



NOI Ammaroo Phosphate Mine

Prepared for: Rum Jungle Resources

Prepared by: EcOz Environmental Services


2014





This page has been intentionally left blank

Document Control Record

Document Code:	EZ12041-C0301-EIA-R-0003
Catalogue Number:	33076
Project Manager:	Ray Hall
Author(s):	Ann Grattidge, Justine Shailes & Huon Clark
Approved by:	
	Ray Hall
Approval date:	13/03/14

DOCUMENT HISTORY

Version	Issue Date	Brief Description	Reviewer/Approver
1.A – E	25 Jan 2013	Report preparation by authors	Authors
1.F	23 May 2013	EcOz review	J. Shailes
0	01 July 2013	First Issue to Client	R. Hall
1	29 July 2013	Client modifications incorporated	J. Shailes
2	14 Nov 2013	Second Issue	K. Munson
2C	12/12/2013	Release draft to CLC DME for comment	R. Hall
2F	13/03/14	Include updates and address comments - Submit to RJR	R. Hall
2G	17/04/2014	Incorporate CT review comments	R Hall

Recipients are responsible for eliminating all superseded documents in their possession.

EcOz Pty Ltd.
 ABN: 81 143 989 039
 Winlow House, 3rd Floor
 75 Woods Street
 DARWIN NT 0800
 GPO Box 381, Darwin NT 0800

Telephone: +61 8 8981 1100
 Facsimile: +61 8 8981 1102
 Email: ecoz@ecoz.com.au
 Internet: www.ecoz.com.au



RELIANCE, USES and LIMITATIONS

This report is copyright and is to be used only for its intended purpose by the intended recipient, and is not to be copied or used in any other way. The report may be relied upon for its intended purpose within the limits of the following disclaimer.

This study, report and analyses have been based on the information available to EcOz Environmental Services at the time of preparation. EcOz Environmental Services accepts responsibility for the report and its conclusions to the extent that the information was sufficient and accurate at the time of preparation. EcOz Environmental Services does not take responsibility for errors and omissions due to incorrect information or information not available to EcOz Environmental Services at the time of preparation of the study, report or analyses.



This page has been intentionally left blank



Table of Contents

1	Introduction	1
1.1	Project Overview.....	1
1.2	Project Location & Tenure	2
1.3	Proponent Details and Contacts.....	2
1.4	Purpose of the Notice of Intent	4
2	Project Description	5
2.1	Overview	5
2.2	Site Selection	7
2.3	Key project components and disturbance areas	8
2.4	Process and Plant Description.....	9
2.5	Mining Schedule	13
2.6	Tailings Storage	13
2.7	Project Infrastructure	14
2.8	Water Use	15
2.9	Transport and Logistics	17
2.10	Workforce & accommodation.....	21
3	Existing Environment	22
3.1	Climate.....	22
3.2	Topography & Land Systems	22
3.3	Geology.....	22
3.4	Surface Water	22
3.5	Ground water	24
3.6	Vegetation communities	25
3.7	Flora and Fauna	25
3.8	Weeds and Feral Animals.....	30
3.9	Air and Noise	32
3.10	Greenhouse Gasses.....	32
3.11	Cultural, Heritage & Archaeological Sites.....	32
3.12	Socio-economic Context.....	33
4	Legislative Framework	34
4.1	Australian Government Legislation.....	34
4.2	Northern Territory Government Legislation	36

4.3	Other relevant Northern Territory Legislation	38
5	Potential impacts and management measures	39
5.1	Surface water	39
5.2	Ground water	40
5.3	Erosion and sediment movement	40
5.4	Flora and Fauna	41
5.5	Air and Noise	42
5.6	Cultural heritage and archaeological sites.....	44
5.7	Socio-economic environment	44
5.8	Traffic and transport infrastructure	45
5.9	Phosphoric acid (Option 3)	46
6	Environmental Management	47
6.1	Environmental Management Plans.....	47
6.2	EMP Implementation	48
6.3	Environmental Assessment and Corrective Actions.....	48
7	Stakeholder consultation	50
8	Acronyms and References.....	52
8.1	Acronyms	52
9	References	53

Tables

Table 1-1.	Potential development options for the Ammaroo project.	1
Table 1-2.	Information requirements for an NOI.....	4
Table 2-1.	Option 1 Whittle Optimisation Parameters.	6
Table 2-2.	Option 2 Whittle Optimisation Parameters.	6
Table 2-3.	Option 3 Whittle Optimisation Parameters.	7
Table 2-4.	Transport and logistics options.....	7
Table 2-5.	Key component and footprint.	8
Table 2-6.	Overview of Ground Water Drilling Results.....	16
Table 2-7.	Indicative Project Water Requirement.....	16
Table 2-8.	Road Transport Details.	17
Table 2-9.	Slurry Pipeline Transport Details.....	18
Table 2-10.	Phosphoric Acid & Sulfuric Acid Pumping.....	18
Table 2-11.	Rail Transport of MBO Ore.....	20

Table 3-1. Major Land Units of the Alinga and Singleton Systems (Perry et al. 1962).	24
Table 3-2. Vegetation types present with the Ammaroo project area.	25
Table 3-3. List of threatened fauna which are either known to or may potentially inhabit the data search area.	30
Table 3-4. Migratory species indicated to be potentially present according to an EPBC matters search.	30
Table 3-5. Weed Species potentially with the vicinity of the project area.	31
Table 3-6. Feral animal species potentially present within the vicinity of the project area.	31
Table 7-1. Stakeholder List for the Ammaroo Project.	51

Figures

Figure 1-1. Location of the Ammaroo Project.	3
Figure 2-1. Schematic of the mining process.	5
Figure 2-2. Barrow Creek 1 and Argannara Deposits.	8
Figure 2-3. MBO Schematic (Initial Option 1).	10
Figure 2-4. MBO/Beneficiation Schematic (Complete Option 1).	11
Figure 2-5. Phosphoric Acid Plant Schematic.	12
Figure 2-6. Typical deposit situation and free digging ability.	14
Figure 2-7. Proposed Transport Corridor.	19
Figure 3-1. Land Systems within the region of the Ammaroo project area.	23
Figure 3-2. Vegetation types present within and in the vicinity of the Ammaroo Project Area.	27
Figure 3-3. Flora and fauna survey locations within EL25184 with claypans in west.	28
Figure 3-4. Threatened fauna species recorded within a data search area (post 1970) encompassing the MLA and proposed Transport Corridor.	29

1 Introduction

1.1 Project Overview

Rum Jungle Resources (RJR) proposes to develop a phosphate mine located approximately 200km south-east of Tennant Creek and 300km north-east of Alice Springs on the Ammaroo Pastoral Lease in the Northern Territory (Figure 1-1). The Ammaroo phosphate project (the project), involves the open cut mining of shallow phosphate deposits, the beneficiation of that ore and the transport of it to markets.

RJR have completed a scoping study and preliminary economic assessment of the Ammaroo project and have selected three possible options as detailed in Table 1-1 below.

Table 1-1. Potential development options for the Ammaroo project.

	Option 1	Option 2	Option 3
Project	A mechanically beneficiated ore (MBO) start-up (up to 5 years) ramping up to 1.8Mtpa product output. MBO operation becomes a flotation beneficiation operation at 1.8Mt per annum of 30% - 32% P ₂ O ₅ rock	Beneficiation through flotation from start-up ramping up to 1.8Mtpa of 30% - 32% P ₂ O ₅ rock from start-up	Production of up to 500 000 tonnes 100% P ₂ O ₅ Phosphoric Acid through either a wet process or a thermal process. Will require approximately 1,000,000 of sulphuric acid as an input, most likely produced at a plant in vicinity of the rail head or at the mine site or railed in tanker wagons from Darwin
Transport to railhead through a common transport corridor	Construction of a haul road and later a slurry pipeline. MBO transported 90km to the railhead by road initially before possible construction of a slurry pipeline, in the same corridor as the haul road to move beneficiated rock to the railhead	Construction of a service road and slurry pipeline in a common transport corridor. Beneficiated rock transported 90km by slurry pipeline to the railhead	Construction of a service road and pipeline infrastructure in a common transport corridor. Phosphoric Acid transported 90km by pipeline to the railhead. Sulphuric acid, as an input, transported by road or pipeline from railhead
Construction start-up	Third quarter of 2015	Third quarter of 2015	Third quarter of 2015
Production commencement	third quarter 2016 for MBO, Fourth quarter 2020 for beneficiated rock	fourth quarter 2016	First quarter 2017
Product specifications	Up to 1.8Mtpa MBO >27% P ₂ O ₅ 1.8Mtpa. Beneficiated rock 30% - 32% P ₂ O ₅	Up to 1.8Mtpa beneficiated rock 30% - 32% P ₂ O ₅	Up to 500 000 tonnes 100% P ₂ O ₅ Phosphoric Acid. Equated to approximately 900,000 tonnes in liquid volume
Indicative waste to ore strip ratio	<3 to 1	<3 to 1	<3 to 1
Project	A mechanically beneficiated ore (MBO) start-up (up to 5 years) ramping up to 1.8Mtpa product output. MBO operation becomes a flotation beneficiation operation at 1.8Mt per annum of 30% - 32% P ₂ O ₅ rock	Beneficiation through flotation from start-up ramping up to 1.8Mtpa of 30% - 32% P ₂ O ₅ rock from start-up	Production of up to 540 000 tonnes 100% P ₂ O ₅ Phosphoric Acid through either a wet process or a thermal process. Potential for a 2800 tonne per day sulphuric acid plant at the rail head or at site



1.2 Project Location & Tenure

The Ammaroo project is situated within ML 29463 within Ammaroo Station which is crown land under perpetual pastoral lease.

The area around the project is sparsely populated with little development. Broad scale tenure mapping identifies the project area and it's surrounds as having the land use of extensive grazing of natural vegetation (e.g. >3000km²) with scattered indigenous communities. Surrounding pastoral properties are grazed with beef cattle.

The unsealed Sandover Highway will be used for access to the project area from the south or the unsealed Murray Downs Road for access from the north until a transport corridor and dedicated haul road is established between the mine site and the central Australian railway. The three closest townships to the proposed site are Ampilatwatja (pronounced 'um-bludder-witch', population of approximately 350 people) located 25 km south-east, Ali Curung (population of approximately 535 people) located approximately 85 km north-west and Barrow Creek (population <20) which is located 130 km to the west. (Figure 1-1).

1.3 Proponent Details and Contacts

Proponent Details

Rum Jungle Resources Ltd
20/90 Frances Bay Drive
STUART PARK NT 0820
GPO Box 775
DARWIN NT 0801
Tel 08 8942 0385 | Mob 0437021415| Fax 08 8942 0318
Contact: Chris Tziolis, Director of Development Projects.

Consultant details

EcOz Pty Ltd
Third floor Winlow House
75 Woods Street
GPO Box 381 Darwin
Tel: 08 8981 1100
Contact: Ray Hall.

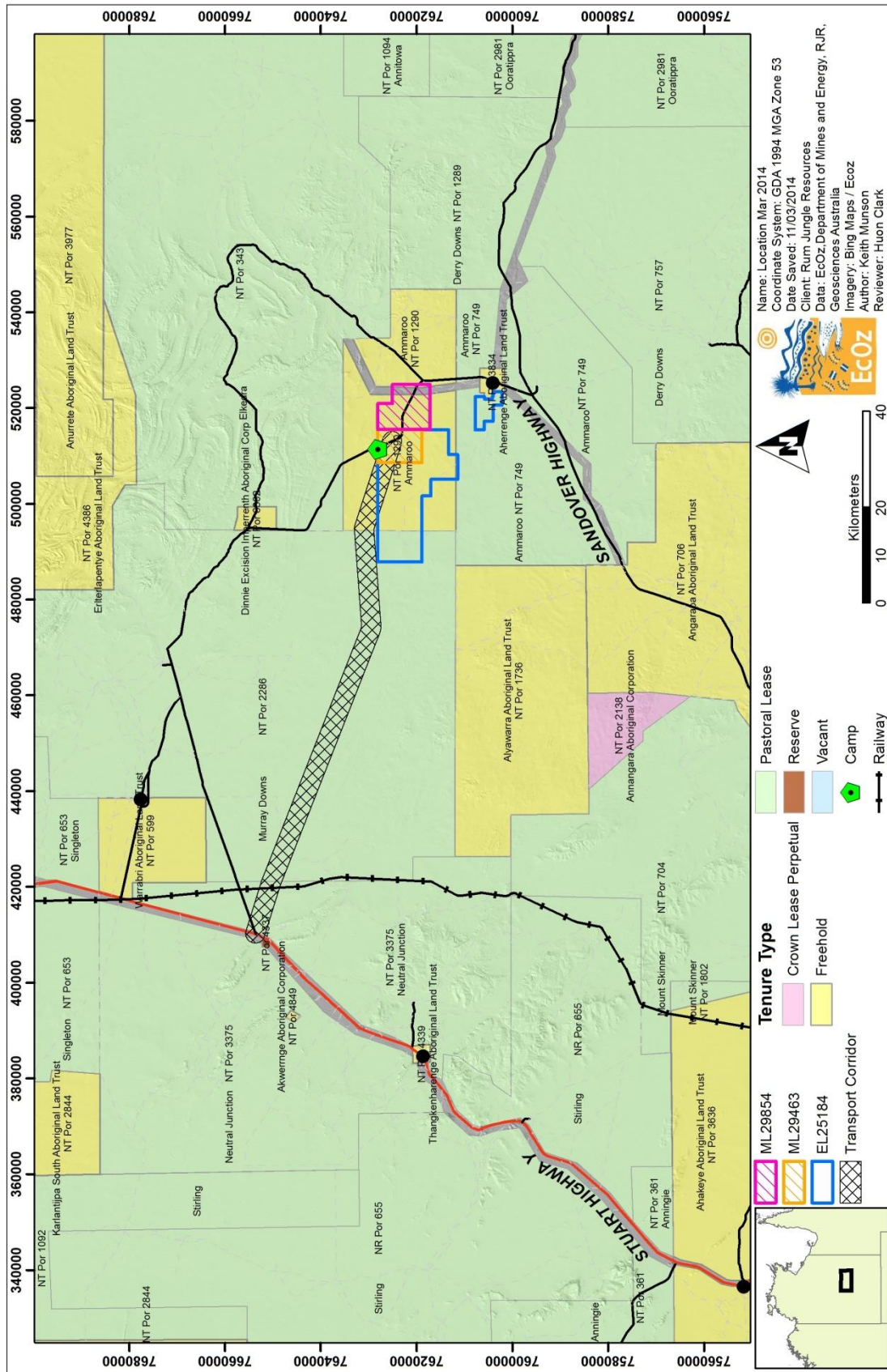


Figure 1-1. Location of the Ammaroo Project.

1.4 Purpose of the Notice of Intent

This Notice of Intent (NOI) provides formal notification to the Northern Territory Government, and other interested parties, of RJR's intention to advance the Ammaroo Phosphate project.

It has been developed so that sufficient information is provided to allow for a level of formal assessment under the *Environmental Assessment Act* to be determined and resultant guidelines produced.

The project has also been referred to the Australian Government under the *Environmental Protection and Biodiversity Conservation (EPBC) Act*. The Australian Government Department of Sustainability, Environment, Water, Population and Communities (DoE) administers the Act and has established a formal referral and assessment process. If DoE determines a project is likely to significantly impact a matter of national environmental significance it is declared a "controlled action" and is required to undergo assessment and approval under the EPBC Act. In the Northern Territory this will be through the bilateral agreement between the Northern Territory and Australian Government. If the project is not a controlled action, assessment will proceed under the Northern Territory legislative approvals process.

This NOI has been prepared in accordance with the Department of Lands, Planning and the Environment (DLPE) *Information Guidelines for a Notice of Intent* (DLPE 2007, Appendix 1), as summarised in Table 1-1, and the Department of Mines and Energy (DME) *Environmental Assessment of Mining Proposals Advisory Note* (DME 2008).

Table 1-2. Information requirements for an NOI.

