

# REFERRAL OF A PROJECT FOR A DECISION ON THE NEED FOR ASSESSMENT UNDER THE *ENVIRONMENT EFFECTS ACT 1978*

## REFERRAL FORM

The *Environment Effects Act 1978* provides that where proposed works may have a significant effect on the environment, either a proponent or a decision-maker may refer these works (or project) to the Minister for Planning for advice as to whether an Environment Effects Statement (EES) is required.

This Referral Form is designed to assist in the provision of relevant information in accordance with the *Ministerial Guidelines for assessment of environmental effects under the Environment Effects Act 1978* (Seventh Edition, 2006). Where a decision-maker is referring a project, they should complete a Referral Form to the best of their ability, recognising that further information may need to be obtained from the proponent.

**It will generally be useful for a proponent to discuss the preparation of a Referral with the Impact Assessment Unit (IAU) at the Department of Environment, Land, Water and Planning (DELWP) before submitting the Referral.**

If a proponent believes that effective measures to address environmental risks are available, sufficient information could be provided in the Referral to substantiate this view. In contrast, if a proponent considers that further detailed environmental studies will be needed as part of project investigations, a more general description of potential effects and possible mitigation measures in the Referral may suffice.

In completing a Referral Form, the following should occur:

- Mark relevant boxes by changing the font colour of the 'cross' to black and provide additional information and explanation where requested.
- As a minimum, a brief response should be provided for each item in the Referral Form, with a more detailed response provided where the item is of particular relevance. Cross-references to sections or pages in supporting documents should also be provided. Information need only be provided once in the Referral Form, although relevant cross-referencing should be included.
- Responses should honestly reflect the potential for adverse environmental effects. A Referral will only be accepted for processing once IAU is satisfied that it has been completed appropriately.
- Potentially significant effects should be described in sufficient detail for a reasonable conclusion to be drawn on whether the project could pose a significant risk to environmental assets. Responses should include:
  - a brief description of potential changes or risks to environmental assets resulting from the project;
  - available information on the likelihood and significance of such changes;
  - the sources and accuracy of this information, and associated uncertainties.
- Any attachments, maps and supporting reports should be provided in a secure folder with the Referral Form.
- A CD or DVD copy of all documents will be needed, especially if the size of electronic documents may cause email difficulties. **Individual documents should not exceed 2MB as they will be published on the Department's website.**

- A completed form would normally be between 15 and 30 pages in length. Responses should not be constrained by the size of the text boxes provided. Text boxes should be extended to allow for an appropriate level of detail.
- The form should be completed in MS Word and not handwritten.

The party referring a project should submit a covering letter to the Minister for Planning together with a completed Referral Form, attaching supporting reports and other information that may be relevant. This should be sent to:

Postal address

**Minister for Planning  
GPO Box 2392  
MELBOURNE VIC 3001**

Couriers

**Minister for Planning  
Level 20, 1 Spring Street  
MELBOURNE VIC 3001**

In addition to the submission of the hardcopy to the Minister, separate submission of an electronic copy of the Referral via email to [ees.referrals@delwp.vic.gov.au](mailto:ees.referrals@delwp.vic.gov.au) is required. This will assist the timely processing of a referral.

---

## PART 1 PROPONENT DETAILS, PROJECT DESCRIPTION & LOCATION

### 1. Information on proponent and person making Referral

<b>Name of Proponent:</b>	VHM Exploration Limited
<b>Authorised person for proponent:</b>	Graham Howard
<b>Position:</b>	Managing Director
<b>Postal address:</b>	Level 2, 389 Oxford St, Mt Hawthorn, WA, 6016
<b>Email address:</b>	graham.howard@vhmexploration.com.au
<b>Phone number:</b>	+61 418920556
<b>Facsimile number:</b>	n/a
<b>Person who prepared Referral:</b>	Amy Sullivan
<b>Position:</b>	General Manager, Approvals
<b>Organisation:</b>	VHM Exploration
<b>Postal address:</b>	Level 2, 389 Oxford St, Mt Hawthorn, WA, 6016
<b>Email address:</b>	amy.sullivan@vhmexploration.com.au
<b>Phone number:</b>	0438054109
<b>Facsimile number:</b>	n/a
<b>Available industry &amp; environmental expertise:</b> (areas of 'in-house' expertise & consultancy firms engaged for project)	<p><b>VHM Exploration Limited (VHM) – (Proponent) –</b></p> <ul style="list-style-type: none"> <li>Executive board and management team have significant experience in developing major mining projects for Newcrest, FMG and WMC</li> <li>Previous Australian projects include Telfer, Cadia Valley, Solomon, Christmas Creek and Mindarie Mineral Sands Project</li> <li>100% of the Goschen Project is owned by VHM</li> </ul> <p><b>Consultants</b></p> <p>Right Solutions Australia, (Lara Jefferson - Approvals and Environment Specialist) Ecology and Heritage Partners (Botanists and zoologists) Ecoscape (Zoologists) Eco Logical (Heritage) Water Technology (Hydrology) CDM Smith (Hydrogeology)</p>

### 2. Project – brief outline

<b>Project title:</b> Goschen Mineral Sands and Rare Earths Project (Goschen Project)
<p><b>Project location:</b> (describe location with AMG coordinates and attach A4/A3 map(s) showing project site or investigation area, as well as its regional and local context)</p> <p>VHM Exploration Limited (VHM) proposes to develop the Goschen Project (the Project), located approximately 20 kilometres (km) south of Swan Hill, in the Murray Mallee bioregion of Victoria. The majority of the Goschen Project is located in the Gannawarra Shire with the northern portion located within the Rural City of Swan Hill (Figures 1 and 2).</p> <p>In this referral, the following terms are used in relation to the Project:</p> <ul style="list-style-type: none"> <li><b>Target Mineralisation Zone</b> – refers to the target mineralisation zone which VHM intends to further define into a mining footprint. It covers an area of approximately 8,300 ha. Also referred to as the <b>Project area</b></li> <li><b>Study Area</b> – an area of approximately 19,500 ha including Target Mineralisation Zone and surrounds. This is the area over which flora and fauna assessments have been undertaken, in order to better understand the environment of the region.</li> </ul>

Coordinates for the approximate Goschen Project location are as follows:

35°32'31.14"S 143°27'20.70"E  
 35°32'29.69"S 143°32'13.98"E  
 35°36'51.17"S 143°32'19.33"E  
 35°37'5.49"S 143°28'11.60"E  
 35°40'29.16"S 143°28'9.95"E  
 35°39'32.72"S 143°23'6.21"E  
 35°36'54.04"S 143°22'33.29"E  
 35°35'8.96"S 143°23'25.23"E

**Short project description (few sentences):**

The Project will involve mining and processing of heavy mineral sands and rare earths. The Goschen deposit contains approximately 300 million tonnes (Mt) of ore and is proposed to produce a zircon and rutile concentrate, titanium concentrate and a rare earth concentrate. Project activities include construction, mining, processing, decommissioning and rehabilitation of a mineral sands and rare earths mine and associated infrastructure.

### 3. Project description

**Aim/objectives of the project (what is its purpose / intended to achieve?):**

The purpose of the Project is to mine heavy mineral sands and rare earths at an initial mining rate of approximately 5 Mt per annum of ore and up to 30 Mtpa of waste, ramping up to 10 Mtpa of ore and 70 Mtpa of waste. The future operation will produce a range of concentrate products including mixed heavy mineral concentrate (HMC), zircon and rutile concentrate, titanium concentrate and rare earth concentrate, over an estimated 30-year life of mine.

VHM will conduct exploration and development activities in a safe and environmentally responsible manner. The Project will be designed and operated to deliver long-term benefits to the community, local, state and federal governments. VHM aims to effectively rehabilitate the Project to enable the continuation of agricultural activities consistent with the previous use, or as agreed with the landholder, following mining; as well as rehabilitate areas of native vegetation, leaving a positive mining legacy for local landowners and the surrounding community.

**Background/rationale of project (describe the context / basis for the proposal, e.g. for siting):**

Heavy mineral sands were first reported in the Murray Basin in Victoria in the 1960s, with significant mining campaigns commencing in the 1980s and 1990s (DEDJTR 2015). Mineral sand mines in Victoria are well placed to provide reliable and quality products to customers in Asia. There is a precedent for mining of mineral sands in the region; for example, the Douglas, Kulwin and WRP mines sites, located near Ouyen, were operated by Iluka from 2005 – 2012. The Project is consistent with the Victorian Government's planning framework.

Within the Project area, a significant mineral sands and rare earths deposit occurs within the near surface Tertiary (Pliocene) Loxton – Parilla Sands. This deposit will form the basis for siting of the proposal, with the location of processing facilities and associated mine infrastructure to be determined based on economics, environmental and social factors.

**Main components of the project** (nature, siting & approx. dimensions; attach A4/A3 plan(s) of site layout if available):

Exploration drilling has identified Target Mineralisation Zones which VHM intends to further define into a mining footprint. The location of these zones is shown in Figure 2. The conceptual mining and processing methods are described below.

**Key mining infrastructure will include:**

- Open pit mining
- Temporary Stockpiles – topsoil, subsoil, clay/overburden and interburden (non-mineralised sand/clay material)
- Processing facilities - Mining Unit Plant (MUP), Wet Concentrator Plant (WCP) and Mineral Separation Plant (MSP)
- Interim tailings storage facility (TSF) – tailings material stored in this temporary facility will be relocated into pit void once capacity becomes available
- Solar drying beds for tailings
- Slurry pipelines to transfer ore from pits to the processing facilities.

**Mining method**

The mining rate is anticipated to commence with 5 Mtpa ore and 30 Mtpa waste ramping up to 10 Mtpa of ore and 70 Mtpa of waste. The approximate depth of the mineralisation zones typically ranges between 15 and 30 metres below ground level (mbgl). Mineralisation can also occur within a few meters of the surface and extend to approximately 60 mbgl in some areas. On-going exploration drilling will provide further information on the depth of the area to be mined. The mining method will involve the following:

- Topsoil, subsoil and underlying clay/overburden layer will be removed and stockpiled separately for rehabilitation using conventional earthmoving machinery.
- The mineralised zone will be mined using conventional earthmoving equipment (e.g., excavators, bulldozers, scrapers, in pit conveyors, front-end loaders and trucks). The potential for use of directional drilling to target mineralised zones is also being investigated.
- The MUP is then used to screen and slurry the ore material so it can be pumped via a pipeline, or transported via truck, to the WCP.

**Processing**

Processing may commence at 1 – 2 Mtpa during commissioning, prior to the initial processing rate of 5 Mtpa which may then be ramped up to 10 Mtpa. Two options are being considered for the processing infrastructure, including:

- MUP and WCP
- MUP, WCP and MSP.

VHM is evaluating whether to commence mining with the MUP and WCP and upgrade the processing facility to include the MSP later, or to commence the project with all stages of processing.

The MUP and WCP produce a heavy mineral concentrate product while additional processing through the MSP produces three products streams:

- zircon and rutile concentrate
- titanium concentrate
- rare earth element concentrate.

Processing will operate continuously throughout the life of the project. The MUP will be located within or adjacent to the active pit area and will be moved regularly to align with the advancing mine face. The WCP is likely to be located outside of proposed pit areas in a central location. The MSP will be located adjacent to the WCP. VHM are also evaluating the option of a moving the WCP/MSP with each pit. This may reduce impacts to the community, through:

- Reducing linear infrastructure requirements, such as roads and pipelines, between the various pits and processing infrastructure
- Reducing the timeframe over which processing infrastructure will be located in the region of particular community receptors
- Minimise the footprint of mining operations at any one time.

Run of Mine Ore will be taken to the MUP, where the ore will be scrubbed in a drum scrubber to liberate mineral particles from clay and screened to remove oversize material. The ore feed will be slurried and pumped to the WCP via a surface pipeline. Slurry from the MUP reports to a trommel to remove coarse particles and is then pumped to cyclones for desliming. Removal of slimes aids the performance of the spirals within the WCP. Cyclone overflow reports to the thickener for treatment, whilst underflow gravitates to a surge bin.

The WCP receives the -2 mm slurry from the cyclone underflow. The +2 mm material discarded by the WCP trommel is stockpiled for pit back fill.

A fine screening stage is then conducted on the -2 mm material. The valuable heavy mineral is less than 350 micrometres ( $\mu\text{m}$ ). The screens remove all the non-mineralised material greater than this size. The slurry then circulates through the following four spiral processes to produce the HMC:

- Rougher spirals
- Scavenger spirals
- Cleaner spirals
- Recleaner spirals

The HMC will either be stockpiled and transported as product or pumped to the MSP for separation into discrete mineral concentrates. The MSP may consist of the following:

- REE Float Circuit – two staged float circuit followed by wet gravity tables to remove impurities.
- Wet MSP Circuit – uses magnetic and electromagnetic separation and spirals.

If a HMC product is produced, without further processing via the MSP, approximately 250 – 500 kt/a of HMC is anticipated.

Should additional processing via the MSP be undertaken, products are anticipated to include up to approximately:

- 220 kt/a – zircon and rutile concentrate
- 200 kt/a – titanium concentrate
- 18 kt/a – rare earth concentrate.

The products will then be packaged and transported via road and/or rail to a port facility for transport to customers.

#### **Tailings management**

There will be 2 tailing streams:

- fines tailings
- sand tailings.

During the first few years of mining an interim TSF will be built to store tailings until capacity is available within the mine pits. Once capacity is available the tailings material will be relocated into pit voids. Prior to disposal in pit, solar drying beds may be required to reduce the moisture content of the tailings before disposal. Supernatant water in the temporarily TSF and in-pit tailings disposal areas may be recovered using floating pontoon pumps, or similar. Recovered water will be re-used for mineral processing.

Fine tailings are produced from the desliming cyclone overflow, surge bin overflow, attritioner desliming, and tails cyclone overflow and will report to the tailings thickener. This high rate thickener consolidates the fines solids with the assistance of a flocculant. The consolidated solids will be combined with the sand tailings from the rougher and middlings scavenger spiral stages. The combined tailings will be pumped to the interim TSF or back to the mining pit where more flocculant is added to aid in water recovery to assist with drying out the tailings material and recycling the water back to the WCP.

The design, construction, monitoring and rehabilitation of the TSF will be in accordance with relevant government and industry guidelines, including the *Technical Guideline for the Design and Management of Tailings Storage Facilities* (DEDJTR, 2004).

### **Topsoil, subsoil and overburden management**

Overburden and interburden (non-mineralised sand/clay found between layers of mineralisation) may be used for construction of mining infrastructure (infrastructure footings, water storage facilities [turkey nests], interim TSF embankments, roads etc). However, the majority will be backfilled into pit voids, co-disposed with the fines and sand tailings, and covered with appropriate layers of overburden, clay, subsoil and topsoil as part of progressive rehabilitation. Overburden/interburden stockpiles will be required at the commencement of mining, until available capacity for disposal in mine pit voids becomes available. As the mineralisation predominantly sits above the saline water table, overburden, subsoil and topsoil are not anticipated to be saline. Any saline waste material will be disposed back in the mine pits at depth, to prevent high salinity in the upper soil profile effecting the success of future rehabilitation.

The majority of the Target Mineralisation Zone occurs on agriculture land, with small areas of remnant native vegetation. To achieve successful rehabilitation and return the land to its former use, detailed analysis of soil structures, and physical and chemical properties will be undertaken prior to mining.

