

Wilgerup Iron Ore Mining Proposal



SUPPORTING DOCUMENTATION FOR MINING
LEASE PROPOSAL

VOLUME 1

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- Rev 2
- 31 October 2008

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- Rev 2
- 31 October 2008

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List of Abbreviations

ANFO	Ammonium nitrate/fuel oil
AS	Australian Standard
BIF	Banded Iron Formation
BOD	Biochemical Oxygen Demand
BOM	Bureau of Meteorology
CCC	Community Consultative Committee
CFS	Country Fire Service
DC	District Council
DEH	Department for Environment and Heritage
DWLBC	Department for Water, Land and Biodiversity Conservation
EC	Electrical Conductivity
EI	Extractive Industries
EL	Exploration Lease
EMP	Environmental Management Plan
EP	Equivalent Person
EP	Eyre Peninsula
EPA	Environment Protection Authority
ER	Emergency Response
FEL	Front End Loader
FTE	Full Time Equivalent
GDE	Groundwater Dependent Ecosystems
GHG	Greenhouse Gas
HDPE	High Density Polyethylene
IBRA	Interim Biogeographical Region of Australia
IRR	Internal Rate of Return
LOM	Life of Mine
LV	Light Vehicle
MARP	Mining and Rehabilitation Program
ML	Mineral Lease
MMU	Mobile Manufacturing Unit
MPL	Miscellaneous Purposes Licence
NAPP	Net Acid Producing Potential
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NPV	Net Present Value
NRM	Natural Resource Management
NVC	Native Vegetation Council



NVMP	Native Vegetation Management Plan
NVMP	Native Vegetation Management Plan
OHS	Occupational Health and Safety
PAF	Potentially Acid Forming
PETN	Pentaerthritol Tetranitrate
PIRSA	Primary Industries and Resources South Australia
PM	Particulate Matter
PRL	Primary Risk Level
PWA	Prescribed Wells Area
RC	Reverse Circulation
RO	Reverse Osmosis
ROM	Run of Mine
RRL	Residual Risk Level
SD	Statistical Division
SEB	Significant Environmental Benefit
SKM	Sinclair Knight Merz
TAPM	The Air Pollution Model
TDS	Total Dissolved Solids
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
VOC	Volatile Organic Compound
WCC	Whyalla City Council
WMCCP	Wilgerup Mine Closure and Completion Plan



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Rev 2	5-6	2	Centrex Metals (Kevin Malaxos)
Rev 2	7-8	2	Sinclair Knight Merz

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Author:	Alana Horan (primary)/ L Daddow/ A Cronin/ M LoMonaco/ D Pierce/ H Bateman
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MLP Project manager:	Danny Simpson/Alana Horan
Name of organisation:	Centrex Metals Limited
Name of project:	Wilgerup Iron Ore Mine
Name of document:	Application for Mining Lease Volume 1
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1. Introduction

1.1. General Description of the Project

Centrex Metals Limited (Centrex) is proposing the development of the Wilgerup Iron Ore Mine, located on dryland farmland in central Eyre Peninsula. Centrex has been granted four (4) Mineral Claims (MC 3947-3950), and is seeking a Mining Lease (ML) over a 9.2 km² portion of EL 3317 for the mine and primary infrastructure. Subject to mining lease approval, Centrex will apply for various approvals required for upgrade of the road transport corridor in the vicinity of the proposed mine site and development of the rail siding.

This initial project will involve the mining of an estimated 10.4 Mt of resources starting in the southern portion of the proposed ML area using open pit mining techniques. As at 1 August 2008, the JORC compliant indicated resource was 10.4 Mt at 59.7% Fe of massive hematite. The ore will be crushed and screened on site, followed by direct transport for export.

Centrex have investigated various options for transporting the ore to port for shipment, including road haulage and use of the existing Lock-Port Lincoln rail network.

Hematite ore will be processed at the rate of 1.6 Mt/annum to produce a lump and fines product for export. The final screened lump and fines ore will be trucked in covered trailers to a rail siding at Tooligie and then loaded into rail wagons for rail transport direct to storage facilities on Port Lincoln Wharf.

Associated infrastructure within the ML area will include crushing and screening facilities, a waste rock dump (comprising overburden and waste rock material), mine offices, maintenance workshop, water storage and a reverse osmosis (RO) plant for water treatment.

Subject to approvals and funding, construction of infrastructure is projected to commence in the second quarter of 2009, with ore export projected to commence in the first quarter of 2010. The initial project has a projected life of six (6) years.

1.2. Background to the Project

The Wilgerup Iron Ore Project has emerged from identification of a small medium-grade hematite deposit in the early 1990s by WMC Ltd [and subsequently Rio Tinto Exploration Ltd (RTE) and Dampier Mining Ltd]. WMC subsequently completed ground surveys over selected targets, principally in the search for base metals. A number of targets were selected for test drilling leading to the identification of two hematite resources. Acacia Resources Ltd (1994–95) unsuccessfully followed up weak base metal anomalies, then RTE (1995-99) explored for magnetite and hematite



iron ore. RTE undertook a detailed magnetic and gravity survey over part of the area, drilled one diamond drill hole and re-evaluated the Wilgerup magnetite and hematite resources.

Based on the relatively low amplitude of the magnetic anomaly and the low tenor of the results from the diamond cored hole, no further exploration for magnetite was undertaken by RTE.

Centrex Metals Ltd was incorporated on 23 March 2001 to explore for iron ore on the Eyre Peninsula. Subsequent work by Centrex and South Australian Iron Ore Group (SAIOG) focused on reviewing all data and re-interpreting gravity-magnetic data over the area to define strategic exploration and development models and targets.

Wilgerup became the main exploration target for Centrex in 2006, with exploration and resource definition drilling commencing in September to enable the calculation of an Indicated Resource (JORC standard). The results of the exploration drilling and the continued demand for iron ore products led to a pre-feasibility study of potential port options to determine the viability of transport and shipment of the ore. The pre-feasibility study of potential port options identified Port Lincoln Wharf as the preferred port location.

Centrex has submitted an application for a total of four (4) Mineral Claims over the project area. These claims were granted on 16 April 2008 and include Mineral Claim numbers 3947-3950.

1.3. Summary of the Land and Environment Description

Local Community

The area surrounding the proposed mine site is sparsely populated. The closest towns are Lock (21 km north west), Cleve (55 km east) and Cummins (60 km south). Lock is one of two main townships in the District Council of Elliston. Cummins is located in the District Council of Lower Eyre Peninsula and Cleve is located in the District Council of Cleve.

Section 4.1 provides a summary of demographics and socio-economic factors.

The emergency services within the region are all located in the residential centres. The Lock Community Health and Welfare Centre is the nearest emergency medical service to the proposed mine site. Elliston, Lock, Cleve, Cowell and Cummins each have police stations within the townships. Lock has the nearest emergency services to the project area.

The key industry and area of employment in the area surrounding the proposed mine site is primary industry, including wheat, barley, wool and livestock.



Land Use and Surrounding Area

The current land use within the proposed ML area is dryland farming, including mixed cereal crops and sheep. Dryland farming is also the main land use in the surrounding area to the north and west of the site. Hincks Wilderness Protection Area is located to the south east of the proposed mine site. The closest boundary of the Wilderness Protection Area is approximately 4.5 km from the southern boundary of the proposed ML area.

Proximity to Housing and Infrastructure

Housing: There are eight (8) known residential homes on farming properties within 5 km of the mine site. The nearest main township is Lock, which is located approximately 21 km north west of the project area.

Water Supply: Current water supply infrastructure within the project area consists of an SA Water main along the Murlong - Murdinga Road, rainwater harvesting and storage from house and farm building roofs and a limited number of groundwater bores.

Road: The site is approximately 200 km by road from Whyalla and 146 km by road from Port Lincoln. A network of minor unsealed roads services the farmers and local community.

Rail: The Thevenard-Port Lincoln narrow gauge rail network is located 18 km west of the project area.

Airports: The project area is located between two commercial airports serviced by Regional Express. The closest is located at Port Lincoln to the south, and the next closest is at Whyalla to the north-east of the project area.

Ports: The preferred port option for the project is Port Lincoln Wharf. The Port Lincoln port facility has an existing ship loading facility for loading cereal grains and the wharf is also used for the unloading of fertilizer. The Port is owned and operated by Flinders Ports. ABB Grain Limited owns their facilities at the site.

Amenity

The project area is not located within an area regarded as being of scenic or aesthetic value. The immediate area in which the mine is proposed is predominantly characterised by dryland farming land. The project area has sparse clumps of degraded mallee (including *Eucalyptus incrassata* / *Melaleuca uncinata* association, *E. socialis* and *E. gracilis*) scattered around the area. Large areas of vegetation have been cleared for cropping and livestock grazing.



Air Quality and Noise

In general, the existing air quality in the project area is expected to be good due to the rural location with very low levels of road traffic, and no industrial activity. Cereal crop farming represents the only significant potential source of elevated particulate matter and dust levels.

No significant permanent man-made noise sources are located near the project area. Attenuated noise measurements taken in the vicinity of the project area indicate that background noise levels in the project area are typical of a rural environment.

Topography and Landscape

The proposed mine site comprises sandy clay flats interspersed with sand dunal ranges which run in a north-west to south-east direction. The topography of the area has a gently undulating slope and is located approximately 100 m above sea level. Tooligie Hill, a granitic gneiss outcrop to the south west of the project area, is the most significant geographical feature in the locality.

Climate

The project area is located in a semi-arid region, and is generally subject to hot dry summers and wet mild winters.

Hydrology

Assessment of the regional contour plans of the Lock area identified that the proposed mine site is not within a defined waterway. Possible overland flow paths from the ridge to the south west of the mine site are not confined to one particular flow path. The predominant sandy soil profile indicates that the majority of rainfall events would not result in runoff.

Groundwater

There are two primary groundwater aquifers in and around the Wilgerup iron ore deposit. The first is a thin (<1m) unconfined sand aquifer located at the base of the tertiary sand cover. The second is a Precambrian fractured bedrock aquifer centred on the ore deposit which is fully saturated with extractable water exhibiting salinity comparable to seawater.

Available information indicates there is limited groundwater use in the central Eyre Peninsula region. A small number of bores in the region west of Tooligie and Lock are known to access brackish water from the Tertiary formations for stock use. There are however, no registered or known bores currently being used for water supply purposes within 20 km of the Wilgerup deposit.

Based on its high salinity there is no recorded or likely use of groundwater from the bedrock aquifer.



Flora

The project area is located within a region of low ecological diversity and poor habitat value because of extensive historic clearing of native vegetation for cropping and grazing purposes and the associated impacts of these activities. The site itself has been mostly cleared of vegetation, but retains several patches of remnant native vegetation in the form of isolated stands of mallee.

A site survey was undertaken by Sinclair Knight Merz ecologists on 27 and 28 February 2008. The majority of the site comprised arable/pastoral fields of little or no habitat value. Weed species were found in high abundance within the arable/pastoral fields. This was particularly evident within the southern half of the proposed ML area.

Fauna

The site and general vicinity provide low to no habitat value for fauna because of the highly degraded nature of the region and intensive use of land for cropping and grazing activities. Bird species are likely to find some habitat in the small mallee patches but, given the lack of ground cover and the impacts from sheep grazing, it is generally unsuited to most mammal and reptiles species.

Geology and Soils

Shallow calcareous loamy sand was observed to dominate the site. This is typically less than 0.2 m deep over sheet limestone (calcrete). Strew limestone gravel and small rock is common on the soil surface. No distinct subsoil layer was observed, although accumulated organic matter and fine clays occur with increasing depth.

The ore body sub-crops and is buried beneath 20-25 m of unconsolidated sand and clay.

The Wilgerup deposit lies within the Gawler Block, a stable craton with crystalline basement rocks which range in age from 2700 million years to 900 million years. Stabilisation of the craton took place after the Kimban Orogeny at about 1450 million years. The Poldia Trough, a major structural and depositional feature, passes from east to west to the north of the ore body.

Cultural Heritage

There are no sites within the project area listed on the Register of Aboriginal Sites and Objects, which is maintained by the Department of Aboriginal Affairs and Reconciliation, or included in the Australian Heritage Places Inventory.

Proximity to Conservation Areas

The Hincks Conservation Park, a significant patch of remnant indigenous vegetation dominated by mallee assemblages, is located to the south east of the proposed mine site and is approximately 4.5 km from the southern edge of the proposed ML boundary.



1.4. Summary of Proposed Operations

The proposed operation at Wilgerup will consist of an open cut mine which will extract approximately 10.4 million tonnes of iron ore over a six year period. Ore will be processed through a crushing and screening plant at a rate of 1.6 million tonnes per annum to produce two saleable products “lump” and “fines”. These products shall be trucked from site to a purpose built rail siding at Tooligie, then transported by rail to Port Lincoln Wharf for export. No further exploration activities are planned in the proposed ML area at this stage.

Once mining commences the operation will employ around 78 people on site. Personnel will reside in or around the nearby towns of Cleve, Rudall or Lock and will commute to and from the mine by a company supplied bus or by personal transport.

In its final (mined out) profile, the proposed pit will be around 920 m long, 370 m wide (at the widest point) and 150 m deep. The overall disturbance footprint of the mine (approximately 1.050 km²) includes the open pit, waste rock dump, crushing facilities, access and haul roads, administration buildings, maintenance workshops and storage areas, water disposal dams and explosives storage.

The key characteristics of the project are summarised in Table 1-1.

■ **Table 1-1 Key characteristics of the project**

Item	Description
Project location	106 km north-north west of Port Lincoln, South Australia
Exploration Lease	3317
Proposed Mining Lease Area	9.2 km ²
Project footprint (disturbed area)	1.050 km ²
Mining method	Open cut
Processing method	Crushing and screening
Mining inventory	13.2 Mt Indicated (10.4 Mt massive hematite and 2.8 Mt hematite carbonate/clays inferred 1.1 Mt)
Open pit dimensions (final pit shell)	150 m deep, 920 m long and 370 m wide
Mine life	Six years
Mining rate	1.6 Mt/a of ore
Operating hours	Continuous operation, 24 hours per day, 7 days per week. Blasting limited to daylight hours.
Power source	On site generators
Raw water source	Rain water supplemented by groundwater (primarily from mine dewatering with an off-site bore field being investigated to provide security of supply). Small reverse osmosis plant on site.
Accommodation	No accommodation within the project area
Employees	78 on site. 120-150 including rail and road transport.



1.5. Key Environmental Impact and Management Strategies

The key environmental impacts and proposed management strategies for the Wilgerup Iron Ore proposal are summarised in Table 1-2, and are based on residual risks levels of moderate or above.



■ **Table 1-2 Key Environmental Impacts and proposed management strategies**

ID	Aspect	Impact	Primary Risk Assessment			Design Control Measures	Operational Management Measures	Primary Risk Assessment		
			Likelihood	Consequences	Risk			Likelihood	Consequences	Risk
Flora and Fauna										
W_001	Clearing of vegetation for site establishment and operations	Adverse impacts on threatened species/communities	Likely	Insignificant	Moderate	Minimise clearance through careful placement of mine infrastructure and associated requirements.	Regeneration and rehabilitation in accordance with NVMP and Mine Closure and Rehabilitation Plan. SEB offset to be established as part of the project.	Likely	Insignificant	Moderate
W_002	Clearing of vegetation for site establishment and operations	Reduced habitat for fauna	Likely	Minor	High	As for W_001	As for W_001	Likely	Insignificant	Moderate
Altered Land Use										
W_004	Altered land use due to mine development and operation.	Decrease in available area for agricultural use and reduced supply of agricultural products.	Almost certain	Insignificant	High	Following closure of the mine, return as much land as practicable to productive agricultural use	Maintain land productivity through soil, erosion and sediment management plan, weed management program, water quality management and chemical and fuel management procedures. Develop and implement mine closure plan. Develop and implement emergency response plan.	Likely	Insignificant	Moderate
Alteration to Landscape										
W_017	Alteration to landscape during to construction, operation and rehabilitation of the mine	Changed landscape and reduced visual amenity of the project area	Almost certain	Moderate	Extreme	Consideration given to mine infrastructure placement during design; design of waste rock dump to incorporate elements that assists with progressive rehabilitation; design of vegetation program to screen waste rock dump; and pit from closest roads, dwellings and Tooligie Hill.	As for W_001	Possible	Minor	Moderate
Cultural and European Heritage										
W_018	Interaction with Aboriginal sites due to mine establishment and operation	Disturbance to sites of artefacts with cultural or heritage value	Possible	Major	Extreme	Potential relocation of mine infrastructure if items of cultural/heritage value are identified.	Develop a protocol with the Barngarla people for the discovery of Aboriginal sites/relics and implement these procedures in the event a discovery is made. Protocol to address statutory requirements. Include procedure in mine operational plan and induction.	Unlikely	Moderate	Moderate
W_019	Interaction with European Heritage sites due to mine establishment and operation	Disturbance to sites with artefacts of cultural or heritage value	Unlikely	Moderate	Moderate	As for W_018	Develop a protocol for the discovery of non-indigenous cultural and heritage sites and implement these procedures in the event a discovery is made. Include procedure in mine operational plan and induction.	Rare	Moderate	Moderate



ID	Aspect	Impact	Primary Risk Assessment			Design Control Measures	Operational Management Measures	Primary Risk Assessment		
			Likelihood	Consequences	Risk			Likelihood	Consequences	Risk
Emissions to Air										
W_020	PARTICULATE MATTER (PM10) dust emissions (ore and overburden) due to initial earthworks activities, stockpiling, and mining operations, including use of explosives, wheel-generated dust.	Decrease in ambient air quality at neighbouring sensitive receptors due to PM10 impacts. Impact to human health, including potential respiratory problems.	Likely	Moderate	High	The amount of disturbed area will be minimised. Progressive rehabilitation will be undertaken to reduce the area available for wind erosion. All above-ground mine haul roads will be gravel/crushed rock sheeted. All mine in-pit haul roads will be sheeted with crushed rock. All main trucking haul roads from the mine gate to Tod Highway will be bitumen sealed; Road-train haul road from ore loading area to Roberts Road will be bitumen sealed.	As for W_001. Water spraying for dust suppression to control fugitive dust emissions from construction, wheel generated dust and active stockpiles. Dust suppression by water sprays at dust-generating sources at ore crusher/screening. Limit vehicle speeds on site to < 50 km/hr. All road-train loads will be covered. Environmental awareness training for staff. Pre-construction Baseline PM10 Monitoring Plan. Ongoing monitoring.	Unlikely	Moderate	Moderate
W_022	DUST DEPOSITION of total suspended particulate (TSP) IRON ORE dust emissions due to wind-generated dust off ore stockpiles, crushing/screening ore, and ore handling.	Contamination of surrounding cereal crops.	Possible	Major	Extreme	As for W_020	As for W_020. Pre-construction dust monitoring comprising of dust deposition gauges at selected sensitive receivers and at Mine Lease Boundary; Ongoing Monitoring.	Unlikely	Major	High
W_023	Combustion emissions associated with gen sets, on-site machinery, road-trains and on-site vehicles.	Decrease in air quality at sensitive receivers due to combustion emissions.	Unlikely	Moderate	Moderate	Emissions can be reduced by the installation of catalytic converters within diesel engines or the use of exhaust filtration devices. Fuel combustion facilities will be designed to meet Australian Standards.	All diesel engines, machinery and generators will be checked annually for compliance with the appropriate manufacturer's exhaust guarantee. Non-complaint engines and machinery would be repaired or replaced, as appropriate. Number of employee vehicles will be limited on site and use of a company supplied bus encouraged.	Rare	Moderate	Moderate
W_026	Combustion emissions associated with gen sets, on-site machinery, road-trains and on-site vehicles. Includes increase in greenhouse emissions from transport corridor.	Increase in greenhouse gas emissions.	Almost certain	Minor	High	As for W_023	As for W_023	Almost certain	Insignificant	High



ID	Aspect	Impact	Primary Risk Assessment			Design Control Measures	Operational Management Measures	Primary Risk Assessment		
			Likelihood	Consequences	Risk			Likelihood	Consequences	Risk
Noise and Vibration Emissions										
W_028	Noise and vibration associated with mine establishment and operations	Disturbance to residents due to noise and vibration	Likely	Moderate	High	Strategically placed earth mound barriers to be built around the noise sources located on the perimeter of the pit	Monitoring of noise and vibration impacts by complaints register. Standard noise abatement devices on machinery. Regular servicing of machinery and equipment. Design and execution of blasting activities by suitably qualified personLimits on blasting timesCompliance with ground vibration overpressure limits	Likely	Minor	Moderate
Groundwater Interaction										
W_034	Interaction with groundwater due to mine dewatering operations or ongoing groundwater abstraction	Degradation of Musgrave PWA groundwater resources, with subsequent negative impact on human and ecological values.	Unlikely	Moderate	Moderate	No specific design control measure identified.	Monitoring of groundwater levels in exploration drillholes and custom built monitoring wells installed around the Wilgerup site during mine feasibility studies. Identification and monitoring of existing water bores located between Wilgerup and the Musgrave PWA to provide confirmation that the significant groundwater drawdown linked to the mining operations is localised around Wilgerup.	Rare	Moderate	Moderate
Fire										
W_037	Fire - Uncontrolled	Death/injury and significant economic loss	Unlikely	Catastrophic	Extreme	Appropriate fire breaks will be established around all site equipment. Compliance with AS 5062-2006: Fire protection of mobile and transportable equipment.	Liaison with CFS and local emergency services. Provision of emergency services on site. Develop and implement emergency response procedures.	Rare	Catastrophic	High
W_038	Fire - Uncontrolled	Pressure on local CFS and emergency services	Unlikely	Moderate	Moderate	No specific design control measure identified.	As for W_037	Rare	Moderate	Moderate
Traffic Movements										
W_049	Road construction - widening	Loss of native vegetation	Likely	Minor	High	Road alignment/design to minimise clearance of native vegetation.	Approval for clearance to be obtained as part of approvals process and appropriate SEB developed.	Likely	Minor	High
W_052	Altered traffic conditions - Increased heavy vehicle movements during mine construction	Deterioration of road pavements	Possible	Moderate	High	Upgrading of unsealed roads and of pavements already showing indications of deterioration.	Negotiate maintenance requirements with DTEI/local council	Possible	Minor	Moderate
W_054	Altered traffic conditions - Ore transport	Amenity impacts associated with noise	Likely	Moderate	High	No specific design control measure identified.	Ongoing consultation with affected landholders during approvals process to identify and mitigate impacts. Develop and implement traffic management plans where necessary.	Possible	Minor	Moderate
W_057	Altered traffic conditions - Increased heavy vehicle movements during mine operation	Deterioration of road pavements	Likely	Moderate	High	As for W_052	As for W_052	Possible	Minor	Moderate



1.6. Proposed Post Mine Land Use

At the conclusion of mining operations, as much of the project area as practicable will be returned to productive agricultural use. Infrastructure that is useful for this purpose will be retained on site, while infrastructure of no use for agriculture will be dismantled and removed.

In accordance with the Mine Closure Plan for the project area (see Section 9) areas not amenable to agricultural use will be vegetated and made safe.

Residual impacts of the mine, following completion of the site rehabilitation works, will include:

- The area underneath the waste rock dump and around the pit void will be unavailable for agricultural use.
- The rehabilitated waste rock dump will result in the visual impact of a low (maximum 50 m high) hill on the otherwise gently undulating topography.
- The flooded pit void will be screened from surface viewing initially by an abandonment bund and later by vegetation as this becomes established. It will be secured against inadvertent public access.

1.7. Mine Closure and Rehabilitation Strategies

The general approach to rehabilitating the mine site will include:

- Minimising the operations footprint and keeping the disturbed areas to the absolute minimum required to conduct the operation in a safe and efficient manner.
- For those areas which are to be disturbed, the topsoil and subsoil layers will be separately removed and stockpiled for placement back onto the disturbed areas at the end of mine life.
- Progressively rehabilitating disturbed areas during the mine life when they are no longer required. This is particularly relevant to the waste rock dump, which will have each lift rehabilitated when dumping is finished on the immediately overlying lift.
- Monitoring the site for as long as required following mine closure and completion of the rehabilitation works to demonstrate that the closure and rehabilitation objectives have been met. Further rehabilitation works may be required during this time if it is found that the initial rehabilitation works have not met the stated objectives.

1.8. Purpose of this Document

This document provides the supporting data and information for the Application of a Mining Lease for the Wilgerup Iron Ore mine and primary infrastructure, and is equivalent to a draft version of the Mining and Rehabilitation Program (MARF). It provides the regulatory authority, Department of Primary Industries and Resources South Australia (PIRSA), with a detailed description of the



environmental, social and economic risks and benefits of the proposed operation, the control and management measures to be implemented throughout the operation's life-cycle and the outcomes to be achieved by the operation.

This document has been prepared in accordance with PIRSA's Regulatory Guideline No. 2, *Preparation of a Mining Lease Proposal or Mining and Rehabilitation Program (MARF)* (Revision 4.8, June 2007) to:

- Provide an appropriately comprehensive and detailed description of the existing social, economic, cultural and natural environment and the proposed operation.
- Identify the social, economic and environmental risks associated with the operation.
- Establish a set of environmental objectives based on the risk assessment, for construction, operation, progressive rehabilitation and closure of the mine.
- Develop measurement criteria for the environmental objectives.
- Develop environmental management plans to meet and measure environmental objectives.

The information contained in this document is intended to enable stakeholders and PIRSA to make an informed, risk based and balanced assessment of the proposed operation. This document will also provide an information and management tool for the operators of the mine.

Following the assessment of this document by PIRSA and other key government stakeholders and the granting of the Mining Lease, this report will be updated to a MARF for further assessment and approval by PIRSA to enable the project to commence. A number of aspects that are discussed in general terms in this lease application will be addressed in more detail in the MARF.



2. Proposal Details

2.1. Overview

Centrex is proposing the development of the Wilgerup Iron Ore Mine. The proposed ML area, comprising 9.2 km², is situated within Centrex's EL 3317 Wilgerup tenement. Centrex has been granted four (4) Mineral Claims (MC 3947-3950) over this area.

2.2. Location of the Proposed Operation

The project area is located on the central Eyre Peninsula, approximately 106 km north-north west of Port Lincoln (146 km via road), 21 km south east of Lock (Figure 2-1) and 290 km north west of Adelaide.

2.3. Exploration Licenses and Land Tenure

2.3.1. Land Ownership

The project area, access and haulage roads are situated within sections 38, 42 and 43 Hundred of Tooligie, as shown on Figure 2-2. The project area is situated within freehold land defined by two certificates of title. The Mineral Claim boundaries (and proposed ML area) were selected to provide sufficient buffer distances to contain fly rock associated with the operations. As part of the proposed development, Centrex has a signed purchase agreement with the owners of the Kamballa property, which will contain the disturbed footprint of the proposed operations. The agreed settlement date is 18 December 2008. Centrex intends to develop share-farming arrangements with a local farm operator, for ongoing cultivation and management of the land.

Details of land ownership records are provided in Table 2-1 and copies of the certificates of title are provided in Appendix B.

■ **Table 2-1 Land Tenure Details**

Project Area / Infrastructure	Mineral Claim	Certificate of Title	Owner
Mine Pit and Waste Rock Dump	MC3947-MC3949	Vol 5942 Folio 583	Kamballa Pty Ltd
Light Vehicle Access and Mine Administration	MC3947	Vol 5942 Folio 583	Kamballa Pty Ltd
Heavy Vehicle Access and Mine Crushing Plant	MC3947	Vol 5942 Folio 583	Kamballa Pty Ltd
Mine De-watering Dam and Topsoil Stockpile	MC3949-MC3950	Vol 5942 Folio 583	Kamballa Pty Ltd
Explosives Magazine	MC3949	Vol 5942 Folio 583	Kamballa Pty Ltd
Buffer zone for fly rock	MC3949-MC3950	Vol 5942 Folio 583	Kamballa Pty Ltd
		Volume 5616 Folio 47	Kingo Enterprises Pty Ltd



2.3.2. Native Title

The project area is subject to the Barngarla Native Title Claim, registered on 4 April 1996. As of the date of this submission, no determinations of Native Title have been made. Further, all parcels of land within the project area are freehold title. Freehold ownership of land extinguishes native title by the enactment of the *Native Title (South Australia) (Validation and Confirmation) Amendment Act 2000*.

2.4. Proponent Details

The proponent of the project is Centrex, a specialist mineral explorer listed on the Australian Stock Exchange (code CXM). The company has extensive tenement holdings over iron ore resources and exploration targets on the Eyre Peninsula and in the southern Gawler Craton adjacent to existing rail/port facilities.

Contact details for Centrex are provided in Table 2-2.

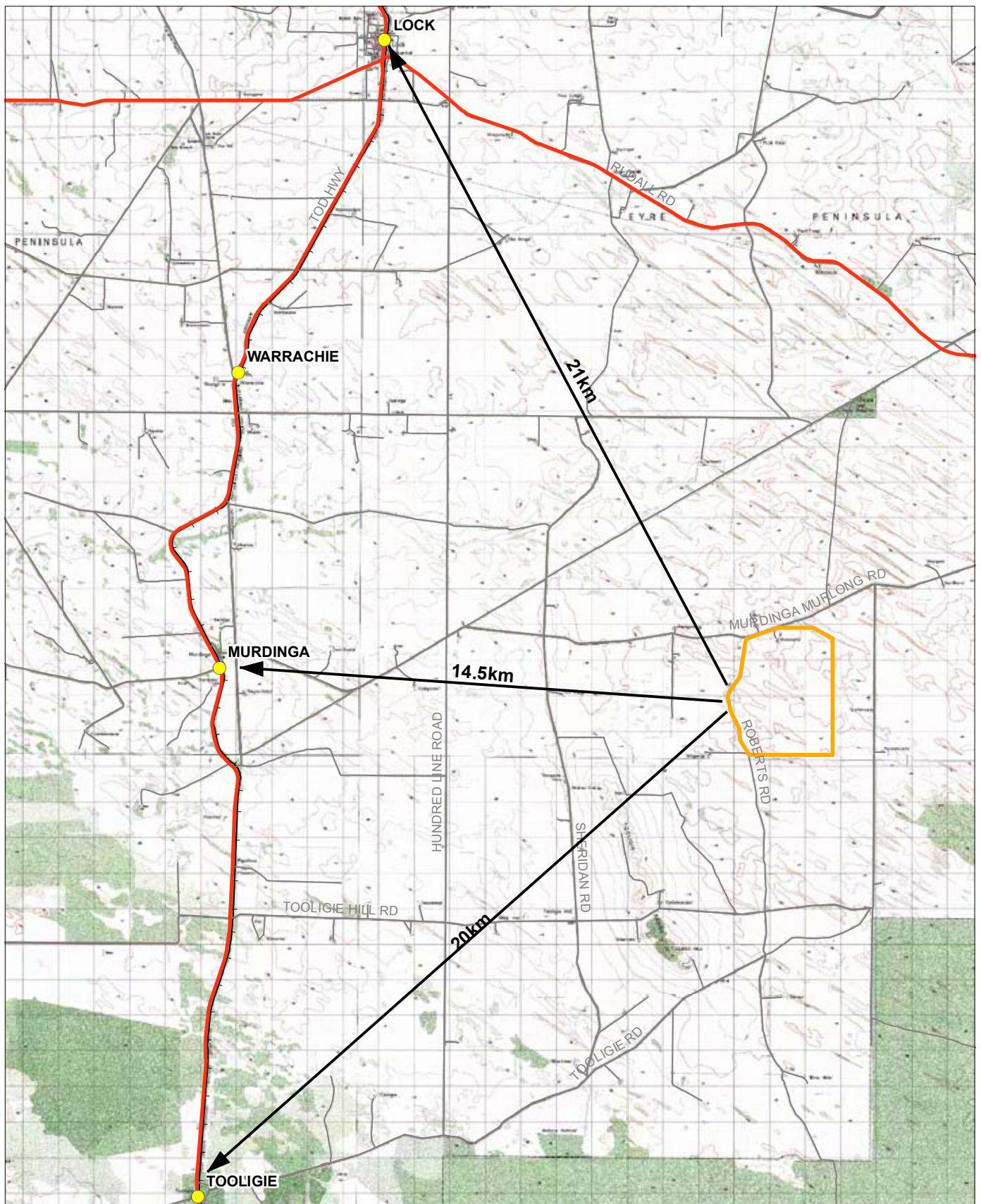
■ **Table 2-2 Centrex Contact Details**

Mine Owner/Operator:	Centrex Metals Limited
Contact Person:	Mr Gerard Anderson, Managing Director
Address:	L3/100 Pirie Street, Adelaide SA 5000
Contact Numbers:	T: 08 8232 0400 M: 0404 672 393 F: 08 8232 0500
Email	ganderson@centrexmetals.com.au

2.5. Local Government

The proposed ML area is located within the District Council (DC) of Elliston. The project area is zoned Primary Industry in the DC of Elliston Development Plan (Consolidated 7 December 2006).

The DC of Cleve administers the township of Lock to the north west of the project area. As the closest community to the proposed mine site, the Council is a stakeholder with interest in the project.



Legend

- Locality
- Main highway
- Proposed mining lease area

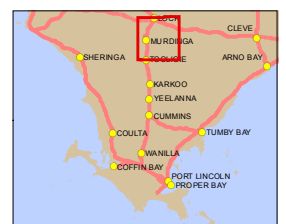
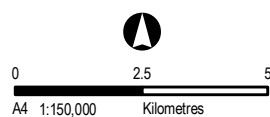
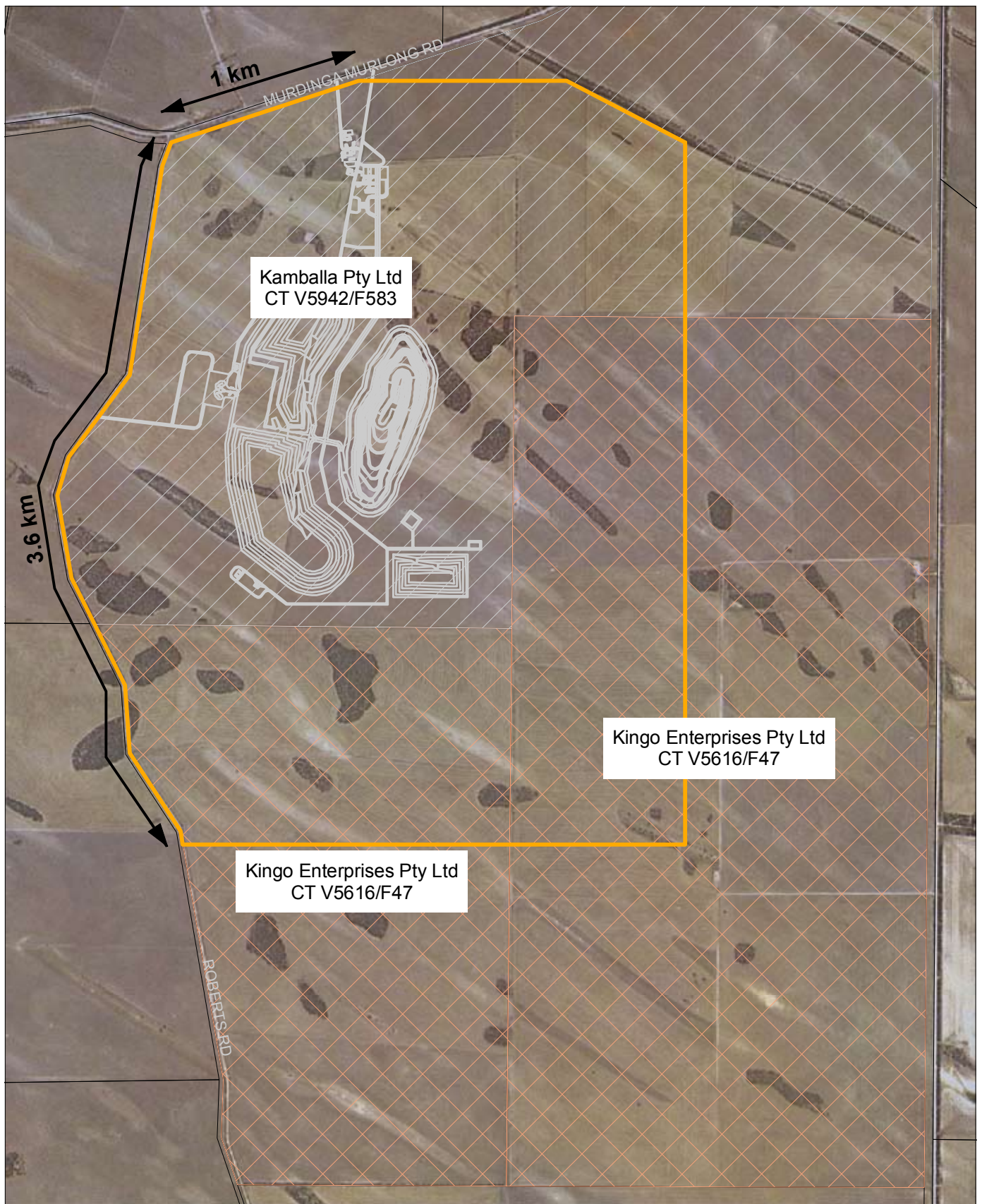


Figure 2-1 Location of proposed mine and proximity to nearest town



Legend

- Proposed mining lease area
- Freehold land
- Kamballa Pty Ltd
- Kingo Enterprises Pty Ltd
- Cadastre

Data Sources
Aerial imagery supplied by DEH 2004

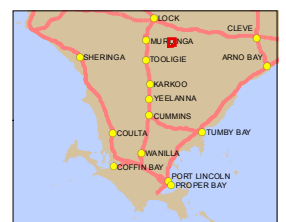
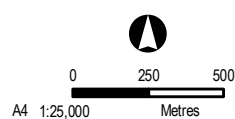


Figure 2-2 Land Tenure

GDA 1994 MGA Zone 53



2.6. Project Alternatives

Centrex has investigated various alternatives for infrastructure and shipment as discussed below. Approvals for development of the preferred port and transport options are outside the scope of this ML proposal and therefore have not been addressed in this document. Centrex is pursuing additional project approvals as described in Section 2.6.4.

2.6.1. Port Options

The iron ore mined at Wilgerup will be exported to international customers. A port selection study was undertaken to assess and compare the feasibility of several potential sites. The considered port options included:

- Proper Bay, Port Lincoln (disused port facility)
- OneSteel owned port facilities, Whyalla (existing operational port)
- New Port facility: Port Bonython (proposed port) or Sheep Hill (undeveloped).
- Port Lincoln Wharf, Port Lincoln (existing operational port)

The port investigation process has included a range of engineering investigations, environmental assessments and stakeholder engagement activities. A summary of activities undertaken for each port option is provided below.

Proper Bay

The following investigations have been undertaken:

- Full engineering evaluation completed on existing wharf infrastructure
- Full engineering conceptual design completed for all site infrastructure
- Marine ecology investigation of wharf location
- Transport methodology options and viability study (road versus rail)
- Transport route assessment completed from mine to port
- Noise and air quality impact assessments completed and impact mitigation strategies identified
- Native vegetation clearance impact assessment completed
- Site water evaluation including rainfall collection and run-off modelling
- Greenhouse gas study
- Road design layout and costing study
- Osprey impact assessment
- Feasibility quotes received for engineering design and construction contract
- Transshipment mooring location selection and evaluation completed including marine investigations



- Completion of Crown Development Application.

Stakeholder engagement has included the following key activities and outcomes:

- Recommended as preferred site by Port Lincoln City Council
- Lease agreement negotiated for 5 x 20 year options to lease port land from land owner
- Commercial terms for transshipping contract finalised.

Whyalla – Onesteel Southern wharf

The following investigations have been undertaken:

- Preliminary engineering concept designs
- Transport route assessment completed from mine to port
- Preliminary design of town bypass road and discussions held with Whyalla City Council.

Stakeholder engagement has included the following key activities and outcomes:

- Heads of Agreement signed with Onesteel for use of port land
- Commercial terms negotiated and agreed with Onesteel
- Negotiations on commercial terms with CSL for use of trans-shipment barges
- Negotiations with Whyalla City Council completed

Onesteel withdrew from the Heads of Agreement citing that a review of operations was being conducted. All investigations regarding the Whyalla site subsequently ceased. Centrex re-established contact with Onesteel in August 2008 with the same response received. Access to the port is not viable.

Port Bonython

Centrex is a foundation member of Port Bonython users group. Evaluation of the design and construction schedule for the Port Bonython development is considered not acceptable to Centrex.

Lipson Cove (Sheep Hill)

The following investigations have been undertaken:

- Complete bathymetric survey of coastal marine environment from Port Neill to Lipson cove
- Transport route assessment completed for road access to site
- Commenced plans for Native Title clearance of coastal strip
- Commenced plans for environmental clearances

Stakeholder engagement has included the following key activities and outcomes:



- Discussions held with multiple land owners for purchase of suitable land
- Purchase contract completed and signed for suitable land for port location
- Commenced discussions with adjacent landowner regarding land for the transport corridor
- Discussion held with DC of Tumby Bay
- Presentation to Tumby Bay business group
- Discussion held with Genessee & Wyoming to determine rail access to port site.

Port Lincoln Wharf – Preferred Option

The following investigations have been undertaken:

- Initial engineering study to evaluate the suitability of Port Lincoln Wharf
- Noise and air quality impact assessments
- Greenhouse gas study.

Stakeholder engagement has included the following key activities and outcomes:

- Commercial terms for use of ABB infrastructure discussed
- Commercial terms for ABB management and operation of Centrex load-out facilities discussed
- Negotiations with Genessee & Wyoming commenced and commercial terms received
- Port Lincoln City Council did not initially support the proposal, recommending Proper Bay as an alternative. However, several councillors are in favour of using Port Lincoln Wharf following a visit to review iron ore export operations at Esperance, WA.

After evaluating each option with regard to access, anticipated approval and development timeframes, transport options and routes and potential impacts and mitigation options, Port Lincoln Wharf was selected as the preferred option. The Port Lincoln Wharf development is proposed as a short-term option to service the needs of the Wilgerup Iron Ore Mine. To meet the company's long term exporting needs on the Eyre Peninsula, Centrex will pursue development of a new port facility.

As approval for access to the port is not covered in the MLP approval process, the investigations and justification for selection has not been addressed in detail in this document.

Centrex will continue to consult with stakeholders to ensure the most suitable option is selected.

2.6.2. Transport Options

Transport options considered as part of the feasibility investigations for the project include:



- 1) Rail direct from Wilgerup Mine to Port Lincoln Wharf (requiring construction of a rail spur and development of a rail siding on the mine site).
- 2) Rail direct from Wilgerup Mine to Proper Bay, Port Lincoln (requiring construction of a rail spur and development of a rail siding on the mine site and development of a rail loop to Proper Bay to link into the existing Coffin Bay rail line).
- 3) Road transport from Wilgerup Mine to Tooligie siding, then rail to Port Lincoln Wharf (requiring upgrading of the road network in the vicinity of the proposed mine site and development of an appropriate site for a rail siding at Tooligie).
- 4) Road transport from Wilgerup Mine to Tooligie siding, then rail to Proper Bay, Port Lincoln (requiring upgrading of the road network in the vicinity of the proposed mine site, development of an appropriate site for a rail siding at Tooligie and development of a rail loop to Proper Bay to link into the existing Coffin Bay rail line).
- 5) Road direct from Wilgerup Mine to Proper Bay, Port Lincoln (requiring upgrading of the road network in the vicinity of the proposed mine site and Proper Bay).
- 6) Road to 5 Mile Siding then via train to Port Lincoln Wharf (requiring upgrading of the road network in the vicinity of the proposed mine site and development of stockpile facilities at rail siding site)
- 7) Road direct from Wilgerup Mine to Whyalla (requiring upgrading of the road network in the vicinity of the proposed mine site and possible bypass road into Whyalla).

The transport options study, in conjunction with the port selection study identified option 3 (road transport to Tooligie siding and then rail direct to Port Lincoln Wharf) as the preferred transport option.

2.6.3. Preferred Transport Option

A rail siding adjacent to Tooligie rail siding is proposed. The rail siding will be approximately 500 m off the main Tod highway. The siding will be approximately 850 m long with dual lines to accommodate the locomotives travelling from one end of the train to the other (called a “run-around”) to pull the loaded train back to Port Lincoln.

The exact location of the proposed rail siding will be subject to negotiations and agreement with local landholders.

The rail siding stockpiles will be open stockpiles consisting of one lump and one fines stockpile. Each stockpile will be a maximum of 80,000 tonnes capacity. Stockpiles and roads shall be watered using an onsite watering truck to control dust.



The ore will be delivered by side tipping road trains direct from Wilgerup mine to the siding. As the road trains travel along the side of the stockpile, they will tip each trailer and drive along depositing the material in small windrows. A front end loader (FEL) will then be used to push this material up into larger stockpiles (windrows) as long as the train (approximately 700 m long). Two FELs will be used to load the product (fines or lump) onto the train. The loading cycle takes approximately 80 – 90 minutes per train.

The FELs will be equipped with load sensors to determine how much is loaded into each rail wagon to prevent overloading. At the completion of loading each wagon, the loaded weight is recorded on a paper printout, in addition to a printout of the total train loaded weight (for safety, insurance and reconciliation purposes).

There will be a small office, lunch and ablution facility at the rail siding for use by the loader operators and train operators. A 5,000 litre fuel storage unit shall also be located at the rail siding for the FELs to refuel.

There are no sensitive receptors in the vicinity of the proposed rail siding, and so noise is not considered an issue.

2.6.4. Additional Project Approvals

Port infrastructure is outside the scope of this ML proposal and will be assessed separately under the *Development Act 1993*. A development application for the port facilities is currently being prepared for submission to the Development Assessment Commission (DAC).

As for the port infrastructure, the ore transport options are outside the scope of the mining proposal assessment. Development approval for the proposed rail siding will also be applied for under the *Development Act 1993*.



3. Legislative Requirements

All activities associated with the proposed operations must comply with the relevant legislation and associated regulations. Centrex's environmental responsibilities pertaining to the proposed mine site are described in the following summaries of relevant legislation.

3.1. South Australian Legislation

3.1.1. Mining Act 1971

Approval for the Wilgerup Iron Ore Mining proposal will be sought under the *Mining Act 1971* as this is the guiding piece of legislation for mining in South Australia. Under this legislation, the proponent must obtain a mining lease (ML) to proceed with a mining operation. To obtain a ML, the proponent must demonstrate that the mining operation will be done in an orderly and skilful manner and in accordance with the Mining and Rehabilitation Program (MARP). An appropriate bond must also be in place.

Supporting documentation is required to be submitted to PIRSA with the ML application to provide a comprehensive and detailed description of the existing cultural, social, economic and natural environment and the proposed operation so that key stakeholders (including PIRSA) may make an informed assessment about the risks and benefits associated with the proposed operation. As noted in Section 1.8, this report forms the supporting documentation for the Mining Lease application (PIRSA Form 10) for the Wilgerup iron ore project. Following the assessment of this document by PIRSA and other key government stakeholders and the granting of the Mining Lease, this report will be updated to a MARP for further assessment and approval by PIRSA to enable the project to commence.

The final MARP will become the key operational document for environmental management at the mine site. A stamped, numbered copy of the MARP must be kept on site at all times. It is PIRSA policy that MARPs will generally be required to be reviewed and updated at least every seven years. PIRSA may request an earlier review if compliance inspections have proven the MARP to be inadequate to address the environmental risks associated with the operation, if there has been a change in the operator or lease owner or if there has been a change of community/stakeholder expectations in regard to the operation.

Construction of infrastructure associated with a mining development (but outside of the ML area) requires the application for Miscellaneous Purposes Licences (MPLs). Under Part 8 of the Mining Act, MPLs may be used for ancillary purposes such as:

- The carrying on of any activity required to achieve economic and practical mining activities on a Mining Lease.



- Water supply to the mine or drainage from the mine.
- Electricity supply for the mining operation
- Ore transport (haul roads, railway etc).

The project may require MPLs for the extended and supplementary well-fields which are outside of the ML area. If required, these will be applied for as soon as all investigation information has been finalised.

3.1.2. Natural Resources Management Act

The abstraction and use of groundwater and the diversion of any watercourses for the Wilgerup iron ore project will be governed by the *Natural Resources Management Act 2004* (NRM Act), which promotes sustainable and integrated management of the State's natural resources and provides for their protection. The Act repeals the *Animal and Plant Control (Agricultural Protection and Other Purposes) Act 1986*, *Soil Conservation and Land Care Act 1989* and *Water Resources Act 1997* and is administered by the Department of Water, Land and Biodiversity Conservation (DWLBC).

Groundwater in the vicinity of the project site is not a prescribed resource. The Musgrave Prescribed Wells Area is located to the west of the project area. There are no creeks or surface water features within the project area.

DWLBC will be consulted during the assessment of this Mining Lease application.

3.1.3. Environmental Protection Act 1993 (SA)

The *Environment Protection Act 1993* provides for the protection of the environment and defines the Environment Protection Authority's (EPA's) functions and powers. The Act promotes ecologically sustainable development and the use of the precautionary principle to minimise environmental harm. It requires polluters to bear an appropriate share of the costs and responsibilities of protecting the environment from their activities.

The Act applies to mining operations. Section 25 of the Act imposes a duty on all persons to take all reasonable and practicable measures to prevent or minimise environmental harm.

The EPA issues guidelines on what are considered reasonable and practicable measures to avoid environmental harm; those relevant to mining include, but are not limited to, the following:

- Noise
- Air pollution impact assessment using design ground level pollutant concentrations
- Bunding and spill management



- Landfill environment management plans
- Odour assessment using odour source modelling
- Wastewater and evaporation lagoon construction.

There are a number of environment protection policies relevant to mining operations and mineral processing. These include, but are not limited to, the following:

- Environment Protection (Air Quality) Policy 1994
- Environment Protection (Noise) 2007
- Environment Protection (Water Quality) Policy 2003.

If the proposed mining operation involves prescribed activities of environmental significance (as listed in Schedule 1 of the Act, e.g. mineral processing), an authorisation in the form of a works approval is required from the EPA and a licence must be obtained before these activities commence. The licence sets mandatory conditions of operation to prescribed activities of environmental significance. The process for obtaining EPA Works Approval involves submitting an Authorisation (Works Approval) Application under Section 38(1) of the Act, with supporting technical documentation. The Licence is then applied for with a New Licence Application.

The EPA has advised that they will accept the MARP as the supporting document to apply for these approvals. The EPA will be consulted before preparing the proposal document or MARP to ensure sufficient detail is provided in these documents to meet all applicable requirements.

Crushing of iron ore on the mine site, as proposed, is unlikely to require an authorisation as this type of activity on a mining lease area under the *Mining Act 1971* does not require an environmental authorisation under the *Environment Protection Act 1993*.

Approvals for prescribed activities under the *Environment Protection Act* are in the form of a works approval and licence and are likely to be required for the following activities:

- Power generation using diesel fuel: a prescribed activity as described in Schedule 1 (8)(2)(a) of the Act as 'fuel burning' at a rate exceeding 5 megawatts, equivalent to approximately 1.25MW electrical.
- Materials handling activities including bulk storage and shipping of iron ore at a wharf.

3.1.4. Development Act 1993 (SA)

Some large mining projects may be deemed to be of major environmental, social or economic impact, and may be required to be assessed under Section 46 of the *Development Act 1993*.



Under the *Development Act 1993*, an application for a mining lease may be referred to the Minister for Urban Development and Planning for advice. All proposals within those areas of the state listed in Schedule 20 of the *Development Regulations 1993* are required to be referred for advice. The area comprising the proposed Wilgerup ML is not within the areas listed in Schedule 20.

If the application is referred for advice to the Minister for Urban Development and Planning, the Extractive Industries (EI) Committee (sub-committee of the Development Assessment Commission) will prepare a report. The Minister will consider the EI Committee report and any associated reports and advise the Minister responsible for the *Mining Act 1971* whether the application should or should not be granted and, if so, what conditions should be included in the tenement in order to mitigate any potentially adverse effects on the environment that may result from the conduct of mining operations.

The Building Rules (as established by the *Development Act 1993*) apply to some aspects of building work that is undertaken on mining leases within the area of a council. These works include:

- Housing or other forms of shelter
- Office accommodation
- Work areas or other amenities which are not directly involved in the performance of operations carried on in pursuance of the *Mining Act 1971*.

For these buildings, building rules consent will be required before any work can take place. This will involve an application to the local council or to a private certifier.

Construction of port facilities will require approval under the *Development Act 1993*, which provides the legislative framework (along with the *Development Regulations 1993*), for the planning and construction of new developments, and is administered at both a local and state government level.

3.1.5. Native Vegetation Act 1991

The *Native Vegetation Act 1991* provides incentives and assistance to landholders in relation to the preservation and enhancement of native vegetation and controls the clearance of indigenous remnant vegetation. All vegetation clearance and pruning potentially required for the mine site would be subject to assessment against the requirements of the *Native Vegetation Act*, and would therefore result in a commensurate Significant Environmental Benefit (SEB) payment to offset the impacts.

PIRSA currently has delegation for the administration of the *Native Vegetation Act 1991*. The MARP must include a Native Vegetation Management Plan (NVMP). A framework for the NVMP



and initial consideration of SEB for the Wilgerup Iron Ore Project is included in Section 8.3.11. The finalised NVMP will be included in the MARP.

3.1.6. Aboriginal Heritage Act 1988 (SA)

The *Aboriginal Heritage Act 1988* (SA) provides for the protection and preservation of Aboriginal heritage, which includes all Aboriginal objects, remains and sites of spiritual, archaeological, anthropological and historical significance whether they are registered or not.

In particular, Section 23 of the Act states that a person must not damage, disturb or interfere with any Aboriginal site, object or remains, whether registered or not, without an authorisation from the Minister for Aboriginal Affairs and Reconciliation. Significant financial penalties apply for contravention of this provision.

An application can be made under Section 12 of the Act to determine whether an area of land is an Aboriginal site or an object is an Aboriginal object. An application under Section 23 may be required if authorisation from the Minister to damage, disturb or interfere with any Aboriginal site, object or remains is necessary.

3.2. Commonwealth Legislation

3.2.1. Environment Protection and Biodiversity Conservation (EPBC) Act 1999 (Commonwealth)

The EPBC Act 1999 protects Australia's nationally significant heritage places, RAMSAR wetlands, threatened species and communities, migratory species and marine areas.

Referral of a proposal to the Commonwealth Environment Minister for assessment is required for actions that are likely to have a significant impact on matters of national environmental significance. The EPBC Act identifies seven matters of national environmental significance:

- World Heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas and
- Nuclear actions (including uranium mining).

If the project is referred under the EPBC Act, the Commonwealth Department for the Environment and Heritage (DEH) will make a determination regarding the status of the proposal as Controlled



Action or Not a Controlled Action. If it is Not Controlled, no further Commonwealth approvals are necessary. If it is Controlled, approval under the EPBC Act will be required. This may be by deferral to the local State processes, or by the requirement of additional information to the satisfaction of the Commonwealth.

3.3. Other relevant legislation

The following Acts and associated regulations may also be relevant to components of the proposed project:

- *Occupational Health Safety and Welfare Act 1986* – all mine operators must comply with general provisions related to occupational health, safety and welfare and the Regulations related to mining work (Division 5.12).
- *Mines and Works Inspection Act 1920* – prescribes a range of requirements in relation to environmental and safety issues in operating mines.
- *Public and Environmental Health Act 1987* – for approval to install a sewage treatment system.
- *Native Title Act 1993 (Commonwealth)* and *Native Title (South Australia) Act 1994* – a mining lease cannot be granted until an agreement has been negotiated with the native titleholders or claimants. However, freehold ownership of land extinguishes native title by the enactment of the *Native Title (South Australia) (Validation and Confirmation) Amendment Act 2000*.
- *National Parks and Wildlife Act 1972* – specifies protected species of plants and animals. Disturbance to these species may require Centrex to seek a permit under this Act.



4. Description of the Environment

4.1. Local Community

4.1.1. Overview of local communities

The project area is located within the District Council of Elliston, which covers an area of about 6,500 km² on the west coast of the Eyre Peninsula. The two main townships in the DC of Elliston include Elliston and Lock, which is located approximately 21 km north west of the project area. The Council also includes a number of rural townships and localities including Port Kenny, Venus Bay, Tooligie and Murdinga¹. Murdinga is located approximately 14.5 km west of the project area, while Tooligie is located about 20 km to the south west.

The DC of Elliston is bordered by the DC of Lower Eyre Peninsula, the DC of LeHunte, the DC of Cleve, of which the DC of Lower Eyre Peninsula and the DC of Cleve are located closest to the project area. The DC of Lower Eyre Peninsula is located south west of the project area and covers an area of approximately 4,770 km². The Council has two major townships including Cummins, which is located approximately 60 kilometres south of the project area². The DC of Cleve is located east of the project area, and covers an area of approximately 4,800 km². The DC of Cleve includes the township of Cleve, located approximately 55 kilometres east of the project area³.

Port Lincoln is the largest regional centre for residents of the Lower Eyre Peninsula and Whyalla is the main service centre for residents of the upper and eastern Eyre Peninsula. Whyalla is located approximately 170 km north east of the proposed mine site and Port Lincoln is approximately 106 km to the south-south east.

The area surrounding the project location is sparsely populated, with seven known residential homes on farming properties within 5 km of the proposed ML area.

The below sections provide an overview of the local community in the vicinity of the project area. A more detailed description is provided in Appendix C.

4.1.2. Population

In 2007, the DC of Elliston had an estimated residential population of 1,170 people and the DC of Cleve had a residential population of 1,976 people. The population of each Council area has remained stable since 2002 (refer Table 4-1).

¹ www.elliston.sa.gov.au

² www.lowereyrepeninsula.sa.gov.au

³ www.cleve.sa.gov.au



■ **Table 4-1 Estimated Residential Population, 2002-2007**

Local Government Area	Estimated Residential Population at 30 June			Change		
	2002pr	2006pr	2007pr	2002-2007p(a)	2006-2007p	
	No.	No.	No.	%	No.	%
Elliston (DC)	1,164	1,175	1,170	0.1	-5	-0.4
Cleve (DC)	1,929	1,988	1,976	0.5	-12	-0.6
Lower Eyre Peninsula (DC)	4,278	4,577	4,631	1.6	54	1.2
Lincoln SD	27,888	28,488	28,567	0.5	79	0.3
South Australia	1,521,119	1,568,204	1,584,513	0.8	16,309	1.0

Notes: p: provisional
a: average
SD: Statistical Division

Source: ABS Cat No. 3218.0, Regional Population Growth, Australia

4.1.3. Employment

Labour Force Participation

At the 2006 Census, Lock had a higher rate of labour force participation compared to SA, whereas Cleve and Cummins had a lower rate of labour force participation compared to SA. At the 2006 Census, people who were either employed or looking for work comprised 59% of people aged 15 years or over in Lock, 56% in Cleve and 55% in Cummins.

Lock had higher proportions of workers compared to Cleve and Cummins. At the 2006 Census, 59% of people aged 15 years or over in Lock were employed, compared to 55% in Cleve and 52% in Cummins. In Lock, 65% of employed persons were employed in full-time work and 31% were employed in part-time work.

In Cleve 40% of people aged 15 years or older were not in the labour force, while of the 55% employed persons 62% were employed in full-time work and 30% were employed in part-time work.

In Cummins 39% of people aged 15 years or older were not in the labour force, while of the 52% employed persons 60% of employed persons were employed in full-time work and 33% employed in part-time work.



■ **Table 4-2 Labour Force Participation, 2006**

	Employed		Not in the Labour Force		Labour Force Participation	
Locality	No.	%	No.	%	No.	%
Lock	72	59.0	40	32.8	72	59.0
Cleve	338	55.3	243	39.8	341	55.8
Cummins	296	51.7	225	39.3	316	55.2
South Australia	685,325	55.8	434,421	35.4	723,422	58.9

Note: Percentages are a calculation of all persons in area aged 15 years and over.

Source: ABS Cat No. 2001.0, Census of Population and Housing: Basic Community Profile, Cummins (L) (UCL 406200), Cleve (L) (UCL404800), Collection District 4021502 (Lock), 2006; ABS Cat No. 2003.0, Census of Population and Housing: Time Series Profile, South Australia (STE 4), 2006.

Unemployment

Table 4-3 shows the rate of unemployment for the District Councils of Elliston, Cleve and Lower Eyre Peninsula between December 2006 and December 2007.

At the December 2007 quarter, each of the District Council areas had lower rates of unemployment compared to South Australia as a whole. The DC of Cleve had the lowest rate of unemployment (0.7%) followed by the DC of Elliston (2.7%). Unemployment rates in each of the District Council areas have remained stable over the 12 months from December 2006.

■ **Table 4-3 Quarterly Unemployment Rate (%), December 2006-December 2007**

Locality	December 2006	March 2007	June 2007	September 2007	December 2007
Elliston (DC)	3.5	3.7	3.1	3.0	2.7
Cleve (DC)	0.8	0.7	0.6	0.7	0.7
Lower Eyre Peninsula (DC)	3.8	3.8	3.3	3.4	3.5
South Australia	5.1	5.1	5.0	5.0	5.0

Source: Department of Employment and Workplace Relations, Small Area Labour Markets Australia, Smoothed Series, December Quarter 2007

4.1.4. Education

Qualifications

At the 2006 Census, 14% of people in Lock aged 15 years or over that had completed non-school qualifications had completed a bachelor degree. A slightly higher proportion of people had completed a bachelor degree in Cleve (17.7%) while a lower proportion had completed this qualification in Cummins (11.3%).



