

2. ABOUT THE PROPOSAL

2.1 THE PROPONENT

The Proponent for the proposed Happy Valley Mineral Sands Project is Bemax Resources Limited, incorporating Cable Sands (WA) Pty Ltd (Bemax). Bemax is one of Australia's most prominent mineral sands companies and is headquartered in Brisbane. In 2006 Bemax was the largest producer of leucoxene, the sixth largest producer of rutile and the seventh largest producer of zircon globally. Cable Sands (WA) Pty Ltd is the oldest mineral sands producer in Western Australia, having commenced mining at Koombana Beach in Bunbury in 1956. Since that time the company has successfully mined and rehabilitated many deposits in various locations throughout the southwest.

In Western Australia, Bemax currently operates the Gwindinup Titanium Minerals Mine, which commenced operations in 2008. A dredge mining operation has also commenced near Pooncarrie in the Murray Basin, New South Wales. Bemax also operates a mineral separation plant at Broken Hill and a plant at North Shore, Bunbury where mineral concentrate from its local mine and a portion of that from its eastern states operations is separated into its constituent components. Products are shipped from the ports of Bunbury and Adelaide to international markets.

Bemax's W.A. operations are conducted in accordance with its certified AS/NZS ISO 14001 Environmental Management System (EMS).

The key contact for this Proposal is:

Environmental Manager
Bemax Resources Limited incorporating Cable Sands (WA) Pty Ltd
PO Box 133
BUNBURY WA 6231
Telephone: (08)9721 0200
Facsimile: (08)9791 1249
Email: Brant.Edwards@bemax.com.au

2.2 LOCATION

The Happy Valley Proposal is located within the Shire of Capel, approximately 25 km south south-east of Bunbury and 10 km south of the town of Boyanup. The ore body designated as Happy Valley North (HVN) intersects Gavins Rd, while the Happy Valley South (HVS) ore body is located approximately 2 km south of Gavins Rd. The Happy Valley deposits are located approximately 500 m east of the Gwindinup South deposit and approximately 700 m south of the Gwindinup North deposit. The neighbouring Yoganup Extended minesite operated by Iluka Resources Limited is 1.6 km west of the HVS deposit.

The mining tenement details are provided in Table 2-1. Current land use and tenure are described in Section 3.4.

Environmental Review

Table 2-1 Tenement and cadastral details of the Proposal

Deposit	Tenement	Land tenure
Happy Valley North	M70/901	State Forest (Argyle block)
	M70/479	Loc 215 (accessed by agreement) and road reserve
Happy Valley South	M70/899	Loc 4965, Loc 4485 and Loc 3829 (all owned by Bemax)
	M70/900	State Forest (Argyle block)

2.3 JUSTIFICATION FOR THE PROPOSAL

The Happy Valley Proposal is critical to Bemax’s continued operation in the southwest. Production of titanium mineral from the company’s only current minesite at Gwindinup is expected to conclude in 2010. The Happy Valley Proposal is therefore required to ensure that a continuity of feedstock is available for the Bunbury secondary separation plant which in turn is essential to satisfy sales contracts with well-established international customers.

Although Bemax continues to pursue other long term mining options in the southwest, the Happy Valley Proposal is the only one which is sufficiently advanced in terms of mining lease access, exploration, feasibility and environmental investigation to realistically provide continuity of supply after Gwindinup. Should the implementation of Happy Valley Proposal not be approved, the Proponent’s future in the southwest is uncertain.

2.3.1 Design and management objectives of the Proposal

Bemax, through its environmental policy², is “committed to sustainable production of titanium minerals in a manner that protects the values of the natural and social environments in which it operates” (Bemax 2008). Associated with the policy are several management commitments relevant to the design and implementation of the Proposal, namely:

- minimise the environmental impact of operations
- continually improve environmental management practices and performance
- work with the community with the aim of achieving mutually acceptable outcomes from all areas of operation
- conduct mining in a manner that ensures that rehabilitation to the agreed end land use can be achieved at the earliest practical time.

These commitments have been implemented by adopting the following priorities in the mine planning process:

- minimise clearing footprint
- minimise clearing of native vegetation for infrastructure
- avoid creeklines and buffer areas, unless absolutely essential for mine function

² The Bemax Environmental Policy is supported by an Environmental Management System accredited to AS/NZS ISO 14001:2004.

Environmental Review

- reconstruct soil profiles that maximise the likelihood of a return to self-sustaining natural ecosystems on vegetated areas and maximise productivity of agricultural areas
- maximise direct and seasonal return (i.e. dry season) of topsoil, to original areas or pre-determined analogues
- minimise disturbance timeframe.