The results of the soil studies will determine which materials need to be stockpiled separately including topsoil, subsoil and material such as the Blanchtown clay and other non-mineralised sand/clay overburden (material located above the mineralised sand/clay). These materials will be stockpiled adjacent to the mining voids.

### **Water supply options**

Water is required for construction earthworks, processing, dust suppression, rehabilitation, kitchen and ablution facilities. VHM is investigating the following sources of water supply:

- Untreated rural water from the Murray River (managed by Grampians Wimmera Mallee Water Authority (GWM Water))
- Brackish to saline water from a nearby groundwater borefield supply.

The bulk of water use at the site will be for the processing plant, and can be met using brackish to saline water quality with approximately 6,000-35,000 milligrams per litre (mg/L) Total Dissolved Solids (TDS). Fresher water is required for earthworks, dust suppression, rehabilitation, a small component of processing, kitchen and ablution facilities. A reverse osmosis plant may be installed to treat groundwater to reduce salinity to supply fresh-brackish water to meet these requirements. A water storage facility may be required to manage high usage periods.

It is anticipated that between 3 Gigalitres (GL) to 5.5 GL per annum will be required for the first few years of mining and will be reduced once tailings water is available for reuse. Process water will be stored in tanks or turkey's nests and will be used to transport ore in pipelines from the MUP in the pits to the WCP and the MSP in a closed water circuit.

All surface water runoff from rainfall events inside the mine footprint will be contained within the mining footprint. There are no defined surface water drainage lines within the Target Mineralised Zone, however any surface water from rainfall events falling outside of the mine footprint will be diverted around the mine site into natural flow paths as identified by the surface water assessment.

### **Support infrastructure**

Support infrastructure is likely to include:

- infrastructure corridors – slurry pipelines, water pipelines, power, etc
- reverse osmosis plant
- administration and mess facilities
- telecommunications infrastructure
- workshop and warehouse for equipment maintenance
- fuel storage areas
- water storage tanks or ponds
- laydown areas
- landfill.

### **Transport and port options**

Products will be transported to a port facility for transport to customers. The following transport options for delivering product to port are currently being investigated:

- Robinvale railway to Portland Port.
- Railway to Port of Geelong
- Truck product to Ouyen and rail to Port Adelaide.

Preliminary investigation indicates that each of these railway and port options may have sufficient capacity to support VHM's proposed activities; however, further investigation is required. Use of the Robinvale railway will involve constructing a rail siding/loading facility between Lalbert and Meatian. Use of the Ouyen railway will involve trucking the product to Ouyen and constructing a rail siding/loading facility at Ouyen or nearby. The transport option will depend on each port's capacity to store and ship VHM's product to the relevant destination. The upgrade of the Maryborough to Manangatang rail network as part of the State funded Murray Basin Upgrade Project is contingent on access to the Geelong, Portland and Adelaide Ports for the transport and export of products to overseas markets.

**Ancillary components of the project** (e.g. upgraded access roads, new high-pressure gas pipeline; off-site resource processing):

The following ancillary components include:

- upgraded access road and new site roads
- potential power generation, diesel or gas generated or solar.

Quambatook-Swan Hill Road is currently a single carriage way with a single car width of bitumen down the centre (Figure 13). This road would need to be upgraded to two lanes of bitumen to allow safe access to the mine site.

Depending upon the location of the final mine footprint, roads that may require upgrading or road verge vegetation trimming may include (but not be limited to):

- Thompson Road
- Jobling Road
- Bennett Road (Figure 13).

Additional haul roads and light vehicle roads may need to be constructed within the mine footprint.

VHM proposes to minimise truck movements in the mine footprint by using slurry pipelines to transport ore from the mine pits to the processing facility.

VHM is investigating power generation options such as:

- accessing the existing 220 kV transmission lines (part of the national electricity grid) located on the eastern edge of the project area
- accessing nearby solar electricity plant
- construction of a power station – diesel or solar.

Diesel will be used for mobile plant and equipment.

### **Key construction activities:**

Key construction activities include:

- upgrade of mine site access roads
- transport of construction equipment and materials to the mine site
- clearing of vegetation, removal and stockpiling of topsoil/subsoil for rehabilitation
- removal of agricultural infrastructure
- relocation of existing infrastructure (where required) – Telstra, water pipelines
- construction of the MUP, WCP and MSP
- construction of the rail siding/loading facility
- construction of site drainage and stormwater management systems including diversion drains, oil interceptors and sedimentation ponds
- construction of supporting infrastructure - administration office and amenities, laydowns, fuel storage facilities, reverse osmosis plant, workshops, communications and warehouse facilities
- construction of powerlines or power generation facilities
- development of a groundwater borefield (and/or access to the GWM water supply), water storage and conveyance infrastructure
- construction of the interim TSF
- construction of solar drying beds for tailings.



**Key operational activities:**

Key operation activities include:

- removal of vegetation, topsoil, subsoil, overburden and interburden, with a view to effective future rehabilitation
- dewatering of orebodies (where required)
- open pit mining using conventional earth moving equipment
- processing of ore in the MUP, WCP and MSP.
- management of mining wastes by either disposal to the pit void, temporary overburden/interburden stockpiles, or to the temporary TSF
- backfill of pit voids using overburden/interburden and tailings
- transport of product to a port facility
- progressive rehabilitation of mine voids and other infrastructure areas
- monitoring of environmental factors (such as dust and noise) to ensure potential impacts from mining operations on the surrounding community are minimised
- transport of employees, consumables, wastes and products to and from site
- maintenance of a key emergency response team.

The mine site is proposed to operate 24 hours per day, 365 days a year.

**Key decommissioning activities (if applicable):**

VHM aims to effectively rehabilitate the Project to enable high quality agricultural activities to continue following mining, as well as rehabilitate areas of native vegetation, leaving a positive mining legacy for local landowners and the surrounding community.

The majority of the Project land disturbance is open pit mining. Progressive rehabilitation will be undertaken throughout the life of mine with the objective to return the paddocks to the standard suitable for farming as soon as practicable. Key decommissioning activities include:

- progressive rehabilitation of mine voids with overburden/interburden and tailings, covered with appropriately contoured layers of clay, subsoil and topsoil
- removal of site infrastructure (pipelines, processing plant, workshops, buildings, roads, fuel storage etc) and rehabilitation of infrastructure areas (unless otherwise arranged with pastoral land owners/occupiers)
- reinstatement of roads, fences and services (if required)
- revegetation of areas previously containing native vegetation.

A Mine Closure Plan (MCP) will be developed for the Project. Revisions to the MCP will be based on consultation and feedback from key stakeholders and updated with information of relevant studies and engineering designs.

**Is the project an element or stage in a larger project?**

No  Yes If yes, please describe: the overall project strategy for delivery of all stages and components; the concept design for the overall project; and the intended scheduling of the design and development of project stages).

The Project is not an element or stage in a larger project.

VHM has applied for additional tenure surrounding the Goschen Project however no exploration work has been undertaken within these exploration licences.

**Is the project related to any other past, current or mooted proposals in the region?**

No  Yes If yes, please identify related proposals.

The Project is not related to any other past, current or mooted proposals.

#### 4. Project alternatives

**Brief description of key alternatives considered to date** (eg. locational, scale or design alternatives. If relevant, attach A4/A3 plans):

Key alternatives considered to date include:

- Project footprint – VHM considered referring a smaller shorter-term project with a staged development approach but has decided to refer the larger project as the Goschen Project. This allows regulators and the community, to understand the cumulative impacts of the project on the environment and the community and will provide ongoing benefits to the community over a 30-year mine life.
- VHM is undertaking resource drilling in consultation with landowners to finalise the proposed mine pit areas.
- Processing options - VHM is considering two processing options:
  - Option 1 - MUP + WCP, producing heavy mineral concentrate, or
  - Option 2 - MUP + WCP + MSP, producing zircon and rutile concentrate, titanium concentrate and rare earth concentrate
- Transport of materials – VHM is assessing slurry pipelines versus trucking to move ore around the mine site. Slurry pipelines (once established) will have less impact on the local community and less clearing of native vegetation will be required.
- The following transport options for delivering product to port is currently being investigated:
  - Robinvale railway to Portland Port
  - Railway to Port of Geelong
  - Truck product to Ouyen and rail to Port Adelaide.

**Brief description of key alternatives to be further investigated** (if known):

As discussed above, the following alternatives are under consideration:

- processing plant and product options
- the final mine infrastructure footprint will be determined based on resource drilling, landowner consultation and environmental studies
- transport options for delivering product to port.

Other alternatives under consideration include:

- mine plan and scheduling (e.g. pit locations, mining sequence, exclusion zones)
- TSF design options
- Mine power supply options:
  - accessing the existing high voltage transmission lines (part of the national electricity grid) located on the eastern edge of the project area (Figure 13)
  - accessing nearby solar electricity plant
  - constructing a power station – diesel, gas or solar.
- Water supply options:
  - make use of the existing GWM Water supply to provide project water requirements
  - develop a groundwater borefield to provide the majority of the project's water requirements and use GWM Water to supplement the freshwater component.
- The final mine infrastructure footprint will determine which roads will need to be upgraded.

#### 5. Proposed exclusions

**Statement of reasons for the proposed exclusion of any ancillary activities or further project stages from the scope of the project for assessment:**

An accommodation village was considered but has been excluded from the scope due to the proximity of the surrounding towns and community within the Gannawarra Shire and the Rural City of Swan Hill. VHM aims to employ a workforce from the local community. VHM has applied for additional tenure surrounding the Goschen Project however no exploration work has been undertaken within these exploration licences and therefore insufficient information is available at the time of referral to determine the viability of any of the future exploration areas outside of the Targeted Mineralisation Zone.

Ongoing exploration and associated metallurgical investigations undertaken on VHM's Exploration Licences and Retention Licences (once granted) are excluded from this referral. VHM are considering undertaking a small scale, short term, field pilot study of the processing facility within the Project area in March/April 2019. VHM will consult with DELWP, EPA, ERR and the Gannawarra Shire to discuss the required permitting process but is anticipating the following approval requirements: EE Act Referral, Planning Permit, Works Approval and Work Plan.

## 6. Project implementation

**Implementing organisation** (ultimately responsible for project, ie. not contractor):

VHM Exploration Limited  
Level 2, 389 Oxford St,  
Mt Hawthorn, WA, 6016  
ABN: 58 601 004 102

**Implementation timeframe:**

VHM proposes the following timeframes:

- commence construction quarter 4, 2020
- operations phase: 2021 – 2051
- progressive rehabilitation throughout the life of the project
- final decommissioning and closure phase: 2051 – 2055

**Proposed staging** (if applicable):

Not applicable

## 7. Description of proposed site or area of investigation

### Has a preferred site for the project been selected?

No  Yes If no, please describe area for investigation.

If yes, please describe the preferred site in the next items (if practicable).

The Target Mineralisation Zone has been selected for the area of investigation based on modelling of historical data and verification via exploration drilling. Detailed resource drilling is required to confirm mine pit boundaries. Once the pits have been defined, other mine infrastructure locations can be determined.

**General description of preferred site**, (including aspects such as topography/landform, soil types/degradation, drainage/ waterways, native/exotic vegetation cover, physical features, built structures, road frontages; attach ground-level photographs of site, as well as A4/A3 aerial/satellite image(s) and/or map(s) of site & surrounds, showing project footprint):

#### Topography/landform

The Project area topography is characterised by an undulating landscape that slopes gently from south to north, towards the River Murray floodplain, located 20 – 25 km northeast of the project area. The Cannie Ridge is the only noticeable topographic feature in the Project area and is the north-south oriented elevated area on the eastern side of the project area. Cannie Ridge has an elevation between 100 and 125 mAHD compared to an average of 80 mAHD for the surrounding project area (Water Technology 2018) (Figure 14).

#### Soil types,

The soils in the Project area are described by Water Technology (2018) as “sandy, loamy and weakly developed, red in colour with white and grey variations laid sporadically”. These characteristics contribute to high evaporation and infiltration rates in the region restricting surface water flow and feeding groundwater reserves.

#### Drainage/waterways/wetlands

There are no surface water drainage lines or channels within the Project area. Historically, the area was dissected with the channels from the Murray River Irrigation System. These channels however, were found to have high losses due to evaporation and have been decommissioned and backfilled, with water now supplied to the area via underground pipelines (Water Technology 2018).

During large rainfall events, the Cannie Ridge distributes surface water flows to the east to Back Creek and Avoca River floodplains, and to the west down to Lake Lalbert. Back Creek and the Avoca River are located approximately 13 km and 18 km (respectively) southeast of the Project area. Lake Lalbert is located approximately 4 km southwest of the project area and is typically dry except during high rainfall events (Water Technology 2018).

There are no wetlands located within the Project area. The Kerang Wetlands are located 15 km to the east of the Project area and are listed as wetlands of international importance (listed under the Ramsar Convention).

#### Native/exotic vegetation cover

The Goschen Project is located within the Murray Mallee bioregion. The majority of the Goschen Project has been cleared for agricultural activities. The remaining vegetation consists of four ecological vegetation classes (EVC): Woorinen Mallee, Ridged Plains Mallee, Riverine Chenopod Woodland and Plains Savannah, which occur in road reserves and small patches of remnant vegetation.

No large patches of weeds listed as noxious under the *Catchment and Land Protection Act 1994* or as Weeds of National Significance (WONS) were found within the project area. However isolated individuals of Onion Weed, Saffron Thistle, Skeleton Weed, Spiny Rush, Prickly Lettuce, and African Boxthorn were found within some road reserves and properties within the project area (EHPL 2018).

#### Physical features

There are no notable physical features within the Project area that are not otherwise described in other sections.

#### Built structures

Approximately seven residential dwellings are located within the target mineralisation zones (identified by aerial imagery). There are approximately 22 residential dwellings within a 2 km radius of the project area. The number of dwellings will be confirmed through consultation. The town of Lalbert is located approximately 2.7 km of the western edge of the Project area. There is also a range of agricultural infrastructure (e.g. silos, tanks, sheds and fences located within the Project area. Other infrastructure within the Project area includes roads, a high voltage transmission lines and underground telecommunications cables and water pipelines.

**Road frontages**

The Project area covers a portion of a number of local roads, including:

- Thompson Road
- Jobling Road
- Bennett Road
- Pola Road
- Shepherd Road
- Bish Road
- Mystic Park – Meatian Road
- Quambatook -Swan Hill Road
- Nalder Road.

**Site area** (if known): The Target Minimisation Zone is approximately 8,300 (hectares)

**Route length** (for linear infrastructure) ..... (km) **and width** ..... (m)

**Current land use and development:**

The current land use within the Project area is agricultural activities.

**Description of local setting** (eg. adjoining land uses, road access, infrastructure, proximity to residences & urban centres):

The main land use within the Project area is agriculture (sheep, wheat, grain, legumes, peas). Other land uses nearby the project area include granite and gypsum mining.

The town of Lalbert is located 2.7 km from the southwest edge of the Project area and Kunat is located 1 km north of the Project on Quambatook-Swan Hill Road.

Swan Hill and Kerang are the main service centres near the Project area. Swan Hill is located 35 km northeast of the Project area and Kerang is located 45 km south east of the Project area.

