



REPORT

Environmental Management Plan

Ardmore Phosphate Rock Project - Start-up Operation

Submitted to:

Centrex Metals Limited

Level 6, 44 Waymouth Street
Adelaide, SA 5000

Submitted by:

Golder Associates Pty Ltd

147 Coronation Drive Milton, Queensland 4064 Australia

+61 7 3721 5400

1782517-016-R-Rev1

23 August 2018



Record of Issue

Company	Client Contact	Version	Date Issued	Method of Delivery
Centrex Metals Limited	Gerard Bosch – Approvals and Stakeholder Manager	Rev A – Draft for Review	27 July 2018	Word and pdf
Centrex Metals Limited	Gerard Bosch – Approvals and Stakeholder Manager	Rev 0 – Final	6 August 2018	Word and pdf
Centrex Metals Limited	Gerard Bosch – Approvals and Stakeholder Manager	Rev 1 – Final	23 August 2018	Word and pdf

Table of Contents

1.0 INTRODUCTION	1
1.1 Purpose of the Environmental Management Plan	1
1.2 Project Description Overview	3
1.1 Environmentally Relevant Activities	3
1.2 Development Timing	6
2.0 ENVIRONMENTAL MANAGEMENT SYSTEMS.....	6
2.1 Environmental Policies.....	7
2.1.1 Occupational Health and Safety Policy.....	7
2.1.2 Social Responsibility Policy	8
2.2 Roles and Responsibilities	8
2.3 Inductions and Training.....	9
2.4 Monitoring.....	10
2.5 Incidents and Emergencies.....	10
2.6 Complaint Management.....	11
2.7 Records and Reporting	11
3.0 ENVIRONMENTAL VALUES AND MANAGEMENT MEASURES.....	12
3.1 General Description of the Environment.....	12
3.2 Air	12
3.2.1 Baseline Environment and Environmental Values.....	13
3.2.2 Potential Impacts.....	15
3.2.3 Management	15
3.3 Noise	16
3.3.1 Baseline Environment and Environmental Values.....	16
3.3.2 Potential Impacts.....	17
3.3.3 Management	18
3.4 Land and Rehabilitation	19
3.4.1 Baseline Environment and Environmental Values.....	19
3.4.2 Potential Impacts.....	19
3.4.3 Management	20

3.5	Ecology.....	25
3.5.1	Baseline Environment and Environmental Values.....	25
3.5.2	Potential Impacts.....	26
3.5.3	Management	27
3.6	Surface Water	30
3.6.1	Baseline Environment and Environmental Values.....	30
3.6.2	Potential Impacts.....	31
3.6.3	Management	31
3.7	Groundwater.....	33
3.7.1	Baseline Environment and Environmental Values.....	34
3.7.2	Potential Impacts.....	34
3.7.3	Management	35
3.8	Cultural Heritage	36
3.8.1	Baseline Environment and Environmental Values.....	36
3.8.2	Potential Impacts.....	36
3.8.3	Management	37
3.9	Waste	38
3.9.1	Management	38
3.10	Traffic	40
3.10.1	Baseline Environment and Environmental Values.....	40
3.10.2	Potential Impacts.....	40
3.10.3	Management	41
3.11	Socio-economic.....	42
3.11.1	Baseline Environment and Environmental Values.....	42
3.11.2	Potential Impacts.....	43
3.11.3	Management	43
4.0	SUMMARY	44
5.0	REFERENCES	45

TABLES

Table 1: Environmentally Relevant Activities	6
Table 2: Environmental Management Roles and Responsibilities	8
Table 3: Project Air Quality Criteria	13
Table 4: Management Relating to Air Aspects	15
Table 5: Project Noise Criteria.....	17
Table 6: Management Relating to Noise Aspects	18
Table 7: Management Relating to Land and Rehabilitation Aspects	20
Table 8: Rehabilitation Requirements within EA Conditions	22
Table 9: Area of Disturbance Associated with Project Footprint	26
Table 10: Management Relating to Ecology Aspects.....	27
Table 11: Management Relating to Surface Water Aspects	31
Table 12: Management Relating to Groundwater Aspects.....	35
Table 13: Management Relating to Cultural Heritage Aspects	37
Table 14: Management Relating to Waste Aspects	39
Table 15: TARS Base Traffic Volume.....	40
Table 16: Management Relating to Traffic Aspects	41
Table 17: Management Relating to Socio-economic Aspects.....	43

FIGURES

Figure 1: Project Location.....	2
Figure 2: Mining Lease Area Conceptual Layout	4
Figure 3: Start-up Operation Conceptual Layout.....	5
Figure 4: Sensitive Receptors	14

1.0 INTRODUCTION

Centrex Phosphate Pty Ltd (Centrex) propose to develop a high-grade phosphate deposit located at Ardmore (Ardmore Phosphate Rock Project), approximately 128 km south of the city of Mt Isa and 23 km west of the town of Dajarra in North West Queensland (Figure 1).