■ **Table 4-4 Highest level of non-school qualification, 2006**

	Lock		Cleve		Cummins		SA	
Highest level of non-school qualification completed	No	%	No	%	No	%	No	%
Postgraduate Degree	0	0	0	0	0	0	22,760	3.9
Graduate Diploma and Graduate Certificate	0	0	8	3.3	3	1.4	15,975	2.7
Bachelor Degree	6	14.3	43	17.7	25	11.3	119,876	20.4
Advanced Diploma and Diploma	6	14.3	35	14.4	18	8.1	78,692	13.4
Certificate	15	35.7	106	43.6	102	46.0	210,132	35.7
Not Stated	6	14.3	6	2.5	11	5.0	15,731	2.7
Not Applicable	9	21.4	45	18.5	63	28.4	125,265	21.3
Total	42	100	243	100	222	100	588,431	100

Source: ABS Cat No. 2001.0, Census of Population and Housing: Basic Community Profile, Cummins (L) (UCL 406200), Cleve (L) (UCL404800), Collection District 4021502 (Lock), 2006; ABS Cat No. 2003.0, Census of Population and Housing: Time Series Profile, South Australia (STE 4), 2006.

4.1.5. Income

In 2006, the median weekly household income in Lock was \$700-\$799, compared to \$600-\$699 in Cleve and \$500-\$599 in Cummins. In 2006, the mean household size in the eastern section of the District Council of Elliston was 2.65 people. In Cleve and Cummins the mean household size was 2.9 people and 3 people, respectively.

■ **Table 4-5 Income statistics, 2006 ABS Census**

	Lock CCD	Cleve UCL	Cummins UCL
Median Age	43 years	43 years	39 years
Median weekly individual income	\$400-\$499	\$300-\$399	\$300-\$399
Median weekly family income	\$800-\$999	\$700-\$799	\$700-\$799
Median weekly household income	\$700-\$799	\$600-\$699	\$500-\$599
Mean household size	2.3 people	2.9 people	3 people

Source: ABS Cat No. 2001.0, Census of Population and Housing: Basic Community Profile, Cummins (L) (UCL 406200), Cleve (L) (UCL404800), Collection District 4021502 (Lock), 2006.

4.1.6. Local Economy Drivers

The key industry and area of employment in the area surrounding the proposed mine site is primary industry, primarily wheat, barley, wool and livestock.



4.1.7. Local Services

Lock is a small service centre for the surrounding rural community. Services include an Area School, Medical Centre, Police Station, Post Office and various retail services. These are the closest community facilities and social services to the project area.

Cleve is the largest town in the District Council of Cleve and has a shopping, health and community centre as well as regional educational, recreational and sporting facilities. Retail facilities in Cleve include supermarket, clothes shops, art & craft supplies, banks, professional services, butcher, service industries, post office, rural supplies, hotel, mechanical and RAA services, news agency and garden centre. There are daily coach buses to and from Port Lincoln and Adelaide and a grain freight rail service passing from northern areas to Port Lincoln. Cleve has a 20 bed hospital with residential general practitioners and a physiotherapist and supported by visiting surgeons, a psychiatrist and other health professionals. The town also has aged care services, a dental surgery and a pharmacy.

Whyalla is the main service centre for the north eastern Eyre Peninsula and provides regional shopping, medical, education, recreation, employment and community services and facilities.

Port Lincoln is a major service centre for the southern and central Eyre Peninsula and provides regional retail, commercial, medical, education, employment, recreation and community services and facilities.

4.2. Land Use and Surrounding Area

The current land use of the proposed ML area is dryland farming, including mixed cereal crops and sheep. Yields and economic returns for the Eastern Eyre Peninsula Agricultural District were mixed during 2007. Crop production estimates for season 2007/2008 for the Eastern Eyre Peninsula Agricultural District were 554,000 ha with a total crop production of 378,400 tonnes (0.68 t/ha)⁴.

Dryland farming is also the main land use in the surrounding area to the north and west of the site (see Figure 4-1).

Hincks Wilderness Protection Area is located to the south and east of the proposed mine site. The closest boundary of the Wilderness Protection Area is approximately 4.5 km from the southern boundary of the proposed mining lease area. Hincks Wilderness Protection Area is 66,934 hectares

⁴ Rural Solutions SA, Crop and Pasture Report – February 2008, released 6 March 2008, Government of South Australia



and was proclaimed under the *Wilderness Protection Act 1992* in 2004. The wilderness protection area adjoins Hincks Conservation Park (882 hectares), and was formerly part of that reserve under the *National Parks and Wildlife Act 1972*. Hincks Wilderness Protection Area is mainly dominated by mallee, with small areas of woodland and shrubland. Several species of conservation significance are protected within the wilderness protection area, including the malleefowl (*Leipoa ocellata*). It also supports populations of the grey-bellied dunnart (*Sminthopsis griseoventer*), which was discovered in South Australia in December 2004.

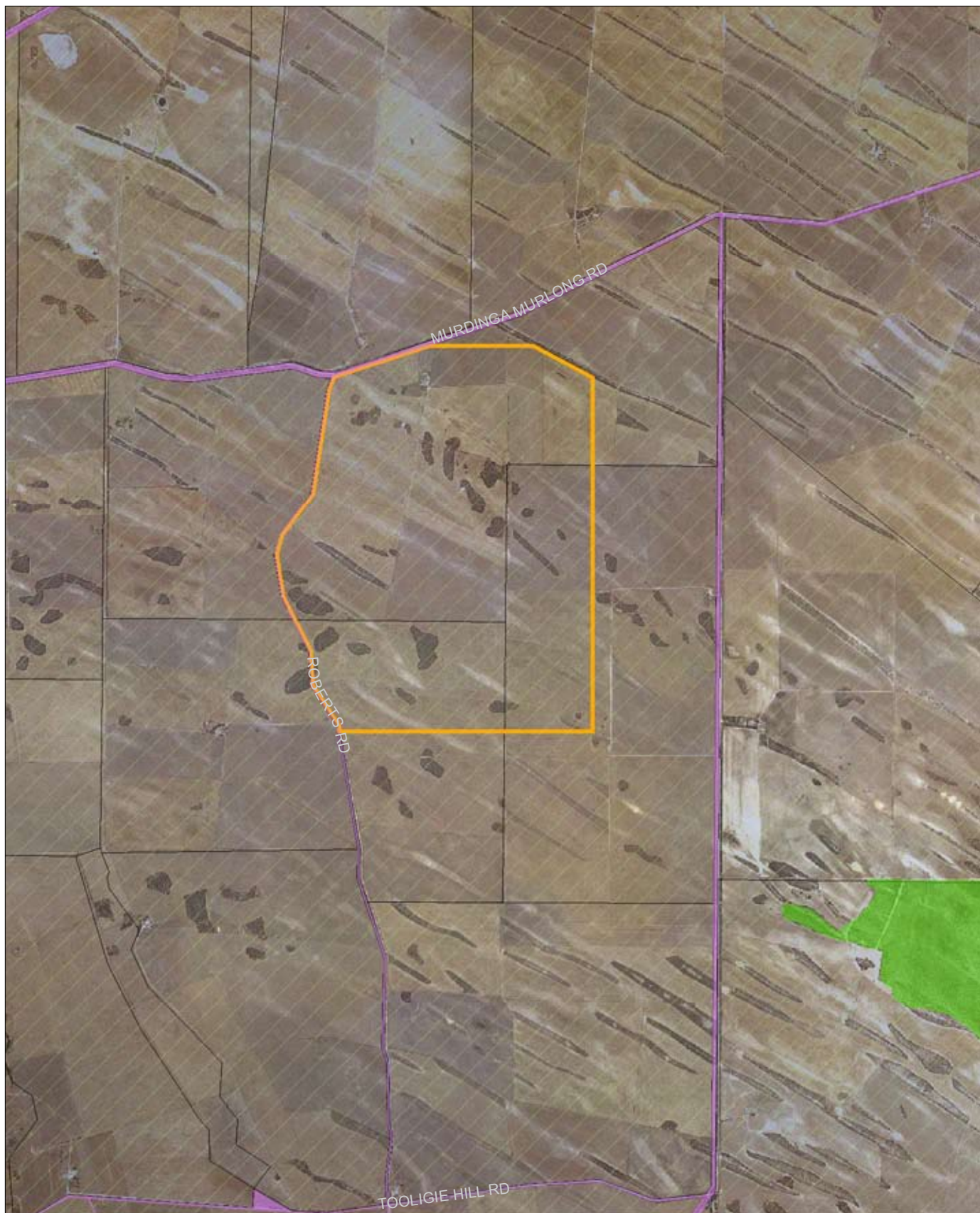
The Hincks Wilderness Protection Area is open to visitors but receives minimal use, with the majority of visitors travelling through or camping on the four-wheel drive track, Nicholls Track. There are no formal visitor facilities within the reserve but there is an informal camping/picnic area along Nicholls Track, the northern entrance of which is via Tooligie or Roberts Road.

4.2.1. Local Government Planning Policy

The proposed ML area is located in the District Council (DC) of Elliston. The boundary of the DC of Cleve is approximately 1.5 km to the east of the project area and boundary of the DC of Tumby Bay is approximately 11 km to the south of the project area. Refer to Figure 4-2.

The proposed ML area is zoned Primary Industry in the DC of Elliston Development Plan. The relevant Development Plan policy is summarised in Table 4-6.

The planning policy summary highlights the need to be socially and environmentally conscientious in the design, operation and closure of the mine site, to minimise land use and traffic conflict and to give consideration to the appearance of the mine operation and its impact on landscape character.



Legend

DWLBC Statewide Land Use

- Cropping
- Grazing natural vegetation
- Transport and communication

- Proposed mining lease area
- Cadastre

Data Sources
Aerial imagery supplied by DEH 2004

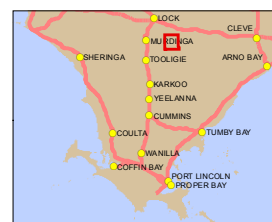
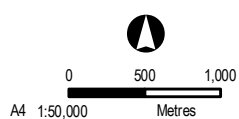
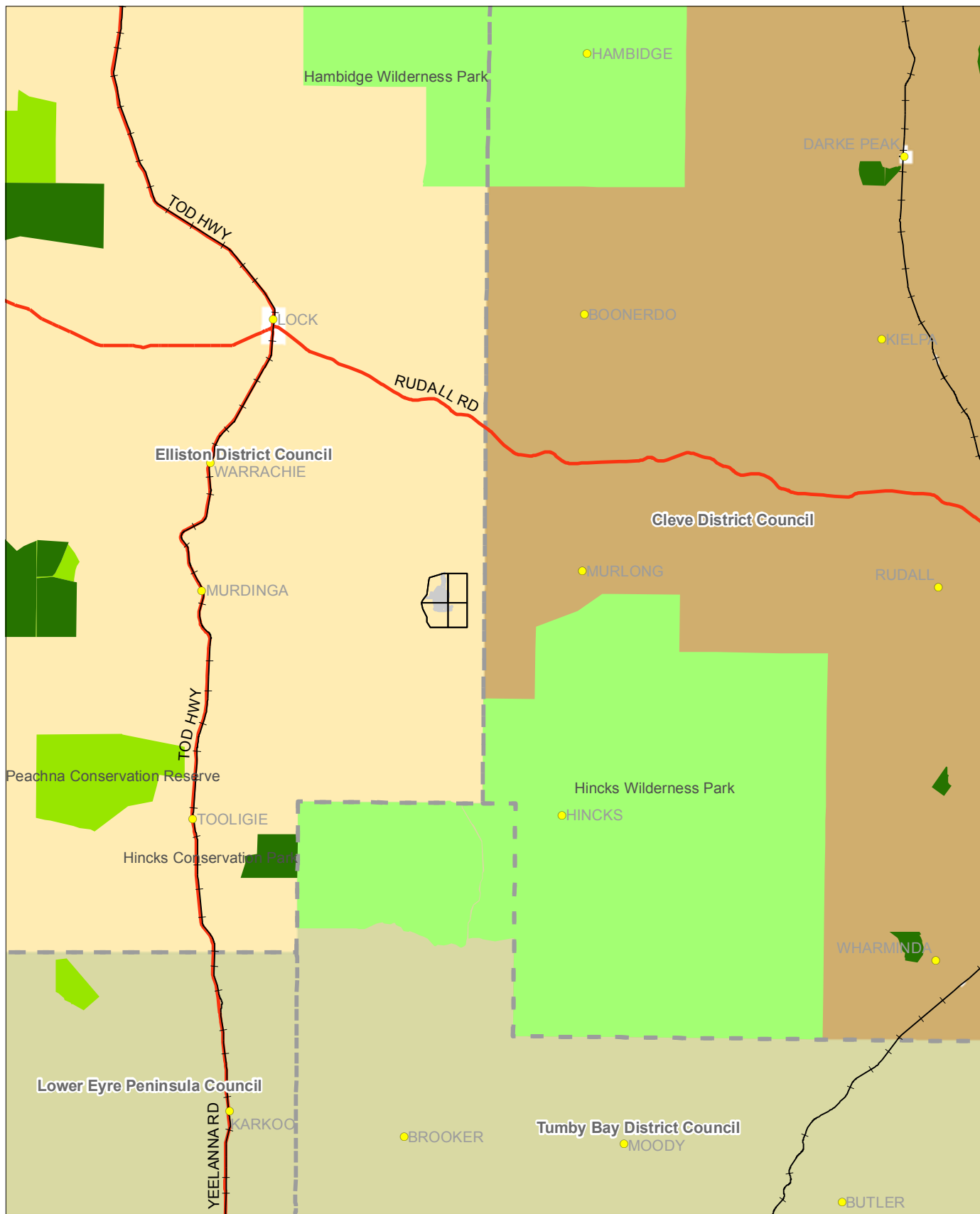


Figure 4-1 Land Use

GDA 1994 MGA Zone 53



Legend

- Locality
- Indicative mining lease
- Indicative Mine Layout
- +— Railway Line
- Main Highway
- LGA
- Planning SA Development Zones
 - General Farming
 - Rural
 - Primary Industry
 - Conservation Park
- Conservation Reserve
- Wilderness Protection Area

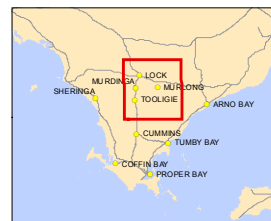
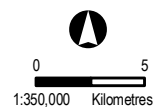


Figure 4-2 Planning Zones & Hincks Conservation Park

GDA 1994 MGA Zone 53



■ **Table 4-6 DC of Cleve and DC of Elliston Development Plan Policy Summary**

Policy Area	Summary of Provisions
General	■ Development should be compatible with other uses in the locality. ■ Physical infrastructure required for development should be economically provided with minimal negative social and environmental impact.
Movement of People and Goods	■ Development and associated points of access and egress should not create conditions that cause interference with the free flow of traffic or safety on adjoining roads. ■ Industrial areas should be designed to allow for the movement of 25 metre long B-double trucks where these vehicles are permitted, or likely to be permitted. ■ Car parking areas should be designed and constructed to accommodate all vehicles generated by the development and should be suitably screened with fencing or landscaping using local indigenous species.
Mining	■ Development likely to be incompatible or limit access to potential mineral resources should not be undertaken in the vicinity of known mineral deposits. ■ Mining operations should not be undertaken unless related environmental impacts can be minimised and no wider ecological damage will result. ■ Mining should be undertaken only if the mining of the resource is in the public interest, is the best alternative in terms of environmental impact and cost, and restoration will ensure minimal impact on the landscape. ■ A progressive rehabilitation program should be undertaken and all buildings, plant, equipment, rubbish and litter removed when operations are complete. ■ An after-use appropriate to the site and the locality should be established on the completion of extractive operations and reclamation to as close as possible to the original condition in terms of vegetation cover and composition undertaken.
Conservation	■ Native vegetation, including the full range of tree, understorey and groundcover species, should be retained and managed so as to maintain and enhance its environmental values and functions, including conservation, biodiversity and habitat, and minimisation of dryland salinity. ■ The planning policy provides guidance on when native vegetation should not be cleared (e.g. when it contains rare or endangered plant species or plant associations, is of high amenity value or associated with a wetland environment). Also, where the clearance of native vegetation will result in soil erosion, salinity problems or affect water quality it should be avoided. When native vegetation clearance is planned consideration should be given to retention of native vegetation for particular purposes such as wildlife corridors and livestock shade and shelter. ■ Development design, construction and the use of land should provide buffers to protect habitats and minimise interference with surrounding biodiversity. ■ Development likely to degrade any area of historic, scientific or cultural value or any natural resource of significance, including drainage systems, water catchment areas, mangrove or samphire wetlands, fauna habitats and areas of scenic beauty should not be undertaken. ■ Development should not impair the character or nature of buildings or sites of architectural, historical, cultural or scientific significance.



Policy Area	Summary of Provisions
Water Resources	- Development should ensure that an adequate water supply, including rainwater tanks, sufficient for the intended use of the land is provided. - In the absence of a reticulated water supply, development should be provided with an independent water supply of a nature, design, quality and capacity sufficient to meet ongoing requirements for domestic, livestock and fire protection purposes. - Water resources, including stormwater, surface and groundwater, should be conserved and natural drainage catchments, river systems and water bodies should be protected to maintain and enhance water quality and facilitate water reuse. - Development should occur in a manner which will not result in an over-exploitation of, or adverse impact, on surface or groundwater resources. - Development should not take place in a manner that may interfere or obstruct a watercourse. - Risk from flooding to life and property or flooding impacts on adjacent properties needs to be considered.
Rural Development	- Development of rural land primarily should be for primary production and other uses compatible with maintaining rural productivity. - The design, siting and maintenance of buildings and structures in rural areas should ensure that the natural landscape character of the area is maintained. - Development should not take place if there is potential for significant conflict with the establishment or operation of facilities for the handling storage or transportation of farm commodities in bulk. - Development should occur in a manner which will not have an adverse impact on the natural, physical, chemical or biological quality and characteristics of soil resources. - Development should minimise soil erosion during construction, operation and closure phases. - Development should not occur in a manner which alters the natural landform, drainage patterns or natural processes of sediment transfer. - Development should occur in a manner which will not increase soil salinity levels.
Appearance /Character	- Development should be of a high standard of design with regard to external appearance, building materials, colours, siting, screening and landscaping so as to preserve and enhance the character and amenity of the locality. - Buildings should be designed and sited to enhance the character of the locality, minimise the need for the excavation or filling of land and minimise the need for the removal of native vegetation. - The visibility of buildings from public roads and adjoining properties should be minimised and the external materials of buildings and structures should minimise the visual obtrusiveness of buildings.
Bushfire Protection	- Development should attempt to reduce the dangers of bushfires. - Buildings and structures should be located away from areas that pose an unacceptable bushfire risk. - Residential and other habitable buildings should: - Be sited on the flatter portion of allotments and avoid steep slopes, especially upper slopes, narrow ridge crests and the tops of narrow gullies, and slopes with a northerly or westerly aspect - Be sited in areas with low bushfire hazard vegetation and set back at least 20 metres from existing hazardous vegetation - Have a dedicated water supply available at all times for fire fighting.



Policy Area	Summary of Provisions
Pollution, Waste & Energy	■ The emission of odours, or other airborne particles, should not cause environmental nuisance or harm external to the site. ■ Industrial uses or processes should not generate pollution or offensive conditions that cannot be effectively managed without detriment to the community and environment. ■ Development should take all reasonable and practical noise reduction steps to prevent or minimise adverse impacts arising from noise. ■ The storage of hazardous substances should occur in a manner which prevents land or water contamination and minimises risk to public health and safety. ■ Untreated waste should not be discharged to any water body. ■ On-site waste treatment should only occur where site conditions are suitable and the capacity of the on-site treatment facility is sufficient to accommodate likely daily demands. ■ Unsewered development should be located at least 100 metres from any nearby watercourse and sewer development should not be located closer than 30 metres to any watercourse. ■ Development located in areas without access to a main sewerage system should incorporate an appropriate effluent disposal system, preferably of an aerobic treatment type in a manner which will not cause pollution or have any other detrimental effects on the environment and watercourses in particular. ■ Development should not be undertaken unless all wastes produced can be managed to avoid environmental pollution. ■ Energy demands and greenhouse gas emissions should be minimised by design that implements energy efficiency and uses renewable energy sources.

4.2.2. State Planning Instruments

The relevant State planning instrument is the Planning Strategy for Regional South Australia (January 2003, amended December 2007).

The Planning Strategy sets out the State Government's vision for development. It indicates directions for future growth and development to the community, the private sector and government. The central vision of the Strategy is "for a regional South Australia in which communities are strengthened and empowered economically, culturally and socially through integrated and flexible support from Government, in partnership with stakeholders and the community".

The Strategy is currently being updated on a region by region basis with Regional Land Use Frameworks. Work on the Eyre Peninsula Regional Land Use Framework has not been commenced (as at April 2008).

Key policy elements are outlined in Table 4-7, including generalised goals for the entire region and specific elements relevant to the Eyre Peninsula.



■ **Table 4-7 Summary of policy elements for the Eyre Peninsula**

	Regional SA Goals	Relevant Regional Strategies	Relevance
Economic Activity	■ A more diversified regional export base ■ Economic development within the context of sustained natural systems ■ A positive business, investment and employment climate	■ Attract and support major development based on the strengths of the area that will provide additional employment and growth through renewable energy, desalinisation and deep sea port facilities ■ Improve the viability and sustainability of agriculture through adoption of new opportunities, improved management, diversification and value-adding ■ Promote expansion of the tourist industry based on the natural and cultural assets of the area ■ Upgrade visitor facilities and infrastructure at key tourist locations and improve visitor access to tourist attractions ■ Develop the area's significant potential for exploration and mining of natural resources, based on exploration initiatives ■ Support existing and new mining opportunities through infrastructure and service provision	The proposed mine will contribute to the economic growth of the region through direct and indirect employment and investment. The development of the mine will result in the permanent loss of approximately 93 hectares of productive agricultural land. The proposed mining area is near the Hincks Wilderness Area which is not a major tourist attraction and receives only minimal visitors. The mine is not expected to impact recreational users of the park.
Environment and Resources	■ Conserved biodiversity and sustained ecosystems ■ Sustainable use of natural assets ■ Natural resource management integrated with land use planning ■ Conserved cultural and built heritage ■ Healthy communities and resources	■ Protect and enhance biodiversity and essential ecological processes ■ Maximise sustainable use of regional water supplies by managing demand and providing opportunities to supply future needs ■ Proactively deal with dryland salinity on commercially viable agricultural land through the preparation of salinity management plans that includes benefits to biodiversity	The native vegetation on site presents only limited ecological benefit, and represents overall poor habitat value. It is intended that the majority of water required for the mine operations and associated infrastructure on the mining lease will be met by rainwater, saline groundwater (primarily from mine dewatering) and a reverse osmosis plant. However, water demand and resource assessments are still being undertaken.



	Regional SA Goals	Relevant Regional Strategies	Relevance
People Towns and Housing	- Healthy and safe communities - Well informed communities participating in decision making - Supportive individuals, families and communities - Health, education and community services that are accessible - Diverse, affordable housing to meet community needs	- Encourage the further development of Port Lincoln as a main regional service centre for the lower and western parts of the area - Improve access to and the quantity and quality of health and community services, such as regional hospitals, aged care facilities, mental health services and Aboriginal health programs - Provide opportunities for young people in education, employment and recreation	The mine workforce will require access to housing, health services and community services. The mine may also provide an employment opportunity for young people. Stakeholder engagement is underway and will continue during the MLP assessment process and mine development.
Infrastructure	- Reliable, efficient and competitive inter and intra-regional infrastructure - Regional infrastructure that supports economic development - A renewable energy industry - Affordable access to electronic information and communication - Efficient and competitive regional freight transport system - A safe regional transport system for all users	- Develop transport infrastructure practices, connections and capabilities to meet existing and future needs of exporters, producers, miners, residents and visitors. This includes investigating the potential to expand the heavy vehicle network for vehicles travelling to and from intermodal terminals - Continue to improve the safety and efficiency of the road network, particularly the roads attracting increased freight movements including the Lincoln and Eyre highways and local Elliston roads - Promote innovative means of energy supply and capacity to areas that are remote from the distribution network - Ensure adequate supply of water of sufficient quantity and quality for industry development and human use	Mine operation will require heavy vehicle transportation of hematite to the proposed port. Mine operation will also require an energy supply, which is proposed to be generated on site. It is intended that the majority of water required for the mine operations and associated infrastructure on the mining lease will be met by rainwater, saline groundwater (primarily from mine dewatering) and a reverse osmosis plant.

4.2.3. Future Land Use Change

Land use change to more intensive use such as residential development is not anticipated in the area surrounding the proposed mine site. The subject site is located within a large rural area and is not in close proximity to a town or urban settlement. Rural planning policy aims to preserve rural land for agricultural use therefore it is unlikely that urban land uses would be proposed adjacent to the site or on the site in the future.

The structure plans (within the Development Plans) for the district councils of Cleve and Elliston both show the subject site and surrounding area remaining as rural.



4.2.4. Post Mining Land Use

Following rehabilitation of the mine site it is intended that as much of the project area as practicable will be returned to productive agricultural use. Infrastructure that is useful for this purpose will be retained on site, while infrastructure of no use for agriculture will be dismantled and removed. Areas not amenable to agricultural use (e.g. the mine pit and waste rock dump) will be made safe and vegetated. Refer to Section 9 for further information on rehabilitation and post mine land use.

4.3. Proximity to Infrastructure and Housing

4.3.1. Housing and Services

Centrex has a purchase agreement in place for the Kamballa farmhouse, which is located within the proposed ML area. A further 7 residential homes on farming properties are located within 5 km of the project area.

In Lock, approximately 21 km to the north west of the project area, the following social infrastructure is located:

- Lock Area School, 2- 16 West Tce, Lock
- Medical Centre, 34-36 Dearman Street, Lock
- Lock School Community Library, West Terrace, Lock
- Lock Community Health & Welfare Centre, North Tce, Lock
- Post Office, Railway Tce, Lock
- Police Station, North Tce, Lock SA

In Cleve, approximately 55 km east of the project area, the following social infrastructure is located:

- Cleve Area School, Second Street, Cleve
- Cleve School Community Library, Second St, Cleve
- Spencer Institute of TAFE, Cleve Campus, 27B Main Street, Cleve
- Cleve District Hospital, North Terrace, Cleve
- Cleve District Health & Aged Care, North Terrace, Cleve
- Cleve Health & Welfare Centre, 15 Main St, Cleve
- Post Office, 22 Main St, Cleve
- Police Station, 2 Main St, Cleve



In Cummins, approximately 60 km south, south-west of the project area, the following social infrastructure is located:

- Cummins School Community Library, McFarlane St, Cummins
- Cummins Area School (including Child Parent Centre), Mc Farlane St, Cummins
- Cummins and District Memorial Hospital, Tumby Bay Rd Cummins
- Country Fire Service Cummins Branch, Cummins
- Cummins State Emergency Service, Hayman Drive Cummins
- Police Station, 20 Railway Tce, Cummins
- SA Ambulance Service, 19 Tumby Bay Rd Cummins

4.3.2. Infrastructure

Water Supply

The SA Water Eyre water supply system has no connectivity to River Murray supplies. The reticulated water supply for much of the Eyre Peninsula comes from a number of well-fields developed by SA Water. The groundwater supplies are located near Port Lincoln and between Lock and Elliston and numerous alternative ground water basins at Poldia, Uley-Wanilla, Uley South and Lincoln.

The Tod River is the only permanently flowing waterway on the lower Eyre Peninsula. The Tod Reservoir has a capacity of 11,300 Megalitres. Due to a steady increase in the salinity of the water in the Tod River, the reservoir has been taken off line. However, Tod Reservoir remains an important part of SA Water's contingency plans for water supply in the region.

Dams provide another key water resource on most areas of the Peninsula, especially in the areas outside the reticulated water scheme.

Current water supply infrastructure within the project area consists of an SA Water main along the Murlong-Murdinga Road, rainwater harvesting and storage from house and farm building roofs and a limited number of groundwater bores.

Communications

The region is well serviced with the basic telecommunication facilities such as telephone, Australia Post and a variety of television services. Next G mobile phone services have been implemented in Lock, Tooligie Hill and Cleve.

4.3.3. Transport

This section discusses the transport network that services the project area and broader region.



Road

The Lock-Rudall Road is the closest major road to the project area. The highway runs east-west approximately 11 km north of the mine site and connects Lock and Cleve. The Tod Highway is also within close proximity to the mine, located approximately 14.5 km west of the project area. The Tod Highway connects Lock and Cummins, intersecting the Flinders Highway at its southern end to provide access to Port Lincoln. Both the Lock-Rudall Road and Tod Highway are maintained by the Department for Transport, Energy and Infrastructure.

The site is approximately 200 km by road from Whyalla and 146 km by road from Port Lincoln. A network of minor unsealed roads services farmers and the local community.

The proposed transport route from the project area to the Tod Highway at Tooligie begins at Roberts Road, approximately 1.5 km north of Tooligie Hill Road. The route then continues along Roberts Road to the intersection of Kay Road and Tooligie Road. The route then follows Tooligie Road in a westerly direction until it reaches the Tod Highway.

Rail

The Thevenard-Port Lincoln narrow gauge rail network is located 18km west of the project area. The rail network is operated by Genesee and Wyoming Australia Pty Ltd. The nearest siding is located at Tooligie, approximately 20 km south-west of the mine site.

The Thevenard-Port Lincoln rail network follows the Tod Highway from Lock through Cummins to the south, before deviating to the south east near the Flinders Highway and heading towards Proper Bay Road. The rail line loops around Kathai Conservation Park and enters Port Lincoln from the south-west.

Air

The project area is located between two commercial airports serviced by Regional Express. The closest is located at Port Lincoln, and the next closest is to the north-east of the project area at Whyalla. The District Council of Cleve maintains an aerodrome adjacent to the town of Cleve, 1.4 km south of the post office. The east-west oriented runway is sealed and has pilot activated lighting for night landing.

Port

There are three existing South Australian ports that have been considered in detail for the mining operation exports associated with the proposed Wilgerup Iron Ore Development: Whyalla, Port Lincoln and Proper Bay.

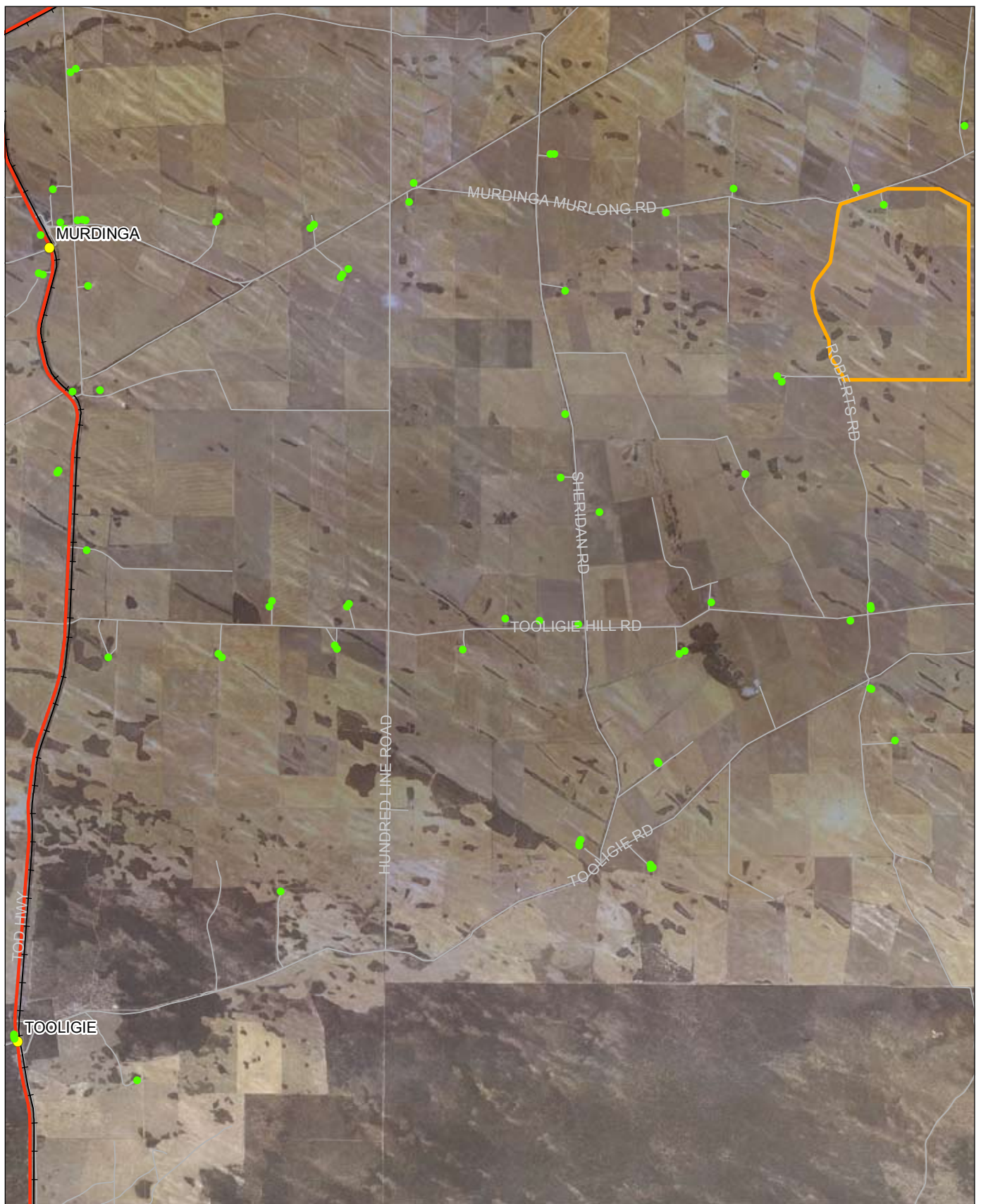
The preferred option is Port Lincoln Wharf, Port Lincoln. The Port Lincoln port facility has an existing ship loading facility for loading cereal grains and the wharf is also used for the unloading



of fertilizer. The Port is owned and operated by Flinders Ports. ABB Grain Limited owns their facilities at the site.

The Proper Bay facility is located on privately owned land. The site was formerly a BHP lime sands storage shed, jetty and bulk handling facility. Proper Bay provides a feasible alternative to the Port Lincoln facility for the shipment of ore from Wilgerup. Centrex has an option to secure a long term lease over the Proper Bay site. Stakeholder engagement has been ongoing as part of this process, as reflected in Section 7.

The Whyalla port is privately owned by OneSteel Manufacturing Ltd. Access to the Whyalla port has been denied by Onesteel to all third parties including Centrex.



Legend

- Dwellings
- Locality
- Main Highway
- Road
- +— Railway line
- Proposed mining lease area

Data Sources
Aerial imagery supplied by DEH 2004

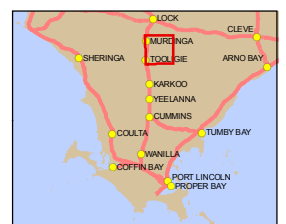
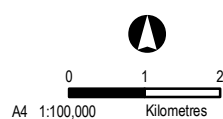


Figure 4-3 Dwellings and Infrastructure Proximity

GDA 1994 MGA Zone 53



4.4. Amenity

The project area is not located within an area regarded as being of scenic or aesthetic value. The immediate area in which the mine is proposed is predominantly characterised by dryland farming land. The project area has sparse clumps of degraded mallee (including *Eucalyptus incrassata* / *Melaleuca uncinata* association, *E. socialis* and *E. gracilis*) scattered around the area. Large areas of vegetation have been cleared for cropping and livestock grazing.

Hincks Wilderness Protection Area is located to the south and east of the proposed mine site. The closest boundary of the Wilderness Protection Area is approximately 4.5 km from the southern boundary of the proposed mining lease. Hincks Wilderness Protection Area is characterised by mallee with small areas of woodland and shrubland.

The project area is visible from Roberts Road to the west of the site and Murdinga-Murlong Road to the north of the site through scattered vegetation. However, it is not visible from the main roads in the locality, including Rudall Road to the north and Tod Highway to the west.

4.5. Air Quality and Noise

4.5.1. Air Quality

An air quality assessment of the proposed Wilgerup iron ore mine site has been undertaken by SKM and is provided in Appendix D.

4.5.1.1. Health and Amenity Effects of Particulate Matter and Dust

Small dust particles, or airborne 'particulate matter', is any material (except water) that exists in the solid or liquid state in the atmosphere (or gas stream) at standard atmospheric conditions. Airborne particles cover a very wide range of sizes from just larger than an air molecule up to approximately 1 millimetre in diameter. In relation to potential air quality impacts from airborne concentrations of small particles, the key air pollutant is Particulate Matter 10 (PM₁₀). PM₁₀ represents a mass concentration of small particles with aerodynamic diameters less than 10 microns (10 µm), with units microgram per cubic metre (µg/m³).

Particulate matter presents a potential health hazard to the lungs, enhances some chemical reactions in the atmosphere and reduces visibility. The health effects of small particles are largely related to the extent to which they can penetrate the respiratory tract. Larger particles, generally greater than 10 µm in diameter, generally adhere to the mucus in the nose, mouth, pharynx and larger bronchi and can be removed by swallowing or expectorating. The deposition of particles larger than 10 µm in diameter ('nuisance dust') has predominantly aesthetic consequences; for example, staining and soiling of surfaces, the contamination of water bodies and vegetation, and affecting personal comfort, amenity and health.



4.5.1.2. Background PM₁₀ and Dust Levels at Wilgerup

There is no EPA data available for the project area, or indeed for most parts of the Eyre Peninsula. Much of the State's effort in relation to dust monitoring and management west of Adelaide has been undertaken for Whyalla; for example, refer to EPA (2007). However, reasonable assumptions can be made about air quality in the project area.

In general, the existing air quality in the project area is expected to be good due to the rural location with very low levels of road traffic and no industrial activity. Agricultural activities pertaining to wheat-crop farming represent the only significant source of activity that could result in elevated particulate matter and dust levels. Elevated particulate matter and dust levels resulting from dry windy conditions (especially during the dry summer and autumn periods) occur frequently in the project area, resulting in significant entrainment of topsoil.

Starting with Whyalla, reasonable estimates for clean air ('background') particle levels can be determined from the High Volume Sampler measurements of 24-hour average PM₁₀ and Total Suspended Particulate (TSP) undertaken at Civic Park (EPA, 2007). Results of PM₁₀ monitoring undertaken from 2001-2003 at Civic Park are summarised in Table 4-8.

■ **Table 4-8 Summary Statistics of PM₁₀ Monitoring – Civic Park, Whyalla (2001-2003)**

Year	Annual Average (µg/m ³)	Highest (µg/m ³)	2 nd highest (µg/m ³)	90 th percentile (µg/m ³)	NEPM exceedences (of 50 µg/m ³)
2001*	12	26	21	20	0
2002**	17	59	43	26	1
2003**	15	48	42	25	0

* Samples only taken from November 2001.

** Sampling rate increased from one in six days to one in three days in May 2002.

These results provide a good starting point for assumptions about air quality in the project area. The "clean air" background PM₁₀ levels at Wilgerup are expected to be approximately 10 µg/m³. The activity that would have the most significant effect on local air quality is wheat-crops, and associated harvesting and soil disturbance. The current dry state of the land in South Australia, together with the poor binding potential of the soil, would contribute to raising PM₁₀ and dust levels in the vicinity, particularly during dry windy conditions. From time-to-time significant dust impacts could be expected from bushfires and "burning off". On days heavily affected by raised dust or bushfires, soil and smoke particles may raise the 24-hour average PM₁₀ levels up to and beyond the corresponding National Environment Protection Measure (NEPM) standard of 50 µg/m³ (NEPC, 2003).



Advice from South Australian Environmental Protection Authority (EPA) (*pers comm.*, 15/11/2007) is that under conditions where PM_{10} concentrations may be elevated in the project area, such as those described above, a conservative background PM_{10} (24-hour) estimate would be approximately $25 \mu\text{g}/\text{m}^3$. This figure is approximately the same as the 90th percentile⁵ of PM_{10} measurements at Whyalla.

In terms of background dust deposition levels, a background level of $2 \text{ g}/\text{m}^2/\text{month}$ is considered a conservative estimate, and is based on the measurement expected for a typical urban (city) environment. This conservatively high value has been used for several previous dust assessments for open-cut coal mine and construction projects in NSW.

4.5.2. Noise

A noise assessment of the proposed Wilgerup Iron Ore proposal has been undertaken by SKM and is provided in Appendix E.

No significant permanent man-made noise sources are located near the project area. The nearest farm homestead site is the Kamballa homestead which is located approximately 800 m to the north of the proposed mine site and the Bacca Hills homestead which is approximately 2,300 m south-west from the mine site. Centrex has a purchase agreement in place for the Kamballa homestead as part of the Wilgerup Mine Development. Figure 4-3 presents an aerial view of the mine site and the relative locations of the homesteads to the proposed mine site.

As part of the noise assessment, unattended noise level measurements were performed in an open field approximately 1,600 m from the mine site and approximately 1,200 m from the Bacca Hills Homestead. This measurement location is indicative of the typical noise environment around the proposed mine site.

Background noise level measurements (L_{A95}) were performed over 15 minute sampling periods, continuously, over a total measurement period of twelve days. Measurements indicate that background noise levels in the proposed ML area are typical of a rural environment. High winds at the measurement site were the only noise source observed to impact the data logger microphone.

The 'A' weighted background Sound Pressure Levels (L_{A95}) measured over a 15 minute period are presented in Table 4-9.

⁵ In the absence of appropriate hourly background PM_{10} data (often used for dispersion modelling purposes), the 70th percentile of one year's observed hourly concentrations can be adopted as a conservative constant value for the background concentration. The 90th percentile 24-hour average would be roughly an equivalent of this.



■ **Table 4-9 Background sound pressure levels measured at the Wilgerup Mine Site**

Time of Measurement	'A' Weighted Sound Pressure Level (L_{A95}) (dBA)
Day Time	32
Night Time	22

4.6. Topography and Landscape

The Eyre Mallee sub-region, which incorporates the project area, is predominantly more centrally located on the peninsula and is climatically more arid than the coastal and southerly regions. Extensive dunes and sand sheets are dominant within the region.

The project area comprises sandy clay flats interspersed with sand dunal ranges which run in a north-west to south-east direction. The topography of the area has a gently undulating slope and is located approximately 100 m above sea level. Tooligie Hill, a granitic gneiss outcrop, is the most significant geographical feature in the locality. Tooligie Hill is located to the south west of the proposed site and the peak is at approximately 190 m above sea level. The feature extends north-south for approximately 7.2 km and east-west for 1.5 km. Tooligie Hill Road passes over the southern section of the hill.

Figure 4-4 presents a general view of the terrain and vegetation of the project area. Regional topography is shown in Figure 4-5.



■ **Figure 4-4 Typical view of mine site landscape**



Legend

-  Contours (metres above sea level)
-  Proposed mining lease area
-  Cadastre

Data Sources
Aerial imagery supplied by DEH 2004

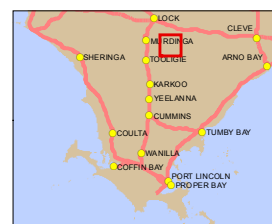
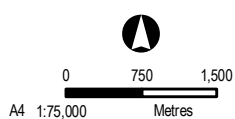


Figure 4-5 Topography

GDA 1994 MGA Zone 53



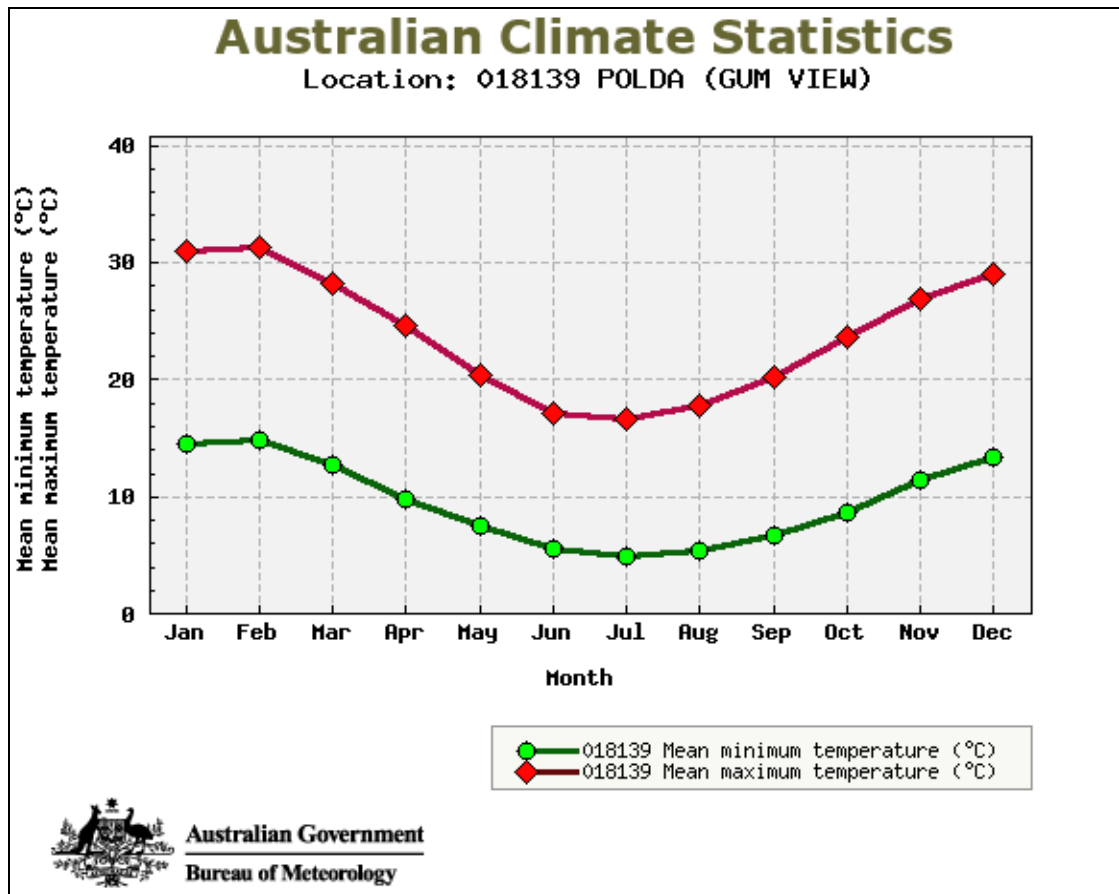
4.7. Climate

There are no Bureau of Meteorology (BoM) stations in the immediate locality of the project area, however there are a number of BoM stations within 50-60 km of the study area which can provide a good approximation of the climate expected at Wilgerup. The closest surrounding BoM monitoring stations are:

- Poldo (BoM Station ID 018139: “Gum View”) – located approximately 53 km north-west of the project area. Elevation 37 m. Commenced observations in 1966, and closed in Dec 2005. This station observed temperature, rainfall, relative humidity and wind speed.
- Cleve (BoM Station ID 018014) – located approximately 57 km east of the project area. Elevation 193 m. Commenced observations in 1896, and is still in operation. This station observes temperature, rainfall, relative humidity and wind speed.
- Cummins Aero (BoM Station ID 018217) – located approximately 60 km south-south west of the project area. Elevation 60 m. This station has only been recording data since June 2007, and hence does not provide sufficient meteorological averages for the purposes of this study.

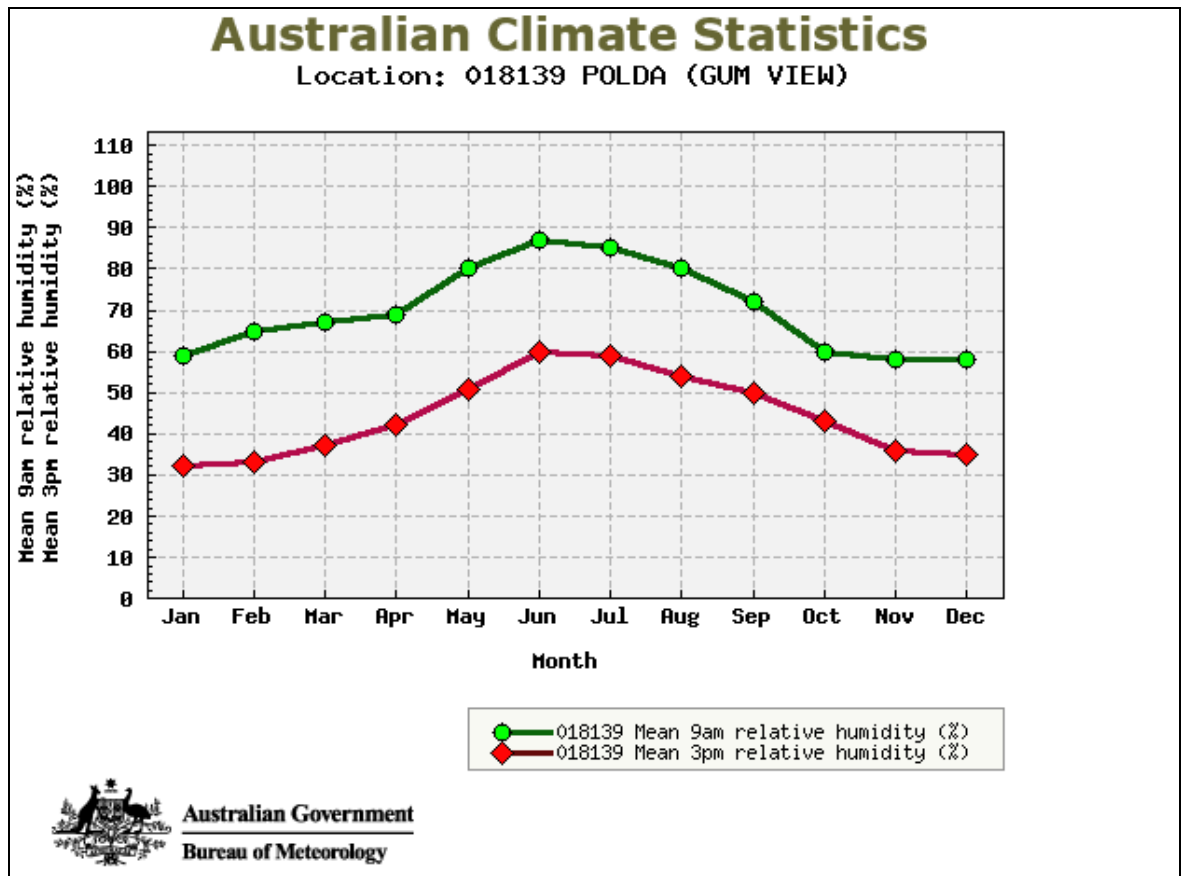
The project area is located in a semi-arid area, and is generally subject to hot dry summers and wet cool winters. The BoM Station at Poldo provides the best approximation to the meteorological conditions likely to be expected at the Wilgerup site, due to it being the closest site to the project area, its elevation, and inland location. Furthermore, it provides a good indication of the cross-peninsula synoptic situations that are experienced at inland localities across the Eyre Peninsula. The long-term meteorological statistics for Poldo are reported using 37 years of observations data.

February and July are the hottest and coldest months respectively for the area. Mean daily maximum temperatures at Poldo range from 16.7°C in July to 31.3°C in February, while mean daily minimum temperatures range from 4.9°C in July to 14.9°C in February. The extreme temperatures recorded at Poldo show a highest recorded maximum temperature of 47.4°C (in January 2001) and the lowest minimum temperature of -4.9°C (in June 1972). The long-term mean maximum and minimum temperatures at Poldo are summarised below in Figure 4-6.



■ **Figure 4-6 Observed temperature data – Polda BoM (1967-2005)**

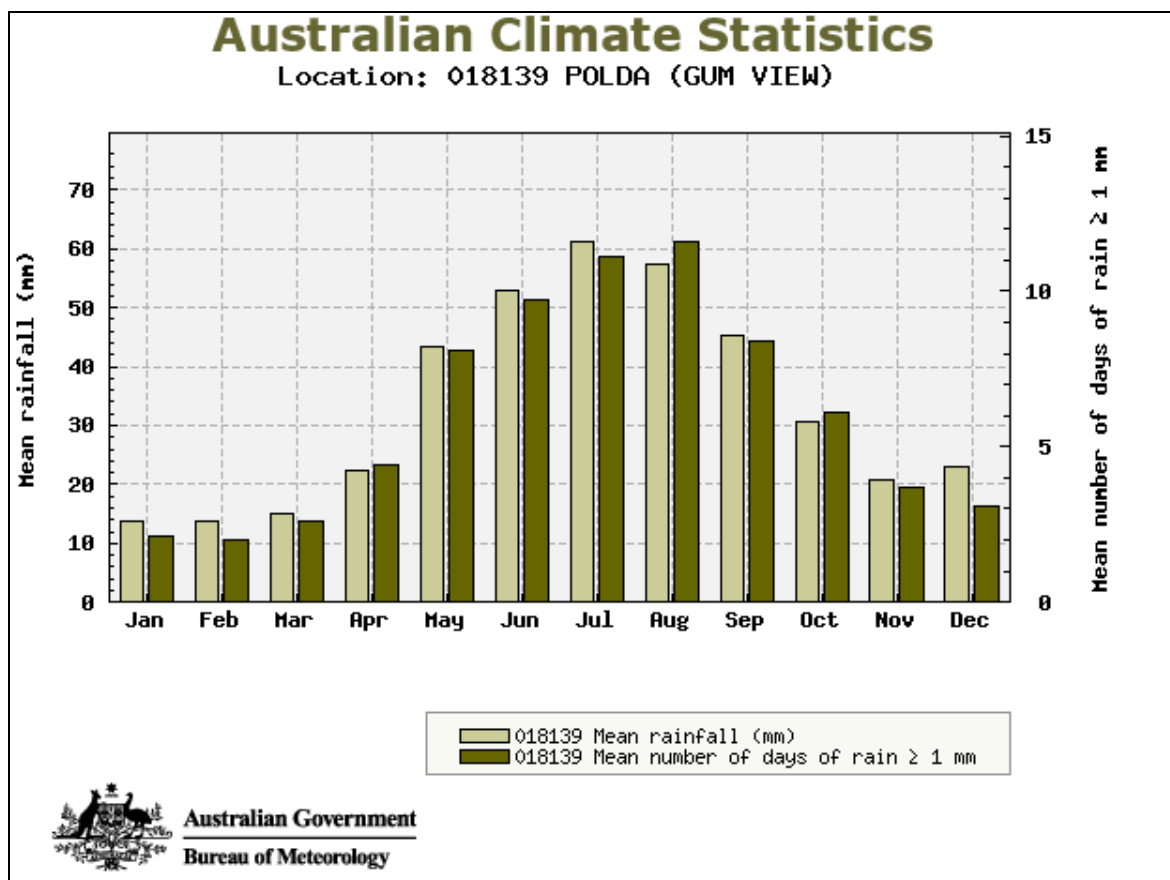
Observed 9am and 3pm monthly average relative humidity (RH) for the BoM site at Polda are provided in Figure 4-7. RH is generally higher in the mornings, decreasing throughout the day. Mean 9am RH is lowest during November and December (58%), ranging up to 87% in June. Mean 3pm RH ranges from 32% in January to 60% in June.



■ **Figure 4-7 Observed 9am and 3pm Relative Humidity data – Polda BoM (1967-2005)**

Average annual rainfall is 397 mm at the Polda BoM station, and 401 mm at Cleve BoM. The mean number of rain days per annum⁶ at Polda is 73, with August having the highest mean number of rain days (11.6), and February having the lowest mean number of rain days (2.0). The long-term mean monthly rainfall and mean number of rain days (≥ 1 mm) for Polda is provided in Figure 4-8. July is the wettest month with a mean monthly rainfall of 61.2 mm, and January/February being the driest months with mean monthly rainfall of 13.7 mm.

⁶ Mean number of days of rain ≥ 1 mm (BoM)



■ **Figure 4-8 Observed mean monthly rainfall – Polda BoM (1967-2005)**

Recent rain gauge observations were also obtained for two localities closer to the project area in order to compare recent rainfall to the longer-term average. 2006 BoM rain gauge data was obtained for “Mungala” (homestead located 4.7 km north east of “Kamballa”), and “Ninamanima” (off Tooligie Hill Road, 8.1 km south-south west of “Kamballa”). The annual rainfall averaged over the two stations for 2006 was 262 mm, which compares to the long-term annual average for the region of approximately 400 mm. The data supports the recent drought conditions currently being experienced across the Eyre Peninsula.

As there are no BoM weather stations in the immediate vicinity of the project area, site-specific hourly averaged meteorological data, to be used in AUSPLUME air dispersion modelling (refer to Appendix D), have been generated using The Air Pollution Model (TAPM) for one study year (2006). TAPM, developed by CSIRO Marine and Atmospheric Research, predicts flows important to local-scale air pollution, such as sea breezes and terrain-induced flows, against a background of larger-scale meteorology provided by synoptic analyses (Hurley, 2005).

The following provides summaries of wind speed and direction parameters generated by TAPM for the project area in 2006, with comparisons made to the long-term BoM Polda observations; refer to



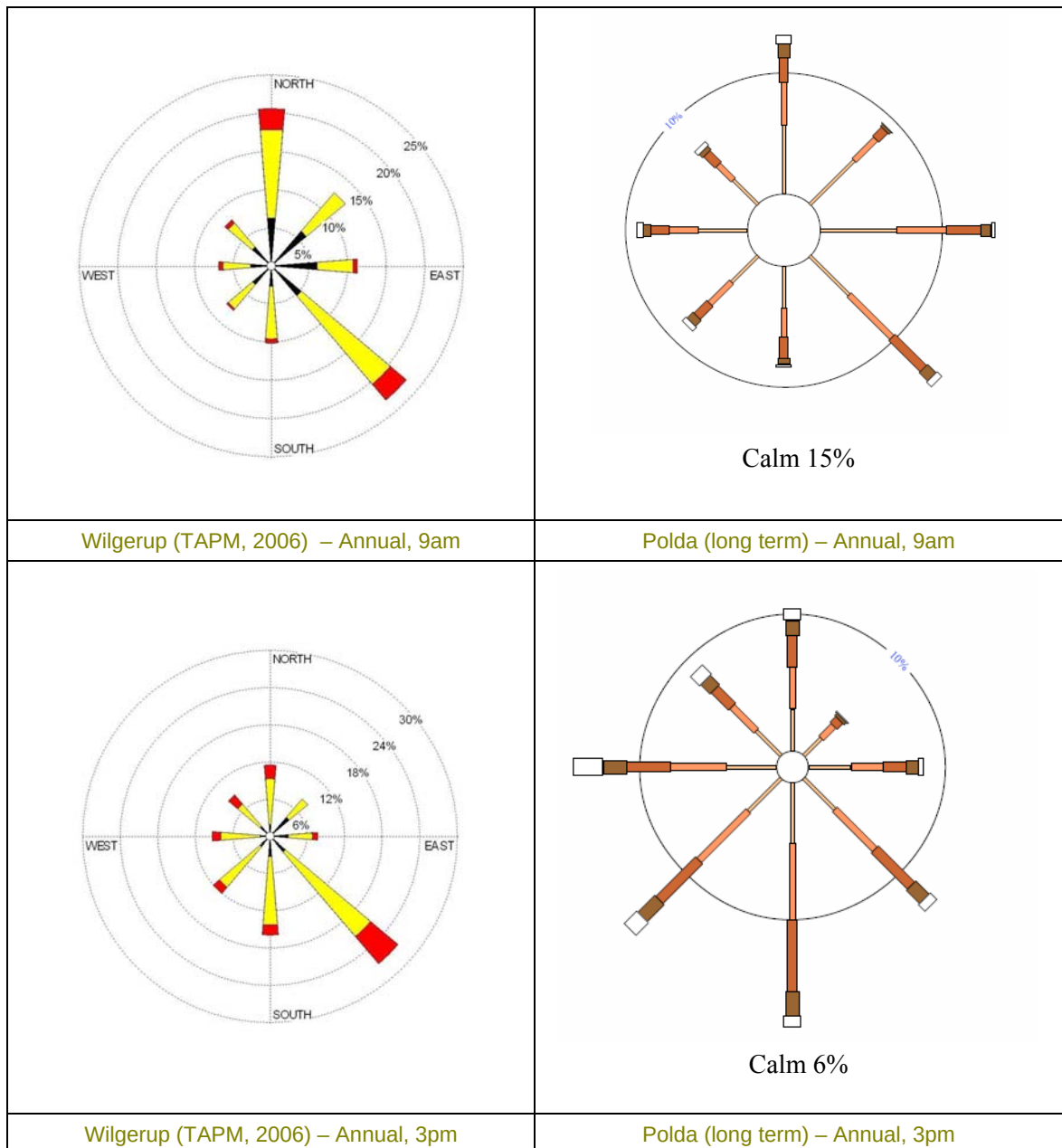
Figure 4-9, Figure 4-10 and Figure 4-11. Wind speeds are shown in units of km/hour for comparisons with the Bureau's (long-term) wind roses. The percentage occurrence of wind direction is shown by the concentric grid scale circles.

The comparison shows that wind speeds are typically higher at Poldia, which may possibly be suggested by a slightly more coastal location (Poldia located approximately 45 km inland from Elliston, compared to the proposed ML area being some 60-65 km from the coast). The synoptic wind condition across the Eyre Peninsula is complex and is heavily influenced by the formation of coastal sea breezes along the Peninsula's coasts. The sea breeze acts as a resultant of local gulf sea breezes combined with the continental sea breeze off the Southern Ocean, with the potential for the sea breeze to carry a significant distance inland across the Peninsula (Physick & Byron-Scott, 1977). As such, the project area may experience to a lesser extent, compared to that of Poldia, this resultant coastal sea breeze phenomenon.