The Project can be accessed from:

- Swan Hill via Murray Valley Highway, Donald-Swan Hill Road and/or Quambatook-Swan Hill Road
- Kerang via Lalbert-Kerang Road and Quambatook- Swan Hill Road.

**Planning context** (eg. strategic planning, zoning & overlays, management plans):

**Zones**

The Project area is covered by the Swan Hill Planning Scheme and the Gannawarra Planning Scheme. The dominant zoning is Farming Zone (FZ), with smaller areas zoned as Public Conservation and Resource (Victorian Planning Scheme Online). Talgitcha Bushland Reserve is located on the edge of the Project area and is zoned Public Conservation and Recreation Zone (PCRZ) and Vegetation Protection Overlay – category 2 (VPO2) (Figure 9).

**Overlays**

The following planning overlays occur within proximity to the Project area:

- BMO - Bushfire Management Overlay
- ESO2 – Environmental Significance Overlay 2 – Highway protection environs
- ESO4 – Environmental Significance Overlay 4 – Areas of poor drainage or potentially subject to inundation
- VPO - Vegetation Protection Overlay (Victorian Planning Scheme Online)(Figure 10).

These overlays largely fall outside the Target Mineralisation Zone, and disturbance of these areas will be avoided as far as practicable (Figure 10). The objectives for management of this area is to identify areas potentially liable to inundation likely to suffer from poor drainage and to ensure that any development *'maintains the free passage and temporary storage of floodwaters, minimises flood damage, is compatible with the flood hazard and with local drainage conditions and will not cause any significant rise in flood levels or flow velocity'* (Gannawarra Planning Scheme, Schedule 4).

### State Planning Policy Framework (SPPF)

The relevant clauses of the SPPF in relation to the permitting of extractive industry are:

- Clause 11.13 – Loddon Mallee North Region
- Clause 12.01 – Biodiversity
- Clause 12.04 – Significant environments and landscapes
- Clause 13.01 – Climate change impacts
- Clause 13.02 – Floodplains
- Clause 13.03 – Soil degradation
- Clause 13.04 – Noise and Air
- Clause 13.05 – Bushfire
- Clause 14.01 – Agriculture
- Clause 14.02 – Water
- Clause 14.03 – Resource exploration and extraction
- Clause 15.02 – Sustainable development
- Clause 15.03 – Heritage (DELWP 2018a)

Clause 11.13 of the State Planning Policy Framework relates to the Loddon Mallee North region, which includes the Mildura, Buloke, Gannawarra and Swan Hill municipal areas. This Clause includes an objective for the framework being to strengthen and diversify the economy through supporting emerging economic opportunities, including mining (DELWP 2018a). The Regional Growth Plan for Loddon Mallee North (Victorian Government 2014) describes a future economic land use strategy as being '*To identify, manage and facilitate access to locally sourced natural resources where appropriate, including sand and stone, minerals, timber and renewable energy*'.

### Local Planning Policy Framework – Gannawarra

Relevant Clauses include:

- Clause 21.03 – Environment and landscape values
- Clause 21.04 – Environmental risks
- Clause 21.05 – Natural resource management
- Clause 21.06 – Built environment and heritage
- Clause 21.08 – Economic development
- Clause 21.09 – Transport
- Clause 21.10 – Infrastructure (DELWP 2018b).

### Local Planning Policy Framework – Swan Hill

Relevant Clauses include:

- Clause 21.02 – Key influences and issues
- Clause 21.05 – Environment
- Clause 21.06 – Natural resource management
- Clause 21.07 – Built environment and heritage
- Clause 21.08 – Economic development
- Clause 21.09 – Infrastructure and transport (DELWP 2018c)

Within Clause 21.02 of the Swan Hill Planning Scheme, '*The need to facilitate the growth of the mineral sands and solar industries*' is identified as a key issue. Clause 21.08 further describes strategies to support new and emerging industries such as mineral sands, including:

- Strategy 5.1 – 'Encourage environmentally sustainable mining and value adding opportunities for mineral sands and extractive industry in non urban areas'.

### Local government area(s):

The Project occurs within two government areas; Rural City of Swan Hill and Gannawarra Shire.

## 8. Existing environment

### Overview of key environmental assets/sensitivities in project area and vicinity

(cf. general description of project site/study area under section 7):

#### Geology and landforms

The Project occurs within the 300,000 km<sup>2</sup> Murray Basin, which comprises flat-lying Tertiary sediments that overlie Proterozoic and Palaeozoic basement rocks. The Tertiary sediments are overlain by a thin blanket of Quaternary aeolian and fluvio-lacustrine sediments. The Project area is characterised by an undulating topography, with shallow depressions in the landscape. The 'Cannie Ridge' occurs down the eastern edge of the Project area trending north to south. On either side of the ridge is a wide flat alluvial plain.

Within the Murray Basin, the near surface Tertiary (Pliocene) Loxton - Parilla Sands consist of various shallow marine and beach deposits, with younger estuarine and fluvial sediments deposited between stranded beach ridges. The predominant lithology is a yellow brown to grey, very fine to coarse, unconsolidated to weakly cemented, well sorted quartz sand with varying content of clay or silt (Mason 2008).

The Goschen Project has been interpreted to host sheet-style (fine-grained) heavy mineral mineralisation and zones of strand mineralisation that overlie the sheet-style mineralisation. Sheet-style deposits are formed in a near-shore environment, are fine grained and can extend laterally over several kilometres.

#### Groundwater

The Loxton-Parilla Sands aquifer (or Pliocene Aquifer) is the dominant superficial aquifer. This aquifer is extensive and has an average thickness of 80 m. Below the Loxton-Parilla Sands, the Remark Group (Olney Formation) is also known to contain a deeper aquifer. These aquifers are thought to be separated by the Geera Clay but may be connected in some locations where the clay may be absent (Figure 3).

The primary recharge mechanism in the Project area is the infiltration of rainfall. Rainfall recharge will actively occur over the Project Area except where the water table is very shallow or intersects the surface, in these locations evaporative discharge occurs. The regional contouring suggests groundwater flow in beneath the Project is generally to the north and northwest. Groundwater will therefore leave the site area (discharge) to north and northwest (CDM Smith 2018).

The water table within the Project area is typically negatively aligned with topography, i.e. water table depth is greatest beneath higher ground elevations and least beneath lower ground elevations. Beneath the north-south orientated ridge / strandline within the area the depth to water table is more than 40 m below the ground surface, whereas closer to the Murray River and near the Kerang Wetlands, the water table is within 5 m of the ground surface. Over much of the Targeted Mineralisation Zone, the water table is expected to be 30 m or more below ground surface.

The Loxton-Parilla Sands aquifer is considered to have relatively low supply of good quality (fresh) groundwater and is not located within a Declared Water Supply Catchment. CDM Smith (2018) assessed available groundwater salinity data for the aquifers and concluded the Loxton-Parilla Sand groundwater has an average groundwater salinity of 22,425 mg/L and Olney Formation groundwater has an average groundwater salinity of 25,720 mg/L. VHM will be undertaking a groundwater field investigation to determine if either aquifer is able to provide a water supply for the Project.

There are unlikely to be any significant private users of the groundwater in the Project area due to its salinity. Registered groundwater users include only one domestic and stock bore in the Project area (Section 2.8 of CDM Smith 2018, provided in Attachment 4). There are however environmental receptors to groundwater effects within the region, including the Kerang wetlands, located approximately 15 km east of the Project area, and terrestrial groundwater dependent ecosystems (GDEs) associated with these wetlands. These GDEs are likely to have only a portion of their water requirements met by groundwater, with majority met by surface water flows and local recharge (Section 2.8 of CDM Smith 2018).

#### Drainage/waterways/wetlands

There are four primary waterways surrounding the Project area (Figure 2):

- Murray River – The Murray River (approximately 20 km to the north of the Project area) forms part of the Murray-Darling basin river system which drains most of the inland waterways in Victoria and New South Wales.
- Avoca River – The Avoca River, approximately 20 km to the south and east of the Project area, has a history of flooding, with large events occurring recently in September 2010 and January 2011. These significant events filled the Avoca Marshes and flow through to Lake Boga. The Avoca River is an anabranching system, with the majority of flood water leaving the river downstream of Charlton and spreading across the floodplain and through various anabranching waterways.

- Back Creek – Back Creek is part of the Avoca floodplain and is one of its anabranching waterways. Back Creek is to the east of the Project area but its catchment occurs over 40% of the Project area. Back Creek also drains a large local catchment to the west of the Avoca River. Back Creek flows back into the Avoca River system at the Avoca Marshes.
- Lalbert Creek – Lalbert Creek is approximately 4 km to the west of the Project, with western parts of the Project area falling within its catchment. Lalbert Creek is an effluent stream of the Avoca River, carrying flood flows to the terminal lake systems of Lake Lalbert and Lake Timboram. Lalbert Creek also drains a large local catchment.

The majority of the Project area falls within the Back Creek and Lalbert Creek catchments (Water Technology 2018). The local catchment is gently undulating, with a major raised dune known as Cannie Ridge, running north-south through the middle of the Study area. Due to the low rainfall, sandy soils with high infiltration and gradually sloping land surface, the formation of natural waterways appears to be inhibited (Water Technology 2018). There are no significant surface water drainage lines or channels within the Project area. Minor waterways in the Project area are ephemeral and flow only temporarily after significant rainfall events (Section 4.2 of Water Technology 2018).

The Kerang Wetlands Ramsar site is located 15 km east of the Project area (Figure 4). The wetlands occupy 9,419 ha and consist of a collection of 23 named lakes, marshes and swamps which vary in area, depth and salinity. The wetlands provide important feeding and nesting habitat for more than 50 waterbird species. Several of these species are considered threatened at the international, national or state level and/or are listed on international migratory bird agreements (JAMBA, CAMBA and ROKAMBA) or the Bonn Convention (Kellogg, Brown & Root Pty Ltd 2011). These wetlands, and associated terrestrial ecosystems in are likely to be partially groundwater dependent. It is not anticipated that the wetlands will be impacted by the Project, but additional hydrogeological assessment will be undertaken to understand any potential impacts from the proposed abstraction associated with mining activities and to establish appropriate mitigation measures (if required).

### **Biodiversity**

The Project lies within the Murray Mallee bioregion, which is the state's largest bioregion, but also has the largest area of fragmented landscape. Only 17.3% of native vegetation within the fragmented landscape is retained. The Project area is representative of many areas within the Murray Mallee bioregion, with large areas of improved pastures and derived native grasslands, scattered patches of remnant vegetation and regrowth from past clearing.

The majority of the Project survey area consists of agricultural land and cleared paddocks (cropping) (EHPL 2018). The remaining areas support native vegetation that is concentrated around roadsides and the dissecting gullies. There are four ecological vegetation classes occurring within the survey area as determined by a field survey of the Project area (EHPL 2018) (Figure 5):

- Woorinen Mallee (EVC 824; Vulnerable)
- Plains Savannah (EVC 826; Endangered)
- Ridged Plains Mallee (EVC 96; Endangered)
- Riverine Chenopod Woodland (EVC 103; Depleted).

The Ecological Characterisation Assessment (EPHL 2018) involved assignment of an Indicative Quality Rating of the remnant vegetation. This rating is assigned based on a number of factors including canopy cover, weed cover, patch continuity, understorey structure, and the life form and species diversity. The majority of the remnant vegetation assessed in the study area ranged from low to moderate condition (544.3 ha). Only 29.6 ha was considered to be of high quality (Figure 6).

A review of the *Flora Fauna Guarantee Act 1988* (FFG Act), and the Advisory List of Rare or Threatened Plants in Victoria reported a total of 47 state significant flora species that were previously recorded within 10 km of the study area. A total of 41 state listed fauna species of significance were identified as potentially occurring at the survey area (Ecoscape 2018).

### **Cultural heritage**

#### *Aboriginal cultural heritage*

The Wamba Wamba people are the traditional custodians of the land, and have historically utilised the lakes and waterways as a source of food and water. Indigenous culture is evident by the number of ovens and middens scattered throughout the region. A review of Victorian Department of Premier and Cabinet cultural heritage sensitivity mapping indicates that there are no known areas of cultural heritage sensitivity within the Project area, however all wetlands and waterways in the adjacent areas have cultural heritage significance (Figure 11). Preliminary consultation with the Wamba Wamba people indicates that they, in collaboration with the Barapa Barapa People, propose to apply for recognition as a Registered Aboriginal Party (RAP) under the *Aboriginal Heritage Act 2006*. VHM will continue to engage with these groups and will prepare a cultural heritage management plan for the project.



#### *Non-indigenous cultural heritage*

The history of the Rural City of Swan Hill and Gannawarra Shire revolves around farming, with challenges of salinity, and drought, and the ability of the land to sustain European methods of agriculture (Allom Lovell & Associates 2001). These challenges occupied the early years of European occupation. Historical buildings and relics that provide a record of European settlement of the area enable long-time residents to remain connected with the past and new settlers and recent generations to understand and relate to the adversity and hardship of earlier times. The Victorian Heritage Register lists the State's most significant heritage places, objects and historic shipwrecks protected under the *Heritage Act 1995*. There are numerous sites that have been listed as significant heritage places in Victoria. The Victorian Heritage Database has indicated that the following are located within the area surrounding the Project:

- Lalbert Hall Honour Roll (ID 189023) - Lalbert Hall, Lalbert, Gannawarra Shire
- Lalbert War Memorial (ID 125897) - Main Street, Lalbert, Gannawarra Shire
  - The Lalbert War Memorial was erected on the main street in 1961. The Quambatook RSL presented the monument in memory of the fallen of all conflicts. The memorial comprises of a marble plaque attached to a simple granite wall and a flagpole nearby.
- Kunat State School No. 3294 (ID 12017) – Included on the VHI (H7526 – 0005).

#### **Landscape and visual amenity**

The Project area is generally flat, with one ridge trending north to south on the eastern side of the Project area. The Bael Bael Grassland Nature Conservation Reserve, Koorangie Wildlife Reserve, Kerang wetlands are located 13 km – 15 km east of the Project area and Lake Lalbert Wildlife Reserve is located 4 km southwest of the Project area (Figure 15).

The Bael Bael Grassland Nature Conservation Reserve covers approximately 1777 ha, and was created in 2009. It is the largest intact and continuous grassland in the district, with a history of sheep grazing. It includes the vegetation communities *Natural Grasslands of the Murray Valley Plains* and *Seasonal Herbaceous Wetlands of the Temperate Lowland Plains*. It is known to support a number of significant flora and fauna species (Grasslands: Biodiversity of south-eastern Australia (2018).

The Koorangie Wildlife Reserve consists of approximately 3000 ha of Loddon-Avoca floodplain, including a number of marshes. It is utilised as a game reserve for duck hunting, but has been closed over the last two seasons due to the potential for unacceptable impacts to protected dust species using the reserve.

There are no significant natural water systems within the Project area. Designed waterways/channels that were part of the Murray River Irrigation System have long been decommissioned and mostly filled in within the Project area.

The dominant land use for the Project area is farming. The relatively flat topography and vegetation in the road reserves and pockets within farmland may provide some natural screening for residences and roadside viewpoints.

Several potential viewpoints from the roadside to the mine site and associated infrastructure are likely; However, impacts to visual amenity should decrease with distance due to the flat landscape. The twilight landscape is primarily dark except for the farm equipment lights that are present for a few weeks of cropping during April/May and the few broadly spaced residences producing minor external light.