The consideration of these priorities in the mine planning process is described in Section 2.5.

2.3.2 Vegetation clearing requirements and alternatives

The development of the Happy Valley Proposal will necessitate the clearing of 155 ha of native vegetation, including State Forest (63 ha). The removal of approximately 90 ha of native vegetation to access ore reserves³ is considered as a fundamental and unavoidable requirement of the Proposal. The clearing for infrastructure (including noise bunds) and support is driven by the limited availability of existing and accessible cleared land within an economic distance of the mine pits. This is an increase of 57.7ha on the proposal described in the Environmental Scoping document which originally included 43.1ha in State Forest. The increase is primarily a result of changing economic parameters such that an additional 20ha of ore reserve (currently vegetated) could be economically mined under current economic conditions. There has been a corresponding increase in areas required for infrastructure such as solar drying dams and overburden and topsoil stockpiles to service the increase in ore.

The Proposal’s Environmental Scoping Document (ESD) includes an action to “assess clearing requirements by identifying and costing alternative locations on cleared land for stockpiles and other infrastructure and comparing with environmental impacts for each area” (Section 4.3.4 of ESD). This is consistent with the EPA principle that biodiversity is best conserved *in situ* (EPA 2004f) and its expectation that Proponents compare development scenarios and demonstrate that all reasonable steps have been taken to avoid disturbing native vegetation (EPA 2000a).

Table 2-2 Assessment of out-of-pit clearing requirements

Area	Selection Consideration	Alternatives
8 ha of Whicher Valleys (WC) vegetation on private land for access corridor, plant site and HMC stockpile, HVS, Loc 4485	To minimise clearing for HVS, overburden and other out-of-pit material will be stored at Gwindinup South and a direct route between the two is required to minimise the cost of this initiative. The corridor and plant site has been selected based on avoidance of Cartis vegetation, vegetation condition and minimum clearing.	Southern approach: same area (8 ha) of Whicher Valley (WCv) vegetation and impact on drainage line. Considerable increase in pumping distance to fines dams. Northwest approach: Reduce clearing to less than 3 ha but would increase truck distance by 4.5 times and require construction of three creek crossings.
46 ha of WC and WCv vegetation for plant site, solar drying dams and overburden stockpiles, HVN, Loc 215	Majority of vegetation is Condition Very Good to Good condition although there are indications of dieback and the effects of cattle grazing.	All viable avenues to purchase or access cleared farmland immediately to the north have been exhausted at this time.

³ Includes mine voids, access corridors and safety buffers with native vegetation stockpiles.

Environmental Review

Area	Selection Consideration	Alternatives
Isolated unmapped remnants on private land for solar drying dams, HVS, Loc 4965	Approximately 3.5 ha of unmapped vegetation as isolated remnants of mainly regrowth jarrah on laterite, the largest being 2.3 ha. Creek buffers have been retained and will be enhanced with additional planting to maximise faunal landscape connections during mining.	No potentially viable alternatives were able to be identified.

The Proposal has been designed to limit clearing in State Forest for the mine pit (defined by the economics of the day), access corridors, a noise bund and native topsoil stockpiles. The latter will be stored within a cleared buffer around each pit. The width of the buffer varies from 15 m to 50 m, depending on the environmental significance of the vegetation (see Section 5) and safety considerations.

Table 2-2 outlines those areas outside State Forest where clearing is proposed to accommodate infrastructure placement requirements. In general, two factors limit the capability of the Proponent to further reduce the clearing footprint:

1. The considerable distance to available and suitable cleared areas.
2. The elevation of the mine site (90 - 110 mAHD) compared to the closest available cleared areas (38 – 48 mAHD).

2.4 PROPOSAL HISTORY

The proposal to mine the Happy Valley deposits originally formed part of the Gwindinup Titanium Minerals Project, referred to the EPA in 1999 (Figure 2-1). In view of the potential environmental impacts associated with the project, the EPA determined that the appropriate level of assessment for the Gwindinup Proposal was Consultative Environmental Review (CER). The CER documentation was subsequently prepared by Cable Sands (WA) Pty Ltd (2000) and released for a four week public review period, ending on 3 April 2000. Fourteen submissions were received from Government agencies, community groups and local landowners.

The assessment process was suspended at this point as the Proponent commenced negotiations to purchase additional private land to reduce native vegetation clearing requirements and to conduct additional studies. Due to the length of time that elapsed since publication of the CER, the Proponent produced an addendum to the CER in October 2003 with the assistance of the (then) Departments of Environment (DoE) and Conservation and Land Management⁴ (CALM). This included the outcomes of investigations undertaken by the Proponent to address submissions made during the public review process.