From inspection of these wind roses, the dominant winds are:

- Summer: South-easterly wind is dominant.
- Autumn: East and north-easterly sector winds dominate in the morning and south-east winds dominate in the afternoon.
- Winter: North and north-easterly winds dominate in the morning with stronger north-westerly winds dominating in the afternoon.
- Spring: The dominant winds swing from north to south through east (morning) to south-east, south, south-west (afternoon).

There is generally a good comparison between the two data sets (Wilgerup 2006 versus Poldia long-term) in terms of wind direction. However, there is a tendency of slightly higher wind speeds at Poldia.

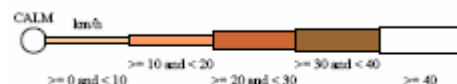


Note: calms not included in TAPM wind roses

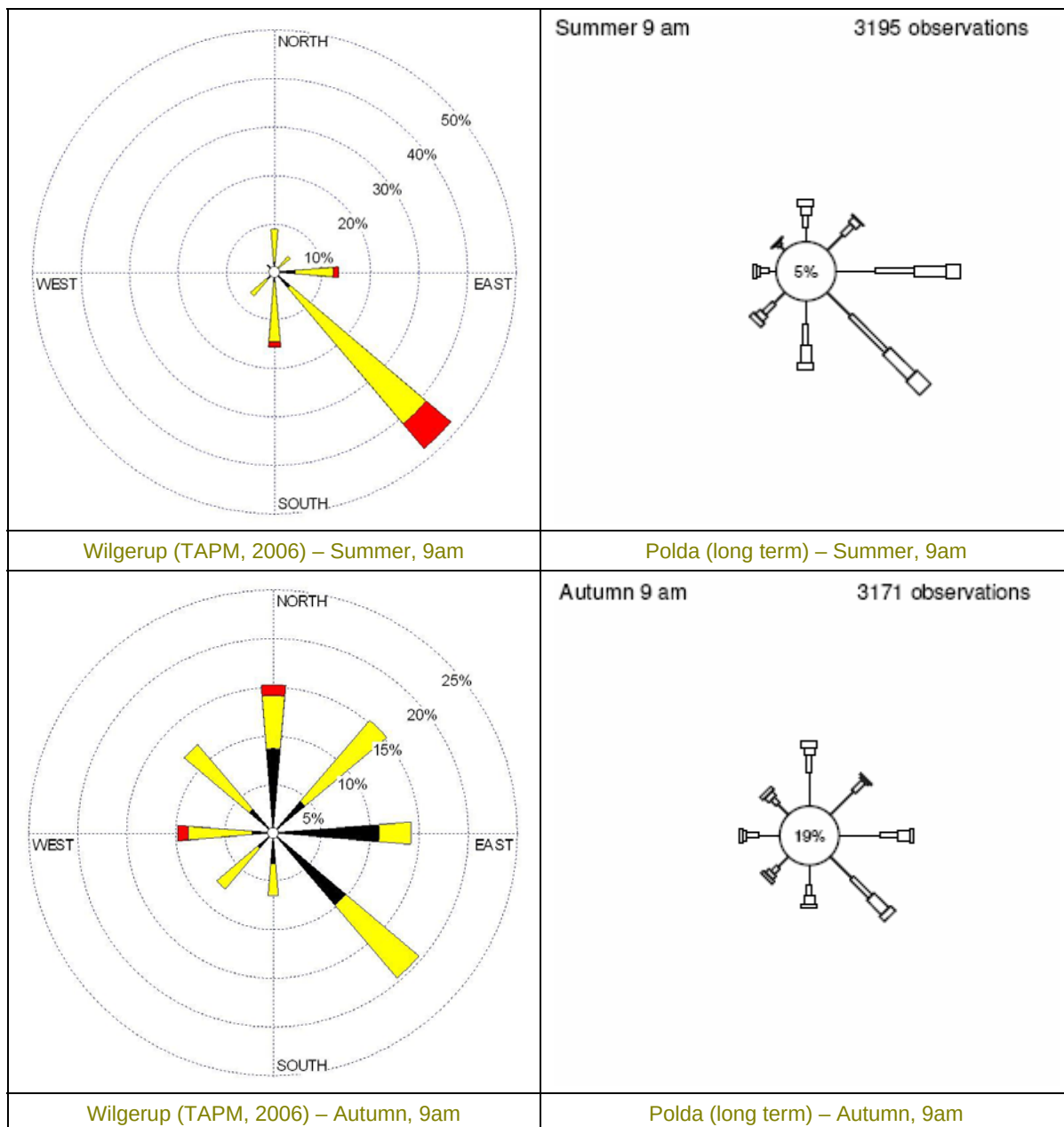
WIND SPEED
(m/s)



Calms: 0.00%



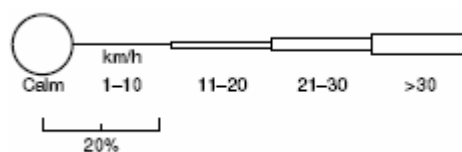
■ Figure 4-9 Annual Wind Roses for Wilgerup (2006) and Polda (Long Term)

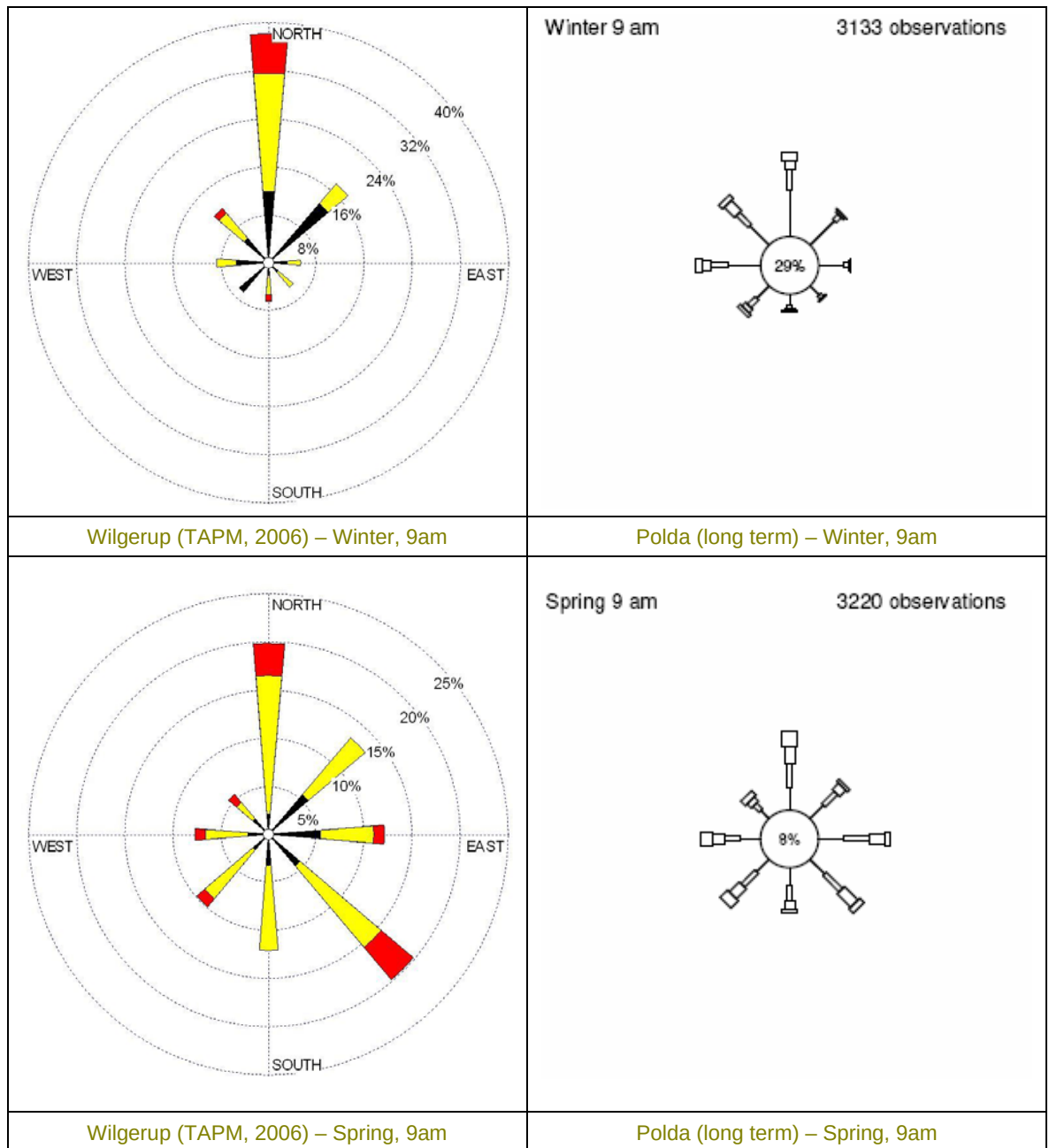


WIND SPEED
(m/s)

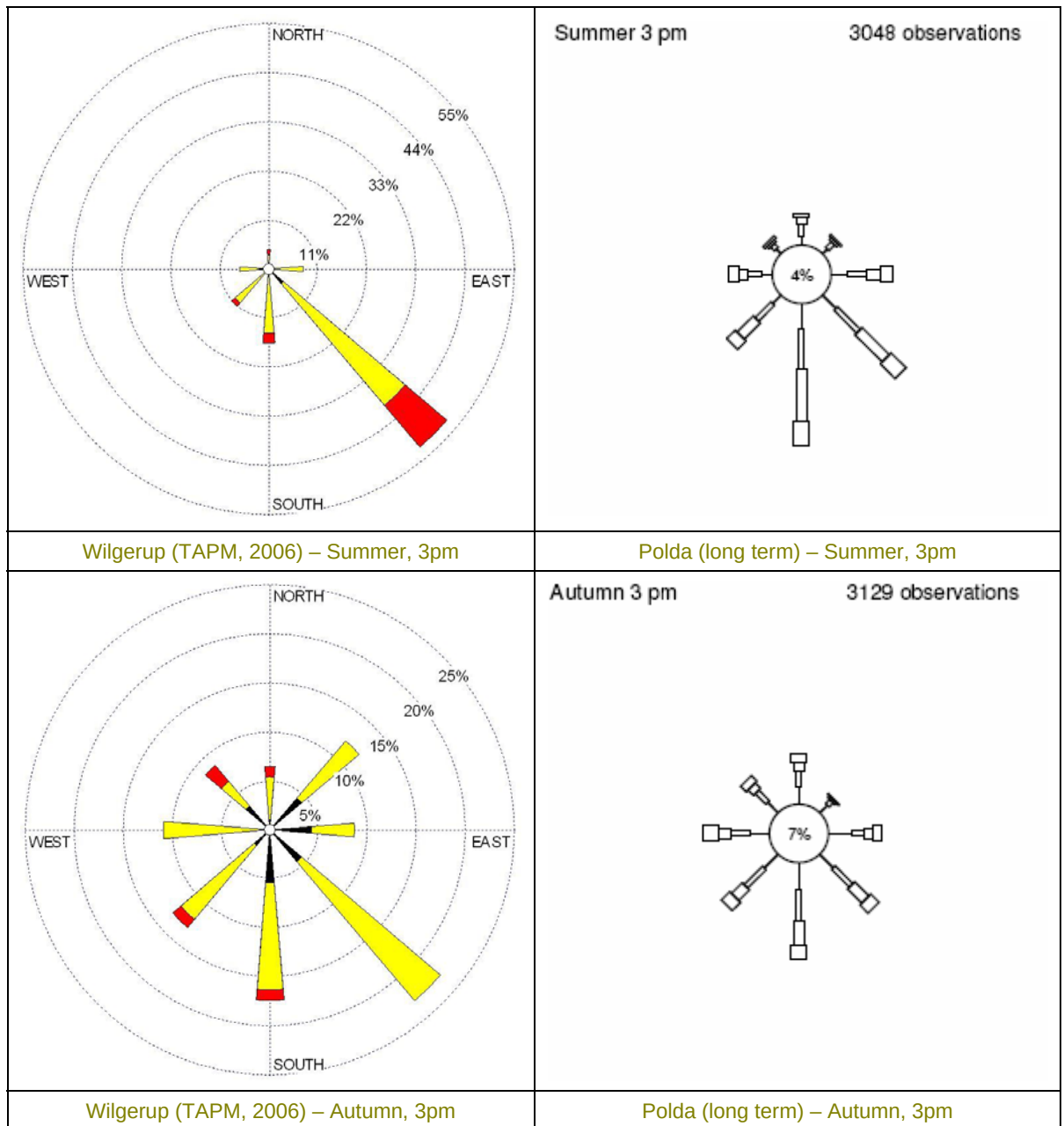


Calms: 0.00%





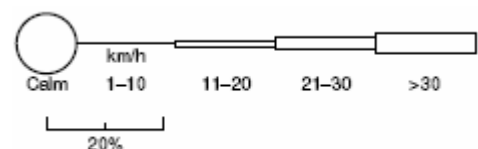
■ Figure 4-10 9am Seasonal Wind Roses for Wilgerup (2006) and Polda (Long Term)

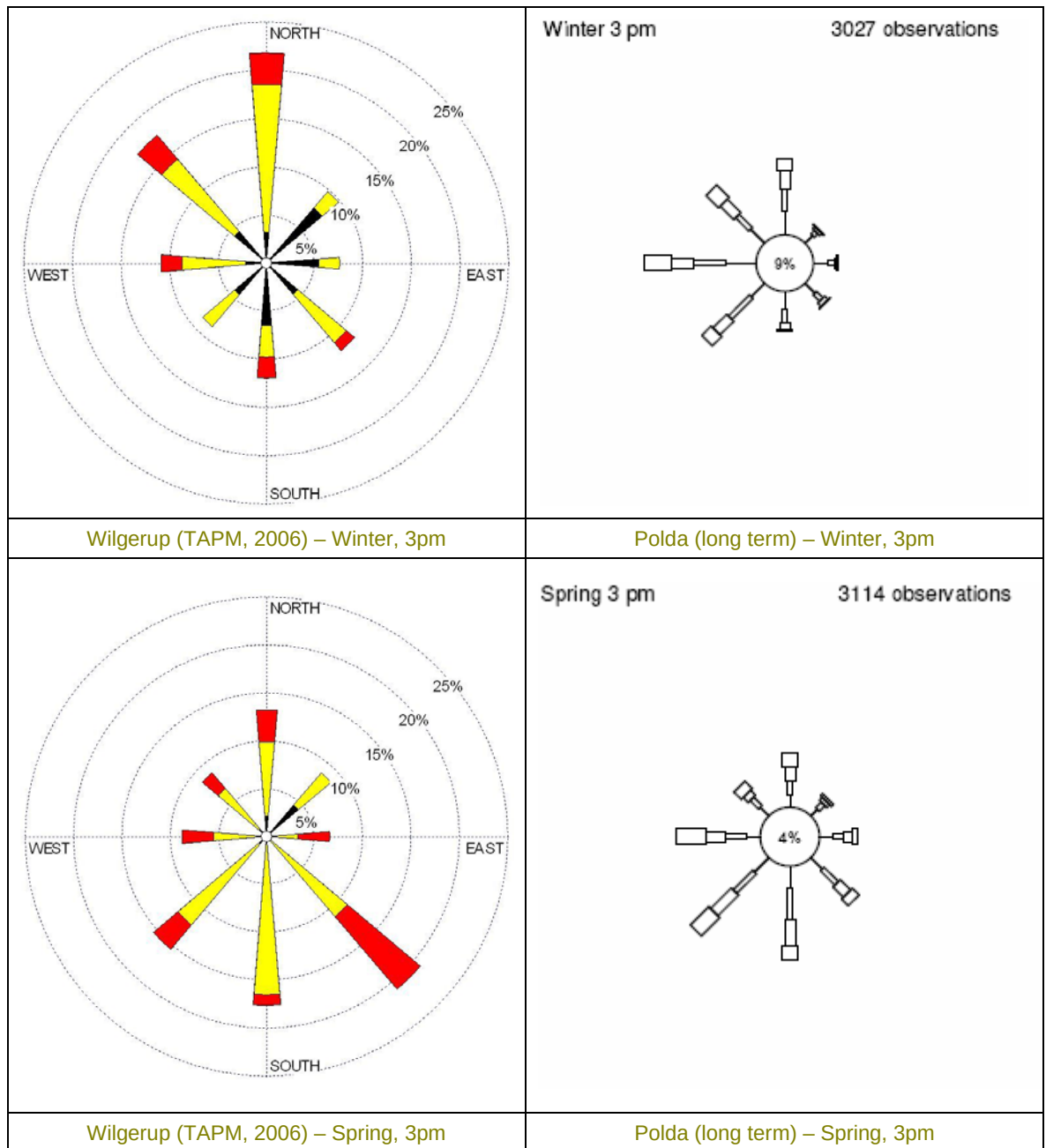


WIND SPEED
(m/s)

Green	>= 40.0
Blue	30.0 - 40.0
Red	20.0 - 30.0
Yellow	10.0 - 20.0
Black	0.0 - 10.0

Calms: 0.00%





■ **Figure 4-11 3pm Seasonal Wind Roses for Wilgerup (2006) and Polda (Long Term)**

4.8. Geohazards

The Earthquake Hazards Zones Map for South Australia (Planning SA, 2008) shows that the project is not located within an area of the state that may be subject to earthquake loads in accordance with AS1170.4 2007 Structural Design Actions – Earthquake Actions in Australia.

The potential for acid rock drainage is considered in Section 5.7.1.



4.9. Hydrology

Assessment of the regional contour plans by SKM (see Figure 4-5) of the Lock area identified that the proposed mine site is not within a defined waterway. Possible overland flow paths from the ridge to the south west of the mine site are not confined to one particular flow path.

The predominant sandy soil profile indicates that the majority of rainfall events will not result in runoff. However, sands of the Eyre Peninsula have potential to be non-wetting sands which could increase the likelihood of runoff and, in larger or longer rainfall events, runoff from the catchment could occur.

4.10. Groundwater

4.10.1. Geological setting

The Wilgerup deposit lies within the Gawler Block, a stable craton with crystalline basement rocks which range in age from 2700 million years to 900 million years. Stabilisation of the craton took place after the Kimban Orogeny at about 1450 million years. The Poldia Trough, a major structural and depositional feature passes from east to west to the north of the ore body.

The main geological formations of the region are summarised in Table 4-10.

■ **Table 4-10 Main regional geological formations**

Archaen	According to previous geological exploration of the region, the area north and west of the deposit is underlain by ancient Archaen to very early Proterozoic rocks of the Sleaford Complex.
Palaeo-proterozoic	Overlying the Sleaford Complex in the area of the Wilgerup deposit are rocks of the Hutchison Group. These are a sequence of highly deformed and metamorphosed mixed clastic and sedimentary rocks which range in age from latest Archaen through to Early Proterozoic. Deposition was terminated by the Kimban Orogeny which deformed and metamorphosed the sequence to Upper Amphibolite facies. The basal member of the group, the Warrow Quartzite outcrops at Tooligie Hill.
Tertiary	Renewed subsidence in the Poldia Trough during the Tertiary (Middle to Late Eocene) caused the deposition of the Poelpena Formation consisting of poorly sorted fine to very coarse grained sands with interbedded grey clays, carbonaceous clays and lignites. The thickness of the unit in the Lock area varies from 15 to 30 metres.
Quaternary	Thin veneers of Quaternary sediments mask the underlying Proterozoic and Tertiary rocks. These are the Pleistocene to Holocene inland, longitudinal dunes and sand spreads of the Wiabuna Formation and Moornaba Sand.

Source : SARIG Open File Envelope 8031

The Wilgerup ore body has been classed in PIRSA (2000) as a palaeoproterozoic residual deposit similar to other Middleback Range deposits on the eastern Eyre Peninsula. Geologically, the Middleback Subgroup occurs as a complex series of discontinuous, folded strike ridges stretching 250 km north-south. Centrex believes that both the Upper and Lower Middleback Iron Formations are represented at Wilgerup.



4.10.2. Regional Hydrogeology

Limited information is available regarding aquifer resources in the central Eyre Peninsula, and there have been few water bores or investigations conducted since the mid 1970s⁷. Nevertheless, the area to the east of the site in the Musgrave Prescribed Wells Area (PWA) has been fairly extensively studied and provides an indication of the main hydrogeological units that may exist in the Wilgerup region.

The underground water resources of the Musgrave Prescribed Well Area (PWA) are contained primarily within the Quaternary Bridgewater Formation limestone and the Tertiary Sand aquifers of the Eucla and Polda Basins⁸. Minor underground water resources are found within Jurassic and fractured basement rocks. Underground water from the PWA currently fills only a minor proportion of Eyre Peninsula's reticulated public water supply needs. The origin of the underground water is dominantly via infiltration of "recent" rainfall.

The main aquifers present in Musgrave PWA are listed in Table 4-11 and illustrated by Figure 4-12.

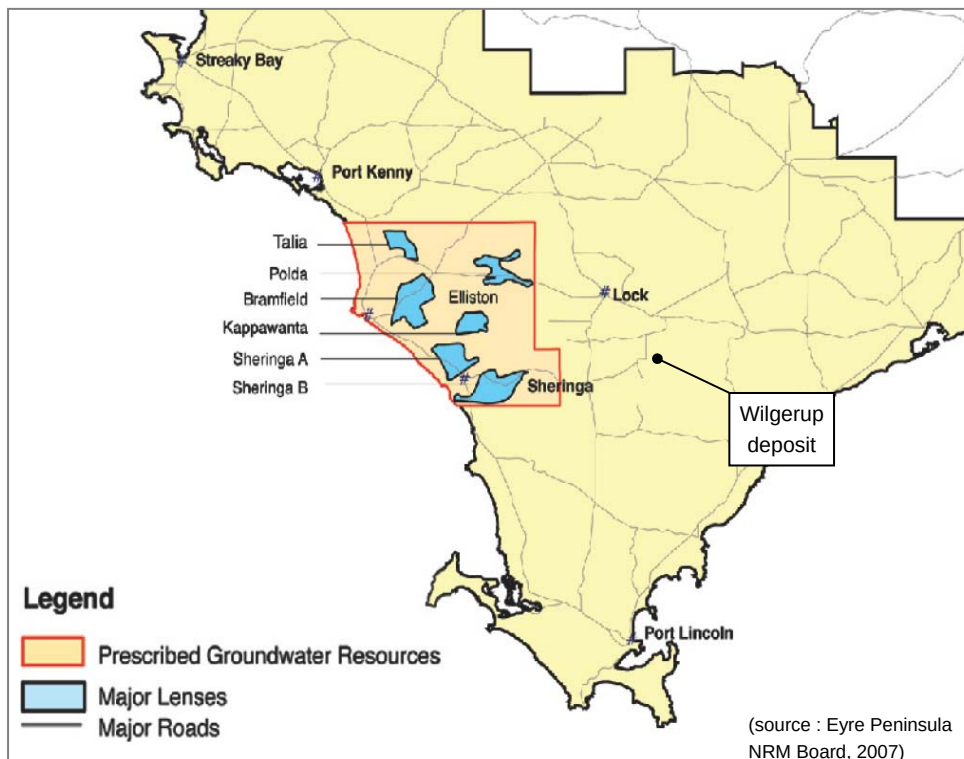
■ **Table 4-11 Main aquifers present in Musgrave PWA**

Quaternary Limestone Aquifer	The Quaternary Limestone aquifer is unconfined. Depth to water table and salinity of the underground water vary widely across the region. The resources of most significance are the major lenses with generally high yields (from 5 up to 50 litres per second) and low salinity (< 1000 mg/L total dissolved solids (TDS)). The major lenses of the Quaternary Limestone unconfined system are Bramfield, Kappawanta, Polda, Sheringa A&B and Talia. Underground water flow within the Quaternary Limestone system is predominantly in a south-westerly direction towards the Southern Ocean. The Quaternary Limestone aquifer is frequently underlain by a Tertiary clay formation which acts as an aquitard separating the aquifer from deeper systems.
Tertiary Sands Aquifer	The Tertiary Sands aquifer occurs throughout the area and consists of unconsolidated fine quartz-sands, has significant storage, a salinity from 500 - 5500 mg/L TDS, with poor to moderate yields (1 to 10 litres per second). It is confined in those areas where it underlies the saturated Quaternary Limestone and Tertiary clay unit, but is also known to be unconfined in other areas. The Tertiary Sands aquifer receives both lateral flow and downward leakage as recharge from the Quaternary Limestone. Underground water flow within the Tertiary system is predominantly in a south westerly direction towards the Southern Ocean.
Jurassic Aquifer	This aquifer has fine-grained sands and occurs predominantly in the east of the Musgrave PWA. Due to high salinity (30,000 to 50,000 mg/L TDS) and low yields it is of little significance within the prescribed area.
Basement Aquifer	There is limited information and understanding regarding the salinity and yield of the Basement aquifer within the Musgrave PWA. The aquifer is composed of weathered bedrock.

Source : SA Dept for Water Resources, 2001

⁷ Mr Prabodh Das, Eyre Peninsular NRM Board, 14 November 2007, *pers. comm*

⁸ SA Dept for Water Resources, 2001



■ **Figure 4-12 Locations of Musgrave PWA and Wilgerup deposit on the Eyre Peninsula**

Based on a review of drillhole information and published geological maps, only the Tertiary Sands Aquifer and Basement Aquifer are thought to be present in the immediate vicinity of the project area. Table 4-12 presents the four registered water bores located within 20 km of the Wilgerup deposit (see Figure 4-13 for locations). Based on information from nearby stratigraphic drillholes, three of these bores appear to be installed in the Tertiary Sands Aquifer and indicate that it has a salinity of greater than 20,000 mg/L. As there are few drillholes located around water bore 6030-30, it is possible this may be installed in the Basement Aquifer, based on its depth.

The Tertiary Sands Aquifer is likely to increase in thickness in the Poldia Basin⁹, the southern boundary of which is located roughly 5 km to the north of Wilgerup (see Figure 4-13). The Jurassic Aquifer also is likely to be present in this northern area; however, few water bores have been registered in the region.

⁹ Mines and Energy, 1995



■ **Table 4-12 Water bores located within 20km of the Wilgerup iron ore deposit**

Bore ID	Construction date	Distance (km)	Depth (m)	Water Level (m below ground)	Est. Yield (L/s)	Salinity (mg/L)
13128 (6030-13)	2/12/1958	1.6	36.6	-	0.19	21,400
13343 (6030-228) *	13/6/1990	1.9	49	-	2.5	43,400
13145 (6030-30)	1967	13.3	54.9	-	-	6,560
13230 (6030-115)	4/5/1937	18.1	27.4	-	2.5	32,700

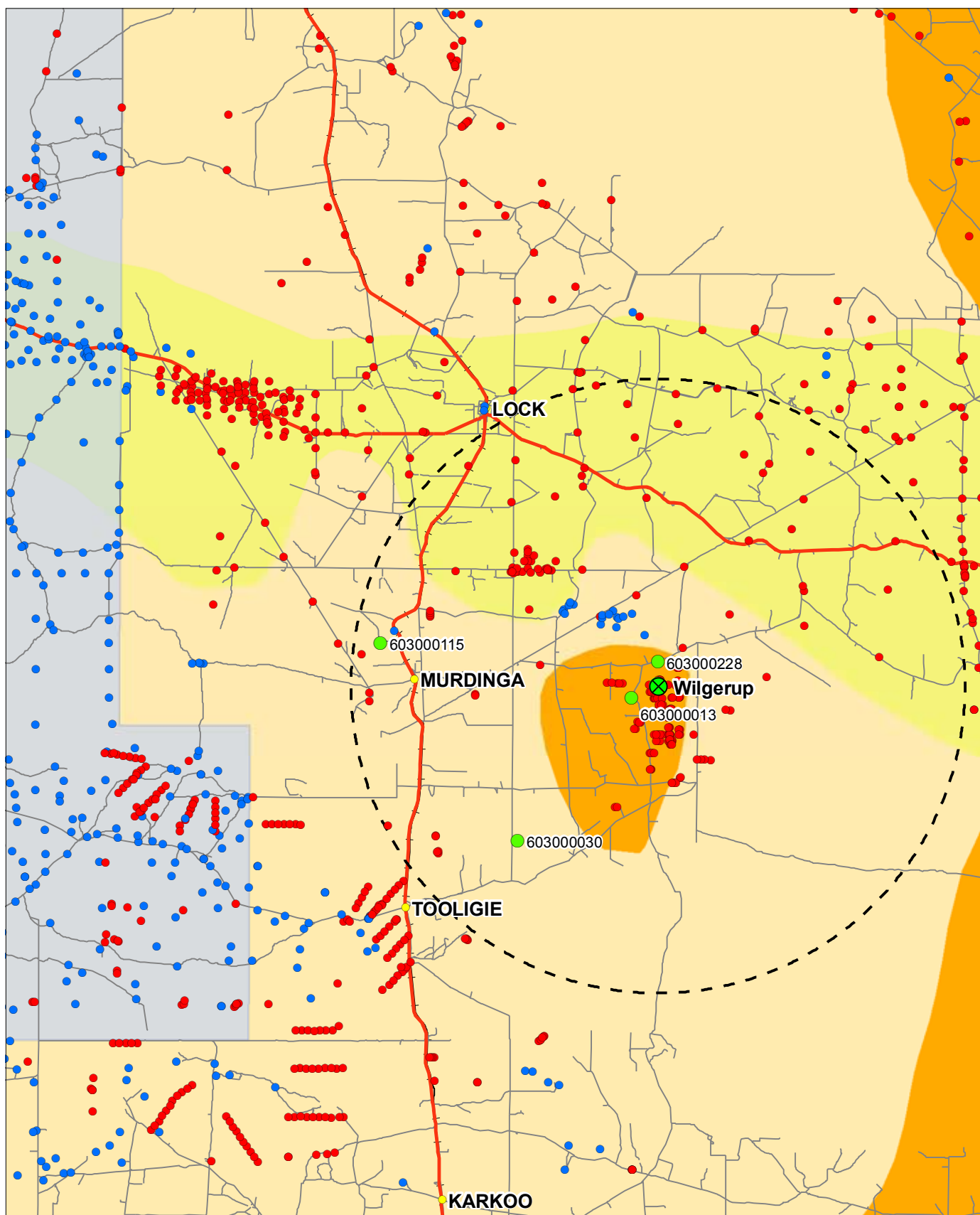
Notes.

1. Taken from DWLBC database (e-NRIMS website, accessed March 2008)
2. * On Leigh Gosling's property
3. A number of shallow bores intercepting a perched aquifer were installed in 1995 for the Murdinga Landcare project., These 16 bores are between 1.2 and 6.6m depth and are located between 5 and 8km from the Wilgerup deposit.

4.10.3. Groundwater Use

Available information indicates there is limited groundwater use in the central Eyre Peninsula region. A small number of wells in the region west of Tooligie and Lock are known to access brackish water from the Tertiary formations for stock use. None of the four registered or known wells within 20 km of the Wilgerup deposit are being used for water supply purposes (due to the high salinities).

Based on its high salinity there is no recorded or likely use of groundwater from the Basement Aquifer or from the aquifers of the Poldia Basin.



- Water Bores Located within 20kms of Wilgerup Iron Ore Deposit
- Mineral Exploration Drillholes
- Water Bores
- Town
- Major Road
- Minor Road
- Railway Line
- Cainozoic sediments
- Precambrian basement with thin Cainozoic cover
- Poldo Basin (Jurassic)
- Musgrave Prescribed Wells Area
- 20km Buffer

Data Sources
PIRSA Geological Layers

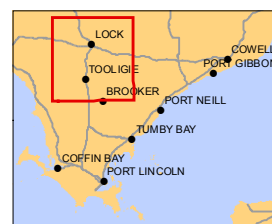
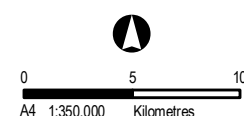


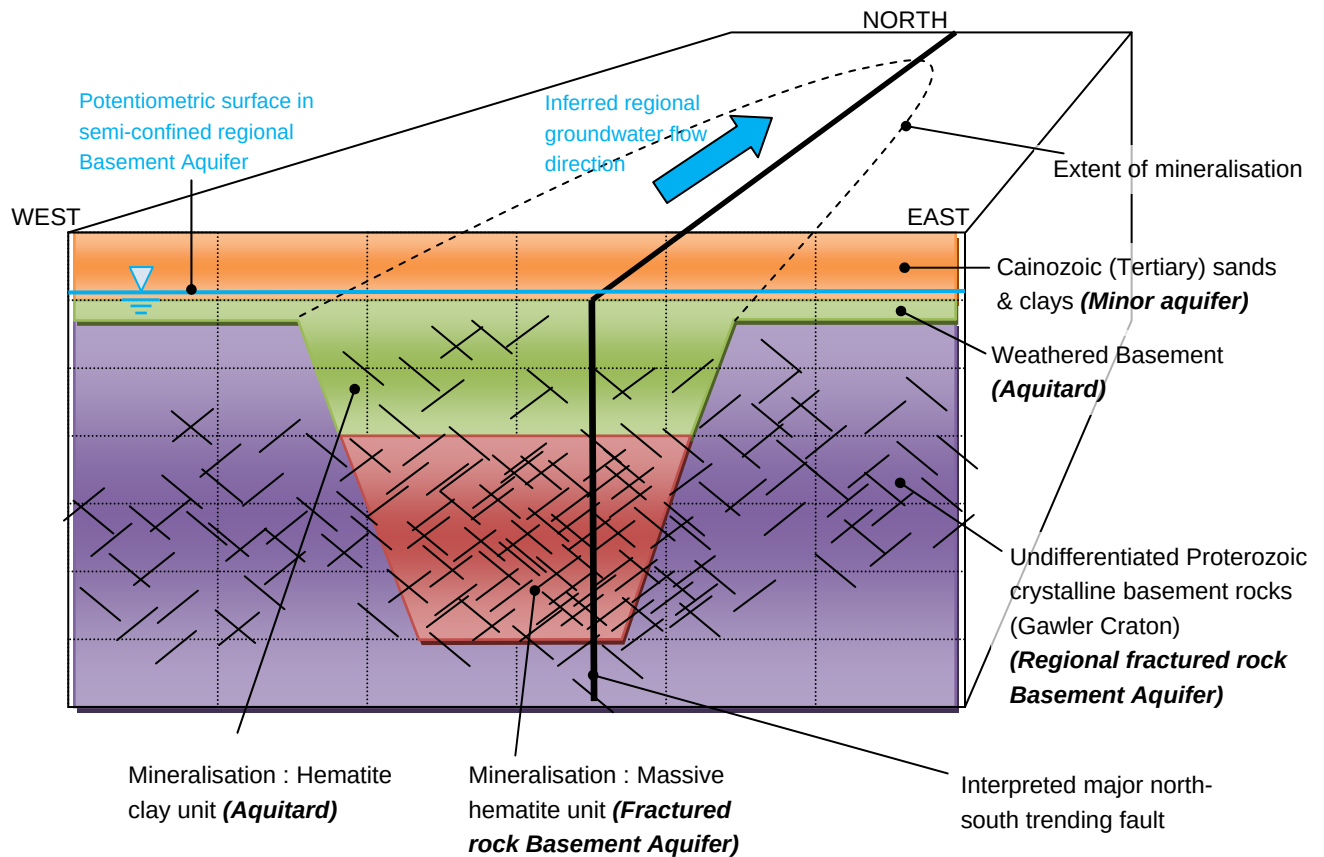
Figure 4-13 Regional geology and registered groundwater wells

GDA 1994 MGA 53



4.10.4. Local Hydrogeology

The two aquifers of interest at the proposed Wilgerup mine-site are the Tertiary Sands Aquifer and Precambrian fractured rock Basement Aquifer. These aquifers are shown in a conceptual hydrogeological model of the Wilgerup iron ore deposit in Figure 4-14 (SKM 2008).



■ **Figure 4-14 Conceptual hydrogeological model of the Wilgerup Iron Ore deposit**

4.10.4.1. Tertiary Sands Aquifer

The lower section of the Tertiary unconsolidated sands (thickness of 20 to 30 m) through the area was found to be consistently saturated during Centrex's exploration drilling in 2007 and 2008. Based on the extensive RC exploration drilling program, the aquifer thickness was found to be generally tens of centimetres. The saturated zone was typically underlain by clays corresponding with weathered basement (hematite, BIF, chert and quartzite).

As witnessed elsewhere on the Eyre Peninsula (SA DWR 2001), the regional Tertiary Sands aquifer is likely to be unconfined and varies in thickness depending on the undulations in the underlying bedrock. While thin interbedded clay layers were observed to be common during exploration drilling in the upper part of the formation (0 to 8 m), sands were ubiquitous with depth



indicating that the thin Tertiary Sands Aquifer is probably unconfined in this area and likely to be directly recharged by rainfall where overlying clays are limited.

The salinity of the Tertiary Sands Aquifer groundwater was not measured at the site, but is likely to be moderately saline (as measured elsewhere in the central Eyre Peninsula). Minor brackish to fresh 'lenses' may form above depressions in the bedrock surface.

Due to the limited saturated thickness of this aquifer, it is unlikely to be of any consequence as a water resource nor be of detriment to mine excavation activities.

4.10.4.2. Precambrian fractured Basement Aquifer

Based on extensive mineral exploration drilling and a preliminary hydrogeological field investigation (SKM, 2008), the Basement Aquifer has well developed secondary porosity (fractures) but probably very little primary porosity. At the Wilgerup deposit, the aquifer appears to be confined to semi-confined below significant clayey weathered zones.

Based on the geological model of the ore-body, the aquifer is likely to be highly heterogeneous. The more permeable sections of the aquifer appear to be associated with deeper fractured zones in 'massive hematite' (with lower clay content) at more than 80 m below ground level.

The piezometric levels in the Basement Aquifer were found to be roughly 20 m below ground level (and above the base of the Tertiary sediments) between 74.5 and 78 mAHD. The levels in the water wells are consistent with water levels in collapsed exploration drillholes. The potentiometric surface is generally flat (with several localised slight anomalies), however may indicate a slight hydraulic gradient to the north. There may therefore be a northerly groundwater flow direction across the site. The Basement Aquifer probably has limited through-flow and limited recharge.

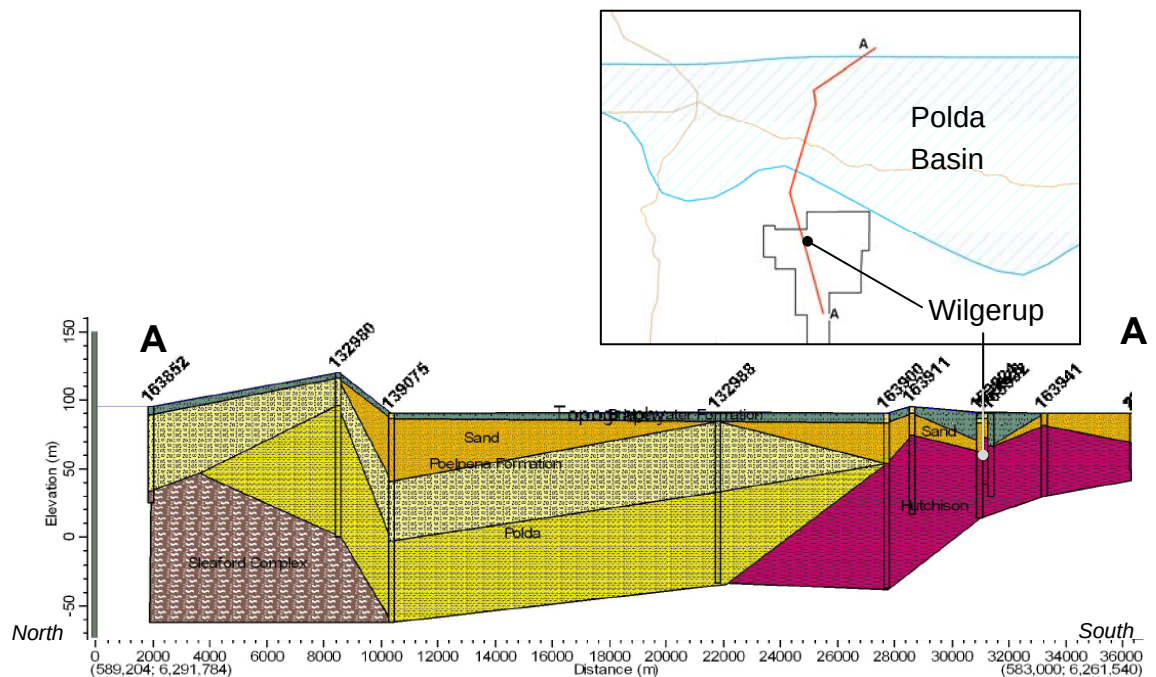
It is unclear how interconnected the Basement Aquifer is with (marginally) water bearing zones encountered at irregular depths throughout the ore-body and rock overburden. Due to the consistently high piezometric levels, it is nevertheless assumed that the ore-body is fully saturated.

The aquifer transmissivity (T) in the immediate surrounds of a test well located in the centre of the ore-body was estimated to be between 20 and 90 m²/day (SKM 2008). Assuming a saturated thickness of between 20 and 40 m, the average horizontal hydraulic conductivity (K_h) is therefore in the range of 1 to 5 m/d. It is however, difficult to assess the horizontal anisotropy of the Basement Aquifer from limited field results, although there are consistent indications that the aquifer is vertically isotropic (ie. K_v = K_h).

The aquifer is likely to be laterally extensive with no significant major structural boundaries found within 500 to 1000 m of the centre of the ore-body. This indicates that it extends outside the ore-



body into the surrounding crystalline basement formations (also likely to be characterised by secondary porosity). However, it is likely that the regional Basement Aquifer is limited to fracture zones associated with geological structures. As there is a major north-south trending fault through the Wilgerup deposit, the Basement Aquifer is best conceptualised as a ‘strip’ aquifer, though the width of the aquifer is possibly fairly extensive (i.e. > 1 km). There may be some hydraulic connection between the Basement Aquifer and the sedimentary (porous media) aquifers of the Poldia Basin located between 5 and 10 km to the north and east of Wilgerup (see Figure 4-15).



■ **Figure 4-15 Stratigraphic cross-section from Wilgerup to the Poldia Basin**

The aquifer storativity was calculated to be roughly 10^{-4} to 10^{-3} which is characteristic of semi-confined systems. For mine dewatering purposes, it is assumed that the rock matrix has a similar specific yield (Sy) to other Precambrian fractured sedimentary rock systems in the region. Dewatering the fractured Proterozoic quartzite & sandstone of the Stuart Shelf at Olympic Dam, for example, produced estimates of Sy of 0.001 to 0.01 (Waterhouse *et al.* 2002).

Due to the arid climate and impermeable clay formations covering the Wilgerup deposit, it is likely that local rainfall associated recharge is negligible. Nevertheless, as the primary fracture system is likely to extend several kilometres to the north and south of the mine site, it is possible that the system has a greater degree of recharge elsewhere.



4.11. Flora

4.11.1. Background

The Eyre Peninsula is recognised as an important area for many flora species (DEH, 2002). Situated between arid lands to the north and the sea to the east and west, the Eyre Peninsula is biogeographically isolated, leading to a high degree of endemism; more than 40 plant species have been identified as unique to the Eyre Peninsula (DEH, 2002).

The Eyre Peninsula is covered by three biogeographic sub-regions [as defined under the Interim Biogeographical Regionalisation of Australia (IBRA)]; the Eyre Hills, the Eyre Mallee (incorporating the proposed ML area), and Talia. The Eyre Mallee sub-region is predominantly centrally located on the peninsula and is climatically more arid than the coastal and southerly regions. Large areas of mallee (including the *Eucalyptus incrassata*/*Melaleuca uncinata* association, *E. socialis* and *E. gracilis*) have been cleared for cereal cropping, with livestock grazing resulting in additional clearance and degradation of lower strata native vegetation. Extensive dunes and sand sheets are also dominant within the region.

The proposed ML area is located on cropping land in the centre of the peninsula. This region is of low ecological diversity and poor habitat value due to extensive historic clearing of native vegetation for cropping and grazing purposes and the associated impacts of these activities. The site itself (Figure 4-16) has been mostly cleared of vegetation, but retains patches of remnant native vegetation in the form of isolated stands of mallee surrounded by cropping land.

4.11.2. Survey methodology

A desktop study has been previously undertaken for the site, reported as *Ecological Review, Wilgerup Mine Site* (SKM, 2007). A site visit was undertaken on 27 and 28 February 2008 by SKM ecologists. The entire study area (the proposed ML area) was surveyed by vehicle and on foot during clear dry conditions. Plant species observed within each distinct vegetation association were then identified to characterise the association and a general assessment of vegetation over the site as a whole was undertaken.

The condition of native vegetation remnants was assessed following the methodology outlined in Guidelines for a Native Vegetation Significant Environmental Policy under the *Native Vegetation Act 1991* and *Regulations 2003* under the *Requirements for Mineral Exploration and Mining*. A key component of this assessment was the determination of vegetation condition and the assignment of a significant environmental benefit (SEB) ratio. SEB ratios are used to calculate the overall area required to be offset in compensation for impacted areas of native vegetation, with high quality native vegetation requiring a greater offset area than low quality native vegetation. Details of SEB calculations are provided in Section 8.3.11



4.11.3. Survey Results – vegetation character of site

Open arable/pastoral fields account for the majority of the site, with small, clearly defined mallee patches occurring throughout. The arable/pastoral fields showed evidence of previous commercial crop species and were stocked with sheep at the date of the survey.

There were a total of 22 isolated small patches of vegetation distributed over the proposed ML area, identified as patches A through V (Figure 4-16). These patches of remnant native vegetation make up a total of 57.2 hectares within the proposed ML boundary (Figure 4-16), and vary in size from 0.34 to 6.35 ha. In some instances, more than one patch of vegetation was grouped together for descriptive purposes when they were proximate to each other and of similar composition.

A total of 17 flora species was recorded within the patches surveyed, with an additional species found in close proximity to Patch R. Overall species diversity was considered very low. Species identified included 6 Eucalypt species (*E. socialis*, *E. leptophylla*, *E. dumosa*, *E. diversifolia*, *E. gracilis*, and *E. incrassata*), and three Melaleuca species (*M. uncinata*, *M. lanceolata*, and *M. acuminata*). Two species of native pine (*Callitris gracilis* and *Callitris verrucosa*) were also recorded, although in low density.

Patches were generally low open forest or open scrub/open heath. The overstorey was usually dominated by *Eucalyptus socialis* or occasionally *E. incrassata* (patches M and W). *E. socialis* was the most widely spread overstorey vegetation and occurred in all patches except the dune ridge in the north-east of the site (patch W). The overstorey was shared between *E. socialis* and four other species of eucalyptus – *E. dumosa*, *E. leptophylla*, *E. gracilis* and *E. diversifolia* – with up to four species in any one patch. The overstorey also comprised occasional *C. verrucosa* and *C. gracilis*. The common names and distribution of these species over the site is summarised in Table 4-13.

Understorey vegetation was clearly dominated by *Melaleuca uncinata*, which was found in high abundance in all patches. *M. uncinata* shared the lower strata with *M. lanceolata* and *M. acuminata*. This vegetation was in some cases almost as tall as the overstorey and could be considered overstorey in some isolated areas. Ground cover was generally sparse due to grazing impacts, but was dominated by *Gahnia deusta*.



Legend

- Indicative Mine Layout
- Significant Environmental Benefit Areas
- Proposed mining lease area
- Cadastre

Data Sources
Aerial imagery supplied by DEH 2004

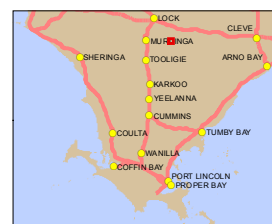
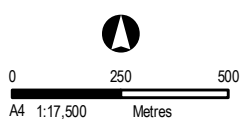


Figure 4-16 Wilgerup vegetation associations

GDA 1994 MGA Zone 53



Bare ground and litter cover varied widely: litter cover ranged from 10-70%, bare ground varied from 5-70% and rocky cover varied from 0-20% (means of 26.3%, 35%, and 5.4% respectively). Areas with high sheep impact were in the poorest condition and had the highest proportion of bare ground. Soil erosion in the form of moderate surface sheeting and scalding was evident. The small size of the scrub blocks is a significant factor in exacerbating disturbance agents such as weed invasion, fertilizer and herbicide drift, grazing pressure and exposure to wind, as the edge to area ratio of patches is high.

Generally, *Eucalyptus socialis* +/- *Melaleuca uncinata* low open woodland was the dominant vegetation association found in the majority of patches. Individual trees within the patches were in relatively good health, showing little evidence of die back. Average height for the eucalypt trees was 5-6 m, usually with small (approximately 1 m) to no gaps between canopies. The parasitic creeper Large Dodder Laurel (*Cassytha melantha*) was observed within approximately half of the mallee patches. Whilst the species is a native, it is considered an environmental weed which can overgrow trees and sometimes lead to mortality.

Intensive grazing by sheep has heavily impacted upon lower strata, ground flora and emergent species. Only low numbers of *Gahnia deusta* were found during the survey, with significant areas often totally devoid of any ground flora. Only one tussock of *Austrostipa* sp. grass (species unknown due to poor specimen) was observed during this survey. This was located close to a fence line to the immediate south of patch R. All patches were unfenced from the main pasture fields, with sheep tracks noted throughout most of the patches. Some patches suffered heavily from grazing impacts. Limited ground litter was evident, possibly exacerbating soil erosion.

It is worth noting that the seasonal timing and clear evidence of drought impacts resulted in suboptimal conditions for the survey. It is likely that additional species would be recorded if a repeat survey was to occur in spring. However, a significant increase in vegetation value arising through identification of additional species diversity and abundance is unlikely to occur due to the intensive grazing occurring throughout the site.

No species or vegetation communities of conservation significance were recorded in the patches, or within the proposed ML area as a whole (Figure 4-16). Comprehensive survey data for each patch are presented in Appendix F.1, including a description of each. Photographs of each patch are provided in Appendix F.2.



■ **Table 4-13 Floral species occurrence by vegetation patch**

Species	Common name	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
<i>Eucalyptus socialis</i>	Red Mallee	●	●	●	●	○	●	●	●	●	●	○	●	●	●	●	●	○	●	●	●	●	●
<i>Eucalyptus leptophylla</i>	Narrow-leaved Red Mallee	●	●	○	○		○		○	●	○		○	●	●	●	○	○		○			
<i>Eucalyptus dumosa</i>	Bull Mallee	○	○	○		○		○		○	○			○	○	○		○	●	●	●	●	●
<i>Eucalyptus diversifolia</i>	Coastal White Mallee			○	○	●	○	○	○						●			●	●		●		●
<i>Eucalyptus gracilis</i>	Yorrell												○										
<i>Eucalyptus incrassata</i>	Yellow Mallee			○	○						○	●	○	○				○					
<i>Melaleuca uncinata</i>	Broombush	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Melaleuca lanceolata</i>	Black Tea-tree	○	○		○	○				○	○			○	○	○	○	○	○	○	○	○	○
<i>Melaleuca acuminata</i>	Mallee Honey-myrtle	○	○		○	○	○	○	○					○	○	○		○	○			○	
<i>Callitris gracilis</i>	Southern Cypress-pine	○	○												○			○	○				
<i>Callitris verrucosa</i>	Mallee Cypress-pine											○											
<i>Gahnia deusta</i>	Gahnia	○	○	○	○	○	○	○	○				○	○	○	○	○	○	○	○	○	○	○
<i>Santalum murrayanum</i>	Bitter Quandong					○									○						○		
<i>Exocarpos aphyllus</i>	Leafless Cherry	○	○										○	○	○	○		○	○	○			
<i>Cassytha melantha</i>	Large Dodder Laurel	○	○	○							○	○	○					○	○			○	○
<i>Leucopogon parviflorus</i>	Coastal Bearded-heath					○																	
<i>Clematis microphylla</i>	Old Man's Beard																	○					
<i>Austrostipa</i> sp.	Spear-grass																		○				

Legend: ● Species dominant within vegetation association
○ Species present within vegetation association



4.11.4. Significant vegetation

No threatened species or vegetation communities were found on the site. While scattered trees occurred, these were almost exclusively plantings of native species along internal roads rather than remnant indigenous vegetation and as such are not included in calculations of environmental impact. No trees were observed that supported hollows suitable for habitation by wildlife. The patches of vegetation on the site are also highly insular and isolated, with little or no value as a wildlife corridor and no connectivity to any other native vegetation in the region. The nearest patch of vegetation with any significant habitat or conservation value is Hincks Conservation Park, which is located approximately 4 km from the southern edge of the proposed ML boundary.

4.11.5. Arable/Pastoral land

The majority of the site (i.e. outside of the patches) comprised arable/pastoral fields of little or no habitat value. Indeed, at the time of survey there was an almost total absence of vegetation of any kind, and native vegetation was limited to a single *Austrostipa* sp. tussock close to Patch R. Other cover included remnants from harvested cereal crops and arable weed species, such as Wild Melon (*Citrullus lanatus*). High density sheep grazing (relative to vegetative cover) occurs throughout these fields, and indeed through the mallee patches, which are currently not fenced. It appears unlikely that the regeneration of native grass species would occur without significant management.

4.11.6. Weeds

Weed species were found in high abundance within the arable/pastoral fields. This was particularly evident within the southern half of the proposed ML area. Dominant weeds in the cropped area of the site included Wild Melon (*Citrullus lanatus*) and Common Heliotrope (*Heliotropium europaeum*). Additional exotic species occur throughout the arable/pastoral and include Wimmera Rye Grass (*Lolium rigidum*), Barley Grass (*Hordeum vulgare*), Red Brome (*Bromus rubens*) and Wild Turnip (*Brassica tournefortii*).

4.11.7. Extent of proposed clearance

The area of vegetation to be cleared will be limited to a small number of mallee patches as indicated in Figure 4-17. Details of the exact areas of the clearance and calculations of offsets are given in Section 8.3.11. The areas to be impacted include the entirety of patch I and J, and some portion of patches K, A, B and C. These patches are of similar quality (except for Patch I, which is of lower quality) and consist of mallee overstorey over melaleuca.



Legend

- Indicative Mine Layout
-  Vegetation impact areas
- Significantly Environmental Benefit (SEB) ratio
-  2:1
-  4:1

Data Sources
Aerial imagery supplied by DEH 2004

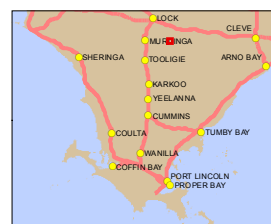
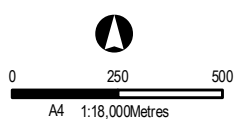


Figure 4-17 Vegetation impact areas

GDA 1994 MGA Zone 53



4.12. Fauna

The site and general vicinity provide low to no habitat value for fauna because of the highly degraded nature of the region and intensive use of land for cropping and grazing activities. While open fields can favour some species, the widespread lack of refuge excludes the majority of fauna and limits biodiversity. Bird species are likely to find some habitat in the small vegetation patches within the proposed ML area but, given the lack of ground cover and impacts from sheep grazing, it is generally unsuited to most mammal and reptiles species. Because of the highly degraded nature of the site, fauna trapping was not undertaken, and investigations were limited to desktop survey and site inspection for evidence of animal presence (tracks, scats and suitable habitat).

4.12.1. Survey Methodology

Desktop investigations were undertaken to identify the possible occurrence of threatened species at the site through a search of the EPBC protected matters database. Following this, opportunistic observations of fauna, and investigations of suitable habitat and traces of animal activity were undertaken during a site visit by SKM ecologists on 27 and 28 February 2008.

4.12.2. Survey results – fauna species occurrence

The desktop survey identified 10 threatened fauna species as possible inhabitants of the area, comprising 9 birds and 1 mammal (Table 4-14). With the exception of the Malleefowl, these listed bird species are all migratory and/or marine species that are unlikely to use the habitat in the vicinity of the proposed ML area. The Malleefowl and Sandhill Dunnart were identified and these species are addressed further within Section 4.12.3. The desktop survey identified a further 11 bird species for which records exist within 2 km of the site. Of these, 3 were introduced species (blackbird, starling and sparrow), and 8 were indigenous (Willie Wagtail, Pelican, Silver Gull, New-holland Honey-eater, Red Wattlebird, Masked Lapwing, Brush Bronzewing and Malleefowl). All of these birds with the exception of the Malleefowl are commonly occurring species with broad distributions. Table 4-14 lists the species found in both searches and the conservation status of these species.

Evidence of other fauna presence at the site was limited to broadly distributed kangaroo scats and fox footprints, and shed skin material of the Shingleback Lizard (*Tiliqua rugosa*) found close to Patches C and E.



■ **Table 4-14 Threatened species identified in desktop study as possibly occurring in area**

Species	Common Name	EPBC Act Status	NP&W Act Status	Search
<i>Charadrius veredus</i>	Oriental Plover, Oriental Dotteral	Migratory	-	EPBC
<i>Leipoa ocellata</i>	Malleefowl	Vulnerable	Vulnerable	EPBC / DEH records
<i>Merops ornatus</i>	Rainbow Bee-eater	Migratory	-	EPBC
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	Migratory	Vulnerable	EPBC
<i>Apus pacificus</i>	Fork-tailed Swift	Migratory	-	EPBC
<i>Gallinago hardwickii</i>	Latham's Snipe, Japanese Snipe	Listed - overfly marine area	-	EPBC
<i>Hirundapus caudacutus</i>	White-throated Needletail	Migratory, Listed - overfly marine area	-	EPBC
<i>Ardea alba</i>	Great Egret, White Egret	Migratory	-	EPBC
<i>Phaps elegans</i>	Brush Bronzewing	-	-	DEH records
<i>Vanellus miles</i>	Masked Lapwing	-	-	DEH records
<i>Anthochaera carunculata</i>	Red Wattlebird	-	-	DEH records
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	-	-	DEH records
<i>Turdus merula</i>	Eurasian Blackbird	Introduced	-	DEH records
<i>Passer domesticus</i>	House Sparrow	Introduced	-	DEH records
<i>Sturnus vulgaris</i>	Common Starling	Introduced	-	DEH records
<i>Pelecanus conspicillatus</i>	Australian Pelican	-	-	DEH records
<i>Larus novaehollandiae</i>	Silver Gull	-	-	DEH records
<i>Rhipidura leucophrys</i>	Willie Wagtail	-	-	DEH records
<i>Ardea ibis</i>	Cattle Egret	Migratory	Rare	EPBC
<i>Sminthopsis psammophila</i>	Sandhill Dunnart	Endangered	-	EPBC

Eleven species of bird were observed during the site visit, including several not recorded by the desktop surveys (Table 4-15) below. None of the observed species are listed as threatened.



■ **Table 4-15 Bird species observed during site visit**

Common Name	Species
Australian Magpie	<i>Gymnorhina tibicen</i>
Australian Raven	<i>Corvus coronoides</i>
Brown Songlark	<i>Cinchoramphus cruralis</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>
Dusky Woodswallow	<i>Artamus Sordius</i>
Galah	<i>Cacatua roseicapilla</i>
Red Wattle Bird	<i>Acanthorhynchus carunculata</i>
Yellow Plumed Honey Eater	<i>Lichenostomus ornatus</i>
Yellow Rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Yellow Throated Miner	<i>Manorina flavigula</i>
White Browed Babbler	<i>Pamatosomus superciliosus</i>

4.12.3. Threatened species

The Malleefowl (*Leipoa ocellata*) and Sandhill Dunnart (*Sminthopsis psammophila*) were identified as potentially occurring at the site in desktop searches.

Previous records exist for Malleefowl in the area of the proposed ML. Malleefowl are known to inhabit intact areas of mallee vegetation, including the nearby Hincks Conservation Park. A sighting in the vicinity of the project area in 2000 indicates the possible occurrence of this species in the isolated mallee patches of the region. Malleefowl has been listed as Nationally Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* and the *National Parks and Wildlife Act 1972 (SA)*. Once widespread through semi-arid and arid regions, the Malleefowl is now considered as Nationally Vulnerable throughout Australia.

Intensive grazing, a lack of leaf litter due to wind erosion and severe isolation of the small to very small patches of mallee scrub have reduced the value of the site for foraging and breeding of Malleefowl. The site visit revealed no evidence of Malleefowl at the site, despite searches for nesting activity in all vegetation patches (Malleefowl mounds are easy to locate in a field survey due to their size).

The Sandhill Dunnart was not seen on the Eyre Peninsula between 1969 and 2000. It was rediscovered in 2000, although not in the immediate vicinity of the proposed ML area. Listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* and the *National Parks and Wildlife Act 1972 (SA)*, the Sandhill Dunnart is a carnivorous marsupial that uses mature *Spinifex* plants as habitat, potentially due to regulation of micro-climate and protection from predators.



The site visit revealed no indications of Sandhill Dunnart presence at the site. The site contains no habitat that could be regarded as suitable for the Sandhill Dunnart.

4.13. Geology and Soils

4.13.1. Topsoil and Subsoil

Shallow calcareous loamy sand was observed to dominate the site. This is typically less than 0.2 m deep over sheet limestone (calcrete). Strew limestone gravel and small rock is common on the soil surface. No distinct subsoil layer was observed, although accumulated organic matter and fine clays occur with increasing depth.

An overview of the regional soils is provided in Figure 4-18.

4.13.2. Geological Environment

The Wilgerup deposit lies within the Gawler Block, a stable craton with crystalline basement rocks which range in age from 2700 million years to 900 million years. Stabilisation of the craton took place after the Kimban Orogeny at about 1450 million years. The Poldia Trough, a major structural and depositional feature, passes from east to west to the north of the ore body.

The main geological formations of the region are summarised in Table 4-16.