#### **Air quality**

Sensitive air quality receptors associated with the Project area will include the approximately 22 residences in the Project area and immediate surrounds. The nearest major town is Swan Hill, which is approximately 20 km from the Project area. Smaller towns such as Lalbert occur within 3 km of the boundary of the Project area. The predominant land use is farming within the Project area, although wetlands and wildlife reserves occur within 4-15 km of the Project area.

Ambient air emissions within the Project area and surrounds generate particulate matter, volatile organic compounds, nitrogen oxides, and sulfur oxides. Key sources of ambient air emissions within the Project area include agricultural activities (e.g. equipment use, crop dusting and ploughing), controlled burning, dust storms, domestic wood heating at residences and motor vehicles.

#### **Noise**

Sensitive noise receptors will include local residences and towns. Land use within and surrounding the Project area is zoned farming and thus the background noise levels reflect the land use i.e. farm equipment, vehicle movement. Roads located within and adjacent to the Project area have low traffic volumes. VHM will undertake baseline noise monitoring and noise modelling to identify potential impacts to surrounding sensitive receptors.

## 9. Land availability and control

<p><b>Is the proposal on, or partly on, Crown land?</b>  <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If yes, please provide details.</p>
<p><b>Current land tenure</b> (provide plan, if practicable):</p> <p>The Target Mineralisation Zone is located on Exploration licence (EL) 5520 with minor sections located on EL 6419. Additional supporting infrastructure such as a rail siding and groundwater bore field may also be located on EL 6419. VHM is the licence holder for both exploration licences.</p> <p>The land within the Project area is freehold land used for agriculture.</p>
<p><b>Intended land tenure</b> (tenure over or access to project land):</p> <p>VHM Exploration has applied for a Retention Licence over EL 5520 and will apply for a Mining Licence over the Project area prior to mining.</p> <p>VHM is consulting with local landowners regarding access to farmlands for exploration and mining activities. All landowners whose properties will be impacted by the Project will be compensated in accordance with relevant legislation and guidelines.</p>
<p><b>Other interests in affected land</b> (eg. easements, native title claims):</p> <p>The Wamba Wamba People have been identified as the traditional custodians of the land, utilising the lakes and waterways as a source of food and water. However, there is no Native Title Determination over the Project area (Figure 12).</p> <p>There are no other known interests in the Goschen Project area.</p>

## 10. Required approvals

<p><b>State and Commonwealth approvals required for project components</b> (if known):</p> <p>State and Commonwealth approvals likely to be required for the project include:</p> <p><b>Commonwealth</b></p> <ul style="list-style-type: none"> <li>Referral of a Proposed Action (Environment Protection and Biodiversity Conservation Act 1999)</li> </ul> <p><b>State</b></p> <ul style="list-style-type: none"> <li>Environmental Effects Statement, subject of this referral (<i>Environmental Effects Act 1978</i>)</li> <li>Mining Licence, Work Plan and Work Authority (Mineral Resources (Sustainable Development) Act 1990)</li> <li>Cultural Heritage Management Plan (<i>Aboriginal Heritage Act 2006</i>)</li> <li>Water bore construction licence and groundwater abstraction licence (<i>Water Act 1989</i>)</li> <li>Works Approval (Environment Protection Act 1970)</li> <li>Permit to take protected flora, (<i>Flora and Fauna Guarantee Act 1988</i>)</li> <li>Native Vegetation Offset Management Plan (DELWP Guidelines for the removal, destruction or lopping of native vegetation.)</li> <li>Dangerous Goods Licence (Dangerous Goods Act 1985)</li> <li>Radiation Management Plan and Radiation Management Licence (<i>Radiation Act 2005</i>)</li> <li>Road closure, diversion and/or opening permits (Road Management Act 2004).</li> <li>Permit to control wildlife (Wildlife Act 1975).</li> </ul> <p><b>Have any applications for approval been lodged?</b>  <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes If yes, please provide details.</p> <p><b>Approval agency consultation</b> (agencies with whom the proposal has been discussed):</p> <p>Department of Environment and Energy (Commonwealth)          Department of Environment, Land, Water and Planning          Department of Economic Development, Jobs, Transport and Resources - Earth Resources Regulation</p>
--

**Other agencies consulted:**

- Heritage Victoria
- Aboriginal Victoria
- Rural City of Swan Hill
- Gannawarra Shire
- Grampians Wimmera Mallee Water

## PART 2 POTENTIAL ENVIRONMENTAL EFFECTS

### 11. Potentially significant environmental effects

**Overview of potentially significant environmental effects** (identify key potential effects and comment on their significance and likelihood, as well as key uncertainties):

#### Flora and Vegetation

VHM has commissioned desktop and field surveys to assess potential flora and vegetation impacts associated with the Project. The *Ecological Characterisation Assessment of the Proposed Goschen Mineral Sands Project, Goschen, Victoria* (EHPL 2018) is provided in Attachment 1, and covered a study area of approximately 19,500 ha, encompassing the Project area and the surrounding area.

The assessment identified that the majority of the study area (97%) consisted of highly modified landscape (i.e. pastoral land). The remaining vegetation consists of four ecological vegetation classes (EVC). The extent of these EVCs mapped within the Study Area and the Target Mineralisation Zone are provided in the table below.

Ecological Vegetation Class	Mapped within Study Area (see pg 13 of EHPL 2018, Attachment 1)	Mapped within Target Mineralisation Zone
Woorinen Mallee (EVC 824; Vulnerable)	611.5 ha	212 ha
Plains Savannah (EVC 826; Endangered)	1 ha	0.72 ha
Ridged Plains Mallee (EVC 96; Endangered)	36.7 ha	2.40 ha
Riverine Chenopod Woodland (EVC 103; Depleted)	18.6 ha	0 ha
Total	667.8 ha	215.12 ha

While five flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have the potential to occur within the Project area (see Section 4.1.1 of EHPL 2018). However, none were identified during field surveys. Likewise, 47 state listed significant fauna species have previously been recorded within 10 km of the Project area; however, surveys to date have identified only two species, the Umbrella Wattle (*Acacia oswaldii*) and Buloke (*Allocasuarina luehmannii*) (Section 4.1.2 of EHPL 2018)(Figure 7).

The Project has the potential to directly impact on these EVCs and listed flora. The key aspects of the project which may have an effect on conservation significant flora or vegetation include the following:

- Direct disturbance of flora or vegetation as a result of clearing for mine pits and support infrastructure.
- Indirect impacts to flora and vegetation due to changes to groundwater, introduction or spread of weeds or pathogens, fragmentation and edge effects, erosion, or contamination by hazardous chemicals or hydrocarbons.

As the Project footprint has not yet been finalised, the total disturbance of significant flora and vegetation has not been determined. VHM will design the Project to minimise disturbance of significant flora and remnant vegetation as far as practicable. VHM will also develop and implement environmental management plans to ensure direct and indirect impacts to conservation significant flora and vegetation are minimised.

#### Terrestrial Fauna

A total of 41 national or state-listed fauna species have been identified as potentially occurring within the survey area. No national or state significant fauna species were identified in the Ecological Characterisation Assessment (Section 4.2.1 of EHPL 2018). However, field surveys conducted as part of the Targeted Conservation Significant Fauna Survey (Ecoscape 2018), as provided in Attachment 2, identified the following four species (Figure 8):

- Superb Parrot (*Polytelis swainsoni*)
- Common Bearded Dragon (*Pogona barbata*)
- Black Falcon (*Falco subniger*)
- Brown Treecreeper (south-eastern) (*Climacteris picumnus victoriae*; (Section 3.2 of Ecoscape

2018)

The Project will result in direct disturbance to fauna and fauna habitat through clearing and earthworks for mining and associated infrastructure. Indirect impacts to fauna may also occur as a result of noise, vehicle movements and lighting.

The key aspects of the project which may have an effect on conservation significant fauna or fauna habitat include the following:

- Direct disturbance fauna habitat as a result of clearing for mine pits and support infrastructure.
- Indirect impacts to fauna habitat due to changes to groundwater, introduction or spread of weeds or pathogens, fragmentation and edge effects, erosion, or contamination by hazardous chemicals or hydrocarbons.
- Direct impacts to fauna as a result of collision with vehicles or equipment.
- Indirect impacts to fauna as a result of reduced habitat availability or fragmentation.
- Changes to fauna behaviour as a result of noise or lighting from project areas.

VHM will design the Project footprint to minimise impacts to fauna habitat as far as reasonably practicable. Further, it will develop and implement environmental management plans to ensure direct and indirect impacts to fauna are minimised throughout the life of mine.

### **Surface Water and Wetlands**

There are no creeks or significant water courses occurring within the Project area. Any surface water drainage within the Project area is ephemeral, flowing only after significant rainfall events (Section 4.2 of Water Technology 2018).

Surface water modelling of an 1% Annual Exceedance Probability (AEP) rain-on-grid model simulation over a 12-hour duration was conducted using ArchHydro (Water Technology 2018). The modelling showed:

- Localised ponding across the site, which are characterised as the lowland ecological niches observed in depressions in the topography, and lakes in the broader region with depths of 0.3 meters up to over 2 metres
- Velocities are generally low, with higher velocities observed in the steeper sections of the topography
- The eastern half of the Project area is at a lower elevation, with the modelling showing larger areas of water pooling.

A detailed risk and impact assessment for surface water is provided in Section 7 of the report by Water Technology (2018) as provided in Attachment 3. Potential impacts could include:

- Discharge of stormwater runoff containing sediment and other contaminants from mine activities
- Modifications to drainage lines (Lalbert Creek and Back Creek)
- Clearance of vegetation
- Construction in a flood prone area with flooding of mineral sands mine or other infrastructure
- Increasing sediment loads to waterways.

The unmitigated risk of these impacts was rated as low-medium, and the residual risk was low for all impacts. Note that this assessment included potential effects of activities in the larger area covered by VHM's exploration licence, rather than just the Target Mineralisation Zone. It is therefore highly conservative, as no impacts to surface water drainage lines outside the Target Mineralisation Zone are anticipated.

There are no significant wetlands that will be directly impacted by the Project. A Ramsar listed wetland, Kerang Wetlands, occurs 15 km east of the Project. It is unlikely that the Project will impact the Kerang Wetlands, however a detailed hydrogeological investigation is planned to ensure any potential indirect impacts to the wetlands are understood. The investigation will also identify management mechanisms to ensure any impacts will be minimised or mitigated.

### **Groundwater**

Given the saline nature of the aquifer within the Project area, there are unlikely to be any significant uses of the groundwater that will be affected by VHM's activities. Potential environmental receptors have been identified, including the Kerang Wetlands and terrestrial groundwater dependent ecosystems associated with these wetlands (Section 2.8 of CDM Smith 2018, in Attachment 4). The potential issues that may result from these aspects include the following:

- Depression of the water table associated with the water supply borefield (if required) and with mine pit dewatering.
- Potential to impact groundwater dependent ecosystems if drawdown reaches these areas.
- Mounding of groundwater and/or reduction of groundwater quality as a result of deposited tailings.
- Reduction in groundwater quality due to discharged chemicals, hydrocarbons or sediment.

To address these potential issues, additional investigations and studies will be undertaken to further characterise the environment and inform Project design and management.

### Soils and Rehabilitation

Mining activities will disturb the local geology and soils, and create various mining waste streams, including overburden, processing waste (tailings) and waste water. It is important that the various streams are appropriately handled and backfilled or discharged into the mine pit voids in order to produce soil profiles that will effectively support rehabilitation back to agricultural land uses and native vegetation. For example, it may be necessary to ensure the soil profile meets certain geochemical and physical characteristics to ensure it meets the requirements for cultivating wheat.

Saline water and waste material have the potential to affect the success of rehabilitation to agricultural land or to native vegetation. Placement of saline tailings or overburden within the upper soil profile may inhibit the growth of vegetation. Further, seepage from the fine tailings during consolidation could result in elevation of the watertable or development of a perched water table. VHM will ensure management of saline water and backfilled waste material to prevent ensure effective rehabilitation to agricultural activities or native vegetation. This will include:

- Investigation of the soil and groundwater characteristics required to support successful rehabilitation
- Selective placement of backfill materials to ensure saline waste is deposited at depth, rather than close to the surface
- Monitoring of groundwater levels and quality throughout mining and rehabilitation.

### Radioactivity

Mineral sands deposits contain naturally occurring radioactive materials (NORMs). Potential impacts regarding radioactivity from development of the Project are associated with the excavation and transport of NORMs. Sensitive receptors include the Project workforce and the public. VHM is currently undertaking assessments to identify the likely radiation expected from the products and wastes generated by the Project. To assist in assessing and managing the NORM associated within the Goschen Project's rare earths deposit, the Company has engaged the following consultants:

- Jim Hondros, JRHC Enterprises Pty Ltd
- Mineral Technologies

Assessments to date have included:

- A preliminary background gamma radiation survey across the resource area
- Assessment for uranium and thorium of over 200 samples from different locations and soil strata across the project area
- Analysis for uranium and thorium concentration in processing waste (i.e. ROM ore, tailings)

The results of the background gamma radiation survey across VHM's resource area show that the measured gamma radiation dose rates were between 0.03 – 0.07  $\mu\text{Sv/h}$ , which is within the normal range for Australia (JRHC Enterprises Pty Ltd 2018a). Assessment of the naturally occurring materials in the project area (topsoil, clays, overburden, ore and low grade ore) indicates that all samples to date have low radioactivity (i.e. concentration less than 1 Bq/g) (JRHC Enterprises Pty Ltd 2018b). A preliminary assessment of processing waste also indicates that mined material and tailings residue would have low radioactivity (less than 1 Bq/g) (JRHC Enterprises Pty Ltd 2018b). However, additional assessment and analysis is required to confirm these preliminary results, and is currently underway. Based on the outcomes of the assessment, VHM will develop a Radiation Management Plan and obtain the necessary approval under the *Radiation Act 2005*.

### Visual Impact

The dominate land use for the Project area is farming. The relatively flat topography and vegetation in the road reserves and pockets within farmland may provide some natural screening for residences and roadside viewpoints. However, there is the potential for impacts to visual amenity and landscape values as a result of mining infrastructure and landforms (e.g. temporary stockpiles). VHM will commission a landscape and visual impact assessment to determine potential effects, and to inform Project design and management to minimise these effects, where possible.

### Air Emissions

Ambient dust emissions in the Project area are naturally high, however mining and associated activities have the potential to increase dust emissions, which may impact surrounding land holders. The extent of emissions and the effect on neighbouring properties will depend on weather conditions and the effectiveness of mitigation measures implemented to control dust. Key potential air quality effects from the Project include:

- Change in particulate matter concentrations in the air
- Reduced amenity
- Reduced crop quality to the south or west (prevailing wind direction is in a southerly and westerly direction) of the mine area
- Decrease in respiratory health due to elevated silica concentration.

A protocol for environmental management (PEM) is an incorporated document to the *State Environment Protection Policy (SEPP) (Air Quality Management)*. The *Protocol for Environmental Management: Mining and extractive industries* (EPA Victoria 2007) sets out guidance to assess the potential impacts of emissions arising from mining and extractive industries on the air environment. The major air pollutants of concern from

mining operations are related to dust generation from the following activities:

- land clearing and exposure of soil (further exacerbated by windy conditions)
- mining of the ore body and removal of overburden
- construction of landforms
- mobile plant and vehicles on unsealed roads
- exhaust emissions.