In November 2004, the EPA indicated that additional vegetation surveys were required at the Happy Valley deposits before a decision on that proposal could be made. The Proponent subsequently amended this proposal by removing the Happy Valley deposits from the Gwindinup Proposal to ensure the assessment of the remainder of the Proposal could continue through the EPA process.

The EPA assessment report (EPA 2005b) for the amended Gwindinup Proposal was released by the Minister for Environment. This report indicated that that the amended proposal was environmentally

⁴ The Department of Environment and the Department for Conservation and Land Management have amalgamated to form the Department of Environment and Conservation (DEC).

acceptable and could be implemented subject to a number of recommended conditions. The Minister for the Environment issued an approval for the implementation of Gwindinup Proposal in April 2006 and mining commenced in 2008.

The Happy Valley Proposal, as it now stands, was referred to the EPA in 2005 and a Level of Assessment set at Environmental Review and Management Program (ERMP). Consequently, an Environmental Scoping Document (ESD) was prepared and released for a two-week public review period in early 2007, consistent with the EPA's Environmental Impact Assessment Administrative Procedures (EPA 2002a).

2.5 PROPOSAL DETAILS

2.5.1 Overview

The Proposal represents a typical dry-mining mineral sands operation, where relatively shallow⁵ strands of mineralised ore are excavated by heavy machinery, such as front-end loaders and scrapers, for processing on-site. Access to the ore follows a strip-mining approach, where the mine pit progresses along the strand(s), backfilling with mine tails (by-products from the separation process) and overburden as it proceeds. Following backfilling, a soil profile is recreated and revegetation of the disturbed areas commences.

The layout of the proposed minesite is shown in Figure 2-1. The overview of the Proposal and the associated environmental footprint are shown in Table 2-3 and Table 2-4 respectively. The stages, plant and equipment relevant to the mining process are shown in Figure 2-2 and Figure 2-3, and are described as follows.

2.5.2 Schedule

The Proposal will commence with the mining of the Happy Valley North deposit, commencing in early to mid 2010 (subject to approval to implement the proposal). Operations, including mine development, will then transfer to the Happy Valley South deposit in 2013, and will conclude in roughly 2017.

The mining and primary separation operations will normally be undertaken 24 hours per day, seven days per week. However, operating hours may vary depending on production requirements.

Relationship to Gwindinup mine

Gwindinup North

To ensure continuity of production of titanium minerals from its minesites, the Proponent must commence developing the Happy Valley North deposit during the late productive stages of the current Gwindinup North minesite. Once mineral production has concluded at Gwindinup North, the mining plant will be transported to Happy Valley North, where mineral production will commence.

⁵ The basement of the proposed mine will range from 8 to 24 m below ground surface

Environmental Review

While mineral production is occurring at one site, the mining activity at the other site will be limited to earthworks for either construction of Happy Valley North or closure and rehabilitation of Gwindinup North. Such activities will only take place during the hours of 7 am to 7 pm, Monday to Saturday and excluding public holidays.

Gwindinup South

The proposed Happy Valley South deposit will be mined in conjunction with the approved Gwindinup South mine. This will allow the sharing of key infrastructure, including fines dams and stockpile areas, thus reducing the potential disturbance footprint.

Although both deposits will be mined simultaneously, only a single separation plant will be employed, so aspects such as water use, truck movements, and noise impacts⁶ will be the same overall as for the Gwindinup South minesite.

2.5.3 Workforce

The operating mine sites will employ 25 - 30 staff, plus contractors. All personnel working on site will be inducted in accordance with Bemax Environmental, Health and Safety Standard and Procedures.

2.5.4 Mine process details

Planning (avoidance and minimisation of impact)

The planning and design of the proposed Happy Valley minesite has focussed on minimising the clearing of native vegetation, with a priority on retaining vegetation within the State Forest tenements. Constraints against achieving this planning objective include requirements for:

- access corridors to the mine pits
- native vegetation topsoil stockpiles
- pit buffer (safety)
- noise bund at Happy Valley North.

Where unavoidable impacts to native vegetation on private land are proposed, areas of vegetation in poor condition or of otherwise relatively low conservation value have been targeted, where practicable.

The mine plan includes a separation buffer between heavy mining operations (pits, dams and stockpiles) and the creeks that flow down through the Happy Valley tenements. The size of the buffer has been based on:

- the extent of the remnant vegetation for those creeks on private agricultural land (Loc.s 4965 and 4485) and has been set at 30 m from the creekline

⁶ There are no sensitive premises within 2 km of HVS

Environmental Review

- the recommendations of the Forest Management Plan (CCWA 2004) for the creek that flows through the mining tenement M70/901 (State Forest) and Loc 215 Gavins Road, which has been set at 50 m from the creekline.