An application for a major amendment to the existing Environmental Authority (EA) BRMN0037 under the *Environmental Protection Act 1994* (Qld) (EP Act) has been submitted by Centrex to apply for authorisation of additional mining activities on Mining Lease 5542 (ML5542).

The mining activities include a Start-up Operation (referred to as 'the Project'), which is a small-scale pit and demonstration plant to be constructed within the Southern Zone of ML5542. The operation will target removal of approximately 70,000 t of ore using shallow open-cut strip mining over a 2 – 3 month period.

This Environmental Management Plan (EMP) was developed by Golder Associates Pty Ltd (Golder) for Centrex to support the EA amendment application under Section 224 of the EP Act. The aim of this EMP is to provide the framework for the management of potential environmental impacts associated with the Start-up Operation and to put measures in place to ensure compliance with the EA conditions. It will also be provided to the mining contractor who will undertake the construction and operational activities on behalf of Centrex. It will be a contractual obligation of the mining contractor to comply with this EMP and to develop site specific Standard Operating Procedures (SOPs) based on this EMP to be provided to on-ground mining personnel.

This EMP covers the environmental aspects expected to be affected through Start-up Operation activities, including but not limited to: flora and fauna, waste management, water, cultural heritage, social, land and rehabilitation, erosion and sediment control, noise and dust management.

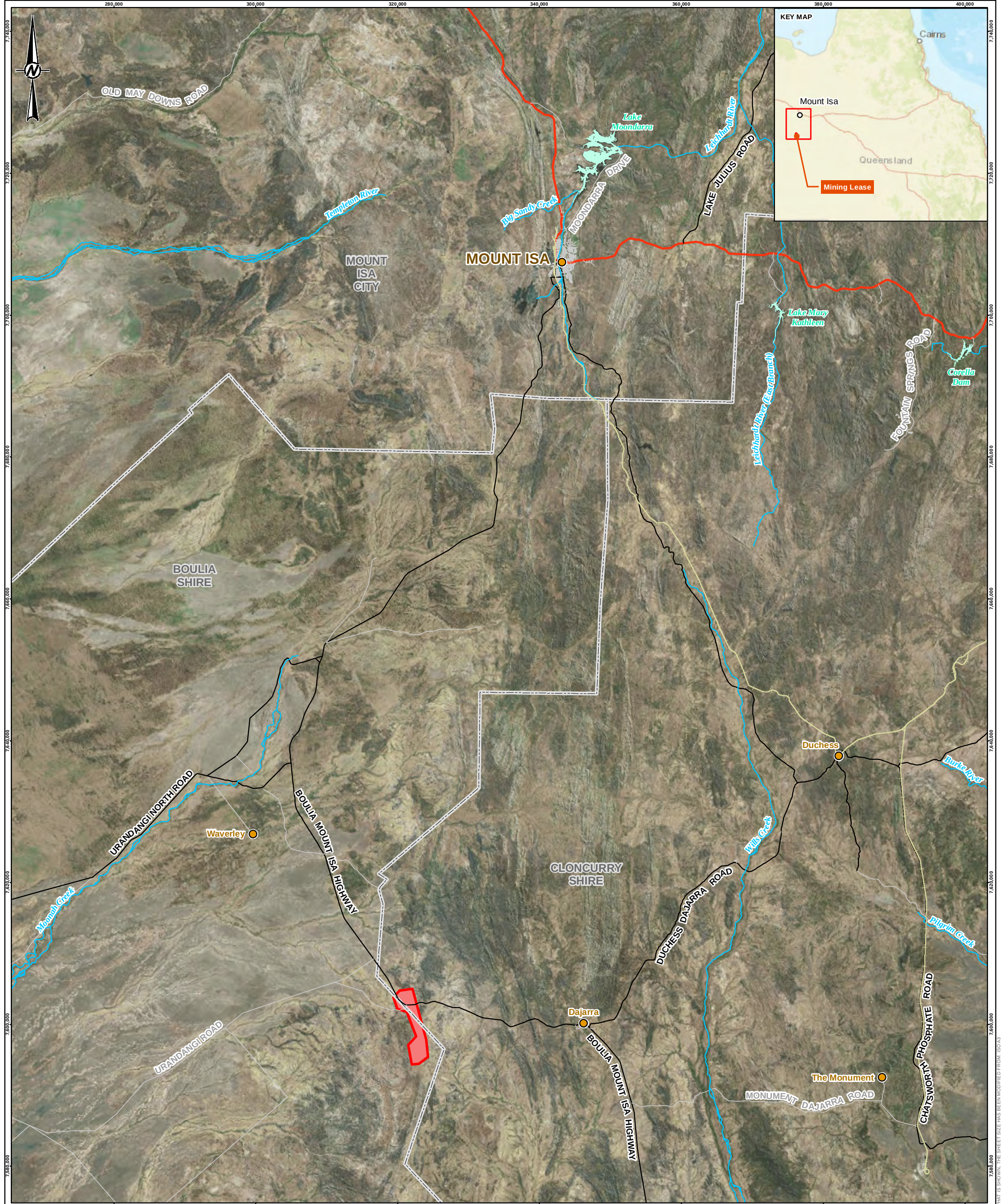
It is the responsibility of all project personnel, contractors and subcontractors to comply with the objectives and requirements of this EMP. Centrex, as the tenement and EA holder is responsible for overall compliance with the Project EA conditions.