The PEM states the following indicators to be assessed:

- PM<sub>10</sub> (i.e., particles with a mean aerodynamic diameter less than 10 microns)
- PM<sub>2.5</sub> respirable crystalline silica (defined as the PM<sub>2.5</sub> fraction)
- Other substances, such as radionuclides, given naturally occurring radionuclide minerals are associated with the target mineralisation, may also require assessment.

Assessment criteria, applicable for the mining and extractive industries, have been developed based on the protection of human health and for some indicators reflect the intervention levels in the SEPP (Air Quality Management). VHM will follow the PEM requirements to monitor the air quality of the existing environment and assess the potential impacts of air emissions generated by the Project.

#### **Noise Emissions**

It is anticipated that the Project will result in noise emissions from increased vehicle movement to and from the sites, and onsite mining, construction and processing equipment and vehicles. These noise emissions have the potential to affect the amenity of surrounding residents.

*Noise from Industry in Regional Victoria (NIRV)* guidelines (EPA Victoria 2011a) provide the methods to set noise criteria for industry in regional Victoria, and *Applying NIRV to proposed and existing industry* guidelines (EPA Victoria 2011b) explains how to apply the levels to proposed sites. The recommended levels apply to noise from all scales of 'commercial, industrial and trade premises', including factories, businesses, farming, mines and quarries.

To meet the requirements of these guidelines, baseline noise monitoring and noise modelling is proposed to be undertaken to quantify potential noise emissions, and a management plan will be prepared addressing mitigation measures to reduce noise as far as practicable.

#### **Traffic and Transport**

The Project is likely to result in increased traffic along some local roads, which may pose safety and amenity impacts to residents of the region. Potential impacts may include:

- Increased traffic volumes and safety on local and regional roads, intersections and level crossings
- Increased traffic volumes and maintenance of road conditions
- Temporary changes to access to areas within the proposed mine footprint associated with road closures or temporary diversions
- The construction of new roads or diversions of existing roads could require planning scheme amendments
- Selection of transport methods (i.e., road and rail) to receive supplies and dispatch product
- Upgrades to existing roads may need to occur to support the transport requirements of large equipment
- Project traffic interacting with existing school bus or local bus routes.

A transport impact assessment will need to determine impacts to roads and management strategies for traffic management, road upgrades and road maintenance.

## 12. Native vegetation, flora and fauna

### Native vegetation

#### Is any native vegetation likely to be cleared or otherwise affected by the project?

NYD  No  Yes If yes, answer the following questions and attach details.

#### What investigation of native vegetation in the project area has been done? (briefly describe)

Three studies have been undertaken in the project area:

- *Native Vegetation Assessment and Net Loss Reporting, Proposed Drilling Sites, Swan Hill Rural City and Gannawarra Shire* (Hamilton Environmental Services 2016).
- *Native Vegetation Assessment and Net Loss Reporting, Proposed Drilling Sites, Goschen, Gannawarra Shire* (Hamilton Environmental Services 2017): The reports by Hamilton Environmental Services provide a desktop and field survey of proposed exploration drilling locations. They are not specifically relevant to this referral, and have therefore not been provided as attachments.
- *Ecological Characterisation Assessment of the Proposed Goschen Mineral Sands Project, Goschen, Victoria* (EHPL 2018): Desktop review of biodiversity databases and literature, vegetation surveys, vegetation mapping, and terrestrial fauna surveys. The survey covered an area of 19,500 ha, including the anticipated Project area and a portion of the surrounding region (Attachment 1).

#### What is the maximum area of native vegetation that may need to be cleared?

NYD Estimated area ...215 .....(hectares)

Within the Target Mineralisation Zone for the Project the majority (97%) of native vegetation has been cleared for agriculture. Approximately 215 ha of native vegetation has been mapped within the Target Mineralisation Zone. VHM will avoid disturbance of this vegetation as far as practicable.

#### How much of this clearing would be authorised under a Forest Management Plan or Fire Protection Plan?

N/A ..... approx. percent (if applicable)

#### Which Ecological Vegetation Classes may be affected? (if not authorised as above)

NYD  Preliminary/detailed assessment completed. If assessed, please list.

There are four ecological vegetation classes occurring within the Project area:

- Woorinen Mallee (EVC 824; Vulnerable)
- Ridged Plains Mallee (EVC 96; Endangered)
- Riverine Chenopod Woodland (EVC 103; Depleted)
- Plains Savannah (EVC 826; Endangered)

#### Have potential vegetation offsets been identified as yet?

NYD  Yes If yes, please briefly describe.

Flora and vegetation assessments to date have identified the presence of conservation significant vegetation which, if removed, will require offset. The extent of required offset and the availability of relevant vegetation and registered credits is yet to be determined.

#### Other information/comments? (eg. accuracy of information)

Field assessments undertaken as part of the *Ecological Characterisation Assessment of the Proposed Goschen Mineral Sands Project, Goschen, Victoria* (EHPL 2018) were conducted in late November 2017, within the flowering season for potentially occurring significant flora species (which are known to flower between September and November).

The results of the *Ecological Characterisation Assessment* will inform the development of a refined footprint and any requirements for further targeted significant species surveys. Further work is required to identify the locations of scattered remnant trees within the proposed disturbance footprint and to determine the habitat hectare data as described in the Vegetation Quality Assessment manual (DSE, 2004).

There are a number of data / information gaps that are required to be addressed for flora and vegetation. The key data gaps are:

- Further characterisation of vegetation, including identification of scattered remnant trees.
- Identification of groundwater dependent ecosystems within the area of potential groundwater



drawdown area for the Project

- Refinement of the actual project disturbance footprint
- Habitat hectares assessment and calculation of offsets based on the disturbance footprint
- Estimation of potential indirect loss of vegetation or habitat quality resulting from hydrogeological change, edge effects, habitat fragmentation or other disturbance impacts.

NYD = not yet determined

## Flora and fauna

### What investigations of flora and fauna in the project area have been done?

(provide overview here and attach details of method and results of any surveys for the project & describe their accuracy)

The following studies have been undertaken in the Project area:

- *Native Vegetation Assessment and Net Loss Reporting, Proposed Drilling Sites, Swan Hill Rural City and Gannawarra Shire* (Hamilton Environmental Services 2016).
- *Native Vegetation Assessment and Net Loss Reporting, Proposed Drilling Sites, Goschen, Gannawarra Shire* (Hamilton Environmental Services 2017): The reports by Hamilton Environmental Services provide a desktop and field survey of proposed exploration drilling locations. The results of the above surveys have largely been superseded with the more detailed reports below, and therefore they are not appended to this referral.
- *Ecological Characterisation Assessment of the Proposed Goschen Mineral Sands Project, Goschen, Victoria* (EHPL 2018): Desktop review of biodiversity databases and literature, vegetation mapping, and terrestrial fauna surveys (Attachment 1).
- *Goschen Project - Targeted Conservation Significant Fauna Survey* (Ecoscape Australia 2018): Targeted fauna survey including habitat assessments, bird surveys, active searches and road spotting, use of Motion Cameras and ultrasonic bat recorders (Attachment 2).

### Have any threatened or migratory species or listed communities been recorded from the local area?

NYD  No  Yes If yes, please:

- List species/communities recorded in recent surveys and/or past observations.
- Indicate which of these have been recorded from the project site or nearby.

The Murray Mallee bioregion contains large areas of improved pastures and derived native grasslands, scattered patches of remnant vegetation and regrowth from past clearing. Approximately 97% of the survey area is highly degraded and consists of agricultural land and cleared paddocks (cropping; also illustrated in Figures 2a to 2o in EHPL 2018). The value of this habitat type for native fauna and flora species is very low due to the homogeneity of the vegetation layer. The Riverine Chenopod Woodland has a diverse shrubby and grassy understorey occurring on most elevated riverine terraces (Section 3.1.2.2 of EHPL 2018), which is likely to support derived grasslands.

#### Flora

The Victorian Biodiversity Atlas (VBA) contains records of five nationally significant (also listed in the Commonwealth Protected Matters Search Tool (PMST)) flora species previously recorded within 10 km of the study area (Section 4.1.1 of EHPL 2018). All five nationally listed flora species have a high likelihood of occurring within the study area:

- Candy spider-orchid (*Caladenia versicolor*)
- Greencomb spider-orchid (*Caladenia tensa*)
- Winged peppergrass (*Lepidium monoplacoides*)
- Chariot wheels (*Maireana cheelii*)
- Slender darling-pea (*Swainsona murrayana*)

None were recorded within the Project areas by EHPL (2018) during the field survey. EHPL (2018) recommended additional surveys for these species in September – November, which will be undertaken in 2018 (see Section 4.1.3 of EHPL 2018).

47 state significant flora species were previously recorded in the VBA within 10 kilometres of the study area. Seven species have a high likelihood of occurrence (highlighted in bold) within the study area (i.e. principally along roadside remnants) (Section 4.1.2 of EHPL 2018):

- Dwarf myall (*Acacia ancistrophylla* var. *lissophylla*)
- **Nealie (*Acacia loderi*)**
- **Yarran (*Acacia melvillei*)**

- **Umbrella wattle (*Acacia oswaldii*)**
- **Weeping myall (*Acacia pendula*)**
- **Buloke (*Allocasuarina luehmannii*)**
- Common joyweed (*Alternanthera nodiflora*)
- Jerry-jerry (*Ammannia multiflora*)
- Flat-top saltbush (*Atriplex lindleyi* subsp. *lindleyi*)
- Cane spear-grass (*Austrostipa breviglumis*)
- Spear-grass (*Austrostipa trichophylla*)
- Frosted goosefoot (*Chenopodium desertorum* subsp. *rectum*)
- Grassland bindweed (*Convolvulus graminetinus*)
- **Hoary scurf-pea (*Cullen cinereum*)**
- **Tough scurf-pea (*Cullen tenax*)**
- Downs nutgrass (*Cyperus bifax*)
- Pale spike-sedge (*Eleocharis pallens*)
- Cane grass (*Eragrostis australasica*)
- Purple love-grass (*Eragrostis lacunaria*)
- Bristly love-grass (*Eragrostis setifolia*)
- Woolly mantle (*Eriochlamys behrii* s.s.)
- Scaly mantle (*Eriochlamys squamata*)
- Long eryngium (*Eryngium paludosum*)
- Bluish raspwort (*Haloragis glauca* f. *glauca*)
- Bundled peppercress (*Lepidium fasciculatum*)
- Warty peppercress (*Lepidium papillosum*)
- Soft sunray (*Leucochrysum molle*)
- Leafless bluebush (*Maireana aphylla*)
- Bush minuria (*Minuria cunninghamii*)
- Smooth minuria (*Minuria integerrima*)
- Satin daisy-bush (*Olearia minor*)
- Glandular phebalium (*Phebalium glandulosum* subsp. *macrocalyx*)
- Knotted poa (*Poa drummondiana*)
- Grey podolepis (*Podolepis aristata* subsp. *affinis*)
- Spiny goosefoot (*Rhagodia ulicina*)
- Branching groundsel (*Senecio cunninghamii* var. *cunninghamii*)
- Yakka grass (*Sporobolus caroli*)
- Downy swainson-pea (*Swainsona swainsonioides*)
- Round templetonia (*Templetonia egena*)
- Scurfy germander (*Teucrium albicaule*)
- Camel bush (*Teucrium sessiliflorum*)
- Oat kangaroo-grass (*Themeda avenacea*)
- Small burr-grass (*Tragus australianus*)
- Sweet fenugreek (*Trigonella suavissima*)
- Club-hair new holland daisy (*Vittadinia condyloides*)
- Dissected new holland daisy (*Vittadinia dissecta* var. *dissecta*)
- Winged new holland daisy (*Vittadinia pterochaeta*)

The umbrella wattle (*Acacia oswaldii*) and Buloke (*Allocasuarina luehmannii*) was recorded within the Project area by EHPL (2018) and Hamilton Environmental Services.

### Vegetation

Five nationally listed ecological communities are predicted to occur within 10 km of the study area (Section 4.3 of EHPL 2018):

- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions, Endangered Community
- Grey Box (*Eucalyptus macrocarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia, Endangered Community
- Natural Grasslands of the Murray Valley Plains, Endangered Community
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowlands Plains, Critically Endangered Community
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, Critically Endangered Community.

However, based on the site assessments, it is considered that the vegetation within the study area does not meet the condition thresholds that define any nationally-significant communities (Section 4.3 of EHPL 2018).

## Fauna

Fauna habitat in the survey area included agricultural land, Mallee woodland and salt lake. The salt lake is unlikely to be disturbed by the Project area. The Mallee woodland habitat was restricted to road verges and remnant patches (Section 3.1 of Ecoscape 2018).

A total of 42 species (listed below) of significance (12 nationally significant, 24 state significant species and 38 species on the Victorian Advisory List) have been identified as potentially occurring within the survey area (Table 5 of Ecoscape 2018). Of these, four species have a high likelihood (highlighted in bold) to occur at the survey area, 18 species have a medium likelihood to occur and the remaining 20 species have a low likelihood to be present at the survey area.

