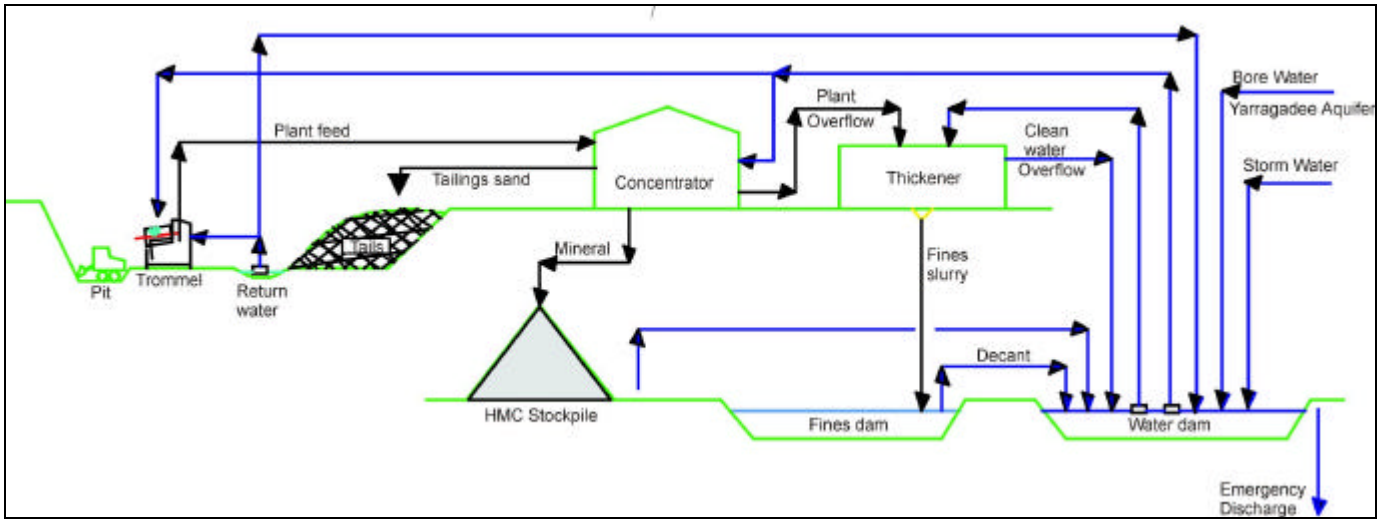


Figure 1. Process water circuit.

Draft for comment

5. ARTIFICIAL RECHARGE SYSTEM.

General

Cable Sands will install, operate and maintain an artificial recharge system to maintain superficial groundwater levels in the vicinity of the adjacent State Forest. The system will be installed prior to removal of overburden in the southern part of the pit.

System Layout

The layout of the artificial recharge system is shown in Figure 2. Key aspects of the system layout and design incorporate:

- Location of the trenches along the boundaries of the State Forest, upstream of the proposed pit.
- Sourcing of clean, fresh raw water supplies from the Yarragadee Formation production bore and the Fresh Water Dam. The water reticulated to the artificial recharge system should be of <10 mg/L Total Suspended Solids concentration.
- Location of water storage (tank or dam) near the southern pit limits, adjacent to bunded topsoil stockpiles and existing reticulated power.
- The water tank will be fitted with high and low water level sensors and telemetry to automatically control the pumping of fresh water to maintain sufficient water in the tank for the artificial recharge system demands.
- Water delivery to the artificial recharge system by pressure-pumps coupled to the water tank and a single 110 mm diameter polyethylene pipeline. Different pumps may be required to operate the trench and direct watering networks.
- Based on the results of the groundwater flow modelling, the tank and pressure pumps will need to meet artificial recharge system demands of:
    - peak - 500 kL/day;
    - 2-year average - 200 kL/day; and
    - longer-term average - <50 kL/day.

Trench Infrastructure

Key aspects of the trench designs include:

- A network incorporating eight trenches (Figure 2). The trenches are numbered 1 to 8 and provide control on incremental increases in water table elevations along the perimeter fences of the State Forest. The design water table elevations to be maintained in the respective trenches are:
    - Trench 1 - 43.0 mAHD;
    - Trench 2 - 43.5 mAHD;
    - Trench 3 - 44.0 mAHD;
    - Trench 4 - 44.5 m AHD;
    - Trench 5 - 45.0 mAHD;
    - Trench 6 - 43.5 mAHD;
    - Trench 7 - 44.0 mAHD; and
    - Trench 8 - 44.5 mAHD.

- All trenches will be excavated to a level beneath the top of the water table (based on monitoring data), and will be nominally 1 m wide.

  The trenches will be predominantly excavated within the ironstone caprock (see Figure 3).

- Trenches 1 and 2 are closest to the crest of the proposed pit. These trenches are under-drained by 200 mm diameter holes that:

  - are spaced at 10 m intervals;
  - have been drilled to 6 m depth; and
  - are backfilled to surface with 12-14 mm crushed rock aggregate.

  The holes will be located along the alignment of these trenches and drilled and filled before the trenches are excavated (Figure 4).

  The purpose of the holes is to promote vertical drainage from the trenches in areas of the most significant potential drawdown impacts due to mining. As such, the holes would prevent the development of a perched water table and/or occurrence of differential heads in the superficial formations that underlie the ironstone caprock.

- Typical cross-sections and long-sections of the trenches are shown Figure 4. These figures schematically show designs that incorporate:

  - a basal 160 mm diameter slotted polyethylene agricultural pipe;
  - a basal 0.5 m thick drainage layer comprising 12-14 mm crushed rock aggregate; and
  - backfill to surface, predominantly comprised of ironstone caprock.

- Water delivery into the trenches is facilitated by a 50 mm diameter riser coupled to a float valve assembly. Both are housed within a nominal 660 mm diameter concrete well-liner that rests on top of the agriculture pipe. The float valve will control water table fluctuations, limiting them to a maximum of 0.2 m. Individual float valve assemblies will be able to deliver up to 170 kL/day to each trench.

  Each float valve assembly will be registered against local elevation controls and installed to depths compatible with the specified water table elevations in the respective trenches.

- The basal 160 mm diameter slotted agricultural pipes will be fitted with 100 mm inlet and 50 mm uPVC outlet pipes that will enable flushing of each trench. This infrastructure will prevent siltation from limiting infiltration from the trenches and the effectiveness of the artificial recharge system.

- Each trench incorporates a 100 mm diameter monitoring standpipe. These standpipes are located nearer central portions of the trenches to provide supporting data on water table elevations. Bottom portions of the standpipes will be slotted and installed within the crushed rock aggregate near the bottom of the trenches.

  The 50 mm outlet pipe may be used in a similar role.

  Protection will be required for these standpipes during the backfilling of the trench eg with steel collars and/or backfilling with sand in these areas.

Backup Watering System

A direct watering system is provided as a back-up support for the trench artificial recharge system. This would only be used if considered necessary; it may never be used. The reticulation is focused in areas closest to the proposed pit and near the fenced perimeter of the State Forest.

The preferred design for the backup system incorporates the use of drip-irrigators, this approach being adopted following discussions with CALM. This system would limit surface water and surface soil moisture contents, except near the drip-irrigators, and hence would be pro-active in terms of dieback management.

Approximately 1,350 m of small diameter pipelines would be reticulated into the State Forest on transects spaced at 7 m intervals (see Figure 5). Drip-valves would be regularly spaced at 2.5 to 3 m intervals.

This is a contingency system and as such should never be used. The required materials are readily available at short notice. Hence, to avoid unnecessary disturbance, the lines will not be installed unless there is evidence that it may be required (eg. high flow rates into trenches and falling water tables).

Management

All monitoring data will be collated and frequently reviewed so that the performance of the artificial recharge system is readily diagnosed and appropriately managed. Operation of the back-up system will be initiated if one or more float valves is fully open and inflows cannot sustain the design water table elevations. Selected sections may be operated to meet local increases in water demand.

Visual inspections of the system will be conducted daily to ensure operational integrity is maintained. The artificial recharge system will be thoroughly inspected on a monthly basis. Key checks during this inspection routine would be the operations of the:

- level controls in the water tank;
- pressure pumps; and
- float valves.