1.1 Purpose of the Environmental Management Plan

The purpose of the EMP is to provide details of the environmental values in the Project area, the potential impacts associated with the project and the management measures that Centrex will implement during the construction and operation of the Start-up Operation.

The EMP has been designed as a stand-alone document for reference during all phases of the Start-up Operation to ensure environmental compliance with legislation and policies and the EA conditions. It includes a description of the project (Section 1.2) and an overview of Centrex's environmental management systems and policies (Section 2.0). Roles and responsibilities for environmental management activities are also identified (Section 2.2). The objectives of this EMP are to:

- Minimise the potential for adverse environmental impacts and/or harm to arise from mining and processing activities.
- Ensure all activities comply with regulatory requirements and EA approval conditions.
- Outline the proposed mitigation measures to ensure environmental impacts are adequately managed during construction, operation and decommissioning of the Project.
- Ensure best practice environmental management for proposed activities is achieved where practical.
- Provide corrective actions to ensure environmental and social values, and ecological processes, are safeguarded through mining activities.



LEGEND

- Locality
- Watercourses
- Road Type
 - Highway
 - Major Road
 - Local Road
 - Railway
- Local Government Area
- Reservoirs

Centrex Mining Lease
ML5542

Coordinate System: GDA 1994 MGA Zone 54
Projection: Transverse Mercator
Datum: GDA 1994

CLIENT

CENTREX PHOSPHATE PTY LTD

CONSULTANT



DD/MM/YYYY	27/07/2018
DESIGNED	BG
PREPARED	BG
REVIEWED	JR
APPROVED	JR

NOTE(S)
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

REFERENCE(S)
Locality, Mining Lease: © State of Queensland (DNRM) 2018
Roads, Watercourses, Local Government Area: © State of Queensland (Department of Natural Resources and Mines - DNRM) 2017
Reservoirs: © State of Queensland (DNRM) 2016

PROJECT
CENTREX ARDMORE PHOSPHATE

TITLE
PROJECT LOCATION

PROJECT NO.	CONTROL	REV.	FIGURE
1782517	016	0	1

1.2 Project Description Overview

The Ardmore phosphate rock deposit (on ML5542) is one of the few remaining undeveloped high-grade phosphate rock deposits with an estimated 16.2 million tonne phosphorite (P_2O_5) Inferred Mineral Resource at 27.8%, using a 16% P_2O_5 cut-off grade (Centrex Metals, 2018).

The ML encompasses 2,209 hectares (ha), with the target high-grade phosphorite deposit occurring as a single, essentially flat lying unit within two separate areas, the “Northern Zone” with a strike extent of approximately 4.0 km (N-S) and the “Southern Zone” with a strike extent of approximately 1.6 km (E-W). The target phosphorite unit is shallow dipping, with the average depths of the hanging wall and footwall contacts being 8.3 m and 12.0 m respectively based on drilling to date (Centrex Metals, 2017).

Centrex propose to develop the ML in two phases, the Start-up Operation and the Full-scale Operation. The purpose of this EMP is for the Start-up Operation, referred to in this report as the Project.

The Start-up Operation consists of a demonstration processing plant and a small-scale open pit to be constructed within the Southern Zone of the ML. The Project will extract approximately 70,000 tonnes of ore using shallow open-cut strip mining over a 2 – 3 month period. ROM ore will be processed in the demonstration plant to produce between 30,000 – 40,000 tonnes of concentrate. The concentrate will be loaded in 20' containers and transported to an existing rail siding at Cloncurry. It will then be railed to the Port of Townsville and shipped to potential customers for independent testing through their facilities. At the completion of the Start-up Operation, the viability and economic merits of the Project will be considered by Centrex to determine whether to expand the operation to a Full-scale Operation in the future. The aim of the mining operation is to supply phosphate rock concentrate to fertiliser plants in Australia (which are currently reliant on imported phosphate) and export throughout the region.