### Mammals

- South-eastern long-eared bat (*Nyctophilus corbeni*), EPBC Act – Vulnerable (VU), FFG Act – Listed (L), Advisory List – Endangered (EN)
- Grey-headed flying-fox (*Pteropus poliocephalus*), EPBC Act - VU, FFG Act – L, Advisory List - VU
- Greater glider (*Petauroides volans*), EPBC Act – VU, Advisory List - VU
- Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT), EPBC Act - VU
- Fat-tailed Dunnart (*Sminthopsis crassicaudata*), Advisory List - Near Threatened (NT)
- Mitchell's Hopping Mouse (*Notomys mitchelli*), Advisory List - NT

### Birds

- Plains-wanderers (*Pedionomus torquatus*), EPBC Act - Critically Endangered (CR), FFG Act – L, Advisory List - CR
- Regent honeyeater (*Anthochaera phrygia*), EPBC Act - CR, FFG Act – L, Advisory List - CR
- Regent parrot (eastern) (*Polytelis anthoepus monarchoides*), EPBC Act – VU, FFG Act – L, Advisory List - VU
- Red-lored whistler (*Pachycephala rufogularis*), EPBC Act – VU, FFG Act – L, Advisory List - EN
- Painted honeyeater (*Grantiella picta*), EPBC Act – VU, FFG Act – L, Advisory List - VU
- Swift parrot (*Lathamus discolor*), EPBC Act – CR, FFG Act – L, Advisory List - EN
- Malleefowl (*Leipoa ocellate*), EPBC Act – VU, FFG Act – L, Advisory List - EN
- Night parrot (*Pezoporus occidentalis*), EPBC Act - EN
- Satin flycatcher (*Myiagra cyanoleuca*), EPBC Act - Migratory
- Yellow wagtail (*Motacilla flava*), EPBC Act - Migratory
- Spotted bowerbird (*Ptilonorhynchus maculatus*) FFG Act – L, Advisory List - CR
- Grey-crowned babbler (*Pomatostomus temporalis temporalis*), FFG Act – L, Advisory List - EN
- Bush stone-curlew (*Burhinus grallarius*), FFG Act – L, Advisory List - EN
- Barking owl (*Ninox connivens*), FFG Act – L, Advisory List - EN
- Purple-gaped honeyeater (*Lichenostomus cratitius*), Advisory List - VU
- Ground cuckoo-shrike (*Coracina maxima*), FFG Act – L, Advisory List - VU
- Major Mitchell's cockatoo (*Lophocroa leadbeateri*), FFG Act – L, Advisory List - VU
- White-browed treecreeper (*Climacteris affinis*), FFG Act – L, Advisory List - VU
- **Black falcon (*Falco subniger*)**, Advisory List - VU
- **Diamond firetail (*Stagonopleura guttata*)** FFG Act – L, Advisory List - NT
- Hooded robin (*Melanodryas cucullata cucullate*), FFG Act – L, Advisory List - NT
- Rufous field wren (*Calamanthus campestris*), Advisory List - NT
- Chestnut quail-thrush (*Cinclosoma castanotus*), Advisory List - NT
- Crested bellbird (*Oreoica gutturalis gutturalis*), FFG Act – L, Advisory List - NT
- Black-eared cuckoo (*Chrysococcyx osculans*), Advisory List - NT
- Spotted harrier (*Circus assimilis*), Advisory List - NT
- Brown treecreeper (south-eastern spp.) (*Climacteris picumnus victoriae*), Advisory List - NT
- Australian pranticole (*Stiltia isabella*), Advisory List - NT
- Red-backed kingfisher (*Todiramphus pyrropygia pyrropygia*), Advisory List - NT
- **Superb Parrot (*Polytelis swainsoni*)**, EPBC Act - Vulnerable

### Reptiles

- Lace monitor (*Varanus varius*), Advisory List - EN
- Carpet python (*Morelia spilota metcalfei*), FFG Act – L, Advisory List - EN
- Bandy bandy (*Vermicella annulate*), FFG Act – L, Advisory List - VU
- Samphire skink (*Morethia adelaidensis*), FFG Act – L, Advisory List - EN
- **Common bearded dragon (*Pogona barbata*)**, Advisory List - EN

- Hooded scaly-foot (*Pygopus schraderi*), FFG Act – L, Advisory List - CR

#### Amphibians

- Growling Grass Frog (*Litoria raniformis*), EPBC Act – VU, FFG Act – L, Advisory List - EN

Two field surveys have been undertaken:

- Field survey (27 November - 1 December 2017; EHPL 2018).
- Targeted fauna survey (13-19 March 2018; Ecoscape 2018).

Five significant species were recorded from within the Project area, namely the:

- Superb Parrot (*Polytelis swainsoni*);
- Common Bearded Dragon (*Pogona barbata*)
- Black Falcon (*Falco subniger*);
- Brown Treecreeper (south-eastern) (*Climacteris picumnus victoriae*; (Section 3.2 of Ecoscape 2018).

The fauna surveys were conducted in the appropriate season, on the basis that a number of species are known to breed in the area in early Summer. However, further fauna surveys are proposed in October 2018.

**If known, what threatening processes affecting these species or communities may be exacerbated by the project?** (eg. loss or fragmentation of habitats) Please describe briefly.

Potential threats to conservation significant fauna are described for each species in Section 3.3 of Ecoscape 2018. The key threatening processes are summarised below:

- Direct loss of remnants of flora and fauna habitat from vegetation clearance
- Indirect disturbance or degradation to flora, vegetation and fauna habitat through increased erosion and dust deposition, introduction of pathogens, introduction or spread of weeds, contamination from accidental spills of hazardous materials, or changes to groundwater.
- Temporary displacement\* of fauna due to noise and vehicle movements and lighting.
- Potential injury or death of fauna from vegetation clearing, earthworks or vehicle movements.

\*Note the displacement of fauna has been considered temporary because many species will become used to the noise and project activities that occur in the immediate vicinity. At closure, fauna species will migrate into the area if suitable habitat is available.

**Are any threatened or migratory species, other species of conservation significance or listed communities potentially affected by the project?**

NYD  No  Yes If yes, please:

- List these species/communities:
- Indicate which species or communities could be subject to a major or extensive impact (including the loss of a genetically important population of a species listed or nominated for listing) Comment on likelihood of effects and associated uncertainties, if practicable.

A total of 28 migratory and water bird species were identified that have been recorded in the region surrounding the Project area, but are unlikely to occur at the survey area due to the lack of suitable permanent wetland habitat, rivers and coastal shores (Section 1.4 of Ecoscape 2018). These included:

- Curlew Sandpiper (*Calidris ferruginea*)
- Eastern Curlew (*Numenius madagascariensis*)
- Australian Painted Snipe (*Rostratula australis*)
- Australasian Bittern (*Botaurus poiciloptilus*)
- Common Greenshank (*Tringa nebularia*)
- Marsh Sandpiper (*Tringa stagnatilis*)
- Black-tailed Godwit (*Limosa limosa*)
- Common Sandpiper (*Actitis hypoleucos*)
- Pectoral Sandpiper (*Calidris melanotos*)
- Red-necked Stint (*Calidris ruficollis*)
- Ruff (*Philomachus pugnax*)
- Sharp-tailed Sandpiper (*Calidris acuminata*)
- Fork-tailed Swift (*Apus pacificus*)
- Double-banded Plover (*Charadrius bicinctus*)
- Latham's Snipe (*Gallinago hardwickii*)
- Swinhoe's Snipe (*Gallinago megala*)
- Pin-tailed Snipe (*Gallinago stenura*)
- Little Curlew (*Numenius minutus*)
- Freckled Duck (*Stictonetta naevosa*)

- Blue-billed Duck (*Oxyura australis*)
- Eastern Great Egret (*Ardea modesta*)
- Hardhead (*Aythya australis*)
- Musk Duck (*Biziura lobate*)
- Australasian Shoveler (*Anas rhynchotis*)
- Nankeen Night Heron (*Nycticorax caledonicus hillii*)
- Whiskered Tern (*Chlidonias hybridus javanicus*)
- Royal Spoonbill (*Platalea regia*)
- Pied Cormorant (*Phalacrocorax varius*)

**Is mitigation of potential effects on indigenous flora and fauna proposed?**

NYD  No  Yes If yes, please briefly describe.

The site layout is yet to be finalised. VHM is taking into consideration any areas identified as important habitat and will avoid or minimise impacts to these areas, where practicable. For example, ancillary infrastructure will be located in areas of previous disturbance wherever possible, and temporary disturbance will be progressively rehabilitated. A number of environmental management plans will be developed to describe mitigation of indirect impacts to indigenous flora and fauna. A risk-based approach will determine mitigation actions.

**Other information/comments?** (e.g. accuracy of information)

Information gaps in relation to significant flora and fauna which will be addressed, include:

- The requirement for additional targeted flora and fauna surveys to confirm the presence/absence of significant species
- Refinement of the Project disturbance footprint once the location of mine pits and processing infrastructure is confirmed
- Estimation of potential direct and indirect impact to significant flora or fauna based on this footprint.

### 13. Water environments

**Will the project require significant volumes of fresh water (eg. > 1 GI/yr)?**

NYD  No  Yes If yes, indicate approximate volume and likely source.

It is anticipated that the Project will need approximately 3-5.5 GL per annum of water. The majority of the water demand will be required in the processing plant and can be brackish to saline water quality. Metallurgical studies are currently underway to determine the maximum level of salinity that can be used and the quantity of freshwater that is required. Water sources may include scheme water supply, or a groundwater borefield.

**Will the project discharge waste water or runoff to water environments?**

NYD  No  Yes If yes, specify types of discharges and which environments.

VHM does not anticipate that water discharge to surface water environments will occur. Tailings water will be discharged to a tailings facility. Water recovery is being considered in metallurgical studies (currently underway). Seepage to groundwater aquifers is another consideration that will be assessed via a hydrogeological seepage study and waste characterisation studies.

**Are any waterways, wetlands, estuaries or marine environments likely to be affected?**

NYD  No  Yes If yes, specify which water environments, answer the following questions and attach any relevant details.

There are five wetlands of international importance listed under the Ramsar Convention on Wetlands occurring within the broader region of the Project area:

- Banrock station wetland complex: 300 – 400 km downstream
- Hattah-kulkyne lakes: 100 – 150 km downstream
- Kerang wetlands: Within 15 km east of the project area
- Riverland: 200 – 300 km downstream
- The Coorong, and lakes Alexandrina and Albert wetland: 300 – 400 km downstream (Section 3.3 of EPHL 2018).

The majority of these wetlands are at a significant distance from the Project and will not be directly or indirectly impacted. The Kerang wetlands are located 15 km east of the edge of the Project area. No direct impacts to this wetland are proposed, and it is unlikely that the Project will result in indirect impacts to the wetland. However, a groundwater investigation for a potential water supply will be undertaken and will include groundwater modelling to predict the extent of drawdown to identify any potential impacts to the Kerang wetlands and if necessary, appropriate mitigation measures.

An unnamed DELWP modelled wetland (DELWP's NVIM tool; EHPL 2018) has been identified 1.7 km from the south-western edge of the Project area. The area falls within the local government planning overlay as a Farming Zone. However, under Victoria's Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017b), modelled wetlands are assumed to contain native vegetation regardless of the condition in the field (except for hard-surfaces such as roads and buildings). As such, any impacts to this area would be assumed to be impacting native vegetation. The Woorinen Mallee EVC 828 was mapped over this wetland (EHPL 2018). No direct impacts to this wetland are expected to occur from implementing the Project.

**Are any of these water environments likely to support threatened or migratory species?**

NYD  No  Yes If yes, specify which water environments.

The Kerang wetlands of international importance are known to support migratory species. A list of migratory species potentially occurring within the Project area is provided in Section 12.

The Targeted Conservation Significant Fauna Survey (Ecoscape 2018) did not identify any threatened or migratory species within the DELWP modelled wetland.

**Are any potentially affected wetlands listed under the Ramsar Convention or in 'A Directory of Important Wetlands in Australia'?**

NYD  No  Yes If yes, please specify.

The Kerang wetlands as listed under the Ramsar Convention and are located 15 km east of the edge of the Project area. VHM does not anticipate any impacts to Kerang wetlands as a result of the Project; however, a groundwater investigation is required to confirm that no impacts will occur.

**Could the project affect streamflows?**

NYD  No  Yes If yes, briefly describe implications for streamflows.

A preliminary hydrology assessment (Water Technology 2018) identified four primary waterways in the broader region:

- Murray River – The Murray River to the north of the project area forms part of the Murray-Darling basin river system which drains most of the inland waterways in Victoria and New South Wales.
- Avoca River – The Avoca River, located 16 km south and east of the Project area, has a history of flooding, with large events occurring recently in September 2010 and January 2011. These significant events filled the Avoca Marshes and flow through to Lake Boga. The Avoca River is an anabranching system, with the majority of flood water leaving the river downstream of Charlton and spreading across the floodplain and through various anabranching waterways.
- Back Creek – Back Creek is part of the Avoca floodplain and is one of its anabranching waterways. Back Creek is located 12.5 km to the south and east of the Project and its catchment occurs over 40% of the Project area. Back Creek flows back into the Avoca River system at the Avoca Marshes.
- Lalbert Creek – Lalbert Creek is located to the west of the Project and western parts of the Project area form components of its catchment. Lalbert Creek is an effluent stream of the Avoca River, carrying flood flows to the terminal lake systems of Lake Lalbert and Lake Timboram. Lalbert Creek also drains a large local catchment.

In the Project area there are no natural waterways or channels. The local catchment is gently undulating, with the Cannie Ridge running north-south through the east of the Project area. Due to the low rainfall, sandy soils with high infiltration and gradually sloping land surface, the formation of natural waterways in the project area appears to be inhibited (Water Technology 2018). Stock and domestic channels previously traversed the Project area, delivering water to the region. However, all channels have been decommissioned and backfilled.

**Could regional groundwater resources be affected by the project?**

NYD  No  Yes If yes, describe in what way.

Conceptual hydrogeological modelling (CDM Smith 2018) has been undertaken based on desktop information, which has highlighted that a Project water supply may exist below or nearby the Project area within the Parilla Sands aquifer or the deeper Olney Formation aquifer. Groundwater abstraction for a water supply or dewatering activities may affect the localised groundwater environment. The Parilla Sands water body is approximately 35 m deep and brackish to saline, and the Olney Formation is approximately 100 m deep and also saline. A detailed hydrogeological assessment is yet to be undertaken to support the conceptual hydrogeological modelling and understand the quantity and quality of groundwater in proximity to the Project area and assess the impacts to other receptors if the groundwater was to be used for the Project.

**Could environmental values (beneficial uses) of water environments be affected?**

NYD  No  Yes If yes, identify waterways/water bodies and beneficial uses (as recognised by State Environment Protection Policies)

CDM Smith (2018) assessed available groundwater salinity data for two hydrograph units within the Project area. Parilla Sand groundwater has an average groundwater salinity of 22,425 mg/L and Olney Formation groundwater has an average groundwater salinity of 25,720 mg/L. This leads to classification of both aquifers as having Beneficial Use Segment D groundwater, which is suitable for the following uses:

- Maintenance of ecosystems
- Industrial water use
- Primary contact (recreation and water sports)
- Buildings and structures.

The groundwater data are also consistent with the state-wide salinity maps for the aquifers defined by the Victorian Aquifer Framework that show, for the Parilla Sand and Olney Formation aquifers, groundwater is classified as Segment D groundwater across the Project area.

Potential groundwater receptors in the Project area include private users of groundwater (i.e. human consumption and agricultural uses) and the environment. However, considering the SEPP criteria and average groundwater salinity concentrations, it is unlikely any potential groundwater users in the Project area would be reliant on groundwater sourced from the Parilla Sand or Olney Formation aquifers. This is supported by the observation that the state-wide database of registered groundwater users indicates there is only one domestic and stock bore within the Project area. Extensive groundwater dependent ecosystems (GDEs) occur to the east of the Project area, and form a component of the Back Creek catchment.

While direct impacts to environmental values is unlikely, further definition of the Project's parameters will provide a greater understanding of indirect impacts to environmental values (beneficial uses).

**Could aquatic, estuarine or marine ecosystems be affected by the project?**

NYD  No  Yes If yes, describe in what way.

There is a lack of aquatic, estuarine or marine ecosystems within the Project area. The nearest Lake is Lake Lalbert, approximately 4 km south west of the Project area and is generally dry except during large rainfall events. A detailed hydrogeological and hydrology assessment of potential impacts to the aquatic ecosystems will be undertaken.

**Is there a potential for extensive or major effects on the health or biodiversity of aquatic, estuarine or marine ecosystems over the long-term?**

No  Yes If yes, please describe. Comment on likelihood of effects and associated uncertainties, if practicable.

There is a lack of aquatic, estuarine or marine ecosystems within the Project area. There is a lack of aquatic, estuarine or marine ecosystems within the Project area. The nearest Lake is Lake Lalbert, approximately 4 km south west of the Project area and is generally dry except during large rainfall events. A detailed hydrogeological and hydrology assessment of potential impacts to the aquatic ecosystems will be undertaken.

**Is mitigation of potential effects on water environments proposed?**

NYD  No  Yes If yes, please briefly describe.