Decommissioning

The system will remain in place until monitoring records show that groundwater levels are stable at or above the target levels, without input from the artificial recharge system, for at least 12 months.

Decommissioning will include:

- Removal of all surface pipelines, water tank, float valves and pumps.
- Cutting off all PVC standpipes 500 mm below ground level, plugging and backfilling.
- Removal and/or breaking up concrete well liners to 500 mm below ground level, and backfilling to surface.

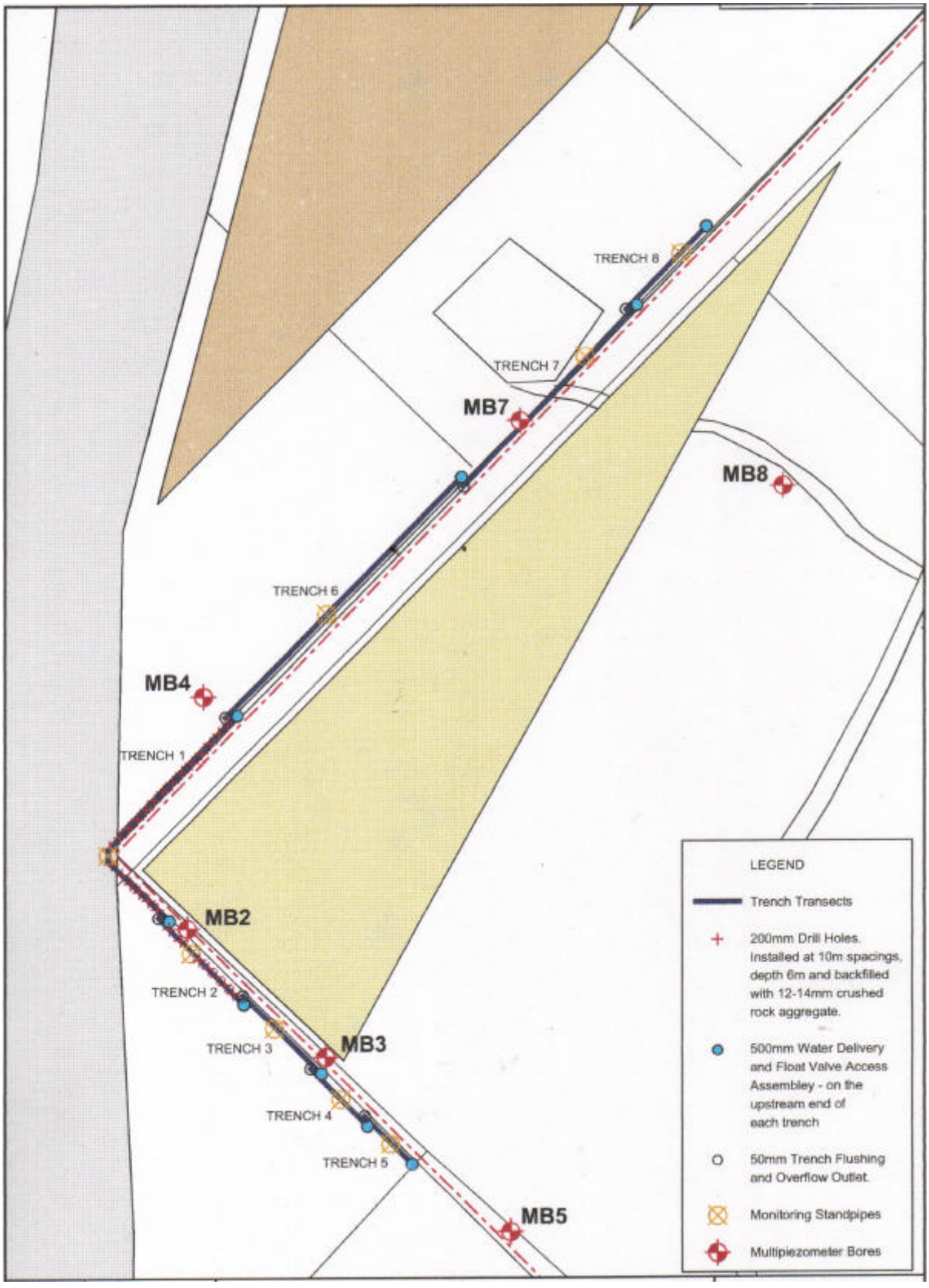


Figure 2. Artificial recharge trenches - schematic layout.

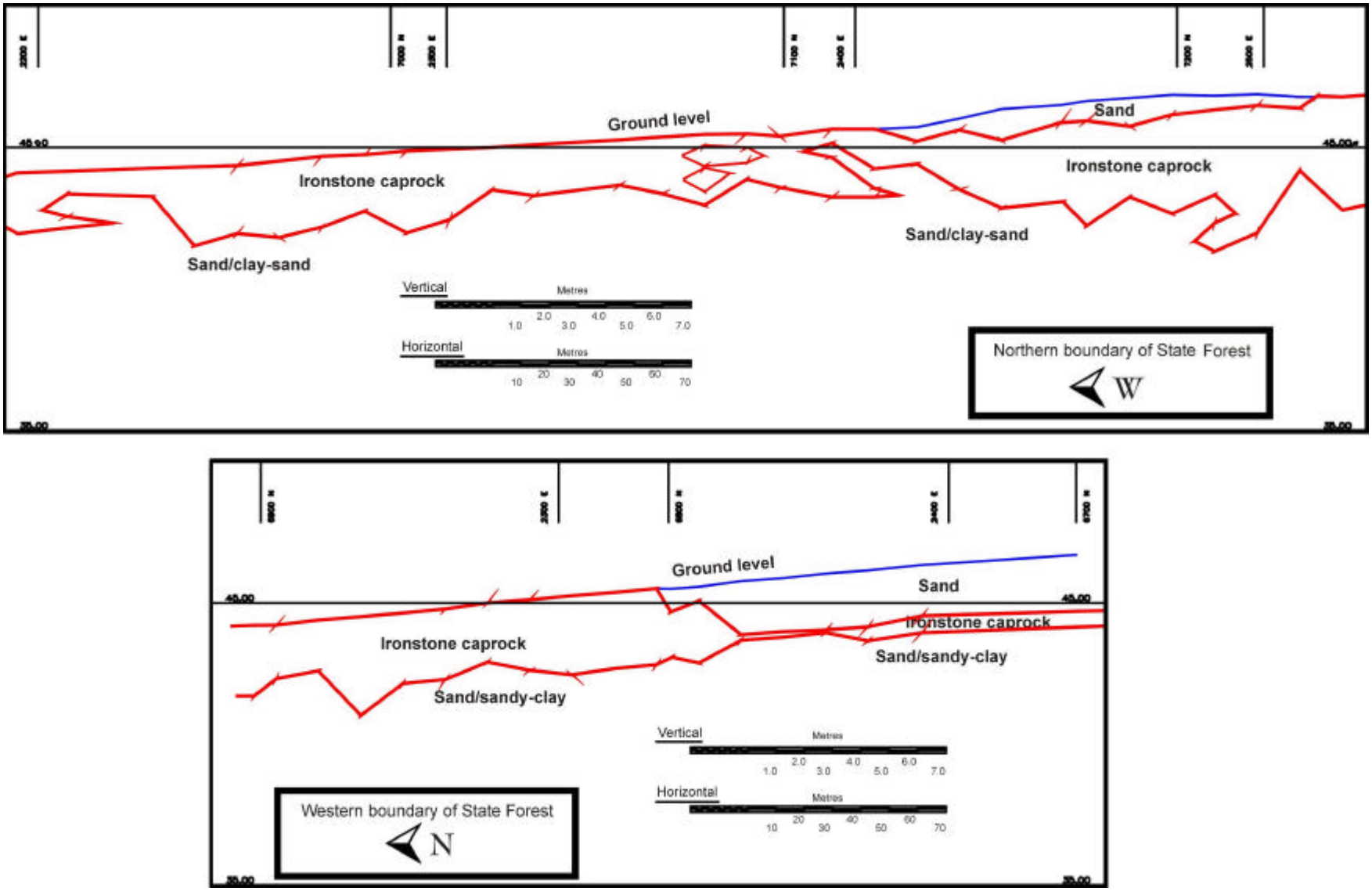


Figure 3. Geological profiles along artificial recharge trench lines.