There remains the unavoidable requirement to construct a combined road and service corridor across each of the creeks, which will require a permit issued under the *Rights in Water and Irrigation Act 1914*.

Pre-clearing and clearing

Collection of suitable native seed resources will be undertaken for later use in rehabilitation prior to clearing of native vegetation for mining. In addition, suitable species, including *Xanthorrhoea acanthostachya*, will be translocated from the mine path for use in the rehabilitation. These individual plants will either be directly transplanted into rehabilitation/revegetation areas or removed to an on-site nursery for storage for future transplantation into native vegetation rehabilitation areas.

Appropriate use will be made of any timber harvested. Commercial timber in areas of State Forest will be harvested by the Forest Products Commission (FPC). On private land, the landowner will retain rights to sell any timber that would otherwise be disturbed by mining. Bemax will consult with the relevant landowners to ensure the harvesting of commercial timber is planned in advance of clearing.

Non-commercial timber and other unsalable vegetation debris will be stockpiled for use as mulch and fauna habitat for the rehabilitation phase. Any cleared vegetation debris that cannot be used in rehabilitation areas or otherwise salvaged will be burnt in accordance with fire restrictions and relevant smoke control guidelines.

Topsoil removal

Topsoil will be double stripped when the soil is dry (nominally between the months of November and April). In areas of native vegetation, the upper 50 mm of topsoil will be stripped using tractors with laser scoops, and stockpiled separately to the lower 150 mm of topsoil (also stripped using tractors with laser scoops). The 'upper topsoil' and 'lower topsoil' resources will be stockpiled separately and according to vegetation type and dieback status. Native topsoil stockpiles will be constructed over cleared native vegetation areas on the mine path, with upper topsoil stockpile height not exceeding 1 m, and lower topsoil stockpile height not exceeding 2 m.

Although it is desirable to return topsoil directly to rehabilitation areas and thus maximise the rehabilitation resources of the material, this is not achievable across the entire vegetated areas due to:

- the top priority of minimising clearing
- the high number of different rehabilitation soil types that have specific placement requirements, including those from areas infected with dieback
- the depth of mining in some areas.

These limitations have resulted in a focus on maximising the seasonal return (i.e. within the same 'dry' period, November – April) of the upper topsoil resource onto areas currently supporting the highest plant species richness: the Whicher Sandy Slopes community and the Sandplain community. It is estimated that direct and seasonal return of upper topsoil will be achieved across at least 40% of the Whicher Sandy Slopes community and 90% of the Sandplain community, for State Forest areas. To

Environmental Review

facilitate direct and seasonal return of topsoil, some overburden will potentially be sourced from nearby Gwindinup South operations.

In farmland areas, topsoil will be stripped to a depth of up to 200 mm using scrapers, stockpiled to a maximum height of 4 m, and stabilised with a fast growing grass cover.

Overburden and ore removal

Overburden, which is of sufficient depth to be handled independently of the ore, will be removed by earthmoving equipment (e.g. front-end loaders, bulldozers and scrapers) and used in the construction of fines dams and infrastructure, stockpiled for later replacement, or used to fill areas already mined. Shallow overburden, in particular the laterite layer and massive loamy sandy clays that underlie it, will be reserved for reconstruction of the upper soil profile and stockpiled separately. In total it is anticipated that a maximum of approximately 2,000,000 bcm ('bank' [*in situ*] cubic metres) of overburden will be removed from each mine.

The ore is mined using similar earthmoving equipment and fed into rotary trommels with 50 mm and 4.5 mm screens to separate large rocks, tree roots and gravel ("oversize").

HMC Production

Following the initial removal of oversize material, the undersize fraction is then pumped as a slurry to the primary separation plant where heavy mineral concentrate (HMC) is separated by conventional wet gravity methods. The HMC production capacity is approximately up to 200,000 tonnes per year, this is influenced by factors such as the nature of the deposit and market demands. Average production is likely to be closer to 150,000 tonnes per year with a total life of mine output of approximately 760,000 tonnes. HMC will be dewatered and stockpiled at the mine site prior to being trucked to the Mineral Separation Plant (MSP) at North Shore, Bunbury.

Mining and process by-products

Sand tailings are left after removal of HMC through the primary separation plant and returned to the mine void as back-fill, with the exception of the start-up phase where the sand tails are stored in a temporary stockpile until sufficient void space becomes available.