NOI Requirement	Report Section
Name of proponent and consultant	Section 1.3
Address and contact details of proponent	Section 1.3
Location of proposal	Section 1.2
Description of proposal	Section 2
Outline of legislative consent and licensing requirements	Section 4
Description of site and existing environment	Section 3
Description of existing marine and land uses in and adjacent to proposal	Section 3
Description of waste management and pollution control on and offsite	Section 5.1, 5.2 & 5.4
Description of other environmental factors	Section 3 & 5
Identification of greenhouse gas emissions from the proposal	Section 3.15
Aboriginal and sacred sites clearance	Section 3.11
Description of timing, including stages and decommissioning	Section 2.5
Description of environmental commitments, safeguards, and monitoring	Section 5
Description of proposed rehabilitation and decommissioning	Section 6

2 Project Description

2.1 Overview

The Ammaroo Phosphate project currently comprises the Barrow Creek 1 deposit and now, after a successful takeover of Central Australian Phosphate, the adjacent Argannara deposit. The combined Measured, Indicated and Inferred Resource is resource is approximately 1.08 tonnes at an average grade of approximately 15% P_2O_5 at a cut off of 10% P_2O_5 . This project resource currently includes a Measured Resource of 136 million tonnes at an average grade of 15.7% at a cut-off of 10% P_2O_5 .

All phosphate resources around the world have some form of heavy metal contaminant. The phosphate resource at Ammaroo, in comparison to global standards, is very low in Uranium (<30ppm) and very low in Cadmium and Arsenic (<5ppm). For example, Moroccan and Florida phosphate ores have in excess of 200ppm Uranium. Some areas of the resource have higher average lead levels (200-800ppm) than comparative global ores. Whilst the level of lead is not high in general terms, the majority of it will need to be removed, somewhere along the phosphate fertiliser value stream, most likely in a phosphoric acid plant.

The rail and port export capacities are assumed to be 1.8 million tonnes of rock product per annum or approximately 900,000 tonnes of liquid phosphoric acid.

The preferred mining method for the Ammaroo project for all 3 of the product options is strip mining. This is relatively shallow open cut mining used to access the ore horizon. Once ore has been exposed it is extracted leaving a void that is backfilled with the overburden excavated to expose the next strip of ore. As progressive strips are mined and the depleted mine is backfilled the mine front moves through the resource. Rehabilitation is progressive reducing the overall environmental impact of the operation, reducing issues associated with erosion and dust.

Strip mining is carried out by conventional truck and shovel systems as well as mechanized surface miners with conveyor belt systems providing mining solutions. Figure 2-1 below is a schematic of the mining process

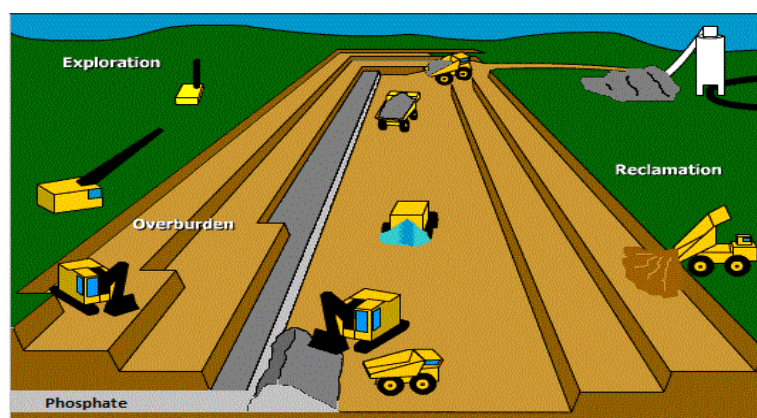


Figure 2-1. Schematic of the mining process

RJR hope to commence construction in the third quarter of 2015 with operations commencing mid to late-2016, pending receipt of all necessary approvals.

Three options have been identified as the most economically and technically viable for the Ammaroo Phosphate project, these are detailed below.

2.1.1 Option 1

Mechanically beneficiated ore (MBO) start up to assume a cut-off run of mine (ROM) grade of 24% upgradeable to >27% through simple crushing and screening assuming a 50% recovery. It would be intended to exploit approximately five years of MBO by high grading the resource before reverting to full beneficiation to produce a >30% P_2O_5 product again at a 66% recovery factor. This option has been modelled as per parameters in Table 2-1 below.

Table 2-1. Option 1 Whittle Optimisation Parameters.

Option 1 Whittle Optimisation Parameters	
Mining Cost	\$2.50/t
MBO	
Cut-off Grade (P_2O_5)	20%
Recovery	50%
Product Grade (P_2O_5)	27%
Beneficiation	
Cut-off Grade (P_2O_5)	12.5%
Recovery	66%
Product Grade (P_2O_5)	30%

2.1.2 Option 2

Option 2 is flotation beneficiation through to a >30% P_2O_5 product at 66% recovery. Mining will commence in high grade areas but grade will vary as operations progress and ROM volumes will increase. The objective is to get as much high grade as possible into this mine plan. This option has been modelled as per parameters in Table 2-2 below.

Table 2-2. Option 2 Whittle Optimisation Parameters.

Option 2 Whittle Optimisation Parameters	
Mining Cost	\$2.50/t
Beneficiation	
Cut-off Grade (P_2O_5)	12.5%
Recovery	66%
Product Grade (P_2O_5)	30%

2.1.3 Option 3

Mine designed to provide sufficient ROM input for a 500kt phosphoric acid (100% P_2O_5) plant which equated to approximately 900,000 tonnes of liquid volume. A phosphoric acid plant of this scale will require a feed of up to 1.2 million tonnes of sulphuric acid. Therefore, under this development option, it is likely that a sulphuric acid plant would need to be built at the railhead to produce sulphuric acid. Approximately 400,000 tonnes of elemental sulphur would need to be imported into Darwin from Asia and transported down the railway line to the plant. Alternately, sulphuric acid could be imported into Darwin and transported via tanker train to the site. Darwin port already has facilities to import sulphuric acid. The sulphuric acid would be piped or trucked to the phosphoric acid plant, adjacent to the mine or transported via a dedicated pipeline. Some

mechanical beneficiation of ROM ore would be needed to provide clean feed stock to the phosphoric acid plant. This scenario has been modelled as per parameters in Table 2-3 below.

Table 2-3. Option 3 Whittle Optimisation Parameters.

Option 3 Whittle Optimisation Parameters	
Mining Cost	\$2.50/t
Beneficiation	
Cut-off Grade (P2O5)	12.5%
Recovery	66%
Product Grade (P2O5)	30%
Phosphoric Acid Plant	
Cut-off Grade (P2O5)	22%
Recovery	95%
Mass Recovery	33%

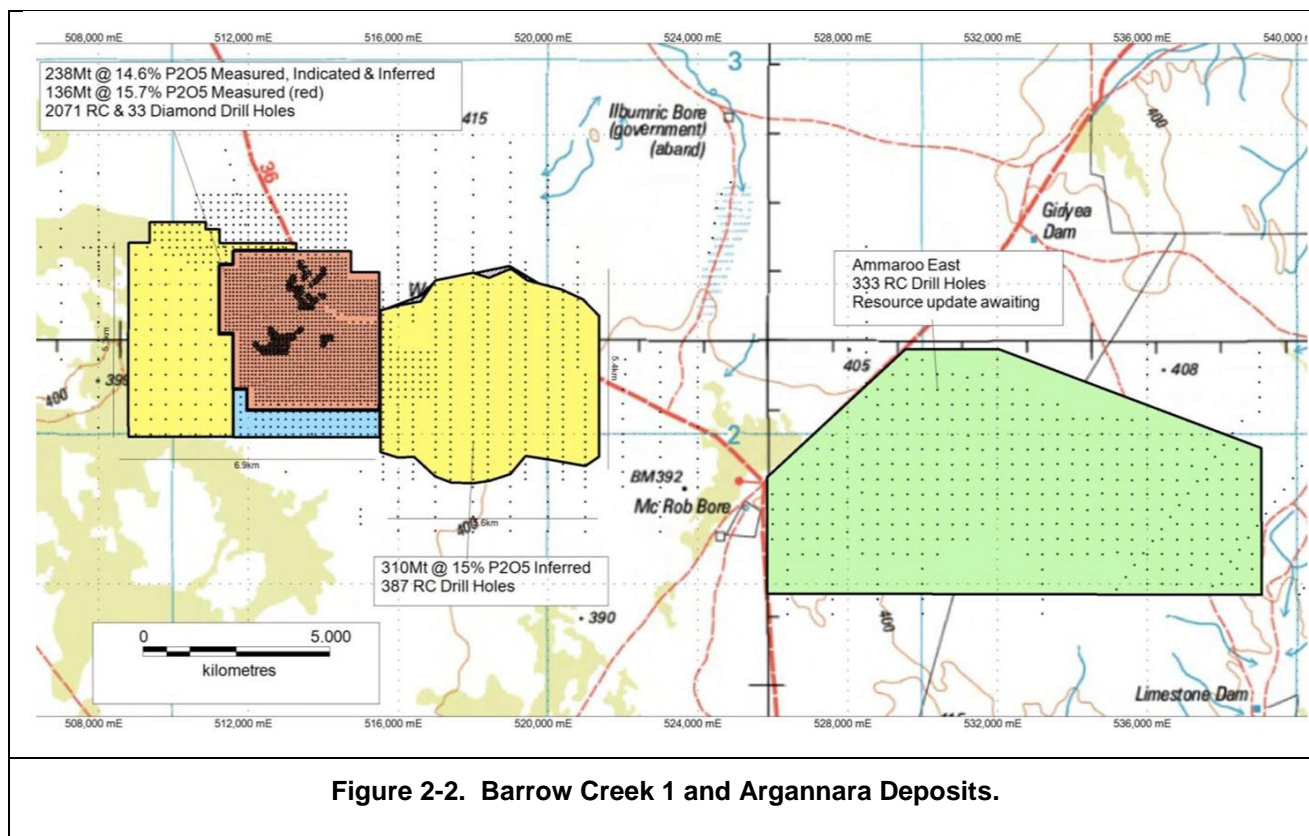
There are also various transport and logistics options being explored for the project, as shown in Table 2-4.

Table 2-4. Transport and logistics options.

Process Method	Transport/Logistic Method
Mechanically Beneficiated Ore (MBO)	Road transport to a rail siding
	Conveyor to a rail siding
	Rail spur to process plant
Beneficiated Concentrate	Road transport to a rail siding
	Conveyor to a rail siding
	Slurry pipeline to a rail siding
	Rail spur to process plant
	Containerized bulka bag
Phosphoric Acid Production	Road transport to a rail siding
	Pipeline to a rail siding
	Rail spur to process plant

2.2 Site Selection

In early 2013 Rum Jungle Resources announced a total phosphate resource at Barrow Creek 1 deposit of 238 million tonnes at 14.6% P2O5 at a 10% cut-off. Rum Jungle Resources has also gained control of Central Australian Phosphate which has a phosphate resource of 310 million tonnes at 15% P2O5 at a 10% cut-off at their Argannara deposit. An additional 528 million tonnes of inferred resource has been identified downstrike to increase the overall resource to 1.08 billion tonnes at 14.6% P2O5 at a 10% cut-off. As per the map below (Figure 2-2) these deposits are adjacent to each other and it is intended to combine them into a single development project, the Ammaroo Phosphate Project. Part of EL25184 is now MLA 29463 and part of EL24726 is now MLA 29854. The parts of the Exploration Leases that have not been converted to MLA's remain as EL's.



2.3 Key project components and disturbance areas

Table 2-5. Key component and footprint.

Component	Footprint – disturbance area (km ²)
Mining area – excavation/pits	A conceptual 25 year mine plan encompasses a 10 km ² footprint with rehabilitation being progressive. Noting the size of the resource, the actual mine life could be more than 50 years and encompass more than 20 square kilometers of mined (and rehabilitated area)
Processing area	1
Accommodation camp/s	0.2
Access Roads	90 km x 100 m corridor to the rail head (with 50 m disturbance) (4.5 km ²)
Infrastructure area (admin, workshops etc.)	0.5
Other (Rail Loading facility/ Power Station)	1
Estimated total Disturbance Area	= 17.5 km ²

2.4 Process and Plant Description

The Ammaroo project facilities will include a plant to process ore from an open pit mine. In the first instance, for the purpose of this NOI, hard ore options have been investigated. These comprise:

- A mechanically beneficiated ore (MBO) proceeding to beneficiation at a later date (Option 1)
- A beneficiation plant (Option 2)

In the event that the concentrate product from Options 1 and 2 contain excessive contaminants, fails to meet the market specifications or is some other way unsuitable or unacceptable to the market, a third option has been designed conceptually, namely:

- A beneficiation plant followed by phosphoric acid production (Option 3)

2.4.1 Processing Options

Option 1 is designed initially as a MBO plant only. It would receive high grade ore and upgrade it slightly by way of screening to a saleable grade. It is estimated that there is enough ore at this grade to feed the plant for a number of years (assumed to be five years for the purpose of this NOI) during which time a grinding and beneficiation circuit is constructed and commissioned. The initial MBO only schematic is shown in Figure 2-3 below.

After the initial period, when high grade ore is no longer readily available, ore leaving the crushing circuit will report to the milling/beneficiation circuit and this will constitute the complete Option 2 design that is shown in Figure 2-4 below.

The milled ore is separated into coarse ore ($P_{80} = 150 \mu\text{m}$) and fine ore ($-38 \mu\text{m}$) by hydrocyclones and treated by individual flotation circuits. The coarse circuit utilises Denver flotation cells whilst the fine circuit utilises specified flotation cells designed for high recovery of fine material. Each flotation circuit has a rougher, cleaner and a scavenger stage. The froth from the cleaner flotation stages are combined and dewatered by high rate thickener before being pumped as 55 % solids slurry to the rail head. Pulp from the scavenger stages are dewatered by the tailings thickener and pumped to the tailings storage facility. The concentrate produced from the beneficiation option assays in excess of 30% P_2O_5 .

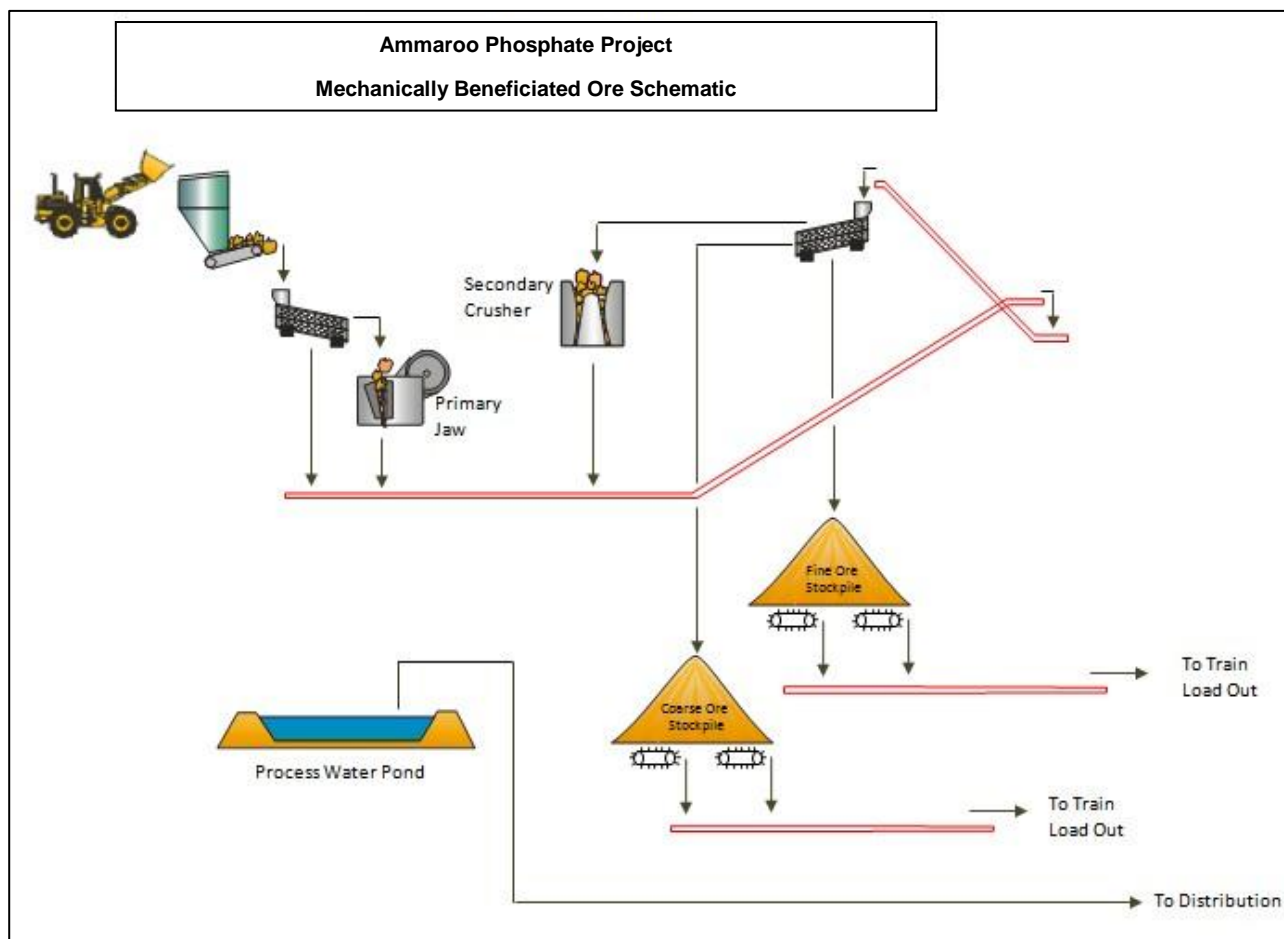


Figure 2-3. MBO Schematic (Initial Option 1).