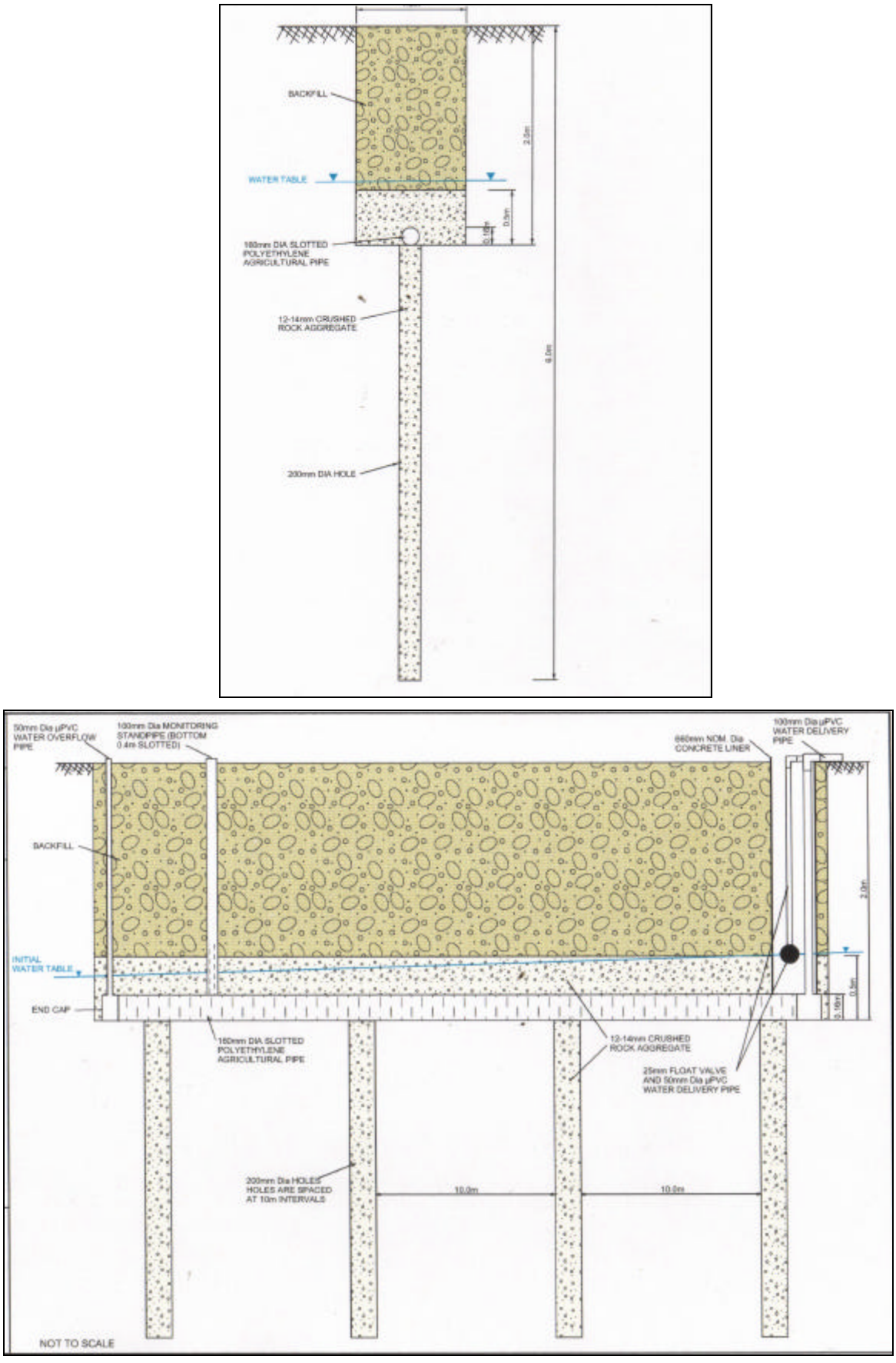


Figure 4. Cross-section and long-section of artificial recharge trench.

Note: 200 mm dia holes are only applicable to trenches 1 and 2

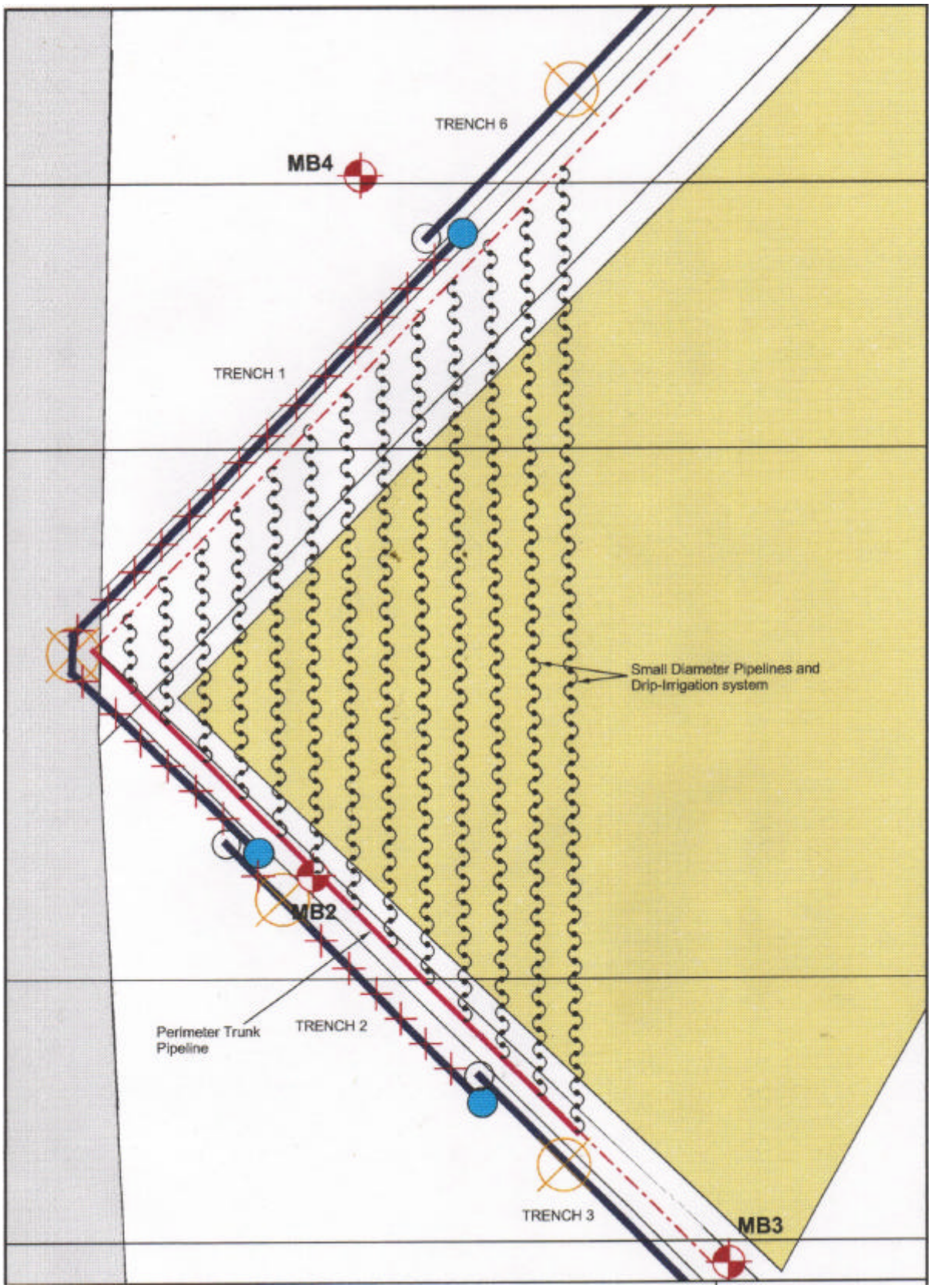


Figure 5. Conceptual layout of backup drip irrigation system.

6. PERFORMANCE MONITORING AND REVIEW

General.

Cable Sands has a commitment, under its Environmental Policy, to audit and monitor its environmental performance on a regular basis, and make relevant information about the Company's activities publicly available.