■ **Table 4-16 Regional geological formations**

Archaen	According to previous geological exploration of the region, the area north and west of the deposit is underlain by ancient Archaen to very early Proterozoic rocks of the Sleaford Complex.
Early Proterozoic	Overlying the Sleaford Complex in the area of the Wilgerup deposit are rocks of the Hutchison Group. These are a sequence of highly deformed and metamorphosed mixed clastic and sedimentary rocks which range in age from latest Archaen through to Early Proterozoic. Deposition was terminated by the Kimban Orogeny which deformed and metamorphosed the sequence to Upper Amphibolite facies. The basal member of the group, the Warrow Quartzite outcrops at Tooligie Hill.
Tertiary	Renewed subsidence in the Poldia Trough during the Tertiary (Middle to Late Eocene) caused the deposition of the Poelpena Formation consisting of poorly sorted fine to very coarse grained sands with interbedded grey clays, carbonaceous clays and lignites. The thickness of the unit in the Lock area varies from 15 to 30 metres.
Quaternary	Thin veneers of Quaternary sediments mask the underlying Proterozoic and Tertiary rocks. These are the Pleistocene to Holocene inland, longitudinal dunes and sand spreads of the Wiabuna Formation and Moornaba Sand.

(Source : SARIG Open File Envelope 8031)



Legend

CSIRO Soil Atlas

-  Mountains - rocky ridges of metamorphic rocks
-  Plains with tracts of dunes: shallow forms of sandy alkaline yellow mottled soils with smaller areas of shallow forms of hard alkaline red soils

Data Sources
Aerial imagery supplied by DEH 2004



Figure 4-18 Soils

GDA 1994 MGA Zone 53



The Wilgerup ore body has been classed in PIRSA (2000) as a palaeoproterozoic residual deposit similar to other Middleback Range deposits on the eastern Eyre Peninsula. Geologically, the Middleback Subgroup occurs as a complex series of discontinuous, folded strike ridges stretching 250 km north-south.

Refer to Section 5.2 for further description of the geological environment.

4.14. Cultural Heritage

There are no sites within the project area listed on the Register of Aboriginal Sites and Objects, which is maintained by the Department of Aboriginal Affairs and Reconciliation, or the Australian Heritage Places Inventory.

As stated in Section 2.3.2, the proposed ML area is subject to a Native Title Claim by the Barngarla People. The project area (which lies within EL 3317), was previously held by a wholly owned Centrex Metals company, the SA Iron Ore Group, under EL 2676. A Work Area Clearance and Aboriginal cultural heritage surveys of several exploration leases on the Eyre Peninsula (including the project area) were undertaken in 2002 on behalf of the SA Iron Ore Group to examine areas affected by the proposed drilling programs at the site.

The survey report concluded that exploration activities would cause no adverse impacts to any areas or objects that are known to be of importance to the local Aboriginal community as long as all exploration activities are restricted to previously disturbed areas.

4.15. Proximity to Conservation Areas

The Hincks Conservation Park, a significant patch of remnant indigenous vegetation dominated by mallee assemblages, is located to the southeast of the proposed mine site and is approximately 4.5 km from the southern edge of the proposed ML boundary (see Figure 4-19). Aside from Hincks, the surrounding landscape consists only of highly fragmented and degraded small to tiny remnant patches which generally follow dune swales. Some of these are located between the project area and the Hincks Conservation Park. These are not currently considered to provide suitable refuge for fauna.

4.16. Pre-Existing Site Contamination and Disturbance

There is no known site contamination within the proposed ML area. There has been extensive historic clearing within the project area for cropping and grazing purposes.

Exploration drilling activities have also been undertaken at the site since 2006.



Legend

- Conservation Park
- Proposed mining lease area
- Cadastre

Data Sources
Aerial imagery supplied by DEH 2004

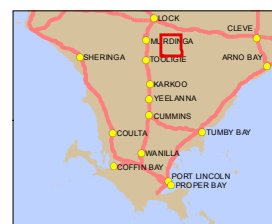
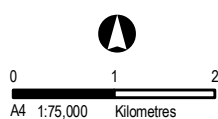


Figure 4-19 Proximity to Conservation Areas

GDA 1994 MGA Zone 53



5. Description of the Operation

5.1. General Description and Summary

The proposed operation will consist of an open cut mine which will extract approximately 10.4 million tonnes of iron ore over a six year period. Ore will be processed through a crushing and screening plant at a rate of 1.6 million tonnes per annum to produce two saleable products – “lump” and “fines” (refer to Section 5.5) – which will then be transported by road in covered trucks to a rail siding near Tooligie and from Tooligie siding by rail to Port Lincoln Wharf for export. During the life of the mine, exploration and resource definition drilling will continue on the lease, generally along the same geological structure that hosts the Wilgerup deposit.

Once mining commences the operation will employ around 78 people on site. Personnel will reside in the nearby towns of Cleve, Rudall or Lock and will commute to and from the mine by a company supplied bus or by personal transport if they prefer.

In its final (mined out) profile the proposed pit will be around 920 m long, 370 m wide (at its widest point) and 150 m deep. The pit wall angles and berm widths used to design the pit were derived from a geotechnical investigation and aim to ensure that the pit walls are stable over the life of the operation. These parameters are outlined in Table 5-1.

■ **Table 5-1 Wilgerup Pit Design Parameters**

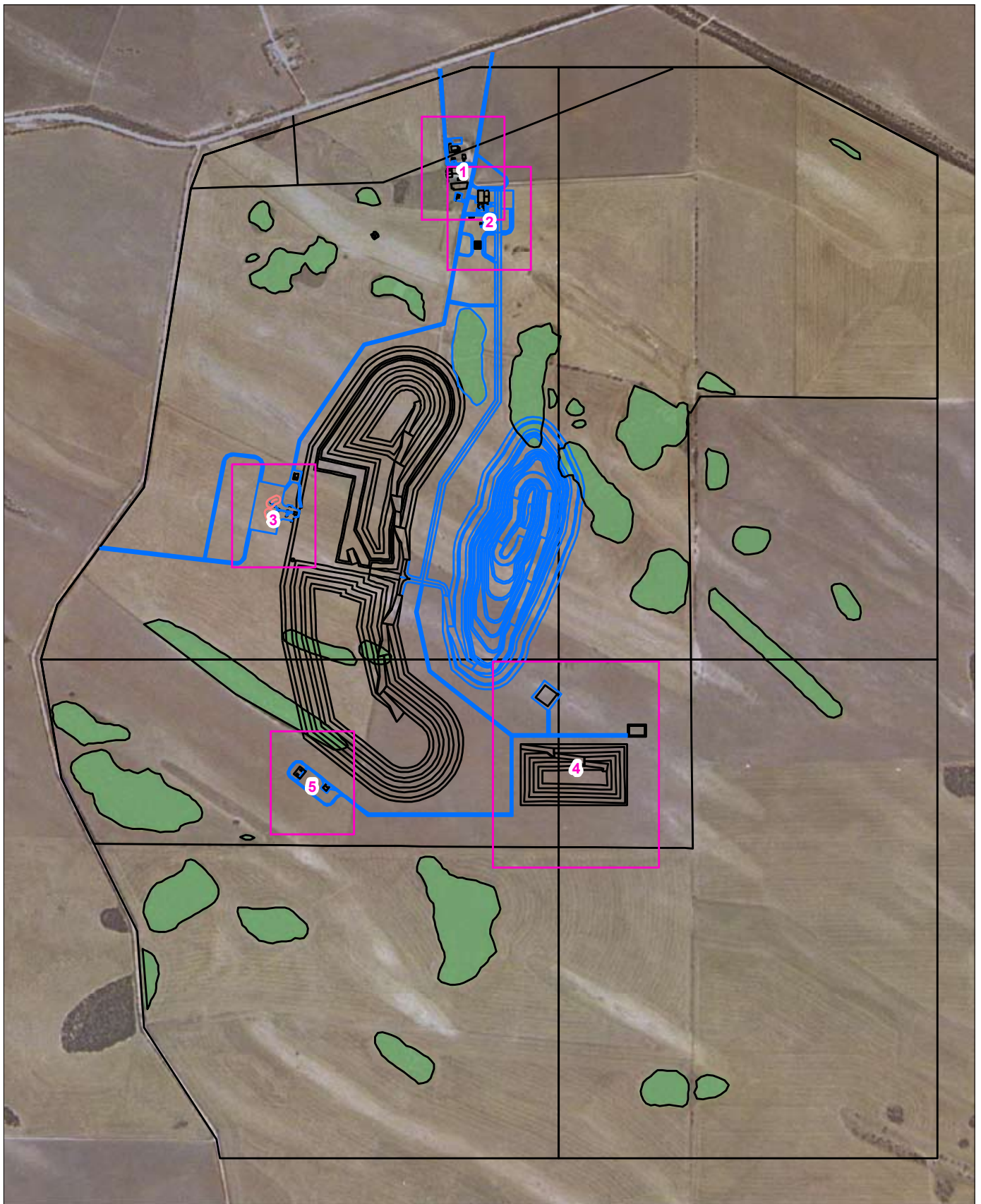
Material	Face Angle	Bench Height	Berm Width	Wall Angle
Overlying Sands / Clays	35°	15m	5m	29.6°
Dolomite Bedrock	65°	15m	5m	51.4°
Massive Hematite	65°	15m	5m	51.4°
Hematite-Carbonate	65°	15m	5m	51.4°
Hematite Clays	65°	15m	5m	51.4°

The proposed overall site layout of the operation is illustrated in Figure 5-1. Detailed drawings of specific areas are also given as:

- Figure 5-2: Mine Administration Area
- Figure 5-3: Mine Maintenance Area
- Figure 5-4: Mine Crushing Plant Area
- Figure 5-5: Mine De-watering Dam Area
- Figure 5-6: Explosives Magazine Area



Descriptions of the numbered items in Figure 5-2 to Figure 5-6 are given in Table 5-2, and the estimated disturbance footprint of the individual components and the total area to be disturbed can be found in Table 5-3. Note that the disturbance footprint in Table 5-3 does not include existing farm buildings (such as the Kamballa farmhouse, which is planned to be used as the site administration office).



Legend

- Mapsheets
- Vegetation

Data Sources
Aerial imagery supplied by DEH 2004

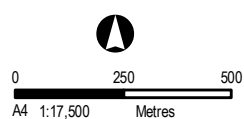


Figure 5-1 Wilgerup Mine - Site layout

GDA 1994 MGA Zone 53

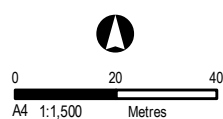
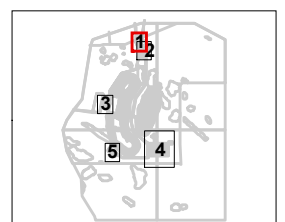
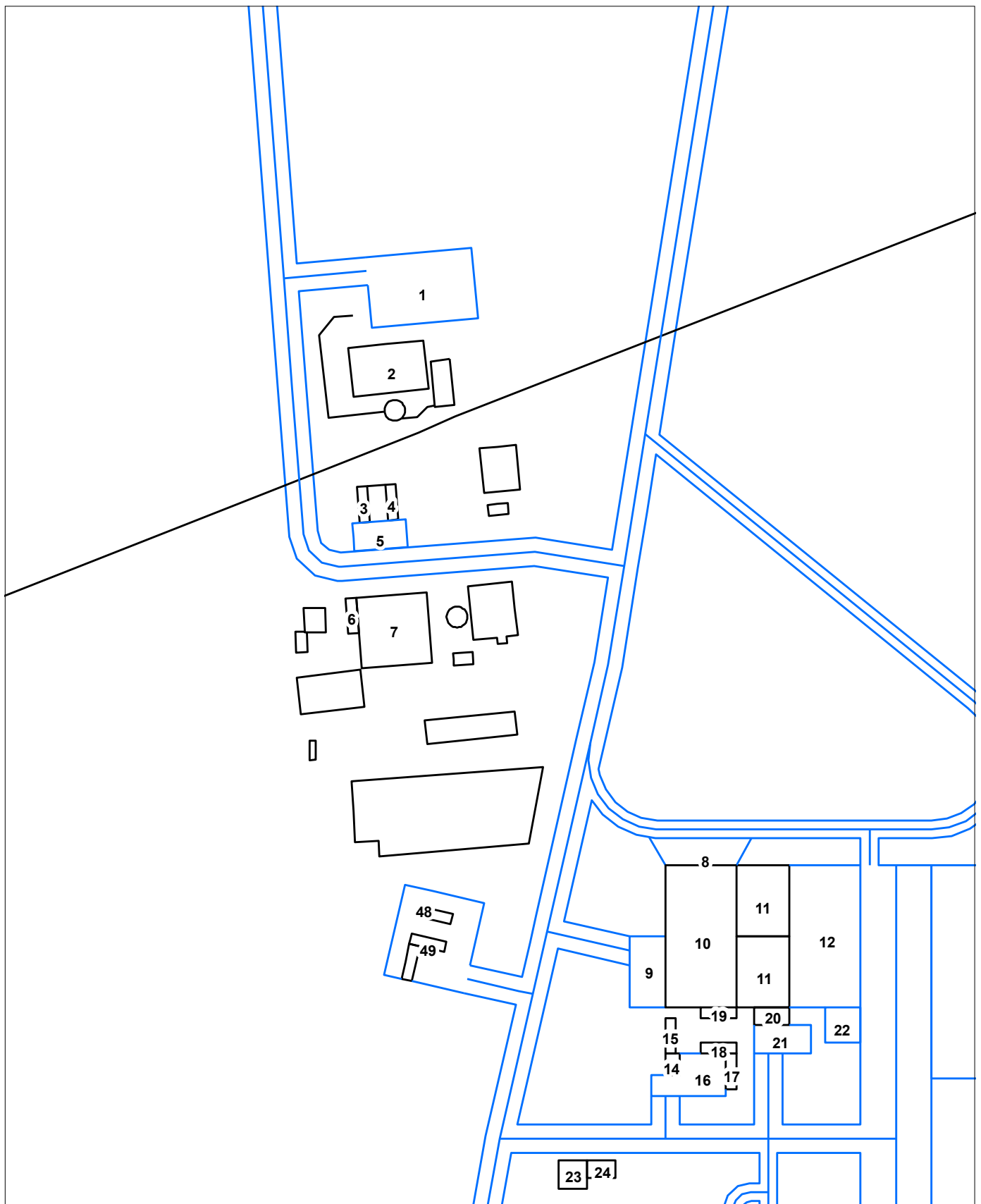


Figure 5-2 Wilgerup Mine - Mine Administration Area (Figure 5-1 Detail 1)

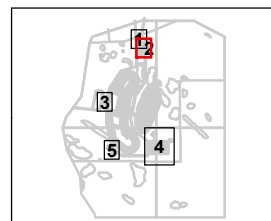
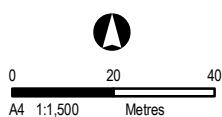
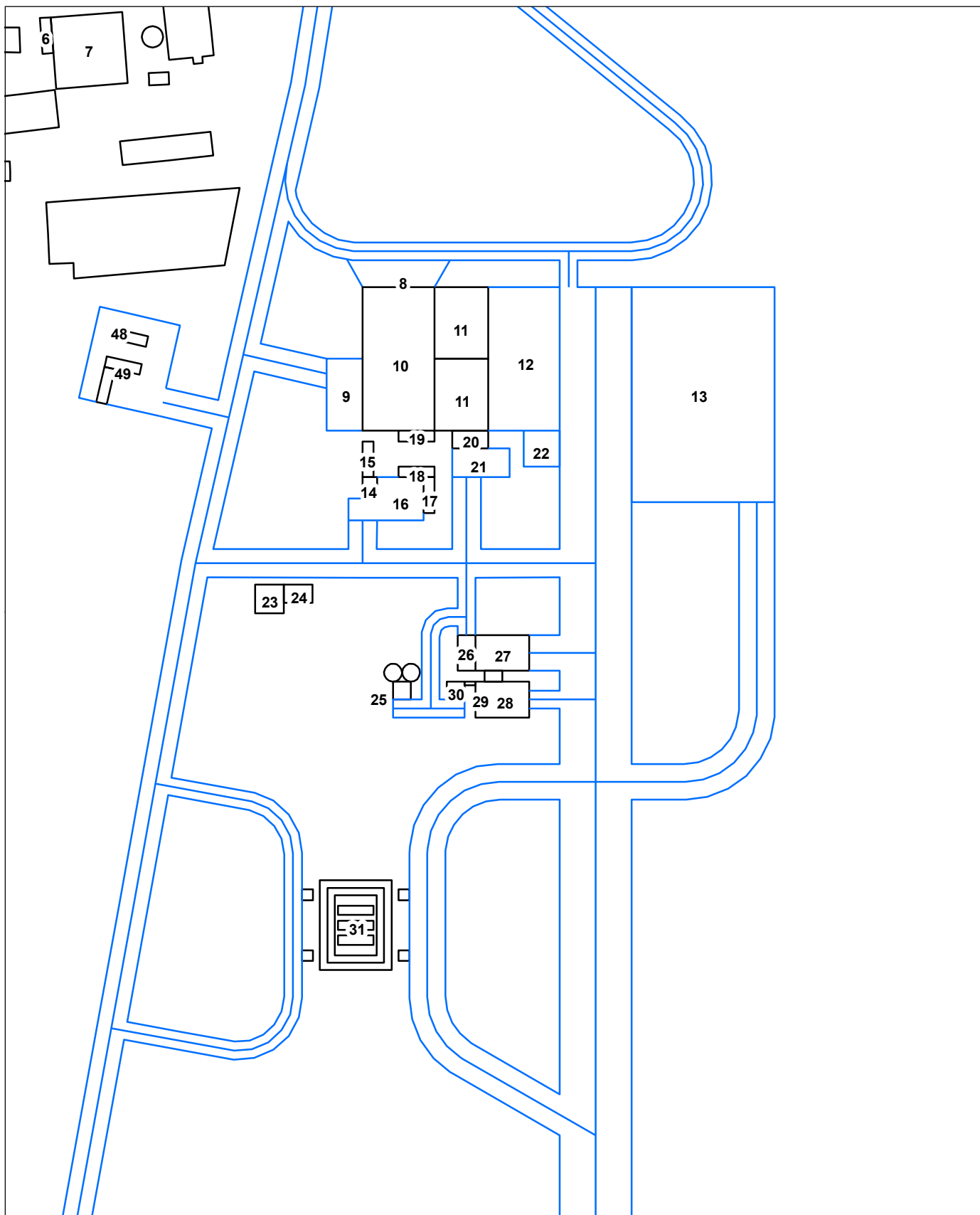


Figure 5-3 Wilgerup Mine - Mine Maintenance Area (Figure 5-1 Detail 2)

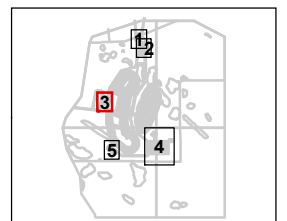
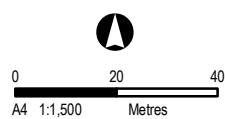
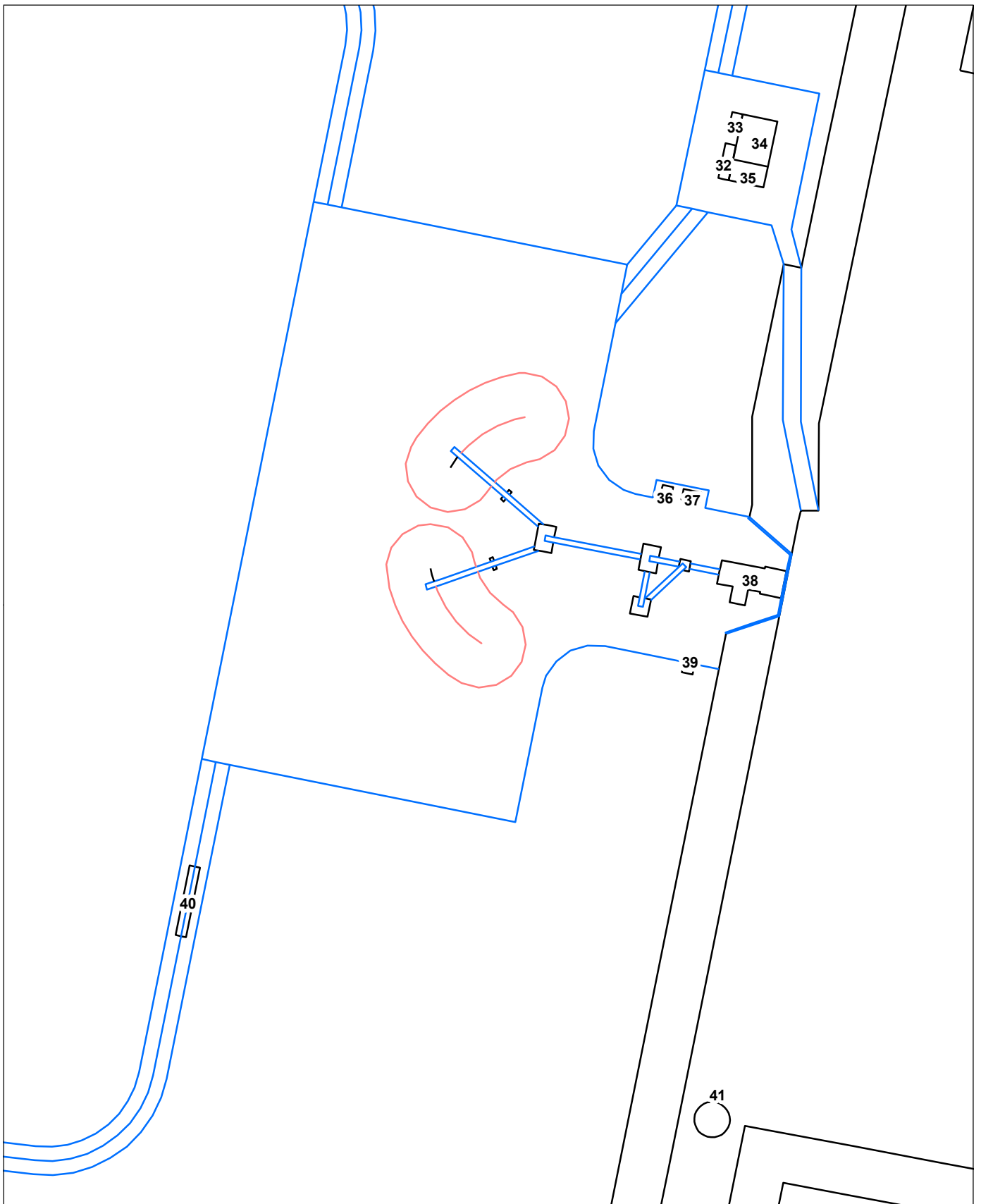


Figure 5-4 Wilgerup Mine - Mine Crushing Plant Area (Figure 5-1 Detail 3)

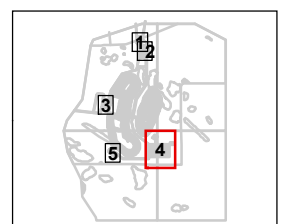
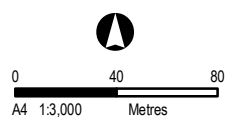
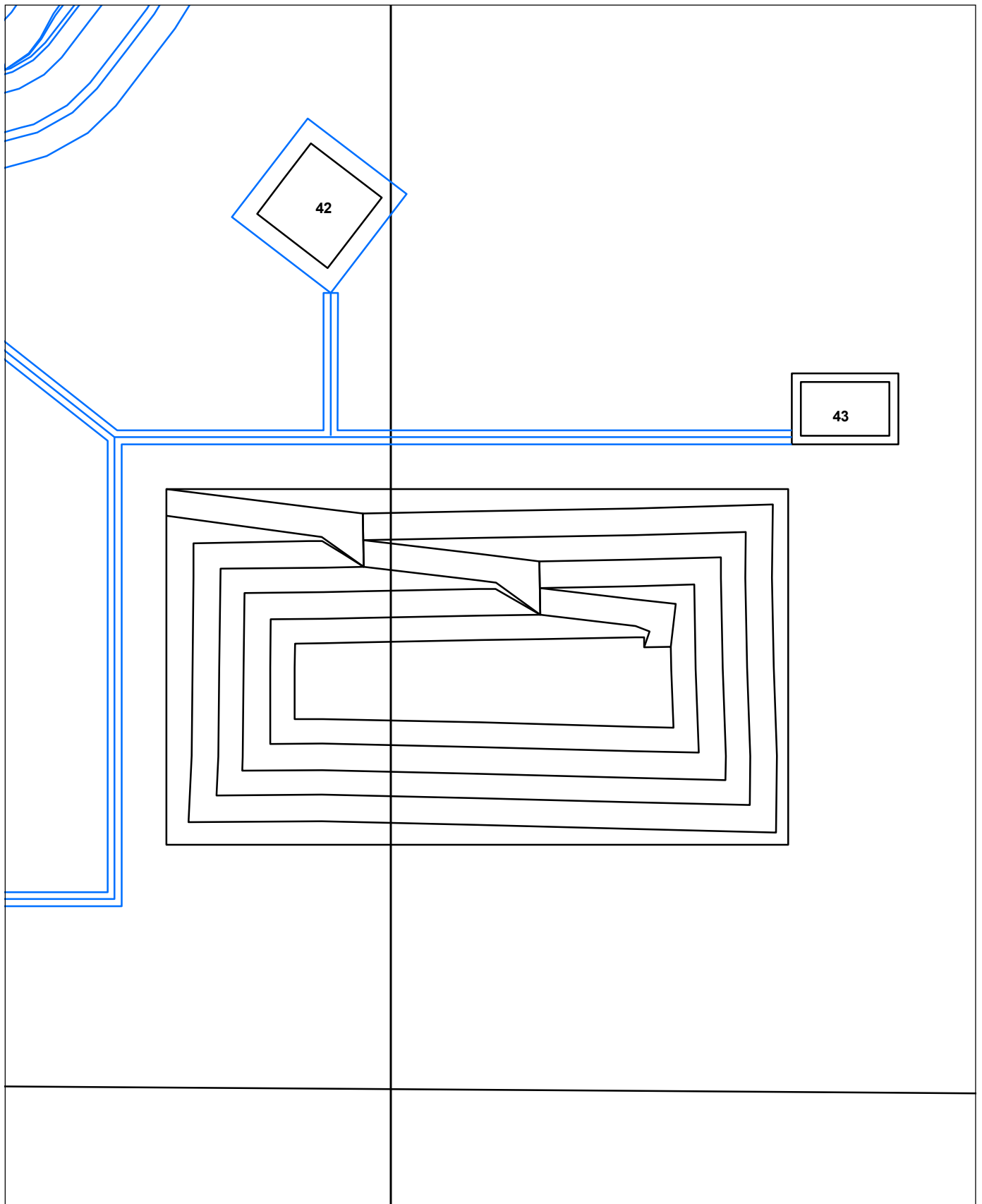
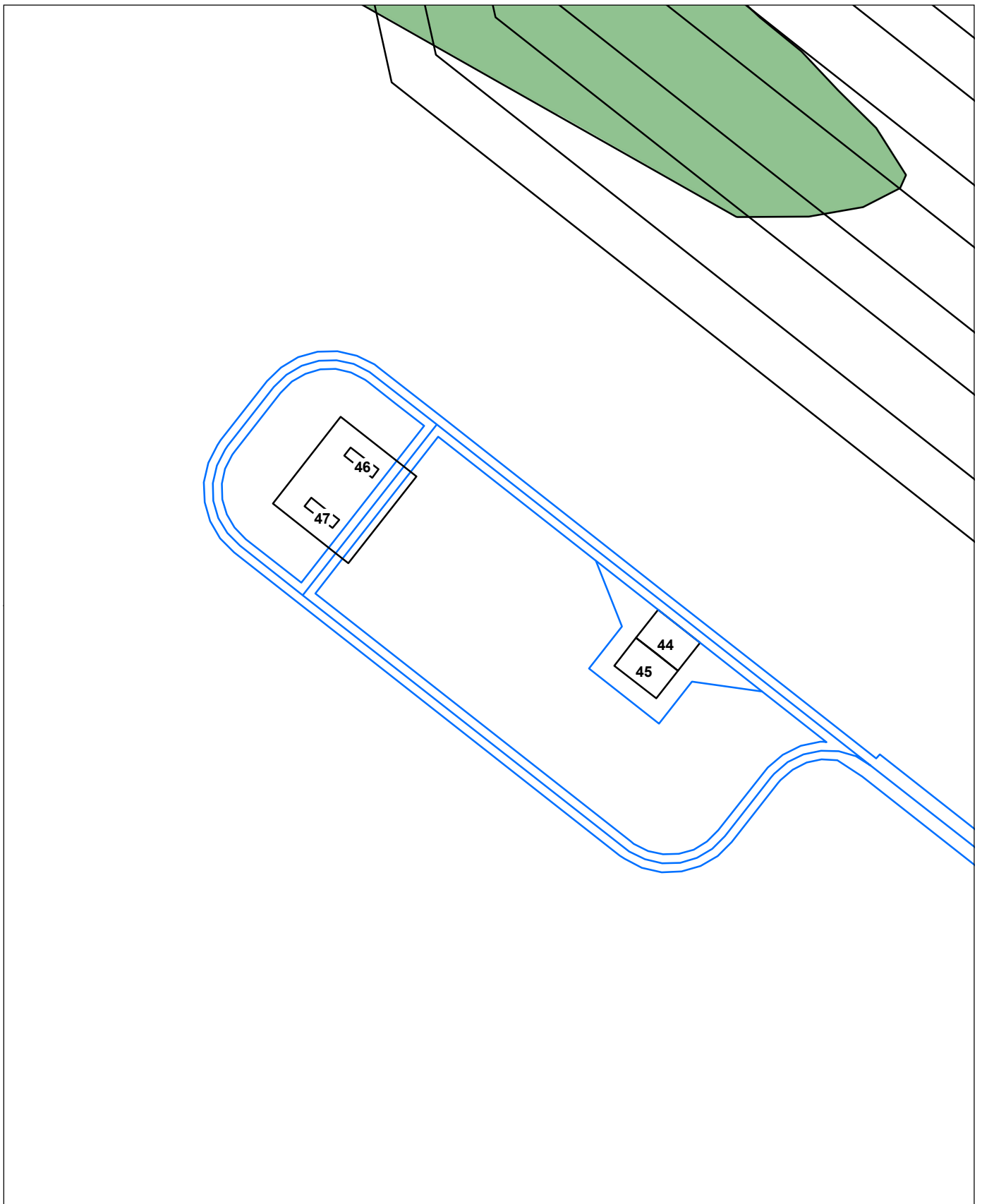


Figure 5-5 Wilgerup Mine - Mine De-watering Dam Area (Figure 5-1 Detail 4)



Legend

 Vegetation

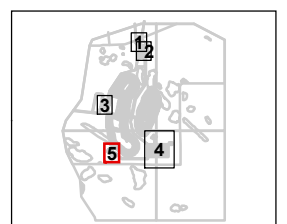
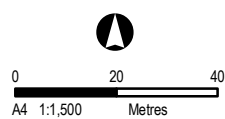


Figure 5-6 Wilgerup Mine - Explosives Magazine Area (Figure 5-1 Detail 5)



■ **Table 5-2 Infrastructure item descriptions**

Location	Description
Administration Area (Detail 1)	
1	Administration car park
2	Site administration office
3	Assay laboratory
4	Assay laboratory office
5	Assay laboratory car park
6	Geology storage shed
7	Core yard
48	Drilling office
49	Drill maintenance workshop
Maintenance Workshop Area (Detail 2)	
8	Road train unloading area
9	Maintenance car park
10	Maintenance store yard
11	Truck maintenance workshops
12	Truck parking area - waiting on maintenance
13	Truck park up area / go bay
14	Ambulance shed (car park)
15	Toilet block
16	E.R. parking area
17	Ambulance room & E.R. control and storage room
18	Crib room
19	Maintenance administration office
20	Light vehicle workshop
21	L.V. workshop parking area
22	Parking area for fuel and lube trucks
23	Bund for generator set fuel tank
24	Generator set
25	R.O. plant
26	L.V. wash down pad
27	Truck wash down pad
28	Wash down pad water collection dam
29	Oil / water separator
30	Water disposal dam
31	Fuel Farm



Location	Description
Crusher Area (Detail 3)	
32	Crusher administration office
33	Toilet block
34	Crusher workshop storage yard
35	Crusher workshop
36	Bund for generator set fuel tank
37	Gen set
38	Primary crusher and control room
39	Small toilet
40	Weighbridge
41	Water tank
Mine Dewatering (Detail 4)	
42	Turkey's nest (water storage for road dust suppression)
43	Water disposal dam
Explosive Storage (Detail 5)	
44	Concrete pad
45	AN shed
46	Detonator magazine
47	Booster magazine

■ **Table 5-3 Wilgerup Mine Site – Disturbance Footprint**

Location	Infrastructure Reference No.	Area Disturbed (m ²)
Roads	n/a	81,500
Administration car park	2	600
Assay laboratory	3,4,5	230
Geology store/core yard	6,7	430
Drill office and workshop	48,49	600
Maintenance admin and workshop area	8 to 21	5,850
Wash down bay/R.O. Plant	25 to 30	640
Gen set	23,24	160
Fuel farm	31	1,050
Crusher office / workshop	32 to 35	1,340
Crusher/loading area	Incl. 36 to 39	17,020
Turkey's nest	42	4,900



Location	Infrastructure Reference No.	Area Disturbed (m ²)
Water disposal dam	43	2,400
AN Shed	44, 45	800
Detonator/primer magazines	Incl. 46, 47	840
Waste rock dumps (to rehabilitation limit)	n/a	666, 450
Pit (area inside abandonment bund not incl.)	n/a	265,330
Total Area Disturbed		1,050,140

5.2. Ore Reserves and Market

5.2.1. Geological Environment

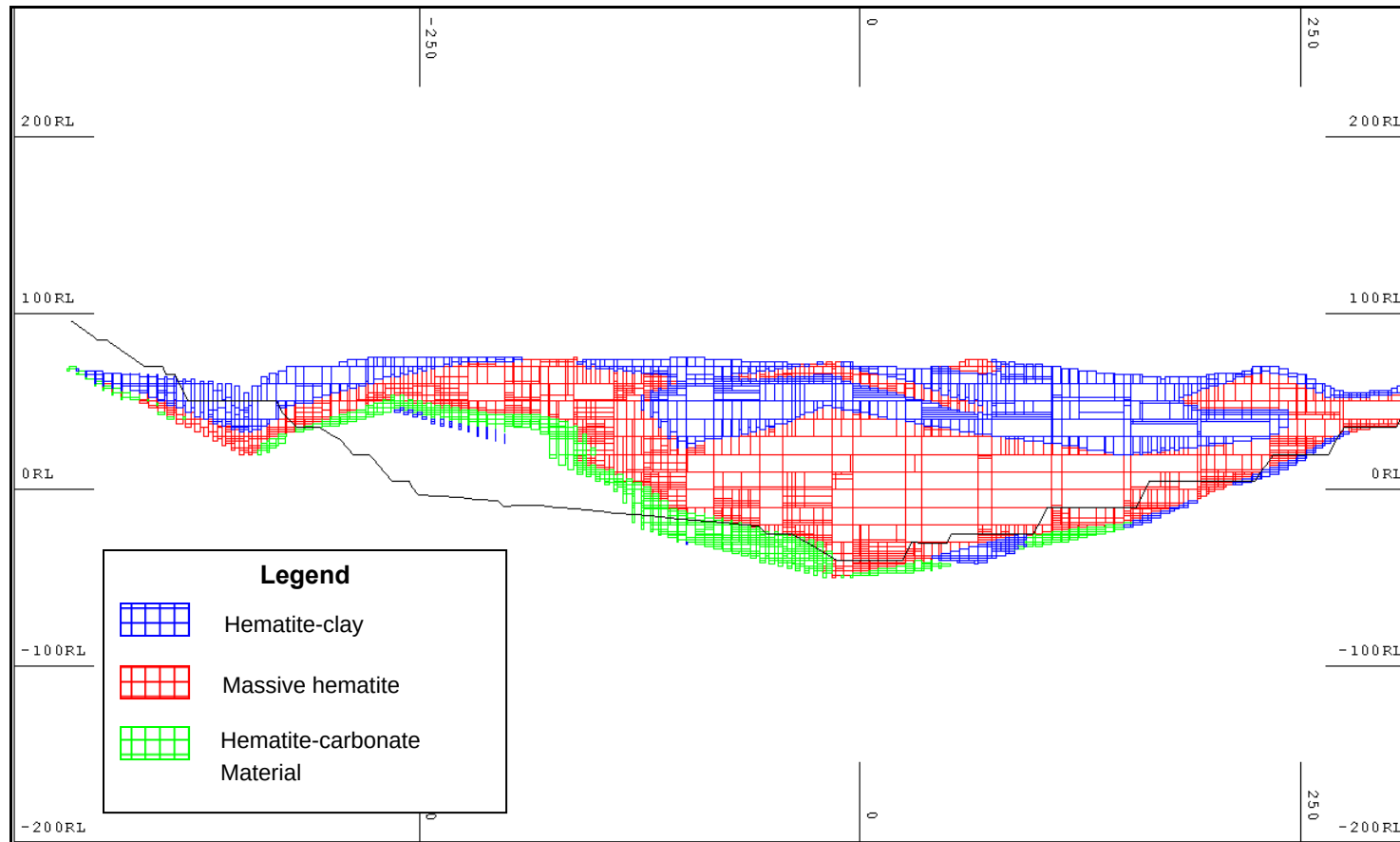
5.2.1.1. Local Geology

The primary material of interest at Wilgerup is massive hematite, an oxide of iron (Fe₂O₃). This material occurs locally as a tabular ore body around 800 m long, 35 m wide and 60 to 100 m thick which dips roughly north-north east and appears to be associated with a number of shears that trend in the same direction.

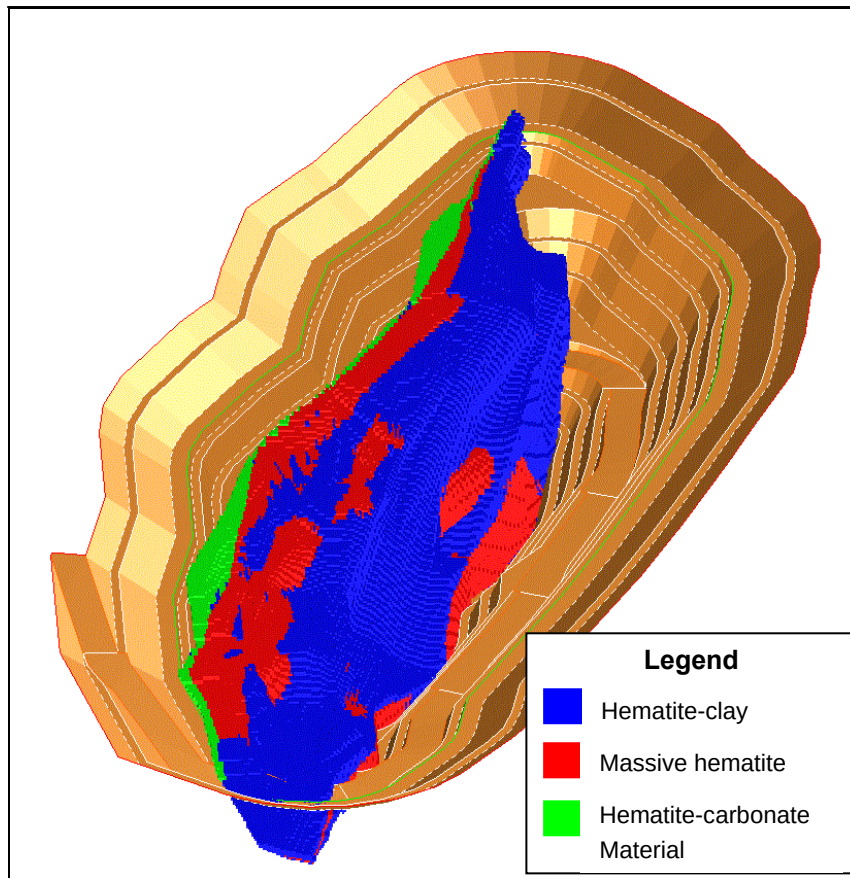
The ore body sub-crops and is buried beneath 20-25 m of unconsolidated sand and clay.

Proceeding vertically, the massive hematite grades into a hematite-carbonate material which itself grades into the massive dolomite material which hosts the ore body. In places the massive hematite is overlaid by a hematite-clay material which consists of high grade hematite interspersed with clay bands which appear to be in-filled palaeo-fractures.

A representative long-section of the ore body and pit is given in Figure 5-7 and a three-dimensional illustration of the ore body and the pit is given in Figure 5-8. In both Figures, blue is hematite-clay, red is massive hematite and green is the hematite-carbonate material.



■ **Figure 5-7 Wilgerup Ore Body – Representative long section (view looking East)**



■ **Figure 5-8 Wilgerup Mine – Pit and ore body (view looking North)**

5.2.1.2. Regional Geology

The Wilgerup tenement is located within the Cleve Subdomain of the Gawler Craton. The Cleve Subdomain is a major Palaeoproterozoic fold belt composed of tightly folded, high grade metamorphic rocks of the Hutchison Group and associated Lincoln Complex extending the length of the eastern Eyre Peninsula.

“The Hutchison Group is a succession of metamorphosed mixed clastic and chemical sedimentary rocks, consisting of calc-silicate and quartzite (Warroo Quartzite), carbonate (Katunga Dolomite), banded iron formation (Lower and Upper Middleback Jaspilite) and schist (Cook Gap Schist, Yadnarie Schist)” (Flint, R.B. Explanatory notes for the Kimba 1:250,000 geological map). All of these rock types are found within the Wilgerup tenement.

Locally the ore body is contained within the Lower Middleback Jaspilite. The genesis of the ore body is thought to be a residual deposit developed *in situ* by enrichment of the host banded iron formations (BIF). There is also clear evidence of hematite replacement whereby the iron replaces



the carbonate. The mineralogy is dominantly microplaty hematite within the three identified ore types comprising Massive Hematite, Hematite Clay and Hematite Carbonate.

5.2.2. Reserves and Resources

The JORC compliant estimated resource of the Wilgerup ore body as at 1 August 2008 is given in Table 5-4 below.

■ **Table 5-4 Wilgerup Mineral Resource Estimate (August 2008)**

Resource	Tonnes	Grade (%)				
Category	(MT)	Fe	SiO ₂	Al ₂ O ₃	P	LOI
Measured	0					
Indicated (<i>Massive Hematite</i>)	10.4	59.7	3.6	2.3	0.49	4.6
Inferred (<i>Massive Hematite</i>)	0.5	58.7	4.1	2.4	0.50	4.2
Indicated (<i>Hematite Clay</i>)	2.2	49.9	10.5	4.8	0.54	6.9
Indicated (<i>Hematite Dolomite</i>)	0.6	49.9	6.8	3.7	0.63	7.9

The potential for additional resources to be delineated on EL 3317 is considered to be high. There is a known hematite pod around 3 km to the south of the proposed pit which will require further drilling before it can be evaluated. In addition, computer modelling of magnetic and gravity data over the Wilgerup area (EL 3317) has highlighted several zones that have a reduced magnetic and high gravity response which is indicative of the presence of hematite. It is expected that exploration drilling will take place in these areas after the south pod is drilled.

5.2.3. Market

Centrex has signed Heads of Agreements with two Chinese companies, Baotou Iron & Steel (Group) Ltd and Shenyang Orient Iron & Steel Co. Ltd. These two companies have indicated that they will each purchase 50% of the iron ore produced from the Wilgerup Mine at the long-term international bench mark price prevailing at the time the ore is purchased.

Baotou is China's tenth largest steel producer while Shenyang is a medium-sized fully integrated producer of steel and steel products. Baotou holds approximately 7% of the shares in Centrex Metals.

A preliminary financial analysis for Wilgerup was carried out by Centrex in August 2008. This analysis indicated that the project had a pre-tax NPV of \$387M.



5.3. Mining Operations

5.3.1. General Description of Mining Method

Wilgerup will be mined by conventional open cut mining methods utilising a truck and excavator fleet supported by the usual array of ancillary equipment (refer Table 5-5 for a detailed list of equipment expected to be used).

Except for the overlying unconsolidated sand and clay material (the top 20-35 m from the surface) it is expected that all of the material will need to be drilled and blasted. A typical blast pattern will consist of about 100 to 150 holes 102 mm in diameter drilled to a depth of 6.5 m (bench height of 5 m plus 1.5 m sub-drill). In general, the top 1.5-2 m of the hole will be backfilled with stemming material. This material acts to improve the fragmentation characteristics of the blast and to reduce noise, dust and fly-rock.

Following blasting, the broken material will be loaded into dump trucks by an excavator for removal from the pit to its designated dumping location. Waste will be placed on the waste rock dump and ore will be sent to the crusher run of mine (ROM) pad.

■ **Table 5-5 Wilgerup Pit – Indicative equipment list**

Equipment Description	Number of Units
Hitachi EX1250 excavator	1
Caterpillar 992 front end loader	2
Caterpillar 990 front end loader	1
Caterpillar 980 front end loader / fork lift	1
Rock breaker	1
Komatsu HD785-D rigid frame haul trucks	5
Caterpillar 14G grader	1
Caterpillar D10 track dozer	1
Blast hole drilling machines (Gardner Denver GD5000)	3
Water truck (converted HD785-D)	1
14t HIAB utility truck	1
14t Lube/maintenance truck	1
10,000l fuel truck	1
20t crane	1
2t Utility Truck	1
Light Vehicle	6



5.3.2. Pit Sequencing and Schedule

Commencing at the southern end, where the base of the ore body is the closest to the surface, the pit will be mined in a number of stages (or cut-backs) progressing from south to north. A plan view of the final pit design is given in Figure 5-9. A conceptual life of mine (LOM) schedule for the pit is given in Table 5-6.

■ **Table 5-6 Wilgerup Pit – LOM In-situ Material Movement Summary**

Wilgerup Pit								
Life of Mine Material Movement Summary								
Material		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	TOTAL
Waste	bcm	4,509,786	3,396,501	1,382,144	827,628	669,831	103,786	10,889,676
	s.g.	1.84	1.97	2.19	2.20	2.21	2.31	1.98
	tonnes	8,286,374	6,692,568	3,022,947	1,822,177	1,480,048	239,615	21,543,728
Ore	bcm	433,308	551,704	548,309	548,309	548,309	573,539	3,203,478
	s.g.	3.25	3.23	3.25	3.25	3.25	3.25	3.24
	Tonnes	1,408,000	1,782,003	1,782,003	1,782,003	1,782,002	1,864,002	10,400,093
Total	bcm	4,943,094	3,948,205	1,930,453	1,375,937	1,218,140	677,325	14,093,154
	Tonnes	9,694,374	8,474,571	4,804,950	3,604,180	3,262,050	2,103,617	31,943,742

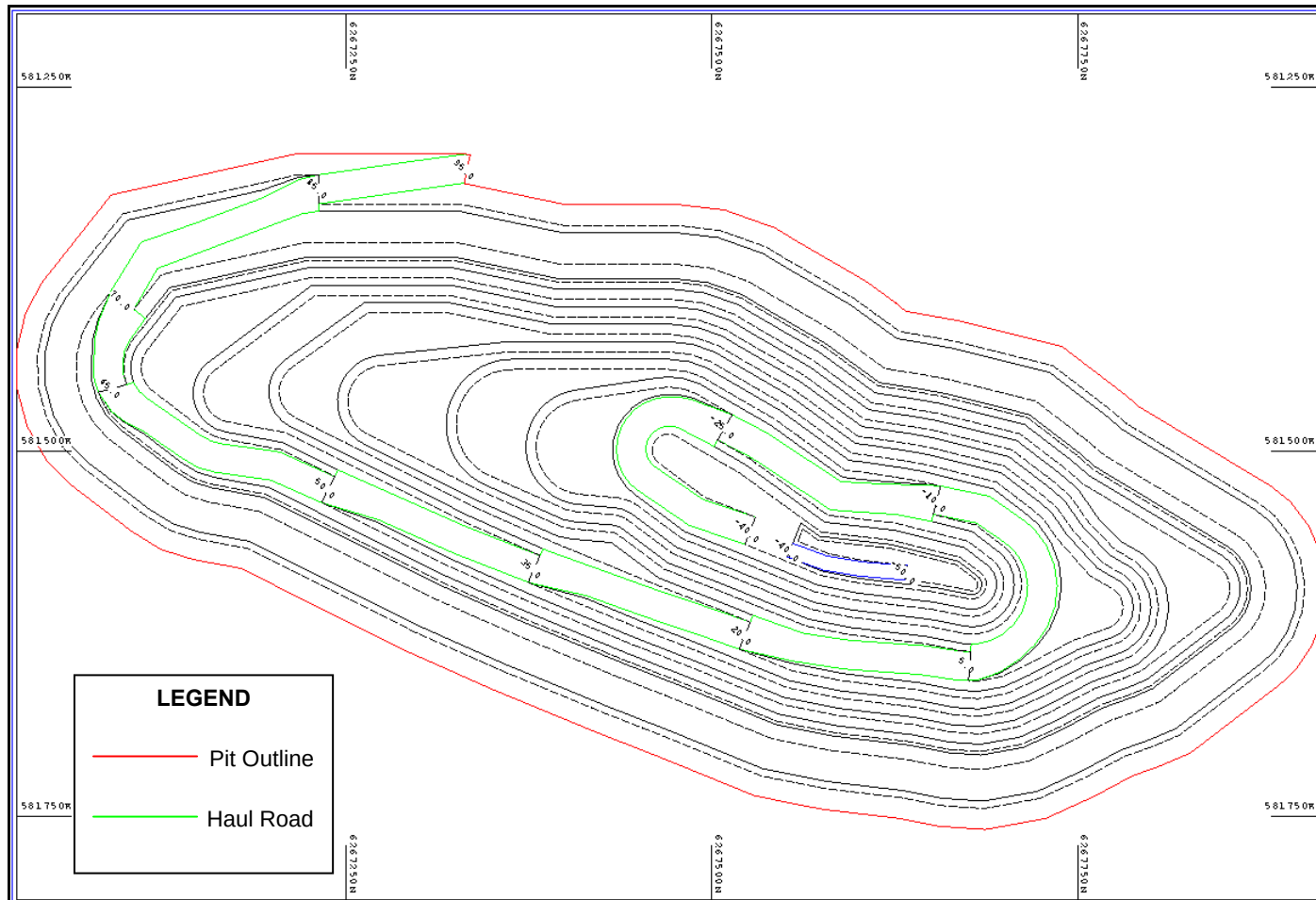


Figure 5-9 Wilgerup Mine – Final Pit Design



5.3.3. Modes and Hours of Operation

The mine will operate 24 hours per day, 7 days per week, 365 days per year.

Blasting will take place only during daylight hours.

5.3.4. Use of Explosives

The Wilgerup iron ore project will use both packaged and bulk type explosives. The bulk explosives used in the operation will be either ammonium nitrate/fuel oil (ANFO) or emulsion based and will usually be manufactured on site with a mobile manufacturing unit (MMU). ANFO will be the preferred explosive used with the use of emulsions generally restricted to those cases where the blast holes contain water.

Blast holes will be typically 102 mm in diameter but may, depending upon fragmentation, heave or special blasting requirements, range from 76 mm to 156 mm in diameter. Holes will be stemmed unless there is some special blasting requirement (e.g., pre-split holes) that dictates otherwise.

Blast holes will be initiated with 100 g or 400 g pentaerthritol tetranitrate (PETN) based boosters primed with non-electric type detonators. Hole sequencing will be achieved by the use of either individual down hole delays (built into the detonators) or via trunk line delays. Blasts will be fired by the use of a single electric detonator attached to a length of detonating cord leading to the first hole to be fired.

Explosive and blasting agents storage will be at the locations indicated in Figure 5-6 (refer Locations 44 to 47).

Magazine capacities will be:

- Detonator Magazine: 3,000 detonators
- Packaged Explosive Magazine: 5,000 kg
- Ammonium Nitrate Shed: 65,000 kg
- Emulsion Tank: 25,000 litres

The magazines have been designed to comply with the *South Australian Explosives Act (1936)* and *Explosives Regulation (1996)* and Australian Standard AS2187.2-2006, Explosives – Storage and Use – Use of Explosives.



5.3.5. Pit Dewatering

A groundwater assessment for the proposed Wilgerup Mine has been undertaken by SKM, and is provided in Appendix H.

Mining operations will extend well below the water table which is located approximately 25 m below the natural ground surface. Using published analytical solutions, it has been demonstrated that up to 25 L/s of groundwater inflows could be experienced during mining, which warrants an engineered aquifer dewatering program.

Due to the heterogeneous nature of the local aquifer system, a well-field system is preferred over a more unpredictable in-pit excavated sump (or trench) system. A number of well-field configurations have been evaluated with the recommended design including four wells located around the edge of the mine pit.

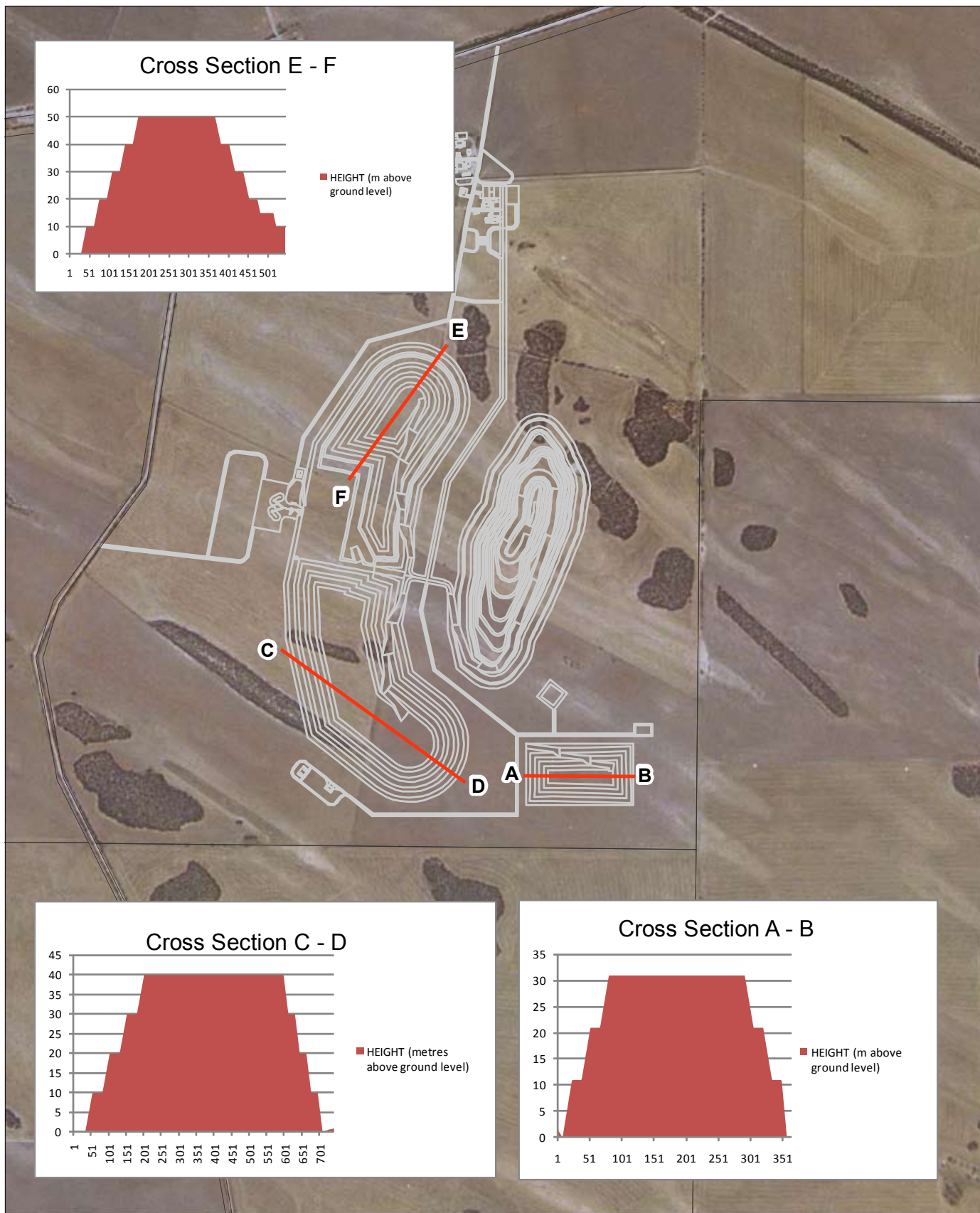
In order to lower groundwater levels in advance of mining, rates of around 30 to 60 L/s (2.6 to 5.2 ML/day) may be required in the first 1.5 years of operations, with subsequent maintenance rates between 20 and 30 L/s (1.7 to 2.6 ML/day). These extraction rates assume that the Basement Aquifer is unlimited in extent and therefore represent the upper bound of dewatering requirements (and long term local water supply potential).

The groundwater is highly saline, with a total dissolved salt (TDS) content in the range of 35,000 to 42,000 mg/l⁻¹ (roughly equivalent to seawater). Some of this water will be sent to the reverse osmosis plant and the remainder will be used on mine roads for dust suppression.

5.4. Stockpiles

Top and sub-soil stockpiles will be placed at the locations indicated on the site plan (refer Mapsheet 4 in Figure 5-1 and Figure 5-5). The stockpiles will be constructed in three lifts, with a total height of no greater than 30 m.

Figure 5-10 provides indicative cross sections of soil stockpiles and the waste rock dump.



Legend

- Cross Section
- Indicative Mine Layout
- Cadastre

Data Sources
Aerial imagery supplied by DEH 2004

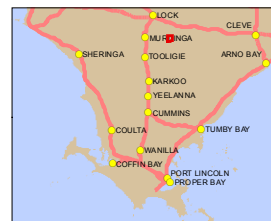
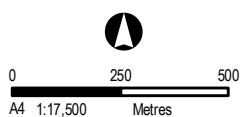


Figure 5-10 Profile of material stockpile

GDA 1994 MGA Zone 53



5.5. Crushing and Processing

The only ore beneficiation which will take place in the project area will be a crushing and screening process to produce two different sized products. These products are colloquially known as “lump” and “fines” and the size ranges are approximately:

- Lump: +6.3 mm to -32 mm
- Fines: -6.3 mm.

The crushing and screening process is straightforward as follows:

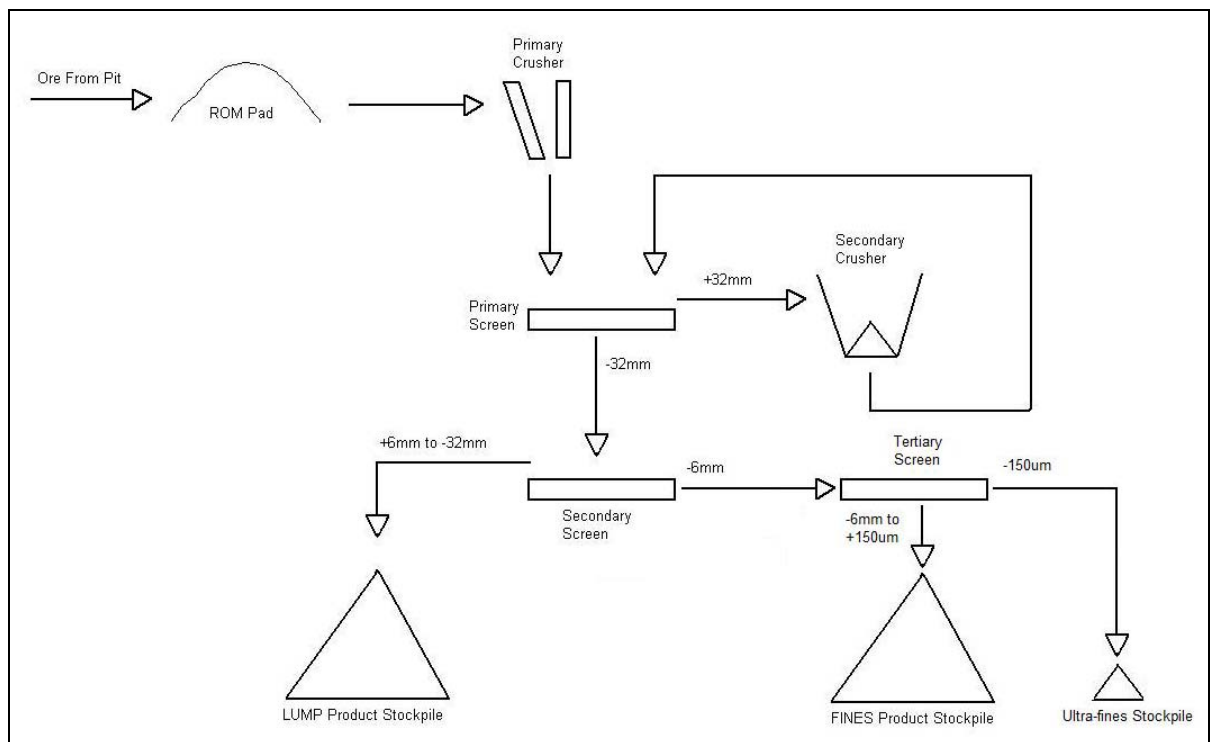
- 1) ROM ore is delivered to the ROM Pad from the pit by haul trucks.
- 2) The ore is then taken from the ROM Pad and fed into the primary (jaw) crusher by a front end loader.
- 3) After going through the primary crusher the ore is conveyed to the primary screening unit which separates the oversize material (> 32 mm fraction) from the product fraction (≤ 32 mm). The oversize material is then sent to the secondary (cone) crusher while the product fraction is sent to the secondary screen.
- 4) After being processed through the secondary crusher the (formerly) oversize material is again sent back to the primary screen.
- 5) The product screen separates the lump product from the fines product and drops them onto separate conveyor belts.
- 6) The lump product is then conveyed to the lump product stockpile.
- 7) The fines product may be conveyed to a tertiary screen to remove ultra-fine material ($\sim 150 \mu\text{m}$) prior to stockpiling. The fines material ($\sim 6.3\text{mm}$ to $+ 150\mu\text{m}$) is conveyed to the fines stockpile whilst the ultra fines would be conveyed to a separate storage stockpile adjacent to the waste rock dump onsite for beneficiation at a later stage if economic. The exposed surface of this low grade dump will be encapsulated to prevent erosion and dust generation.
- 8) The lump and fines products are then loaded into separate road trains for haulage to the rail siding at Tooligie.