Pit dewatering and abstraction for water supply is predicted to result in localised impacts to the groundwater environment. Mitigation measures will be developed for potential indirect impacts.

**Other information/comments? (e.g. accuracy of information)**

There are a number of data / information gaps that will inform the assessment and are inter-related. The key data gaps are:

- Specific location of the proposed mine pits and infrastructure within the Project area
- Location of potential groundwater supply borefield
- Water table depth at the specific location of proposed mine pits
- Dewatering requirements (based on depth of mineralisation and water table)
- Hydraulic connection between Parilla Sand and Olney Formation hydrostratigraphic units
- Location of potentially sensitive groundwater receptors relative to the proposed site layout and mining areas.



## 14. Landscape and soils

### Landscape

#### Has a preliminary landscape assessment been prepared?

No  Yes If yes, please attach.

The Project area is characterised by roads and road reserves, fence lines, farm dams, pockets of degraded native vegetation along property boundaries, and road reserves, redundant depressions where there were once designed waterways, homesteads and associated non-native gardens, and farm sheds. The Project area is generally flat, with no significant ridges or crests within or immediately adjacent to the site although topographical mapping shows a slight rise in topography from north to south in the centre of the Project area (the Cannie Ridge). The Bael Bael Grassland Nature Conservation Reserve, Koorangie Wildlife Reserve, and Kerang wetlands that comprise a large lake system extending north to Lake Boga, occur at least 10 km to the east of the Project area. Lake Lalbert Wildlife Reserve occurs to the southwest of the Project area. There are no significant watercourses within the Project area.

The Project area is sparsely populated with 12 farms. The flat topography and vegetation in the road reserves and pockets within farmland may provide some natural screening for residences and roadside viewpoints. Several potential viewpoints from the roadside to the mine site and associated infrastructure are likely; however, impacts to visual amenity will rapidly decrease with distance due to the flat landscape. The twilight landscape is primarily dark with the few broadly spaced residences producing minor external light.

The Murray Valley Highway is the main tourist route, which goes through the Rural City of Swan Hill, and travels to the north and east of the Project area. It is unlikely there will be any viewpoints from this Highway.

During the first few years of operations, small landforms will be created. VHM plan to backfill the pits and will progressively rehabilitate landforms and other disturbed areas. Dependent on the outcomes of a landscape assessment, VHM will utilise mitigation actions such as vegetation screens, limited heights of landforms if visual impacts are determined.

#### Is the project to be located either within or near an area that is:

- **Subject to a Landscape Significance Overlay or Environmental Significance Overlay?**

NYD  No  Yes If yes, provide plan showing footprint relative to overlay.

A number of Environmental Significance Overlays occur within the region of the Project area (Environment Significant Overlay 1 – ESO2, ESO4). However, as the mine pit and processing infrastructure locations are not yet finalised, it has not yet been confirmed whether the Project disturbance footprint will intercept these overlays.

- **Identified as of regional or State significance in a reputable study of landscape values?**

NYD  No  Yes If yes, please specify.

- **Within or adjoining land reserved under the *National Parks Act 1975* ?**

NYD  No  Yes If yes, please specify.

- **Within or adjoining other public land used for conservation or recreational purposes?**

NYD  No  Yes If yes, please specify.

#### Is any clearing vegetation or alteration of landforms likely to affect landscape values?

NYD  No  Yes If yes, please briefly describe.

The Project will involve clearing of vegetation and alteration of landforms, however most impact will occur in areas previously significantly disturbed for agriculture. The extent of disturbance has not yet been characterised, and will be addressed as part of the impact assessment.

#### Is there a potential for effects on landscape values of regional or State importance?

NYD  No  Yes Please briefly explain response.

It is unlikely that the Project will impact on landscape values of regional or state importance; however, this will be determined based on further ecological assessments and finalisation of the Project footprint.

#### Is mitigation of potential landscape effects proposed?

NYD  No  Yes If yes, please briefly describe.

Should potential landscape impacts be identified, VHM will ensure appropriate mitigation measures are implemented.

**Other information/comments?** (eg. accuracy of information)

Assessments required to address information gaps in relation to this factor include:

- Characterisation of the visual character and associated landscape values for the Project area.
- Identification of public views to or incorporating the Project area
- Project design and layout
- Assessment of potential impacts to landscape values based on the project layout, and the significance of these impacts.

**Note:** A preliminary landscape assessment is a specific requirement for a referral of a wind energy facility. This should provide a description of:

- The landscape character of the site and surrounding areas including landform, vegetation types and coverage, water features, any other notable features and current land use;
- The location of nearby dwellings, townships, recreation areas, major roads, above-ground utilities, tourist routes and walking tracks;
- Views to the site and to the proposed location of wind turbines from key vantage points (including views showing existing nearby dwellings and views from major roads, walking tracks and tourist routes) sufficient to give a sense of the overall site in its setting.

**Soils****Is there a potential for effects on land stability, acid sulphate soils or highly erodible soils?**

NYD  No  Yes If yes, please briefly describe.

Detailed soil assessments and waste characterisation are yet to be undertaken. However, the Project area is not covered by an Erosion Management Overlay.

Due to the relatively flat and homogenous nature of the landscape, there are no obvious challenges associated with this aspect of the Project. However, given the nature of the activity (i.e. large-scale mining), there are obvious issues that are common to all mining projects and have well-established mitigation measures. The Project activities that have the potential to impact geology, landforms and soil include:

- Vegetation and topsoil clearing
- Topsoil and subsoil management
- Deposition of co-disposed mining by-products
- Contamination of co-disposed mining by-products from high concentrations of heavy metals, salts or radionuclides
- Rehabilitation of cleared areas

These all have the potential to affect:

- Erosion due to landform design and infrastructure areas obstructing natural surface water movement during heavy rainfall events
- The capability of the land to support post-mining agriculture and existing ecosystems
- Successful rehabilitation of the land
- Successful closure of the Project

Boron is known to be concentrated in some sub surface layers and there may be disturbance of these layers. High boron concentrations may impact the growth of certain crops and fruit trees. Accordingly appropriate placement of this material within the soil profile at rehabilitation will be required to ensure it does not impact the success of rehabilitation.

Naturally occurring radioactive minerals coexists with the target ore body. Given metallurgical test work is on-going and the process plant design has not yet been finalised, on-going tailings, concentrate and product characterisation will continue to occur.

**Are there geotechnical hazards that may either affect the project or be affected by it?**

NYD  No  Yes If yes, please briefly describe.

Geotechnical assessments have not yet been completed.

**Other information/comments?** (eg. accuracy of information)

A soils assessment and geotechnical assessment will be undertaken to ensure hazards are identified and mitigated. These assessments are proposed to address the following:

- Characterisation of the soil lithology of topsoil and subsoil horizons
- Characterisation of the relevant physical and chemical properties of overburden and topsoil material to be used in rehabilitation
- Assessment of acid mine drainage potential
- Determination of geochemical or physical aspects of the topsoil or subsoil that may affect rehabilitation success.

## 15. Social environments

### Is the project likely to generate significant volumes of road traffic, during construction or operation?

NYD  No  Yes If yes, provide estimate of traffic volume(s) if practicable.

The residents of Gannawarra and Swan Hill LGAs rely on efficient transport corridors. Specifically, the Loddon and Murray Valley Highways provide regional connections to Bendigo and Mildura, and the Mallee Highway links Adelaide and Sydney. The local road network is important road infrastructure that needs to be maintained and improved, especially with the development of the Project.

Surrounding and within the Project area is a system of highways and regional and local roads (Figure 13). These include declared roads managed by VicRoads, as well as local roads managed by the Rural City of Swan Hill and Gannawarra Shire. Several regional arterial and sub-arterial roads and arterial highways are being considered as a part of the transport route for the construction and operation of the Project. While declared roads in the area are sealed, the majority of the smaller municipal roads are only partially sealed, and will require upgrade to support the Project.

During construction, there will likely be 200-250 people on-site and approximately up to 250 people during operations. Traffic volumes are likely to increase due to implementing the Project for transport of employees, consumables, waste and product. Road traffic volumes will be further defined once the Project footprint and feasibility studies are completed. VHM will be investigating options to reduce traffic volumes such as providing bus services and using pipelines to move ore around the mine site rather than using heavy vehicles.

### Is there a potential for significant effects on the amenity of residents, due to emissions of dust or odours or changes in visual, noise or traffic conditions?

NYD  No  Yes If yes, briefly describe the nature of the changes in amenity conditions and the possible areas affected.

Given the flat landscape and distance of 2.7 km from the nearest township of Lalbert, it is unlikely visual amenity at the township will be significantly impacted by the Project. VHM is currently in discussions with residences occurring within the Project area in relation to land access, and environment and amenity.

The Project is likely to result in increased noise and dust emissions in the local area due to the operation of mining equipment and processing infrastructure. The extent of these impacts will be dependent on the proximity or residences, weather and wind direction, during and timing construction and operational activities, and the effectiveness of mitigation measures. Additional studies are proposed to assess potential noise and dust impacts associated with the Project. An environmental management plan will then be prepared to address appropriate mitigation measures. There are no odours expected from the Project.

The Project will result in increased traffic in the region (heavy and light vehicle movements). An assessment of potential impacts will be undertaken as part of the environmental impact assessment in the ESS.

### Is there a potential for exposure of a human community to health or safety hazards, due to emissions to air or water or noise or chemical hazards or associated transport?

NYD  No  Yes If yes, briefly describe the hazards and possible implications.

The potential impacts to human health will be assessed during the impact assessment for the preparation of the environment effects statement. The assessment will include the exposure to naturally occurring radioactive material (NORM), dust and noise. As discussed in Section 11, preliminary assessment of the NORM radiation levels associated with the project are relatively low.

### Is there a potential for displacement of residences or severance of residential access to community resources due to the proposed development?

NYD  No  Yes If yes, briefly describe potential effects.

VHM will avoid displacement of residences wherever possible. There are approximately three residences within the Project area that may need to be relocated or the occupiers temporarily displaced to allow for mining of deposits. VHM will negotiate access and compensation to landholders in accordance with regulatory requirements. The potential impact on residences including displacement or severance of residential access will be assessed during the impact assessment for the Project.

<p><b>Are non-residential land use activities likely to be displaced as a result of the project?</b>  <input type="checkbox"/> NYD <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes If yes, briefly describe the likely effects.</p> <p>Farming is the main land use activity within the Project area. Farming activities on some properties will be displaced for the short to medium term and then rehabilitated to standard suitable to recommence agricultural activities. No other non-residential land uses are anticipated to be displaced as a result of the Project.</p>
<p><b>Do any expected changes in non-residential land use activities have a potential to cause adverse effects on local residents/communities, social groups or industries?</b>  <input type="checkbox"/> NYD <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes If yes, briefly describe the potential effects.</p> <p>Temporary impacts to farming activities will occur from implementing the Project. Progressive rehabilitation will be undertaken as soon practicable to return the mined areas to a standard suitable for agricultural activities.</p> <p>Key land use and planning aspects associated with the Project include:</p> <ul style="list-style-type: none"> <li>• The development of an extractive industry on agricultural land that falls within the Farming Zone.</li> <li>• Disturbance of land zoned for protection and conservation for the development of mining and supporting infrastructure.</li> <li>• Impacts to environmental and heritage values associated with the region.</li> </ul> <p>The potential effects of these aspects include the following:</p> <ul style="list-style-type: none"> <li>• Development of the Project will temporarily reduce available farmland in the region</li> <li>• Introduction of mining may affect the rural character or the area.</li> <li>• Environmental values associated with remnants of native vegetation within the Project area and surrounds will be influenced by the change in land use.</li> <li>• Economic aspects will provide opportunities for the LGAs. The Project will diversify industry prospects and associated services required by an extractive industry. Additional job opportunities will also be available to LGA residents.</li> </ul>
<p><b>Is mitigation of potential social effects proposed?</b>  <input type="checkbox"/> NYD <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes If yes, please briefly describe.</p> <p>VHM will consult with landowners and the local community to determine the potential impact of the proposed mining activities and how to mitigate against potential social impacts.</p> <p>All landowners that are directly impacted by the Project will be compensated in accordance with the <i>Mineral Resources (Sustainable Development) Act 1990</i>.</p>
<p><b>Other information/comments?</b> (eg. accuracy of information)</p> <p>To address the social impacts of the Project, VHM will undertake a Landuse Planning Assessment and a Socioeconomic assessment. These studies will assess the existing social environment and land uses, and the potential effects of the project on the community.</p>

## Cultural heritage

<p><b>Have relevant Indigenous organisations been consulted on the occurrence of Aboriginal cultural heritage within the project area?</b>  <input type="checkbox"/> No If no, list any organisations that it is proposed to consult.  <input checked="" type="checkbox"/> Yes If yes, list the organisations so far consulted.</p> <p>VHM has commenced consultation with the Wamba Wamba and Barapa Barapa people, which have indicated their intention to apply for recognition as a Registered Aboriginal Party (RAP). VHM will continue to engage with these groups to prepare a Cultural Heritage Management Plan for the Goschen Project.</p>
<p><b>What investigations of cultural heritage in the project area have been done?</b>  (attach details of method and results of any surveys for the project &amp; describe their accuracy)</p> <p>Desktop assessments have been conducted, and further field investigations are proposed. The results of desktop assessment are provided in reports prepared by Eco Logical in Attachments 5 and 6.</p>

**Is any Aboriginal cultural heritage known from the project area?**

NYD  No  Yes If yes, briefly describe:

- Any sites listed on the AAV Site Register
- Sites or areas of sensitivity recorded in recent surveys from the project site or nearby
- Sites or areas of sensitivity identified by representatives of Indigenous organisations

A desktop assessment was undertaken for the Project area and surrounding region by Eco Logical Australia (2018b), which identified the following:

- Assessment of the Australian Heritage Database identified:
  - There were no places classified as Indigenous heritage within the Project area.
  - Lake Lalbert (Place ID 100418), located to the west of the Project, was classed as a Natural Heritage place with a legal status of 'Indicative'. The listing provides details of the nominator's Statement of Significance and a further description of the heritage values associated with Lake Lalbert; these relate exclusively to the area's ecological values.
- Assessment of the Victorian Aboriginal Heritage Database identified:
  - 414 registered Aboriginal cultural places located within 30 km of the centre of the Project area. Most of these places are located either on landforms associated with ephemeral lakes situated to the east of the study area, or floodplain landforms south-east of the study area. Only a few Aboriginal cultural heritage places have been identified on Mallee landforms away from naturally occurring waterbodies or watercourses.
  - There were no Aboriginal cultural heritage places identified within the proposed target mineralisation area for the Project (Figure 11).
- The Project area does not contain any places included on the World Heritage List, National Heritage List or Commonwealth Heritage List, and consequently there are no places within the study area that are protected under the EPBC Act.
- The Project area does not contain any Aboriginal cultural heritage places listed on Local Planning Scheme Heritage Overlays for the Gannawarra Shire or Rural City of Swan Hill.

A review of Victorian Department of Premier and Cabinet cultural heritage sensitivity mapping also indicates that there are no known areas of cultural heritage sensitivity within the Project area, however all wetlands and waterways in the adjacent areas have cultural heritage significance (Figure 11).

**Are there any cultural heritage places listed on the Heritage Register or the Archaeological Inventory under the *Heritage Act 1995* within the project area?**

NYD  No  Yes If yes, please list.