Routine Monitoring

Monitoring points are shown in Figure 6 and Figure 7. Cable Sands bore No. 1 is located within the pit, and will be removed during overburden removal. This multipiezometer bore will be re-instated in a similar location and configuration following backfilling of the pit.

All water samples will be collected in accordance with AS5667.1:1998[1]. Electrical conductivity, pH and temperature measurements will be carried out in the field, using calibrated equipment[2]. Chemical analyses will be conducted by a laboratory with NATA registration for the analyses specified.

Monthly and annual monitoring will be conducted by the environmental section, more frequent monitoring will be the responsibility of minesite personnel.

[1] WI047 Determination of water quality and standing water level

[2] SP27 Control of Inspection, Testing and Measuring Equipment
WI049 pH calibration, and WI045 Conductivity calibration.

Groundwater abstraction

Table 1. Pre-commissioning – baseline data.

Bore(s)	Parameter	Monitoring Frequency
Production bore TPB1	Groundwater levels	Monthly, then daily for 1 week prior to commissioning of bore.
Iluka bores YP3S, YP3D	Groundwater levels	Monthly, then daily for 1 week prior to commissioning of bore.
Cable Sands bores 9, 10, 11	Groundwater levels, EC, pH	Monthly
WRC bores BUS21, BUS22, BUS29	Groundwater levels	Monthly

Table 2. Operational monitoring.

Bore(s)	Parameter	Monitoring Frequency
Production bore	Cumulative flow volume, Operating hours, Groundwater levels	Daily for first week of operation, weekly for first month of operation, monthly thereafter.
	EC, pH, temperature	Monthly when operating
	Fe (soluble), Na, K, Ca, Mg, Cl, CO_3, HCO_3, SO_4, NO_3, Mn, SiO_2, Al	Annually
Iluka bores YP3S, YP3D	Groundwater levels	Weekly for first month of operation, monthly thereafter.
Cable Sands bores 9, 10, 11	Groundwater levels, EC, pH	Monthly
WRC bores BUS21, BUS22, BUS29	Groundwater levels	Monthly

Artificial Recharge.

To ensure the design artificial recharge is effective, routine monitoring protocols will be put in place. The key protocols would be focused on:

- the measurement of water table elevations in each trench;
- ensuring sufficient water is delivered to the trench system to meet demands and maintain the specified water table elevations;
- monitoring of water table elevations upstream of the trenches; and
- defining circumstances that dictate the back-up system needs to be operated.

Monitoring frequency will be adjusted during the various phases of the operation in line with the degree of risk of impact at that time.

Table 3. Artificial recharge monitoring.

Location	Parameter	Monitoring Frequency
Pre-mining		
Monitoring bores 1-8	Water levels, EC, pH	Monthly
Overburden removal		
Monitoring bores 2-8	EC, pH	Monthly
	Water levels	Weekly
Well-liner assemblies (x8) Trench standpipes (x8) Overflow standpipes (x8)	Water levels, metered flow volume	Initially daily, then weekly when stable
Pit open in area adjacent to artificial recharge system		
Monitoring bores 2-8	EC, pH	Monthly
	Water levels	Weekly
Well-liner assemblies (x8) Trench standpipes (x8) Overflow standpipes (x8)	Water levels, metered flow volume	Initially daily, then weekly when stable
Backfilling		
Monitoring bores 2-8	EC, pH	Monthly
	Water levels	Weekly
Well-liner assemblies (x8) Trench standpipes (x8) Overflow standpipes (x8)	Water levels, metered flow volume	Weekly
Post-mining		
Monitoring bores 1-8	Water levels, EC, pH	Monthly
Well-liner assemblies (x8) Trench standpipes (x8) Overflow standpipes (x8)	Water levels, metered flow volume	Monthly, while artificial recharge system is in operation.

Internal Review[1]

Internal reviews of performance, including number and handling of environmental incidents, are conducted quarterly by Cable Sands' Senior Management in the forum of the Environmental Committee. The Environmental Officer, through the EMS, acts upon the findings and recommendations of the Committee.

Reporting[2]

Regulatory reporting of monitoring results and the performance of the management controls will be included in the Annual Hydrological Review or case by case, if required. The AHR reporting year covers the period November to October.

Routine distribution of the report is limited to relevant government agencies, but is available to the public, on request.

EMS Audits

Cable Sands will routinely conduct internal audits[3] to assess the compliance with, and effectiveness of the various components of its EMS, including the GMPOS. In addition, the Company's EMS system will be audited externally every six months, with a full re-certification audit every three years.

Audit findings will be reviewed by the Company's Environmental Committee, including the General Manager, and acted upon by the Environmental Officer, through the EMS.

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[1] SP16 Formal Management Review

[2] SP01 Environmental Reporting.

[3] SP15 Internal Audits.

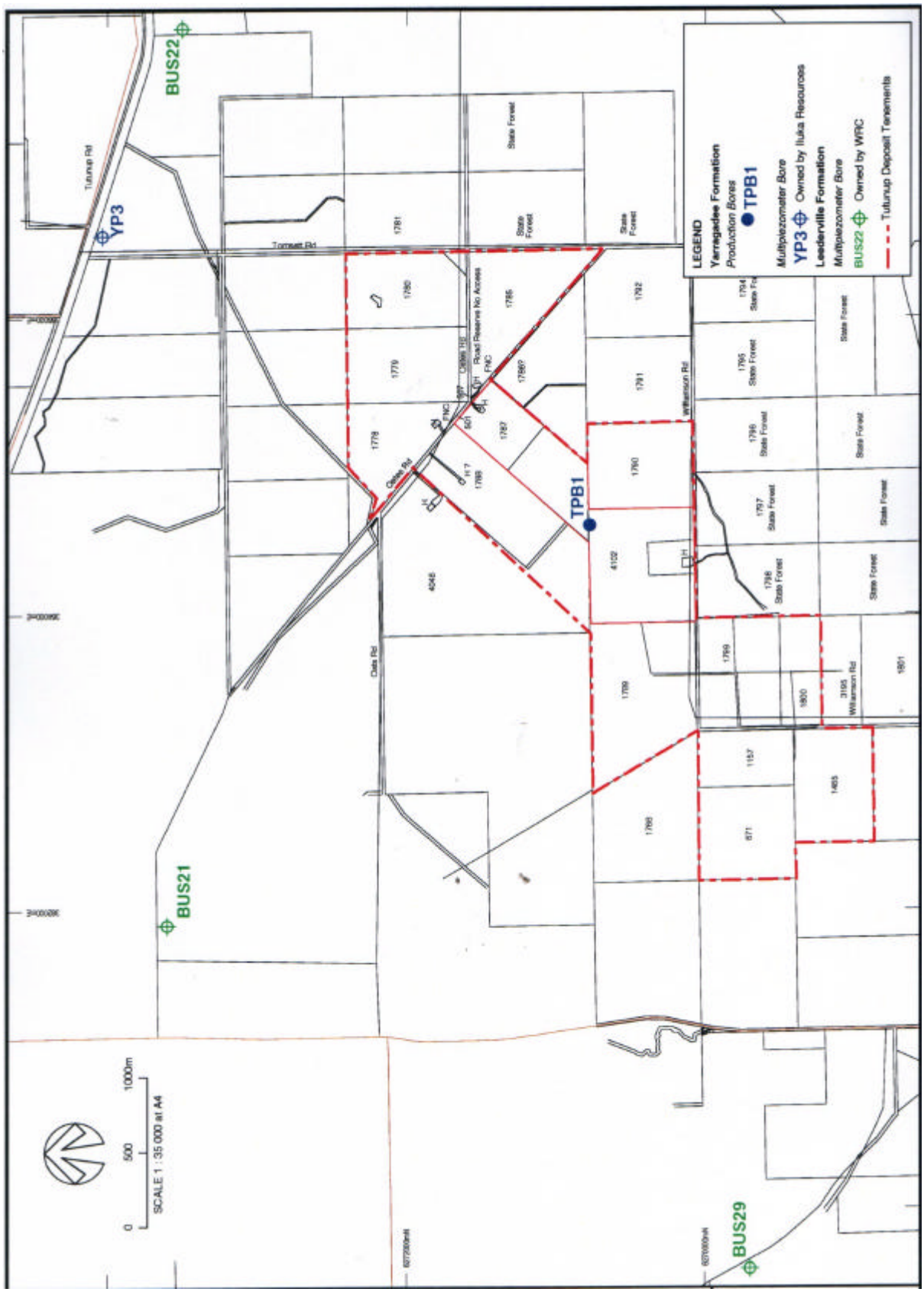


Figure 6. Regional groundwater monitoring locations.