Typical sales contracts for hematite fines allow for up to 15% of ultra fines in the fines product. Ultra fines are defined as particles with a diameter of less than 0.15mm. The screening process may be modified to incorporate a tertiary screen deck to facilitate the removal of the ultra fines component of the fines stockpile.

This sequence is illustrated schematically in Figure 5-11.



No chemicals will be used in the crushing and screening process and both products are basically chemically identical. Water sprays will be used for dust suppression at the primary crusher and at the ends of the lump and fines product conveyors.



■ **Figure 5-11 Crushing and Screening Plant Flow Diagram**

The primary crusher will be a standard 60" by 48" jaw crusher with a minimum gap measurement of 110 mm. The secondary crusher will be a standard cone crusher with a 32 mm closed gap setting.

The primary sources of noise from the crushing plant will be from the jaw and cone crushers, the vibrating screens and the loader feeding the primary crusher.

Dust from mineral processing will be generated from:

- Primary crusher feed operations.
- Operation of the vibrating screens and the primary and secondary crushers.
- Discharge of the lump and fines products onto their respective stockpiles.

Based on current data the iron ore dust generated during crushing and screening operations is expected to be composed on average of:

- 90% Fe₂O₃



- 3.7%% SiO₂
- 2.4% Al₂O₃;
- 1.3 CaO; and
- 0.5% P.

The remainder is expected to be made up minor percentages (less than 1%) of other trace elements such as MgO, Na₂O, TiO₂ and K₂O.

The potential ignition sources from the crushing plant are:

- The internal combustion engine machines used around the plant (e.g. the loader feeding the plant; plant electrical generator; etc.).
- Crusher and conveyor motors.
- Conveyor rollers and drums.
- Hot maintenance work (e.g. welding or grinding).
- Rubbing together broken metal components.

For each potential ignition source industry standard safety procedures will be adopted in relation to:

- Undertaking preventative maintenance and operational checks.
- Promptly controlling and extinguishing any fires should they occur.
- Removal of combustible residues.

Crushing activities will be undertaken 12 hours per day (day shift), seven days a week.

5.6. Fuel and Lubricants

The only fuel stored on site will be diesel which will be contained in three 50,000 litre tanks adjacent to the refuelling facilities (Location 31 in Figure 5-3) and one 50,000 litre tank adjacent to the crushing plant gen set.

Lubricants will be stored in a designated compound in the mine maintenance store yard (refer Location 10 in Figure 5-3).

Both the fuel and lubricant storage facilities have been designed and will be installed in accordance with:

- Australian Standard 1940-2004: The storage and handling of flammable and combustible liquids
- Australian Standard 1692-2006: Steel tanks for flammable and combustible liquids.



- Petroleum Products Regulation Act 1995 and Petroleum Products Regulations 2008 (amendments to take effect 1 July 2008).
- Dangerous Substances Act 1979 and Dangerous Substances Regulations 2002.

5.7. Wastes

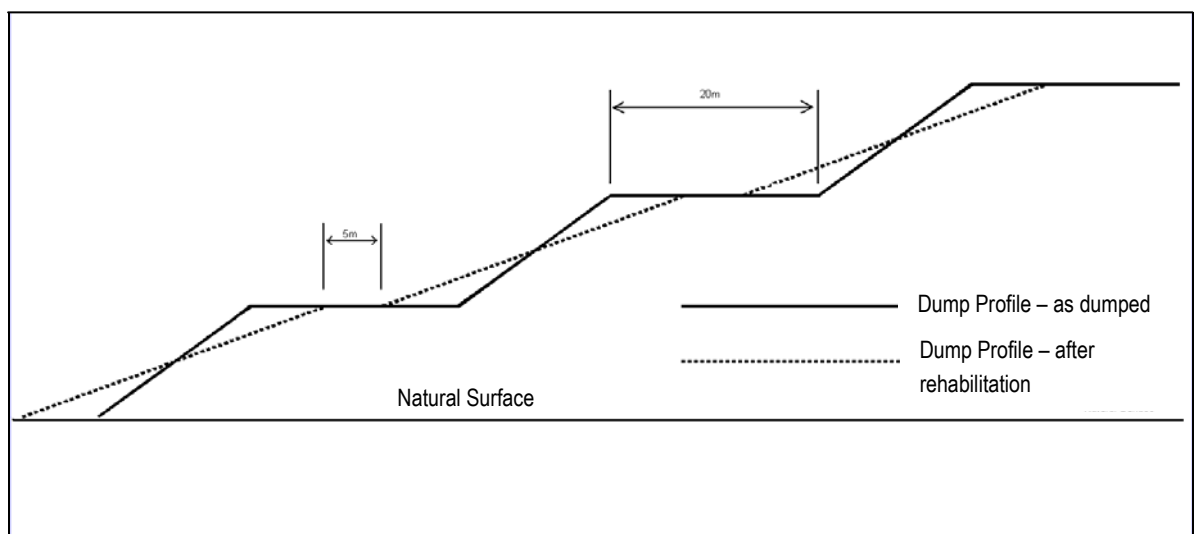
5.7.1. Waste Rock

Samples of waste rock and ore were taken from each geological domain within the pit limits (16 April 2008) and were assessed on the materials' potential for:

- Acid formation (i.e., acid mine drainage)
- Release of heavy metals or other deleterious compounds
- Mechanical disintegration and silt formation.

Only one of the results indicated a capacity to potentially form acid rock drainage. As the samples are composites and there are 6 further composite overburden samples, then the PAF sample is not likely to be significant in terms of acid generation (also based on low S content). Details of the test work and results can be found in Appendix G.

The final waste rock dump will be a maximum height of 50 m and constructed in 10 m high lifts with 20 m wide berms. When rehabilitated, the sides of the dump will be dozed to an angle of 20° which will leave the dump with 5 m wide berms which will be sloped into the dump to help keep water runoff to a minimum. A schematic section of a waste rock dump as constructed and showing the final rehabilitated slope is given in Figure 5-12.



■ **Figure 5-12 Schematic cross-section of waste rock dumps**



5.7.2. Industrial and Domestic Waste Materials

This section provides an overview of the wastes that will be generated by the operation and how they will be dealt with.

Note that for each class of waste, clearly labelled and colour coded bins will be provided for collection. The construction of the bins and the material used to make them will be appropriate for the waste types they are to contain.

5.7.2.1. Domestic Waste

Domestic waste includes such items as food scraps and associated small paper bags and similar biodegradable food containers. All domestic waste will be collected in rubbish bins which will be periodically removed and disposed of at an approved community disposal site.

5.7.2.2. Recyclable Materials

Recyclable materials such as glass, paper not associated with food (e.g. newspapers, shredded documents), plastics and metals (e.g. aluminium cans), etc., will be collected in separate bins and sent off-site for recycling.

5.7.2.3. Tyres

All tyres changed on site will be collected and sent off-site for recycling.

5.7.2.4. Workshop Waste

Workshop waste includes such items as used grease cartridges, oily rags, spent oil filters, etc. All such materials will be sent off-site for disposal by an accredited company.

5.7.2.5. Engine oils and Batteries

Spent engine oils will be collected in sealed containers and then sent off-site for disposal. Spent batteries will be stored in pallet sized wire enclosures and sent off-site for disposal or recycling.

5.7.3. Wastewater

An overview of the wastewater generated on site and how it will be managed is provided in the following sections.

5.7.3.1. Wash Down Pad

The wash down pad will be used primarily to clean heavy earthmoving equipment and light vehicles. As a consequence, water running off the pad is likely to contain some oil and, in particular, large amounts of sediment.



Water from the wash down pad will drain directly into a nearby settling pond. The overflow from the settling pond then reports to an oil/water separator. Grease and oil is then removed from the water, collected in containers and sent off site for disposal. Water from the separator will be sent to the adjacent evaporation/infiltration dam or if possible, reused.

Sediment from the settling pond will be removed as required to the bio-remediation area for treatment to remove residual hydrocarbons.

5.7.3.2. RO Plant Brine

A small reverse osmosis plant will be required to supplement rain water supplies for situations where potable water is required. Brine from this plant will be sent directly to the evaporation/infiltration dam adjacent to the wash down pad.

5.7.3.3. Sewerage System

Two 25 equivalent person (EP) aerobic wastewater treatment units will be installed on site to treat domestic wastewater (water from sinks, toilets, etc.). One will be located adjacent to the mine administration office and one near the mine maintenance office. Treated wastewater from the aerobic wastewater treatment units will be used to irrigate vegetation that will be planted around the office areas.

Compliance with the *Public and Environmental Health Act (Waste Control) Regulations 1995* will be maintained at all times.

5.7.4. Silt Control and Drainage

A drainage system will be established on site to separate water from disturbed and undisturbed areas and direct surface water flows so that operations are maintained and impacts to the environment are minimised. Sediment will be contained on site.

Specific controls will include:

- Management of surface water around the mine site via a series of diversion banks and drainage channels. Sizing of diversion banks and drainage channels to consider appropriate design rainfall events.
- Run-off from the broader catchment to be diverted around the mine site using diversion banks and floodways. Sizing of diversion banks and drainage channels to consider appropriate design rainfall events.
- Run off from waste rock dump during establishment phase to be directed to sediment basins, and potentially contained within retention basins, depending on the expected quality of the runoff. Sizing of basins to consider appropriate rainfall events.



- Run-off from disturbed sites, including hard stands and roads to be directed through vegetated swales and/or sediment traps and or detention basins to provide sediment removal treatment. Sizing of basins to consider appropriate rainfall events.
- Bund to be constructed around rim of pit to prevent surface waters from discharging into the pit.

Run off from the rehabilitated waste rock dump is not expected to result in significant run off and water quality issues. The dump itself will consist largely of broken rock and will be capped with sandy soils, hence rainfall is expected to infiltrate the dump rather than run off. Furthermore, all flat areas on the rehabilitated dump will be sloped inwards to limit run off from the dump (refer Section 5.7.1). Should run off prove to cause water quality concerns then rock lined chute drains will be installed at periodic intervals on the dump batters. These drains would be directed to sediment basins.

5.8. Supporting Surface Infrastructure

5.8.1. Access

There will be three access roads into the mine site (see Figure 5-13):

- 1) A light vehicle access road to the Site administration office from the Murdinga – Murlong Road
- 2) A heavy vehicle access road to the Site workshops and maintenance area from the Murdinga – Murlong Road
- 3) A road train access road to the processed ore stockpile area for the ore haulage vehicles from Roberts Road

Note that 1 and 2 above are existing access roads onto the Kamballa property.

The ore haulage route along Roberts Road and Tooligie Road from the mine site to the Tod Highway at Tooligie will be up-graded and sealed (refer Figure 5-13).

5.8.2. Public Roads, Services and Utilities used by the Operation

Apart from a broadband telecommunications link, the only other external services to be used at Wilgerup will be the existing water and power connections to the farm house which is to be used as the site administration office. The water and power services will be used solely in their existing capacity and will not be extended to service other locations on site. The existing farm house phone connection will be replaced with a direct telecommunications microwave link to the Telstra exchange in Lock.



The mine site will be accessed by two roads, namely Roberts Road and the Murdinga – Murlong Road, which border the northern and western edges of the mining leases respectively (refer Figure 5-13). Roberts Road connects the mine Site to the Tooligie siding via Tooligie Road while the Murdinga – Murlong Road connects the mine Site to the Birdseye Highway at Murlong.

Both Roberts and Tooligie Roads will be upgraded and sealed. All other roads will be left in their current condition.

The estimated numbers of vehicle movements per day on the roads to the mine site are:

- Site – Roberts Road – Tooligie Road – Tooligie – 140
- Site – Murdinga - Murlong Road – Tod Highway – Lock: 25
- Site – Murdinga - Murlong Road – Murlong : 10

The existing Thevenard-Port Lincoln rail line will be used to transport the ore from Tooligie to Port Lincoln for export. The network is operated by Genessee and Wyoming Australia Pty Ltd and is currently used for grain haulage.

5.8.3. Accommodation and Offices

No accommodation is to be provided at the proposed mine site. Office accommodation and vehicle parking on site will include:

- Site administration office (existing Kamballa homestead)
- Administration car park
- Drilling office
- Maintenance administration office
- Crusher administration office.

5.8.4. Visual Screening and Site Security

A “green belt” of vegetation will be established along the northern and western boundaries of the proposed mining lease area to screen the site from public viewing. A list of appropriate species (found on site or within the region) that will be considered for site screening purposes is provided in Table 5-7 .

To prevent unauthorised public access to the Site the boundary of the Kamballa property will be securely fenced with “Danger – Active Mine Site – Do Not Enter” warning signs hung every 500m (refer Figure 4-14). The only access to the Site will be via the three access roads. Access to the mining areas via the northern entrance roads will be blocked with a boom gate opposite the maintenance car park. Access via the western entrance will similarly be blocked with a boom gate.



Both boom gates will be able to be remotely activated by authorised personnel to allow the passage of mine vehicles.

■ **Table 5-7 Proposed plant species for visual screening**

Species	Common Name	Plant Description
<i>Acacia ligulata</i>	Umbrella bush	Densely-leaved, spreading, height 2-3 metres
<i>Acacia paradoxa</i>	Kangaroo thorn	Dense, prickly, height to 4 metres
<i>Acacia pycnantha</i>	Golden wattle	Fast growing, useful general coloniser species, height 3-6 metres
<i>Atriplex semibaccata</i>	Berry saltbush	Groundcover, very hardy, spread to 1.5 metres
<i>Austrodanthonia spp.</i>	Wallaby-grass species	Groundcover grass species, tolerant of several climatic conditions
<i>Austrostipa spp.</i>	Spear-grass species	Groundcover grass species, tolerant of several climatic conditions
<i>Eucalyptus diversifolia</i>	Coastal white mallee	Moderate growth-rate, height to 15 metres
<i>Eucalyptus incrassata</i>	Ridge-fruit mallee	Multi-stemmed mallee, height to 10 metres
<i>Eucalyptus socialis</i>	Red mallee	Moderate to fast growing, height to 8 metres.
<i>Gahnia deusta</i>	Gahnia	Groundcover sedge, tolerant of dry conditions
<i>Kennedia prostrata</i>	Running postman	Groundcover, prefers open soil and some shade (provided by overstorey species)
<i>Melaleuca acuminata</i>	Mallee honey-myrtle	Moderate growth-rate, dense form, height to 5 metres
<i>Melaleuca lanceolata</i>	Dry-land Tea-tree	Shady, black barked tree, fast growing, hardy, height to 10 metres
<i>Melaleuca uncinata</i>	Broom bush	Multi-stemmed species, slow-growing, height to 4 metres.



Legend

Proposed vehicle access

- Light
- Heavy

Proposed service location

- Water
- Electricity

Data Sources

Aerial photography supplied by DEH

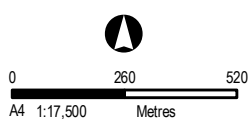


Figure 5-13 Wilgerup Mine - Public Roads, services and utilities and access



Legend

- Proposed boom gates
- Proposed fence line

Data Sources

Aerial photography supplied by DEH

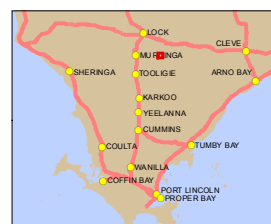
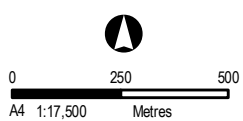


Figure 5-14 Wilgerup Mine - Site fencing and site security



5.8.5. Resource Inputs

5.8.6. Workforce

Once Wilgerup commences normal mining operations, Centrex expects to directly employ 78 personnel on the mine site with another 45 personnel required for its ore transport operations and 6 for its port operations. In total this workforce will be comprised of the following personnel:

■ Management and supervision:	15
■ Professional staff:	8
■ Secretarial staff:	1
■ Equipment operators:	33
■ Un-skilled labour:	10
■ Trades people:	18

With the exception of the management and supervision and professional staff categories, it is expected that the majority of the workforce will be sourced locally from the Eyre Peninsula region. Due to the current level of demand for staff within the mining industry, obtaining management, supervisory and professional staff is expected to be difficult and as a consequence these may be sourced from anywhere within Australia.

5.8.7. Energy Sources

Power Sources

With the sole exception of the mine administration office which will remain connected to the local electricity grid, all electrical power for Wilgerup will come from the 1.2 MW diesel generation set at the crusher site and two 200 KW diesel generators at the office / workshop location.

From the outcomes of the Greenhouse Gas Study undertaken for the project, it is anticipated that a total of 29.4 ML of diesel will be used at the mine site over the life of the mine (a maximum of 8.73 ML of diesel in year one of operation). A further estimated 12.1 ML of diesel will be used along the transport corridor (i.e. the road rail combination) over the life of the mine (a maximum of 2.38 ML per year in years 2-5 of operations).

Greenhouse Gas Emissions

The Greenhouse Gas Study (GHG) for the project is presented in Appendix I. The Greenhouse Gas Study will be used as a basis to develop a Greenhouse Gas Action Plan. The Greenhouse Gas Action Plan will identify Centrex's approach to off-setting greenhouse gas emissions throughout the lifecycle of the project (mine site to shipment point).



The GHG emissions associated with each operational phase of the proposed Wilgerup Iron Ore Mine development, except for shipping emissions, were calculated using the method described in the *National Greenhouse Accounts Factors* (DoCC, 2008). This method involves determining greenhouse gas emissions based on the quantity of fuel used. Using this methodology the greenhouse gas emissions associated with an activity can be calculated for different ‘scopes; as listed in the following (DoCC, 2008):

- **Scope 1** covers *direct* emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes;
- **Scope 2** covers *indirect* emissions from the consumption of purchased electricity, steam or heat produced by another organisation. Scope 2 emissions result from the combustion of fuel to generate electricity, steam or heat and do not include emissions associated with the production of fuel. Scope 1 and 2 are carefully defined to ensure that two or more organisations do not report on the same emissions in the same scope;
- **Scope 3** include *all other indirect* emissions that are a consequence of an organisation’s activities but are not from sources owned or controlled by the organisation; and
- A **full fuel cycle** emission factor gives the quantity of emissions released per unit of energy for the entire fuel production and consumption chain. For fuel combustion, the full fuel cycle emission factor is the sum of the direct emission factor (scope 1) and the specific ‘scope 3’ emission factor for the emissions from the extraction, production and transport of the fuel.

Expected equivalent annual carbon dioxide generated by the operations is summarised in Table 5-8. Emissions have been estimated for each year of the 6-year mine lease period; either based on the total tonnage of material (overburden plus iron ore) handled each year at the mine site (for the case of determining mine greenhouse emissions), or based on the tonnage of ore transported to port (for the case of transport emissions).

The estimated GHG emissions were based on the most significant component of energy consumption for the project; *i.e.*, diesel fuel usage. The results do not take into account, for example, energy consumed from the S.A Electricity Grid for powering port offices, operation of the storage and material handling sheds, operation of conveyors, etc. These latter estimates are unlikely to be known until establishment and commissioning of the facility. As such the assessment is restricted to fuel consumption within operations.



■ **Table 5-8 Expected equivalent carbon dioxide emissions**

Activity	Greenhouse Gas Emission (tonnes CO ₂ -e)						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Mining Operations¹							
Scope 1	23,574	21,613	12,429	9,424	8,568	3,681	79,289
Full fuel cycle	25,090	23,003	13,232	10,035	9,124	3,925	84,408
Transport Corridor							
Scope 1	3,217	6,435	6,435	6,435	6,435	3,605	32,560
Full fuel cycle	3,456	6,911	6,911	6,911	6,911	3,872	34,972
Storage/Handling Facility							
Scope 1	173	345	345	345	345	193	1,747
Full fuel cycle	185	371	371	371	371	208	1,877
Ship Loading							
Scope 1	2,184	4,368	4,368	4,368	4,368	2,447	22,104
Full fuel cycle	2,345	4,689	4,689	4,689	4,689	2,627	23,728
TOTAL Scope 1	29,148	32,761	23,577	20,572	19,716	9,927	135,700
TOTAL Full Fuel Cycle	31,075	34,974	25,203	22,006	21,095	10,631	144,985

¹ Includes mine site establishment and initial earthworks (Year 1 only). Also includes power generation on site by diesel gen sets.

5.8.8. Water Sources

5.8.8.1. Estimated Water Usage

The mine operations will require both a potable and non-potable water supply. The primary operation requiring non-potable water is dust suppression. Operations that require potable water include domestic (drinking, showering, etc.), dust suppression sprays on the crushing and screening plant and equipment wash down facilities.

Expected annual usage requirements for the mine are summarised in Table 5-9.



■ **Table 5-9 Expected annual water usage for Wilgerup Iron Ore Mine**

Source	Use	Usage (ML/Year)	Assumptions
Mains water	Domestic	~1	No extension to existing supply network. Mains network to be used for continued domestic use only.
Rainwater	Crusher Spray	~0.5	Assuming 2,000m ² of roof area is available to capture rainfall, and using historical rainfall records from Cleve (Site 018014, Bureau of Meteorology). Assuming a 60% runoff efficiency (to allow for no runoff for rainfall events less than 1mm) and adequate storage is available at the time of rainfall.
Groundwater (mine dewatering and supplementary well field)	Dust suppression Crusher spray Vehicle wash down	~517	Approximately 2ML/day available from mine dewatering network for first three years of operations. Supplementary supply network may be required to meet demand after this period. Investigations are ongoing. Assumes a water recovery rate of 40% for the reverse osmosis plant.
Wastewater	Irrigation	~0.9	Irrigation of vegetation on site only.
TOTAL WATER USAGE		~519	i.e. 1.4 ML/day

Notes:

Demand assessment based on the following assumptions:

- An average population of 30 people per shift with two 12 hour shifts per day (i.e. 60 people working on site each day) – 1 ML/year.
- Information on water usage acquired from the Building Code of Australia, the AS3500 National Plumbing and Drainage Code, and Metcalf & Eddy, *Wastewater Engineering Treatment and Reuse* (4th Edition).
- An average daily demand of 98 kL for the crusher spray (based on 3L/s over 10 hours per day for 330 days) – 36 ML/year
- Washdown has been estimated at 12 uses/day with each wash using 1 kL of water – 4.5 ML/year
- Dust suppression assumes full time operation of the equivalent of one 90 tonne water cart with application rate of 50kL/Hour – 416 ML/year

Due to the high salinity of local groundwater resources, there is currently minimal use of this water source. There are only four registered bores within 20 km of the project area (including one bore located within the proposed ML boundary). Therefore, use of the local groundwater resource will constitute more than 5% of annual groundwater withdrawal from these aquifers.

Water discharges include brine from the RO process and wastewater from the septic tank. This is discussed further in Section 5.7.3.

5.8.8.2. Water Supply

Local groundwater is to be used as the main water source. Where potable water is required, the groundwater will be treated on site via a reverse osmosis plant. Rainwater will be captured and used where possible. The mains network in the project area has a limited supply capacity. The



existing water services will be used solely in their existing capacity and will not be extended to service other locations on site, so as not to impact the local community water supply.

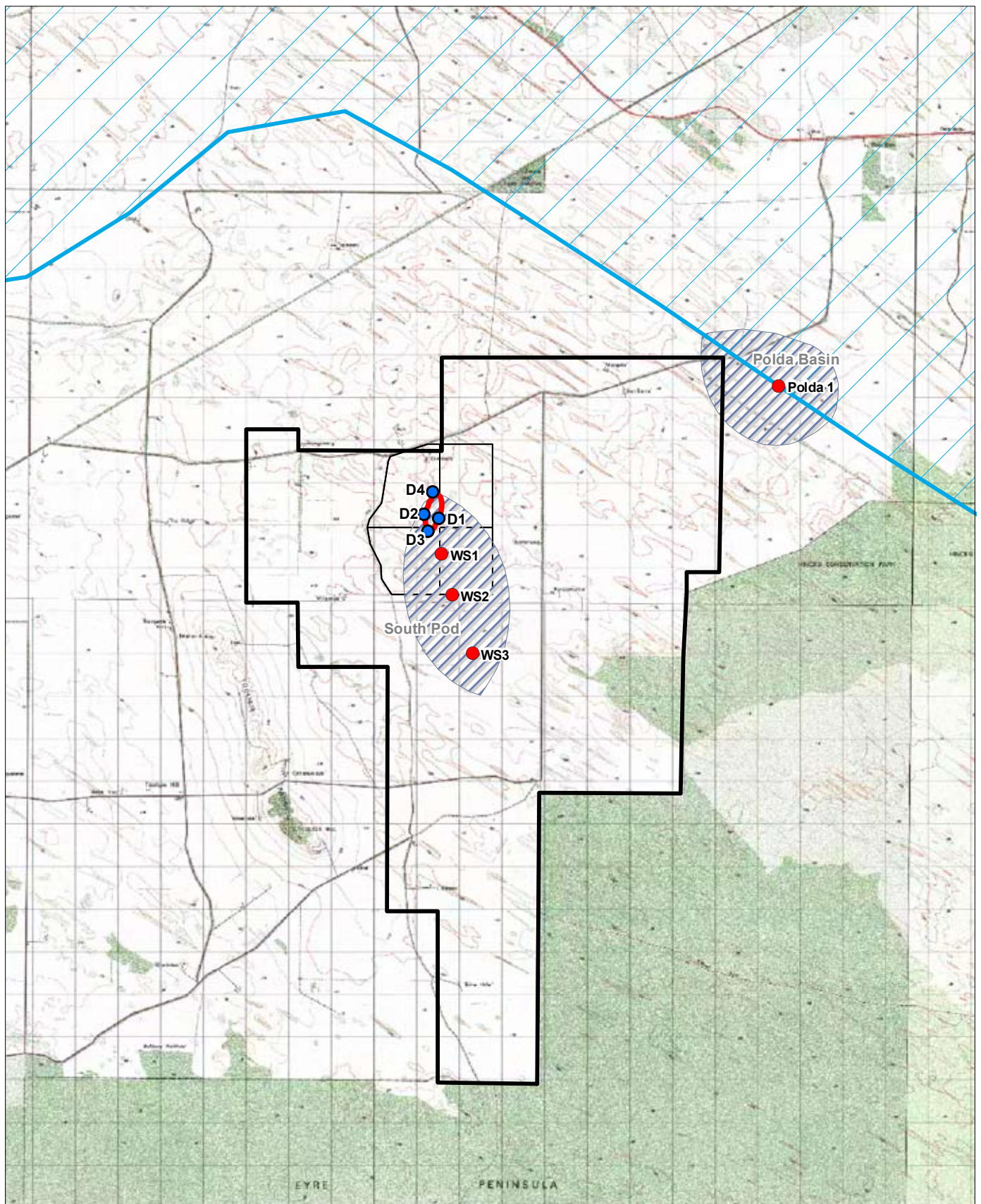
Initially, groundwater will be sourced from mine dewatering operations. The preliminary groundwater assessment (see Appendix H) undertaken indicates that based on a number of assumptions, the dewatering well-field can possibly supply between 20 and 30 L/s (1.7 to 2.6 ML/d) of saline groundwater over the six year mine life.

Recent desktop investigations undertaken by SKM indicate that there is little drilling or water bore information available to define the regional extent of the Basement Aquifer. There is some indication that the geological formations characteristic of the Wilgerup area and which are known to host a reasonably transmissive fractured rock aquifer, are not regionally extensive. It is unlikely that the key assumption of an unbounded regional aquifer of reasonable transmissivity (i.e. ~20 m²/day) can be demonstrated in the near future. The conservative position is that the Basement Aquifer is likely to be bounded within fractured zones associated with faulting. The expected long term groundwater production rate is therefore likely to be less than 20 L/s.

If required, it may be possible to boost production from the Basement Aquifer locally by locating a well-field in the region to the south of the mine site, where exploration drilling has confirmed the presence of the Basement Aquifer (see Figure 5-15). It should be noted that long term supplies will rely upon an extensive regional network of interconnected fracture zones or accessing the secondary porosity of the host rock matrix.

Based on uncertainties relating to the safe yield of the proposed dewatering well-field and the likely shortfall between dewatering rates and mine water needs, a supplementary option of extracting saline groundwater from the extensive Jurassic sediments of the Poldia Basin located 5 to 10 km to the north of the project area is also being developed (Figure 5-15). If required, approval for the supplementary well-field will be applied for by way of an MPL, following negotiation of appropriate access rights.

A mine site water balance is shown in Figure 5-16.



Legend

- Dewatering Wells
- Test Production Wells
- Indictive Mining Lease
- Poldas Basin
- Groundwater Exploration Targets

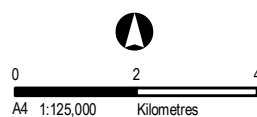
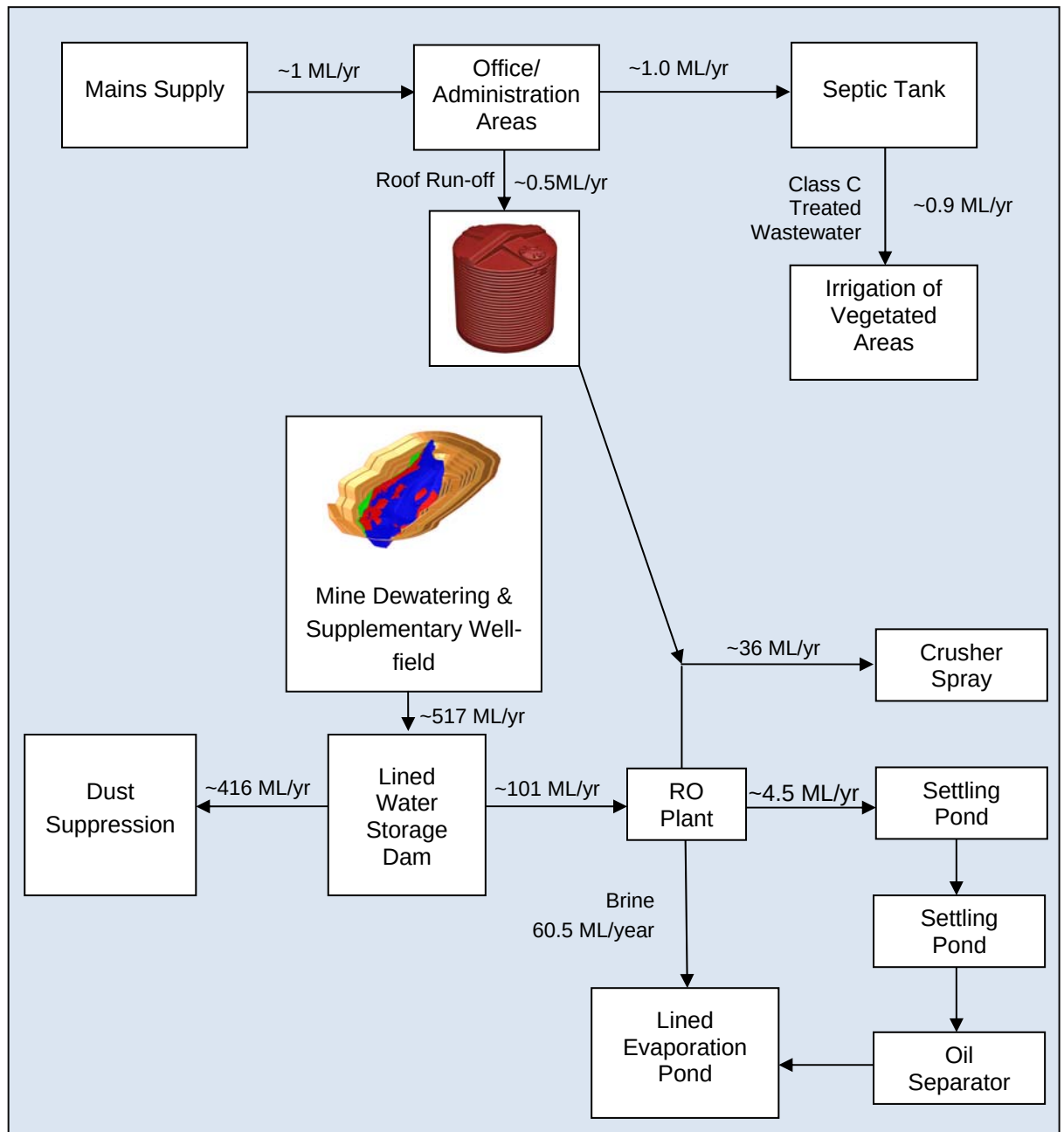


Figure 5-15 Wilgerup Mine - Target areas for groundwater supply



■ Figure 5-16 Mine site water balance



6. Description of Benefits

6.1. Social

6.1.1. Full time employment

The Wilgerup Mine is estimated to directly employ an average of 78 full time equivalent (FTE) positions per annum over the six-year life of the mine. Total annual employment generated by the mine is expected to peak in 2009-10 when the bulk of capital expenditure on construction occurs and the mine commences operation. The total impacts of the mine on regional employment are expected to diminish over time as the resource is depleted.

Centrex has a local employment target of at least 80%, aiming to increase participation of indigenous people and unemployed in the labour force through direct, indirect or induced employment.

6.1.2. Indigenous and local employment and business support

The proposed Wilgerup mine is located on open farmland that has been extensively cleared and grazed since the 1960s. Successive droughts in the area have forced many farmers who want to remain on the land to seek job opportunities in mining such as the Olympic Dam mine, the Middleback Range iron ore mines and Prominent Hill mine. The proposed Centrex Wilgerup mine would provide a much needed economic stimulus to the area.

Centrex anticipates this project will provide between 120-150 full time jobs and expects an indirect employment multiplier of between 2 and 3. The Company will employ locally wherever possible and has committed to buying locally where it makes commercial sense. Centrex will also employ practices that encourage contractors to participate in and support activities to maximise local (and Indigenous) employment opportunities.

6.1.3. Training and development

In addition to the employment and business support outlined above, a range of other initiatives to support local and indigenous people in gaining employment will be investigated, including but not limited to:

- Mine access/vocational training programs
- Mentoring and peer support
- Scholarships, secondary and tertiary
- Vacation experience/employment
- Literacy, numeracy and other skill development programs



6.1.4. Local unemployment

As noted in Table 4-2 and Table 4-3, the labour force status in Lock, Cleve and Cummins shows negligible levels of unemployment but indicates many people do not participate in the labour force. Therefore the mine is likely to absorb locally unemployed people but have a greater impact on labour force participation rates and structural shifts in employment attracting people from other industries, particularly from struggling farms.

It is estimated that there were approximately 700 people employed in Lock, Cleve and Cummins in 2006. With the Wilgerup iron ore mine estimated to contribute 120 - 150 direct jobs per annum in the region, the mine thus has the potential to boost labour demand in the region by approximately 20 per cent.

6.2. Economic Benefits

6.2.1. Revenue and Expenditure

Successive droughts in the area have forced many farmers who want to remain on the land to seek job opportunities in areas such as the Olympic Dam mine, the Middleback Range iron ore mines and Prominent Hill mine. The Centrex Wilgerup mine will provide a much needed economic stimulus to the area.

The project will generate significant economic benefits for the region, including:

- Royalty payments of \$3.3 million per annum (i.e., approximately \$17 million for the life of the project based on revenue expectations).
- Tax payments of \$30 million per annum (i.e., approximately \$180 million for the life of the project).
- Direct wages to employees of around \$14 million per annum (i.e., approximately \$78 million for the life of the project).
- Capital expenditure of about \$75 million.
- Total operating expenditure (excluding capital costs and taxes and royalties) of about \$60 million per annum (i.e., approximately \$350 million for the life of the project).
- Direct employment of up to about 35 people during construction and about 78 people during operations plus 45 ore transport operators.
- Indirect employment of around 370 people during operations.
- A direct contribution to the gross regional product of around \$60 million per annum.
- Increased support to local communities through mechanisms such as sponsorships and donations, employment opportunities, training and education opportunities.



The Company will employ locally wherever possible and has committed to buying locally where it makes commercial sense to do so. The Company does not plan to have fly-in/fly-out operations and will encourage employees sourced from outside the district to live locally. Such policies will see a significant percentage of the expected \$60 million annual spend remain within the local community.

6.3. Environmental Benefits

6.3.1. Benefits to Habitat

Establishment of a suitable offset in the form of an SEB will be of overall benefit ecologically. In addition, the removal of stock during operations and restoration of the site during rehabilitation will create new habitat to a similar (or higher) ecological quality. Any works that reduce the patchiness and permit regeneration of natural structure will be of benefit to the habitat in general.

6.3.2. Carbon Offsets

Centrex is committed to reducing the carbon footprint of its operations. A greenhouse gas study has been undertaken for the proposed project (see Appendix I) and will be used as a basis to develop a Greenhouse Gas Action Plan. The Greenhouse Gas Action Plan will identify Centrex's approach to off-setting greenhouse gas emissions throughout the lifecycle of the project (mine site to shipment point).



7. Stakeholder Consultation

Centrex Metals and its consultants are committed to providing information about the Wilgerup project in a transparent and timely manner and receiving feedback in accordance with the PIRSA Guidelines for the preparation of a Mining Lease Proposal or MARP.

The proposed Wilgerup project is a significant project for the mid and lower Eyre Peninsula communities. Stakeholder consultation is a vital component of the project as it enables the project team to draw on local knowledge held by the community and other stakeholders and to address issues of concern before project design is finalised.

Importantly, the individual elements of the project (the mine site, transport corridor and port) are not perceived as separate by many members of the community. Therefore issues raised in stakeholder consultation relate to the entire project footprint (i.e. a wider scope of issues that just the proposed ML area).

7.1. Objective and Approach

The overall objective of community and stakeholder engagement for the project is to inform stakeholders and the community of the proposed project elements, to obtain feedback on these elements and to consider the key issues and concerns in design decisions. Recognising that the community do not distinguish between the individual elements of the proposed Wilgerup project, the consultation program has consulted on all of the elements together, incorporating the mine site, transport corridor and port.

The program has used a number of different approaches which include:

- **Meetings or briefings with key stakeholders** – a range of meetings have been held with local councils, State Government Agencies, business groups and other key stakeholders.
- **Establishment of a Community Consultative Committee (CCC)** - Centrex established the CCC in September 2007 as a forum for exchange of information and for community consultation on issues related to Centrex projects on the Eyre Peninsula. The CCC includes representatives from a range of stakeholders and community groups including Port Lincoln City Council, District Council of Lower Eyre Peninsula, District Council of Elliston, Eyre Regional Development Board, Eyre Peninsula Local Government Association, tourism industry, fishing industry, education and training, chamber of commerce, health and community services, Port Lincoln ratepayers, residents and service clubs.
- **Community information displays** – Community information displays have been held in Lock, Cummins and Port Lincoln to provide an opportunity for people to discuss issues one on one with Centrex and their consultants.



- **Community fact sheets** – a range of fact sheets have been prepared and have been available at the community information displays and on the Centrex website. The fact sheets cover project overview, dust, noise, mine site environmental management, environmental management at Proper Bay and frequently asked questions.
- **Community feedback forms** – community feedback forms have been available since April 2008 and were distributed at the Cummins and Port Lincoln community events. 47 forms were received at the Cummins Community Event and 31 forms were received at the Port Lincoln Community Event.

7.2. Stakeholder Identification

Stakeholders consulted through the activities listed in Section 7.1 are summarised in Table 7-1.

■ **Table 7-1 List of Project Stakeholders**

Type of Stakeholder	Individual Stakeholder/Stakeholder Groups
Communities	Local townships and localities (Lock, Rudall, Tooligie, Murdinga, Murlong) Regional towns (Cummins) City of Port Lincoln
Specially impacted	Nearest neighbours Wilgerup landowners Barnarla Native Title claimants Nauo Native Title Claimants Landholders and residents along the proposed transport corridor
Government officials	Hon. Liz Penfold MP, Member for Flinders Hon Paul Holloway, Minister for Mineral Resources Development Hon Pat Conlon, Minister for Transport
Industry	ABB Flinders Ports Australian Southern Bluefin Tuna Industry Association Ltd Genesee & Wyoming Australia Pty Ltd Port Lincoln Chamber of Business and Tourism
Local government	City of Port Lincoln District Council of Elliston District council of Lower Eyre Peninsula City of Whyalla District Council of Cleve Eyre Peninsula Local Government Association
State Government Agencies	Primary Industries and Resources SA Coast Protection Board



Type of Stakeholder	Individual Stakeholder/Stakeholder Groups
	Environment Protection Agency Planning SA Department for Environment and Heritage – Coast and Marine Conservation Branch Native Vegetation Council Department for Water, Land and Biodiversity Conservation Department for Transport, Energy and Infrastructure Eyre Peninsula Natural Resource Management Board Department of Health
Regional bodies	Eyre Regional Development Board Whyalla Economic Development Board
Community infrastructure and service providers	Port Lincoln Health Services Port Lincoln TAFE
Special interest groups	Eyre Peninsula Community Alliance Port Lincoln Ratepayers' Association Port Lincoln Rotary Club Sarin Group Property Tourism Eyre Peninsula Tumby Bay Business Centre Port Lincoln Times ABC Radio Port Lincoln
Project Stakeholder Groups	Community Consultative Committee Port Lincoln Community Action Group Cummins Community Action Group

7.3. Engagement to Date

The record of stakeholder consultation undertaken to mid August 2008 is summarised in Table 7-2.

■ **Table 7-2 Consultation Record**

Date	Stakeholder	Type
May 2006	City of Port Lincoln; Eyre Regional Development Board	Briefing
July 2006	Wilgerup landowners	Meeting
August 2006	Lock residents	Briefing
October 2006	Barngarla Native Title claimants	Work Area Clearance Agreement
April 2007	City of Port Lincoln	Meeting



Date	Stakeholder	Type
June 2007	City of Port Lincoln	Briefing
July 2007	Hon. Liz Penfold MP, Member for Flinders	Meeting
July 2007	City of Port Lincoln	Briefing
July 2007	Eyre Regional Development Board	Briefing
July 2007	Elliston Council	Briefing
July 2007	PIRSA	Meeting
August 2007	PIRSA	Meeting
September 2007	Port Lincoln Community Consultative Committee	Advisory Group Meeting
September 2007	Rudall Staying Strong Community Event	Briefing
November 2007	City of Whyalla; Whyalla Economic Development Board	Meeting
November 2007	Port Lincoln Rotary Club	Meeting
December 2007	Port Lincoln Community Consultative Committee	Advisory Group
February 2008	Hon Paul Holloway, Minister for Mineral Resources Development	Meeting
February 2008	Port Lincoln City Council	Briefing
February 2008	Gary Richardson, General Manager, Sarin Group Property	Briefing
February 2008	Mark Cant, CEO, Eyre Regional Development Board	Briefing
15 February 2008	PIRSA Identification of stakeholders for State Government agency presentation of project proposal and discussion for Mining Lease and MARP	Meeting
5 March 2008	State Government agency presentation of project proposal and discussion for Mining Lease and MARP	Briefing and discussion
11 March 2008	Stakeholder presentation and discussion at Lock	Briefing presentation and consultation
14 March 2008	DC of Elliston	Discussion
17 March 2008	Liz Penfold MP, Member for Flinders	Briefing
17 March 2008	Port Lincoln City Council	Briefing
18 March 2008	Port Lincoln Community Consultative Committee	Advisory Group Meeting
18 March 2008	District council of Lower Eyre Peninsula	Briefing
18 March 2008	Gary Richardson, General Manager, Sarin Group Property	Briefing
25 March 2008	State Government Agency Presentation of project proposal and discussion for Section 49 Proposal	Briefing and discussion
8 April	Cummins stakeholder Engagement Event	Briefing, interactive issues boarding, discussion
18 April 2008	Meeting – District Council of lower Eyre Peninsula, Cummins	Briefing and discussion
21 April 2008	Meeting – Port Lincoln City Council	Briefing on new information
20 -22 May 2008	Port Lincoln Community Consultative Committee visit Esperance	Site tour and meetings



Date	Stakeholder	Type
22 April 2008	Coastal Protection Board	Meeting
23 April 2008	PIRSA, Discussion on MLP Progress and whole of project issues	Meeting
28 April 2008	Seafood and Mining Industry Forum (arranged by the Eyre Regional Development Board)	Presentation and group discussion
29 April 2008	Department for Transport, Energy and Infrastructure	Discussion
1 May 2008	DC of Elliston	Discussion and update
6 May 2008	Port Lincoln City Council	Meeting with planning staff
7 May 2008	PIRSA, discussion on MLP Progress and whole of project issues	Meeting
9 May 2008	Environment Protection Agency	Meeting
13 May 2008	Planning SA (for DAC)	Meeting
14 May 2008	Department for Environment and Heritage – Coast and Marine Conservation Branch	Meeting
17 May 2008	Port Lincoln community information day	Display and interactive discussion
29 May 2008	Port Lincoln Community Consultative Committee	Advisory Group Meeting
	Phillip Teitzel lawyer for Barngala Aboriginal Consultative Council	Discussion
June 2008	Community Action Group (Port Lincoln)	Invitation to present to Centrex (which was declined)
June 2008	Tourism Eyre Peninsula	Briefing
June 2008	Tumby Bay Business Centre	Briefing
June 2008	Cummins Community Action Group	Phone conversation
13 June 2008	PIRSA, Discussion of MLP draft and Case Officer handover	Meeting
26 June 2008	Port Lincoln Community Consultative Committee	Advisory Group Meeting
July 2008	Port Lincoln Community Consultative Committee	Advisory Group Meeting
3 July 2008	Hon Pat Conlon, Minister for Transport	Briefing
7 July 2008	Port Lincoln City Council	Presentation to Council meeting
17 July 2008	PIRSA, discussion of MLP draft and confirmation of scope of mine approvals documentation	Meeting
August 2008	Port Lincoln Community Consultative Committee	Advisory Group Meeting
August 2008	PIRSA, Aquaculture	Meeting
14 August 2008	PIRSA, MLP progress including discussion of outcomes of additional groundwater investigations	Meeting
22 August 2008	OneSteel	Meeting
23 September 2008	PIRSA, MLP progress including potential approval options for rail siding	Meeting



7.4. Results of Stakeholder Consultation

The proposed project has generated a large amount of discussion within the Eyre Peninsula communities, particularly in Port Lincoln. Centrex has received community feedback through community feedback forms, emails, telephone correspondence and through the CCC.

A description of the issues relating to all the three main elements of the project (the mine site, transport corridor and port) and the Centrex response is detailed in Table 7-3 below.



■ **Table 7-3 Results of Stakeholder Consultation**

Stakeholder Type	Concerns / Issues Raised	Response
Mineral Lease Area		
State Government Agencies	Future of freshwater and salt water aquifers following rehabilitation. What are the implications to the mine site and water after mining?	The pit void will remain as a permanent feature of the landscape. It is expected that the pit will flood to the same level as the base of the overlying sands, some 25 to 30 m below the surface. The potential for accumulation of groundwater in the rehabilitated pit with changed chemical characteristics resulting in degradation of Musgrave PWA groundwater resources has been assessed as part of the risk assessment (see Section 8.11). Although this risk was assessed to be low, further groundwater investigations will be undertaken to assess the extent of the Tertiary Sands and Basement aquifers significantly affected by mine activities (dewatering). A groundwater monitoring program will also be implemented throughout mining operations and closure, with an objective to preserve the values of the Musgrave PWA groundwater resources and tertiary sands aquifer.
State Government Agencies	Environmental outcomes post closure and assurances that rehabilitation will occur.	Centrex has prepared a Mine Closure and Completion Plan, which will be reviewed regularly to ensure that the most relevant standards and technology are being adopted. The broad objectives of the Mine Closure and Completion Plan are to: ■ Protect the environment and public health and safety. ■ Reduce or eliminate adverse post-mining environmental impacts. ■ Establish conditions that enable the pre-determined end land use objectives to be met. Within these objectives, the purpose of the Mine Closure and Completion Plan is to ensure that at the end of the mine's life: ■ As much of the Mine Site as is practicable is returned to productive agricultural use. ■ Infrastructure useful for agricultural purposes is retained. ■ Infrastructure of no agricultural use is dismantled and removed. ■ Areas not amenable to agricultural use are made safe and vegetated, with the vegetation density equalling or exceeding that of the surrounding (pre-mining) vegetation areas. ■ The pit void is secured against inadvertent public access. Further detail is provided in Section 9. Centrex are committed to full and complete remediation of the mine site. Good



Stakeholder Type	Concerns / Issues Raised	Response
		environmental performance is important to Centrex's future approvals and operations on the Eyre Peninsula. Further, as part of the statutory approvals process Centrex will also be required to provide an environmental bond to cover the full liability of third party rehabilitation. This is required from all prospective miners to guard against the risk of rehabilitation not occurring.
State Government Agencies	What are the processing requirements for the ore materials?	Wilgerup will be mined by conventional open cut mining methods utilising a truck and shovel fleet supported by the usual array of ancillary equipment. Following blasting, the broken material will be loaded into dump trucks by an excavator for removal from the pit to its designated storage location. Waste will be placed on the waste rock dump and ore will be sent to the crusher run of mine (ROM) pad. The only ore beneficiation which will take place in the project area will be a crushing and screening process to produce two different sized products. These products are colloquially known as "lump" and "fines". The crushing and screening operation is described in Section 5.5.
State Government Agencies	How much power will be required for the mine site? How will power be generated?	With the sole exception of the mine administration office which will remain connected to the local electricity grid, all electrical power for Wilgerup will come from the 1.2MW diesel generation set at the crusher site and two 200 KW diesel generators at the office / workshop location.
State Government Agencies Community	What is the quantity of water required for the mine site? How will the mine site operate in relation to water use (including supply and disposal)?	Expected annual demand is approximately 1.4 ML/day. The mine operations will require both a potable and non-potable water supply. The primary operation requiring non-potable water is dust suppression. Operations that require potable water include domestic use (drinking etc.) and vehicle wash down facilities. The crusher dust suppression spray may require a blend of potable and non-potable water. The potable water currently supplied to the property will be used solely in their existing capacity and will not be extended to service other locations on site. Potable water supply to administration buildings will be supplemented by harvested rainwater supply. The remaining water will be sourced from mine dewatering in the first instance, with a supplementary groundwater well-field being investigated to the south of the Wilgerup deposit (where exploration is ongoing). Based on investigations to date, it is expected that these sources will provide sufficient water for the Wilgerup operations. However, groundwater resources to the north in the Poldia basin continue to be investigated



Stakeholder Type	Concerns / Issues Raised	Response
		as a back-up supply option. A reverse osmosis plant will be used where higher quality water is required. Brine from this plant will be sent directly to the evaporation/infiltration dam adjacent to the wash down pad. Water from the wash down facility will pass through an oil water separator prior to disposal to the evaporation/infiltration dam.
Community	Concern that use of saltwater for dust suppressant on roadways could lead to contamination	The use of saline groundwater for dust suppression on mine roads and stockpiles has the potential to degrade the soil quality and structure within the areas of its use. At completion of mining, all haul roads and impacted soil will be removed and disposed of appropriately, the road scarified and topsoil reapplied. Ongoing monitoring of soil salinity levels [measured by electrical conductivity (EC)] will be undertaken in areas intended for future agricultural use to enable potential issues to be identified and addressed early.
State Government Agencies	What is the water depth at the mine site? What are the potential impacts on surrounding groundwater users from mine dewatering?	Measurements indicate that surface water levels are approximately 75-77 mAHd (a few metres above the top of the deposit). A risk assessment of potential impacts of mine dewatering on surrounding users has been undertaken and is included in Section 8.11. Available information indicates there is limited groundwater use in the central Eyre Peninsula region. There are only four (4) registered or known bores within 20 km of the Wilgerup deposit and, because of high salinity, none of them are being used for water supply purposes. As such potential impacts of mine dewatering on surrounding groundwater users are not expected to be significant.
State Government Agencies	What are the potential impacts of water supply to the mine site (e.g. on the Tod Reservoir, Port Lincoln borefield, use of rainwater)?	Water supply to the mine will not result in any additional pressure on the Tod River Main, with the current connection only to be used in its existing capacity only. The Port Lincoln borefield will not be affected. Roof run-off from buildings within the ML area will be captured and used on site.
State Government Agencies	Excess water – what will be done with the water from mine dewatering?	Lined evaporation ponds will be used for water storage. A water truck will collect and use this water for dust suppression on site. The water truck has a water cannon fitted on top, which can also be used in the case of fire emergency.
State Government Agencies	Make sure the correct studies/modelling is being undertaken, in particular air quality.	The methodology developed for air quality modelling has been discussed and agreed with the EPA and undertaken in accordance with the relevant EPA guidelines.



Stakeholder Type	Concerns / Issues Raised	Response
		The detailed air quality report is provided as Appendix D.
State Government Agencies	Dust impact on vegetation should be considered.	Potential for dust generated from mine operations has been considered as part of the risk assessment for the project and is included in Section 8.8.
State Government Agencies	Monitoring of air quality will be essential.	Monitoring of air quality will be undertaken in order to obtain baseline air quality data for the site and to monitor the ongoing environmental performance of the mine once operational. The conceptual monitoring proposed is described in Section 8.8.10.
Community	What about the safety of the kids when they get dropped off and picked up by the school bus?	Safety will be a primary feature of all Centrex operations. Community feedback has highlighted the concern over road safety. Centrex has already promised residents residing on the roads leading from the Mine site to Tod Highway that pull over verges for the school bus will be included in the proposed road upgrades. Further community consultation and investigations may come up with other safety improvements. There is also the option to have transport shift changes (when the trucks are off the road) scheduled to coincide with school pick up and drop off times.
Community	Comments on the local economy have been mixed. Some people are concerned with the potential for local businesses losing employees to the higher wages of a mine site. Other people are interested in employment opportunities or supply contracts.	Centrex believes the proposed Wilgerup Mine will enhance and diversify the regional economy. The mine is likely to absorb locally unemployed people but have a greater impact on labour force participation rates and structural shifts in employment attracting people from other industries, particularly from struggling farmers. Successive droughts in the area have forced many farmers who want to remain on the land to seek job opportunities in mining such as the Olympic Dam mine, the Middleback Range iron ore mines and Prominent Hill mine. Centrex believes the proposed Wilgerup mine would provide a much needed economic stimulus to the area. Centrex will employ locally wherever possible and has committed to buying locally where it makes commercial sense. Centrex will also employ practices that encourage contractors to participate in and support activities to maximise local (and Indigenous) employment opportunities. Indirect employment opportunities stimulated by the mine are anticipated to include: trucking and rail operations, catering, accommodation, hospitality, road maintenance, work supplies, building and construction, seeds and nursery supplies and mechanical repairs.



Stakeholder Type	Concerns / Issues Raised	Response
Transport Corridor		
Community Local Council	Potential impacts of trucking including: - Impacts on the community and Cummins Main Street - Road transport issues at Cummins and the potential need for a bypass or traffic calming measures - Trucking to Port Lincoln Wharf Traffic during harvest time along the Tod Highway (and through Cummins) is already busy	The preferred option is to transport the ore to Port Lincoln Wharf by train. Road transport to Port Lincoln Wharf is not considered feasible due to limited space.
State Government Agencies Community	Dust impacts from transportation including: - Dust impacts on vegetation - General reddening from transport related dust emissions	Dust management is an important environmental consideration in the iron ore industry, and one which Centrex takes very seriously. For Centrex, dust control begins at the mine site and continues until the ore is loaded onto a ship and is on its way to market. Measures to mitigate potential impacts from dust along the transport route include: ■ All trucks carrying ore will be covered. ■ Rumble strips will be installed to ensure that any dust on the outside of the trucks is shaken off prior to exiting the mine site. ■ Roads from the mine site to the rail siding at Tooligie will be sealed. The rail siding will not be located near sensitive residential receptors. A water cart operating as required at the rail siding to minimise dust generation.
State Government Agencies	Greenhouse gas emissions of ore transport, in particular road transport.	Centrex is committed to reducing the carbon footprint of its operations. A greenhouse gas study for the project (from mine site to ship) has been undertaken for the proposed project (see Appendix I). Outcomes of the study indicate that Centrex's operations are likely to trigger National Greenhouse and Energy Reporting requirements under the <i>National Greenhouse and Energy Reporting Act 2007</i>. The Greenhouse Gas Study provides a comparison between the rail and road transport options. The Greenhouse Gas Study will be used as a basis for Centrex to develop a Greenhouse Gas Action Plan to reduce greenhouse gas emissions and ensure Centrex is prepared for



Stakeholder Type	Concerns / Issues Raised	Response
		when the Government introduces its Carbon Trading Scheme.
State Government Agencies Local Council Community	General preference for transport of ore by rail rather than road. Rail options for transport - considering the cumulative impact/opportunities of numerous developments in the Eyre Peninsula. There are at least 20 prospects on the Eyre Peninsula that have the potential to increase truck movements. Eyre Peninsula farmers are now putting \$2M of their own capital into a rail upgrade as part of \$30M program. – do not want to lose rail. Safety issues also favour rail.	The preferred approach is to transport the iron ore to Port Lincoln Wharf via the existing rail line. Use of rail will reduce the cumulative impact of increased truck movements resulting from mining development on the Eyre Peninsula. The rail network is currently under utilised. Use of the existing corridor by Centrex will support upgrade and continued maintenance of the network.
State Government Agencies	Need to consider distance from transport route to homes as the Department of Health is very concerned about increased diesel emissions within 150-200 metres of residential homes. These emissions have significant impact on health, particularly asthma in children.	The preferred approach is to transport the iron ore to Port Lincoln Wharf via train. Therefore, there will not be additional heavy vehicle traffic to the Tod Highway or through Cummins. The Centrex proposal will have minimal impact when compared to the high volume of grain traffic passing though Cummins during harvest season.
State Government Agencies Community	Concern about the impacts of increased heavy vehicle traffic on the Tod Highway. DTEI will be seriously considering the need for contribution to maintenance costs for Tod Highway.	The preferred approach is to transport the iron ore to Port Lincoln Wharf via train. Therefore, there will not be additional heavy vehicle traffic to the Tod Highway.
Port Location		
State Government Agencies	Has the investigation of port facilities considered more than one option?	Centrex has explored all potential port options (including proposed ports) as part of its investigations to develop the Wilgerup Iron Ore Mine. Ports considered include Thevenard (not of sufficient depth), Port Bonython (outside development timeframes for Wilgerup Iron Ore mine), OneSteel owned facilities at Whyalla (access not permitted), Proper Bay and Port Lincoln Wharf. Port Lincoln Wharf and Proper Bay at Port Lincoln have been identified as feasible options for exporting iron ore from Wilgerup. Port Lincoln Wharf has been identified as the preferred option in response to issues raised through the stakeholder and community



Stakeholder Type	Concerns / Issues Raised	Response
		consultation process. Centrex intend to use Port Lincoln Wharf to meet the exporting requirements of the Wilgerup Iron Ore Mine. Centrex is investigating development of a new port facility to meet the exporting requirements of its other deposits on the Eyre Peninsula. An overview of the decision making process for port selection is provided in Section 2.6.
State Government Agencies	How have cumulative infrastructure requirements been considered in terms of the location of facilities and the potential use of Proper Bay for other ore products?	Centrex understand that there are limited port options for prospective miners on the Eyre Peninsula, and has considered potential expansion of the mining industry on the Eyre Peninsula in its port selection process. For example, Centrex's investigations have included consideration of development of a multi-user facility at Proper Bay. However, following a detailed site selection process, the preferred port location is Port Lincoln Wharf (as detailed in Section 2.6).
State Government Agencies	Make sure the correct studies/modelling is being undertaken, in particular presentation of air quality modelling.	Centrex is committed to minimising risk of environmental impact from its port operations by adopting industry best practice design. Centrex has undertaken a range of environmental and engineering investigations at both Port Lincoln Wharf and Proper Bay. Throughout this process it has consulted with the EPA to: ■ Ensure the environmental modelling methodologies, including background air quality levels are acceptable to the regulator ■ Ensure data and information is presented in the most appropriate way. ■ To discuss the environmental mitigation measures adopted in the engineering design process and provide an opportunity to maximise environmental outcomes through modifications to site layout or design elements.
State Government Agencies Community	Dust impacts from port operations including general reddening from transport related dust emissions. Concerns for health impacts, in particular from dust or particulate emissions have also been raised.	Dust management is an important environmental consideration in the iron ore industry, and one which Centrex takes very seriously. For Centrex, dust control begins at the mine site and continues until the ore is loaded onto a ship and is on its way to market. The iron ore is proposed to be crushed and screened on site at the Wilgerup mine site, transported via covered road train a rail siding at Tooligie and then by rail wagons to the port. This is in stark contrast to the situation in Whyalla, where the crushing and processing of ore was undertaken within the town, causing the infamous red dust problem. The proposed minerals exporting facility will also include substantial detail on dust mitigation, including: ■ Fully enclosed unloading facilities



Stakeholder Type	Concerns / Issues Raised	Response
		- Fully enclosed negative pressured shed - Fully enclosed conveyors Utilising Port Lincoln Wharf for iron ore export will also remove the need for transshipping, an issue that has caused significant concern amongst the fishing industry and the community.
Community	The community have expressed concerns in relation to noise and dust impacts from a port facility in Port Lincoln. In particular they are concerned that even if strict conditions are imposed, there is potential that the conditions may be ignored and not enforced.	Centrex is committed to minimising risk of environmental impact from its port operations and to meeting any conditions imposed. In order to achieve, manage and monitor its environmental performance, an Environmental Management Plan will be prepared and implemented for the minerals exporting facility. Centrex will also be required to operate under the conditions of an environmental licence, and its compliance with its environmental obligations will be regulated by the relevant authorities.
State Government Agencies	Monitoring of air quality will be essential.	As for the mine site, monitoring of air quality will be undertaken in order to obtain baseline air quality data for the site and to monitor the ongoing environmental performance of the minerals exporting facility once it is operational. Monitoring would be included as part of the Environmental Management Plan for the site.
State Government Agencies	The port storage facility and infrastructure should be sited to reduce the impact on native vegetation. Ideally development should be contiguous with adjacent development to reduce fragmentation of native vegetation. It will be important to undertake a native vegetation survey of the whole area (not just the development site) to ensure any threatened species in the area are identified and management arrangements can be put in place.	The selection of Port Lincoln Wharf as the preferred port site alleviates impacts on native vegetation. Port Lincoln Wharf is an existing bulk commodities facility and will not require native vegetation clearance.
State Government Agencies	What are the proposed arrangements for shipping? Will dredging be required? If a seabed mooring is being considered for transshipping, a study on the seabed will need to be undertaken to determine whether it will hold a	It is proposed to export the iron ore from Wilgerup from Port Lincoln Wharf, which is an existing operational port. No dredging will be required. There is sufficient water depth at Port Lincoln Wharf to load a panamax size vessel. A panamax vessel can typically carry 60,000 to 80,000 tonnes. A Development Application under the <i>Development Act 1993</i> will be prepared for the



Stakeholder Type	Concerns / Issues Raised	Response
	mooring. At Whyalla the seabed will not hold a mooring and ships need to anchor.	proposed minerals exporting facility detailing the key design features and proposed operations. Centrex will continue to consult with the community as information becomes available.
Community	Potential impacts on the marine environment and subsequent impacts on aquaculture have been a large area of concern for the community. In particular, the impact of iron ore dust on the marine environment has been raised. Concerns regarding attention to dust minimisation for barges and transshipment.	As previously stated, management of dust impacts starts at the mine site and extends until the ore is loaded on the ship and is on its way to market. Air quality modelling has been undertaken to assess the potential impacts of the ship loading process and to verify the effectiveness of the engineering design control measures. The selection of Port Lincoln Wharf as the preferred port option removes the need for transshipment point and seabed mooring. This means no new development is proposed in proximity to aquaculture zones.
State Government Agencies	A nesting pair of Ospreys has been identified at the Proper Bay Jetty. DEH advised an Osprey expert will be need to be consulted in relation to the proposed relocation of the osprey nest.	Throughout the site selection process, an Osprey specialist was consulted in relation to potential relocation of the ospreys at Proper Bay. However, selection of Port Lincoln Wharf as the preferred port site means that the Ospreys will not need to be disturbed.
Community	The potential impact on Port Lincoln's 'clean green' image from a minerals exporting facility has been raised as an issue of concern. The Port Lincoln community as well as the seafood and tourism industries take pride in the aesthetic and environmental values of the area and are concerned that his image will be lost.	The minerals exporting facility would operate with strict environmental design and environmental management controls to minimise any impacts on the Port Lincoln Brand and preserve the aesthetic and environmental values of the area. Centrex have been working with the community, and in particular the CCC to provide reassurance that minerals exporting can coexist with other industries including fishing and tourism. Esperance and Geraldton have been identified as relevant examples. The CCC has had an opportunity to visit Esperance and consult with industry as part of this process. Further, the selection of Port Lincoln Wharf as the preferred port site also means that loading activities will not be occurring in close proximity to aquaculture zones.
Community	Amenity impacts have also been an area of concern within the community, in terms of noise, dust and visual impacts on residential amenity and lifestyle.	The minerals exporting facility would operate with strict environmental design and environmental management controls to minimise any impacts on the Port Lincoln brand and preserve the aesthetic and environmental values of the area.
Community	Issues around water supply have been raised for the minerals exporting facility. Impacts on ground	For the proposed minerals exporting facility at Port Lincoln Wharf, Centrex intend to capture rainwater run-off from the storage facility and administration buildings. This water



Stakeholder Type	Concerns / Issues Raised	Response
	water, concern for how much water Centrex will use and where they will get it from have all been raised.	will provide the basis of water supply for the site.
Local Council	Potential impacts in Port Lincoln due to the use of locomotives	Centrex will be undertaking investigations to address and manage the potential impacts of increased rail traffic into Port Lincoln (including noise and potential traffic delays due to rail crossings). Overall, feedback from the community has favoured the rail option above truck transport on the grounds of safety, reduced frequency and lower greenhouse gas emissions. An increase in traffic through Port Lincoln is unavoidable, in order to achieve a higher utilisation of the existing main wharf in Port Lincoln. However, Centrex are committed to reducing its impacts on the community. A Development Application under the <i>Development Act 1993</i> will be prepared for the proposed Port Lincoln Wharf exporting facility detailing the key design features and proposed operations, including management of rail and shunting operations.