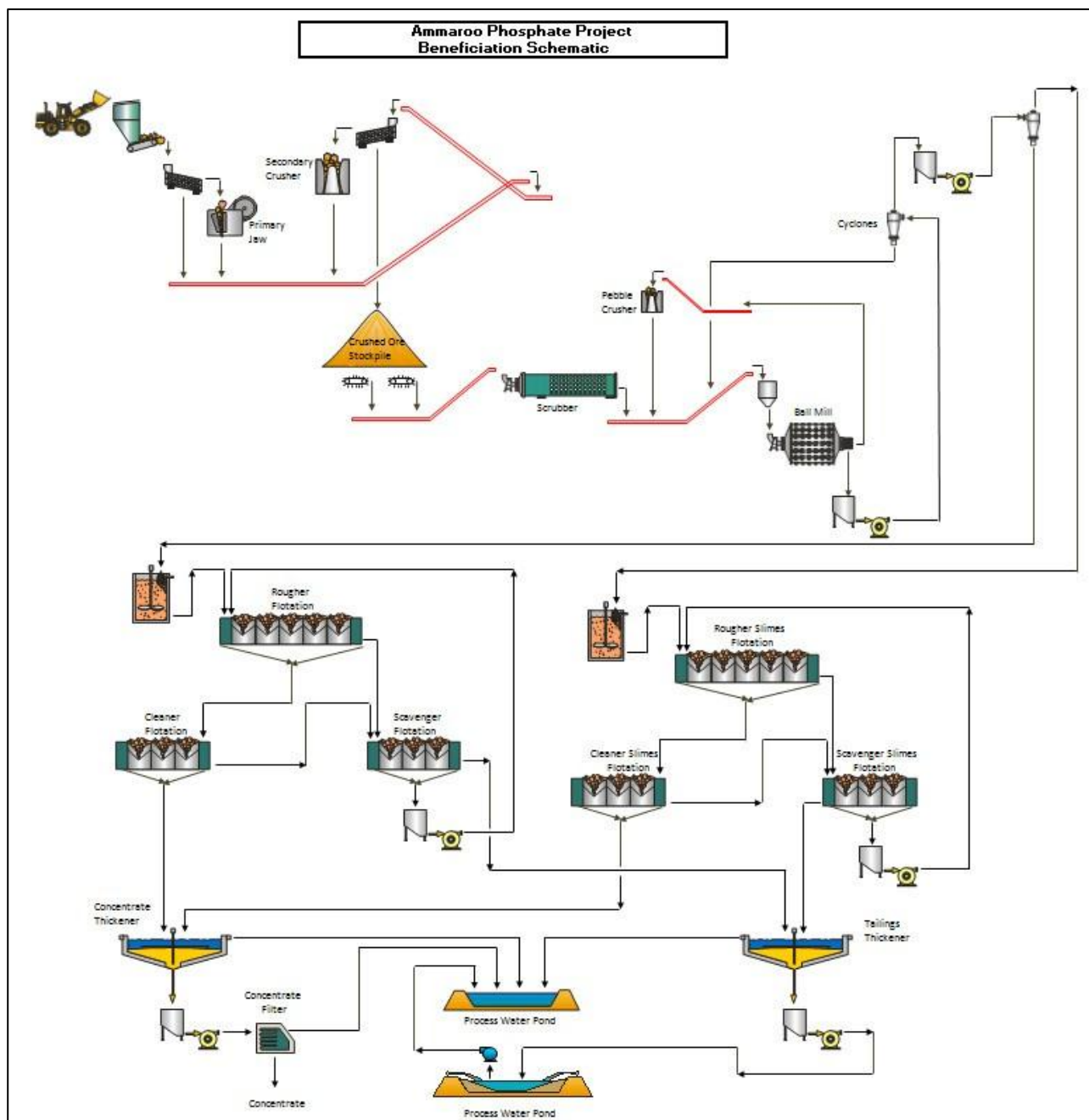


Figure 2-4. MBO/Beneficiation Schematic (Complete Option 1).

Because phosphate is heavily influenced by market fluctuations and varying product contaminants, the MBO product may be subjected to reduced saleability during the initial period of MBO production. The design of Option 2 is similar to Option 1, however does not incorporate a MBO operation in the early years. This option focuses on reducing the aforementioned negative influences by commissioning and operating a beneficiation plant from the first year of production. This will produce a similar phosphate concentrate to the later years of Option 1 which assays above 30% P_2O_5 . The schematic for Option 2 is the same as that shown in Figure 2-4 above.

Option 3 comprises a crushing/grinding/beneficiation plant to feed a downstream phosphoric acid plant. Hence the front end comprises the Option 2 schematic to which is added the phosphoric acid plant as shown in Figure 2-5 below.

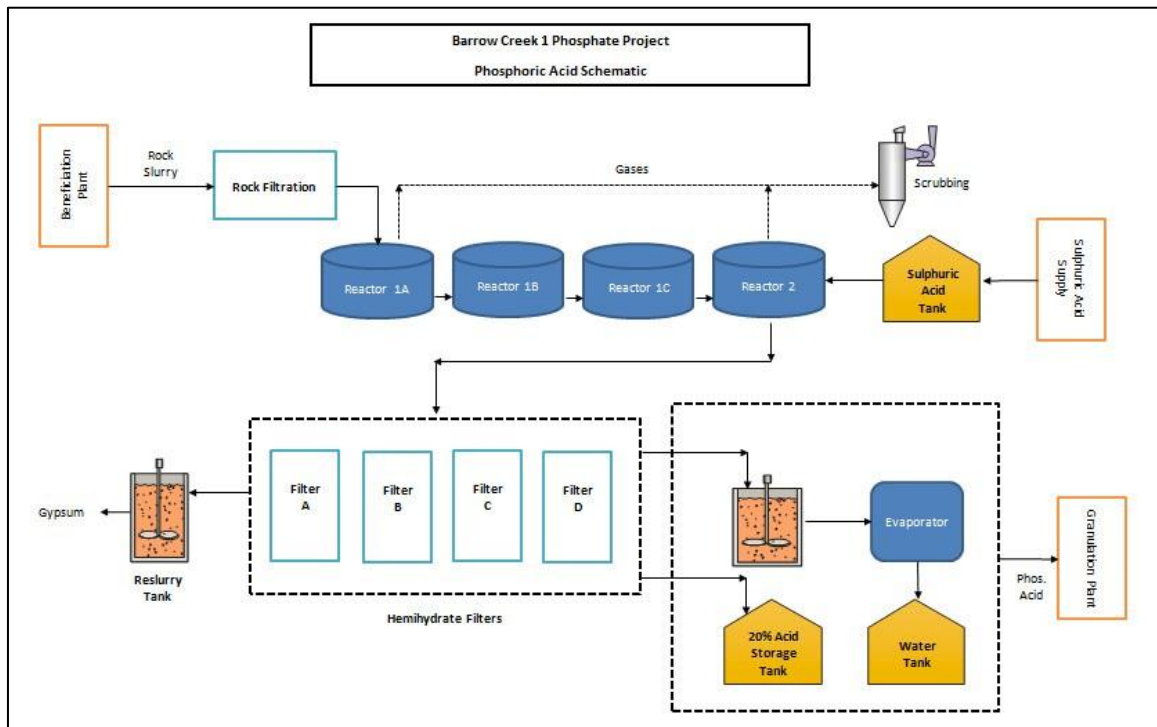


Figure 2-5. Phosphoric Acid Plant Schematic.

Metallurgical leaching test work has shown that the phosphate dissolves readily whilst the silica and other metal contaminants, such as lead are largely non-reactive. The phosphate is leached from the rock concentrate with excess sulfuric acid which produces gypsum (CaSO_4), hydrofluoric acid and phosphoric acid. The excess sulfur ions react with the small amount of lead which goes into solution to produce a solid precipitate of lead sulphate which is disposed of in the gypsum waste stream, removing it from the final product. Although coupled with high operating and capital cost, Option 3 has the potential to provide the greatest value, as phosphoric acid is a high value product and the longest mine life due to the phosphoric acid plant feed grade being significantly lower than the target concentrate rock grade and the impacts of transport economics would be minimised.

Further Study Work

Further investigation into an optimal comminution circuit will be conducted to optimise the power and consumable requirements of Option 3. Specifically, the abrasiveness of the ore and the feasibility of utilising a semi-autogenous grinding mill to replace the ball mill will be investigated.

Phosphoric Acid Production Option 3 is the most economically viable option from a processing perspective. The overall plant could be installed progressively, firstly as MBO only (Option 1), then the beneficiation component (Option 2) and finally adding the phosphoric acid plant (Option 3).

The benefits of this progressive approach are:

- Early cashflow benefits
- The ore is treated at the lowest operating cost

- The ore can be extracted from the entire resource, thereby significantly extending the mine life
- There may be benefits of working the cost of the plant upgrades into the operating cost of the plant.

This approach offers flexibility of overall project development and time is available so that:

- Further metallurgical test work can be conducted to optimise recoveries and plant performance
- Solutions to potential lead contamination can be identified
- The stages of development and plant capacity can be related to market requirements at that time
- Capital commitments are spread over a period of time.

2.5 Mining Schedule

Mining is expected to proceed at an average of approximately 5 million tonnes of ore and 11 Mt of waste rock per year for 25 years. The waste rock will be disposed of in the adjacent open pit area. Obviously mining rates will be lower in the early years when higher grade shallower material is mined. The Ammaroo Resource is relatively shallow and should enable free digging of run of mine ore. See Figure 2-6 – demonstrating typical deposit situation and free digging ability

2.6 Tailings Storage

For the rock export options, tailings storage will be required and a tailings storage facility (TSF) has been designed with an initial four to five years capacity for a 3 Mtpa rate of deposition (appropriate for the beneficiation options). The tailings from either of the rock export options will be largely inert. The tailings content will largely be process water and gangue minerals separated from the phosphate ores in a beneficiation process consisting of milling and flotation. The gangue minerals will mainly be made up of quartz, silicates, clays, carbonates, iron and aluminium bearing minerals and trace elements. A small proportion of the benign flotation reagents such as fatty acid or corn starch, and flocculant will also be present.

The TSF design is a typical industry construction standard and will be unlined. The design assumes a dam crest width of 9 m with 1.2 m high windrows on both sides, enabling light vehicles to traverse around the crest of the dam and deposition piping to remain on the crest throughout its intended use. A process water decant causeway and decant tower with pumps have been included in order to enable return of decant water for reuse in the process plant.

Subsequent to the initial start-up period, tailings can be disposed of in the initial sections of the open pit mine, thus enabling eventual covering and rehabilitation. This concept of in-pit tailings storage will provide an environmentally sustainable way of managing inert tailings.

For the phosphoric acid production option, waste management becomes more complex. The waste stream from the plant is generally Calcium Sulphate (Gypsum) which would be stacked in specifically designed waste dumps and dried. Liquid waste from the gypsum stacks and the plant, will need to be captured and stored in appropriate impermeable storage facilities and recycled through the plant. The dried and inert gypsum could be subsequently relocated to open mining pit areas for rehabilitation, which would add cost or as is done in the United States, the gypsum stacks can be re-planted in their own right and rehabilitated, albeit, changing the natural topography of the land.



Figure 2-6. Typical deposit situation and free digging ability

2.7 Project Infrastructure

2.7.1 Infrastructure General

Infrastructure required to support the project includes:

- Access road
- Power station and facilities
- Fuel supply and storage facilities
- Gas supply pipeline
- Bore field water supplies and treatment facilities
- Waste water treatment and disposal facilities
- Site buildings, workshops and warehouses
- Accommodation village
- Access to an airstrip (at Ampilatwtja) or alternatively a new airstrip to support fly-in/fly-out operations
- Rail siding including train loading facilities at the main line at a yet to be defined location between Barrow Creek and Neutral Junction

- Port export facilities at Darwin.

Additionally, for the Beneficiated Ore (Option 2) or Phosphoric Acid Production (Option 3) overland slurry and acid carrying pipelines respectively will be required between the mine plant and the rail head, unless trucking proves to be the most sustainable option.

2.7.2 Power Supply

The APA Group managed gas pipeline is approximately 120 kilometres west of the project site and 25 km from the proposed railhead and loading facilities. Hence, due to its proximity and cost, gas fired power generation is the preferred option. It is envisaged that the power station would be built adjacent to the rail loading infrastructure and overhead wires constructed to the mine and plant along the common transport corridor.

Currently, the use of reciprocating gas fired power generators appear to be the lowest suitable capital and operating cost solution. However, the selection will be revisited during future studies once the electrical loads have been defined with a higher degree of certainty.

A build, own and operate proposal, which includes supply of natural gas and an operation and maintenance proposal, was obtained to provide acceptable power costs for scoping study purposes. It is expected that approximately 16-20 mega watts of power will be required, depending on the development option. The construction of a sulphuric acid plant will negate the need for a large standalone power plant as the sulphuric acid plant produces sufficient heat and steam to create approximately 30 Mw of power. Un used power could be fed into the grid.

Further definition and confirmation of costs will be obtained as part of future studies.

2.8 Water Use

The project is located on the South Georgina Sedimentary Basin, on what has been termed the Elkedra Shelf where the Cambrian Georgina Basin on-laps the Proterozoic Tenant Creek Block.

Expected production bore yields from the Georgina Basin carbonates are:

- W103: >20 L/s @ 960 mg/L TDS
- W104: ~10 L/s @ 1430 mg/L TDS
- W105: >10 L/s @ 1100 mg/L TDS

RJR estimate that a groundwater supply of approximately 30 L/s (2600 m³/day) close to the project area will be adequate for this project should the MBO option go ahead.

Desktop investigations (Groundwater Science 2012) identified the carbonate formations of the Georgina Basin as a prospective groundwater target. Locations to the south and west of the project were selected on the basis that the Georgina Basin Sediments deepen and thicken in this direction due to likely faulting.

The initial drilling campaign comprised three pilot holes drilled using reverse circulation methods. The aim of these holes was to test the groundwater potential at these sites and to provide information to allow planning of efficient production bores.

A significant supply of suitable quality groundwater within ten kilometres of the project site has been identified. The very high transmissivity encountered at the W103 site indicates that one to two bores at this site would be capable of yielding the required 30 L/s project water requirement. Should beneficiated ore options be pursued then project water requirements may increase to 110 L/s (or 9 500 m³ per day).

In addition, up to 400 litres per person per day of treated water will be required for showering, ablutions and amenities including water usage by the camp kitchen. It is also proposed that a Reverse Osmosis (RO) plant

be installed to treat saline bore water to potable water. Typical RO plants consume 1.5 times their output in feed water creating a brine of hyper-saline waste. Based on a current workforce estimate of 110 personnel, the accommodation water consumption will require 66 m³ per day of bore water feed to the RO plant.