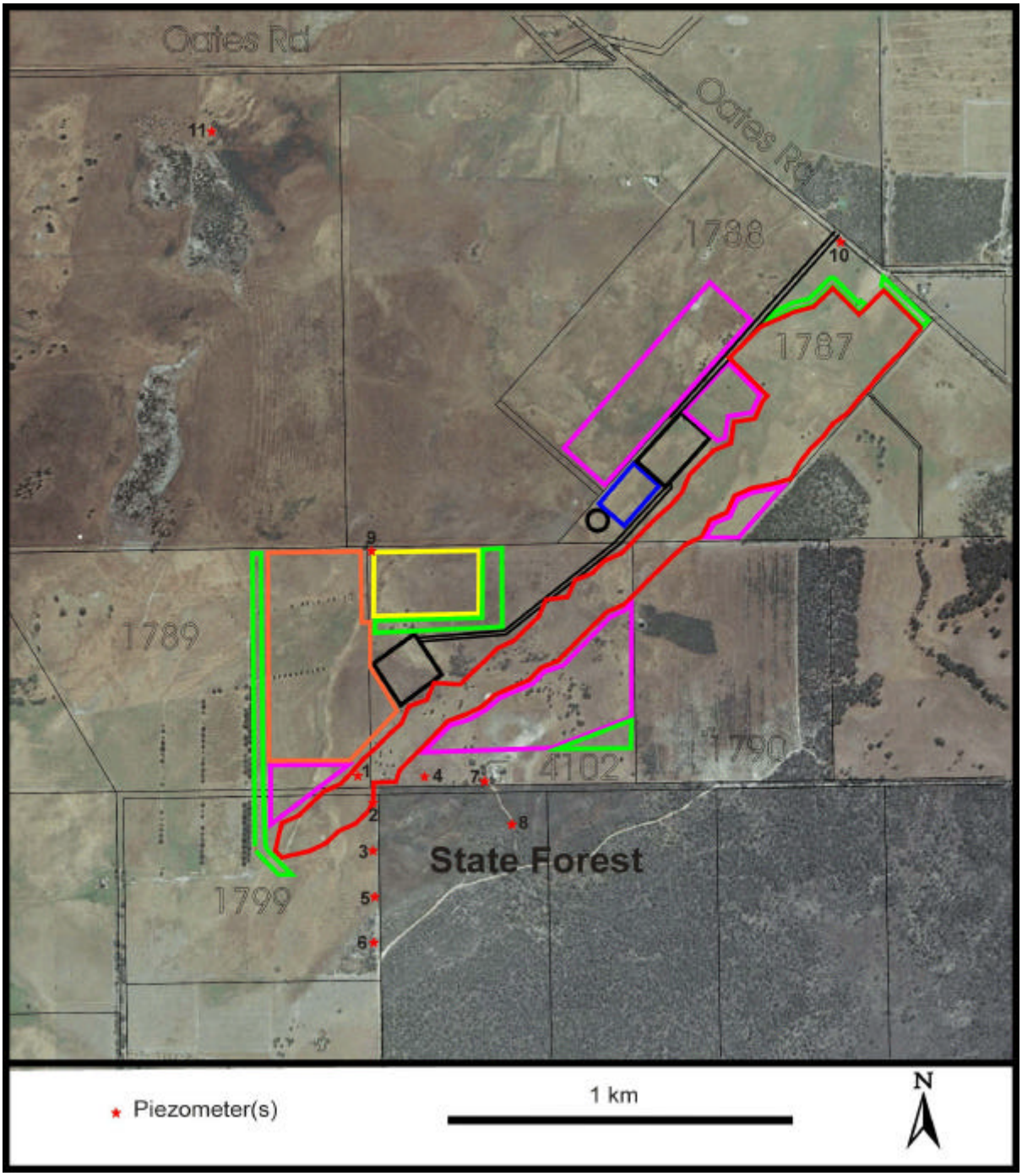


Figure 7. Cable Sands groundwater monitoring locations.

7. AUDIT SCHEDULE

Objectives	
1. To operate in compliance with legislation. 2. Cause no impact on other users of the resource (including the environment).	
Action – Cable Sands will:	Evidence
1. Limit abstraction from the production bore to: Maximum annual abstraction 1 500 000 kL Maximum daily abstraction 4 500 kL	Abstraction records
2. Operate the water supply for the minesite on a closed, recirculating system to ensure maximum recycling of process water.	Plan of water circuit.
3. Install, operate and maintain an artificial recharge system to maintain superficial groundwater levels in the vicinity of the adjacent State Forest. The system will be installed prior to removal of overburden in the southern part of the pit.	Plans, site inspection, operating records
4. Provide a direct watering system as a back-up support for the trench artificial recharge system.	Plans, site inspection.
5. Operate the back-up system if one or more float valves is fully open and inflows cannot sustain the design water table elevations.	Operating records
6. Maintain the artificial recharge system until monitoring records show that groundwater levels are stable at the target levels, without input from the system for at least 12 months.	Operating records
7. Decommission the artificial recharge system by: Removal of all surface pipelines, water tank, float valves and pumps. Cutting off all PVC standpipes 500 mm below ground level, plugging and backfilling. Removal and/or breaking up concrete well liners to 500 mm below ground level, and backfilling to surface.	Site inspection
8. Ensure workforce are aware of groundwater control issues and the responsibilities of individual employees.	Toolbox meeting minutes, training attendance lists.
9. Ensure a copy of this Groundwater Management Plan and Operating Strategy is appended to the site Environmental Management Plan, a copy of which is kept at the minesite.	Document control records

Action – Cable Sands will:	Evidence
10. Continue to conduct or coordinate public forums as required, for the purpose of informing the community about environmental issues, including groundwater management, or to obtain community feedback and attitudes towards its operations and performance. These forums will supplement Cable Sands' practice of liasing with residents directly.	Records of meetings
11. Formally process any groundwater complaints through Cable Sands' ISO14001 certified EMS system. The Environment Department will report complaints and other non-conformances to the Department of Environmental Protection (DEP).	Incident reporting documentation.
12. Monitor groundwater as specified in this plan.	Monitoring records
13. Conduct internal audits to assess the compliance with, and effectiveness of the GMPOS	Internal audit records
14. Report on monitoring results and the performance of the artificial recharge system in the annual environmental report or case by case, if required.	Annual Environmental Report.
15. Conduct internal reviews of performance, including number and handling of environmental incidents, by Cable Sands' Senior Management in the forum of the Environmental Committee.	EMS Committee minutes.

Appendix E

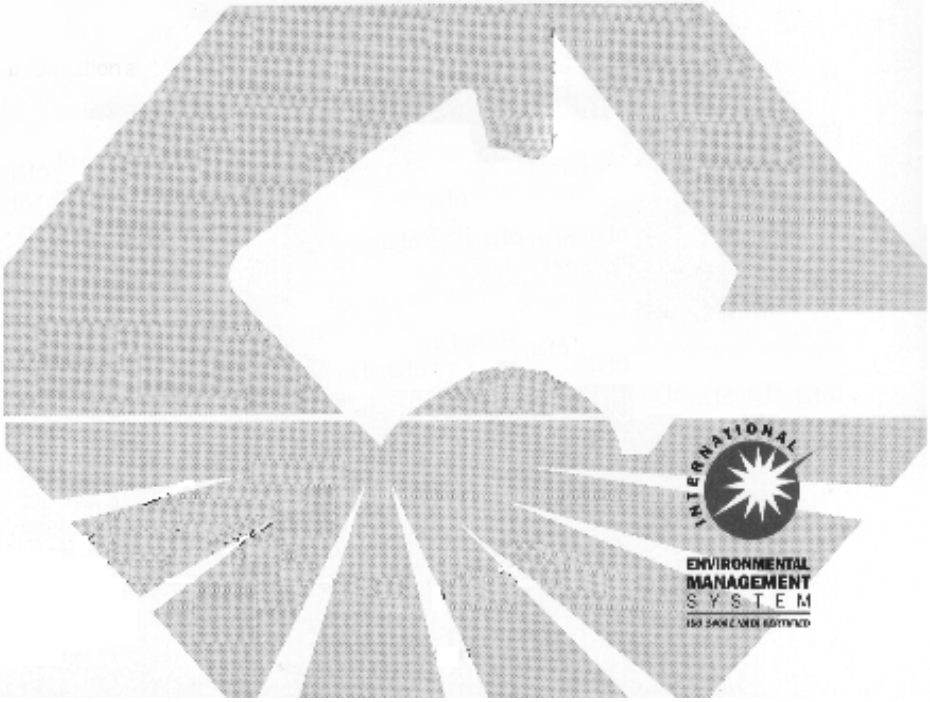
DRAFT NOISE MANAGEMENT PLAN

CABLE SANDS (WA) PTY LTD

CD620
Noise Management Plan
TUTUNUP MINE

Revision 0

November 2001



Contents

Related Documents.