8. Environmental, Social and Economic Aspects

8.1. Background

ISO 14001 Environmental Management Systems – Specifications with guidance and for use, sets out an approach to enable organisations to formulate a management system that takes into account legislative requirements and information about their environmental impacts.

For the Wilgerup Mine Development Project an Aspect Identification and Risk Assessment (based on the principles of ISO 14001) has been undertaken to identify the highest risk environmental aspects of the project (construction and operation) and provide the basis for environmental, social and economic management and mitigation measures for the activities.

8.2. Methodology

8.2.1. Aspect and Impact Identification

The environmental aspects associated with Centrex's proposed Wilgerup Mine Development Project are those *elements of their activities, products or services that can interact with the environment*. For this project the aspect identification focussed on the activities associated with construction and operation of the mine.

The impacts associated with Centrex's proposed Wilgerup Mine Development Project are *any changes to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects*. The process of identifying impacts is one of progressively breaking down each activity into its environmental aspects.

8.2.2. Approach

A risk assessment was undertaken to determine the level of risk associated with the identified impact events. The assessment of environmental, social and economic impacts was undertaken in accordance with Guidelines for the Preparation of a Mining and Rehabilitation Program (MARP), Version 4.8 (the MARP Guidelines).

The Primary Risk Level (PRL) of the identified aspect was considered without taking into account the management and mitigation measures that will be employed by Centrex during all stages of project (i.e., mine development and planning, operations and mine closure) to address these impacts. Identification of the potential impacts is based on knowledge of the existing environment, experience with similar operations elsewhere and issues of concern to key stakeholders.

Consideration has then been given to elimination, mitigation and/or management measures. These have been categorised as Design Control Measures (i.e., those measures that can incorporated into



the design of the mine and associated infrastructure) and Management System Measures (e.g., identification of management approaches and plans to be implemented both during and following operations).

The Design Control Measures and Management System Measures are considered technically and economically feasible and reflect Centrex's commitment to minimising adverse environmental and socio-economic impacts.

The final component of the assessment involved assessing the Residual Risk Level (RRL) associated with each of the identified aspects. This assessment assumes the effective implementation of the proposed Design Control and Management System Measures.

8.2.3. Risk Assessment

8.2.3.1. Likelihood

The likelihood of each risk occurring was classified using the likelihood category definitions provided in the MARP Guidelines, shown below:

- **Almost Certain** – Will occur, or is of a continuous nature, or the likelihood is unknown.
- **Likely** – Likely to occur during mine lifetime.
- **Possible** – Could occur in most mines.
- **Unlikely** – Could occur in some mines, but is not expected to occur.
- **Rare** – Has almost never occurred in similar mines but conceivably could.

8.2.3.2. Consequence

The severity or consequence of an event was determined based on consideration of the potential scale of the event, the stakeholders who may be affected, the duration of the event and the difficulty in remediating the impact. The following classification system was used in this risk assessment (PIRSA MARP Guidelines):

- **Insignificant** – Possible impacts but without noticeable consequence.
- **Minor** – Very local consequence with no significant long term changes, may be simply rehabilitated or alleviated at some cost without outside assistance, not of significant concern to wider community.
- **Moderate** – Significant local changes, but can be rehabilitated or alleviated with difficulty at significant cost and with outside assistance.



- **Major** – Substantial and significant changes, will attract public concern, only partially able to be rehabilitated or alleviated. May be doubtful that can be successfully rehabilitated, major costs involved. Changes will be substantial if cumulative effects are considered.
- **Catastrophic** – Extreme permanent change to social or natural environment (not able to be practically or significantly rehabilitated or alleviated), deaths or widespread health and economic effects on public, major public outrage or the consequences are unknown.

The risk associated with each event was classified for comparative purposes using the risk ranking matrix described in the PIRSA MARP Guidelines, provided in Table 8-1.

■ **Table 8-1 Risk Ranking Matrix**

		Likelihood of Consequences				
		Rare	Unlikely	Possible	Likely	Almost Certain
Severity of Consequence	Insignificant	Low	Low	Low	Moderate	High
	Minor	Low	Low	Moderate	Moderate	High
	Moderate	Moderate	Moderate	High	High	Extreme
	Major	High	High	Extreme	Extreme	Extreme
	Catastrophic	High	Extreme	Extreme	Extreme	Extreme

Discussion regarding the risk acceptance for the identified aspects and impacts are discussed in the respective sections below.

8.2.4. Outcomes and Assessment Criteria

A set of predicted outcomes (environmental standards) has been developed by Centrex based on the results of the residual risk assessment. These predicted outcomes are accompanied by conceptual performance criteria that will be used by Centrex to assess their performance against the stated outcomes. These criteria will be further developed by Centrex prior to submission of the MARP.

Predicted outcomes have not been developed for each individual aspect, impact and risk as detailed in the project risk register (Appendix J). Where appropriate, individual aspects and impacts have been consolidated to develop one single predicted outcome.

8.2.5. Environmental Monitoring and Reporting

Conceptual environmental monitoring requirements are set out for each aspect and are also reflected in the environmental management plans (Sections 8.3.12, 8.3.13 and 8.11.11).



A detailed company monitoring program will be developed for inclusion in the MARP to measure the effectiveness of each strategy and the achievement of each outcome.

Reporting requirements will be discussed with PIRSA and included in the MARP, but Centrex anticipate that annual reporting is appropriate, with provision for notification of any incidents to PIRSA as required.

8.3. Flora and Fauna

8.3.1. Context and Stakeholder Views

Environment: The mine site occurs in a relatively remote area which has been largely cleared of remnant vegetation. Isolated small to tiny patches of remnant mallee vegetation are scattered across the landscape within the proposed ML area and it is likely that some of these patches may require clearing or will be impacted by the mine development. An ecological assessment of the project area showed that these mallee patches are highly degraded with low species diversity and significant weed incursion. They are characterised by little to no litter cover and overgrazing, and display evidence of wind erosion. The patches are considered to represent low habitat value.

Stakeholders: Stakeholders include the Department of Environment and Heritage (potential flora and fauna impacts) and the Native Vegetation Council (for vegetation clearance; though it is noted that authority for vegetation clearance is delegated to PIRSA for the purposes of a MARP).

8.3.2. Applicable Legislation or Standard

Threatened flora and fauna species (as indicated by legislatively established Conservation Status) within South Australia are protected both at the Commonwealth and at the State level. Additionally, all native vegetation is protected. The operative legislative documents within South Australia are:

- *Environment Protection and Biodiversity Conservation Act, 1999* (see s179)
- *National Parks and Wildlife Act, 1972* (Schedules 7, 8 and 9 of the Act)
- *Native Vegetation Act, 1991.*

In the case of the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) the categories of national environmental significance are **extinct in the wild**, **critically endangered**, **endangered** and **vulnerable**. As well as the EPBC Act conservation categories listed, an additional category “Migratory Species” is included under the Act for migratory species assessed as of national environmental significance, which requires assessment and approval provisions where impacts are likely. A person must not take an action that has, will have, or is likely to have a significant impact on a listed migratory species without approval from the Commonwealth



Environment Minister. The National List of Migratory Species consists of those species listed under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals - (Bonn Convention).

The *National Parks and Wildlife Act, 1972* (NP&W Act) assigns species to State conservation categories by listing in the relevant Schedule of the Act. The assigned categories are **Endangered** (Schedule 7), **Vulnerable** (Schedule 8) and **Rare** (Schedule 9).

The *Native Vegetation Act, 1991*, regulates the clearance of native vegetation in South Australia, and is particularly relevant for mining operations. Native vegetation may be defined as any uncleared vegetation or areas which have been previously cleared but have regenerated naturally. This does not include planted vegetation unless undertaken in compliance with a condition imposed by the Native Vegetation Council (e.g., as part of an offset project).

The Native Vegetation Act is regulated by the Native Vegetation Council (NVC) which delegates the administrative responsibilities to Primary Industries and Resources South Australia (PIRSA) for mining projects. PIRSA applies the policies of the NVC on clearance and revegetation through the use of 'Mining and Rehabilitation Programs' (MARPs) under regulation 42 of the Mining Act.

MARP approvals to clear native vegetation must demonstrate specific criteria are met. This includes the potential to avoid areas of intact strata of native vegetation, the absence of alternative site locations thereby avoiding native vegetation clearance, and the consideration of site location in relation to the least significant native vegetation.

The concept of a Significant Environmental Benefit (SEB) forms a major component of the assessment. The MARP must demonstrate that impacts associated with clearance of native vegetation will be offset by works to re-vegetate, restore, regenerate or enhance native vegetation and habitat value for fauna via an SEB project. The calculation of the SEB requires the nature and extent of impacts on native vegetation be clearly defined in the MARP. The assessment then takes into account the presence of plant species and plant communities, their conservation significance and habitat value for fauna.

8.3.3. Potential Impacts

The mine operation will require clearance of vegetation for mine infrastructure, transport routes, and ore extraction itself. Most of the project area is cleared cropping/grazing land of no ecological value. Vegetation at the site is limited to a number of small mallee patches scattered over the proposed ML area (Figure 4-16) as previously described.



Impacts to fauna are primarily those associated with habitat loss, as it is unlikely that any species will be impacted directly by clearance activities. An ecological assessment indicated that there is likely to be little habitat of value for mammals or reptiles at the site and thus most impacts to fauna are likely to be for bird species.

Clearance of Vegetation – reduced cover and species diversity

Vegetation at the site will have to be cleared for development of the pit and mine infrastructure (see Figure 4-17). The removal of vegetation will result in a reduction of flora species abundance and loss of available habitat for fauna. The majority of the area that will be impacted by the development is cleared farmland of no ecological value. However, clearance of entire mallee patches or sections thereof will reduce the available habitat in the area and further reduce the already scarce native vegetation in the region.

Every effort will be made to minimise any adverse impacts on the vegetation at the site. However, because of the highly degraded and patchy nature, and similar quality and composition of the patches, it is not envisioned that there would be any benefit from selectively favouring clearance of some sections of vegetation over others. As identified in the ecological assessment, the habitat loss associated with clearance of this vegetation should be minimal because there is no connectivity with significant vegetation, the patches are small, isolated and of poor quality. Establishment of a suitable offset in the form of an SEB will be of overall benefit ecologically. Furthermore, restoration of the site should be possible following completion of works to a similar (or higher) ecological quality: any works that reduce the patchiness and permit regeneration of natural structure will be of benefit to the habitat in general.

Clearance of Vegetation - Effects on threatened species/communities

There was no evidence of the presence of threatened flora or fauna species at the site and, given the degraded nature of the habitat; it is unlikely that threatened species occur in the immediate area at this time. Clearance of some patches of vegetation will therefore have negligible impact on threatened species/communities. Indeed, a suitable offset in the form of an SEB may be of overall benefit to threatened species in that a larger continuous patch of mallee vegetation may support malleefowl.

Clearance of Vegetation - Impacts on Fauna

Impacts on fauna resulting from vegetation clearance are likely to be minimal, as the already degraded nature of the patches of vegetation at the site does not lend itself to use as a refuge for many fauna species. There was no evidence of threatened species at the site, and thus clearance should have no impact on threatened fauna. Bird species are likely to suffer the greatest in terms of habitat loss, though this should be mitigated overall via implementation of the SEB.



Spread of weed species

Several weed species were identified at the site (see Section 4.11.6), primarily associated with cleared areas. Due to the poor conditions at the time of the site visit (drought, late summer), it is possible if not likely that further weed species will germinate at different times. Further clearance of vegetation may result in the spread of weed species to cleared areas, and the movement of vehicles around the site could result in the spread of weeds over a wider area. However, given the similar nature of much of the surrounding property (i.e. degraded farmland) there is almost an equal likelihood that weeds will move *into* the site from adjacent properties. Nonetheless it is the responsibility of the operator to implement control procedures to minimise weed propagation and dispersal that could result from mining and development activities. Although the impact of weed dispersal is likely to be minimal at the site, concern should be given to the possible impacts of weed spread to other properties adjacent to the site and along the transport route.

8.3.4. Control and Management Strategies

The management system control measures that will be adopted to assist in the avoidance and mitigation of impacts associated with vegetation clearance and weed dispersal include:

Design Control Measures

- Minimise clearance through careful placement of mine infrastructure and associated requirements.

Management System Measures

- Impacts to flora (and consequently fauna habitat) cannot practically be avoided, since clearance of vegetation is a requirement for the operation of the mine. However, clearance of native vegetation requires approval by the Native Vegetation Council (here delegated to PIRSA under the Native Vegetation Act and Regulations) which requires the calculation of a SEB and determination of method of SEB to be offered (e.g. payment into the Native Vegetation fund, identification of land that can be protected and managed, or the development of alternative offset activities). This offset method will alleviate any ecological impacts by replacing or building ecological values in another area. SEB calculations are provided in Section 8.3.11.
- Management measures for native vegetation and fauna at the site are detailed in the Native Vegetation Management Plan (Section 8.3.12).
- Management measures for weeds as detailed in the Weed Management Plan (Section 8.3.13).

8.3.5. Risk Levels

The likelihood of vegetation clearance associated with the mining operation is **certain** as although the majority of the area is open farmland, some vegetation patches lie within the footprint of the



mine development (see Figure 4-17). Nonetheless, given the patchy and degraded nature of the vegetation, the overall impact to the vegetation in the region as a whole will be **minor**. Impacts to fauna will be **low** overall, as the vegetation is not considered to provide good habitat value.

8.3.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-2.

■ **Table 8-2 Risk assessment outcomes – Flora and Fauna**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Clearance - reduced cover and species diversity	Likely	Insignificant	Approved SEB offset project. Implementation of Native Vegetation Management Plan	Likely	Insignificant	Moderate	Yes
Clearance - reduced habitat for fauna (including threatened species)	Likely	Insignificant	Approved SEB offset project. Implementation of Native Vegetation Management Plan	Likely	Insignificant	Moderate	Yes
Spread of weed species	Likely	Minor	Implementation of weed management plan	Unlikely	Minor	Low	Yes

8.3.7. Risk Acceptance

The most significant risk to flora and fauna will be due to required clearance. Given site clearance will require approval from PIRSA (delegate of the Native Vegetation Council), an offset project (or payment into the Native Vegetation Fund) will result in a net gain of native vegetation in the local area. Additionally, it is expected that the vegetation/habitat in affected areas will recover once operations have ceased, leading to a further overall net gain.



8.3.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- All native vegetation clearance associated with mine activities is undertaken in accordance with the *Native Vegetation Act*, Regulations and SEB Policy.
- No net loss of threatened or non-threatened native flora species or communities (abundance or diversity) as a result of mine operations following rehabilitation.
- No permanent reduction in the health and condition of remnant native vegetation due to mine operations (excluding native vegetation approved for clearance).
- No disturbance to rare, vulnerable or endangered flora and fauna due to mine operations.
- No increase in weed distribution or introduction of new weed species and infestations due to mine operations.

8.3.9. Assessment Criteria

The following assessment criteria will be adopted:

- Demonstration of the successful implementation of Native Vegetation Management Plan and PIRSA approved SEB offset measures for all native vegetation clearance.
- Photopoint monitoring and site surveys of native vegetation adjacent to operational areas will show similar vegetation abundance and diversity to baseline results within two years of operations ceasing.
- No death or injuries to rare, vulnerable or endangered native fauna as a result of operations.
- No operations in areas containing rare, vulnerable or endangered flora and fauna.
- No increase in weed density/distribution (compared to baseline data).
- No new establishment of declared weeds (compared with baseline data).

8.3.10. Monitoring Program

Monitoring will include:

- Supervision of clearance activities by qualified person.
- Regular surveys and photo-point monitoring (within identified areas) to identify changes in vegetation condition against baseline.
- Regular monitoring of areas identified as having a high susceptibility to weed infestations (e.g. recently cleared areas and roads).
- Inspection and wash down of project vehicles and equipment when arriving on site.
- Ongoing monitoring of fauna deaths on site associated with mining operations.



- Records of disturbed areas and rehabilitated areas to monitor overall net change in native vegetation.

8.3.11. Significant Environmental Benefit (SEB)

Native vegetation clearance that will be required due to the proposed mining development site is depicted in Figure 4-17. This demonstrates that the complete clearance of some patches, and partial clearance of others, will be required. Details and area calculations for this vegetation is in Table 8-3 below. In addition, some clearance of vegetation will likely take place along access roads, but as this vegetation consists of planted trees, it is not subject to Native Vegetation Act requirements and thus not incorporated into calculations of SEB.

The Mallee patches at the site were assigned an SEB ratio of 4:1, with the exception of Patches I and V which were assigned a ratio of 2:1 (Figure 4-16 and Appendix F.1). This was primarily due to the absence or depletion of the ground flora strata within all patches, and the strong evidence of wind erosion. Patches I and V were observed to have particularly sparse vegetation cover together with absent or reduced ground cover, resulting in a reduced conservation value.

8.3.11.1. SEB Scope

A total area of almost 4 ha of native vegetation will need to be cleared for mine development works at the Wilgerup site. A breakdown of the impacts is provided in Table 8-3 below.

Table 8-3 Breakdown of SEB calculations for vegetation clearance

Vegetation Patch	Disturbance (ha)	SEB ratio	Total SEB Area (ha)	Total SEB Compensation*
A	0.08	4:1	0.32	\$64
B	0.66	4:1	2.64	\$528
C	0.62	4:1	2.48	\$496
I	0.54	2:1	1.08	\$432
J	1.12	4:1	4.48	\$896
K	0.97	4:1	3.88	\$776
Total	4.0	-	14.9	\$3,192

*This value is based on the indicative NVC flat rate of \$800/ha for implementation of re-vegetation works.

Where re-vegetation will be undertaken off-site, it is a requirement of the SEB calculation to include the land value for the area to be cleared, based on current land values for sites in the area. Current valuations of the sites on which the clearances are to occur based on Valuer General determinations are as shown in Table 8-4.



■ **Table 8-4 SEB calculations for land value**

Property Number	Owner	Value	Area (ha)	Value per hectare
H533000/S42	Kamballa Pty Ltd	\$550,000	827ha	\$665.05
H533000/S38 & S43	Kingo Enterprises Pty Ltd	\$680,000	1,198	\$567.62
Overall valuation		\$1,230,000	2,025	\$607.41

Based on a clearance area of 14.9 ha at a mean value per hectare of \$607.41, the total value of the land to be cleared is \$9,050. Thus the total value of the SEB offset for the clearance of vegetation at the site is \$12,242.

The contribution of \$12,242 may go towards re-vegetation of cleared land in the area or preservation of an area of existing remnant vegetation from disturbance through installation of fencing, or providing weed management works where most relevant to improve habitat quality.

Ratios and justifications

Vegetation assemblages within the site were predominantly assigned an SEB ratio of 4:1, with two patches being allocated a lower ratio of 2:1 because of the degree of degradation. Open fields were assigned a value of 0. The defining characters for these ratios are provided in Appendix F.3, and ratios for each vegetation patch are mapped out in Figure 4-16.

Previous offsets

Centrex has not yet undertaken any offsets and thus has no SEB credits to date.

Existing Protection of Remnant Vegetation

The site is currently cropped and grazed and lacks any protection for areas of native vegetation. There are thus significant impacts within vegetation assemblages from sheep activity. Isolation of individual small patches by cropping land increases the edge effect and reduces overall habitat value.

Offset details

Details of the offset are yet to be determined but will be resolved in consultation with regional authorities to the satisfaction of PIRSA and the NVC.

8.3.12. Native Vegetation Management Plan

This section contains guidelines for management of the native vegetation at the site.



8.3.12.1. Native Vegetation

Native vegetation cover at the site is limited to well defined patches of similar composition throughout the proposed mining lease area (see Table 4-13 for details). Except where impact is necessary because of clearance requirements relating to the mine development, these areas should be avoided. As most of the site consists of open farming land, impacts to vegetation patches, apart from those necessary for the initial development, should be minimal. Management recommendations for these vegetation patches are provided below. No recommendations are provided for open farmland as this is of no current ecological value, though revegetation of unneeded cleared areas would be a significant benefit, and could be integrated into the calculation of the SEB offset.

- Vegetation patches should be monitored for weed incursions and treated appropriately
- Vegetation should not be cut or damaged or otherwise disturbed during mine operations
- Dumping or storage of material should not take place in vegetation patches

Vegetation of Conservation Significance

There are no associations of particular conservation significance at the site and no individual threatened plants or plants of particular value. All vegetation patches can thus be considered equal in a conservations sense (except for generally lower quality of patches I and V) and thus management recommendations given here apply to all patches.

8.3.12.2. Fauna

The vegetation at the site represents generally poor fauna habitat, though provides habitat for several bird species. As such none of the vegetation patches can be considered 'significant', though care should be taken to avoid unnecessary disturbance to vegetation (i.e.: that which will not be cleared for the development) as the area in general is almost devoid of remnant vegetation and thus any patch is of some value to the fauna present.

Mammals: there are unlikely to be any mammals using the site on a permanent basis though kangaroos are probably itinerant residents in the area. Pest species such as foxes and rats are likely to be present. The development should not have a significant impact on any mammalian fauna.

Birds: several species of bird use the site for foraging and possibly nesting (see Table 4-15) and should be considered when valuing vegetation. No species of conservation significance are likely to occur on site, but vegetation clearance may result in disturbance to other resident species. Birds should adapt to the clearance given the minor percentage of vegetation at the site to be cleared.



Reptiles: no reptiles were observed on site, though it is possible that snakes and lizards inhabit some vegetation patches. Clearance of some patches should not impact these species given their motility and the minor proportion of clearance taking place.

Given the lack of vegetation in the area in general, these patches, though degraded, should be left undisturbed to maximise their utility for fauna. In this regard:

- Personnel should not enter vegetation patches unnecessarily.
- Fauna found within pits or other mine infrastructure areas will be caught by qualified personnel and relocated outside of the site (including snakes).
- Waste management procedures should be followed to reduce the likelihood of pest species utilising such as food sources (i.e., bins should be covered).

8.3.13. Weed Management Plan

Weed species occurred on site and are thus a concern with regard to the potential for spread to adjacent sites. Two main points regarding weeds are as follows:

- i. Weeds found during the survey in late summer during a drought may not be representative of the weed abundance at the site, and adaptive measures may be required if noxious weeds appear. Management measures employed should thus assume the potential for higher weed diversity than reported here.
- ii. The site is highly degraded as is most of the surrounding property to which weed spread may occur. Moreover, the weed species found are common to much of the area and in some cases intentionally planted cropping grasses. Thus spread of many of these 'weeds' to adjacent properties is of little concern. Nonetheless, because of point i) above, and because the presence or absence of weeds on adjacent properties is unknown, weed control measures should be employed.

The greatest risks for weed spread are disturbances to the soil during earthworks and vehicle movements. Despite the points above, it is the responsibility of the operator to implement control procedures to minimise weed propagation and dispersal that could result from mining and development activities.



8.3.13.1. Weed Species

Weed species identified on site are summarised in Table 8-5.

■ **Table 8-5 Weed species found at the proposed mining lease area.**

Common Name	Scientific Name	Status
Wild Melon	<i>Citrullus lanatus</i>	Naturalised
Common Heliotrope	<i>Heliotropium europaeum</i>	Naturalised
Wimmera Rye Grass	<i>Lolium rigidum</i>	Naturalised
Barley Grass	<i>Hordeum vulgare</i>	Naturalised
Red Brome	<i>Bromus rubens</i>	Naturalised
Wild Turnip	<i>Brassica tournefortii</i>	Naturalised

All of the identified weed species are naturalised introduced species and none are declared weeds. Several are cropping species.

8.3.13.2. Weed Control Measures

Weed management protocols should be followed on site, including:

- The presence of noxious weeds (e.g. Bridal Creeper) should be monitored and treated where outbreaks occur as a matter of urgency
- Vehicles should not leave developed or designated roadways and transport routes should be kept well clear of weed species
- Vehicles should be regularly washed
- The site, including stockpiles and storage areas, should be monitored for weed incursions
- Weed outbreaks should be treated where they occur
- Weeds should be treated prior to any earth works occurring in an area.

8.4. Altered Land Use

8.4.1. Context and Stakeholder Views

Environment: Agriculture (dryland farming) is the only major land use in the project area. The area surrounding the project area is sparsely populated with settlements in the broader region following key transport routes. The closest town to the project area is Lock, approximately 21 km north-west of the site. Rudall Road, the key transport link between Lock and the town of Cleve in the east is located approximately 11 km north of the proposed mining lease. The Tod Highway, the key transport link south from Lock, is located approximately 14.5 km west of the proposed mining lease.



Stakeholders: The stakeholders relevant to land use change include local landholders, the agriculture industry and Elliston District Council. Surrounding landholders have expressed concerns about the change in land use to mining due to the associated potential negative impacts of mining (e.g., dust, noise and truck traffic), but have also expressed interest in the job opportunities associated with the development of the mine.

8.4.2. Applicable Legislation or Standard

The relevant legislation relating to land use and land use management is as follows:

- *Mining Act 1971*
- *Natural Resource Management Act 2004*
- *Environment Protection Act 1993*
- *Development Act 1993*

8.4.3. Potential Impact Events

The change in land use within the mining lease area from agriculture to mining will result in a number of land use impacts as summarised below.

Loss of productive agricultural land and reduced supply of agricultural products

The change of land use from dryland farming to mining on the site will result in the temporary loss of 918 hectares of productive agricultural land and permanent loss of approximately 93 hectares of productive agricultural land. A loss of productive agricultural land will result in a reduction in supply of agricultural products.

Changed local amenity and quality of life

The development and operation of the mine has potential to impact the surrounding residents. Noise, vibration, dust, increased traffic, additional people and night time flood lighting from the mining operations could disrupt the existing lifestyle and quality of life of residents in the adjoining properties who are accustomed to the current rural amenity.

Potential land use conflict with surrounding farming activities

Noise, vibration and dust from mining operations could affect the viability of dryland farming on the surrounding properties due to impacts on crops, stock and land management activities. Potential impacts of dust on crops and weed invasion due to changed land management is discussed in Section 8.3.



Impacts to the image of the Eyre Peninsula as an eco-tourism destination

Regionally, the development of a new mine on the Eyre Peninsula could impact on the image of the Eyre Peninsula. Currently the Eyre Peninsula is a popular tourist location within South Australia for its numerous national parks and conservation reserves, fishing and whale watching. The development of a new mine has the potential to conflict with state and local tourism campaign images of the Eyre Peninsula.

8.4.4. Control and Management Strategies

Design Control Measures:

- Following closure of the mine, return as much land as practicable to productive agricultural use.
- Ongoing stakeholder engagement plan during mine design and construction to include dialogue with surrounding land holders.
- Air quality and dust management measures as described in Section 8.7.7.
- Noise and vibration management measures as described in Section 8.8.8.
- Traffic management measures as described in Section 8.14.
- Land management measures as discussed in Section 8.5.

Operational Control Measures:

- Maintain land productivity through implementation of a soil management plan, weed management program, water quality management and chemical and fuel management procedures as described in Section 8.5.
- Air quality and dust management measures as described in Section 8.7.7.
- Noise and vibration management measures as described in Section 8.8.8.
- Traffic management measures as described in Section 8.14.
- Land management measures as discussed in Section 8.5.
- Ongoing stakeholder engagement with surrounding land holders during mine operation to identify and minimise impacts.
- Develop and implement Emergency Response Plan.
- Implementation of Mine Closure and Rehabilitation Plan.

8.4.5. Risk Levels

Loss of productive agricultural land and reduced supply of agricultural products

The reduction in supply of agricultural products is considered to be **almost certain** given that the mine would be developed on land currently used for agriculture. However the consequence is



considered to be **insignificant** as the amount of land to be used for the mining will be very small compared to the amount of farming land within the Eyre Peninsula.

Changed local amenity and quality of life

It is considered **likely** that the additional number of people, vehicles and machinery in the locality, night time flood lighting, potential dust emissions and vibrations from mining activities during construction, operation and rehabilitation of the mine site will reduce the local amenity and quality of life of the surrounding landholders. The consequence of these impacts would be local and therefore **minor** in nature if unmitigated.

Potential land use conflict with surrounding farming activities

The potential impact on the viability of surrounding farming activities from operation of the mine is considered to be **possible** with **moderate** consequences if unmitigated, as this would cause concern within the local community.

Impacts to the image of the Eyre Peninsula as an eco-tourism destination

The potential impact of the mine on the existing image of the Eyre Peninsula is considered to be **possible** with a **moderate** impact initially, although it is anticipated that long term impacts would be mitigated by good ongoing environmental performance of the mining operations.

8.4.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-6.

■ **Table 8-6 Risk assessment outcomes – Altered Land Use**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Loss of productive agricultural land and reduced supply of agricultural products due to change of land use from dryland farming to mining	Almost certain	Insignificant	Following closure of the mine, return as much land as practicable to productive agricultural use. Maintain land productivity through soil management plan, weed management program, water quality management and chemical and fuel management procedures. Develop and implement	Likely	Insignificant	Moderate	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
			Emergency Response Plan. Implement Mine Closure and Rehabilitation Plan.				
Changed local amenity and quality of life on adjacent properties due to impacts from mine construction, operation and rehabilitation	Likely	Moderate	As above. Air quality and dust management measures as discussed in Section 8.7.7. Noise and vibration management measures as discussed in Section 8.8.8. Traffic management measures as described in Section 8.14.	Possible	Insignificant	Low	Yes
Potential land use conflict with surrounding farming activities due to mine operation impacts such as dust and noise.	Possible	Moderate	Ongoing stakeholder engagement with surrounding land holders during mine operation to identify and minimise impacts. Land management measures as discussed in Section 8.5.	Unlikely	Minor	Low	Yes
Impacts to the image of the Eyre Peninsula as an eco-tourism destination.	Possible	Moderate	All measures listed in this table.	Unlikely	Minor	Low	Yes

8.4.7. Risk Acceptance

With the implementation of design and operational management measures as outlined above, the majority of residual risks associated with the altered land use of the mine site are considered low. The consequence of changed local amenity and quality of life will be much reduced by mitigation measures so the residual risk level is considered low, however it is acknowledged this may be an ongoing concern for the local community and ongoing dialogue and engagement with the local community is essential. The risk of loss of productive agricultural land and reduced supply of agricultural products is considered to be moderate, as there will be permanent loss of agricultural land. As such, the risks are considered as low as reasonably practicable and are acceptable to the project.



8.4.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcome:

- All land outside the permanently disturbed footprint (mine pit and waste rock dump) will be returned to productive agricultural use.

8.4.9. Assessment Criteria

The following assessment criteria will be adopted:

- Area of land permanently removed from agricultural use will be less than 100 hectares.
- Soil salinity levels [measured by electrical conductivity (EC)] in areas intended for future agricultural use not to exceed salinity levels suitable for dryland farming.

8.4.10. Monitoring Program

Monitoring will include:

- Ongoing monitoring of soil salinity levels [measured by electrical conductivity (EC)] in areas intended for future agricultural use.

8.5. Altered Land Management

8.5.1. Context and Stakeholder Views

Environment: The site and surrounding area is currently managed to support the use of the land for dryland farming. The construction and operation of the mine will effectively cease current land management practices undertaken on the site, with new management practices required for the mine development and operation.

Stakeholders: Stakeholders relevant to altered land management include the local land holders, District Council of Elliston, agriculture industry and Eyre Peninsula Natural Resources Management Board. The local community have expressed concerns regarding impact of dust on crops. The impact of altered land management on long term land capability and ecological value of the site will be of concern to all stakeholders.

8.5.2. Applicable Legislation or Standard

The relevant legislation relating to land use and land use management is as follows:

- *Mining Act 1971*
- *Natural Resource Management Act 2004*
- *Environment Protection Act 1993*
- *Development Act 1993*



- *Explosives Act 1936*
- AS 1940-2004: The storage and handling of flammable and combustible liquids.
- AS 1692-2006: Steel tanks for flammable and combustible liquids
- AS 2187.2-2006: Explosives: Storage and use – Use of explosives

8.5.3. Potential Impacts

Construction and operation of the mine will introduce a range of activities from the altered land management that have the potential to impact the surrounding natural environmental, mining infrastructure and the future land use. Discussion of the potential land management impacts are provided below.

8.5.3.1. Soil disturbance, erosion and land degradation

Soil disturbance (topsoil and sub-soil) will occur as a result of general vegetation clearance, excavation activities, stockpiling of topsoil, road construction, off-road driving, construction of infrastructure, wind and surface water flows at the mine site. Soil disturbance may lead to soil erosion and land degradation. Some areas of the proposed mining lease, particularly vehicle tracks, will be prone to soil compaction. Stockpiling activities may also result in soil degradation and loss of soil. Ceasing current land management practices on the site may have an impact on the wider mining lease area and surrounding properties, not just the land covered by mining activity.

Potential impacts on the surrounding environment include:

- Spread of weeds to cleared and disturbed areas or adjoining properties (see discussion Section 8.3.3)
- Increase in erosion resulting in loss of topsoil and increased deposition and sedimentation within the site and nearby vegetation
- Increased erosion which could reduce the capability of the land for future agriculture use
- Increased sedimentation and erosion, also has the potential to reduce the effectiveness of the site drainage system
- Decreased fertility of soil as nutrients and fertilisers are no longer applied. This could reduce the capability of the land for future agriculture use.

8.5.3.2. Contamination

Application and storage of saline water

The groundwater is highly saline, with a TDS content in the range of 35,000 to 42,000 mg^l⁻¹ (roughly equivalent to seawater). The use of this water for dust suppression on mine roads and stockpiles has the potential to degrade the soil quality and structure within the areas of its use.



Suppression of vegetation growth also may occur as a result of the use of saline water. However, water used on haul roads and shoulder drains for dust suppression is contained within these areas, and at completion of mining, all haul roads and impacted soil will be removed and disposed of appropriately. The road scarified and topsoil reapplied. Unmitigated, the storage of saline water in the proposed turkey's nest dam and water disposal dam will have impacts on topsoil and sub-soil. Land salinisation due to storage and application of saline water could have long term affects on the land capability of the site.

Storage and handling of hydrocarbons and chemicals – uncontrolled release

The storage and handling of hydrocarbons and chemicals on site creates potential for soil contamination to occur as a result of uncontrolled releases (spills and leaks). Hydrocarbons and chemicals to be stored on site are as follows:

- Diesel fuel stored in three 50,000 litre tanks and located adjacent the refuelling facilities
- Diesel fuel stored in one 50,000 litre tank located adjacent to the Crushing plant genset
- Lubricants stored in the designated compound adjacent to the mine workshop
- Packaged and bulk type explosives [Ammonium Nitrate/Fuel Oil (ANFO) or emulsion based], stored with dedicated explosive and blasting agent magazines

Acid rock drainage

Mining activities can potentially trigger acid rock drainage by exposing large surface areas of rock to water and oxygen. The most significant newly exposed rock surfaces are in the fragmented pieces of waste rock that are removed from the ground and placed in dumps. Acid rock drainage has the potential to result in groundwater contamination.

As discussed in Section 5.7.1, analysis of waste rock and ore samples for Net Acid Producing Potential (NAPP) and release of heavy metals or other deleterious compounds indicated one composite overburden sample demonstrated a capacity to potentially form acid rock drainage.

Only one of the results indicated a capacity to potentially form acid rock drainage. As the samples are composites and there are 6 further composite overburden samples, then the PAF sample is not likely to be significant in terms of acid generation (also based on low S content).

Further limited sample analysis will be undertaken to confirm that no treatment of the waste or special placement techniques are required.

8.5.4. Control and Management Strategies

The design control measures that will be adopted to assist in the avoidance and mitigation of impacts associated with land use practices include:



Design Control Measures:

- The turkey's nest will be lined with a high density polyethylene (HDPE) liner to minimise any potential leakage to soil or groundwater from the storage.
- Management of surface water around the mine site via a series of diversion banks and drainage channels.
- Management of surface water on site in accordance with the design control measures outlined in Section 8.9.6.
- Design of soil stockpile storage and location to minimise erosion and losses.
- Designated internal vehicle routes.
- Staging clearing activities and undertaking progressive rehabilitation (where practicable) (refer to Section 9 on Mine Closure and Rehabilitation).
- Design of hydrocarbon and chemical storage facilities in accordance with Australian Standards, relevant legislation and best practice guidelines.
- Both the fuel and lubricant storage and dispensing facilities will be designed and installed in accordance with:
 - AS 1940-2004: The storage and handling of flammable and combustible liquids
 - AS 1692-2006: Steel tanks for flammable and combustible liquids
 - Relevant South Australian legislation
 - Best practice guidelines
- Design and construction of the explosive magazines in accordance with the South Australian Explosives Act (1936) and Regulation (1996) and Australian Standard AS 2187.2-2006.

Operational Control Measures:

The operational control measures that will be adopted to assist in the avoidance or mitigation of impacts associated with land use practices include:

- Develop and implement a soil management plan including:
 - Permanent and temporary erosion and sediment control structures to be used on site as required during construction and operation.
 - Regular inspection program to be developed and implemented for inspection, monitoring and maintenance of erosion and sedimentation control structures.
 - Procedures to manage use of saline water for dust suppression and a soil quality monitoring program.
- Remove any salt contaminated soil associated with dams and replacement of topsoil and sub-soils from stockpiles and contouring (refer to Section 9 on Mine Closure and Rehabilitation).



- Develop and implement soil stockpile management and monitoring procedures to address compaction and loss of soil due to stockpiling activities.
- Implement site operational procedures to minimise off road driving with vehicles by requiring use of designated internal routes.
- Develop and implement a management program for rehabilitated areas (refer to Section 9 on Mine Closure and Rehabilitation).
- Develop and implement a regular inspection for auditing, monitoring and maintaining of surface water design elements (diversion banks and drainage channels) (refer to Section 8.9.6).
- Develop and implement an opportunistic water quality monitoring program (refer to Section 8.9.6).
- Implement weed protocols outlined in the Weed Management Plan (Section 8.3.13).
- Develop and implement a periodic monitoring program to check for potentially acid forming material during operations.
- Develop and implement chemical and fuel storage, handling and emergency response (including clean up) procedures.
- Develop and implement a regular inspection program to audit and monitor fuel and chemical storage areas to ensure integrity, housekeeping and correct use.
- Maintain appropriate spill kit/clean up material as required by the developed procedures.

8.5.5. Risk Levels

8.5.5.1. Soil disturbance, erosion and land degradation

It is considered **almost certain** that soil erosion, degradation and weed spread will occur during the life of the mine, due to the nature (i.e., open cut) of the proposed mining operations and high winds that occur at the site.

As the proposed mine site is not located within a defined waterway, and the majority of the proposed mining lease area is cleared cropping/grazing land of limited ecological value, environmental impacts of erosion, deposition and sedimentation are considered to be **minor** (localised and able to be readily rehabilitated).

The impacts to the future use of the land for agriculture are considered to be **moderate** as the alteration to the current land capability could be significant but can be rehabilitated.



8.5.5.2. Contamination

Application and storage of saline water

The application of saline water for dust suppression is considered **likely** to impact on soil quality, structure and consequently vegetation growth within the areas of its use. Without appropriate management of saline water use, the potential impacts are considered **moderate**, as there is a potential for significant long term changes to occur at the site.

It is considered **possible** that the storage of saline water will adversely impact soil quality and structure in the vicinity of the dams. The pit de-watering operation will involve the pumping of saline water from the mine pit to the turkey's nest dam where the water will be disposed of by evaporation and seepage (refer to Section 5.3.5). The consequence of storage of saline water is considered to be **moderate** as it involves a significant local change but can be rehabilitated.

Storage and handling of hydrocarbons and chemicals – uncontrolled release

In the absence of appropriate design and operational control measures, it is considered **likely** that a spill or leak will occur. Considering the type and quantities of hydrocarbons and chemicals to be stored on site, there is potential for **moderate** impacts to occur.

Acid rock drainage

Based on the analytical results, acid rock drainage is considered **unlikely** to occur, and the impacts are considered **minor** due to the localised nature of the impacts.

8.5.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-7.

■ **Table 8-7 Risk assessment outcomes – Altered Land Management**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Spread of weeds to cleared and disturbed areas or adjoining properties	Almost Certain	Minor	Implement weed management protocols outlined in NVMP Development and implement a management program for rehabilitated areas	Unlikely	Minor	Low	Yes
Sedimentation and erosion – increased	Almost Certain	Minor	Staged clearing and progressive rehabilitation	Unlikely	Minor	Low	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
sediment deposition within site and nearby vegetation			Permanent and temporary erosion and sediment control structures to be used on site as required during construction and operation. Regular inspection and monitoring.				
Reduced land capability for future agriculture use due to soil erosion, reduced weed control and decreased soil fertility	Almost Certain	Moderate	Implement weed management protocols outlined in NVMP Development and implement a soil, erosion and sediment management plan Designated internal vehicle routes to minimise off road driving	Unlikely	Minor	Low	Yes
Sedimentation and erosion – reduced effectiveness of site drainage system	Almost Certain	Minor	Monitoring and management of drainage features on site.	Unlikely	Minor	Low	Yes
Soil salinisation due to storage of saline groundwater in dams	Possible	Moderate	The water storage areas will be lined with HDPE liner to minimise any potential leakage. Removal of any salt contaminated soil associated with dams, replacement of topsoil and sub-soils from stockpiles and contouring	Unlikely	Minor	Low	Yes
Reduced soil quality and vegetation growth due to use of saline groundwater for dust suppression	Almost Certain	Moderate	Progressive rehabilitation. Develop and implement a procedure to manage use of saline water for dust suppression.	Unlikely	Minor	Low	Yes
Reduced soil quality and vegetation growth due spill/leak from water supply pipeline	Possible	Minor	Regular inspection program to be developed and implemented for inspection, monitoring and maintenance of surface water design elements	Unlikely	Minor	Low	Yes
Soil contamination from uncontrolled releases of hydrocarbons and chemicals	Likely	Moderate	Design of storage and transfer points in accordance with regulatory requirements, Australian Standards and Best Practice Guidelines (including impervious, bunded storage areas) Develop and implement chemical and fuel storage, handling and	Rare	Minor	Low	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
			emergency response procedures.				
Soil contamination due to acid rock drainage	Unlikely	Moderate	Periodic checks of potentially acid forming materials during mining activities.	Unlikely	Minor	Low	Yes

8.5.7. Risk Acceptance

As outlined above, with the implementation of design and operational management measures, the residual risks associated with altered land management at the mine site are considered low.

Specific operational management measures are required to address identified impacts during project construction, operation and mine closure; however, the risks are considered as low as reasonably practicable and for this reason are acceptable to the project.

8.5.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- Land capability of the project area will be maintained such that the site can be returned to agricultural use.
- No loss of agricultural production on properties adjacent to the proposed ML area as a direct result of mining during mining operations.
- No impacts to groundwater due to acid rock drainage.
- Maintain the natural landscape erosion processes of adjoining land.
- No long term impact to soil quality due to contamination.

8.5.9. Assessment Criteria

The following assessment criteria will be adopted:

- Soil salinity levels [measured by electrical conductivity (EC)] in areas intended for future agricultural use not to exceed salinity levels suitable for dryland farming.
- No increase in weed density/distribution (compared to baseline data) due to mine operations at mine closure.



- No new establishment of declared weeds (compared with baseline data) due to mine operations at mine closure.
- Complaints register: No reasonable complaints from neighbouring farmers that crops yields have been adversely affected by mining operations.
- No erosion caused or exacerbated by mining operations.
- Monitoring of acid rock drainage potential of waste rock (comparison to baseline data).
- Concentrations of contaminants in soil to be in compliance with investigation levels detailed in the National Environmental Protection Measure (NEPM) 1999.

8.5.10. Monitoring Program

Monitoring will include:

- Ongoing monitoring of soil salinity levels [measured by electrical conductivity (EC)] in areas intended for future agricultural use.
- Any complaints received concerning mining operations from neighbouring residents will be recorded, investigated and reasonable complaints addressed.
- Regular photopoint monitoring of stockpiles and adjoining land.
- Undertake regular and opportunistic (during rainfall events) inspection of sediment and erosion controls.
- Periodic checks of potentially acid forming materials during mining activities.
- Monitoring and validation of soil contamination status as part of progressive rehabilitation.
- Regular monitoring of areas identified as having a high susceptibility to weed infestations (e.g. recently cleared areas and roads).

8.6. Alteration to Landscape and Amenity

8.6.1. Context and Stakeholder Views

Context: The landscape and visual amenity of the mine area will be impacted by the proposed mine operations. The extent of the impact to the landscape and visual amenity is dependent on a number of factors including size and scale of proposed mining operations, sensitivity of the existing views and character of the existing landscape.

Environment: The immediate area in which the mine is proposed is predominantly characterised by dryland farming land and scattered mallee vegetation. Large areas of mallee vegetation have been cleared for cropping and livestock grazing. Extensive low dunes systems and sand sheets are dominant within the region. The topography of the area has a gently undulating slope.



Stakeholders: Stakeholders potentially most affected by alteration to landscape include local land holders and travellers along Roberts Road and Murdinga-Murlong Road. The project site and surrounding area is sparsely populated and is not located on a major transport route. As a result, the wider community have not expressed significant concern with visual impact or associated issues in stakeholder engagement activities so far.

8.6.2. Applicable Legislation and Standards

The relevant legislation relating to alteration to landscape and visual amenity is as follows:

- *Mining Act 1971*
- *Environment Protection Act 1993*
- *Development Act 1993*

8.6.3. Potential Impact Events

The construction and operation of the mine will impact the landscape and visual amenity of the mine site and surrounding area due to:

- Removal of vegetation
- Soil disturbance and stockpiling
- The formation of the mine pit and waste rock dump
- Dust emissions
- Location of buildings and infrastructure
- Flood lighting to allow 24 hour operation of the mine
- Increase in the number of people, vehicles and machinery in the locality.

Closure and rehabilitation of the mine site will not return the site to its original condition so there will be a long term impact to the landscape and visual amenity of the site and surrounding area. The mine pit (void to possibly fill with saline groundwater), waste rock dump and safety bunds will remain permanent features of the landscape.

8.6.4. Control and Management Strategies

Design Control Measures:

- Consideration of potential landscape and visual amenity impacts, particularly as viewed from closest roads, dwellings and Tooligie Hill, will continue to be taken into account during the design phase of the mine.



- The waste rock dump placement and design will incorporate elements that assist with progressive rehabilitation of dump and minimises long term visual impact (including restricting height to 50 metres and rounding ends).
- Re-vegetation program will be designed to screen waste rock dump, infrastructure, buildings and pit from closest roads, dwellings and Tooligie Hill.
- Air quality and dust management measures will be implemented as discussed in Section 8.7.7.
- All outdoor lighting on site will be designed to have minimal visual impact on residents and onlookers, as well as minimal impact on flora and fauna, without compromising the safety of workers on site. The Australian Standards provide very specific guidelines on lighting levels and general lighting setups to control the obtrusive effects of outdoor lighting. Relevant standards that will be applied are:
 - AS 4282 - Control of the obtrusive effects of outdoor lighting
 - AS 1158.1.1 – Lighting for roads and public spaces – Vehicular traffic lighting
 - AS1158.3.1 – Lighting for roads and public spaces – Pedestrian area lighting
 - AS2293 – Emergency escape lighting and exit signs for buildings.

Operational Control Measures:

- Regeneration and rehabilitation will be carried out in accordance with Native Vegetation Management Plan and Mine Closure and Rehabilitation Plan including screening of mine pit and waste rock dump.
- Air quality and dust management measures will be implemented as discussed in Section 8.7.7.

8.6.5. Likelihood and Severity of Consequence – Risk

It is considered **almost certain** that the construction and operation (including the associated ground disturbance and vegetation removal) of the mine site will result in cumulative changes to the landscape and visual amenity of the area. Views from adjacent roads (Roberts Roads and Murdinga-Murlong Road), nearby dwellings, Hincks Wilderness Protection Area and Tooligie Hill may be affected.

It is considered **almost certain** that closure and rehabilitation of the mine site will result in a long term impact on the landscape and visual amenity of the site and surrounding area.

Due to the remote nature of the mine site location from nearby dwellings, townships and major roads the impact on the region is considered **insignificant** but the impacts on the site are **moderate** in nature.



Landscape and visual amenity impacts on Hincks Wilderness Protection Area are expected to be **insignificant** as the reserve is located approximately 4.5 km south of the proposed mining area.

8.6.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-8.

■ **Table 8-8 Risk assessment outcomes – Alteration to landscape**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence		
Changed landscape and visual amenity of the area due to construction, operation, closure and rehabilitation of the mine site.	Almost certain	Moderate	Consideration of potential landscape and visual amenity impacts during the design phase of the mine, particularly waste rock dump. Re-vegetation program designed to screen waste rock dump, infrastructure, buildings and pit from closest roads, dwellings and Tooligie Hill. Air quality and dust management measures as discussed in Section 8.7.7. Design lighting in accordance with Australian Standards.	Possible	Minor	Moderate	Yes

8.6.7. Risk Acceptance

The residual risk rating for the changed landscape and visual amenity of the project area due to the construction (including the associated ground disturbance and vegetation removal) of the mine pit, associated infrastructure and buildings and waste rock dump is **moderate**. Although the consequences of the changed landscape and visual amenity are reduced to **minor** by the implementation of controls the likelihood that there will be some change to the landscape and visual amenity of the project area remains **possible** due to the nature of the development. It is considered that the impact of the potential landscape and visual amenity changes will be limited to the project site area and possibly views from surrounding roads, dwellings and properties.

Specific design and operational management measures will address identified impacts during all stages of the project. The residual risks are considered to be acceptable to the project as they are as low as reasonably practical.



8.6.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- Maintain public safety.
- Positive long term change to the landscape associated with the rehabilitation of the waste rock dump and establishment of native vegetation.
- No adverse impacts to nearby residents due to light emanating from the mine site.

8.6.9. Assessment Criteria

The following assessment criteria will be adopted:

- Height of waste rock dump not to exceed 50 metres.
- Photos taken from public areas demonstrate operations screened from public view as far as practical.
- Establishment of new habitat as a result of final rehabilitation.
- Complaints register: No reasonable complaints from surrounding residents in relation to flood lighting.

8.6.10. Monitoring Program

Monitoring will include:

- Periodic verification that mining and stockpiling activities undertaken in accordance with mine operations plan.
- Any complaints received concerning mining operations from neighbouring residents will be recorded, investigated and reasonable complaints addressed.
- Ongoing monitoring of vegetation establishment post mine closure in accordance with mine rehabilitation plan.

8.7. Cultural Heritage

8.7.1. Context and Stakeholder Views

There are no sites within the project area listed on the Register of Aboriginal Sites and Objects, which is maintained by the Department of Aboriginal Affairs and Reconciliation, or the Australian Heritage Places Inventory.

As stated in Section 2.3.2, the proposed Mining Lease area is subject to a Native Title Claim by the Barngarla People. . The project area (which lies within EL 3317), was previously held by a wholly owned Centrex Metals Company, the SA Iron Ore Group, under EL 2676. A Work Area Clearance



and Aboriginal cultural heritage surveys of several exploration leases on the Eyre Peninsula (including the project area) were undertaken in 2002 on behalf of the SA Iron Ore Group to examine areas affected by the proposed drilling programs at the site.

The survey report concluded that exploration activities would not impact any areas or objects that are known to be of importance to the local Aboriginal community as long as all exploration activities are restricted to previously disturbed areas.

All parcels of land within the project area are freehold title. Freehold ownership of land extinguishes native title by the enactment of the *Native Title (South Australia) (Validation and Confirmation) Amendment Act 2000*.

8.7.2. Applicable Legislation or Standard

The relevant legislation relating to cultural and European heritage issues and management for the project area is as follows:

- *Aboriginal Heritage Act 1988*
- *Native Title (South Australia) Act 1994*
- *Native Title (South Australia) (Validation and Confirmation) Amendment Act 2000*
- *Native Title Amendment Act 1998 (Cth)*
- *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*
- *Heritage Places Act 1993*

8.7.3. Potential Impact Events

Activities associated with mine construction and operation that have the potential to disturb items/areas of indigenous and/or European heritage include:

- Vegetation clearance
- Removal of overburden
- Drill and blast operations
- Establishment of site infrastructure including buildings and haul roads
- Stockpiling activities

Interaction with items/areas of cultural and/or European heritage has the potential to result in permanent loss or damage of these items or areas.



8.7.4. Control and Management Strategies

Design Control Measures:

- If any Aboriginal or European heritage sites or items of significance are identified during mine establishment, mine infrastructure will be relocated where practical and feasible.

Operational Control Measures:

- Develop and implement procedures to be followed in the event that Aboriginal sites are discovered during mine construction or operations that comply with the Aboriginal Heritage Act 1988 (i.e. including stop work and appropriate notification and assessment procedures).
- Develop and implement procedures to be followed in the event that non-Aboriginal heritage sites are uncovered during mine construction or operations that comply with the relevant legislation (i.e. including stop work and appropriate notification and assessment procedures).
- Site inductions and training will include:
 - Obligation for machine operators to conduct earthworks and excavations with due care.
 - Obligations in the event that and Indigenous or non-Indigenous site/area of significance is discovered on site.

8.7.5. Risk Levels

Movement of the dunes and swales in the project area over time may have resulted in the items of Aboriginal cultural significance being buried at the site. However, as the project footprint has been highly disturbed through grazing and agricultural practices, potential discovery and disturbance to sites/items of Aboriginal significance is considered **possible**, while disturbance to European Heritage sites is considered **unlikely**.

Disturbance to sites or items of Aboriginal cultural significance has the potential to attract significant public concern and may constitute a legislative breach if not managed properly. On this basis, the potential consequences are considered **major**. It is considered that interaction with Heritage sites would result in **moderate** consequences.

8.7.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-9.



■ **Table 8-9 Risk assessment outcomes – Cultural Heritage**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Disturbance to Aboriginal sites/items of significance	Possible	Major	Develop and implement procedures for discovery of Aboriginal sites/items of significance.	Unlikely	Moderate	Moderate	Yes
Disturbance to European heritage sites	Unlikely	Moderate	Develop and implement procedures for discovery of European Heritage Sites	Rare	Moderate	Moderate	Yes

8.7.7. Risk Acceptance

As summarised in Table 8-9, the residual risks for cultural and European heritage risk events associated with construction and operation of the mine are considered to be **moderate**. Ongoing awareness and management of the risks is required throughout mine construction and operation. It is considered that the operational and design control measures have minimised the likelihood of disturbance to items or sites of cultural or heritage significance, and for this reason the risks are considered as low as reasonably practicable and acceptable for the project.

8.7.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- No disturbance to Aboriginal or European sites/items of significance unless prior approval has been obtained as required under the relevant legislation (Aboriginal Heritage Act 1988 or Heritage Places Act 1993).

8.7.9. Assessment Criteria

The following assessment criteria will be adopted:

- No unauthorised disturbance to Aboriginal or European heritage.

8.7.10. Monitoring Program

Monitoring will include:

- Should Aboriginal or European sites of significance be identified, the process followed will be monitored (against the developed procedure).



8.7.11. Leading Indicator Criteria

In the event that Aboriginal or European sites/items of significance are uncovered during mine construction or operations, compliance with the relevant legislation will rely heavily on site personnel following the developed procedures. For this reason, the following leading indicator criterion will be adopted:

- All site staff will attend site induction training which includes obligations in relation to cultural heritage during their probation period.

Completion of induction training will be recorded on a training register, and will be reviewed quarterly.

8.8. Emissions to Air

8.8.1. Context and Stakeholder Views

Environment: The nearest existing farm homestead site is the Kamballa property which is located approximately 800 m to the north of the proposed mine site. Centrex intend to purchase this property as part of the mine development. The next closest is the Bacca Hills homestead, approximately 2.3 km SWW from the mine site. There are another seven known residential homes on farming properties within 5 km of the mine site.

Broadly, the Wilgerup mine site provides limited ecological benefit, and overall represents poor habitat value. This is primarily due to the degraded vegetation assemblage resulting from historic land use practices (grazing). A notably low diversity of floral species would consequently be expected to limit habitat opportunities for fauna species. As such, the impact of dust emissions on flora and fauna is expected to be insignificant.

The existing air quality at Wilgerup has been discussed in detail in Section 4.5.1.2, and is expected to be good due to the rural location and minimal air emissions. From time to time significant dust impacts could be expected from bushfires, “burning-off” and raised dust from agricultural practices and high winds.

Stakeholders: The most sensitive receptors have been identified to be homesteads located within a few kilometres of the mine, and crops surrounding the mine.