The primary separation process also washes the clay and fines from the ore and sand tails. To enable the process wash water to be re-used, it is treated using a thickener tank to which settling agents (flocculants and/or coagulants) are added. The thickener tank removes and concentrates the fines, which are then allowed to dry in one of a number of solar drying dams constructed for this purpose. The fines dams will be up to 4 m deep, with wall height up to 7 m. Once the fines have dried to a manageable state, they are broken up for burial or blending within the backfill.

Approximately 60,000 tonnes per year of mill tailings from the MSP at North Shore (Bunbury) will be returned to the Happy Valley minesite for disposal. Mill tailings are the by-product of the secondary dry separation process and consist of the silica sand and other crystalline minerals that could not be removed during primary processing at the wet separation plant. The mill tailings will contain less than 200 parts per million (ppm) of naturally-occurring radioactive elements (principally uranium and thorium). Consistent with the approved Company Radiation Plan, the tailings will be blended with sand tails and/or overburden to pre-mining levels of uranium and thorium and buried at sufficient depth to ensure surface activity levels are equivalent to, or less than, those that existed pre-mining.

2.5.5 Rehabilitation

Rehabilitation will aim to restore as many of the pre-disturbance ecological values and functions of the site as possible, by repairing to the best extent practicable, the capacity of the ecosystems to provide habitats for biota and services to people (EPA 2006b).

The rehabilitation process will commence with the start of mining, by preserving vegetative and soil materials for use on the reconstructed landscape. Mining will alter site vegetation (as do other disturbances), but Bemax will commit to returning a self-sustaining plant community that maintains representative species composition and structure, based on existing vegetation types, in those areas where native vegetation currently exists.

An Integrated Mining and Rehabilitation Plan (IMRP) has been drafted and is included in Volume 2 of the ERMP. The scope and content of the IMRP is also discussed under relevant sections of this Environmental Review.

Backfilling and reconstruction

The objectives of the backfill program, as per the IMRP, will be to:

- manage dieback risk by keeping infested soils separate and isolated from uninfested soils, in accordance with the Dieback Plan
- create overall soil profiles that fully encourage plant root penetration, infiltration of rainwater and the passage of groundwater, unless specific reasons exist to do otherwise⁷
- maximise the use of original overburden in the reconstruction of upper soil profiles, particularly under areas to be revegetated
- match upper soil profiles, subsoils and topsoils to the correct landscape position.

The backfill will focus on the restoration of the upper 6 m of the soil profile, using material and depths prescribed in the IMRP. Backfill material deeper than 4 m for vegetated areas and 1 m for pasture areas will consist of a combination of dried fines, sand tails and overburden, deposited in such a way as to best satisfy the objectives of the Proposal and the backfill program.

Bemax will deep-rip the overburden layers prior to replacing the subsoil and topsoil to reduce soil compaction.

Revegetation

All rehabilitation areas will be fenced to reduce grazing impacts by kangaroos and rabbits, and to minimise other disturbances prior to revegetation works commencing.

⁷ Examples where this might be the case include the Yarloop rubbish reserve, where deep-rooted vegetation were not desirable above the waste containment cell; and Gwindinup North, where shallow aquatards will be reconstructed to retain inundated sumpland features.

Environmental Review

Translocation

There will be two types of translocation occurring as an integral component of rehabilitation activities at Happy Valley:

- selected blocks of vegetation supporting dense ground covers dominated by sedges and/or significant plant taxa will be moved *in situ*
- recalcitrant or slow growing plant species will be targeted as individual plants.

Bemax has successfully implemented both translocation methods at the Jangardup, Ludlow and Gwindinup North mine sites for a variety of plant taxa including *Anarthria scabra*, *Xanthorrhoea gracilis*, *Xanthorrhoea preissii* and *Macrozamia riedlei*.

A major goal will be to undertake translocation in a single process directly onto prepared rehabilitation surfaces. Where this cannot be achieved, short-term storage will occur on stockpiles comprising 'lower topsoil' material.

Direct seeding

Direct seeding will be used to provide a fast establishing vegetative cover, while also enhancing overall plant biodiversity. Native seed will be supplied by experienced operators, familiar with the Whicher Scarp region. All collections will be local provenance and harvested under an appropriate permit issued by DEC.

The objective is to re-establish on mined ground as far as practicable *Kingia*, Whicher Slopes and Sandplain vegetation communities. The seed mix composition for each community will reflect differences recorded in the pre-mining environment with sowing rates reflecting dominance of the structural units required. Sowing rates for individual species in the final mix will be influenced by seed availability, seed quality and germination characteristics, and the relative importance of each taxa desired in the revegetation.