Procedures

SP01. Environmental Reporting

SP03. Identification and Management of Environmental Issues

SP06. Environmental Management Program

SP07. Structure and Responsibility

SP09. Communication

SP13. Non-conformance & Preventative Action

SP15. Internal Audits

SP16. Formal Management Review

SP19. Purchasing

SP22. Process Control

SP27. Control of Inspection, Testing and Measuring Equipment

SP32. Training

Work Instructions

WI042. Occupational Noise Control Policy & Plan

WI053. Operation of Noise Data Logger Unit

WI289. Operation of Handheld Noise Meter (B&K 2260) (in prep)

Reference Documents

AS 4360:2000 Risk Management

AS/NZS ISO 14001:1996 Environmental Management Systems

AS 2012.1:1990 Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition. Part 1: Determination of compliance with limits for exterior noise.

1. PURPOSE OF THIS DOCUMENT

General.

This Noise Management Plan (NMP) is part of the Cable Sands (WA) Pty Ltd (Cable Sands) ISO14001 certified Environmental Management System (EMS) and is consistent with the company's Environmental Policy. It contains the objectives and strategies for noise management at the Tutunup minesite.

Work Instructions referred to in the NMP are not provided in this document.

Cable Sands recognises that noise from its Tutunup minesite has the potential to affect the amenity of mine neighbours. As such, the issue has a HIGH impact rating[1] and thus requires an appropriate management strategy.

[1] SP03 Identification and Management of Environmental Issues.

2. CABLE SANDS' POLICY ON NOISE

General.

Cable Sands operates a certified ISO 14001 Environmental Management System (EMS). The core of the EMS is the company's Environmental Policy. This policy has been approved and signed by the company's General Manager, and is displayed at all sites, and available to the public.

Primarily, Cable Sands' policy on management of environmental noise is to operate in compliance with the *Environmental Protection (Noise) Regulations 1997*, with the principle objective of causing no public nuisance or complaint.

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

Responsibilities[1]**.**

General Manager: includes ensuring that all Cable Sands' activities conform to the Environmental Policy.

Environmental Superintendent: includes taking immediate action where necessary on the receipt of communications and/or complaints regarding environmental issues.

Senior Environmental Officer: includes ensuring compliance with relevant environmental legislation and regulations.

Environmental Officer: includes managing the EMS, maintaining documents and records to demonstrate conformance, and identification of non-conformances with the EMS.

All employees: includes ensuring that all operations are carried out in accordance with specified procedures and work practices.

Communication[2]**.**

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

All external complaints automatically generate an incident report that is forwarded to and dealt with by the Environment Department[3].

Training[4]**.**

All Cable Sands' employees and principal contractors undertake environmental awareness training, with regular refresher courses and toolbox meetings.

[1] CD116 Environment Management Manual.

[2] SP09 Communication.

[3] SP13 Non-Conformance and Preventative Action.

[4] SP32 Training

3. IDENTIFICATION OF RISKS (IMPACT REGISTER)[1]

General.

Dry mining requires the use of various types of earth moving equipment, all of which have the potential to be significant generators of environmental noise. Another aspect of mineral sands mining in the South West is the proximity of residences and other noise sensitive premises (NSP) such as public buildings and caravan parks.

Factors affecting the transmission and/or intrusiveness of mine noise include climatic conditions (wind speed and direction, temperature inversions), the absence of other noises (road, rail) and personal sensitivity or attitude towards mine noise.

Given the wide number of variables, it is therefore obvious that there is a real risk of a noise incident, or complaint, occurring. This is further supported by past experience, with the result that noise impact has been designated a risk level in the in the EMS of HIGH.

Table 1. Variables influencing the risk of excessive noise

Key Variable	Additional Factors
Proximity to residence	• production benefits vs noise control costs • direction and elevation of residence in relation to the mine • prevailing weather conditions • nature of construction and materials of the residence • sensitivity and/or attitude of the resident(s) towards the mine • work habits of resident(s) eg shift workers
Nature of mining activity	• elevation of active area or activity • hardness of materials being excavated (eg presence of rock) • number and nature of mining equipment • operating hours • location, elevation and orientation of the primary plant in the pit
Mine vehicle performance	• changes to mine equipment • noise reduction measures vs performance reduction • engine and exhaust noise vs transmission noise • operator style and awareness/consideration • frequency and extent of equipment maintenance
Background noise	• sensitivity/awareness of traffic and other noise • interference with performance monitoring
Weather conditions	• wind speed and direction • cloud cover and height • temperature inversions

[1] SP03 Identification and Management of Environmental Issues.

4. NOISE CONTROL[1]

General.

Management to reduce the risk of noise impact is split into three components:

1. planning,
2. control at source, and
3. community relations.

Mine Planning

Cable Sands will endeavour, through the planning process, to identify Noise Sensitive Premises prior to the construction phase. Once identified, a Risk Analysis using the factors listed in Table 1 will be undertaken as required by the EMS[2].

Following assessment, a selection of the following controls will be used to minimise the risk.

Acoustic Bund Walls.

The installation of 2-4m earthen bund walls between mining operations and noise sensitive premises is known to effectively reduce noise levels at those locations by redirecting or reflecting noise away from the premises. It is also recognised that the effectiveness of bund walls as a noise reducing measure is lessened under certain climatic conditions, such as temperature inversions. Additional measures are utilised in such conditions.

Although only a short-term activity, the construction of these walls can be noisy, and residents will be consulted with before the commencement of any such installation. Regulatory advice is that construction of bund walls is governed by Regulation 13 of the *Environmental Protection (Noise) Regulations 1997*. Construction would be limited to daylight hours (7.00 am to 7.00 pm) between Monday and Saturday. Most barriers are usually completed within several working days.

The bund walls themselves are usually stabilised with vegetation or coated to minimise dust and erosion. Topsoil and/or overburden stockpiles may be strategically located to act as bund walls.

Limitations on Work in Early/Late Hours

During after-hours operations (as defined by the noise regulations) in areas that may affect residents, mobile mining equipment will be limited to front-end loaders working at depth in the mine pit and, when necessary, water carts. This eliminates any contributions to noise levels by bulldozers and other units.

The above limitations will remain in effect until 9.00 am on Sunday and Public Holidays.

[1] WI042 Occupational Noise control Policy and Plan.

[2] SP03 Identification and Management of Environmental Issues.

The Company reserves the right to utilise any piece of equipment at any time in an appropriate or controlled fashion, including, but not limited to, emergency work. Such a use will still be conducted in accordance with the NMP and Cable Sands' Environmental Policy.

Noise Sensitive Zones

Areas of the proposed mine which are close to neighbouring residences will be designated as "Noise Sensitive Zones". Extra noise restrictions will be invoked on the site when working in these areas. These include:

- Reduced operating speeds on heavy equipment.
- Restricting the number of units in the area at any one time.
- Sign-posting access routes to the area.
- Limiting operations to day-time activities where possible.
- Sensible placement and orientation of stationary equipment such as trommels and lights.

The use of Noise Sensitive Zones in the past by Cable Sands has proven very effective in managing off-site noise impacts.

Control at Source

Cable Sands will, in a manner consistent with Best Practice, maintain and operate equipment under its control to ensure that optimum noise performance is achieved. Consideration to noise characteristics is also given during the purchasing of new equipment[1].