There have been community concerns regarding the potential impact of dust emissions to surrounding wheat crops, and the potential for contamination of the crop product with iron ore dust. Although the majority of projected dust emissions predicted from the mining operations are from overburden (i.e., limited iron ore dust emission), the potential and associated risk of crop contamination is assessed in later parts of Section 8.8.6.



8.8.2. Applicable Legislation or Standard

Dust impacts are regulated both by the *Mining Act, 1971 (SA)* and the *Environment Protection Act, 1993 (SA)*. The *Native Vegetation Act, 1991* may also be applicable if dust impacts native vegetation.

The South Australian EPA guidelines for the Presentation of air pollution modelling outputs (2005) and Air quality impact assessment using design ground level pollutant concentrations (2006), provide no standards for PM₁₀ or dust deposition; however, in the absence of South Australian data the EPA expects development proponents to conduct a review of literature to determine most appropriate standards. Ambient air quality standards and guidelines commonly used in air quality assessments throughout Australia are set out in the National Environment Protection Measure (NEPM); refer to NEPC (2003). The NEPM has been adopted for impact assessment of particulate matter emissions (PM₁₀); refer to Table 8-10.

■ **Table 8-10 NEPM Standard and Goal for PM₁₀**

Assessment Parameter	Standard / Goal
Averaging Period	24 hours
Maximum Ground Level Concentration (at sensitive receivers)	50 µg/m ³
Goal within 10 years (i.e. to 2013)	Maximum allowable exceedences: 5 days per year

It should be noted that the NEPM applies to residential areas or areas where there are sensitive receivers. A cumulative assessment of impacts (including conservative background levels) at individual sensitive receiver locations is required surrounding the project site, for comparison against the NEPM.

There are no ambient air quality standards for dust deposition in South Australia. However, as dust deposition poses potential amenity impacts around sensitive receivers, impact assessment criteria for nuisance dust deposition provided by the NSW Department of Environment and Conservation (DEC) has been used in this assessment; refer to Table 8-11 (DEC, 2005).

■ **Table 8-11 NSW DEC Impact Assessment Criteria for Dust Deposition**

Assessment Parameter	Standard / Goal
Averaging Period	Annual (but reported as monthly average)
Maximum increase in deposited dust level	2 g/m ² /month
Maximum total deposited dust level	4g/m ² /month



8.8.3. Potential Impact Events

The Potential impacts to ambient air quality in the project and surrounding area that are likely to be associated with the construction and operation of the project are outlined in the Environmental Aspects and Risks Register (Appendix J). Further discussions of the potential impacts are provided below, while discussion regarding the proposed Design Control and Operational Management Measures for the project is provided in Section 8.8.4. A detailed quantitative air quality impact assessment has been undertaken as part of this proposal, including AUSPLUME dust dispersion modelling. The full report of this assessment is provided as Appendix D.

Dust Generation

Consideration of the open-cut mining activities and equipment inventory proposed for Wilgerup indicates that the key air pollution issues will be associated with dust emissions from material handling activities on a large exposed area.

The primary sources of dust generation from the proposal are:

- Initial Earthworks – Removal of Surface Rock/Sand/Overburden Layers (first 24-30 m)
 - Dozers.
 - Truck loading of topsoil/overburden waste by front end loader (FEL).
 - Wheel-generated dust from trucks travelling around work zone on unpaved roads.
 - Truck unloading of topsoil/overburden onto stockpiles.
 - Wind erosion of exposed construction areas and active stockpiles.

The pre-operation earthworks could potentially occur continuously, 24 hours per day.
- Open Cut Iron Ore Mining
 - Two-stage iron ore crushing/screening plant (conveyors, handling and transfer points).
 - Haul truck unloading of pre-crushed ore; truck loading of processed ore.
 - Wheel-generated dust from five x 90 tonne capacity haul trucks (it is anticipated all mine haul roads will be gravel/crushed rock sheeted).
 - Haul truck unloading of overburden onto waste stockpiles.
 - Rock breaker, dozer, and excavator at base of mine pit.
 - Dust emissions from drilling and blasting.
 - Wind generated dust from disturbed areas and active stockpiles.

The mine will operate continuously, 24 hours per day, 7 days per week, 365 days per year.



Failure to control dust emissions effectively could conceivably result in the following consequences:

- Human health impacts, in particular respiratory system irritation.
- Reduced visibility and public nuisance.
- Reduced or contaminated cereal crop yields.
- Damage to native flora and fauna habitat.
- Reduced visual amenity involving dust deposition on vegetation, dwellings and private vehicles.

Combustion Emissions

Diesel exhaust emissions would arise from the use of any machinery item operating at the mine site. This would include:

- Generator set (x 2) for power supply.
- Road-train exhaust emissions arriving and leaving the site, and during idling periods whilst being loaded. A minimum of 75 road-train cycles per day would be loaded with iron ore.
- Exhaust emissions from mine pit machinery (dozer, FELs, excavator, grader) and haul trucks.
- Exhaust emissions from ancillary equipment and vehicles [e.g. water truck(s), fuel truck, crane, maintenance truck, utility truck, light vehicles].

Combustion products that are likely to result as pollutants include sulfur dioxide (SO₂), nitrogen oxides (NO_x), inhalable particulates (PM₁₀), carbon monoxide (CO) and carbon dioxide (CO₂).

The impacts of products of combustion emission are expected to be localised around the emission source, and have the potential to impact workers' comfort if not properly controlled. On a local scale the incremental increase in emissions is expected to be minor, with impacts beyond the Mine Lease Boundary, or indeed at sensitive receivers (including flora and fauna), expected to be negligible.

Odour Emission

There are a number of ancillary activities proposed at the mine site that may give rise to odour emissions. These include:

- Two 25 EP (equivalent person) aerobic wastewater treatment units, installed on the site to treat domestic sewage (wastewater from toilets, sinks, etc.). The specific odorous marker would be hydrogen sulphide (H₂S).
- Use of treated wastewater to irrigate vegetation planted around office areas, and seeded stockpiles.



- Fugitive volatile organic compound (VOC) emissions from fuel loading operations and the fuel farm. Specific odorous marker would include benzene.
- Diesel exhaust odorous emissions from combustion emission sources (see above). Specific odorous compounds would include benzene and sulphur dioxide (SO₂).

Similar to combustion product emissions, odorous emissions have the potential to affect the comfort of site workers. High short-term odour concentrations have the potential to cause nausea, headaches, and overall discomfort. It is highly unlikely that odours will impact beyond the Mine Lease Boundary.

8.8.4. Control and Management Strategies

The air emissions described in Section 8.8.3 are unlikely to be practically avoided; however the severity and likelihood of any consequences will be reduced by implementation of the following control strategies:

Dust Emissions

Design Control Measures:

- The amount of disturbed area will be minimised. Progressive revegetation/rehabilitation will be undertaken to reduce the area available for wind erosion.
- All mine haul roads will be gravel/crushed rock sheeted. This lowers the silt content of the road surface by approximately 50% (USEPA, 2006).
- All mine in-pit haul roads will be sheeted with crushed rock where required.
- All main trucking haul roads from the mine gate to Tod Highway will be bitumen sealed.
- Road-train haul road from ore loading area to Roberts Road will be bitumen sealed.

Management System Measures:

- Water sprays used as dust control on active stockpiles provides approximately 50% control of dust emissions.
- The use of a water truck to control fugitive dust emissions arising from construction activities, and wheel-generated dust on unpaved roads from road-trains entering and leaving the site, spraying at the rate of 2 L/m²/hr and greater will provide approximately 75% control efficiency.
- Dust suppression on all mine haul roads.
- Water sprays will be used as a dust suppressant at each of the dust generating locations within the crushing/screening plant (i.e., at primary and secondary crushing, screening, and at transfer points on conveyors).



- Re-vegetation of the initial topsoil stockpile (southern area of site). Re-vegetation provides approximately 99% control efficiency of dust emissions.
- Vehicle speeds will be limited to speeds (< 50 km/hr) that will not generate excessive dust.
- All road-train loads will be covered.
- In regard to rehabilitation at the completion of the mine project:
 - Disturbed areas will be covered back with the initially removed topsoil (seeded stockpile). This will assist the rehabilitation of these disturbed areas by providing a supply of seeds and vegetable material already embedded in the soil, thus minimising the risk of soil erosion and wind-generated dust.
 - The waste rock dump stockpiles (which are to remain as a permanent feature of the landscape) will be covered with a layer of subsoil and topsoil, and then appropriately seeded to provide a vegetation cover, this reducing wind erosion and dust emissions.
- Monitoring and implementing corrective actions to improve management techniques.
- PM₁₀ monitoring to be undertaken at carefully selected locations as soon as possible to establish baseline PM₁₀ levels prior to earthworks and mining activities commencing, and then continuing throughout the life of the mine.
- Dust deposition has the potential to impact the quality of neighbouring crops (however, it should be noted that iron ore dust emissions represent only 5% of the total dust emission from the mine site). A network of dust deposition gauges will be placed in the Wilgerup locality at strategic locations (e.g., at Mine Lease Boundary, and at least two sensitive receivers (the homestead properties), to build knowledge of dust deposition for the locality prior to mining commencing and throughout the life of the mine.
- In relation to expected effects of dust on amenity in the Wilgerup locality, a high level of communications with the community will be undertaken as follows:
 - Detailed logs will be maintained for:
 - Community complaints related to visible dust plumes;
 - Community complaints related to surface dust depositions;
 - Mining operations (especially blasting); and
 - Monitoring data / results for airborne and deposited dust.
 - Knowledge specific to dust emissions from the site will be developed by processing and analysing monitoring data, and this will be communicated to the community.
- Staff will receive training to improve awareness of dust management.



Combustion Emissions

Design Control Measures:

- Combustion emissions can be reduced by the installation of catalytic converters within diesel engines or the use of exhaust filtration devices.
- Fuel combustion facilities will be designed to meet Australian Standards.
- Generator sets will be located away from working areas, such that impact to workers from exhaust emissions is minimised.

Management System Measures:

- All diesel engines, machinery and generators would be checked annually for compliance with the appropriate manufacturer's exhaust guarantee.
- Non-complaint engines and machinery would be repaired or replaced, as appropriate.
- Idling time of road-trains, dozers, haul trucks and ancillary equipment will be minimised.
- The number of employee vehicles will be limited on site. Personnel will reside in the nearby regions of Lock, Rudall or Cleve, and will preferably commute to and from the mine site by a company supplied bus.
- Although not a necessity, improvements to overall combustion emissions can be made by replacing existing equipment as new engine technology of alternative fuels to diesel becomes available.

Odour Emissions

Design Control Measures:

- The wastewater treatment units will be designed as aerobic as opposed to anaerobic, thereby reducing the potential for localised odour.
- The wastewater treatment units will be designed to meet EPA S.A. odour criteria at the Mine Lease Boundary, and Department of Health requirements.
- Significant buffer from odour source design locations to nearest sensitive receiver.

Management System Measures:

- Use of treated wastewater for irrigation of vegetation, etc., will not be undertaken during very stable conditions that give rise to poor odour dispersion and dilution (e.g., wind speeds less than 1 m/s).
- Fugitive VOC emissions from the fuel farm and during refuelling operations will be minimised by strict adherence to the appropriate storage and handling of fuel standards (e.g. AS 1940-2004).
- For periods where close personal contact with diesel product and/or transfer is required, and for periods of longer than normal durations, appropriate personal protective equipment (PPE)



would be worn by workers (or appropriate OH&S risk assessment undertaken in order to minimise exposure to VOC emissions).

8.8.5. Likelihood and Severity of Consequence – Risk

Dust Generation

The probability of dust being generated from mining activities is almost certain and will occur for the duration of the project (six years).

A comprehensive air quality impact assessment including AUSPLUME dust dispersion modelling was undertaken for this proposal (attached as Appendix D). The methodology of this assessment, and the assessment criteria to be used, has been approved in consultation with the South Australian EPA. A worst-case 24-hour PM₁₀ emissions scenario, excluding the relatively short-term effects from blasting and the dust emissions from drill rigs¹⁰, was modelled for the Wilgerup Mine Project. Total suspended particulate (TSP) emissions were also modelled to predict monthly dust deposition predictions. Results of this air quality modelling undertaken for the Wilgerup Mine Project shows that:

- Airborne PM₁₀ concentrations in the locality are expected to be elevated significantly, with some risk of marginal exceedence of the NEPM for PM₁₀ at (1) Bacca Hills homestead, approximately 1 km due west of the south-west corner of the Mine Lease Boundary; and (2) the homestead just north off Murlong-Murdinga Road, approximately 600 m NW of Kamballa. The NEPM allows for 5 exceedence days per year, with the modelling predicting up to 8 exceedence days per year at these receivers. The NEPM criterion is not expected to be exceeded at any other sensitive receptor locations in the vicinity of the mine.
- Nuisance dust levels (as dust deposition) are **not expected to exceed** the Victorian / NSW standard of 4 g/m²/month at the sensitive receptor locations.

The air quality assessment assumes water spaying and dust suppressant controls as discussed above in Section 8.8.4. It is considered **likely** that dust emissions from the proposed mine's operations will reduce ambient air quality and adversely impact sensitive receivers if not managed effectively. However, with the appropriate design and management controls in place, there are not expected to be any significant public nuisance or visual amenity issues, or public health impacts associated with dust emissions from the site.

¹⁰ This short-term dust emission is considered to be negligible when compared to the overall 24-hour dust emissions scenario.



A number of control measures (as detailed above) will be used to minimise the risk of dust impacting at sensitive receivers beyond the Mine Lease Boundary.

Some indications can be made of the potential effects of dusts on plant functioning based on the physical characteristics of the dust. Leaf temperature increase as a result of dust deposition can potentially occur, and can be described by the dust load and the temperature increase occurring per unit of shortwave radiation incident upon a leaf surface. Experimental evidence from NSW and QLD (e.g. Doley et al, 2006) shows that dust emissions will only have adverse effects on tree leaves when high dust loads are applied, as in the immediate vicinity of the source; or in contrast, fine dusts may have greater effects at much lower loads. The discussion in regard to potential iron ore and overburden dust from the Wilgerup mine site needs to be further qualified. Any deposition of particulate beyond the Mine Lease Boundary is expected to be **minimal**, and would only be deposited on vegetation of low ecological and habitat value. As such the associated risk of impact is predicted to be extremely **low**. Damage to flora and local fauna habitat from dust deposition is considered to be extremely **unlikely**, however further site-specific flora studies would be required in order to qualify this speculation.

Crops are located immediately adjacent the project area. It is **possible** that some minor dust emissions from the mine will deposit on neighbouring crops, however model predictions show only a small increment in dust deposition above the existing background level. As mentioned previously, the contribution of iron ore dust represents approximately only 5% of the total dust emission from the site, and is therefore not expected to be a significant amount. As such, the majority of dust potentially deposited on crops will be overburden dust. The consequence of the deposition on crop product is still uncertain in that it will depend on the level of dust contamination that is “allowable” by grain authorities, for example. An impact review by a grain specialist would be required in order to provide any further elaboration. In conclusion, it is possible that there will be some minor incremental levels of dust (95% of which is general overburden soil dust) deposited on surrounding crops; however the increment is small in comparison to the existing background dust levels, and is likely to be comparable to (if not less than) normal dust-generating activities during harvesting. Any increment to the existing background dust levels will be confirmed with the commencement of the planned dust monitoring, with the risk of deposited dust on surrounding crops reviewed accordingly.

Combustion Emissions

The likelihood of combustion emissions arising from ancillary operations associated with the mine project is **almost certain**. These emissions will occur for the duration of the earthworks and operational phases of the mine project.

There is expected to be an increase in combustion products (SO₂, NO_x, CO, PM₁₀ and CO₂) to the total contribution of these emissions within the local airshed, given that there are minimal sources



of emission within the Wilgerup area. The impacts of on-site emissions beyond the Mine Lease Boundary however, are considered **unlikely** to impact sensitive receivers. Potential impacts are expected to be **insignificant**, with an extremely **low** risk of impact at sensitive receivers.

Because of the high number of road-train movements (no fewer than 75 per day, or approximately 3 per hour), there will be an increase in combustion products to the airshed along the transport corridor. Local air quality impacts to receivers along the transport corridor, however, are expected to be **insignificant**.

Odour Emissions

The likelihood of odorous emissions arising from ancillary operations associated with the mine project is **likely**.

The distance to the nearest sensitive receiver to odours arising from the on-site wastewater treatment unit (the most significant odour source) at the mine administration office is approximately 800 m. This receiver is the homestead located to the north off Murdinga-Murlong Road. This is a significant buffer (distance) for such an odour source and, as such, it is **unlikely** that there will an odour impact at this receiver, given the small scale nature of the treatment unit. There is a **moderate** risk for personnel working in the vicinity of the maintenance or administration sheds to experience odours from the wastewater treatment units.

It is **unlikely** that VOC odours from diesel exhausts and refuelling operations on site will impact receivers beyond the Mine Lease Boundary.

8.8.6. Risk Levels

The results of this analysis for the above-identified risk events are summarised in Table 8-12.

■ **Table 8-12 Risk assessment outcomes – Air Quality**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Decrease in ambient air quality at neighbouring sensitive receptors due to dust generation.	Likely	Moderate	Minimise disturbed area. Progressive rehabilitation. Haul roads sealed/sheeted. Water spraying for dust suppression.	Unlikely	Moderate	Moderate	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Decrease in ambient air quality at neighbouring sensitive receptors due to dust deposition impacts.	Likely	Minor	Minimise disturbed area. Progressive rehabilitation. Haul roads sealed/sheeted. Water spraying for dust suppression. Pre-construction and ongoing dust monitoring.	Unlikely	Minor	Low	Yes
Contamination of surrounding cereal crops by iron ore dust.	Possible	Major	Minimise disturbed area. Progressive rehabilitation. Haul roads sealed/sheeted. Water spraying for dust suppression. Pre-construction and ongoing dust monitoring.	Unlikely	Major	High	Yes
Decrease in air quality at sensitive receivers due to combustion emissions.	Unlikely	Moderate	Installation of catalytic converters/use of exhaust filtration devices Regular inspection and maintenance.	Rare	Moderate	Moderate	Yes
Impact to surrounding flora; impact to fauna habitat due to dust generation.	Unlikely	Insignificant	Minimise disturbed area. Progressive rehabilitation. Haul roads sealed/sheeted. Water spraying for dust suppression. Pre-construction and ongoing dust monitoring.	Unlikely	Insignificant	Low	Yes
Impact to surrounding flora; impact to fauna habitat due to combustion emissions.	Unlikely	Insignificant	Installation of catalytic converters/use of exhaust filtration devices Regular inspection and maintenance.	Rare	Insignificant	Low	Yes
Increase in greenhouse gas emissions.	Almost certain	Minor	Installation of catalytic converters/use of exhaust filtration devices Regular inspection and maintenance.	Almost certain	Insignificant	High	Yes
Adverse effects and nuisance to neighbours (sensitive receivers) due to odour emissions.	Unlikely	Minor	Wastewater treatment units designed as aerobic, and to meet EPA and Department of Health Standards. Significant buffer distance to nearest sensitive receiver.	Rare	Minor	Low	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
			Controlled irrigation of treated wastewater (e.g. awareness of potential downwind sensitive receivers). Storage of fuels in accordance with Australian Standards.				

8.8.7. Risk Acceptance

As outlined above, the likelihood of occurrence of all potential air quality impacts identified are either **unlikely** or **rare**. Ambient air quality issues are given significant consideration in environmental regulation and policy in Australia and South Australia. This is primarily due to the potential consequences of poor air quality, in particular, to human health. Although the majority of significant air quality impacts to human health are acute, impacts can often lead to longer-term effects, such as bronchial and asthma-related illnesses. As such, some of the risks identified in Section 8.8.6 above for impact against the social/natural environment have a level defined as **moderate**, even after the Residual Risk Assessment. This is a direct result of the general consequence of the pollutant type on human health and is not considered a likely consequence of the proposed operation or management of dust issues at the mine site.

Specific operational management measures are required to address the identified issues during project development, construction and operation to ensure that the likelihood of occurrence of the identified impacts remains unlikely (or rare). The control measures that are proposed provide the level of control required in order to ensure the risk is as low as reasonably practicable and are hence considered acceptable for the project.

Similarly, the residual risk of potential iron ore dust emissions on neighbouring cereal crops is identified as “high”, even though there is an unlikelihood of this occurring from mining operations. It is considered that such an impact would generate a significant level of concern from stakeholders and the public. As with the controls identified to significantly reduce the risk of dust impact to human health, the dust controls proposed to suppress iron ore dust emissions from the site are considered to be of the level to ensure the risk of iron ore dust dispersion on neighbouring crops is as low as reasonably practicable.



The trigger for the residual risk of greenhouse gas emissions being “high” is due to there being no practicability in reducing the likelihood of occurrence of emissions to less than “almost certain”. The benefits of the mine project at large (economic, social, political, etc) grossly outweigh the small increment of greenhouse gas emissions resulting from the project’s operations (when compared to the national inventory of greenhouse gas emissions). As such, the risk is considered acceptable in the context of the mining industry and given the other benefits that will arise from the mining operation.

The acceptance of the identified residual risks forms the basis of the approach to ongoing management of the operations at the mine. Further details of the predicted outcomes, objectives and criteria for ongoing operations are outlined in the below sections.

8.8.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- Maintain public health and safety.
- No permanent loss of vegetation will occur as a result of dust generated by the mining operations.
- No contamination of surrounding cereal crops from iron ore dust deposition.

8.8.9. Measurement Criteria

The following assessment criteria will be adopted:

- No more than five exceedances of Ambient Air NEPM PM₁₀ (24-hour) criterion (50 µg/m³) per year, at sensitive receivers directly attributable to the mining operation.
- Assessment of dust deposition against NSW DEC requirements. Dust deposition levels to be less than 4 g/m²/month over baseline dust deposition levels.
- No nuisance odour at the nearest sensitive receiver.
- Annual greenhouse gas emissions over the life of the mine (based on annual production rate) will not exceed greenhouse gas emissions for year 1 of operations.
- No reasonable complaints from the public in relation to air quality or dust deposition impacts from the mine activities.

Centrex will liaise with grain authorities to determine whether additional (stringent) measurement criteria should be applied.



8.8.10. Monitoring Program

Monitoring will include:

- PM₁₀ will be measured and recorded on a daily basis by the onsite OHS officer (or qualified consultant) at two monitoring sites. Station 1 would be located north of the mine based on prevailing summer wind conditions. Station 2 would be located south of the mine to capture background levels.
- Dust deposition gauges will be located at four sites. Two will be co-located with the particulate monitoring stations and the other two locations will be determined following a site inspection.
- Calculation of annual greenhouse gas emissions (based on annual production rate) and reporting as part of EMP.
- Any complaints received concerning mining operations from neighbouring residents will be recorded, investigated and reasonable complaints addressed.
 - Complaints registered about dust will incorporate information relating to wind speed and direction at the time of complaint.
 - Complaints registered about combustion emissions will align with details of the operational activity causing the complaint.
 - Complaints registered about odour will include consideration of wind speed and direction at the time of complaint, and identification of potential source of odour.

8.8.11. Leading Indicator Criteria

Leading indicator criteria proposed in relation to potential dust impacts are:

- Dust monitoring network will include a monitoring location in potentially high risk areas. Assessment of dust deposition against NSW DEC requirements. Monthly dust deposition levels to be less than 4 g/m²/month over baseline dust deposition levels.
- No visual dust impacts to neighbouring crop areas. Regular visual inspection of neighbouring crops will be undertaken and outcomes recorded.

8.9. Noise and Vibration Emissions

Environment: No significant permanent man-made noise sources are located near the project area. Potential sensitive noise receivers are as follows:

- The Bacca Hills homestead which is approximately 2,300 m west, south-west from the mine site.



- A residence approximately 1,200 m north of the mine.
- A residence approximately 2,500 m north-west from mine

Malleefowl, which has a State and National conservation rating as Vulnerable, may potentially be utilising the fragmented patches of mallee to the north and east of the exploration lease area. This is considered unlikely to occur in the vicinity of the project area and no evidence of malleefowl activity has been identified during field investigations.

Stakeholders: Stakeholders have expressed concern over potential noise impacts associated with mine and transport activities.

8.9.1. Applicable Legislation or Standard

Clause (18) of Part 4- General Noise Control Provisions in the South Australian 'Environment Protection (Noise) Policy 2007', titled 'Compliance with noise goals satisfies general environmental duty', states:

The noise complies with the noise goals if measurements taken in relation to the noise source and the noise-affected premises show that-

- The source noise level (continuous) does not exceed the background noise level plus 5 dBA; or
- The source noise level (continuous) does not exceed the indicative noise level for the noise source.

Clause (3) of Part 5- Development Authorisation Applications part (3) also states that 'A predicted noise level (continuous) for the development should not exceed the relevant indicative noise level less 5 dBA. Part 1- Indicative Noise Levels of the Environment Protection (Noise) Policy 2007' prescribes the "Indicative Noise Factor"

Australian Standard 2187.2-2006 – Explosives – Storage and use – Use of explosives sets out the requirements and precautions for the use of factory-made commercially available explosives and certain explosives mixed or assembled at sites.

8.9.2. Potential Impact Events

Mine construction and operation will produce noise and vibration from both fixed and mobile equipment and blasting activities. The major sources of noise associated with the Wilgerup Mine Project have been identified as follows:

- Vehicles
- Machinery (conveyors, bull dozers, excavators, front end loaders, haul trucks)



- Crushing operations
- Drilling and blasting activities

Vibration impacts have the potential to cause structural damage to buildings in the vicinity. People are able to detect vibration at much lower levels than required to cause building damage. Therefore, potential impacts associated with noise and vibrations are also related to disturbance to nearby residences and fauna.

The initial noise generated by the actual construction of the mine pit will be marginally higher than the normal operating configuration of the mine pit as some of the mine equipment will not be acoustically shielded by the mine pit walls.

8.9.3. Control and Management Strategies

Design Control Measure:

- Noise attenuation mounds will be developed around the noise sources located at ground level within the ore crushing area. These mounds will be formed from crushed product. The mounds will provide acoustic attenuation of the surface mine equipment and will reduce the impact at neighbouring homestead sites.
- Further attenuation of specific equipment will be undertaken as required to meet the Noise Limits at the location of Residence 2 (the detailed design of this attenuation requires the detailed design of the plant layout and equipment specifications).

Management System Measures

- Monitoring of noise and vibration (blasting) impacts by complaints register.
- Standard noise abatement devices on machinery.
- Regular servicing of machinery and equipment.
- Monitoring and implementing corrective actions to improve management techniques.
- Design and execution of blasting activities by a suitably qualified person.
- Exclude blasting at night and early mornings (i.e. the times when ground-based or low level inversions will be present).
- Compliance with ground vibration and overpressure limits and AS 2187.2:2006, to ensure the comfort of employees, neighbouring residents and properties.

8.9.4. Risk Levels

The generation of noise from mine construction and operational activities is unavoidable and will occur for the duration of the project (six years).



The noise assessment undertaken (Appendix E) shows that predicted noise levels exceed noise limits for two of the four identified sensitive receptors (the two closest residences north of the mine site).

With no control measures in place, it is **likely** that noise and vibration impacts will impact local residents. A number of noise control measures will be adopted on site to minimise the impact of operational noise. However, it is considered **likely** that blasting will still cause some impact to local residents, although this disturbance will be short in duration (i.e. no more than 10 seconds). It is highly **unlikely** that noise and vibration impacts could cause property damage to nearby dwellings due to the cushioning effect of the tertiary sand cover. It is **unlikely** that significant fauna species will be disturbed by noise and vibration impacts due to the low likelihood of species of significance near the project area.

Due to the sparse nature of the population in the vicinity of the project area, it is considered that if noise and vibration impacts occur, they will result in localised disturbance that will be able to be readily mitigated in consultation with affected landholders. Therefore the consequence level is considered **minor**.

A number of control measures (as detailed above) will be used to minimise the risk of noise and vibration impacts extending beyond the operations area.

8.9.5. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-13.

■ **Table 8-13 Risk Assessment Outcomes – Noise and Vibration**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Disturbance to residents due to noise and vibration	Likely	Moderate	Strategically based noise attenuation barrier/mound. Blasting times limited to daylight hours.	Likely	Minor	Moderate	Yes
Disturbance to fauna due to noise and vibration	Unlikely	Minor	Targeted searches for malleefowl mounds prior to construction.	Unlikely	Minor	Low	Yes
Property Damage due to noise and vibration	Unlikely	Minor	Design and execution of blasting activities by a suitably qualified person and in accordance with Australian Standards.	Unlikely	Minor	Low	Yes



Risk Event	Risk Prior to Implementation of Controls	Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
		Compliance with ground vibration and overpressure limits				

8.9.6. Risk Acceptance

While there may be noise and vibration impacts during operations, the impacts will be temporary and localised in nature (as the project area is sparsely populated). Two out of three of the residual risk ratings have been deemed as low. While blasting will be undertaken in accordance with the relevant Australian Standards and will be limited in frequency and duration, some disturbance to residents due to blasting remains likely and the residual risk is considered moderate.

The complaints register for the project will enable noise and vibration impacts to be monitored, and further remedial measures put in place if required. For this reason, these risks are considered as low as reasonably practicable and are acceptable to the project.

8.9.7. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcome:

- Blasting will be the only source of noise and vibration disturbance associated with mine activities. Blasting activities will be limited to once a day, will only occur during daylight hours and will not exceed 10 seconds in duration.

8.9.8. Criteria

The following assessment criteria will be adopted:

- Blasting to occur no more than once a day during daylight hours.
- The duration of a blast event will not exceed 10 seconds.
- No reasonable complaints from the public in relation to noise or vibration impacts (i.e. outcomes not achieved).
- No damage to third party off site assets caused by blasting.

8.9.9. Monitoring Program

Monitoring will include:

- Any complaints received concerning mining operations from neighbouring residents will be recorded, investigated and reasonable complaints addressed.



- Complaints registered about noise or vibration will incorporate information relating to wind speed and direction at the time of complaint and align with details of the operational activity.

8.10. Alteration to Surface Drainage

8.10.1. Context and Stakeholder views

The site for the proposed Wilgerup Mine Development is currently farmland comprising sandy clay flats interspersed with sand dunal ranges which run in a north-west to south-east direction. Assessment of the regional contour plans of the Lock area identify that the proposed mine site is not within a defined waterway. Possible overland flow paths from the ridge to the south west of the mine site are not confined to one particular flow path.

The predominant sandy soil profile indicates that the majority of rainfall events would not result in runoff. However, sands of the Eyre Peninsula have potential to be non-wetting sands which could increase the likelihood of runoff, and in larger or longer rainfall events, runoff from the catchment could occur. Furthermore, compacted hardstand areas and access/haul roads will result in localised runoff from even minor rainfall events.

8.10.2. Legislative Controls and Standards

The relevant legislation relating to protection and management of surface water is as follows:

- *Mining Act 1971 (SA)*
- *Natural Resources Management Act 2004 (SA)*
- *Environment Protection Act 1993 (SA)*

8.10.3. Potential Impact Events

The key environmental implication of the proposed development is the impact that the pit and waste rock dump may have on surface water quality and passage in and around the site. Altered flow regimes and clearance of existing crops and vegetation will change erosion patterns, and the increased sediment loads will decrease quality of surface runoff. Runoff from the waste rock dump, roads and hardstand areas could also decrease surface water quality. Changes to water quality include turbidity and total suspended solids (TSS) concentrations.

The potential impact will vary depending on the intensity and duration of any rainfall event at the mine site and across the broader area. Control and management measures will need to consider levels of flow and storage capacity requirement to manage and mitigate flows from a range of design rainfall events.



8.10.4. Control and Management Strategies

Design Control Measures

- Management of surface water around the mine site via a series of diversion banks and drainage channels. Sizing of diversion banks and drainage channels to consider appropriate design rainfall events.
- Run-off from the broader catchment to be diverted around the mine site using diversion banks and floodways. Sizing of diversion banks and drainage channels to consider appropriate design rainfall events.
- Run off from waste rock dump during establishment phase to be directed to sediment basins, and potentially contained within retention basins, depending on the expected quality of the runoff. Sizing of basins to consider appropriate rainfall events.
- Run-off from disturbed sites, including hard stands and roads to be directed through vegetated swales and/or sediment traps and or detention basins to provide sediment removal treatment. Sizing of basins to consider appropriate rainfall events.
- Bund to be constructed around rim of pit to prevent surface waters from discharging into the pit.

Management System Measures

- Regular inspection program to be developed and implemented for monitoring and maintenance of surface water design elements (diversion banks, floodways, drainage channels and associate culverts, sediment traps and detention basins).
- Permanent and temporary erosion and sediment control structures to be used on site as required during construction and operation.
- Develop and implement opportunistic water quality monitoring program.

8.10.5. Risk Levels

Adverse impacts to flow volumes, frequencies, velocities and regimes of surface water bodies in the area are **unlikely** given the hydrological conditions of the project area and absence of defined flow paths, and the implementation of the above control measures to facilitate passage of any flows around the mine site.

Although an increase in erosion and sedimentation is likely to occur, adverse impacts from sediment laden water are **unlikely** to occur due to the absence of sensitive receiving waters and the patchy, degraded condition of native vegetation within the project area.



8.10.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-14.

■ **Table 8-14 Risk assessment outcomes – Surface Drainage**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Adverse impacts to surface flow resulting from altered flow paths created by the pit and waste rock dump in significant rain events.	Unlikely	Minor	Surface water management via diversions channels and sediments/retention basins. Catchment runoff diverted around mine site. Regular inspection, monitoring and maintenance of surface water design elements.	Unlikely	Minor	Low	Yes
Adverse impacts to surface water quality	Unlikely	Insignificant	Permanent and temporary sediment control structures as required. Opportunistic water quality monitoring.	Unlikely	Insignificant	Low	Yes

8.10.7. Risk Acceptance

As summarised in Table 8-14, the residual risks for adverse impacts from altered surface drainage conditions in the project area are considered to be **low**. This is due to the lack of defined flow paths and limited run-off expected within the project area. Any impacts from altered surface drainage conditions at the site are generally expected to be very localised and minor in nature. However, any potential impacts can be readily managed by appropriately designed drainage channels, complemented by a monitoring and maintenance program. For this reason, these risks are considered as low as reasonably practicable, and are acceptable to the project.

8.10.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcome:

- Maintain the natural landscape erosion processes on adjoining land.



8.10.9. Criteria

The following assessment criterion will be adopted:

- No erosion off the lease area caused or exacerbated by operations (photopoint monitoring).

8.10.10. Monitoring Program

Monitoring will include:

- Regular photopoint monitoring of stockpiles and adjoining land.
- Undertake regular and opportunistic (during rainfall events) inspection of sediment and erosion controls.
- Opportunistic water quality monitoring program.

8.11. Groundwater Interaction

8.11.1. Context and Stakeholder Views

Environment: The primary groundwater aquifer found in and around the Wilgerup iron ore deposit is the regional Basement Aquifer, a fractured rock aquifer associated with regional basement formations, including the iron ore deposit. The deposit itself is likely to be fully saturated with groundwater with salinity comparable to that of sea water. Water levels in the Basement Aquifer are roughly 25m below the ground surface at Wilgerup. The lower sections of the aquifer are known to be more permeable. The regional extent of the aquifer is unknown but thought to extend along a main North-South fracture zone for several kilometres, and is likely to connect with the sedimentary aquifers of the Poldas Basin (particularly saline groundwater associated with the Jurassic 'Poldas Formation' sediments). There is also a minor unconfined sand aquifer (the Tertiary Sands aquifer) generally located at the base of the 20 to 30 metre thick Tertiary unconsolidated sediments covering the ore body. The saturated zone is less than 1m in thickness over the Wilgerup deposit. There are only 4 known water bores and no groundwater users within 20 km of the Wilgerup deposit. The closest groundwater users are located to the west in the Musgrave Prescribed Wells Area, where there are several shallow freshwater lenses, primarily directly recharged by rainfall. The closest lens is the Poldas Lens, located roughly 40 km from Wilgerup.

Stakeholders: Groundwater users in the Musgrave Prescribed Wells Area (PWA) including potable water supply for human use and Groundwater Dependent Ecosystems (GDEs).

8.11.2. Applicable Legislation or Standard

Interaction with groundwater is governed by the *Natural Resources Management Act, 2004*, which prohibits draining or discharging water directly or indirectly into a watercourse or lake contrary to



a National Resource Management Plan for that area (unless holding a permit for this activity under the NRM Plan).

8.11.3. Potential Impact Events

The main hypothetical impacts of mine activities on groundwater are centred around the excavation of the mine pit and extraction of groundwater from local aquifers for water supply purposes. They include:

- Drainage of the surrounding Tertiary Sands Aquifer (if it exists) and regional fractured Basement Aquifer leading to:
 - Lowering and/or removal of localised fresh water lenses currently used for stock and domestic water supply or which have the potential for future human use or which support groundwater dependent ecosystems;
 - Reductions in recharge to ‘down-gradient’ aquifers, particularly in the Musgrave PWA, with subsequent negative impact on human and ecological values.
- Pollution of localised fresh groundwater lenses (if any exist within the catchment area) from infiltration of excess saline water generated by dewatering activities.
- Post-mine (i.e., long term) modification of groundwater quality in the rehabilitated pit (e.g., acidification) which may influence groundwater quality in regional aquifers.

8.11.4. Control and Management Strategies

While the qualitative analysis indicates the potential groundwater impacts are of low risk, further investigation will be undertaken to assess the impact of mine activities (dewatering and water supply) on the Tertiary Sands and Basement aquifers.

The information required for this investigation should become available as additional characterisation of the local groundwater conditions occurs as part of engineering considerations for the mine.

Additionally, as the regional characteristics of the Tertiary Sands and Basement Aquifers are poorly defined, it is anticipated that a limited amount of additional data collection will be undertaken, through the identification and monitoring of key existing regional groundwater monitoring wells.

The generation of potentially large quantities of saline groundwater from dewatering operations presents other potential environmental impacts not related to groundwater. These are considered in Section 8.5.



Design Control Measures

- None required.

Management System Measures

- Monitoring of groundwater levels in exploration drillholes and custom built monitoring wells installed around the Wilgerup site during mine feasibility studies.
- Identification and monitoring of existing water bores located between Wilgerup and the Musgrave PWA to provide confirmation that groundwater drawdown linked to the mining operations is localised around Wilgerup.

8.11.5. Risk Levels

No known freshwater resources have been identified within 20 km of the Wilgerup deposit. There are no current users and future demand is likely to continue to be low in this area. It is also unlikely that the Tertiary Sands aquifer supports any stygofauna as it is of limited thickness and permeability as well as being highly saline (EPA WA ,2003). Therefore drainage of the surrounding aquifer or pollution of freshwater lenses or impacts to local groundwater dependent ecosystems (stygofauna) is **highly unlikely**.

The Quaternary Limestone aquifer in the Musgrave PWA is considered to be the main regional groundwater resource potentially at risk from the Wilgerup development. The ongoing viability of the resource is linked to maintaining current rates of inputs (ie. primarily rainfall recharge) and outputs (extraction, leakage into underlying aquifers, etc).

The Limestone aquifer is known to be recharged locally and is largely independent of water levels in the deeper aquifers (due to the widespread underlying Tertiary clay aquitard). The Wilgerup deposit is located about 40 km from the nearest Quaternary Limestone aquifers in the PWA (the Sheringa-B and Poldas lenses). The area of groundwater drawdown within the thin Tertiary Sands aquifer and the more predominant Basement aquifer is likely to be limited to within several kilometres of Wilgerup. The degree of connectivity to the Musgrave PWA Limestone aquifers, even in areas where the Tertiary clay aquitard is not present, is therefore likely to be extremely limited. It should be noted however, that there is limited hydrogeological data available concerning the Basement fractured rock aquifer. There is a slight risk of unusual high connectivity (eg. due to faulting) or via the Poldas Basin Jurassic aquifers that should be considered. Nevertheless, the overall risk of degradation of the Quaternary Limestone aquifer resource is assessed to be **highly unlikely**.

The acid generating capacity of the ore body rock has been assessed to be low (see Section 5.7.1). The risk of movement of acidified groundwater into the regional groundwater systems from the rehabilitated pit is therefore deemed **highly unlikely**.



8.11.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-15.

■ **Table 8-15 Risk assessment outcomes – Groundwater**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Drainage of the surrounding aquifers during pit dewatering or ongoing groundwater abstraction - Removal of localised fresh water lenses	Unlikely	Minor	Identification and monitoring of existing water bores located between Wilgerup and the Musgrave PWA to provide confirmation that the significant groundwater drawdown linked to the mining operations is localised around Wilgerup. Monitoring of groundwater levels in exploration drillholes and custom built monitoring wells installed around the Wilgerup site during mine feasibility studies.	Unlikely	Minor	Low	Yes
Drainage of the surrounding aquifers during pit dewatering or ongoing groundwater abstraction - Degradation of Musgrave PWA groundwater resources	Unlikely	Moderate	As above	Rare	Moderate	Moderate	Yes
Infiltration of excess water from dewatering activities - Pollution of localised fresh water lenses	Unlikely	Minor	As above	Unlikely	Minor	Low	Yes
Accumulation of groundwater in rehabilitated pit with changed chemical characteristics - Degradation of Musgrave PWA groundwater resources	Rare	Minor	As above	Rare	Minor	Low	Yes



8.11.7. Risk Acceptance

In relation to groundwater resources, the level of risk presented by the project is assessed to be acceptable and does not necessitate specific control measures.

There is, nevertheless, a small degree of uncertainty into the connection between local groundwater systems and the regulated groundwater resources of the Musgrave PWA. A groundwater management plan has therefore been devised to cover this risk (see Section 8.11.11). Ongoing monitoring of regional groundwater levels will provide an 'early warning' system and provide progressive information on any unexpected regional groundwater impacts and the need for, and feasibility of control measures.

8.11.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcome:

- No reduction in the quantity or quality of water for existing users in the Musgrave PWA due to the impacts of mine activities (i.e. dewatering or water supply extraction).

8.11.9. Criteria

The following assessment criterion will be adopted:

- No long term changes to groundwater levels and quality in the Musgrave PWA (based on baseline monitoring data).

8.11.10. Monitoring Program

Monitoring will include:

- Groundwater monitoring of three local groundwater bores (including the Kamballa bore) and three regional groundwater bores [locations to be determined in consultation with Eyre Peninsula Natural Resource Management (EP NRM) Board].
- Groundwater levels will be monitored monthly for the local bores and bi-annually for the regional bores.
- Annual groundwater quality monitoring will be undertaken for local groundwater bores.

Results will be reported annually to PIRSA, DWLBC and the EP NRM Board.

8.11.11. Groundwater Management Plan

The purpose of a groundwater management plan is to maintain defined values for the local groundwater resources. As the main objective of mining activities is to remove local groundwater, the primary management objective is simply to see that groundwater levels are dropping as



predicted. A secondary natural resource management objective also needs to be addressed, namely the preservation of the values of the Musgrave PWA groundwater resources and tertiary sands aquifer.

The proposed groundwater management plan for the Wilgerup mine project comprises the following groundwater data collection (monitoring) activities. Baseline groundwater data, including water quality measurements, are to be collected during project planning stages.

Location	Water bores	Purpose	Data collected	Frequency
Local	x 3	Assess rate of dewatering of ore body	Groundwater levels	Weekly
	x 3 (including Kamballa bore)	Assess impacts on Tertiary Sands aquifer and Basement aquifer	Groundwater levels Groundwater quality	Monthly Annually
Regional	x 3 (to be decided in consultation with the EP NRM board)	Assess impacts on Tertiary Sands aquifer and Basement aquifer	Groundwater levels	Biannually

Data collected will be interpreted in the form of ongoing operations reviews (for mine dewatering and water supply) and detailed in the project annual environmental report.

8.12. Fire

8.12.1. Context and Stakeholder views

Environment: The pastoral districts of the Eyre Peninsula, including the project area, are susceptible to fires during periods of high winds, high temperatures and dry conditions.

The project area is located within the West Coast fire ban district, which includes the District Council of Elliston.

Stakeholders: During previous Fire Danger Seasons, fires have been started by harvesting operations and become uncontrolled. Although grain harvesting is not the cause of the greatest number of fires, those that occur from grain harvesting generally result in greater loss (in hectares) than other avoidable fires. This has led to the development of a voluntary Code of Practice that provides that grain harvesting operations be suspended when the local actual Grass Fire Danger Index (GFDI) exceeds 35.

8.12.2. Legislative Controls and Standards

The relevant legislation and guidelines relating to fire and emergency services are:



- *Fire and Emergency Services Act 2005 SA*
- *Fire and Emergency Services Regulations SA*

8.12.3. Potential Impact Events

The risk of fire is associated with the potential for sparks from machinery or other ignition sources to set fire to surrounding grassland or vegetation patches. The following impacts may occur as the result of a fire started by mining operations:

- Uncontrolled fire escapes lease area resulting in death or injury to the public and widespread economic loss.
- Pressure on local CFS and emergency services.

8.12.4. Control and Management Strategies

Design Control Measures

- All site infrastructure to be designed in accordance with building/fire requirements standards and include alarms, fire suppression/fighting mechanisms etc.
- Appropriate fire breaches will be established around all site equipment.
- Compliance with AS 5062-2006: Fire protection of mobile and transportable equipment.

Operational Control Measures:

- Mine rescue and emergency response team established at mine.
- Ongoing liaison with local CFS and emergency services.
- Adopt regular inspection and maintenance program for machinery associated with mine operations.
- Develop and implement emergency response procedures which include a fire fighting plan. This will include ensuring access to appropriate radio or mobile phone communications.

8.12.5. Risk Levels

Fire is considered **unlikely** to occur as a result of mine operations as the majority of activities that could start a fire will be undertaken clear of grassland and vegetation which could fuel a fire (i.e., within the pit, on the waste rock dump or along access cleared access roads).

An out of control fire that escapes the project area has the potential to cause death or injury to members of the public, and is therefore considered **catastrophic**.

Fire at the mine site will put pressure on the local emergency services and CFS for only a limited period, and is therefore considered a **moderate** consequence.



8.12.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events summarised in Table 8-16.

■ **Table 8-16 Risk assessment outcomes - Fire**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Uncontrolled fire escapes mine lease area and causes death/injury and significant economic loss	Unlikely	Catastrophic	Liaison with CFS and local emergency services. Appropriate fire breaches will be established around all site equipment. Compliance with AS 5062-2006: Fire protection of mobile and transportable equipment. Mine rescue and emergency response team established at mine. Emergency response procedures.	Rare	Catastrophic	High	Yes
Pressure on local CFS and emergency services	Unlikely	Moderate	Liaison with CFS and local emergency services. Provision of emergency services on site.	Rare	Moderate	Moderate	Yes

8.12.7. Risk Acceptance

The residual risks for the two identified impacts of fire are considered to be high (fire causes death and injury) and moderate (pressure on CFS and local emergency services) residual risk ratings that are considered to be moderate.

Although the control measures are considered to reduce the likelihood of these events occurring to rare and control the spread of fire through the development of emergency response plans and provision of fire fighting equipment, there is always the potential for a fire to burn out of control and cause widespread damage when weather conditions are unfavourable. However, the risk of fire as a result of mining activities is considerably lower than for surrounding properties where grain harvesting is undertaken during fire danger periods, due to no activities being undertaken in cropped or vegetated fields.



Specific operational management measures are required to address identified impacts during project construction, operation and mine closure; however, the risks are considered as low as reasonably practicable and for this reason are acceptable to the project.

8.12.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcome:

- All fires caused by operations are controlled in the lease area.

8.12.9. Criteria

The following assessment criterion will be adopted:

- No fires off lease proved to be caused by operations when investigated by appropriate authority.

8.12.10. Monitoring Program

Monitoring will include:

- Annual review of environmental incidents and incident investigation outcomes (including fire).

8.12.11. Leading Indicator Criteria

As identified in Table 8-16, a fire escaping the mining lease boundary has potentially catastrophic consequences. A breakdown in the nominated controls could increase the likelihood of the risk event occurring. For this reason, the following leading indicator criteria will be adopted:

- Number of fire related near misses and incidents.
- Audit of fire controls and emergency preparedness shows:
 - Site emergency response plan is up to date and the nominated mine rescue and emergency response team has received adequate training.
 - All fire breaches are in place and maintained.
 - Compliance with AS 5062-2006: Fire protection of mobile and transportable equipment.

Review of fire controls and emergency preparedness will be undertaken monthly during the fire danger season. Centrex will liaise with emergency services during this period and seek advice where necessary.



8.13. Waste Management

8.13.1. Context and Stakeholder views

Context: The operation is expected to employ 78 people on site during its peak operational phase. Personnel will reside in accommodation at the nearby areas of Lock, Rudall or Cleve and will commute to and from the mine. Therefore, the domestic waste generated on site will be limited to mine operations (i.e., there will be no waste generated from accommodation). During the operational phase, it is assumed that approximately 30 people will be working on site each shift in two 12-hour shifts per day.

8.13.2. Applicable Legislation or Standards

The relevant legislation and guidelines relating to waste management are:

- *Environment Protection Act 1993 SA*
 - Requires that an EPA licence is obtained before undertaking a prescribed activity of environmental significance (as defined in Schedule 1 of the Environment Protection Act 1993) unless an exemption is granted.
 - Requires the usage, storage and disposal of waste tyres to be undertaken in accordance with the general provisions of the Environment Protection Act 1993 - Environmental Authorisations and Environmental Harm. Guidance is given in EPA (SA) Guideline: Waste tyres.
 - Under the *Environment Protection Act 1993* (the Act), an environmental authorisation (works approval, licence or exemption) is required for the reception, storage, treatment or disposal of waste, other than in certain circumstances. In the case of waste tyres or tyre pieces an environmental authorisation is not required if:
 - the tyres are handled solely for recycling or reuse and are not in quantities exceeding five (5) tonnes per year (approximately 500 passenger vehicle tyres)
- *Environment Protection (Waste Management) Policy 1994*
 - Clause 6 provides that when transporting waste, take reasonably care to cover, contain or/and secure waste.
- *Public and Environmental Health (Waste Control) Regulations 1995*
 - Septic Tanks: Ensure that the construction, sale, use, installation or alteration of a waste control system (septic tank) or component is performed under approval of the relevant authority. Approval is also required for the disposal or reuse of waste from such a system. Ensure that the system is maintained in good order and do not, without approval, use a waste control system in a manner that contravenes or fails to comply with, a prescribed code (regulation 7-11 and 23).



- Refuse: Ensure that refuse capable of causing an insanitary condition is kept in receptacles that:
 - are adequate to hold the refuse
 - prevent access by flies, pests, vermin or other animals
 - are impervious to water
 - prevent, as far as practicable, the emission of offensive odours.

Take reasonable steps to ensure that:

- refuse capable of causing an insanitary condition is disposed of as often as appropriate in view of its nature, but at least once a week
- receptacles are kept in a clean and sound condition
- any putrescible waste placed in receptacles is contained in wrapping or sealed in a disposable container to minimise the discharge of fluids and the emission of offensive odours.

[Public and Environmental Health (General) Regulations 2006, r4]

8.13.3. Potential Impact Events

Mine operations will result in the generation of the following categories of waste, which will require disposal:

- Solid domestic waste
- Septic waste
- Tyres
- Brine from RO plant
- Domestic wastewater (grey water from showers etc.)
- Hydrocarbons (grease and oils)

Generation and disposal of these wastes has the potential to result in the following impacts:

- Reduced visual amenity due to build up of waste
- Increased waste to landfill.
- Potential contamination of soil and groundwater from seepage of septic waste
- Potential contamination of soil and groundwater from inappropriate brine disposal
- Potential contamination of soil from sediment laden/oily water from the washdown pad
- Adverse health impacts from raw sewerage overflow.
- Waste tyres stored in large quantities can:



- Present a fire hazard
- Harbour disease vectors such as mosquitoes and vermin.

8.13.4. Control and Management Strategies

Design Control Measures:

- Water from the wash down pad will drain directly into a nearby lined settling pond to minimise seepage/leakage to the soil or groundwater. The overflow from the settling will drain to an appropriately designed oil/water separator.
- Brine from the reverse osmosis plant will be sent directly to the evaporation/infiltration dam. The dam is anticipated to be lined with high density polyethylene (HDPE) liner to minimise any potential leakage to soil or groundwater from the storage.
- The sewerage system will comply with *Public and Environmental Health Act (Waste Control Regulations) 1995* at all times (see Section 5.7.3.3 for further detail).
- Tyres will be stored on a level site away from surface drainage pathways and flammable or combustible liquids.

Operational Control Measures:

- A waste management contractor will be selected to provide clearly labelled and colour coded bins for each class of solid domestic waste (e.g., paper, plastic, etc.) generated on site. The construction of the bins and the material used to make them will be appropriate for the waste types they are to contain. The waste management contractor will remove the waste material to a licensed waste management facility for recycling and disposal.
- Grease and oil from the oil/water separator will be removed from the water and collected in drums for disposal by the waste management contractor. Water from the separator will be reused on site. The drums containing grease/oil will be stored in an appropriately designed facility (eg impervious floor, bunded).
- Sediment from the settling pond will be removed as required to the bio-remediation area for treatment to remove residual hydrocarbons.
- Treated wastewater will be used to primarily irrigate the native vegetation planted on the noise abatement bunds (refer Figure 1). It may also be used to irrigate native vegetation that is planted elsewhere on Site. The wastewater will be sourced from both grey water and black water. Depending on the configuration of the plumbing system (i.e., if grey water can be separated easily), it may be possible to treat only black water by the 2 aerobic treatment units. These systems can treat the wastewater to Class C (assuming post-treatment disinfection) which is suitable for irrigation purposes (i.e., BOD < 20 mg/L, SS < 30 mg/L) (EPA 1999).
- The septic system will be pumped out and maintained as required by a licensed contractor.



- Following decommissioning, the septic system will be pumped out, cleaned, inspected and repaired if necessary by a licensed contractor prior to be re-commissioned for post-mining service.
- All tyres changed on site will be collected and sent off site for recycling on a regular basis.

8.13.5. Risk Levels

Reduced visual amenity due to build up of waste

Without appropriate waste management planning, in rural and scarcely populated areas such as Wilgerup, it is **likely** that a build up of waste would occur at the site resulting in reduced visual amenity and potentially creating insanitary conditions. As no accommodation is to be provided on site, production of solid domestic waste is anticipated to be limited, and the impacts **minor** in nature.

Increased waste to landfill

It is considered **likely** that the construction, operation and decommissioning of the mine will result in an increase in domestic waste requiring disposal to landfill. Due to the size and anticipated mine life, this impact is considered **minor**.

However, Centrex will seek to minimise disposal of waste to landfill through opportunities for re-use and recycling.

Potential for contamination of soil and groundwater from septic waste

Impacts associated with seepage of sewerage to groundwater, which could reduce its suitability for use, are considered **unlikely**. The size of the septic system is small, and water table deep. However, it is considered **possible** that localised soil contamination could result in **minor** impacts.

Potential contamination of soil and groundwater from inappropriate disposal of brine

It is considered **possible** that the inappropriate disposal of highly saline brine on site could impact site soil quality, resulting in **minor** impacts including reduced vegetation growth on a local level. Impact of the deep water table is considered unlikely.

Potential contamination of soil from sediment laden/oily water from the wash down pad

It is considered **possible** that the inappropriate disposal of sediment laden or oily water on site could impact site soil quality, resulting in **minor**, localised contamination.



Adverse health impacts from raw sewerage overflow

It is considered **possible** that adverse health impacts could result on a localised level in the event of a raw sewerage overflow. The potential adverse impacts are considered **minor** in consequence.

Storage of waste tyres in large quantities

Waste tyres will not be stored in large quantities on site, with used tyres being sent off site for recycling. The likelihood of fire or introduction of mosquitoes or vermin due to the storage of waste tyres is considered **unlikely**. The potential adverse impacts are considered **minor** in consequence.

8.13.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-17.

■ **Table 8-17 Risk assessment outcomes – Waste Management**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Reduced visual amenity due to build up of waste	Possible	Minor	Provision of appropriate covered bins and regular collection by licensed contractor.	Unlikely	Minor	Low	Yes
Significant increase in waste to landfill	Possible	Minor	Provision of recycling bins and collection by licensed contractor. Tyres sent off site for recycling.	Unlikely	Insignificant	Low	Yes
Potential for contamination of soil and groundwater from septic waste	Possible	Minor	Sewerage system will comply with <i>Public and Environmental Health Act (Waste Control Regulations) 1995</i> Maintenance in accordance with design requirements.	Unlikely	Minor	Low	Yes
Potential for contamination of soil and groundwater from brine (from RO plant)	Possible	Minor	Disposal of brine water to a lined evaporation pond.	Unlikely	Minor	Low	Yes
Potential for contamination of soil from sediment laden/oily	Possible	Minor	Water from wash down pad to drain directly to a nearby lined settling pond. The overflow from the settling pond will drain to an	Unlikely	Minor	Low	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
water from wash down pad			appropriately designed oil / water separator.				
Adverse health impacts from raw sewerage overflow	Possible	Minor	Sewerage system will comply with <i>Public and Environmental Health Act (Waste Control Regulations) 1995</i> Maintenance in accordance with design requirements.	Rare	Minor	Low	Yes
Introduction of disease vectors or fire resulting from the storage of waste tyres in large quantities	Unlikely	Minor	Tyres will not be stored in large quantities on site. Tyres will be stored on a level site away from surface drainage pathways and flammable or combustible liquids. Tyres will be changed on site, with the used tyres to be sent for recycling.	Rare	Minor	Low	Yes

8.13.7. Risk Acceptance

As outlined above, the residual risks associated with waste management at the mine site (in light of the implementation of the design and operational management measures) are considered low.

Specific operational management measures are required to address identified impacts during project construction, operation and mine closure, however, the risks are considered as low as reasonably practicable and for this reason are acceptable to the project.

8.13.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- No contamination of soil or groundwater as a result of waste disposal.
- No disturbance to public amenity associated with waste generated on site.
- Maintain public health and safety.



8.13.9. Criteria

The following assessment criteria will be adopted:

- Concentration of contaminants in soil to be in compliance with soil investigation levels detailed in the National Environmental Protection Measure (NEPM) 19999.
- Complaints register: No reasonable complaints from neighbouring residence that waste management practices on site are interfering with public health, safety or amenity.

8.13.10. Monitoring Program

Monitoring will include:

- Monitoring and validation of soil contamination status as part of progressive rehabilitation.
- Monthly inspection by site OHS officer to check that good housekeeping is maintained on site and to instigate remedial action if required.
- Any complaints received concerning mining operations from neighbouring residents will be recorded, investigated and reasonable complaints addressed.

8.14. Roads and Traffic

8.14.1. Context and Stakeholder Views

Environment: The proposed road route from the project area to the proposed rail siding facility at Tooligie, begins at Roberts Road, approximately 1.5 km north of Tooligie Hill Road.

The route will continue along Roberts Road (which currently is an unsealed Gazetted route) to the intersection of Kay Road and Tooligie Road. From this intersection the ore will be transported along Tooligie Road until it reaches Tooligie, adjacent the existing rail line.

The ore will be loaded onto rail wagons and transported south to Port Lincoln Wharf using the existing rail line. The trains will travel through the towns of Cummins and Port Lincoln on route to the port facility.

Stakeholders: Any issues relating to minor/local roads are managed by the relevant local council.

Potentially affected stakeholders along the transport route include local residents in the vicinity of the project area, and in the township of Cummins, Port Lincoln and other localities along the transport route. Noise, dust and safety impacts have been raised as key concerns of the community along the transport route from the mine to Tooligie siding.



8.14.2. Applicable Legislation or Standard

The relevant legislation and standards relating to roads and traffic are:

- *Road Traffic Act 1961 SA* provides two categories for the operation of heavy vehicles on South Australian roads: General Access Vehicles; and Restricted Access Vehicles (restricted to approved routes).
- Austroads Guide to Traffic Engineering Practice (GTEP), Parts 1 to 15
- Austroads Guide to The Geometric Design of Rural Roads
- Austroads Guide to The Geometric Design of Major Urban Roads
- Austroads Road Safety Audit Guidelines Second Edition
- Department for Transport, Energy and Infrastructure (DTEI) Route Assessment Guidelines for Restricted Access Vehicles – June 2007

8.14.3. Potential Impact Events

Upgrades to local road network

Upgrades to the local road network will be required to accommodate the vehicle configuration required for ore haulage. Roadwork activities likely to be required include:

- Intersection upgrades
- Road widening
- Upgrading of road pavements and/or sealing of roads
- Vegetation clearance/pruning as required for road upgrades and to provide required sight distances

Potential impacts in the vicinity of the project area due to roadwork activities are as follows:

- Potential short term disturbance and delays to local traffic due to speed/access restrictions during roadwork activities.
- Disturbance to nearby residents due to dust and noise generated from construction activities.
- Loss of native vegetation due to road widening and clearance to provide adequate site distances.

Impacts during mine construction

Construction activities associated with the mine will result in short term increase to local and regional traffic volumes, and in particular an increase in heavy vehicle traffic associated with delivery of infrastructure and equipment to site.



The increase in heavy vehicle movements in the vicinity of the project area has the potential to result in safety issues for local and regional road users. Noise associated with the short term increase in heavy vehicle movements may also cause nuisance for residents in the vicinity of the proposed transport route.

Increased heavy vehicle movements have the potential to result in deterioration of the road pavement (requiring additional maintenance).