Table 2-6. Overview of Ground Water Drilling Results.

Hole ID	Max Depth (m)	Easting *	Northing *	RL (mAHD)	SWL (mBGL)	Salinity (mg/LT DS)	Depth to Georgina Basin Carbonates (m)	Max yield during drilling (L/s)	Aquifer Transmissivity (m ² /day)	Expected production well yield (L/s)
WI03	199	504178	7617160	427	81.2	960	64	1.8	2600	>20
WI04	247	505983	7615030	429	81.9	1430	76	1.9	50	~10
WI05	247	507368	7613089	427	80.4	1100	88	1.8	460	>10

*: GDA94 Zone 53

The total water requirement, depending on the option pursued, would range from around 1266 m³/day to a potentially much greater volume depending on processing methodology and production rate (refer to Table 2-7).

Table 2-7. Indicative Project Water Requirement.

Water Use	Water Requirement (m ³ /day)
Camp Supply (110 person camp)	66
Dust suppression and road maintenance	500
Processing	
Mechanically Beneficiated Ore	700
Beneficiation (Flotation)	9,500
Phosphoric Acid (additional to BF)	5,000

It is proposed that the bore located at WI03 will be pump tested to determine the bore capacity and aquifer properties, and then equipped and brought into use.

If additional capacity is required, then it is proposed that an additional pilot hole and bore be installed stepping out to the north-west towards the project site. Minimum separation between bores will be determined from the results of the pumping test at WI03.

If the yield at WI03 is insufficient to meet the project water requirements, an additional bore would be installed as close to WI03 as possible. The rationale behind the close spacing is to maximise the chance of encountering similarly high yields and low salinity.

Overall water consumption and hydrological modeling will be a key component of more advanced technical studies. These will include commentary on impacts to potential other users of these aquifers.

Technical solutions will also aim to ensure that recycling of water resources is maximized.

2.9 Transport and Logistics

This section describes transport and logistics options for each of the three process plant options, including:

- The transport of the products to a rail siding on the mainline
- Transport of products to the port of Darwin
- Darwin port facilities.

A dedicated private transport corridor for all options is intended. Land tenure plans for the corridor and rail head facility are yet to be investigated and negotiated. The proposed corridor including existing land tenure is illustrated in Figure 2-7.

2.9.1 Transport to Rail Head for Option 1 – MBO/Beneficiated Ore

Direct shipping ore will be transported by road for the first four years of operations. Road trains will be utilised in a triple configuration with a net capacity of 90 tonne per movement on a 24 hour a day basis from the process plant to a rail siding (Figure 2-7).

Summary details are provided in Table 2-8 and Table 2-9 below.

From year 5 onwards the beneficiated ore will be pumped as a slurry concentrate from the process plant to the rail siding. A small plant at the siding will comprise a concentrate horizontal belt type filter with filter cake storage and train loading equipment. The plant will receive its feed from the concentrate thickener underflow at approximately 55% solids via the slurry pipeline. The filter cake will maintain a solids density of no less than 85% solids and the filtrate will be collected and batch pumped back to the process water dam at the mine plant site.

Table 2-8. Road Transport Details.

Unit	Measure
Tonnes per annum	1,834,560
Availability (%)	91
Availability (hrs)	7972
Tonnes per day	5525
Tonnes per haul	90
Haul Distance – one way (km)	102
Cycle time per haul (return) (hrs)	3.5
Cycles per unit per day	6
Tonnes haul per day x 1 unit	540
Number of trucks required	11 (10.2)

Beneficiated ore slurry pipeline transport details are provided in Figure 2-7 below.

Table 2-9. Slurry Pipeline Transport Details.

Unit	Measure
Slurry m ³ per annum	2,192,300
% solids	55
Density	1.54
Tonnes per annum	1,856,687
Availability (%)	91
Availability (hrs)	7972
Slurry pumping rate (m ³ per hr)	275
Slurry per day (m ³)	6,600

2.9.2 Transport to rail head for option 2 – Beneficiated ore

The product will be a slurry concentrate as described for Option 1 from year 5 onwards in the above Section 2.9.1 and Table 2-9. At the rail head the same concentrate filter and train load-out facilities will be used as described above.

2.9.3 Transport to rail head for option 3 – phosphoric acid production

For Option 3 the phosphoric acid product will be pumped in a pipeline from the mine plant to the rail siding. This pipeline will also be used to convey the sulfuric acid from the rail head to the process plant as reverse batch pumping. Details are in Table 2-10 below.

Table 2-10. Phosphoric Acid & Sulfuric Acid Pumping.

Unit	Measure
Tonnes per annum	500,000
Availability (%)	91
Availability (hrs)	7972
Sulfuric Acid pumping rate (m ³ per hr)	203
Phosphoric Acid pumping rate (m ³ per hr)	67
Acid per day (m ³)	6,480

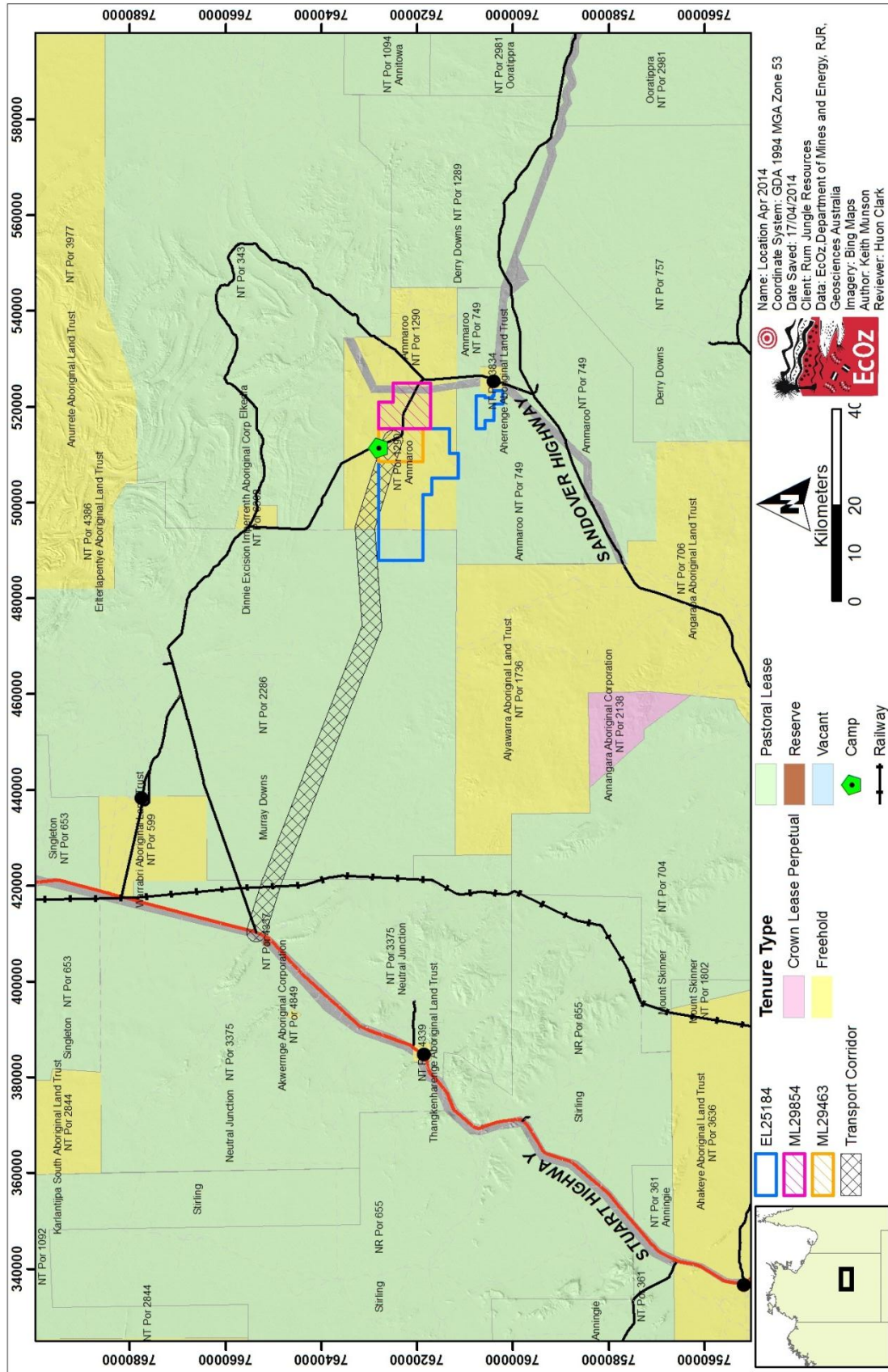


Figure 2-7. Proposed Transport Corridor

2.9.4 Rail Transport to Darwin

Genesee & Wyoming Australia Pty Ltd (GWA) owns the Tarcoola to Darwin portion of the Adelaide to Darwin railway. Details of the transport of products for all three options from a rail siding at Barrow Creek to the East Arm of Darwin Port are as offered by GWA. Summary details for rail transport of Option 1 MBO are shown in Table 2-11.

Table 2-11. Rail Transport of MBO Ore.

Material	Phosphate Rock
Quantity	1,834,560 tpa
Size	+10mm to -50mm
Load Point	The 1,650km point midway between Alice Springs and Tennant Creek on GWA Tarcoola to Darwin railway
Load Method	Conveyor or FEL
Rail Wagon	Covered top, bottom dumping or containerised
Product destination	Darwin Port
Unloading facility	Dedicated bottom dump facility in vicinity of East Arm Wharf
Reclaim method	Either FELs loading dump trucks, or hopper reclamation onto conveyor

For beneficiated ore, product in the form of a dewatered filter cake will be stored in a shed at the siding from where it will be conveyed to a 400t loading bin that is automated to load the hopper wagons for the train. Train loading will require indexing the wagon movements on the rail siding and this is proposed to be further evaluated in the next stage of the study.

For Option 3, the phosphoric acid product will be pumped from the mine plant to a storage tank at the rail head. The phosphoric acid will then be transferred into isotainers mounted on rail wagons. A similar system will be used in reverse to receive delivery of sulfuric acid.

2.9.5 Port facilities

Product export will be from Darwin. This is in line with the RJR strategy to strongly focus on the project being Northern Territory based. Furthermore, the main product markets are likely to be in Asia and therefore exporting through Darwin will offer lower shipping costs than the alternative of utilizing South Australian ports.

The Port of Darwin East Arm Wharf facilities include a bulk liquids berth, a common user facility, a container facility and a bulk loading berth. Therefore, the port is able to accept any of the project products; be they MBO, concentrate filter cake or liquid acid. Likewise, the Port of Darwin is well placed as the import facility for bulk reagents and other consumables for the project.

The East Arm Wharf can handle up to Panamax size vessels (nominally 65 000 to 80 000 dwt). Darwin Port Corporation has existing infrastructure including a 1 500 tph rail dump facility with the capacity to handle 25 ore trains per week and a bulk ship loading facility with a capacity of up to 2 000 tph.

It is proposed that covered storage facilities will be constructed at a location identified by Darwin Port Corporation in the East Arm Wharf area appropriate to the product option(s) finally selected for the project.



2.10 Workforce & accommodation

Approximately 110 personnel will be housed at an accommodation village located within MLA 29463. The camp will consist of a kitchen mess, dongas, and ablution facilities. Depending on final operation, camp could be a 100-250 man camp with full messing and recreation facilities. Appropriate sewerage and garbage disposal facilities will be constructed. A phosphoric acid production operation would require a larger work force, in the order of 200 people that would need to be accommodated.

3 Existing Environment

3.1 Climate

The climate is described as arid tropical by Baker et al. 2005. The year is divided into two main seasons, a short, hot summer featuring the bulk of the annual rainfall and a longer mild to cold and dry winter. These two dominant seasonal patterns are separated by short (1-2 months) transitional periods (Christian et al. 1954).

The mean monthly maximum and minimum temperature over a 30 year period (1981 – 2010) indicate that the summer temperatures can fluctuate between 21 and 38 degrees Celsius and the winter temperatures can flux between 7 and 27 degrees Celsius (BOM 2012). Rainfall figures over a 30 year period (1981 – 2010) indicate an annual average rainfall of 383 mm (BOM 2012).

3.2 Topography & Land Systems

The regional topography surrounding the project area is described as generally flat to undulating sand plains with some rounded ridges or broad rises.

Land systems have been mapped and described by Perry et al. (1962) (Figure 3-1). The lease is dominated by the Alinga (Ag) land system, with the Singleton (Sn) land system also occurring in places, notably in the north, central and southern parts of the lease. The Alinga Land System can generally be described as Mulga or spinifex undulating sand plain featuring minor elements of rounded, strike ridges with shallow stony soils, red earths and red clayey sands (Perry et al. 1962) (Table 3-1). The Singleton land system can be generally described as spinifex sand plains featuring undulating plains, sand rises, separated by moderately wide, flat swales and minor components of alluvial flats and drainage. The predominant land unit features course grained red clayey sands (Table 3-1).

3.3 Geology

The Georgina Basin is a polyphase intracratonic basin (a classic sedimentary basin within the continent) containing unmetamorphosed Neoproterozoic to Devonian sedimentary rocks (Jeuken 2012). The project area is located in the Southern Georgina Basin, where the Cambrian basin sediments overlap the Proterozoic rocks of the Tenant Creek Block (Jeuken 2012).

The Cambrian sediments are the host to the phosphate deposit, and at the project site these are approximately 30 m to 50 m thick (Jeuken 2012).

To the north and east of the site Proterozoic basement rocks are thinly covered and outcrop some 5 km to 10 km distance from the site. Georgina Basin sediments deepen and thicken to the south and west of the site and dip to the south west (Jeuken 2012). These sediments are overlain by the Devonian Dulcie Sandstone some 40 km to the south west (Jeuken 2012).

3.4 Surface Water

The project area is located on the border of the Wiso and Georgina River Basins. There are no major river systems or wetlands within the immediate vicinity of the project area. The main drainage systems close to the project area include Murray and Skinner Creek (located in the Wiso River Basin) approximately 80 km to the north-west, and the Sandover floodout (a 20 km wide flood plain with no major channels within the Georgina River Basin) lies approximately 30 km to the south of MLA29463.