The conceptual layout of the Project within the ML area is provided in Figure 2 and the details of the Project conceptual layout are provided in Figure 3 which consists of a single pit, overburden and indurated storage facility, ROM pad, processing plant and tailing storage facility (TSF) including an earthen bund.

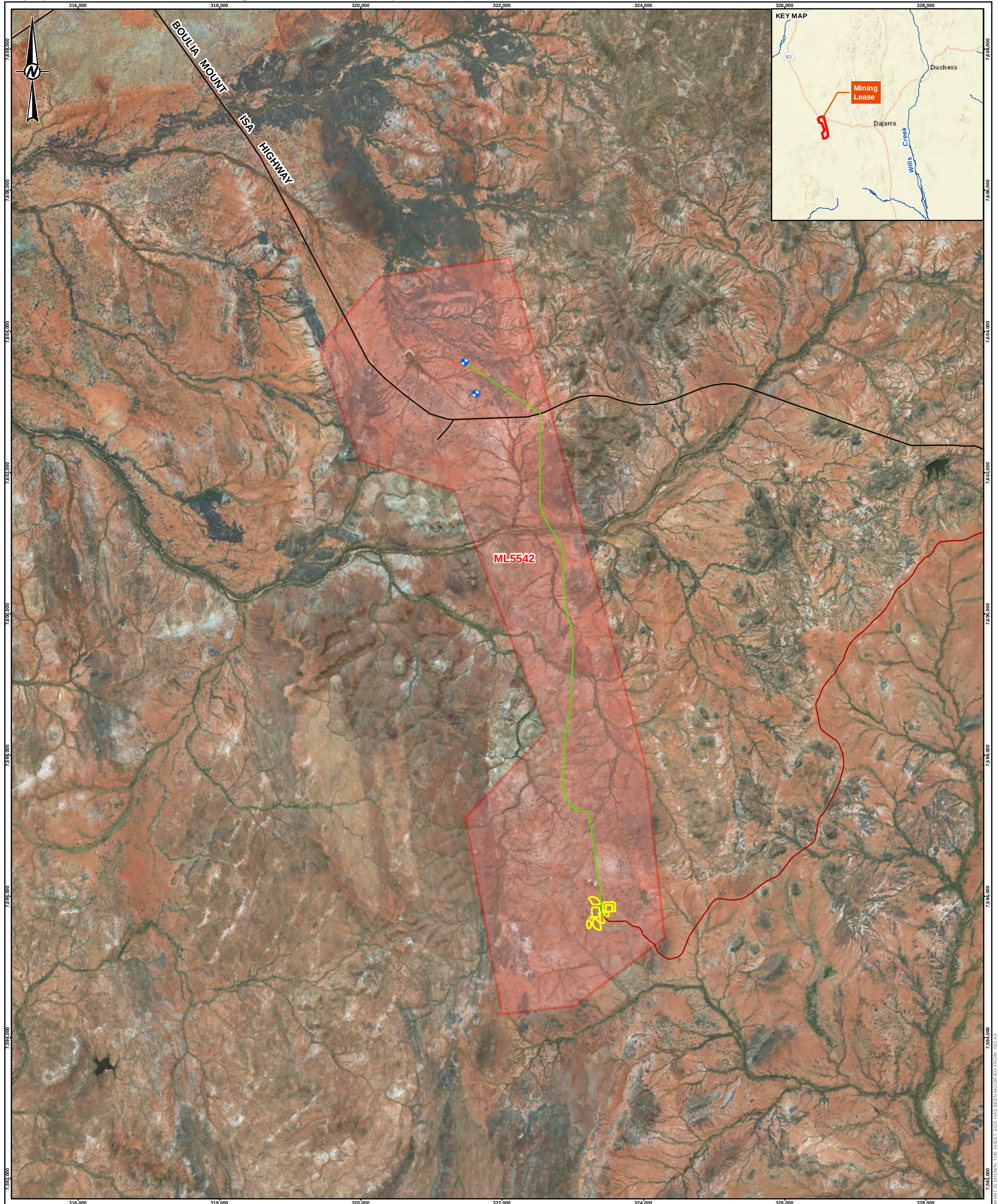
The Project will disturb a total area of approximately 16 ha. This accounts for 7.8 ha for Project infrastructure with an additional 4 ha of predicted disturbance incorporating the areas around and between the open pits and including a 10 m buffer around the infrastructure.

A 5 m wide corridor approximately 8.5 km in length will accommodate an 80 mm diameter water pipeline from two bores in the north of the ML to the processing facilities and an accompanying single vehicle access track for pipeline maintenance (4.3 ha). The pipeline will be temporarily laid on the surface along a route from the north to the south of the ML as shown in Figure 2. An access track will be formed along-side the water pipeline for maintenance purposes. An existing station road will be used for access and temporary haulage along a 11 km distance from the processing plant to the highway (1 km from the processing plant to the ML boundary).