Infill planting

A number of species occurring within the Proposal area survive fire and other disturbance by resprouting from epicormic buds, lignotubers, rhizomes, corms, tubers or bulbs. Some of these resprouters also regenerate readily from seed, while for others this is rare (recalcitrant species). Regeneration from seed may be limited by low or infrequent seed set, low seed viability, the requirement for specific germination stimuli, or a short-lived seed bank. For species that only set small quantities of viable seed, seedlings will be propagated from this resource in the Bemax nursery and then planted into prepared rehabilitation areas. For species where seed collection or germination of seed is not possible, plants will be produced by vegetative propagation using cuttings or rootstock material. Commercial nurseries will be contracted to supply much of the required stock, with the balance supplied by Bemax's own nursery in Bunbury. All nurseries will be required to operate in accordance with the Nursery Industry Association of Australia's NIASA Best Practice Guidelines.

Seedlings for understorey species will be planted evenly across the entire rehabilitation site at a rate >1,000 plants/ha. With a variety of other understorey species also developing from seed, the re-established vegetation is expected to have a suitably randomised distribution.

Maintenance

Rehabilitation progress will be routinely assessed against performance criteria set through the management planning process. Where performance criteria are not met, remedial works such as additional planting, weed or erosion control will be implemented.

2.5.6 Decommissioning

Decommissioning of the Happy Valley North and South mine sites will commence soon after completion of mining. In this context ‘decommissioning’ refers only to the removal (or appropriate retention) of infrastructure and assessment and removal of potentially contaminated materials. The actual rehabilitation of the site is a discrete phase of the project and is addressed by the IMRP.

Consistent with Bemax’s Environmental Policy, the specific objectives in managing the decommissioning process will be:

- to ensure that rehabilitation and decommissioning are carried out in a planned sequential manner, consistent with best practice
- to ensure that agreed post-mining land-use outcomes are achieved
- to avoid ongoing liability.

Closure concepts

A draft Conceptual Decommissioning and Closure Plan (DCP) has been developed and is included in Volume 2 of the ERMP. Its contents include:

- removal of plant, infrastructure and other materials
- retention of specific infrastructure
- removal of contaminated material (if relevant)
- care and maintenance
- monitoring and reporting.

Best Practice requires that mine closure planning be undertaken progressively throughout the lifetime of an operation. As such, the conceptual DCP will be reviewed annually and detail added as it becomes available. The final DCP will be submitted to the relevant authorities for approval at least six months prior to closure of the site.

Infrastructure removal

A range of infrastructure will be established as part of the mine development – plant, roads, boundary fences, bores, water dams etc. In State Forest areas (M70/901 and M70/900) all infrastructure will be removed as soon as practicable following completion of mining to allow for timely rehabilitation. M70/479 and M70/899 are located on private property with some mining operations infrastructure installed such as roads, bores, fences, water dams etc which may be left in place dependent upon agreements with landowners. Bemax’s aim is to remove all infrastructure, except where it will provide ongoing benefit to a landowner or community, in a timely manner. Details on any infrastructure to remain on the mining lease beyond closure of the site will be outlined in the Happy Valley DCP.

Site decontamination

Bemax's Integrated Management System is designed to minimise the probability of contamination occurring, and outlines the procedures for clean up and reporting of contamination that may occur. The primary potential source of contamination is anticipated to be hydrocarbon spills. Work instruction WI044 Hydrocarbon Management outlines Bemax's procedures for management of hydrocarbons and CD118 Emergency Preparedness and Response Plan outlines the actions to be taken in the event of a spill.

The other potential source of site contamination is via the return of MSP tailings to the site for disposal. The MSP tailings that will be returned to Happy Valley typically contain less than 200 ppm of radioactive elements and thus do not classify as radioactive. As per Bemax's Radiation Management Plan a post mining gamma survey is conducted upon the completion of rehabilitation to ensure that no radioactive contamination has occurred during the mining process.

2.6 WATER REQUIREMENTS

2.6.1 Overview

The Proposal will require water for dust control, as well as screening, slurring and separation of the titanium mineral. Water for processing purposes is continually recycled, with losses to evaporation and infiltration requiring the addition of make-up water. This water will be sourced from the Yarragadee production bore scheduled to supply the Gwindinup South operations and from the harvesting of stormwater collected from the site. This practice also ensures that sediment-laden water is kept within the operations and not released into catchments.

Any requirements for potable water will be serviced either by collection in rainwater tanks or by purchase from a commercial supplier.