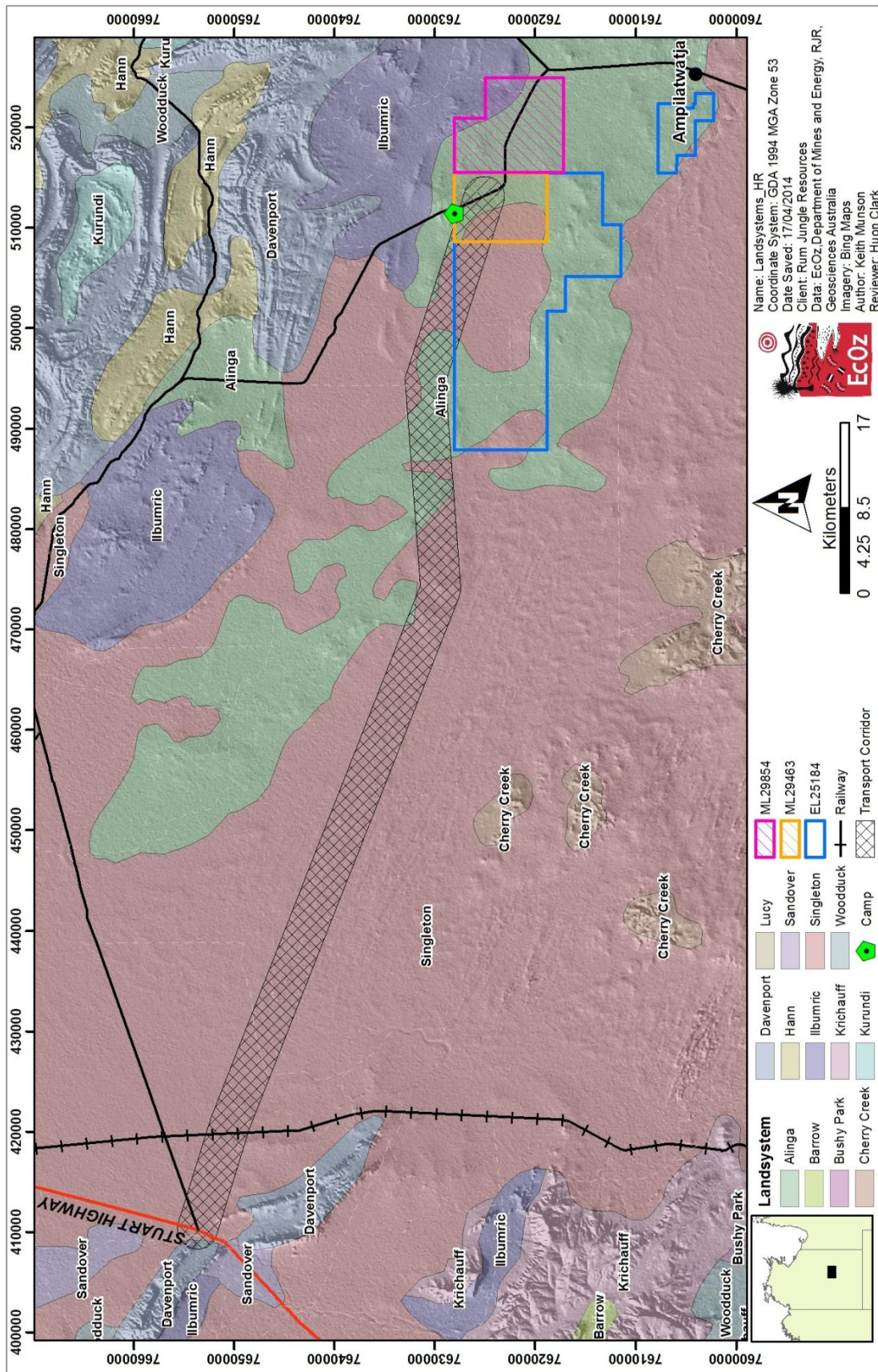


Figure 3-1. Land Systems within the region of the Ammaroo project area.

Table 3-1. Major Land Units of the Alinga and Singleton Systems (Perry et al. 1962).

Land System	Land Unit & Coverage	Land Form	Soil	Vegetation
Alinga (Ag)	1 (predominant)	Plains up to 2.5km wide; little channel drainage	Red earths	<i>Acacia aneura</i> (mulga). Some <i>A. georginae</i> (Gidgee) over short grasses and forbs.
	2 (Small)	Sand plains	Red clayey sands	Sparse shrubs and low trees over <i>Triodia species</i> . (Spinifex)
	3 (Small)	Rounded ridges and small mesas with stony crests up to 20m high with lateritic gravels. Slopes 3-10%	Outcrop with shallow stony soils	Sparse shrubs over <i>Triodia pungens</i> (Soft Spinifex)
				<i>A. kempeana</i> (Witchetty Bush) over <i>Cassia</i> species over sparse grasses and forbs
Singleton (Sn)	1 (predominant)	Sand plain; hummocky surfaces fixed by vegetation	Red clayey sands and coarse textured red earths	Sparse shrubs and low trees or minor component of <i>Allocasurina decaisneana</i> over <i>Triodia</i> sp (Spinifex)
				<i>Acacia aneura</i> (Mulga) over short grasses (<i>Aristida holathera</i> & <i>Eragrostis eriopoda</i>) and forbs
	2 (Medium)	Swales; flat floor up to 250m wide	As above	As unit 1
	3 (Medium)	Sand rises up to 2m high, 500m wide and continuous for distances. Flat or broadly rounded crests. Steeper north and east flanks, surfaces fixed by vegetation	Red sands	Sparse shrubs and low trees over Spinifex

3.5 Ground water

Most of the successful bores drilled in the project area and surrounds are located within the Georgina Basin sediments. The sandstone, limestone and dolostone units exhibit reasonable primary porosity, whilst fault structures and solution joints provide secondary porosity to facilitate well yields (Jeuken 2012).

Groundwater flows from the margins of the Georgina Basin from north-east, north-west and south-west and converges towards the centre, to an area south of a centre point within the project boundary, and then towards the east (Jeuken 2012). Standing water levels in this area are some 60 to 100m below ground surface (Jeuken 2012). Further information on bore yield is available in Section 2.8.

3.5.1 Ground water chemistry

The salinity of the ground water ranges around 960 to 1430 mg/L TDS and improves toward the south. This gradient in reduced salinity is likely due to recharge during intermittent flow events in the Sandover River

(Jeuken 2012). Australian Drinking Water guideline values suggest that for health reasons salinity levels should not exceed 500 mg/L TDS.

3.5.2 Ground water users and management

The project area is located near but outside of the Western Davenport Water Control District.

Fourteen functional registered bores are identified within a 20 km radius of the centre point in the project area. Most of these bores have been drilled as stock water supply bores, with a few drilled to provide road maintenance supplies and community or station supplies. The water requirement for these uses is low; for stock bores 1-2 L/s is adequate, while the department of roads stipulates 2 L/s as the required supply.

The Ampilatwatja community is located 25km to the south of the Site.

Four bores within the MLA 29463 site have been drilled to 72 to 82m depth and yield 1.5 to 2 L/s of potable water.

3.6 Vegetation communities

The best available vegetation mapping for the region is the Territory wide Vegetation map at 1:1 Million scale by Wilson et al. 1991. This mapping (Figure 3-2) indicates that project areas and the near vicinity is predominantly Acacia tall open shrubland (Class 65) with smaller amounts of Triodia low open hummock grassland (Class 76) occupying the far western and southern portions of the lease area (Table 3-2).

Table 3-2. Vegetation types present with the Ammaroo project area.

Class	Description	Detail
65	Acacia tall open shrubland	<p>Upper Storey: <i>Acacia aneura</i>, <i>Corymbia opaca</i>, <i>Hakea leuconota</i> subsp. <i>leuconota</i> (Shrub Height, >2m, crown cover 20-50%)</p> <p>Mid Storey: <i>Acacia aneura</i>, <i>Senna artemisioides</i> subsp. <i>filifolia</i>, <i>Rhagodia spinescens</i>, chenopod shrub. (Shrub Height 1-2m, Crown cover 5-20%)</p> <p>Ground Layer: <i>Eragrostis eriopoda</i>, <i>Aristida contorta</i>, <i>Solanum quadriloculatum</i></p>
76	Triodia low open hummock grassland	<p>Upper Storey: <i>Eucalyptus pruinosa</i>, <i>Corymbia opaca</i> +/- <i>Eucalyptus setosa</i> (Tree Height, >3-10m, crown cover 0-5%)</p> <p>Mid Storey: <i>Acacia stipuligera</i> +/- <i>Grevillea wickhamii</i> (Shrub Height >2m, Crown cover 5-20%)</p> <p>Ground Layer: <i>Triodia pungens</i>, <i>Triodia schinzii</i> +/- <i>Yakirra australiensis</i> (Hummock grass, Tussock grass Height <0.5m, Crown cover 20-50%)</p>

3.7 Flora and Fauna

Assessment of potential impacts to significant species to the proposed project (to date) has focused on species and habitat listed under EPBC Act 1999 or the TPWC Act 2000. Existing data within a 9449 km² search area surrounding the project, inclusive of the transport corridor, together with the results of the two flora and fauna baseline studies (Figure 3-3), have both been interrogated for species and habitat which are of particular conservation value.

Based on the EPBC matters Search tool and a search of existing data from the NT flora and fauna atlas, there are ten threatened species (either EPBC or Territory listed) known to, or potentially occur within a 30 to 60km buffer of the project (totalling a 9449km² area).

Of the ten threatened fauna species which may be considered as present or potentially present nine are listed as threatened under EPBC Act (Table 3-3). None of the ten threatened fauna species potentially occupying the data search area have been recorded within the boundary of EL25184 (Figure 3-4) or during the surveys.

Seven EPBC listed migratory species are potentially present with the 30 – 60km buffer surrounding the project area (Table 3-4). These are species which are listed in various international conventions to which Australia is a signatory. None of these were confirmed during field surveys.

Based on NT flora atlas data and surveys, no Federal or State listed threatened plant species are present in the project area.

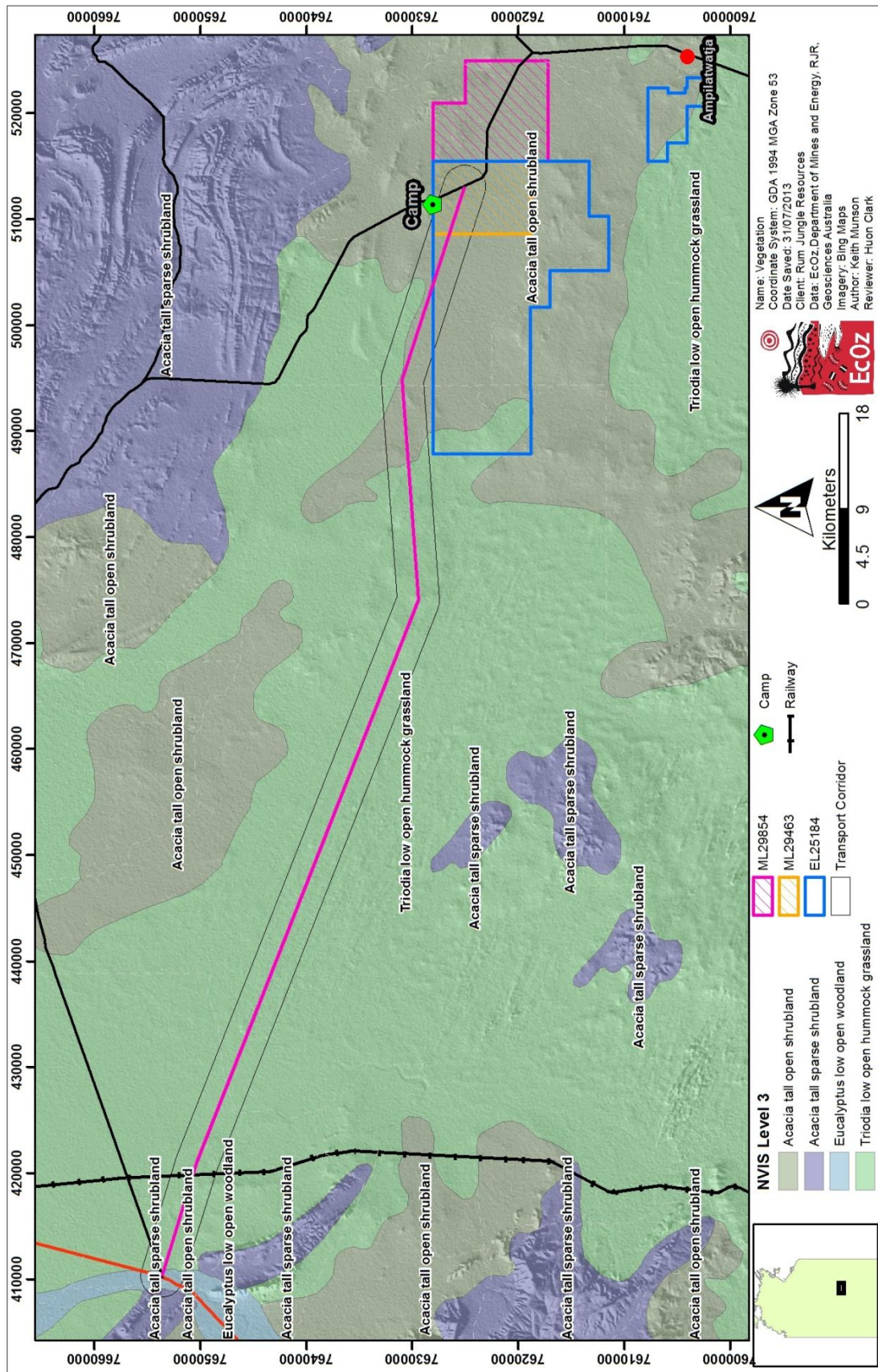


Figure 3-2. Vegetation types present within and in the vicinity of the Ammaroo Project Area.

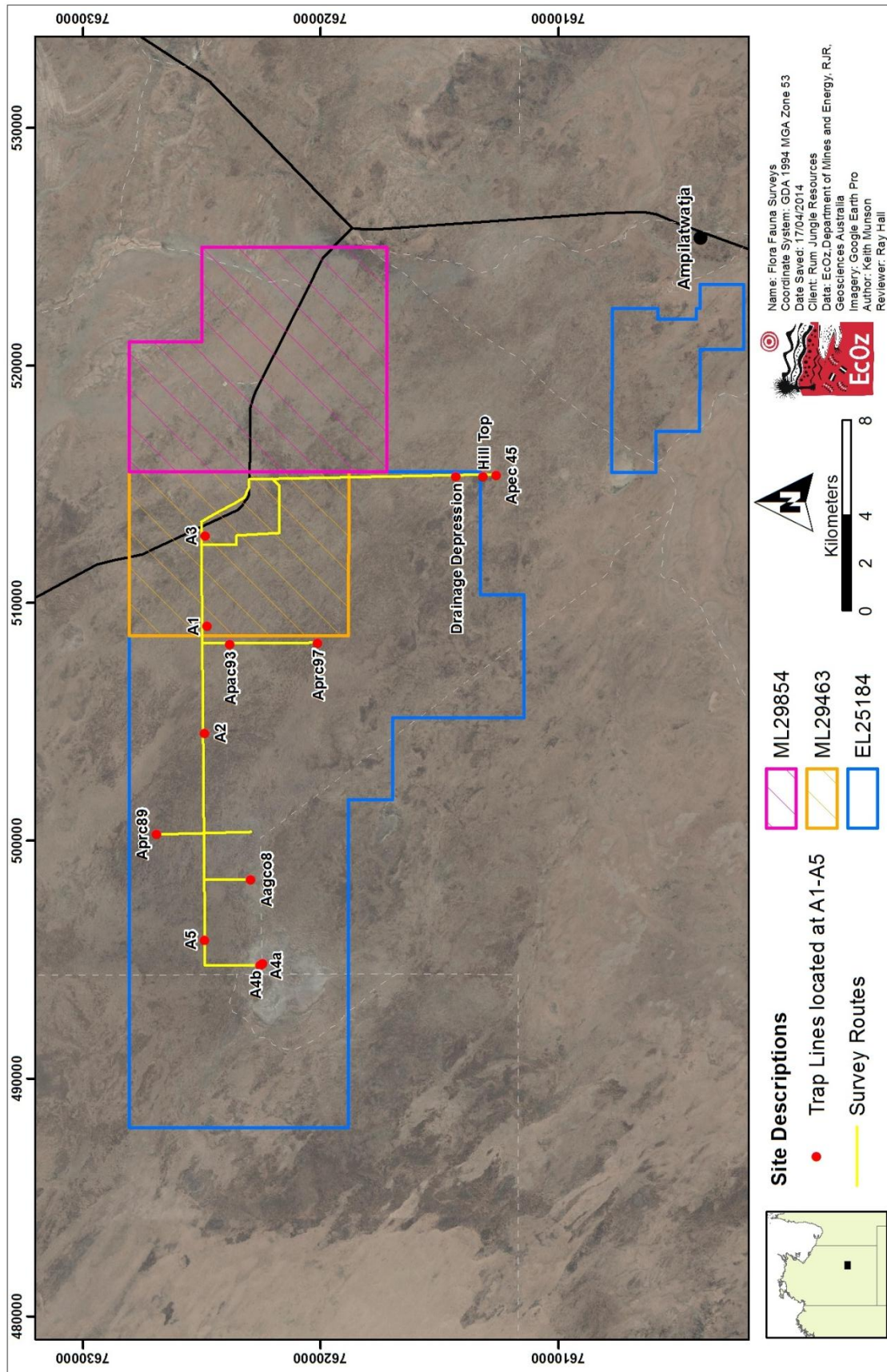


Figure 3-3. Flora and fauna survey locations within EL25184 with claypan in west.