1.1 Environmentally Relevant Activities

Environmentally relevant activities, as listed in Schedule 2 of the *Environmental Protection Regulation 2008* (EP Reg) are being sought under this application. These are listed in Table 1 below.

In accordance with section 19A of the EP Act, activities listed in Schedule 2 of the EP Reg are referred to as ancillary activities as they form part of the recourse activity as a single integrated operation on-tenure.



LEGEND

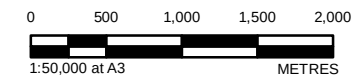
- Groundwater boreholes
- Water Pipeline and Access Track
- Roads
- Start-up Operation Access Track
- Start-up Operation
- Centrex Mining Lease
- ML5542

Coordinate System: GDA 1994 MGA Zone 54
Projection: Transverse Mercator
Datum: GDA 1994

CLIENT

CENTREX PHOSPHATE PTY LTD

CONSULTANT



DD/MM/YYYY	23/08/2018
DESIGNED	BG
PREPARED	BG
REVIEWED	JR
APPROVED	JR

NOTE(S)

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

REFERENCE(S)

Roads, Watercourses: © State of Queensland (Department of Natural Resources and Mines - DNRM) 2017
Mining Lease: © State of Queensland (DNRM) 2018
Start-up Operation, Water Pipeline and Access Track, Start-up Operation Access Track: Provided by Centrex 2018.