Earthmoving Equipment Noise Reduction Engineering

Observations indicate that much of the noise from mobile earth-moving equipment (excluding tracks) operated by Cable Sands comes from the engine compartment.

Motor noise – managed by enclosing engine housings with sound-absorbing materials and training operators.

Exhaust noise – can be tonal, and is managed by fitting modified manifolds and mufflers to further dissipate noise energy.

Fan noise – enclosing the engine bay requires larger cooling fans, and noise from these is managed by placing the fan on the top of the engine to direct noise upwards, or using baffles or louvres.

Noise as a result of the transmission or hydraulic systems is managed through regular maintenance and driver training (see below).

Cable Sands equipment operating outside daylight hours have their reversing alarms modified, so that at night time (while the headlights are switched on), the audible alarm is switched off and replaced by a flashing light.

[1] SP19 Purchasing.

Cable Sands has adopted benchmarking of noise performance of heavy machinery operating on-site[1]. The process is triggered:

- whenever heavy machinery is replaced,
- whenever work is done on the exhaust or engine compartment, and
- annually every March or April.

Workforce Training and Involvement[2]

Under general environmental training and awareness, noise control issues and the responsibilities of individual employees are discussed via monthly minesite staff meetings. This follows on from initial induction courses where employees and principal contractors are made aware of the importance of their environmental performance.

A copy of this Noise Management Plan is to be appended to the site Environmental Management Plan, a copy of which is kept at the minesite.

Community Relations

Cable Sands has a commitment, under its Environmental Policy, to involve the community in aspects of impact management. This reflects the company's belief that a positive community attitude towards its activities in the area not only has immediate benefits, but makes future proposals more favourable to the wider community.

Reporting of environmental performance is discussed in Section 5.

Community Consultation

Cable Sands will, at its discretion, continue to conduct or coordinate public forums with the purpose of informing the community about environmental issues, including noise, or to obtain community feedback and attitudes towards its operations and performance. These forums will supplement Cable Sands' practice of liasing with residents directly.

Complaint Response Procedures

To establish an open line of communication, Cable Sands has contacted neighbouring residents to discuss noise issues and continues to liaise with them on a regular basis. These residents have been informed of the Noise Management Programme for the minesite and are aware of whom to contact in the event of a noise incident occurring.

With the more sensitive noise locations, a wind sock will provide visible indications of wind direction. These tools will assist supervisors to recognise when wind conditions are more likely to cause elevated noise transfer to neighbouring residences and allow them to take appropriate precautions.

[1] AS 2012.1:1990 Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition.

[2] SP32 Training

In addition to the minesite response, any noise complaints will also be formally processed through Cable Sands' ISO14001 certified EMS system[1]. Responsibility for action lies with the Environmental Superintendent. The Environment Department reports complaints and other non-conformances to the Department of Environmental Protection (DEP).

Operating Agreements

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

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

[1] SP13 Non-Conformance and Preventative Action

5. PERFORMANCE MONITORING AND REVIEW

General.

Cable Sands has a commitment, under its Environmental Policy, to audit and monitor its environmental performance on a regular basis, and make relevant information about the Company's activities publicly available.

Routine Monitoring

Cable Sands currently monitors minesite noise[1] at the current operations on a regular basis (four times a year) and when feedback indicates that noise levels may be increasing or problematic.

The Company also periodically deploys its noise logger unit[2] (Acoustic Engineering Instrument) to continuously monitor environmental and mine noise levels in various locations as the mine progresses.

Major operating development and rehabilitation events, such as overburden stripping, fines dam construction and plant relocation are monitored more closely as these short term events are recognised as having high noise potential.

Benchmarking.

As previously indicated, Cable Sands now assesses the performance of mining equipment in terms of noise generation potential.

EMS Audits

Cable Sands will routinely conduct internal audits[3] to assess compliance with, and effectiveness of the various components of its EMS, including the NMP. In addition, the Company's EMS will be audited externally every six months, with a full re-certification audit every three years.

Audit findings will be reviewed by the Company's Environmental Committee, including the General Manager, and acted upon by the Environmental Officer, through the EMS.

Reporting[4]

Regulatory reporting of monitoring results and the performance of the acoustic controls will be included in the annual environmental report or case by case, if required.

Routine distribution of the report is limited to relevant government agencies, but is available to the public, on request.

---

[1] WI289 Operation of the Handheld Noise Meter (B&K 2260) (in prep).

[2] WI053 Operation of the Noise Data Logger Unit.

[3] SP15 Internal Audits.

[4] SP01 Environmental Reporting.

Internal Review[1]

Internal reviews of performance, including number and handling of environmental incidents, are conducted quarterly by Cable Sands' Senior Management in the forum of the Environmental Committee. The Environmental Officer, through the EMS, acts upon the findings and recommendations of the Committee.

[1] SP16 Formal Management Review

6. AUDIT SCHEDULE

Objectives	
1. Operate in compliance with the *Environmental Protection (Noise) Regulations 1997* 2. Cause no public nuisance or complaint	
Action – Cable Sands will:	Evidence
1. Identify Noise Sensitive Premises prior to the construction phase	Plan of noise sensitive premises
2. Construct acoustic bund walls	Plan
3. Limit construction (as defined by the noise regulations) to daylight hours (7.00 am to 7.00 pm) between Monday and Saturday	Log sheets
4. Limit mobile mining equipment in use after-hours (as defined by the noise regulations) in areas that may affect residents, to front-end loaders working at depth in the mine pit and, when necessary, water carts. The above limitations will remain in effect until 9.00 am on Sunday and Public Holidays.	Log sheets
5. Designate areas of the proposed mine which are close to neighbouring residences as "Noise Sensitive Zones". Extra noise restrictions will be invoked on the site when working in these areas. These include: • Reduced operating speeds on heavy equipment. • Restricting the number of units in the area at any one time. • Sign-posting access routes to the area. • Limiting operations to day-time activities where possible. • Sensible placement and orientation of stationary equipment such as trommels and lights.	Plan of noise sensitive zones
6. Maintain and operate Cable Sands equipment in a manner consistent with Best Practice to ensure that optimum noise performance is achieved. Consideration will also be given to noise characteristics during the purchasing of new equipment.	Noise assessments of equipment.

Action	Evidence
7. Conduct benchmarking of noise performance of Cable Sands heavy machinery working after hours • whenever heavy machinery is replaced, • whenever work is done on the exhaust or engine compartment, and • annually every March or April.	Noise assessments of equipment.
8. Ensure workforce are aware of noise control issues and the responsibilities of individual employees.	Toolbox meeting minutes, training attendance lists.
9. Ensure a copy of this Noise Management Plan is appended to the site Environmental Management Plan, a copy of which is kept at the minesite.	Document control records
10. Continue to conduct or coordinate public forums as required, for the purpose of informing the community about environmental issues, including noise, or to obtain community feedback and attitudes towards its operations and performance. These forums will supplement Cable Sands' practice of liasing with residents directly.	Records of meetings
11. Formally process any noise complaints through Cable Sands' ISO14001 certified EMS system. The Environment Department will report complaints and other non-conformances to the Department of Environmental Protection (DEP).	Incident reporting documentation.
12. In the event that noise from the mining operations, despite all other attempts at control, continues to have an impact on any neighbouring resident, consider actively seeking an agreement with the resident as a means of resolving the issue.	Records of agreements
13. Monitor minesite noise at least 4 times per year.	Monitoring records
14. Conduct internal audits to assess the compliance with, and effectiveness of the NMP	Internal audit records
15. Report on monitoring results and the performance of the acoustic controls in the annual environmental report or case by case, if required.	Annual Environmental Report.
16. Conduct internal reviews of performance, including number and handling of environmental incidents, by Cable Sands' Senior Management in the forum of the Environmental Committee.	EMS Committee minutes.