Impacts during operation

It is anticipated that two-way traffic movements on the local road network will increase by approximately 150 vehicles per day. Potential impacts associated with the increase in (predominantly heavy vehicle) traffic are as follows:

- Amenity impacts associated with dust from ore transport.
- Amenity impacts associated with noise from increased truck movements and train operations.
- Safety issues due to increased heavy vehicle traffic using the local and regional road network.
- Potential delays and congestion due to increased traffic volumes.
- Increased heavy vehicle movements have the potential to result in deterioration of the road pavement (requiring additional maintenance).

8.14.4. Control and Management Strategies

Design Control Measures

- Sections of the route that are not included in the DTEI current Gazettal Notices for Restricted Access Vehicles, will require an independent route assessment to identify necessary road/intersection upgrades and to obtain approval for the proposed vehicle configuration to travel the route.
- Unsealed sections of road will be paved/sealed (whichever is appropriate) to minimise dust and to maintain a suitable pavement for the proposed truck configuration.
- Road upgrades will be undertaken in accordance with DTEI Guidelines for Restricted Access Vehicles and Austroad Guidelines, and will include:
 - Widening of roads so that they are adequate to cater for the proposed traffic to and from the mine site.
 - Upgrading of intersections in accordance with the outcomes of a comprehensive intersection assessment (e.g. installation of turning lanes).
 - Provision of appropriate signing, speed limits and removal / cut back vegetation where safe sight distances are restricted.



- Where required, the pavement will be strengthened to deal with the stresses of breaking and turning.
- A Construction Environmental Management Plan will be developed and implemented to control environmental impacts associated with road work activities.

Operational Control Measures

- Centrex will undertake ongoing liaison with DTEI and the local councils to identify and implement traffic control management during road works.
- Centrex will undertake ongoing consultation with DTEI, local councils along the transport route and local community members potentially impacted by increased traffic volumes.
- Develop and implement traffic management plans where necessary.
- All truck loads will be covered to control dust.
- Vegetation clearance associated with road upgrades will be limited to the amount of clearance or pruning required to meet safety requirements. Approvals for clearance of Native Vegetation will be obtained by Centrex as part of the road upgrade approvals process. An appropriate SEB offset will be developed in accordance with the level of clearance proposed.
- Development approval for the proposed rail siding will be applied for under the *Development Act 1993*.
- Further noise and dust modelling studies will be undertaken at critical locations along the transport corridor (e.g. Cummins) to assess potential impacts and determine appropriate mitigation measures and controls.

8.14.5. Risk Levels

Upgrades to local and regional road network

It is considered **likely** that road works undertaken to upgrade pavements, road geometry and intersection safety will result in adverse impacts including potential delays, nuisance noise and dust and some vegetation clearance. However, as these impacts will generally be short term and localised in nature, the consequences have been categorised as **minor**.

Impacts during mine construction

Potential impacts to safety and noise nuisance resulting from increased heavy vehicle traffic during mine construction are considered **likely**, based on the current condition of the road corridor and the proximity of the local residents to the transport route. The impacts have the potential to cause significant changes and inconvenience to the local community, in the absence of appropriate management and mitigation measures (ie a **moderate** consequence).



Similarly, deterioration of pavements would potentially cause significant changes to the local road network (**moderate** consequence). However, due to the short term nature of the construction phase, the likelihood of impact is considered **possible**.

Impacts during operation

Based on an existing two-way traffic volumes and an assessment of the level of service provided by the existing road network, no significant impacts on the current operations of the proposed transport route are expected. In particular, the increased traffic volumes will not be travelling on the main highways and will not add to any delays on these roads. Therefore, the risk of potential delays and congestion is considered **unlikely** and **minor**.

Potential impacts include safety, noise and dust nuisance, and road pavement deterioration resulting from increased heavy vehicle traffic during mine operation. Noise and dust impacts may also result from rail transport operations. These impacts are considered **likely**, based on the current condition of the road corridor, the increase in traffic volume and the proximity of the local residents to the transport route. The impacts have the potential to cause changes to the local environment and inconvenience to the local community over the life of the mine, in the absence of appropriate management and mitigation measures (ie a **moderate** consequence).

8.14.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in Table 8-18.

■ **Table 8-18 Risk assessment outcomes – Roads and Traffic**

Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Potential short term disturbance and delays to local and regional traffic due to speed/access restrictions during roadwork activities.	Likely	Minor	Ongoing liaison with DTEI and local council to determine traffic management requirements during road works.	Possible	Insignificant	Low	Yes
Disturbance to nearby residents due	Likely	Minor	Ongoing consultation with affected land holders during	Possible	Insignificant	Low	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
to dust and noise generated from construction activities.			approvals process. Develop and implement construction environmental management plan for road works.				
Loss of native vegetation due to road widening and clearance to provide adequate site distances.	Likely	Minor	Native Vegetation clearance to be kept a minimum. Approval for clearance to be obtained as part of approvals process and appropriate SEB developed.	Likely	Minor	High	Yes
Safety issues for local and regional road users due to increased heavy vehicle traffic during mine construction.	Likely	Moderate	Road upgrades in accordance with DTEI and Austroads standards. Provision of signage and speed limits as appropriate. Pruning of vegetation where necessary to improve visibility.	Unlikely	Minor	Low	Yes
Noise nuisance to residents due to increased heavy vehicle traffic movements during mine construction.	Likely	Moderate	Ongoing consultation with affected land holders during approvals process to identify and mitigate impacts.	Unlikely	Minor	Low	Yes
Deterioration of road pavements due to increased volumes of heavy vehicles during construction.	Possible	Moderate	Upgrading of unsealed roads and of pavements already showing indications of deterioration. Negotiate maintenance requirements with DTEI/local council.	Possible	Minor	Moderate	Yes
Amenity impacts associated with dust from ore transport.	Likely	Moderate	Unsealed roads to be sealed. Trucks and trains to be covered. Approval process for rail siding. Air quality studies will be undertaken at critical locations along the transport corridor to assess potential impacts and identify	Unlikely	Minor	Low	Yes



Risk Event	Risk Prior to Implementation of Controls		Primary Control Measure	Residual Risk After Implementation of Controls			ALARP
			appropriate controls.				
Amenity impacts associated with noise from ore transport.	Likely	Moderate	Ongoing consultation with affected land holders during approvals process to identify and mitigate impacts. Approval process for rail siding. Noise studies will be undertaken at critical locations along the transport corridor to assess potential impacts and identify appropriate controls.	Possible	Minor	Moderate	Yes
Safety issues resulting due to increased heavy vehicle traffic using the local and regional road network.	Likely	Moderate	Road upgrades in accordance with DTEI and Austroads standards. Provision of signage and speed limits as appropriate. Pruning of vegetation where necessary to improve visibility.	Unlikely	Minor	Low	Yes
Potential delays and congestion due to increased traffic volumes.	Unlikely	Minor	Ongoing liaison with DTEI and local council as required. Develop and implement traffic management plans where necessary.	Unlikely	Minor	Low	Yes
Deterioration of road pavements due to increased volumes of heavy vehicles during operation.	Likely	Moderate	Upgrading of unsealed roads and of pavements already showing indications of deterioration. Negotiate maintenance requirements with DTEI/local council.	Possible	Minor	Moderate	Yes

8.14.7. Risk Acceptance

The residual risk score for deterioration of road pavements, noise impacts due to ore transport and clearance of native vegetation was considered to be medium, medium and high respectively. However, all three are considered to be as low as reasonably practicable and for this reason are accepted for the project.



The higher residual risk ratings are related to the unavoidable nature of the impact event occurring, however, the approvals process will ensure that:

- Responsibility for ongoing maintenance of the road network has been negotiated and agreed with DTEI.
- An appropriate approval and a SEB offset is developed and implemented for any native vegetation clearance required.
- Impacted landholders are consulted and suitable mitigation measures identified and implemented.

The remaining residual impacts are considered low, and are considered as low as reasonably practicable.

In determining the acceptability of these levels, Centrex have considered the proposed management mechanisms, as well as the practicalities and economics of managing the impacts.

8.14.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- No medium or long term congestion impacts on public roads due to mine associated traffic movements.
- Maintain public safety associated with mine related traffic.

8.14.9. Criteria

The following assessment criteria will be adopted:

- No reasonable complaints from the public regarding congestion, delays due to mine traffic or road deterioration.
- No long term damage to public roads.
- No deaths or injuries to the public as a direct result of negligent acts of mine operations.

8.14.10. Monitoring Program

Monitoring will include:

- Any complaints received associated with mine related traffic (including damage to public roads) from neighbouring residents will be recorded, investigated and reasonable complaints addressed.



8.14.11. Leading Indicator Criteria

Changed road and traffic conditions due to mine operations, in particular the increase in heavy vehicle traffic, has been identified as a concern by the local community. The potential consequences of any road accident are very serious. Therefore, it is important to have checks in place to verify whether or not the control measures proposed during mine operations are effective. For this reason, the following leading indicator criterion will be adopted:

- Potential hazards identified and reported by the truck operators.
- The number of reasonable complaints received from the public in relation to near misses or hazards associated with mine traffic.
- Demonstration that all potential hazards and near misses are addressed.

All near misses will be investigated and remedial action implemented as soon as possible.

8.15. Socio-Economic

8.15.1. Context and Stakeholder Views

Environment: The mine site is in a rural area of Central Eyre Peninsula, located 21 km south east of the township of Lock, 55 km west of Cleve and 60 km north of Cummins. Whyalla is the main service centre for residents of the upper and east areas of the Eyre Peninsula. Port Lincoln is also a major service centre in the southern Eyre Peninsula. Whyalla is approximately 170 km north east of the mine site and Port Lincoln is approximately 106 km south-south east of the mine site.

The area surrounding the mine site is sparsely populated. There are two residential homes within 2 km of the mine site. There are eight known residential homes on farming properties within 5 km of the mine site.

The local economy is dependent on agricultural activities to a significant extent. There is little other mining activity in the region. The mine therefore has the potential to diversify the economic base of the region.

Stakeholders: The local community has expressed strong support for the proposed Wilgerup Mine through community workshops and feedback forms. A more detailed analysis of stakeholder views on the diversity of socioeconomic considerations is described in detail in Section 7.

8.15.2. Applicable Legislation or Standard

There are no specific Acts or Regulations applicable to social impacts of the proposed development. However the *Development Act 1993* provides a general framework for development assessment that encompasses socioeconomic considerations.



8.15.3. Potential Impact Events

Building on the baseline information presented in Section 4.1, this section considers the operation and potential associated socio-economic risk events and control measures. Discussion of each risk event is provided below and is summarised in Table 8-19.

Housing and accommodation shortages

The workforce required to construct, operate and rehabilitate the mine has the potential to increase demand for rental housing and tourist/temporary accommodation in the project footprint area creating inflationary pressures and shortages.

Increased competition for local workers

There is a possibility that the workforce requirements for the mine over its different phases could increase competition for local workers attracting them from other sectors of the economy.

Economic inequities of disadvantaged people are further exacerbated

There are existing disadvantaged groups on Eyre Peninsula in the project footprint area. Without management controls, there is the potential for existing social and economic inequities to be widened if there are not opportunities for disadvantaged groups to participate and benefit from the mine.

Change in community values

The influx of temporary and permanent workers for various phases of the mine has the potential to impact upon community values, particularly where the newcomer workforce characteristics vary significantly from the values of the host communities of Lock, Cummins and Cleve and surrounding localities.

Increased demand for community infrastructure and services

Potential population changes may also impact upon the cost and quality of community services in areas such as schools, libraries, health services, utilities the project area of influence. This has an important influence on residents' well-being and satisfaction with the community.

Pressure on local emergency services

In the event of a major safety incident at the mine, there is a risk that local emergency services may be stretched to be able to respond to the scale and type of emergencies that may arise from the mine construction, operation and rehabilitation activities.



Reduced local access and connectivity

The proposed construction activities and operations to haul ore to a shipping facility for export, has the potential to affect local access and mobility to community desired goods, services, activities and destinations which may impact on daily living and movement patterns and social networks. This would most likely affect school aged children and the elderly (e.g., potential impacts to school bus pick up points or routes, road crossing safety).

8.15.4. Control and Management Strategies

Design control measures

Consistent with the risk assessment approach detailed in Section 8.2.2, the hierarchy of controls has been considered in developing appropriate mitigation measures. Specific design control measures include:

- Design measures detailed in earlier Sections 8.6 to mitigate environmental impacts on local amenity.
- Design measures detailed in Section 8.14 to mitigate increased traffic flows.
- Stakeholder engagement strategy which provides a framework for identifying and analysing stakeholders and their interests and employing appropriate methods and techniques for them to participate and benefit from the mine.
- Local and indigenous employment and training policies to govern recruitment and provide opportunities for affected communities, particularly disadvantaged groups, to participate and directly benefit from mine activities.

Operational management measures

Operational management measures include:

- Ongoing engagement with local communities, training providers, community service providers, tourist accommodation providers, low cost housing providers and emergency services to collaboratively monitor project risks and impacts as well as mitigation measures.
- Social investment plan including support for vocational training of the local labour force and local business development to develop local human and social capital to benefit from the mine and other development opportunities.
- Implementation of environmental design and operational control measures on local amenity.

Control and management measures for the potential social impacts identified are summarised in Table 8-19.



8.15.5. Risk Levels

The primary risk levels for each event are discussed as follows:

Housing and accommodation shortages

The shortage of housing and accommodation is considered to be **possible** given that the population change induced by the potential influx of workers and their families to provide a workforce for the mine. The consequence is considered to be **minor** as it may affect local property prices and vacancy rates of low cost rental and tourist accommodation, particularly during the construction phase when the workforce peaks.

Increased competition for local workers

The workforce needs of the mine for both construction and operational phases are considered to be **possible** with a **minor** consequence for other sectors, particularly pastoralists, as workers are attracted to the mining industry from other industries.

Economic inequities of disadvantaged people are further exacerbated

In the absence of any management controls, disadvantaged groups such as the unemployed and indigenous people, there is a **possible** likelihood that existing disparities may be further exacerbated. This event would have a **minor** consequence on affected communities.

Change in community values

The influx of temporary and permanent workers for various phases of the mine has a **possible** likelihood of having a **minor** consequence on existing local community structure, values and social norms particularly if newcomers' characteristics differ significantly.

Increased demand for community infrastructure and services

Population changes which result from the workforce demands of the mine over its various phases has a **possible** likelihood of affecting demand for community infrastructure and services such as education and health services as well as recreational and sporting facilities. The consequence of this event is considered to be **minor** given the proposed scale and duration of the mine.

Pressure on local emergency services

In the event of a major safety incident at the mine, there is a **possible** likelihood of placing increased pressures on local emergency services. Given the nature of possible mine safety incidents or emergencies, there is a **moderate** consequence on existing local emergency service capacity to respond effectively.



Reduced local access and connectivity

Given construction activities and proposed operations to haul ore to a shipping facility for export, heavy traffic on local roads will increase which provides a **possible** likelihood that the mine may affect local access and mobility to community desired goods, services, activities and destinations. The consequence is considered to be **minor** based on the community profiles and scale and duration of the mine.

8.15.6. Likelihood and Severity of Consequence – Risk

The results of this analysis for the above-identified risk events are summarised in summarised in Table 8-19.

■ **Table 8-19 Risk assessment outcomes- Socio-economic**

Risk Event	Primary Risk Assessment		Primary Control Measures	Residual Risk After Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Housing and accommodation shortages	Possible	Minor	Local employment of mine workforce Regular consultation with tourist accommodation providers, low cost housing providers Monitor vacancy rates of tourist accommodation, private, trust & community housing	Unlikely	Minor	Low	Yes
Increase competition for local workers	Possible	Minor	Regular engagement with local training providers Support for local vocational training	Unlikely	Minor	Low	Yes
Economic inequities of disadvantaged people are further exacerbated	Possible	Minor	Indigenous employment policy and support for training Local employment policy	Unlikely	Minor	Low	Yes
Change in community values	Possible	Minor	Ongoing engagement with local communities Social investment plan Implementation of environmental design and operational control measures on local amenity Local employment policy	Unlikely	Minor	Low	Yes
Increased demand for community infrastructure and services	Possible	Minor	Ongoing engagement with community service providers Alignment of social investment program with local/ regional development plans	Unlikely	Minor	Low	Yes



Risk Event	Primary Risk Assessment		Primary Control Measures	Residual Risk After Controls			ALARP
	Likelihood	Consequence		Likelihood	Consequence	Residual Risk	
Pressure on local emergency services in the event of a major safety incident at the mine	Unlikely	Moderate	Regular engagement with local emergency services Assess and support emergency response capability Mine rescue and emergency response team established on site.	Unlikely	Minor	Low	Yes
Reduced local access and connectivity	Possible	Minor	Review upgrades to local and regional road network Stakeholder engagement on public safety	Unlikely	Minor	Low	Yes

8.15.7. Risk Acceptance

As outlined above, the residual risk levels of the majority of identified potential socio-economic impacts of the mine development (in light of the mitigation measures) are considered **low**. Specific design and control and operational management measures are required to address the potential identified socioeconomic risks across all phases of the mining cycle. With the proposed measures in place, the residual risks are considered as low as reasonably practicable and for this reason are acceptable to the project.

The acceptance of identified residual risks informs the approach to ongoing management of the operations. It is underpinned by Centrex's commitment to meaningful stakeholder engagement to manage community expectations and collectively identify and address issues and concerns to maintain the project's social license to operate.

8.15.8. Outcomes

The mine operator will commit to, in constructing and operating the mine, the following outcomes:

- Local economic and employment inequities are not increased.
- Standard of community infrastructure and services maintained.
- Increased wage levels and employment opportunities.



8.15.9. Criteria

The following assessment criteria will be adopted:

- Direct and indirect employment and income by social equity category (based on baseline).
- No reasonable complaints from the public regarding community and infrastructure and service levels.
- Number of direct and indirect locally employed staff from Wilgerup mine activities.
- Average weekly income (compared to baseline).

8.15.10. Monitoring Program

Monitoring will include:

- Any complaints received concerning mining operations from neighbouring residents will be recorded, investigated and reasonable complaints addressed.

8.16. Ongoing consultation

Centrex is committed to ongoing consultation to enhance project outcomes through addressing community concerns and incorporating local knowledge. Centrex's consultation program involves statutory consultation under the Development and Mining Acts as well as a range of other events.

Under the *Mining Act 1971* public notification of the development application will be undertaken by PIRSA. Additional consultation activities planned include, but are not limited to:

- Continuation of the CCC
- Community displays
- Ongoing liaison with local councils in relation to the proposed transport corridor
- Continued one-on-one liaison with key stakeholder groups on the Eyre Peninsula
- Continued dissemination of information relating to project developments through facts sheets and media outlets.



9. Mine Closure and Completion Plan

9.1. Introduction

The Wilgerup Mine Closure and Completion Plan (WMCCP) will be revised not less than annually to take into consideration:

- Changing technologies
- Potential climate (global warming) impacts
- Changing local community expectations.
- Changing global commodity prices
- Changes to Mine ore reserves

Consequently some of the detail given in this section may change over the course of the mines life (in consultation and with approval from PIRSA).

9.2. Plan Objectives

The broad objectives of the Mine Closure and Completion Plan are to:

- Protect the environment and public health and safety.
- Reduce or eliminate adverse post-mining environmental impacts.
- Establish conditions that enable the pre-determined end land use objectives to be met.

Within these objectives, the purpose of the Mine Closure and Completion Plan is to ensure that at the end of the mine's life:

- 1) As much of the Mine Site as is practicable is returned to productive agricultural use.
- 2) Infrastructure useful for agricultural purposes is retained.
- 3) Infrastructure of no agricultural use is dismantled and removed.
- 4) Areas not amenable to agricultural use are made safe and vegetated, with the vegetation density equalling or exceeding that of the surrounding (pre-mining) vegetation areas.
- 5) The pit void is secured against inadvertent public access.

9.3. Context

The current land use of the proposed ML area is dryland farming, including mixed cereal crops and sheep. Dryland farming is also the main land use in the surrounding area to the north and west of the site. The ML area is located in the District Council of Elliston, within the Primary Industry zone.



Following rehabilitation of the mine site it is intended that as much of the project area as practicable will be returned to productive agricultural use.

An ecological assessment undertaken at the proposed ML area (see Section 4.11) identified that the ML area has been largely cleared of remnant vegetation for grazing. Isolated small to tiny patches of remnant mallee vegetation are scattered across the landscape within the proposed ML area. Though some portions of these areas will require clearance as a result of mining operations, the assessment of the project area showed that these mallee patches are highly degraded with low species diversity and significant weed incursion.

As a result of the poor quality of existing vegetation, there is an opportunity to improve the ecological quality of the site. Any works that reduce the patchiness and permit regeneration of natural structure will be of benefit to the habitat in general. Native vegetation planted as part of the rehabilitation process (e.g. waste rock dump and pit) can benefit ecologically and contribute to improved amenity.

9.4. Stakeholder Involvement and Issues

A number of stakeholders may have an interest in the site after mine closure, and this interest may change over time. As a minimum, these stakeholders would include:

- Centrex Mining Limited (including employees)
- Community (local business and service providers, landholders, neighbours, nearby residents)
- Local government
- Regulators (PIRSA)
- Other government agencies (DWLBC, EPA).

As discussed in Section 7, stakeholder consultation to date has been undertaken on a 'whole of project level', and will continue throughout the project and post closure. Issues specifically relating to mine closure and rehabilitation that have been raised to date are as follows:

- Environmental outcomes post closure and assurances that rehabilitation will occur.
- Water quality within the rehabilitated mine pit.
- Implications to the mine site and water post mining.

9.5. Scope and Description of Closure Domains

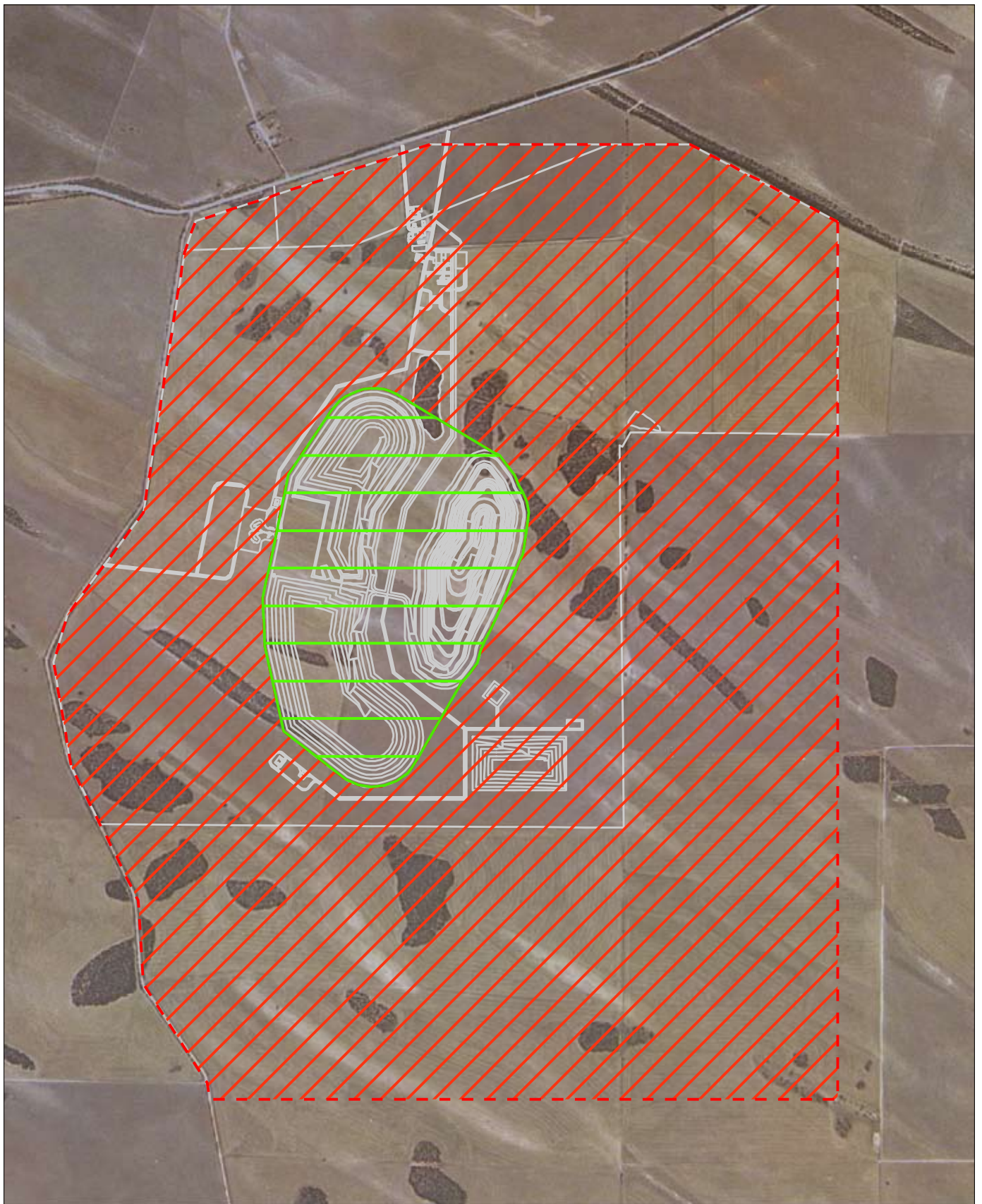
The approach taken with the WMCCP has been to divide the mine site into two "closure domains". Each domain is essentially a grouping of areas to reflect the differing post mine land use and



closure objectives for the site. Closure domain detail is given in Table 9-1. Domain areas are graphically illustrated in Figure 9-1.

■ **Table 9-1 Description of closure domains for Wilgerup Iron Ore Mine**

Domain	Description of Areas
1. End land use: Productive Agriculture	Roads and vehicle areas Car Parks. Product Stockpile Area Core Yard. Product Loading Area Haul Roads. Storage and Lay Down Areas Light Vehicle Access Roads Buildings to be Removed. Ambulance Room Drilling Office Ambulance Shed Drill Maintenance Workshop Assay Laboratory Explosive Magazines Assay Laboratory Office Geology Storage Shed Crib Room Maintenance Toilet Block Crusher Admin Office Maintenance Admin Office Crusher Toilet Block Weighbridge Crusher Water Header Tank Fixed Plant Crusher Wash Down Pads Power Generation Sets Fuel Farm RO Plant Dams RO / Wash Down Pad Dam Water Disposal Dam Turkeys Nest Contaminated Soil Stockpile Hydrocarbon Contaminated Soil Stockpile Buildings to be Retained. Site Admin Office Light Vehicle Workshop Truck Maintenance Workshop
2. End land use: New habitat area	Waste Rock Dump Waste Rock Dump Pit Abandonment Area Pit Void Abandonment Bund



Legend

-  Domain 1 - Production
-  Domain 2 - New habitat area

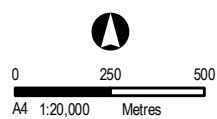


Figure 9-1 Wilgerup Closure Domains



9.6. Potential Impacts of Mine Closure

Following completion of the site rehabilitation works there will still be some residual environmental impact from the operation. The key residual impacts associated with the mine will be:

- The permanent loss of approximately 93.2 ha to agricultural use (the area underneath the waste rock dump and around the pit void).
- The visual impact of a low (maximum 50 m high) hill on the otherwise undulating topography (the rehabilitated waste rock dump).
- The flooded pit void. This will be screened from surface viewing initially by the abandonment bund and later by vegetation as this becomes established.
- Altered socio-economic conditions due to mine closure resulting from mine closure resulting in reduced employment opportunities.

The potential impacts for each domain are summarised in Table 9-2.

■ **Table 9-2 Potential residual impacts of the Wilgerup Iron Ore Mine**

Domain No.	Potential Residual Impacts (after mine closure)
1. End land use: Productive Agriculture	Roads and vehicle areas.
	Potential rehabilitation failure (i.e. required crop re-establishment not achieved) due to: ■ Reduced soil quality and vegetation growth due to use of saline groundwater for dust suppression. ■ Loss of critical soil resources (i.e. topsoil).
	Buildings to be Removed.
	■ Potential injury to public from unmaintained buildings and infrastructure. Potential rehabilitation failure (i.e. required crop re-establishment not achieved) due to: ■ Reduced soil quality and vegetation growth from compaction of soil and potential application of saline water on hardstand areas. ■ Loss of critical soil resources (i.e. topsoil).
	Fixed Plant
	■ Potential injury to public from unmaintained buildings and infrastructure. ■ Potential soil contamination resulting from spills or leaks throughout mine operations. Potential rehabilitation failure (i.e. required crop re-establishment not achieved) due to: ■ Reduced soil quality and vegetation growth from compaction of soil and potential application of saline water on hardstand areas. ■ Loss of critical soil resources (i.e. topsoil).
	Dams
	■ Potential injury to public from unmaintained buildings and infrastructure. Potential rehabilitation failure (i.e. required crop re-establishment not achieved) due to: ■ Reduced soil quality and vegetation growth from compaction of soil and potential increases in soil salinity due to leaks or seepage through liner. ■ Loss of critical soil resources (i.e. topsoil).
	Contaminated Soil Stockpile
	■ Potential soil contamination associated with the contaminated soil stockpile. ■ Potential for exposure of humans and fauna to contaminated material and consequential health impacts.



Domain No.	Potential Residual Impacts (after mine closure)
	Buildings to be Retained. - Potential injury to public from unmaintained buildings and infrastructure. - Site Admin Office (existing Kamballa homestead), Truck Maintenance Workshop and Light Vehicle Workshop will remain on site. These structures will result in minimal visual impact long term, and will benefit future users of the site by providing facilities useful for servicing and housing farm machinery.
2. End land use: New habitat area.	Waste Rock Dump - Potential injury to public traversing the waste rock dump, slipping or falling due to steep wall angles. - Potential injury to the public as a result of subsidence/failure of the waste rock dump. - The permanent loss of approximately 93.2 ha to agricultural use (the area underneath the waste rock dump and around the pit void). - Potential for runoff and water quality issues from the waste rock dump (mitigated through progressive rehabilitation of the waste rock dump). - Rehabilitation failure due to unacceptable erosion rates from the waste rock dump. Pit Abandonment Area - Potential injury to the public accessing the mine pit (by vehicle or foot). - Potential injury to the public as a result of subsidence/failure of the pit walls. - The permanent loss of approximately 93.2 ha to agricultural use (the area underneath the waste rock dump and around the pit void). - The flooded pit void. This will be screened from surface viewing initially by the abandonment bund and screening vegetation.

A risk assessment of these potential impacts has been undertaken, and is included as the *primary risk assessment* component in Table 9-5.

9.7. Outcomes and Completion Criteria

Outcomes and completion criteria for each domain are stated in Table 9-3.

■ **Table 9-3 Rehabilitation outcomes and measurement criteria**

Domain	Rehabilitation Outcomes	Success Measurement Criteria
1. End land use: Productive Agriculture	All land within this domain will be returned to productive agricultural use. Retained buildings will be fit for agricultural use. Site is safe to the public post closure. No disturbance to public amenity. Hydrocarbon contamination of soil removed.	Minimum crop density to be approximately the same as for the immediately surrounding areas that have not been disturbed by mining activities. Buildings are in a clean and safe condition. No reasonable complaints from surrounding residents due to landscape and visual amenity impacts associated with mine closure. Hydrocarbon breakdown complete (assessed by a 3rd party). Underlying soils show no signs of hydrocarbons. Concentrations of contaminants in soil to be in compliance with investigation levels detailed in the National Environmental Protection Measure (NEPM) 1999.



Domain	Rehabilitation Outcomes	Success Measurement Criteria
2. End land use: New habitat area.	Site is safe to the public post closure. No disturbance to public amenity. Increased stability (against sedimentation and erosion) of the waste rock dump through vegetation. Stable vegetation established between inner and outer safety bunds.	Bunds created to prevent vehicular access and impede pedestrian access to the pit void. Bunds constructed to design criteria. Plant species growing well and at required density (plants per square metre). Hydrocarbon breakdown complete (assessed by a 3rd party). Underlying soils show no signs of hydrocarbons. Concentrations of contaminants in soil to be in compliance with investigation levels detailed in the National Environmental Protection Measure (NEPM) 1999.

9.8. Sustainable Closure Strategies (Control Measures)

9.8.1. Rehabilitation Approach

The general approach to rehabilitating the mine site will be to:

- Minimise the operations footprint and keep the disturbed areas to the absolute minimum required to conduct the operation in a safe and efficient manner.
- For those areas which are to be disturbed, the topsoil and subsoil layers will be separately removed and stockpiled for placement back onto the disturbed areas at the end of mine life. These stockpiles will be around 5m high and sloped inwards to encourage moisture infiltration from rainfall. The stockpiled material designated to be spread back onto areas to be used for agriculture will be seeded with appropriate grass species while the material designated to be spread over the waste rock dump will be seeded with a combination of grass and shrub species. This will help prevent erosion of the stockpiles until they are used and also help with the rehabilitation of the designated areas by providing a supply of seeds and vegetable material already embedded in the soil. Note that further seeding of the replaced topsoil will still occur after final placement.
- Progressively rehabilitating disturbed areas during the mine life when they are no longer required. This is particularly relevant to the waste rock dump, which will have each lift rehabilitated when dumping is finished on the immediately overlying lift.
- Monitoring the site for as long as required following mine closure and completion of the rehabilitation works to demonstrate that the closure and rehabilitation objectives have been met. Further rehabilitation works may be required during this time if it is found that the initial rehabilitation works have not met the stated objectives.



9.8.2. Detailed Rehabilitation and Closure Plan of Mine Areas

The sections below describe the proposed closure works to minimise ongoing environmental impacts of the mine after closure.

Figure 9-2 provides an overview of the overall visual spatial impact of the final mine layout. Figure 9-3 provides an overview of footprint impacts following mine closure.

9.8.2.1. Domain 1 – Productive Agricultural Use

Crushing Plant

The crushing plant will be dismantled and removed from site. With the exception of the primary crusher footing, all concrete footings, pads and retaining walls will be removed and placed in the bottom of the pit. Due to its size and the difficulty in ensuring its safe removal, the primary crusher footing will be buried underneath the waste rock dump when it is rehabilitated (the footing is immediately adjacent to the as-built dump so covering it will not be an issue).

All hardstand material will be removed and placed in the bottom of the pit. Topsoil and subsoil will then be replaced and over the former hardstand areas and contoured appropriately.

Top and subsoil will then be replaced and smoothly contoured to match the sides of the area from which the hardstand material has been removed.

Any soil contaminated with hydrocarbons will be placed in a stockpile for bio remediation.

Product Stockpile and Ore Loading Area

All hardstand material will be removed and placed in the bottom of the pit. Top and subsoil will then be replaced and smoothly contoured to match the sides of the area from which the hardstand material has been removed. Any soil contaminated with hydrocarbons will be placed in a stockpile for bio remediation.

Dust Suppression and Water Disposal Dams

All dewatering pumping infrastructure will be dismantled and removed from site. Rubber liners from the dams will be removed and either reused elsewhere (off-site) or sent to an approved rubbish tip. Earthworks for the dams will be removed and any salt contaminated soil will be removed and placed in the bottom of the pit. Following removal, top and subsoil will be replaced in the (former) dam areas and contoured.

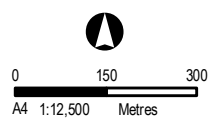


Figure 9-2 Overview of final mine layout and footprint impacts



Legend

-  Rehabilitation layout
-  Bund armoured with rocks
-  30m vegetation buffer

Data Sources
Aerial photography supplied by DEH

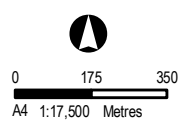


Figure 9-3 Overview of mine closure layout



Explosive Magazines

The explosive magazines and associated infrastructure (fences etc.) will be dismantled and removed from site. All hardstand material will be removed and placed in the bottom of the pit. Top and subsoil will then be replaced and smoothly contoured to match the sides of the area from which the hardstand material has been removed.

Office and Workshop Areas

The office shall be removed from site. Workshop areas, including the associated hardstand areas will be retained for future agricultural use. Identified post mining risks are:

- Potential threat to public safety from structural deficiencies.
- Damage to the environment from hydrocarbon contaminated hardstand material.

Any hardstand material contaminated with hydrocarbons will be removed and placed in a stockpile for bio remediation. New hardstand material will then be used to replace that which was removed. All buildings will be thoroughly cleaned and repaired as necessary to make the structures safe.

Fuel Storage

The fuel tanks and all other infrastructure associated with the facility will be removed.

An identified post mining risk is the potential damage to the environment from hydrocarbon contaminated material. Any material, including that within the spillage retention bund, that is contaminated with hydrocarbons will be removed and placed in a stockpile for bio remediation. The area will be thoroughly cleaned and all remaining infrastructure and equipment will be repaired if necessary.

Sewerage Facilities

The site toilet and sewerage facilities (which service the mine office and workshop) will be removed and rehabilitated.

Haul Roads

All hardstand material used in road construction will be removed and placed in the bottom of the pit. Top and subsoil will then be replaced and smoothly contoured to match the sides of the area from which the hardstand material has been removed. Any soil contaminated with hydrocarbons will be placed in a stockpile for bio remediation.

Site Fencing

As a final step in the mine site rehabilitation, all site fencing will be removed. The poles and associated fencing material will either be reused elsewhere or sent to a scrap yard for recycling.



Hydrocarbon Contaminated Soil Stockpile

Throughout the mine life and during the rehabilitation work, any soil contaminated with hydrocarbons will be deposited at this location and seeded with bacteria, which breaks down the hydrocarbon material into their natural compound state. The completion status of remediation of the stockpile, or sections of it, will be verified by an external third party. When remediation is complete, the stockpile (or relevant section) will be removed and placed in the bottom of the pit void.

Following the final removal of the stockpile, the area will be returned to agricultural use.

9.8.2.2. Domain 2 – New Habitat Area

Pit Void

The pit void will remain as a permanent feature of the landscape. It is expected that the pit will flood to the same level as the base of the overlying sands, some 25 to 30m below the surface. Given that the groundwater is highly saline (equivalent to sea water) no use for the water that floods the pit is envisaged.

The main post-mining risk for the void is from public access and people inadvertently driving into the pit. To mitigate this, an abandonment bund to make the pit inaccessible by vehicles will be constructed around the pit perimeter, far enough away from the edge of the pit so that it will be unaffected by any potential pit wall failure. The bund will be 3m high by 3m wide at the top, with the pit side bund wall sloped at 20° and the far side wall sloped at 36°. The far side of the bund will be armoured with large rocks to maintain the integrity and prevent access by four wheel drive vehicles. The top and pit side wall of the bund will be covered with topsoil and vegetated, as will be the area between the bund and the crest of the pit. A smaller bund to impede pedestrian access will be placed around the pit crest.

The exit point of the pit ramp will also be bunded off to prevent vehicle access.

Waste Rock Dump

The waste rock dump will remain as a permanent feature of the landscape. The risks associated with the dump are:

- Excessive erosion by the elements resulting in wind or water borne material adversely impacting on the surrounding land; and
- Adverse impact on visual amenity.

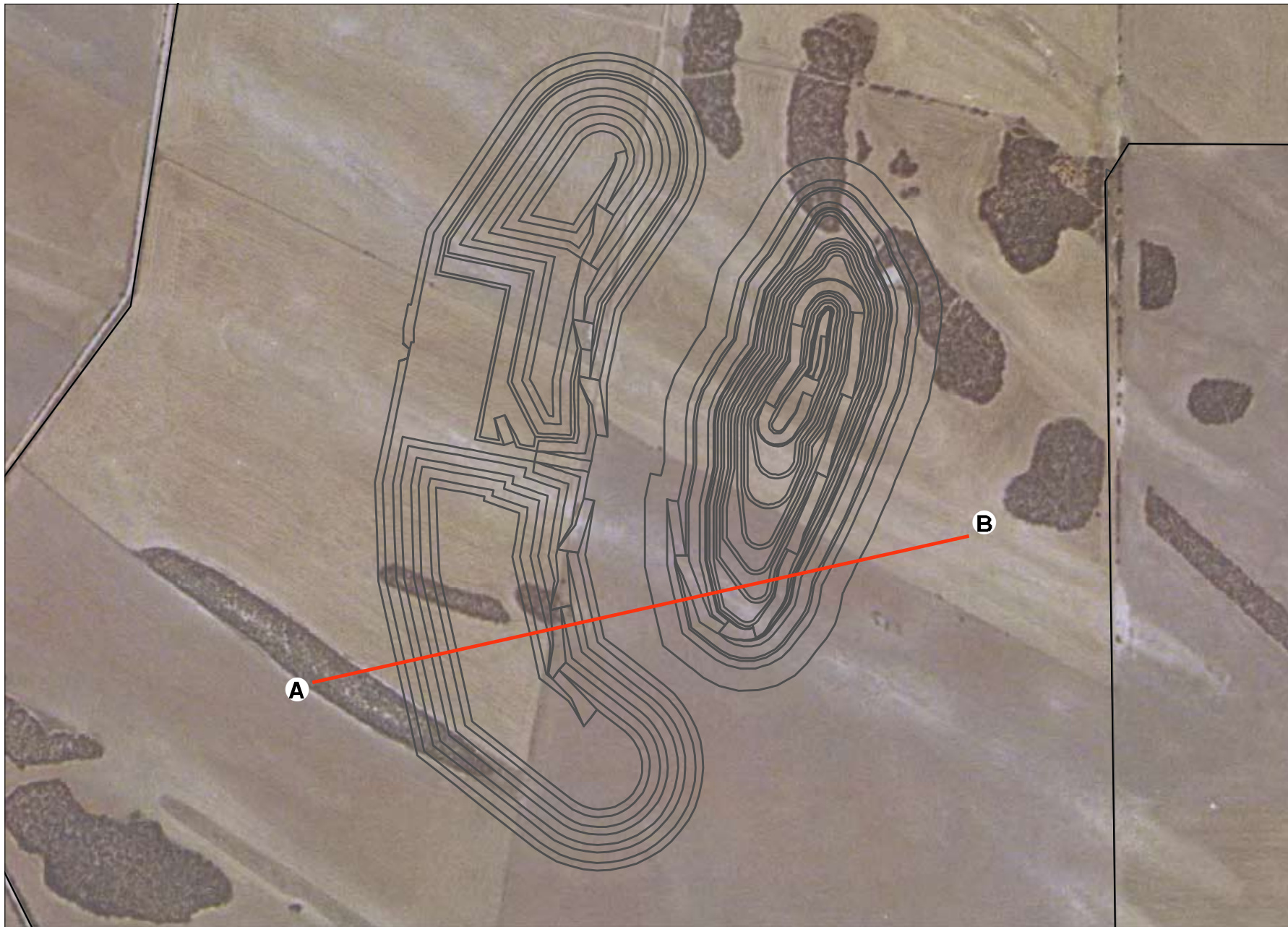
To reduce the potential for erosion the waste rock dump will be constructed in 10m high lifts with 18.71m wide berms. When rehabilitated, the sides of the dumps will be dozed to an angle of 20°.



This will leave 5 m wide berms between each lift and these will be sloped into the dump (Figures 5-12 and 9-5 illustrate these profiles). The dump will then be covered with a layer of subsoil and topsoil and furrows ripped along the sides of the dump at 2.5 m vertical intervals. The dump will then be seeded with appropriate species.

To reduce the impact on visual amenity the height of the dump will be restricted to 50m and the ends rounded to give the rehabilitated dump a more natural look (rather than square).

Note that geochemical testing has indicated that there should be no issues with either acid mine drainage or leaching of deleterious substances (e.g. heavy metals) from any material in the pit. Therefore, apart from the placement of top and sub-soil on the surface of the dump, no special placement or encapsulation regimes for the waste material is envisaged to be required. Monitoring (visual inspection and testing if necessary) of the mine waste will take place during the life of the mine to ensure that this remains the case.



Legend

- Cross section
- Fence

Data Sources
Aerial imagery supplied by DEH 2004

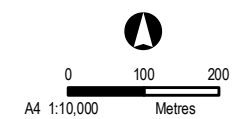


Figure 9-4 Cross section of mine closure

GDA 1994 MGA Zone 53

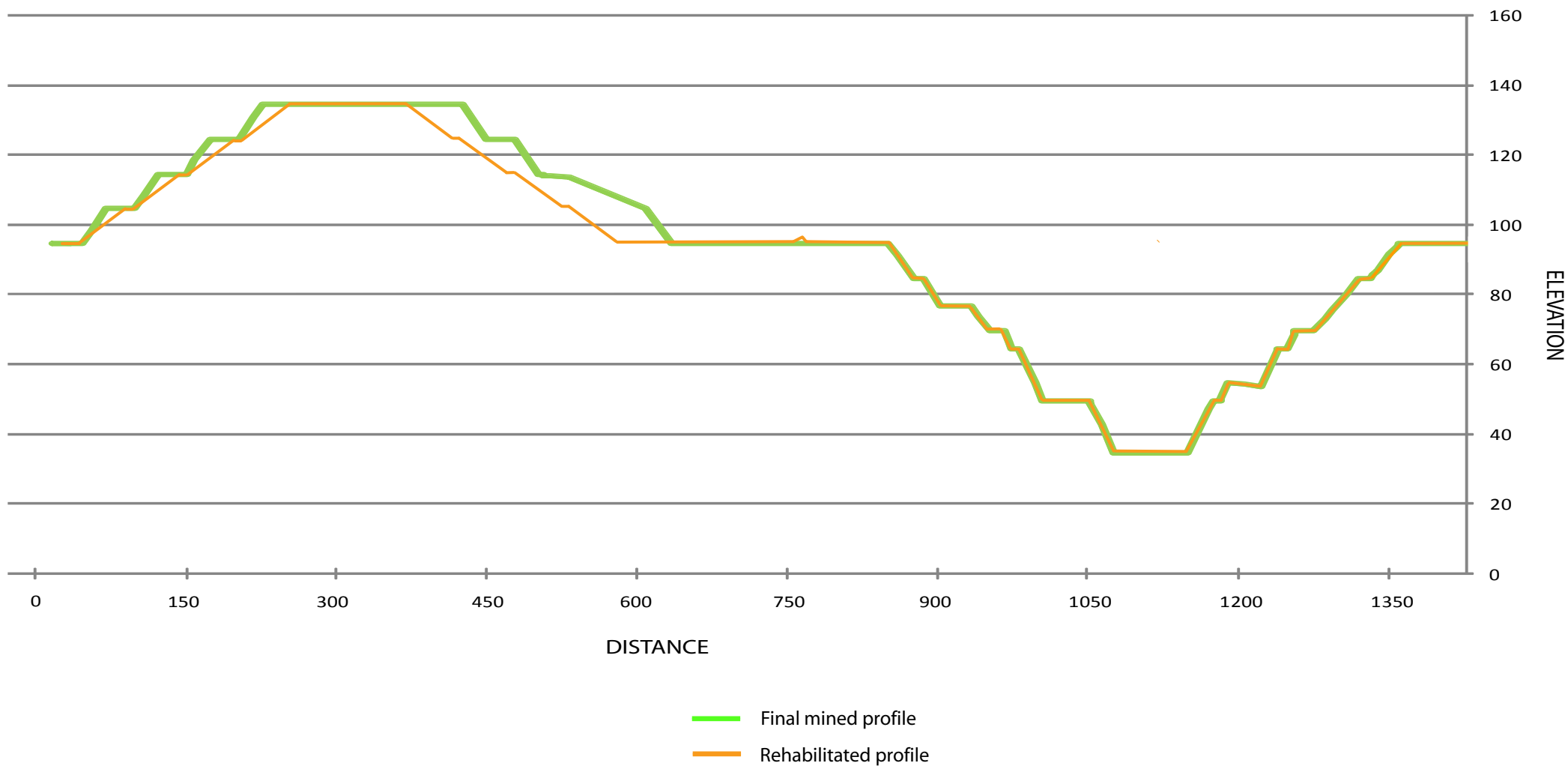


Figure 9-5 Cross section A-B (final mined profile and rehabilitated profile)



9.8.3. Summary of Closure Strategies

■ Table 9-4 Summary of rehabilitation works

Domain	Sub-Area	Rehabilitation Works
1	Roads and vehicle areas.	Remove any fencing ¹ . Remove road base material ² . Replace topsoil. Contour topsoil to match adjacent undisturbed areas.
	Buildings to be Removed.	Disconnect services ³ . Remove any fencing ¹ . Remove buildings from Site. Remove service reticulation lines. Remove hardstand material ² . Replace topsoil. Contour topsoil to match adjacent undisturbed areas.
	Fixed Plant	Disconnect services ³ . Remove plant. Remove service reticulation lines. Remove concrete foundations (except primary crusher foundation) ² . Remove any bunds or earthworks. Remove any hydrocarbon contaminated soils to stockpile. Remove hardstand material ² . Replace topsoil. Contour topsoil to match adjacent undisturbed areas.
	Dams	Pump any remaining water from dams to the pit void. Remove all piping and associated equipment. Remove dam liners. Remove dam walls ² . Remove any salt contaminated sub-soil ² .
	Contaminated Soil Stockpile	Seed stockpile with necessary bacteria as necessary. Place stockpile in bottom of pit void at end of mine life once hydrocarbon breakdown is complete.
	Buildings to be Retained.	Clean, repair and renovate. Relocate LVWS access. Remove and replace and contaminated hardstand material.
2	Waste Rock Dump	Construct as-built dump correctly ⁴ . Doze wall angles to 20°. Slope remaining berms inwards (and angle not less than 2°) Place topsoil to nominal depth of 0.5m over the dump. Use grader rip entire dump to create furrows. Use dozer to rip deep furrows every 2.5m (vertical) on



Domain	Sub-Area	Rehabilitation Works
		sloped surfaces. Deposit seeds, fertilizer and mulch material.
	Pit Abandonment Area	Create small safety bund 5m back from the pit crest (inner bund). Create large safety bund outside of largest potential failure zone (outer bund). Use grader to rip area between the two bunds. Deposit seeds, fertilizer and mulch material in ripped area.

Notes:

1. Any concrete footings will be dug up (except primary crusher footings which will be buried in the waste rock dump) and placed in the bottom of the final (mined out) pit.
2. Material will be placed in the bottom of the final (mined out) pit.
3. Power and water reticulation.
4. This is required so that the final planned rehabilitated profile can be readily achieved.

9.9. Post Rehabilitation Management

Following the completion of the rehabilitation works the site will continue to be monitored until lease relinquishment to ensure that the end use objectives outlined above are achieved.

Maintenance work will take place in any area where deficiencies in the rehabilitated landscape develop.

With the exception of the waste rock dump, following completion of the rehabilitation works the residual risk to public safety and the environment from the former mine site is considered to be minimal.

Potential issues with the waste rock dump are the failure of vegetation to grow on the dump at the required density and erosion of the dump surface by rain events. Should vegetation fail to grow at the required density then a number of remedial actions will be considered such as:

- Use of alternative (non-local) plants which may be more suited to the prevailing conditions.
- Direct planting of seedlings or more mature plants directly onto the waste rock dump rather than just using seeds.
- Installation of an irrigation system to assist with initial vegetation establishment.

Run off from the rehabilitated waste rock dump is not expected to result in significant run off and water quality issues. The dump itself will consist largely of broken rock and will be capped with sandy soils, hence rainfall is expected to infiltrate the dump rather than run off. Furthermore, all flat areas on the rehabilitated dump will be sloped inwards to limit run off from the dump (refer Section 5.7.1). Should run off prove to cause water quality concerns then rock lined chute drains will be installed at periodic intervals on the dump batters. These drains would be directed to sediment basins.



9.10. Residual Risk Assessment

Identification and assessment of any post-rehabilitation residual risks that may remain for each domain is given in Table 9-5.

The risk assessment has been undertaken in accordance with the methodology described in Section 8.2. Residual risks with a low ranking are considered by Centrex to be acceptable for the project.



■ **Table 9-5 Residual Risk Assessment**

	Primary Risk Level			Summary of Control Strategies	Residual Risk Level			Justification for Risk Acceptance	Contingency Plan
Aspect and Impact	L	C	PRL		L	C	RRL		
Domain 1 – Productive Agricultural Use									
Rehabilitation failure due to reduced soil quality and vegetation growth from use of saline groundwater.	P	Mod	H	Development and implementation of a soil monitoring program that will include testing of the salinity within the soil profile during mining and after rehabilitation to check for upward migration of salts and salt build up within the soil profile. Monitoring of rehabilitation success.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Examine soil quality to determine the reasons why the vegetation density is not being achieved. Address soil deficiencies with fertiliser or additional additives or treatments as required.
Rehabilitation failure due to loss of critical soil resources.	L	Mod	H	Design soil stockpile storage and location to minimise compaction, erosion and losses.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Imported soil resources required to be brought to site to make up shortfall.
Soil contamination resulting from spills or leaks over the life of the operation - failure to effectively remediate.	L	M	M	See Section 8.5.4 for control strategies to prevent contamination during operations. Contaminated material will be treated as soon as it presents. It is expected that minor amounts will be encountered during the life of the mine which will allow ample time to assess the efficacy of the treatment options so that by the end of the mines life what works (and what does not work) will be known.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Investigate soil chemistry to determine why bacteria are not breaking down the contaminated material. Address deficiencies and/or use additional additives or treatments as required.
Potential exposure of humans and fauna to contaminated material and consequential health	P	Mod	H	See Section 8.5.4 for control strategies to prevent contamination during operations. Rehabilitation will be undertaken in	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is	None.



Aspect and Impact	Primary Risk Level			Summary of Control Strategies	Residual Risk Level			Justification for Risk Acceptance	Contingency Plan
	L	C	PRL		L	C	RRL		
impacts.				accordance with the EPA Guidelines for Environmental Management for On Site Remediation (2006).				considered low.	
Injury to the public from unmaintained buildings and infrastructure.	U	Mod	M	Buildings and infrastructure will be dismantled and removed from site.	R	I	L	As the natural landform contour will be re-established, there will be no post-rehabilitation safety risks to the public.	None.
Decreased amenity and compatibility with post mining land use due to failure to completely rehabilitate the site.	P	Mod	H	Development and implementation of a soil monitoring program that will include testing of the salinity within the soil profile during mining and after rehabilitation to check for upward migration of salts and salt build up within the soil profile. Monitoring of rehabilitation success.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Examine soil quality to determine the reasons why the vegetation density is not being achieved. Address soil deficiencies with fertiliser or additional additives or treatments as required.
Potential injury to public from unmaintained buildings and infrastructure.	U	Mod	M	Infrastructure to be retained will be inspected and upgraded as required to meet Building Code requirements.	R	I	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	None.
Domain 2 – New Habitat Area									
Potential injury to the public traversing the waste rock dump (slip or fall) due to steep wall angles.	P	Mod	H	Final dump batter angle will be 20°. This angle is readily traversable by foot and furrows and berms will prevent people from slipping excessive distances down the side of the rehabilitated dump.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Inspection of slope stability and photo monitoring at completion of rehabilitation
Potential injury to the public as a result of subsidence/failure of	P	Maj	E	All final landform slopes to be designed to be consistent with existing slope angles, and in accordance with stability	R	Mod	M	Realisation of this risk is considered to be extremely unlikely. Also, it is	Inspection of slope stability and photo monitoring at completion of rehabilitation



	Primary Risk Level			Summary of Control Strategies	Residual Risk Level			Justification for Risk Acceptance	Contingency Plan
Aspect and Impact	L	C	PRL		L	C	RRL		
the waste rock dump or pit walls.				parameters as determined by detailed geotechnical testing.				considered that the potential consequences have been reduced as far as reasonably practicable. For this reason, a residual risk of moderate is considered by Centrex to be acceptable to the project.	
Potential injury to members of the public accessing the mine pit	U	C	E	An abandonment bund to make the pit inaccessible by vehicles will be constructed. A smaller bund to impede pedestrian access will be placed around the pit crest.	R	Mod	M	Vehicle access to the pit void will not be possible. Pedestrian access will be inhibited. Also, because of the shallow angle of the pit wall to the level of flooding anyone falling into the pit should be able to get out. Realisation of this risk is considered to be extremely unlikely. Also, it is considered that the potential consequences have been reduced as far as reasonably practicable. For this reason, a residual risk of moderate is considered by Centrex to be acceptable to the project.	Inspection to ensure abandonment bunds constructed as designed.
Economic impacts resulting from the permanent loss of 93.2 ha to agricultural	P	I	L	Area of permanent disturbed footprint to be minimised.	P	I	L	Based on current knowledge and proposed management strategies, the residual risk is	None.



Aspect and Impact	Primary Risk Level			Summary of Control Strategies	Residual Risk Level			Justification for Risk Acceptance	Contingency Plan
	L	C	PRL		L	C	RRL		
use.								considered low.	
Potential for runoff and water quality issues from the waste rock dump.	P	Mod	M	Appropriate contouring and re-vegetation of waste rock dump. Progressive rehabilitation of waste rock dump. See Section 8.10.4 for control strategies to be adopted during mine operation.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Should run off prove to cause water quality concerns then rock lined chute drains will be installed at periodic intervals on the dump batters. These drains would be directed to sediment basins.
Accumulation of groundwater in rehabilitated pit with changed chemical characteristics - Degradation of Musgrave PWA groundwater resources	R	M	L	Identification and monitoring of existing water bores located between Wilgerup and the Musgrave PWA to provide confirmation that the significant groundwater drawdown linked to the mining operations is localised around Wilgerup. Implementation of Groundwater Monitoring Plan.	R	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	None.
Rehabilitation failure due to unacceptable erosion rates.	P	M	H	Appropriate contouring and re-vegetation of waste rock dump. Progressive rehabilitation of waste rock dump. See Section 8.10.4 for control strategies to be adopted during mine operation.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Should run off prove to cause water quality concerns then rock lined chute drains will be installed at periodic intervals on the dump batters. These drains would be directed to sediment basins.
Rehabilitation failure due to failure of vegetation to re-establish properly.	P	M	H	Vegetation trials will commence early in the mines life. Consequently by the end of the end of the mines life which plant species work, which do not and what is required in order to get vegetation to grow properly should be	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	Examine soil quality to determine the reasons why the vegetation density is not being achieved. Address soil deficiencies with fertiliser or additional additives or



Aspect and Impact	Primary Risk Level			Summary of Control Strategies	Residual Risk Level			Justification for Risk Acceptance	Contingency Plan
	L	C	PRL		L	C	RRL		
				well known. The realisation of the identified risk will not be acceptable and the indicated contingency plans would be implemented until such time as vegetation is satisfactorily established.					treatments as required.
Visual amenity impacts associated with the waste rock dump and flooded pit void.	P	M	Mod	To reduce the impact on visual amenity the height of the dump will be restricted to 50m and the ends rounded to give the rehabilitated dump a more natural look (rather than square). Re-vegetation of waste rock dump and abandonment bunds. The site will be screened as described in Section 5.8.4.	U	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	None.
General									
Unnecessary waste generation and energy use due to failure to reuse/recycle equipment and infrastructure.	UL	M	L	Infrastructure retained where practicable for agriculture use. Re-use of equipment/infrastructure off site will be considered as part of the disposal process.	UL	M	L	Based on current knowledge and proposed management strategies, the residual risk is considered low.	None.

Key:

Likelihood

AC – Almost certain
L – Likely
P – Possible
U – Unlikely
R - Rare

Consequence

I – Insignificant
M – Minor
Mod – Moderate
Maj – Major
C - Catastrophic

Risk Level

L – Low
M - Moderate
H – High
E - Extreme



10. Management Systems and Capability

10.1. Previous Experience of Operator

Centrex was incorporated on 23 March 2001 to explore for iron ore on Eyre Peninsula. In June 2001, Centrex acquired the Greenpatch, Bungalow and Cockabindie tenements. Centrex has extensive tenement holdings over iron ore resources and exploration targets on Eyre Peninsula in the southern Gawler Craton adjacent to existing rail/port facilities. Centrex's major business activities to date have been exploration and resource definition.

Centrex has publicly available corporate policies for Occupational Safety and Health, Environment and Social Responsibility (endorsed by the Board on 27 September 2006). These company policies outline the company's commitment to:

- The health and safety of its employees and the communities in which they operate
- Sustainable production of iron ore in a manner that protects the values of the natural and social environment in which it operates.
- Developing Environmental and Occupational Health and Safety Management Plans and a Social Management Plan to support its operations.

Centrex is directed by an experienced management team, with a strong track record in the mining industry in Western Australia.

Gerard Anderson – Managing Director

Gerard Anderson is a geologist with over 30 years experience in exploration and mine geology. He has held senior management positions with Worsley Alumina Pty Ltd, Great Central Mines Pty Ltd and Kalgoorlie Consolidated Gold Mines Pty Ltd. He was General Manager of the Golden Grove Operations for Normandy Mining Ltd and Newmont Australia Ltd from 1999 to 2004 and General Manager Joint Ventures for Newmont until February 2005. Mr Anderson was Managing Director of Croesus Mining Ltd from February to September 2005.

Mr Anderson has an Associateship in Applied Geology from the Western Australian Institute of Technology, a Graduate Diploma in Business and a Masters in Science (Mineral Economics) from Curtin University.



Kevin Malaxos – Chief Operating Officer

Kevin Malaxos is a Mining Engineer with over 20 years experience in open pit and underground mining. He has held operational and executive roles with Kalgoorlie Consolidated Gold Mines Pty Ltd, WMC Resources Limited, Byrnecut Mining Pty Ltd, Perilya Ltd and Central Asia Resources Ltd. He has his own consultancy business and has worked for clients including BHP Billiton in South Africa, Limestone quarries in UAE and Barra Resources in Western Australia.

He held the position of Mining Manager at WMC Resources Kambalda Nickel operations, General Manager – Australia for Byrnecut Mining from 2003 to 2005, Resident Manager of Broken Hill operations for Perilya Ltd and Chief Executive Officer of Central Asia Resources in 2007.

Mr Malaxos hold a Bachelor of Science degree in Mining Engineering from the WA School of Mines.



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