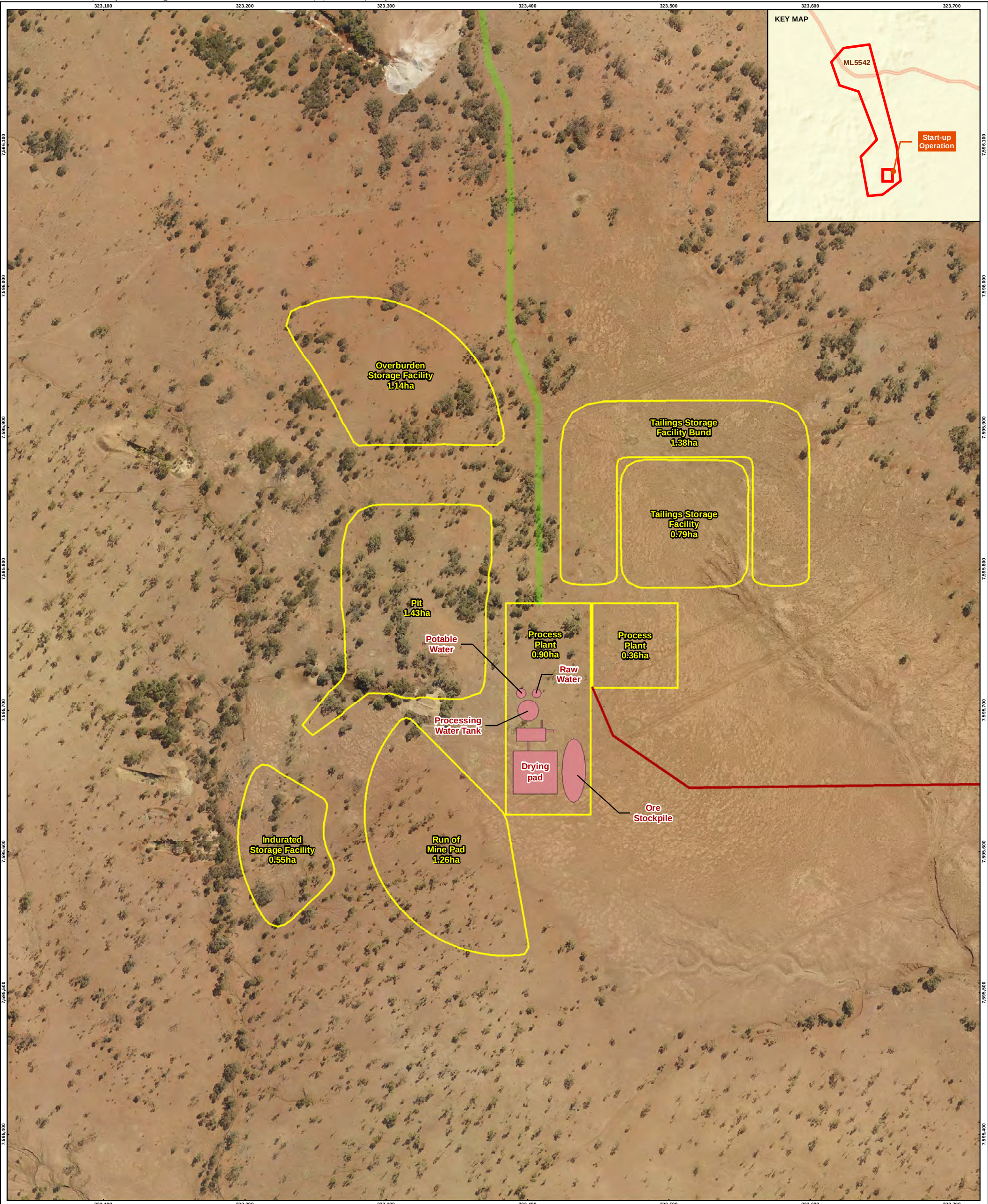
PROJECT

CENTREX ARDMORE PHOSPHATE

TITLE

MINING LEASE AREA CONCEPTUAL LAYOUT

PROJECT NO.	CONTROL	REV.	FIGURE
1782517	016	0	2



LEGEND

- Water Pipeline and Access Track
- Start-up Operation Access Track
- Start-up Operation
- Centrex Mining Lease
- ML5542
- Processing Plant

Coordinate System: GDA 1994 MGA Zone 54
Projection: Transverse Mercator
Datum: GDA 1994

CLIENT

CENTREX PHOSPHATE PTY LTD

CONSULTANT



YYYY-MM-DD	27/07/2018
DESIGNED	BG
PREPARED	BG
REVIEWED	JR
APPROVED	JR

REFERENCE(S)

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
Start-up Operation, Water Pipeline and Access Track, Start-up Operation Access Track: Provided by Centrex 2018.
Processing Plant: Golder 2018.
Mining Lease: © State of Queensland (DNRM) 2018

PROJECT

CENTREX ARDMORE PHOSPHATE

TITLE

START-UP OPERATION CONCEPTUAL LAYOUT

PROJECT NO.	CONTROL	REV.	FIGURE
1782517	016	0	3

Table 1: Environmentally Relevant Activities

Environmentally Relevant Activity (Ancillary Activity)	Threshold	AES Score
21 (Resource)	A mining activity that is an ineligible ERA, other than a mining activity mentioned in items 9 to 20	136
31(2)(a) – Mineral Processing	Washing, leaching, classifying, mixing and concentrating mineral products (between 1,000t to 100,000t)	179
33 – Crushing, Milling, Grinding or Screening	Crushing, grinding, milling or screening more than 5,000t of material in a year	No score

Note: **screening** includes washing, crushing, grinding, milling, sizing or separating material.

1.2 Development Timing

The Project will commence once all regulatory approvals are in place, which is anticipated to be in late 2018. Erection and commissioning of the plant infrastructure is expected to be completed in 4-6 weeks but will not occur until early to mid-2019 due to the delivery time of the processing plant (24 weeks). The construction period for the pit will take approximately 2-3 weeks and the mining period 6-8 weeks. Processing of the extracted ore is expected to be undertaken over 7-10 weeks following commissioning of the plant. Mined ore will be stockpiled on the ROM pad until the process plant is complete.

Following completion of the mining, the pit will be left as a void and once processing is completed, the process plant associated infrastructure will be decommissioned. A significant portion of the infrastructure will be leased equipment therefore it will be removed from site and returned to the rental companies. The decommissioned processing plant will be made safe and will remain in situ for a period of approximately one year while a determination as to the viability of proceeding with Full-scale Operations is made.

If Full-scale Operations are to proceed on the ML, the pit void created by Start-up Operations will become part of the main southern pit and progressively backfilled with overburden as part of the Full-scale Operations mine plan. Processing equipment will be re-located to the Full-scale Operation processing plant location outside of the pit margins while the contents of the tailings dam will be relocated to the full scale TSF (as part of the Full-scale Operation).

2.0 ENVIRONMENTAL MANAGEMENT SYSTEMS

Centrex will use an existing health, safety and environmental management framework throughout the Project's construction, operations and decommissioning. The key elements of the framework are:

- Health, Safety and Environment (HSE) Management Systems which provide the structure to manage social, environmental, health, safety and security aspects of the Project.
- Policies and codes which describe the management processes and procedures to manage health, safety and security on site.
- An EMP required under the EP Act relating to a prescribed ERA (this EMP meets the requirement). This EMP provides the proposed mitigation and management measures that are applicable to the protection of environmental values during construction, operation and decommissioning of the Project. This EMP will be updated prior to construction of the Project with the management system bridging between Centrex and the mining contractor's HSE Management Systems.