2.6.2 Process description

Production bore

The maximum projected rate of water abstraction is 1.5 GL/annum. The maximum usage rate for the existing Gwindinup North mine site is also 1.5 GL/annum. Operating in a sequential manner, it is anticipated that water use at Happy Valley North will commence following completion of mining at Gwindinup North so net water use by the Proponent will remain substantially unchanged. The concurrent mining operations at Gwindinup South and Happy Valley South will utilise only one processing plant situated between the two so water requirements should not significantly increase.

Bemax currently has a total allocation from the Yarragadee aquifer for all of its operations of 3.9 GL/annum (GWL 161841(4)), which is sufficient for the purposes of the Happy Valley Proposal.

Re-use

Minesite water will be recycled for use in the mining and processing of mineral sands (process water circuit) where possible. Water from the wet plant is returned to the thickener for clarification and reuse.

A deep-vane thickener of 2270 m³ capacity will remove fine clay from the water circuit. Water from the wet separation plant will be recycled to reduce water requirements. Prior to re-use, the water is treated with flocculants (at approximately 15 ppm) and passed through the thickener, where the solid fraction (clays or fines) settles to the bottom and clear water overflows from the top. Flocculants used are anionic flocculants that are benign and are not classified as hazardous according to National Occupational Health and Safety Commission (NOHCS) criteria. The flocculants and thickener are very similar to those used to treat drinking water.

Tailings are disposed of at approximately 40 - 50% solids, so a significant amount of water is returned to the tailings storage facility or the mine pit with the tails. This water will be collected and returned to the process water circuit for reuse.

Water storage

A single joint water storage dam will be constructed and shared between the Gwindinup South and Happy Valley South deposit in order to minimize additional clearing and reduce costs. The dam will be constructed from on-site materials and will be lined with low-permeability material to reduce leakage. The Happy Valley North project will be serviced by a single dam constructed on the Location 215 property to the north of Gavin's Road. Again this dam will be constructed from on-site material and will be lined with a low permeability material to reduce leakage.

Dams are constructed with a central bund that allows the water to settle between the dam's recycled water feed point and the plant pick up point to reduce turbidity of the water in the process circuit.

Stormwater harvesting

A significant amount of stormwater will collect in these areas and will be available for harvesting due to the considerable open area in the pit and fines dams. The process water circuit is expected to be able to accommodate winter storms as water storage and fines dams will provide a significant buffering capacity. Water from the fines dams and pit will collect in these areas and can then be pumped back into the process water circuit for reuse. During the winter months this will considerably reduce the water abstraction requirements of the site.

2.6.3 Discharge

Eventualities may arise where stormwater that has collected in operational pit areas will need to be removed and treated and is excess of storage capacity. In these instances, water will be discharged from a controlled discharge point on the water supply dam, with the location of the discharge point to be determined in consultation with the relevant stakeholders. For Happy Valley South, the Gwindinup South water circuit will be used.

2.7 INFRASTRUCTURE

Access to the deposits and recovery and separation of the ore will require the construction of access roads, support areas and corridors for pipelines and powerlines. Additionally, dams will be needed for water storage and for the settling and drying of clay fines. These and other major infrastructure items are described in more detail below.

Access and internal roads

Internal roads will be constructed within the minesite for mining and service operations. The roads will be constructed from gravel, road-base 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 maintained on site for this purpose. Roadside drains will be integrated with the drainage network and runoff will be directed away from areas of native vegetation.

Main entrance roads will be stabilised along the approach to the public road to reduce dust and the deposit of dirt onto the public road. The access road to the mine will be signposted and access to the active mining area other than the designated access road will be prevented by fencing or other obstruction.

Plant sites and lay-down areas

The separation plant, HMC stockpiles and site laydown area for the Happy Valley North project will be situated on Loc 215, off Gavin's Road. The plant established for the pending Gwindinup South minesite is proposed to be only partially relocated to the HVS deposit so that the operational requirement to clear additional land is minimised. Similarly, the site lay-down area and stockpiles will be shared between the Happy Valley South and Gwindinup South sites to further reduce clearing requirements.

The separation plant and facilities will be relocated from other minesites and will include workshops, store, shed, site office, toilets and a lunch room. HMC towers will be located adjacent to the plant sites.

Overburden and topsoil stockpiles

A topsoil and subsoil handling program forms part of the IMRP. Stockpiles are normally located as close to the pit area as possible and arranged or laid down in a 'last out – first in' sequence. However, the environmental benefit of locating stockpiles further afield in areas previously cleared has been a major consideration of mine planning. No overburden stockpiles will be located in State Forest.