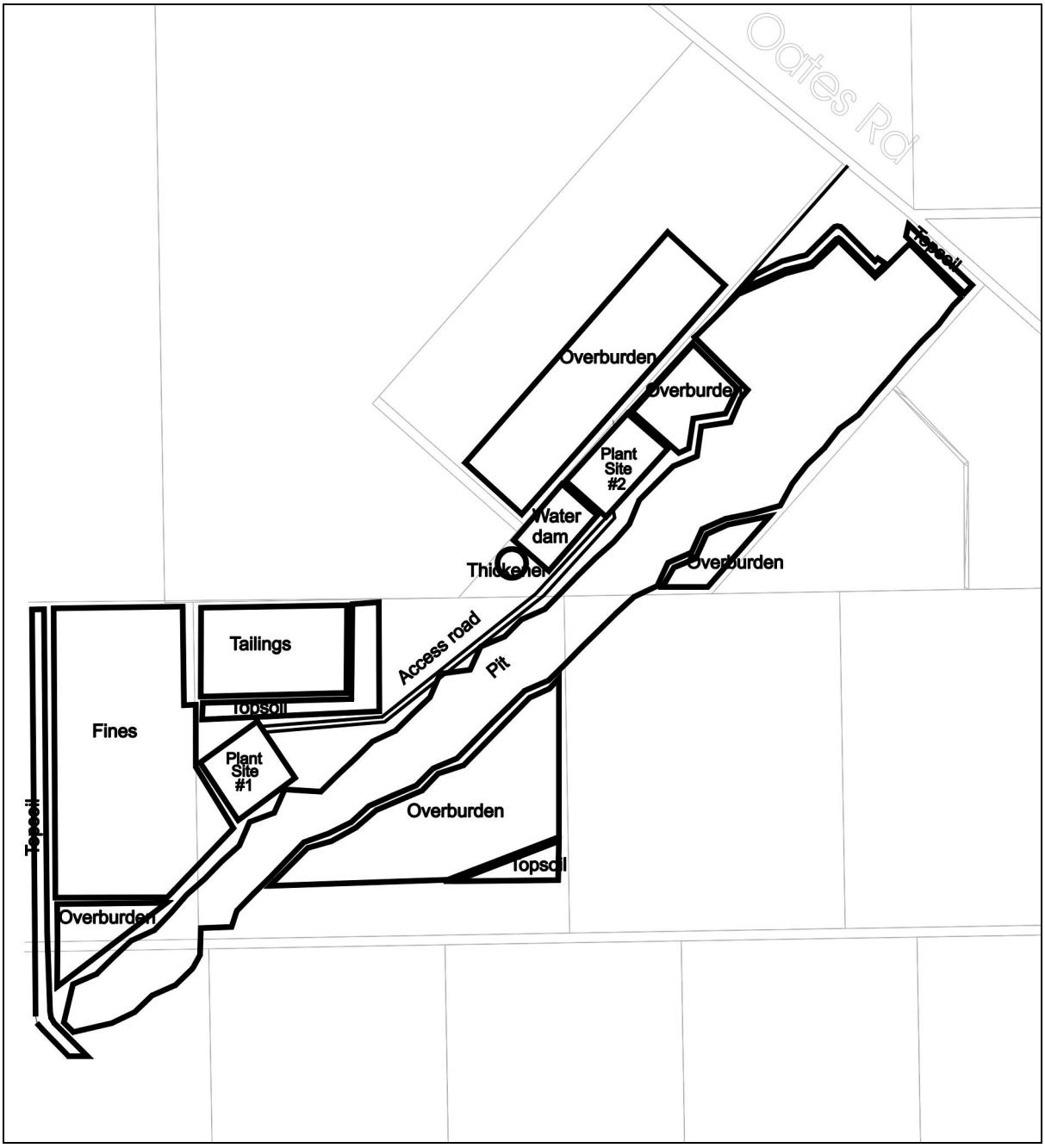


Figure 1. Layout of Tutunup minesite.

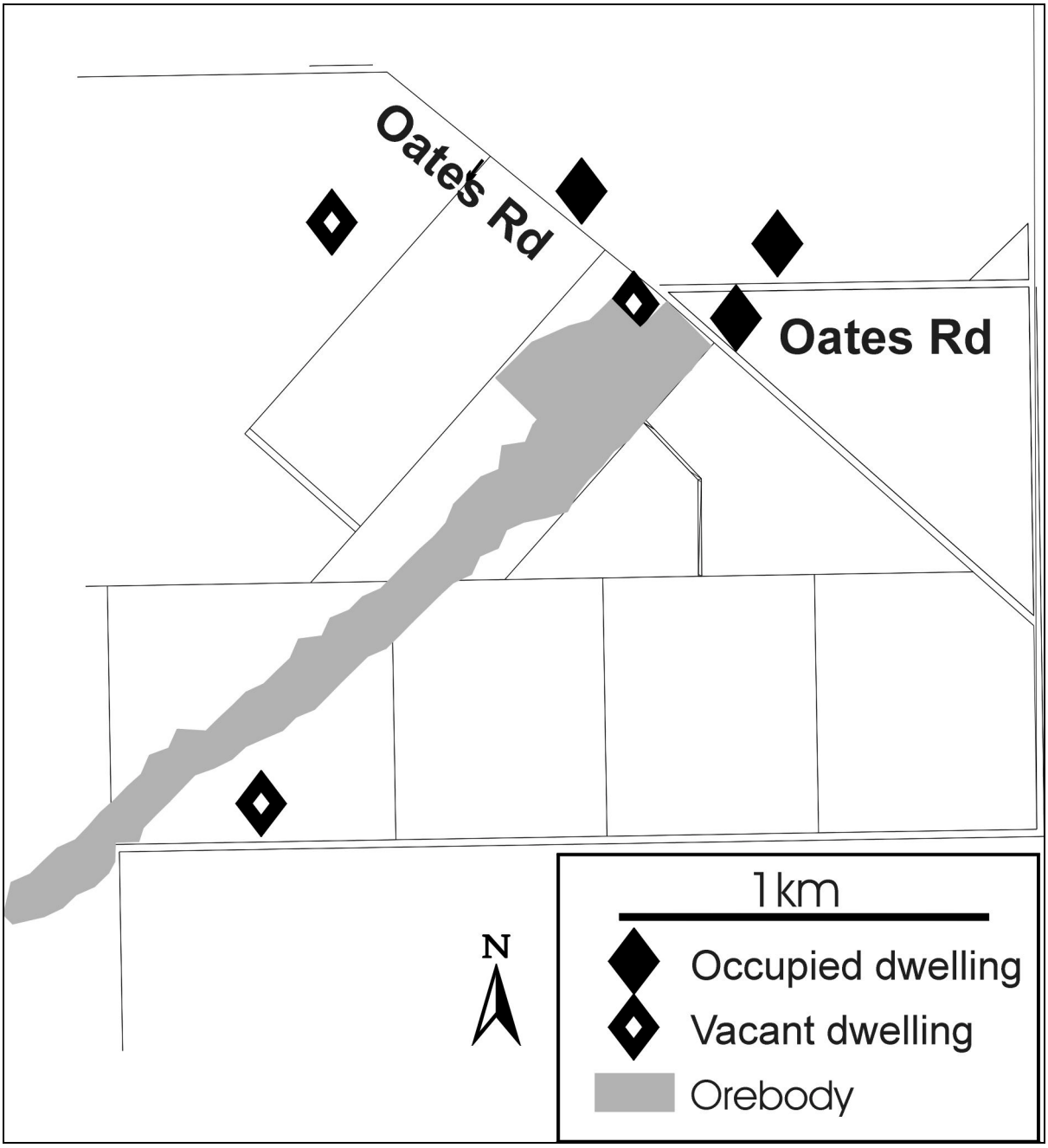


Figure 2. Identified noise sensitive premises.

Table 2. Typical Machinery Noise Levels.

Equipment	Task	Lmax	L1	L10	L90
Rotary screen	Normal operation (2 screens), 25 m, 5 min	66.1	65.9	65.2	64.4
FEL Komatsu	Normal operation, 1-3 krpm, 10-50 m, 5 min	87.6	84.0	81.9	78.8
D9R Caterpillar Dozer	Normal operation, ~25 m, 5 min	93.5	91.1	88.5	84.9
D11 Caterpillar Dozer	Ripping caprock, ~25 m, 14 min	92.9	89.3	83.0	73.3
Excavator	Normal operation, 40 m, 3 min, 2-3 krpm	72.5	72.2	71.2	65.0
Wet Plant	Normal operation, 5 m, 5 min	74.7	74.7	74.4	73.6
Total pit noise	Normal operations, 5 min	76.5	73.8	71.1	68.8

All results in decibels, A-weighted, slow (dBA)