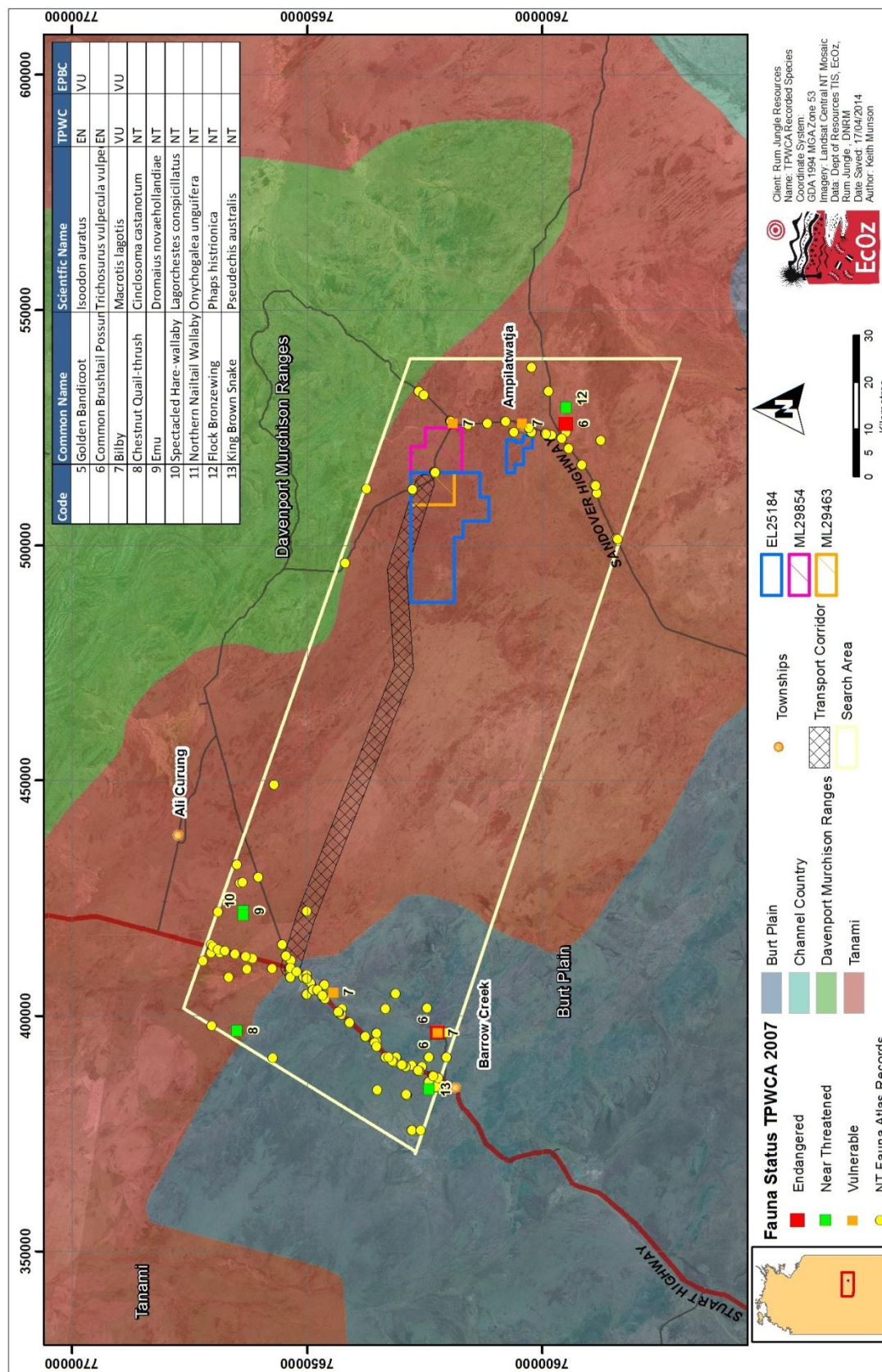


Figure 3-4. Threatened fauna species recorded within a data search area (post 1970) encompassing the MLA and proposed Transport Corridor.

Table 3-3. List of threatened fauna which are either known to or may potentially inhabit the data search area.

Common Name	Scientific Name	TPWC	EPBC
Birds			
Red Goshawk	<i>Erythrotriorchis radiatus</i>	VU	VU
Australian Painted Snipe	<i>Rostratula australis</i>	VU	VU
Mammals			
Central Rock-rat	<i>Zyzomys pedunculatus</i>	EN	EN
Golden Bandicoot	<i>Isodon auratus</i>	EN	VU
Common Brushtail Possum (Sth NT.)	<i>Trichosurus vulpecula vulpecula</i>	EN	
Crest-tailed Mulgara	<i>Dasycercus cristicauda</i>	VU	EN
Bilby	<i>Macrotis lagotis</i>	VU	VU
Southern Marsupial Mole	<i>Notoryctes typhlops</i>	VU	VU
Black Footed Rock Wallaby	<i>Petrogale lateralis</i>	VU	NT
Reptiles			
Great Desert Skink	<i>Liopholis kintorei</i>	VU	VU

Table 3-4. Migratory species indicated to be potentially present according to an EPBC matters search.

Common Name	Scientific Name	TPWC	EPBC
Birds			
Fork-tailed Swift	<i>Apus pacificus</i>		
Great Egret, White Egret	<i>Ardea alba</i>		
Cattle Egret	<i>Ardea ibis</i>		
Oriental Plover, Oriental Dotterel	<i>Charadrius veredus</i>		
Oriental Pratincole	<i>Glareola maldivarum</i>		
Rainbow Bee-eater	<i>Merops ornatus</i>		
Australian Painted Snipe	<i>Rostratula australis</i>	VU	EN

3.8 Weeds and Feral Animals

The NT Infonet data profiler indicates that, within a 20 km radius of the project site and buffer for the transport corridor, seven introduced flora species may potentially be present. The weed species potentially present and their listing under the NT Weeds Act are detailed in Table 3-5.

The Northern Territory *Weeds Management Act 2001* Classifies declared weeds into three categories which are defined as follows:

- **A** - To be eradicated reasonable effort must be made to eradicate the plant within the NT
- **B** - Growth and spread to be controlled Reasonable attempts must be made to contain the growth and prevent the movement of the plant

- **C** – Not to be introduced to the Territory All Class A and Class B weeds are also considered to be Class C weeds. Not to be introduced.

Table 3-5. Weed Species potentially with the vicinity of the project area.

Common Name	Species Name	Listing under the NT Weeds Act
Athel pine	<i>Tamarix aphylla</i>	Class B/C
Buffel Grass	<i>Cenchrus ciliaris</i>	Not listed
Rubber Bush	<i>Calotropis procera</i>	Class B/C
Smaller Stinkgrass	<i>Eragrostis minor</i>	Not listed
Spiked Malvastrum	<i>Malvastrum americanum</i>	Not listed
Parkinsonia	<i>Parkinsonia aculeata</i>	Class B/C
Mesquite	<i>Prosopis spp.</i>	
Caltrop	<i>Tribulus terrestris</i>	Class B/C
Noogoora Burr	<i>Xanthium strumarium</i>	Class B/C

Buffel Grass (*Cenchrus ciliaris*) and Rubber Bush (*Calotropis procera*) have been recorded within the project area through the flora surveys. Parkinsonia (*Parkinsonia aculeata*) is identified as potentially present within the transport corridor. Parkinsonia is a Weed of National Significance (WoNS). If this species is located along the haul road, a management plan will need to be implemented.

The NT Infonet data profiler indicates that within a 20 km radius of the project site and buffer over the proposed transport corridor that eight introduced animal species may potentially present (Table 3-6). Tracks and signs of cat, dingo, rabbit, fox and cattle have been recorded within the EL boundary site through the two fauna surveys.

Table 3-6. Feral animal species potentially present within the vicinity of the project area.

Species Name	Common Name
<i>Canis lupus</i>	Dingo
<i>Camelus dromedarius</i>	Camel
<i>Equus asinus</i>	Donkey
<i>Equus caballus</i>	Horse
<i>Felis catus</i>	Cat
<i>Mus musculus</i>	House Mouse
<i>Oryctolagus cuniculus</i>	Rabbit
<i>Vulpes vulpes</i>	Fox

3.9 Air and Noise

The project area is remote and far from the pollution sources often associated with larger population centres or industry. The only air pollutant likely present at significant concentrations is particulate matter from wind-blown dust and bushfire smoke during the dry season.

The baseline dust levels in terms of Total Suspended Particulates and Particulate Matter less than 10 Microns (PM10) is in the process of being monitored over a four month period.

Baseline noise and vibration levels are also naturally very low in the vicinity of the project with no significant development for several hundreds of kilometres.

3.10 Greenhouse Gasses

The Department of Climate Change and Energy Efficiency (DCCEE) states the Northern Territory's 2009/10 greenhouse gas emissions (using a Kyoto accounting basis) were approximately 14.7 Mt CO₂-e excluding emissions from Land Use, Land-Use Change and Forestry (LULUCF). When the exclusions for LULUCF are taken into account greenhouse gas emissions are approximately 14.514.7 Mt CO₂-e (DCCEE 2012). The principal source of emissions in the NT is Agriculture, predominately the burning of savannahs in Northern Australia.

Greenhouse gas emissions within the mine area vicinity are largely limited to bush fires and methane (CH₄) emitted from pastoral activities.

3.11 Cultural, Heritage & Archaeological Sites

A search of the EPBC Protected Matters search tool indicates that no world heritage properties, national heritage places nor wetlands of international significance are present within the project area or proposed transport corridor.

A search of the AAPA data base for known sites protected under the *Sacred Sites Act* for both the transport corridor and the ML indicates a number of recorded sites and restricted areas along the proposed transport corridor.

RJR has consulted with the Central Land Council (CLC) for a Sacred Sites Clearance Certificates. A number of sacred sites and artefacts are located within the project area.

Rum Jungle Resources has multiple Native Title Agreements over the Ammaroo Phosphate Project. Each of the ELs under the agreement(s) contains areas of various levels of restricted access relating to sacred sites, dreaming trails or other sites of significance to the Aboriginal people. These are documented in multiple generations of Sacred Site Clearance Certificates; the most recent of which is C2013-029 Part A over the area around EL25184 (Barrow Creek 1). The locations of sites of significance and of restricted access are kept in confidence to the Traditional Owners and the CLC. Such sites and areas have deliberately not been depicted on maps here-in.

A search of the NT Heritage data base for the cattle stations inclusive of Neutral Junction, Ammaroo and Murray Downs (NT portions, 3375, 1290 and 2286 respectively) indicates that there are no registered Heritage sites for these NT portions within the vicinity of the project.

Although there are no previously recorded prescribed Aboriginal archaeological sites located within EL 25184 or along the proposed haul road route, this may be due to the fact that no archaeological surveys have been conducted in that specific area, rather than an absence of sites.

Archaeological surveys and full AAPA Clearance for both the ML and transport corridor are scheduled to be undertaken.

3.12 Socio-economic Context

The area around the Ammaroo project area is sparsely populated. However there are significant Aboriginal communities in the area (Ampilatwatja, Alekarenge {Ali Curung}, Arlparra and Murray Downs) with high unemployment levels and few opportunities. The nearest sizable towns located from the centre of the project area are Ampilatwatja located approximately 25 km south-east (approximately 30 km by road) and Ali Curung located approximately 100 km north-west (109 km by road).

Reference to the Australian Bureau of Statistics 2011 census data (ABS 2012) indicates that Ampilatwatja had a population of 365 persons of which 341 (93%) were indigenous persons. The median age was 24 years. There were 40 people working in some form of employment, with most of these working full time (63%). There was 37.5% unemployment at the time of the 2011 census (ABS 2012).

In Ampilatwatja 95% of the people lived in separate dwellings the majority of which (74%) were State or Territory housing authority dwellings. Most dwellings typically housed more than 6 persons (67%) and paid between \$0-\$74 rent per week (77%). Twenty people (0.05%) held certificate of higher levels of education, of which the majority (65%) were females.

Alekarenge (Ali Curung) is slightly larger with a population of 535 of which 96% were Indigenous persons. The median age for Alekarenge was 21 years at the time of the 2011 census. The dominant language spoken is Warlpiri and Alyawarr spoken at home with English as a second language. There were 69 people who reported being in the labour force in the week before Census night in Alekarenge and the majority (49%) of these reported to be working part time (ABS 2012).

In 2011 there were 69 private dwellings occupied by Aboriginal and Torres Strait Islanders in the Alekarenge Indigenous Locations area, and these were predominantly (92.8%) separate houses (ABS 2012). The average household size was 5.8, with 2.3 persons per bedroom and 0.3 registered motor vehicles per dwelling (ABS 2012). The median weekly rent was \$40 and none of the surveyed households were purchasing a home through a mortgage (ABS 2012).

Nearest training institutes in the region are located in Tennant Creek (300 km north by road) and Alice Springs (300 km South by road via the Sandover Highway).

While economic growth may present new opportunities for remote community residents, they need to have the required skills set to take advantage of this. Currently employment is most commonly through Community Development Employment Projects (CDEP) funded work and pastoral stations.

RJR will seek advice from the CLC and other relevant organisations so as to be able to maximise employment opportunities for local people.

4 Legislative Framework

4.1 Australian Government Legislation

Environmental Protection Biodiversity Conservation Act

Under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the minister).

Assessment under the Commonwealth EPBC Act is required for actions that are likely to have a significant impact on a matter of national environmental significance or for actions on Commonwealth land the environment or undertaken by Commonwealth agencies.

The matters of National Environmental Significance are:

- World Heritage properties
- National Heritage places
- Wetlands of international importance (Ramsar wetlands)
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines).

The Australian Government Department of the Environment (DoE) administer the Act and have established a formal referral and assessment process. If DoE determines a project is likely to significantly impact a matter of national significance the project is declared a “controlled action” and is required to undergo assessment and approval under the EPBC Act. In the Northern Territory this means the environmental assessment will be through the bilateral agreement between the Northern Territory and Australian Governments. If DoE declares the project a “non-controlled” action, assessment will proceed under the Northern Territory legislative approvals process only.

National Environment Protection Measures (Implementation) Act 1998

Under the National Environment Protection Measures (Implementation) Act 1994, the National Environmental Protection Council (NEPC) was established to set national environmental objectives and standards for Australia through the development of National Environment Protection Measures (NEPMs). The NEPC is part of the Environment Protection and Heritage Council.

Section 14(1) of the NEPC Act prescribes that NEPMs may relate to any one or more of the following:

- Ambient air quality
- Ambient marine, estuarine and fresh water quality
- The protection of amenity in relation to noise
- General guidelines for the assessment of site contamination
- Environmental impacts associated with hazardous wastes

- The re-use and recycling of used materials.

NEPM's are made by NEPC ministers and implemented in each jurisdiction.

Native Title Act 1993

Native title is the recognition in Australian law that some Indigenous people continue to hold rights to their land and waters, which come from their traditional laws and customs. The *Native Title Act 1993* sets out basic principles regarding native title in Australia and establishes a regulating and governing body, the National Native Title Tribunal. The Act sets out processes by which native title rights are determined, protected and compensated for, should they be impaired or extinguished.

Final decisions over native title claims can take time therefore a system called the 'future act process' was devised to facilitate dealings that would affect native title both during the claim process and after native title is recognised. Native title claimants and those recognised as native title holders have the right to negotiate about some future acts, such as the grant of a mining lease or proposed developments. Claimants only gain this right if their native title claim satisfies all of the registration test conditions.

The project area does not have a native title claim declared but there are three in progress. The provisions of the *Native Title Act 1993* do apply as the applications have satisfied the registration test therefore the Right To Negotiate applies. At the request of the Central Land Council (CLC), Rum Jungle Resources has undertaken to ensure that the environmental permitting process of the project meets the requirements of Section 46 of the Aboriginal Land Rights (Northern Territory) Act..

Another important function of the Act is through facilitating Indigenous Land Use Agreements (ILUA's) between native title parties and other interest holders. Land Use Agreements may be used as part of the negotiations leading to a consent determination of native title. Alternatively, they may be made entirely separate from the determination process. The parties to the agreement apply to the Registrar of the Tribunal to have the agreement registered. If an ILUA is entered onto the Register of Indigenous Land Use Agreements, it binds all native title holders to the terms of the agreement, even those who are not a party to the agreement, so long as it remains on the Register.