Topsoil management aims for direct and seasonal return of topsoil to native vegetation areas, to this end there will be minimal stockpiling in areas of native vegetation. Topsoil from the initial clearing stage will be stockpiled on the cleared mine-path, subsequent topsoil will be either stripped and directly replaced onto rehabilitation areas or stockpiled on the mine-path for return within a 12 month period. Topsoil stockpiles from areas with native vegetation and/or dieback infestation will be located and managed to minimise the spread of dieback and weeds. In addition, topsoil from disturbed areas will not be stockpiled next to forested areas, to minimise the risk of spreading disease or weeds.

Fines dams

Fines dams are required to dry and consolidate the clay fines removed from the wash circuit. The dams will initially be constructed on cleared agricultural land, but as backfilling of the mine progresses, they will be located on backfilled areas. The dam walls will typically be 5 m high, with a maximum height of 7 m.

No fines will be discharged from the site. The clay from the fines dams is eventually incorporated with tails and overburden when the landscape of the backfilled mine pit and affected surrounds is re-contoured.

2.8 HMC TRANSPORTATION

The transportation of the HMC will be by truck and trailer units similar to those currently used to transport HMC from existing operating mine sites. Trucking would be undertaken as a batch run with actual trucking frequency to be determined by the requirements of Bemax's North Shore MSP.

At estimated production rates and truck payloads of between 40 to 60 tonnes and an average of 35 truckloads per day could be expected during batch run periods at Happy Valley.

The transport route to and from the minesite has yet to be finalised. However, three options similar to those presented in the original Gwindinup CER will be considered (Figure 2-4):

Option 1. Boundary-Boyanup Route

- N 7.0 km on Gundagai Road and Boundary Road to Railway Road
- ENE 3.4 km on Railway Road to the South Western Highway
- N 23.0 km to the North Shore processing plant via Main Roads Western Australia (MRWA) approved heavy haulage routes of the South Western Highway (passing through Boyanup), Robertson Drive and Koombana Drive.

Option 2. Lowrie-Boyanup Route

- N 3.6 km on Gundagai Road and Boundary Road to Lowrie Road
- ENE 4.9 km on Lowrie Road to the South Western Highway
- N 26.1 km to the North Shore processing plant via MRWA approved heavy haulage routes of the South Western Highway (passing through Boyanup), Robertson Drive and Koombana Drive.

Option 3. Gavins-Capel Route

- N 1.0 km on Gundagai Road to Gavin's Road
- W 11.9 km on Gavin's Road to the Bussell Highway (bypassing Capel)
- N 30.0 km to the North Shore processing plant via MRWA approved heavy haulage routes of the Bussell Highway, Robertson Drive and Koombana Drive.

The status of roads considered in the above options is as follows:

- Railway Road and Boundary Road are gazetted as heavy haulage routes by MRWA. Railway Road is managed by MRWA whilst Boundary Road is administered by the Shire of Capel. Heavy haulage permits for both roads are issued by MRWA. In respect to Boundary Road, MRWA would consult with the Shire of Capel before issuing a heavy haulage permit
- the South Western Highway and Bussell Highway are MRWA approved heavy haulage routes
- Gavin's Road is currently being used by Iluka Resources as part of the transport route for their Yoganup project.

Further consultation with the Shire of Capel, MRWA and the local residents will be undertaken prior to finalisation of the transport route.

Environmental Review

Table 2-3 Summary of proposal characteristics

Characteristics	Happy Valley Proposal
Proponent	Bemax Resources Limited, incorporating Cable Sands (WA) Pty Ltd (Bemax)
Location	Locations 215, 4485, 4965, State Forest 27
Map reference (GDA Zone 50)	6287000N381000E North mine, 6285000N379000E South mine
Mining Tenements	M70/489, M70/899, M70/900, M70/901
Mining	
Mining period	2010 to 2017
Depth of mine pit	8 m to 24 m below ground surface (max)
Tailings disposal	In pit and dams
Output	Approximately 730,000 tonnes HMC total
Throughput	Approximately 2 million tonnes ore per annum
Maximum annual water use	1.5 GL/annum, sourced from existing Yarragadee bore
Maximum fuel storage	100 KL
Mining method	Dry mine with heavy earthmoving machinery
Operating hours	24 hrs 7 day/week

Table 2-4 Environmental Disturbance Footprint

Disturbance area	Vegetation	Total
Mine pits	67 ha	74 ha
Infrastructure	88 ha	174 ha
Total area	155 ha	248 ha
State Forest disturbed	63 ha	63 ha
Rehabilitation	155 ha	248 ha