There are no cultural heritage places listed on the Heritage Register or the Archaeological Inventory under the *Heritage Act 1995* within the Targeted Mineralisation Zones. However, within the surrounding region, there are a number of sites listed in the Victorian Heritage Register, including:

- Lalbert Hall Honour Roll (ID 189023) - Lalbert Hall, Lalbert, Gannawarra Shire
- Lalbert War Memorial (ID 125897) - Main Street, Lalbert, Gannawarra Shire
  - The Lalbert War Memorial was erected on the main street in 1961. The Quambatook RSL presented the monument in memory of the fallen of all conflicts. The memorial comprises of a marble plaque attached to a simple granite wall and a flagpole nearby.
- Kunat State School No. 3294 (ID 12017) – Included on the VHI (H7526 – 0005) (EcoLogical Australia (2018a))

**Is mitigation of potential cultural heritage effects proposed?**

NYD  No  Yes If yes, please briefly describe.

The Aboriginal cultural heritage aspects and issues relate to:

- The presence of known waterways and wetlands of cultural heritage significance and their proximity to the Project area
- The presence of unknown sites of cultural heritage significance that may occur within the Project area
- Preparation and implementation of a Cultural Heritage Management Plan (CHMP)

The non-indigenous cultural heritage aspects and issues relate to:

- The presence of unknown sites of cultural heritage significance that may occur within the Project area that could require salvage work or protection.

Aspects and issues are tied to the historical connection to land of both the Traditional Owners and the farmers. In addition, VHM recognises that there may be undiscovered/unknown sites of cultural heritage significance within the Project area. Based on desktop assessments conducted to date, no effects to places of cultural heritage significance are anticipated. However, further investigations and consultation are required to further understand the cultural heritage significance of the Project area.

**Other information/comments? (eg. accuracy of information)**

On ground assessments for potential Aboriginal cultural heritage sites are required to be undertaken.

## 16. Energy, wastes & greenhouse gas emissions

### What are the main sources of energy that the project facility would consume/generate?

- Electricity network. If possible, estimate power requirement/output  
Not yet determined.....
- Natural gas network. If possible, estimate gas requirement/output .....
- Generated on-site. If possible, estimate power capacity/output .....
- Other. Please describe.  
Diesel for mobile plant and equipment  
Please add any relevant additional information.

VHM is investigating power generation options such as:

- accessing the existing 220 kV transmission lines (part of the national electricity grid) located on the eastern edge of the project area (Figure 13)
- accessing nearby solar electricity plant
- construction of a power station – diesel, gas or solar.

### What are the main forms of waste that would be generated by the project facility?

- Wastewater. Describe briefly.  
Sewage
- Solid chemical wastes. Describe briefly.  
Solid chemical wastes will be domestic wastes
- Excavated material. Describe briefly.  
Mining will involve the excavation of waste material (sand/clay) and ore.
- Other. Describe briefly.  
Waste hydrocarbons (e.g. oils, hydraulic fluids), Tailings material from the Processing plant

Please provide relevant further information, including proposed management of wastes.

Sewage management is yet to be determined, however it will be either collected and temporarily stored in a septic tank or it may be treated on-site in a Wastewater Treatment Plant (WWTP). An approved contractor will regularly empty the tank for off-site disposal of the sewage.

Domestic wastes will be managed by strategically placed bins either removed off-site or approval will be sought for an onsite landfill.

Tailings fines and sands from the processing facility will be stored above ground in an interim facility and then used to back-fill the pit. Waste characterisation studies are currently underway to understand the materials chemical and physical properties.

Waste material (interburden/overburden [sand/clay]) will be stockpiled near the open pit. Waste characterisation studies are currently underway to understand the materials chemical and physical properties.

Waste hydrocarbons will be maintained in enclosed containers within secondary bunded areas until removal off-site by a licensed contractor.

### What level of greenhouse gas emissions is expected to result directly from operation of the project facility?

- Less than 50,000 tonnes of CO<sub>2</sub> equivalent per annum
- Between 50,000 and 100,000 tonnes of CO<sub>2</sub> equivalent per annum
- Between 100,000 and 200,000 tonnes of CO<sub>2</sub> equivalent per annum
- More than 200,000 tonnes of CO<sub>2</sub> equivalent per annum

Please add any relevant additional information, including any identified mitigation options.

It is expected that greenhouse emissions will be similar to that of the nearest mineral sands mining project, the Balranald Mineral Sands Project, which has calculated its emissions of 0.3-0.6 million tonnes of CO<sub>2</sub> equivalent per annum from direct and indirect emissions sources.

## 17. Other environmental issues

**Are there any other environmental issues arising from the proposed project?**

No  Yes If yes, briefly describe.

## 18. Environmental management

**What measures are currently proposed to avoid, minimise or manage the main potential adverse environmental effects?** (if not already described above)

Siting: Please describe briefly

VHM has commissioned environmental studies of its broader Project area to inform the location of sensitive environmental receptors prior to determining the site layout. The site layout will take account of hydrology patterns and sensitive environmental receptors such as significant ecological communities, proximity to wetlands, and flora/fauna habitat values.

Design: Please describe briefly

The waste stockpiles and interim TSF design will take account of seismic activity, waste material and tailings physical and chemical characterisation studies, tailings pore water analysis, seepage assessment and closure objectives.

Environmental management: Please describe briefly.

A series of Environmental Management Plans (EMPs) will be developed to describe mitigation of potential direct and indirect impacts to the environment as a result of implementing the Project. Mitigation actions will be identified using a risk-based approach. Procedures, forms and registers will provide supporting documentation to the EMPs. The EMPs will sit within an overarching Environmental Management System, which will align with the international standard (ISO 14001) and based on a model of continual improvement.

Other: Please describe briefly

Add any relevant additional information.

## 19. Other activities

**Are there any other activities in the vicinity of the proposed project that have a potential for cumulative effects?**

NYD  No  Yes If yes, briefly describe.

There are no other activities in the vicinity of the Project that have the potential for cumulative effects. The Balranald Mineral Sands Project is the nearest mining development, 100 km to the north of the Project, and occurs approximately 80 km north of Swan Hill in New South Wales. Preliminary investigation indicates that there is sufficient capacity in road, rail and port infrastructure to support the Goschen Project and other project should they be developed in the area.

Farming has significantly impacted the environmental values in the vicinity of the Project. As a result, remnants of habitat remain and any impact to them from the Project will have a cumulative effect on previous impacts to flora/fauna habitat from farming.

## 20. Investigation program

### Study program

**Have any environmental studies not referred to above been conducted for the project?**

No  Yes If yes, please list here and attach if relevant.



**Has a program for future environmental studies been developed?**

No  Yes If yes, briefly describe.

Targeted flora surveys to determine if the significant flora species do occur within the Project area. These will be conducted during spring when flora species are likely to be flowering. Additional habitat mapping and targeted fauna surveys and will also be undertaken.

Waste characterisation studies will include physical and chemical characterisation of topsoil, waste material and tailings materials. Radiation assessment of mining products, tailings and stockpiled material (overburden and interburden) will also be undertaken.

An air quality assessment will be undertaken once further definition of the Project has been determined by the metallurgy and engineering teams. An assessment of greenhouse gas emissions from the Project operations will be undertaken.

A baseline noise monitoring and noise modelling assessment will be undertaken.

A detailed hydrogeological assessment will be undertaken upon determination of the pit shell, mining rate, and water demand requirements, and will involve step tests and continuous rate pump testing, and modelling. It will include an assessment of potential impacts to Lake Lalbert and the Kerang Wetlands.

A preliminary visual impact and landscape assessment will be commissioned, subject to consultation with DEWLP.

Aboriginal heritage surveys of the Project area are to be undertaken.

An assessment of traffic and transport impacts will be undertaken, including estimation of use of road and rail infrastructure.

There are no significant surface watercourses within the Project area, however additional surface water assessment will be undertaken if required.

Agronomy assessment, to better understand the surrounding agricultural activities and the effect on the environment.

Socio-economic assessment and land use planning assessment.

**Consultation program****Has a consultation program conducted to date for the project?**

No  Yes If yes, outline the consultation activities and the stakeholder groups or organisations consulted.

VHM will develop and implement a Community Engagement Plan. VHM has commenced community consultation, involving consultation activities with identified key stakeholders. To-date, consultation has primarily involved discussions of investigative studies involved in characterising elements of the Project e.g. mineral exploration, environmental field investigations and the referral process.

**Has a program for future consultation been developed?**

NYD  No  Yes If yes, briefly describe.

The Community Engagement Plan will describe VHM's consultation program, and key stakeholders that will be engaged. VHM primarily informs key stakeholders of its activities, investigations and outcomes, by disseminating information and encouraging feedback.

**Authorised person for proponent:**

I, ..... Graham Howard.....(full name),

Managing Director.....(position), confirm that the information contained in this form is, to my knowledge, true and not misleading.

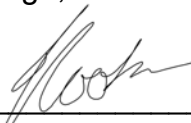
Signature  \_\_\_\_\_

Date 31/8/18

**Person who prepared this referral:**

I, ...Jenny Cookson .....(full name),

Manager, Environment and Community Relations .....(position), confirm that the information contained in this form is, to my knowledge, true and not misleading.

Signature  \_\_\_\_\_

Date 31/8/18

**Figures**

- Figure 1: Regional Location Map
- Figure 2: Goschen Mineral Sands and Rare Earth Project Location
- Figure 3: Geological Cross Section
- Figure 4: RAMSAR Wetlands
- Figure 5: Ecological Vegetation Classes
- Figure 6: Vegetation Quality
- Figure 7: Significant Flora
- Figure 8: Significant Fauna
- Figure 9: Gannawarra Shire and Rural City of Swan Hill Planning Scheme Zones
- Figure 10: Gannawarra Shire and Rural City of Swan Hill Planning Scheme Overlays
- Figure 11: Cultural Heritage
- Figure 12: Native Title Determinations
- Figure 13: Infrastructure
- Figure 14: Topography
- Figure 15: Reserves and Wetlands

**Attachments**

Attachment 1: EHPL (2018) *Ecological Characterisation Assessment of the Proposed Goschen Mineral Sands Project, Goschen, Victoria*. Environment and Heritage Partners Limited (EHPL), unpublished report for VHM Exploration Pty Ltd.

Attachment 2: Ecoscape Australia (2018) *Goschen Project – Targeted Conservation Significant Fauna Survey*. Unpublished report for VHM Exploration Pty Ltd. 20 April 2018.

Attachment 3: Water Technology (2018) *Surface Water Assessment – Goschen Mineral Sands and Rare Earth Project*, Unpublished report for VHM Exploration Pty Ltd.

Attachment 4: CDM Smith (2018) *VHM Exploration Pty Ltd Goschen Hydrogeological Assessment*. CDM Smith Inc., unpublished report for VHM Exploration Pty Ltd, March 2018

Attachment 5: EcoLogical Australia (2018a) *Goschen Project Historical Heritage Assessment*, Unpublished report for VHM Exploration Pty Ltd.

Attachment 6: EcoLogical Australia (2018b) *Goschen Project Cultural Heritage Assessment*, Unpublished report for VHM Exploration Pty Ltd.

Version 5: July 2013

## References

- Allom Lovell and Associates (2001) *Rural City of Swan Hill Heritage Study Stage II Introduction and Background*. Unpublished report for the Rural City of Swan Hill. July 2001.
- CDM Smith (2018) *VHM Exploration Pty Ltd Goschen Hydrogeological Assessment*. CDM Smith Inc., unpublished report for VHM Exploration Pty Ltd, March 2018
- DEDJTR (2015) *Mineral Sands*, Available at: <http://earthresources.vic.gov.au/earth-resources/industry-and-investment/key-resource-opportunities/mineral-sands>. Accessed 1 June 2018.
- DEDJTR (2017) *Technical Guideline for the Design and Management of Tailings Storage Facilities*, Department of Economic Development, Jobs, Transport and Resources, April 2017
- DELWP (2018a) *Victoria Planning Provisions*, Department of Environment, Land, Water and Planning, May 2018.
- DELWP (2018b) *Gannawarra Planning Scheme*, Department of Environment, Land, Water and Planning, May 2018.
- DELWP (2018v) *Swan Hill Planning Scheme*, Department of Environment, Land, Water and Planning, May 2018.
- DSE (2004) *Vegetation quality assessment manual : guidelines for applying the habitat hectares scoring method*. Department of Sustainability and Environment: Biodiversity and Natural Resources Division.
- EcoLogical Australia (2018a) *Goschen Project Historical Heritage Assessment*, Unpublished report for VHM Exploration Pty Ltd.
- EcoLogical Australia (2018b) *Goschen Project Cultural Heritage Assessment*, Unpublished report for VHM Exploration Pty Ltd.
- Ecoscope Australia (2018) *Goschen Project – Targeted Conservation Significant Fauna Survey*. Unpublished report for VHM Exploration Pty Ltd. 20 April 2018.
- EHPL (2018) *Ecological Characterisation Assessment of the Proposed Goschen Mineral Sands Project, Goschen, Victoria*. Environment and Heritage Partners Limited (EHPL), unpublished report for VHM Exploration Pty Ltd.
- EPA Victoria (2007) *Protocol for Environmental Management State Environment Protection Policy (Air Quality Management) Mining and Extractive Industries Publication 1191*. <https://www.epa.vic.gov.au/~media/Publications/1191.pdf>. Accessed 6 May 2018.
- EPA Victoria (2011a) *Guidelines Noise from Industry in Regional Victoria*. Publication 1411 <https://www.epa.vic.gov.au/~media/Publications/1411.pdf>. Accessed 1 June 2018.
- EPA Victoria (2011b) *Applying NIRV to proposed and existing industry*. Publication 1413. <https://www.epa.vic.gov.au/~media/Publications/1413.pdf>. Accessed 24 May 2018.
- Grasslands: Biodiversity of south-eastern Australia (2018) *Bael Bael Grassland Nature Conservation Reserve*, Available: <http://grasslands.ecolinc.vic.edu.au/grassland/bael-bael-grassland-nature-conservation-reserve>, accessed 20 August 2018.
- Hamilton Environmental Services (2016) *Native Vegetation Assessment and Net Loss Reporting, Proposed Drilling Sites, Swan Hill Rural City and Gannawarra Shire*, Unpublished report for VHM Exploration.
- Hamilton Environmental Services (2016) *Native Vegetation Assessment and Net Loss Reporting, Proposed Drilling Sites, Goschen, Gannawarra Shire*, Unpublished report for VHM Exploration.
- JRHC Enterprises Pty Ltd (2018a) *Gamma Radiation Monitoring Goschen Project Swan Hill*, Unpublished report for VHM Exploration.
- JRHC Enterprises Pty Ltd (2018b) *Advice on the EPBC Act Nuclear Actions Requirements for the VHM Goschen Project in North West Victoria*, Unpublished report for VHM Exploration.
- Kellogg, Brown & Root Pty Ltd (2011) *Ecological Character Description for the Kerang Wetlands Ramsar site*. Report to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

Mason (2008) EL 4701, *Goschen Project Annual Report for the period 16th November 2007 to 15th November 2008*.

Water Technology (2018) *Surface Water Assessment – Goschen Mineral Sands and Rare Earth Project*, Unpublished report for VHM Exploration Pty Ltd.