Aboriginal Land Rights (Northern Territory) Act 1976

The Aboriginal Land Rights (Northern Territory) Act 1976 provides for the granting of inalienable freehold title to traditional Aboriginal owners of land in the Northern Territory, the establishment of Land Councils, and the establishment and management of Land Trusts to hold the Aboriginal land for the benefit of traditional owners of the land. The Act also regulates exploration and mining on Aboriginal land and sets out the processes to be followed when negotiating with Traditional Owners (TO) for access to and leases over Aboriginal land. An exploration license cannot be granted in relation to Aboriginal land without the consent of the relevant Land Council (for the traditional owners) and the Minister. A mineral lease cannot be granted unless an agreement has been entered into under the Act.

Other Relevant Australian Government Acts

Other Australian Government legislation relevant to the project includes the following acts and their associated amendments and regulations:

- Aboriginal and Torres Strait Islander Heritage Protection (ATSIHP) Act 1984
- Environment and Heritage Amendment Act No. 1 2003, No 88 2003
- Protection of Movable Cultural Heritage (PMCH) Act 1986.

The purpose of the ATSIHP Act is the 'preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, that are of particular significance to Aboriginals in accordance with Aboriginal tradition' (section 4). The ATSIHP Act is meant to provide a last resort for Indigenous

Australians to seek protection of their traditional areas and objects, if there is no effective protection of the areas or objects under the laws of their state or territory.

Environment and Heritage Amendment Act amends the *Environment Protection and Biodiversity Conservation Act 1999* to identify, conserve and protect places of national heritage significance and to provide for the identification and management of Commonwealth heritage places. The Act contains transitional provisions in relation to places included in the current Register of the National Estate.

The PMCH Act prohibits the export of prescribed Indigenous objects, such as sacred objects and human remains, bark and log coffins used as traditional burial objects, rock art, and carved trees (dendroglyphs).

4.2 Northern Territory Government Legislation

Environmental permitting of mining activities is regulated in the NT by both the *Mining Management Act* and the *Environmental Assessment Act*.

Environmental Assessment Act

The Environmental Assessment Act and the Environmental Assessment Administrative Procedures establish the framework for the assessment of potential or anticipated environmental impacts of development, and provide for protection of the environment. The NT Minister for Lands, Planning and the Environment is responsible for administering the Act. The Minister also determines the appropriate level of assessment for new developments or material changes to existing operations, based on the sensitivity of the local environment, the scale of the proposal and its potential impact upon the environment.

This NOI is informing the administrators of the *Environmental Assessment Act* of the proposed activity so that the appropriate level of assessment required for determining how the potential impacts of the project may be addressed.

The Mineral Titles Act and Mining Management Act

The *Minerals Titles Act* and the *Mining Management Act* are the principal legislation for the regulation of mining proposals in the Northern Territory, both of which are administered by the Department of Mines and Energy.

The *Minerals Titles Act* establishes the framework within which activities to explore and mine mineral resources can occur. The Act sets out the administrative processes for authorising these activities through the granting of a title.

An authorisation for mining activities is required under the *Mining Management Act* for activities that will result in substantial disturbance of the ground. The objectives of the *Mining Management Act* are to ensure that the development of mineral resources is in accordance with the best practice health, safety and environmental standards and to protect the environment and health and safety of all persons on mining sites.

Under the *Mining Management Act*, an application for an authorisation to carry out mining activities must be accompanied by a Mining Management Plan (MMP). An MMP includes information relating to the description of mining activities, the management system to be implemented for the management of health, safety and environmental aspects, costing of closure activities and particulars of organisational structure. Plans of any existing or proposed mine workings and infrastructure must also be included. The MMP is required to be reviewed annually as specified in the authorisation to carry out mining activities.

The Ammaroo project will be required to operate under an approved Mining Management Plan.

Territory Parks and Wildlife Conservation Act

The *Territory Parks and Wildlife Conservation Act* is administered by the Territory Parks and Wildlife Commission and makes provision for the establishment of Territory parks and reserves as well as and the study, protection, conservation and sustainable utilisation of wildlife.

A permit system managed by the Northern Territory Parks and Wildlife Commission serves to monitor and manage native flora and fauna and to protect them against potential damage. Permits are required for conducting, camping, filming, driving off road, scuba-diving, fishing and other actions which may impact on wildlife. All commercial activities and disturbance to natural features and use of certain substances are some of the activities that required to be permitted if they are being conducted within a Protected Area. These permits are known as By-Laws and are governed under the *Territory Parks and Wildlife Conservation Act 2006* and the Territory Parks and Wildlife Conservation By-Laws (as of 2008).

The Water Act

The *Water Act* is administered by the Department of Land Resource Management and it provides for the investigation, allocation, use, control, protection and management of surface water and groundwater resources, as well as the administrative process for licensing these activities. The Act allows the enforceable allocation of water to various declared beneficial uses including; agriculture, aquaculture, public water supply, riparian and industry, while ensuring that adequate provisions are made to maintain cultural and environmental requirements.

Water Control Districts are declared in areas where it is recognised that increasing development and demand for water have the potential to cause degradation to water quality and reduce flows required to maintain water dependent ecosystems in the region. The Mining Project Area is not located within a Water Control District; however, it does occur just outside the Western Davenport Water Control District declared 11 October 2007. Transport of product to the rail spur is likely to occur through this Water Control District.

Northern Territory Aboriginal Sacred Sites Act

The Northern Territory *Aboriginal Sacred Sites Act* recognises the need to preserve and enhance Aboriginal cultural tradition in relation to certain land in the NT and Aboriginal self-determination. The Act provides for the protection and registration of sacred sites by the traditional owners of the sacred sites or the custodians who have the responsibility for protecting a sacred site in accordance with Aboriginal tradition.

The Aboriginal Areas Protection Authority (AAPA) is responsible for administering the Act and records and maintains a sacred sites register. Custodians may apply to the AAPA to have a sacred site included in the Register and may also include, amongst other things, restrictions on activities that may be carried out on or in the vicinity of the sacred site.

Unauthorised entry on to a sacred site is an offence under the Act and penalties are prescribed accordingly. A person or entity may apply to the Authority to issue an Authority Certificate to allow a person or entity to undertake work on or in the vicinity of a sacred site. Again, unauthorised entry to undertake work on or in the vicinity of a sacred site is an offence under the Act and penalties are prescribed.

The Minister may issue a Minister's Certificate for work to be undertaken on or near a sacred site when an Authority Certificate has not been issued. Whilst a Minister's Certificate has the same effect as an Authority Certificate, in the event of variance the Authority Certificate will have no force or effect.

The Act provides for the preservation of proprietary rights of owners of land comprised in a sacred site. Proprietary owners may enter and remain on that land and do anything on that land for the normal enjoyment of that owner's proprietary interest in the land.

Heritage Act 2011

The Northern Territory's Heritage Act 2011 is administered by the Department of Lands, Planning and the Environment. The object of this Act is to provide for the conservation of the Territory's cultural and natural heritage. The Heritage Council is the body responsible for assessing the heritage significance of places and making recommendations to the Minister for Lands, Planning and the Environment about whether or not a site or area should be declared as a heritage place. The Heritage Council is also responsible for making decisions about whether or not to approve works to heritage places (other than major works, which must be approved by the Minister for Lands, Planning and the Environment).

4.3 Other relevant Northern Territory Legislation

Northern Territory legislation relevant to the project includes the following acts and their associated amendments and regulations:

- Bushfires Act
- Control of Roads Act
- Crown Lands Act NT
- Dangerous Goods Act
- Environmental Offences and Penalties Act
- Fisheries Act
- Mineral Royalty Act
- Mineral Titles Act
- Mining Management Act
- Planning Act
- Public and Environmental Health Act 2011
- Soil Conservation and Land Utilisation Act
- Traffic Act
- Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act
- Waste Management and Pollution Control Act
- Water Supply and Sewage Services Act
- Weeds Management Act 2001
- Work Health and Safety (National Uniform Legislation) Act 2011.

5 Potential impacts and management measures

5.1 Surface water

5.1.1 Potential impacts

Local surface water may be affected by:

- Contaminants in surface runoff;
- Eroded sediment from disturbed areas, the fines storage facility and temporary waste rock stockpiles;
- Changes in surface water quantity, downstream of the dam site;
- Leachate from waste rock and ore, particularly that with acid generating potential; and
- Altered surface water flow patterns due to incorrect surface water management on site.

5.1.2 Mitigation and management measures

Impacts associated with altered surface water flows and potentially contaminated water may be managed through the following measures:

- Infrastructure design and placement will factor in the need to minimise disturbance and retain the natural surface flows as much as possible.
- Where surface flows may have the potential to be concentrated (e.g. roads) drainage design will ensure surface flows are dissipated evenly and potential sediments trapped to avoid increased erosion risk and sediment movement.
- Bare areas will be kept to a minimum and re-vegetation promoted as soon as possible. Contouring and ripping will be employed to minimise wind and water erosion potential while areas are exposed and devoid of vegetation.
- Chemicals and hydrocarbons will be stored in accordance with relevant legislation and standards (AS1940:2004) and a Hydrocarbon and Chemical Management Plan to be developed.
- Surface water diversion structures will be designed, installed and managed to enable non-contaminated water to be directed around disturbance areas.
- Contaminated water from work areas will be kept separate from clean storm water.
- Erosion and sediment control structures will be installed downstream of disturbance areas.
- Cleared vegetation and topsoil will be stockpiled away from watercourses and in discrete stockpiles to avoid any interference to surface flows.
- Water interfacing with workshop and machinery maintenance areas will be directed to oil/water separators.

5.1.3 Further investigations

A surface water management plan will be established prior to the onset of construction and development. This will outline locations of surface water management infrastructure as well as any monitoring programs. Due to the arid nature of the region rainfall, and therefore the presence of surface water bodies, is highly

intermittent and irregular. As a result, surface water sampling would be conducted on an opportunistic basis, in line with any rainfall events and the subsequent potential for surface water bodies to form.

5.2 Ground water

5.2.1 Potential impacts

The potential impacts to groundwater relate to:

- Groundwater extraction. Groundwater will be used to provide water for the construction and operation of the project. Groundwater extraction may adversely impact regional groundwater resources and affect existing operating bores.
- Groundwater contamination. Contaminants have the potential to enter groundwater aquifers from spills or seepage from waste rock storages and final voids.

5.2.2 Mitigation and management measures

Management measures to reduce or avoid impacts associated with reduction in groundwater quality and quantity may include:

- Groundwater extraction in accordance with the relevant NT Government authority.
- Groundwater abstraction rates will be monitored to ensure groundwater resources are not adversely impacted.
- Groundwater used for construction and operation activities will be disposed of in an approved manner.
- The mine will be designed to ensure the safe storage, bunding and handling of hazardous materials to prevent contamination.
- If new bores are required to be installed in any area of the Project, the required approvals and licenses will be sought from the relevant NT Government authority prior to construction and commissioning.

5.2.3 Further investigations

Current studies include: “*Hydrogeological Review and Identification of Groundwater Supply*” undertaken by Ground Water Science. Further studies include drilling and hydrological assessment, ground water modelling, calculation of a water balance and a proposed monitoring program.

5.3 Erosion and sediment movement

5.3.1 Potential impacts

The mine project will result in an increased area of bare exposed earth and construction of infrastructure and land forms which may influence the surface water flow and increase the likelihood of both wind and water driven erosion.

5.3.2 Mitigation and management measures

Management measures to reduce or avoid impacts of increased erosion potential associated with projects clearing and infrastructure may include the following:

- Bare areas to be kept to a minimum and re-vegetation promoted as soon as possible. Contouring and ripping will be employed to minimise wind and water erosion potential while areas are exposed and devoid of vegetation.
- Infrastructure design and placement will factor in the need to minimise disturbance and retain the natural surface flows as much as possible.
- Initial clearing should be carried out using the raised blade technique to retain the root stock of the remaining vegetation.

Where surface flows may have the potential to be concentrated (e.g. roads) drainage design will ensure surface flows are dissipated evenly and potential sediments trapped to avoid increased erosion risk and sediment movement.

5.3.3 Further investigations

An Erosion and Sediment Control Plan will be developed.

5.4 Flora and Fauna

5.4.1 Potential impacts

Impacts to flora and vegetation will be primarily caused through land clearing. Potential impacts to flora and vegetation as a result of Project activities are summarised below:

- Loss of threatened fauna, flora and ecological communities;
- Habitat fragmentation and reduced connectivity;
- Impacts on vegetation communities and flora due to changes in surface water hydrology;
- Decline or loss of vegetation as a result of dust emissions and saline dust suppressants;
- Clearing of vegetation in excess of permitted allocation (non-compliance);
- Mortality of small and sedentary fauna that are unable to move out of the area prior to clearing;
- Loss of biodiversity and ecological function;
- Change in community structure due to the negative response of wildlife to new stimuli;
- Increase in feral predator numbers leading to increased predation rates on native animals;
- Increased weed species may contribute to a decline in overall species richness, canopy cover or frequency of native species;
- Increased likelihood of vehicle strikes to native fauna;
- Open voids such as steep sided mine pits, uncapped drill holes and steep sided bunded areas can trap fauna species; and
- Localised reduction in ecological function can be expected as a result of habitat loss, fragmentation, traffic, noise, and pollution.

5.4.2 Mitigation and management measures

Management of impacts to flora and fauna may include the following:

- Vegetation clearing will be minimised throughout the mining process;

- DLRM will be consulted regarding the management of any potential rare, priority and significant fauna species;
- Where practicable, project design will incorporate the principles of avoiding and minimising impacts to fauna habitats;
- Disturbed areas will be progressively rehabilitated with local species that provide suitable habitat for native fauna;
- Foundation holes, drill holes and trenches will be covered, fenced, bunded or otherwise capped to prevent fauna entrapment. Where appropriate fauna egress matting will be installed;
- Native fauna will not be captured, taken or fed without the appropriate permits;
- Vehicle speed limits on site will be set and enforced;
- Any injuries or fatalities to fauna will be reported to the Site Environmental Manager, as an environmental incident;
- Barbed wire will not be used in the Project area;
- All personnel will be provided with training to assist in their general awareness and understanding of fauna species and feral fauna;
- Fires will not be permitted on site without appropriate approvals and safety precautions;
- Vehicle inspections will be carried out particularly when leaving areas with a high occurrence of weed species and into areas with low weed numbers or significant species/habitat;
- Site personnel will be provided with training to raise awareness, particularly with regard to identification of Weeds of National Significance; and
- Pre-clearance surveys of the haul road route will identify conservation areas and locations where weed management measures will be required. Where possible, habitat trees will be retained and the ROW reduced in conservation areas to reduce the impact in these areas. Further investigations

5.4.3 Further Investigations

Further studies will including vegetation and habitat mapping within the mining lease and proposed transport corridor. Targeted surveys will be conducted for threatened fauna which may inhabit the area. Targeted fauna and flora surveys may also be required along the transport corridor if any unique or sensitive habitats are located during these further studies.

5.5 Air and Noise

5.5.1 Potential Impacts

The main air quality issues that may arise during the construction and operation of the project include an increase in dust levels with potential to have adverse effects on human health, vegetation and visual amenity. The main sources of dust include:

- Excavations and clearing activities;
- Loading and unloading of ore and waste rock;
- Truck and vehicle movements over unsealed roads; and
- Wind erosion from exposed surfaces (e.g. stockpiles).

Vehicle and processing plant emissions of fuel combustion products such as carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and particulate matter will occur and also have the potential for minor adverse impacts to local air quality.

Noise impacts include:

- Excessive noise may cause fauna species to move away or alter their behaviour; and
- Noise can attract feral predators to areas as they associate human activity with food resources. An increase in feral predator numbers will result in a corresponding increase in predation rates on native animals.