- Centrex will ensure that a contractual obligation of the mining contractor is to comply with the Project EMP and ensure their HSE Management Systems bridge to comply with Centrex's systems.
- SOPs will be developed to provide more detailed procedures that relate to the mitigation and management measures for the Project. These SOPs will include aspects such as detailed procedures for vegetation and soils clearance, spillage management and emergency plans, overburden and tailings management, erosion and sediment control, flora and fauna management and cultural heritage management. The mining contractor will develop the detailed SOPs to ensure compliance with this EMP and the EA conditions.

Environmental management of the construction, operation and decommissioning of the Project will be in accordance with the conditions of approval determined through the EA assessment process at a minimum. These conditions along with commitments made in the EA supporting report, have been incorporated into this EMP and will be included within future detailed SOPs.

2.1 Environmental Policies

Centrex has corporate policies which directly address the areas of occupational health, safety and environment, social responsibilities and rehabilitation (e.g., OHS_POL Occupational Health and Safety, OHS_POL Social Responsibility and OHS_POL Rehabilitation) which are relevant to the Project. Additional policies will be developed as the project evolves.

2.1.1 Occupational Health and Safety Policy

Centrex aim to have an injury free workplace with 'No Harm' and no unplanned environmental impacts. The OHS Policy (OHS_POL Occupational Health and Safety) manages Occupational Health, Safety & Environmental ('OHS&E') aspects of mining activities through:

- Committing adequate resources and funding for the effective implementation and maintenance of the OHS Management System.
- Identifying and complying with health, safety and environmental laws and regulations and adopt industry best practice.
- Establishing effective systems and consistent methodology for identifying hazards, evaluating and controlling risks.
- Ensuring all employees are appropriately trained to accomplish their job tasks in a safe and environmentally responsible manner.
- Defining improvement objectives and assigning responsibility and accountability for OHS performance and regular public reporting of our performance.
- Establishing procedures and management systems, fully integrating them into operating and contracting activities.
- Leading constructive consultation and communication with all stakeholders, encourage full participation in the prevention of accidents and incidents, and endeavour to achieve mutually acceptable outcomes from all activities.
- Investigate accidents, incidents and near misses, taking preventative and corrective action to prevent reoccurrence, identify areas to improve performance.
- Recognise that activities may have a localised and short-term impact on the environment and will work to reduce this impact wherever practicable.

- Conduct activities in a manner that ensures that rehabilitation to the agreed end land use can be achieved at the earliest practical time.

2.1.2 Social Responsibility Policy

The Social Responsibility Policy (OHS_POL Social Responsibility) outlines Centrex's commitments:

- Respect the social, economic and cultural rights of indigenous people.
- Develop a Social Management Plan, where applicable, which identifies key objectives and targets and specifies time-based actions to meet the objectives.
- Communicate our performance in an accurate, transparent and timely manner.
- Adopt policies such as Employ Locally and Buy Locally where this makes business sense to do so.
- Consult stakeholders in matters that affect them.
- Seek to share success by partnering with stakeholders to support appropriate community development programs.
- Centrex understand the actions and conduct of every Centrex Metals employee and contractor are the basis on which its stakeholders will evaluate its commitment to achieving the highest standards of social responsibility.
- Since environment, health and safety issues can affect the communities where we operate, Centrex will carry out the Social Responsibility Policy in conjunction with Centrex's Occupational Health Safety and Environment Policy.

2.2 Roles and Responsibilities

Centrex is ultimately responsible for the ongoing environmental management of Project activities. However, during construction, operation and decommissioning of the Start-up Operation, all Centrex employees and contractors will be responsible for the environmental performance of their activities and must demonstrate compliance with the procedures and policies, EA conditions and with any commitments made as part of this EMP.

There will be project personnel with specific environmental responsibilities when managing environmental management issues. These personnel and their responsibilities are presented in Table 2.

Table 2: Environmental Management Roles and Responsibilities

Role	Responsibilities
Chief Executive Officer	<ul style="list-style-type: none"> ■ Development and ownership of corporate environmental policy ■ Implementation of corporate environmental policy ■ Systems and resources to ensure compliance with environmental policy
General Manager Projects	<ul style="list-style-type: none"> ■ Implementation of management and monitoring practices and procedures in all operation areas ■ Accountable for compliance

Role	Responsibilities
	<ul style="list-style-type: none"> ■ Ensuring mining contractors hold appropriate resources and systems to comply with EA conditions and Centrex policies
Manager Approvals and Stakeholder Relations	<ul style="list-style-type: none"> ■ Authorised officer for signing environmental documentation and management of approvals ■ Ensuring management and monitoring practices and procedures are documented and clearly communicated within the organisation ■ Performance measurement and reporting, including recommendations for improvement and corrective actions ■ Development of operational procedures and practices ■ Accountable for compliance
Mining contractor	<ul style="list-style-type: none"> ■ Coordinating incident response ■ Reporting and compliance related issues ■ Develop detailed SOPs that provide specific instructions or procedures for each of the mitigation and management measures for the Project ■ Coordinating incident response and ensuring the SOP is followed
All site and field personnel	<ul style="list-style-type: none"> ■ Development of operational procedures and practices relevant to the environment and specific work stream ■ Coordinating incident response ■ Reporting and compliance related issues ■ Training in and implementing procedures, including those that address environmental management, at a site/operational level ■ Carrying out specific activities that ensure compliance with EA conditions, including following SOPs, environmental monitoring and data collection

2.3 Inductions and Training

Employees, contractors and site visitors will be required to undertake inductions to meet site health, safety and environmental requirements, prior to working on site.