5.5.2 Management

Management of impacts to air quality and noise may include the following:

- A dust monitoring program will be established as part of Rum Jungle Resources environmental management system.
- All vehicles will be required to stay on defined tracks and roads unless otherwise authorised
- Dust suppression measures will be used such as water trucks, spray bars and cannons;
- Speed limits will be set and enforced;
- The extent of exposed areas susceptible to wind erosion will be minimised;
- Rehabilitation will be undertaken progressively to minimise exposed soil;
- High dust-generating activities will be limited during adverse weather conditions;
- Design of construction and operations to incorporate methods to minimise vehicle movements and duplication of activities to reduce cost, greenhouse gas emissions and increase efficiency;
- Energy consumption will be considered as a criterion in equipment selection;
- design of power infrastructure will incorporate energy efficiency and innovative methods for reducing the carbon footprint of the site, such as waste heat recovery;
- Vegetation clearing will be minimised where practicable;
- Progressive rehabilitation of open areas will result in partial offsets of emissions over the life of the Project;
- Alternative fuels will be investigated for use for onsite power;
- A Greenhouse Reduction Program will be implemented onsite to identify and reduce greenhouse emissions on an ongoing basis;
- All vehicles and plant will be maintained in accordance with manufacturer's instructions and the site maintenance schedule.

5.5.3 Further Investigations

Noise and air emission assessments will be conducted to gain an understanding of the degree of potential impacts and management plans developed.

5.6 Cultural heritage and archaeological sites

5.6.1 Potential impacts

Sites of indigenous or cultural heritage significance may exist in the area. Potential impacts include:

- Direct destruction or damage through mining activities
- Mining infrastructure preventing access by traditional owners / interested parties.

5.6.2 Mitigation and management measures

Exploration activities are undertaken in accordance with a Mining Management Plan approved by the NT Department of Mines and Energy. Rum Jungle Resources has consulted with the Central Land Council (CLC) regarding the proposed mining activity.

All activities will be in accordance with issued certificates and agreements. Other management measures to reduce or avoid impacts with associated disturbance or destruction of cultural heritage and archaeological sites may include:

- The site inductions for employees and subcontractors shall incorporate awareness of the legislative obligations for protecting cultural and heritage sites, how to recognise potential cultural and heritage sites, and the steps for reporting their discovery.
- Establishing a specific protocol to be followed in the event that a suspected indigenous site, object or burial is discovered.
- Clearance/disturbance permits will be obtained for any ground disturbance within the ML.
- Establishing sound working relations with those having a cultural connection to the area affected by the project which will be initiated through a stakeholder consultation processes.

5.6.3 Further investigations

RJR is seeking a clearance certificate from the Aboriginal Areas Protection Authority. Archaeology assessment will be carried out for both the proposed ML and transport corridor.

5.7 Socio-economic environment

5.7.1 Potential impacts

A mining project of this scale has potential for both positive and negative social and economic impacts on the local communities depending on the size of the fly in/fly out workforce and pressure placed on the local community services.

5.7.2 Mitigation and management measures

Socio-economic impacts may be managed by undertaking the following:

- Place a high emphasis on stakeholder consultation to foster and maintain good relationships and continue to consult with the community through all phases of the project cycle.
- Consultation with relevant government agencies and local registered training organisations to discuss training and skill requirements.

- Preferentially source people, goods and services from within the local region and the Northern Territory.
- Invest in training and education programs for employees and potential employees.

5.7.3 Further investigations

Rum Jungle Resources will undertake continuous community consultation based on open sharing of information with all stakeholders and communities. Rum Jungle Resources has commenced consultations with key stakeholders such as Australian and Northern Territory Government departments, land councils, land managers, land owners and traditional owners.

5.8 Traffic and transport infrastructure

5.8.1 Potential impacts

The project will be constructing a transport corridor to traverse between the project area and the Stuart Highway.

There is the potential to impact upon existing infrastructure (such as the Stuart Highway) and users. There will be potential increases to local and regional traffic volumes and traffic type during both construction and operations.

5.8.2 Mitigation and management measures

All appropriate laws and regulations associated with the use of public roads and other infrastructure will be abided by. Management measures to reduce or avoid any impacts will include:

- Ensuring the traffic load is within the capacity of the existing road network and will not cause any disturbance to it.
- Provision of measures such as escort vehicles and appropriate signage for heavy haulage of construction and mining equipment to site.
- Construction of temporary diversion roads for local traffic (if required).

5.8.3 Pipeline (option 2 and 3 only)

Product may be transported to the rail siding by pipeline. Potential impacts associated with this option include pipeline failure or leak resulting in product spillage. Management strategies, such as spill response and regular pipeline inspections, will need to be employed to ensure the integrity of the pipeline is not compromised. There are two options for a pipeline: 1) above ground, or 2) below ground. The decision on this will be influenced by cost, life of mine and safety aspects. If the pipeline is decided to be underground, the construction of this involves digging a trench before backfilling it once the pipeline has been constructed and lowered into the ground. This increases the chance and likelihood of erosion issues. Regular inspections of the pipeline corridor will allow early detection of such issues and management strategies put in place. Access to the pipeline should be restricted to mining personnel to minimise the chances of a fault or avoidable accident occurring.

5.8.4 Further investigations

RJR will develop a Traffic Management.

5.8.5 Further investigations

A dust monitoring program has been established to determine baseline air quality levels. Further studies will be undertaken to estimate greenhouse gas emissions and their offsets in accordance with the NT Environmental Impact Assessment Guide – Greenhouse Gas Emissions and Climate Change.

5.9 Phosphoric acid (Option 3)

5.9.1 Potential impacts

According to the Australian Government National Pollution Inventory website, Phosphoric and the Sulphuric Acid inputs can have toxic impacts on aquatic and other life. Small quantities can be neutralised quite easily, nevertheless large quantities can acidify soils for extended periods of time. Risks associated with spillages and the subsequent environment damage needs to be considered in the event of a plant or pipeline failure or road or rail accident. Methods of minimising the risk associate with this, as well as emergency response, will also need to be explored.

The waste stream from the plant is generally Calcium Sulphate (Gypsum) which would be stacked in specifically designed waste dumps and dried. Liquid waste from the gypsum stacks and the plants, which will be acidic, will need to be captured and stored in appropriate storage facilities and recycled through the plant. The gypsum could be subsequently relocated to open mining pit areas for rehabilitation, which would add cost or as is done in the United States, the gypsum stacks can be re-planted in their own right and rehabilitated, albeit, changing the natural topography of the land.

5.9.2 Mitigation and management measures

Impacts associated with Phosphoric and Sulphuric Acid may be managed by undertaking the following:

- Implement a strategy that prevents and minimises the likelihood of a spill
- Implementing an Emergency response and spill response program
- Regular staff training in emergency and spill response
- Regular inspection of storage and transportation devices
- The use of spill prevention techniques and infrastructure as per Australian Standards and guidelines (i.e. bunding).

6 Environmental Management

6.1 Environmental Management Plans

Management commitments will be developed and finalised throughout Project planning and through the development of the Project EMP and Mining Management Plan (MMP). The Project EMP will be developed within the framework of an Environmental Management System (EMS) based on ISO14001 criteria. Rum Jungle Resources has undertaken a number of baseline environmental studies of the proposed site; including vegetation and flora surveys. Further studies will be undertaken as project planning progresses and project scope is finalised, studies may include; surface water, groundwater, dust modelling, noise modelling, geotechnical studies, aboriginal and European heritage surveys and greenhouse gas emission assessments.

A central component of the Project EMP is to identify those activities that may have a significant risk to the natural environment and develop management strategies to:

- Completely avoid the impact if possible;
- Substitute with a lesser impact;
- Design rehabilitation and engineering solutions to reduce the degree and risk of impact; and
- Design operational controls and emergency response around reduction of impact.

In assessing the significance of environmental impacts potentially resulting from this proposal, Rum Jungle Resources will consider relevant legislation, standards and guidelines; biological assessments of the Project area and input from government and stakeholders.

A risk-based Project EMP will be developed for the project to:

Document project commitments;

- Document potential impacts, management measures, and key performance indicators, monitoring and reporting requirements;
- Document conditions of approval resulting from the environmental approval process; and
- Provide the basis for the development of environmental guidelines and work procedures to be prepared by the construction contractor.

The Project EMP will include objectives and management strategies that address:

- Surface Water Management;
- Groundwater Management;
- Vegetation and Flora Management;
- Fauna Management;
- Dust Management;
- Greenhouse Gas Emissions Management;
- Weed Management;
- Fire Management;
- Hydrocarbon and Chemical Management;
- Aboriginal Heritage Management;

- Rehabilitation Planning and Management;
- Topsoil Management; and
- Closure Planning.

6.2 EMP Implementation

Information contained within the EMP will be dispersed to personnel to ensure that each employee understands their role in ensuring that Rum Jungle Resources conducts construction activities and operations in an environmentally sound manner.

The objectives of communicating environmental issues include:

- Provides access to information for all Rum Jungle Resources employees;
- Ensures that employees are aware of, and understand, their accountabilities for environmental management;
- Facilitates internal auditing and reporting;
- Enables regulatory reporting;
- Encouraging employee involvement in continuously improving environmental systems and procedures;
- Providing information on Rum Jungle Resources environmental performance to the broader community; and
- Addressing environmental concerns of local communities.

Communication on environmental issues can take on many forms with a variety of audiences. Various methods of communication will be pursued both internally and externally. In addition to this, new employees will undergo an induction which will include detail on the Rum Jungle Resource's environmental systems and procedures. Management plans will be made available to the public.

Elements of the EMP will be continuously updated to incorporate further information, new techniques and relevant legislative requirements and adaptations resulting from monitoring results. Implementation strategies will be directed to achieving the performance criteria set out in the EMP and any statutory requirements.

6.3 Environmental Assessment and Corrective Actions

Rum Jungle Resources will promote the use of systems and procedures that encourage continual improvement. This will include robust monitoring systems which will provide information to assist in assessing the environmental performance and the effectiveness of its procedures. Should inadequacies be detected then appropriate measures can be implemented to mitigate risk to the environment.

Audits and inspections are another method which will be employed to monitor the effectiveness of management systems at Rum Jungle Resources. Both internal and external avenues will be used for audits and inspections. Outcomes of these audits will be documented and action plans implemented to address any issues that may have been raised.

Reviews of the management system and its effectiveness will be conducted annually. This review will identify any gaps in the system to allow management to allocate necessary resources to facilitate any improvements to the management system. Management systems will be reviewed, monitored and evaluated against key environmental performance standards to ensure environmental compliance.

Other Environmental Monitoring

Monitoring of environmental changes is a crucial part of an environmental management system. Monitoring should focus on threats, pressures and opportunities. Rum Jungle Resources will develop an environmental monitoring program, as part of the EMP, and will include:

Identification and monitoring of trends and threats;

Identification and monitoring of potential long term impacts/patterns;

Identification and exploration of emerging opportunities;

Monitoring of both direct and indirect impacts;

Strategies for assessing and measuring effectiveness of policies and/or projects; and

Provision for updating policies, plans, strategies and projects.

If monitoring indicates that the desired level of protection is not being met, improved techniques or management methods will be initiated to guarantee the standard of protection expected by stakeholders and the general public.

7 Stakeholder consultation

7.1.1 Stakeholder engagement

Stakeholders are parties with an interest in the project who can potentially influence, or are influenced by its development. The currently identified stakeholders of the RJR project are listed in Table 7-1.

Potential unfavourable responses to the Project may arise from stakeholders including community groups, individuals, landholders, government bodies, indigenous groups and traditional owners, decision-making authorities and non-government agencies.

Concerns anticipated to be raised by local communities/landholders include:

- Availability of resources e.g. water, infrastructure
- Noise and traffic levels
- Population changes
- Employment opportunities
- Infrastructure capability and suitability
- Local economic issues
- Cultural impacts including disturbance to unidentified heritage areas
- Greenhouse gas emissions
- Changes to biodiversity
- Habitat destruction and clearing of native vegetation
- Waste dumps and tailings dams
- Groundwater impacts
- Weed/disease introduction/spread.

Community consultations will focus on raising awareness of the project, employment and future employment opportunities that might exist, and developing an engagement and participation strategy.

A Community Impact Assessment may be undertaken and conducted on behalf of RJR in relation to this Project. The purpose and objective of a Community Impact Assessment will be to assist RJR and the stakeholder to better understand regional concerns in order to:

- Make informed decisions regarding models of community engagement that will enhance community consent and support for continued exploration, development, construction and the ongoing operation of the RJR project;
- Ensure that commitments and community investments (financial and non-financial) are achievable and have maximum impact
- Ensure business and employment opportunities in the communities of interest can be maximised.

Indigenous groups, local residents, local community members and local businesses will be a key focus of a Community Impact Assessment to assist RJR in meeting its corporate and operational objectives in community relations.

Table 7-1. Stakeholder List for the Ammaroo Project.

Interest Group	Stakeholder Name
Northern Territory Government	Minister for Lands Planning and the Environment Minister for Mines and Energy Department of Lands, Planning and the Environment Department of Land Resource Management Power Water Corporation Aboriginal Areas Protection Authority Environmental Protection Authority
Local Government	Barkly Shire Council
Australian Government	Department of the Environment Federal Minister for the Environment Department of Families, Housing, Community Services and Indigenous Affairs
Indigenous Groups	Central Land Council Jalaliki Council Traditional Owners
Local Community	Pastoral Property Owners or operators Other Landholders Barkly Landcare Group
Education, Training and Employment	Bachelor Institute Papulu Apparr-Kari Aboriginal Corporation Barkly Employment and Training
Non-government Organisations	Arid Lands Environment Centre
Media	Local, regional, NT and national
Industry	NT Cattlemen's Association NT Chamber of Commerce Minerals Council of Australia AusIndustry Northern Territory Industry Capability Network

7.1.2 Consultations to date

There have been a number of engagements with the Central Land Council regarding native title agreements and progressing toward a minerals lease. An on country meeting was held with Traditional Owners in October 2013. Further consultations are planned. Stakeholder consultations will be on-going throughout the construction phase and the life of the project.

8 Acronyms and References

8.1 Acronyms

AAPA	Aboriginal Areas Protection Authority
ABS	Australian Bureau of Statistics
AFD	Australia Fuel Distributors
ASS	Acid Sulfate Soils
BoM	Bureau of Meteorology
DLRM	Department of Land Resource Management
DME	Department of Mines and Energy
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EL	Exploration Lease
EPBC	Environment Protection and Biodiversity Conservation Act
FEL	Front End Loader
FIFO	Fly In Fly Out
HMC	Heavy Mineral Concentrate
IUCN	International Union for the Conservation of Nature
MCP	Mine Closure Plan
ML	Mineral Lease (granted)
MLA	Mineral Lease Application
MMP	Mining Management Plan
MOC	Mine Operation Centre
NGO	Non-Government Agencies
NOI	Notice of Intent
NVIS	National Vegetation Information System
pa	Per Annum
RMCP	Rehabilitation and Mine Closure Plan
SEWPAC	Department of the Environment, Water, Heritage and the Arts
TIS	Title Information System
TPWC	Territory Parks and Wildlife Conservation Act
TSF	Tailing Storage Facility
WRD	Waste Rock Dumps

9 References

Baker, B, Price, O, Woinarski, J, Gold, S, Connors, G, Fisher, A and Hempel, C 2005, *Northern Territory Bioregions – Assessment of Key Biodiversity Values and Threat*, Published by NRETAS.

BOM 2012, *Bureau of Meteorology*, accessed November 2012, <<http://www.bom.gov.au/>>.

Christian, CS, Noakes, LC, Petty, RA, Slatyer, RO, Stewart, GA and Traves, DM 1954, *Survey of the Barkly Region, Northern Territory and Queensland, 1947-48*, Land Research Series No.3, Commonwealth Scientific and Industrial Research Organisation, Melbourne, Australia.

DCCEE 2012, *Australian National Greenhouse Accounts: State and Territory Greenhouse Gas Inventories 2009/10*, accessed Nov 2012, <<http://www.climatechange.gov.au/~media/climate-change/emissions/2011-12/StateAndTerritoryGreenhouseGasInventories-2009-10.pdf> >.

Jeuken, B 2012 Barrow Creek Project: Hydrogeological Review and Identification of Groundwater Supply Prospects, Prepared for Rum Jungle Resources