The inductions will include compliance with this EMP, EA conditions and any relevant monitoring requirements specific to the type of work the personnel will be conducting. Training will be provided if the employee or contractor requires more specific guidance in the implementation of mitigation or control measures or monitoring requirements.

2.4 Monitoring

Monitoring provides an indication of the effectiveness of the mitigation or control systems. Planned monitoring on the Project will include the following:

- Regular inspection of construction and operational activities.
- Regular inspection of physical control or management strategies (e.g., sediment control structures, water diversion drains).
- Environmental monitoring of activities over time and at mine closure (e.g., photo-monitoring and audits).
- Any other prescribed monitoring and reporting in accordance with the conditions of the relevant EA.

2.5 Incidents and Emergencies

Incident reporting and management will be reinforced through the requirements set out in the SOPs developed by the mining contractor.

The requirements of the SOPs will link to Centrex's emergency response plan and Incident and Accident Reporting Procedure (OHS_PR_021) for escalation if required.

The EA conditions (currently in draft format) specify that Centrex must notify the administering authority by written notification within 24 hours, after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with, the conditions of the environmental authority. Within 10 business days following the initial notification of an emergency or incident, or receipt of monitoring results, whichever is the latter, further written advice will be provided to the administering authority, including the following:

- a) results and interpretation of any samples taken and analysed
- b) outcomes of actions taken at the time to prevent or minimise unlawful environmental harm
- c) proposed actions to prevent a recurrence of the emergency or incident.

These procedures will be emphasised during the training of relevant personnel involved in the project and within the Incident and Accident Reporting Procedure. More detailed procedures for emergency preparedness and response will be developed by the mining contractor. However, the general process for incidents and emergencies includes the following:

- Environmental incidents will be reported by the Manager Approvals and Stakeholder Relations as soon as practicable (and within 24 hours) of any release of contaminants and in any event where environmental harm (excluding environmental nuisance) has been caused or may be caused.
- Corrective actions will be implemented to prevent recurrence.
- If there are any releases of contaminants, spills or any other incidents they will be managed in accordance with this EMP and the relevant SOP.
- The Manager Approvals and Stakeholder Relations will also be notified as soon as practicable (and within 24 hours) by any employee or contractor of becoming aware of any non-compliance with conditions of the EA. DES will be notified as soon as practicable.
- Other incidents such as fauna injuries will be reported according to the process in the relevant procedure.
- Incidents will be recorded using the Centrex Incident Report Form or Hazard Report Form.

2.6 Complaint Management

Centrex is committed to managing community concerns in an accountable, transparent, timely and meaningful way. The Community Enquiries and Complaints Procedure (OHS_PRO_023) provides the complaints management procedure. It outlines how personnel should handle, report and address complaints. If Centrex or contractors receive any complaints during the course of the mining operation the OHS_PRO_023 will be followed.

The EA conditions (currently in draft format) specify that Centrex must record all environmental complaints received about the mining activities including:

- a) name, address and contact number of the complainant
- b) time and date of complaint
- c) reasons for the complaint
- d) investigations undertaken
- e) conclusions formed
- f) actions taken to resolve the complaint
- g) any abatement measures implemented
- h) person responsible for resolving the complaint.

These procedures will be emphasised during the training of relevant personnel involved in the project and within the Community Enquiries and Complaints Procedure. The processes for complaints includes:

- Complaints will be recorded in the complaints management system database. All complainants will be treated courteously and kept informed of the progress of their complaint throughout the complaint management process.
- By monitoring complaints and recording their outcomes, Centrex will ensure continued improvement in its operations and activities through meaningful feedback.

2.7 Records and Reporting

Recorded environmental data or records relating to the EA conditions or this EMP will be stored in a database. Any identified non-conformances or complaints will be recorded, reported and managed in accordance with the Incident and Accident Reporting Procedure or Community Enquiries and Complaints Procedure.

The EA conditions (currently in draft format) specify that Centrex must:

- a) within one year of the commencement of the environmental authority, obtain from an appropriately qualified person, a report on compliance with the conditions of the environmental authority
- b) obtain further such reports at regular intervals, not exceeding three-yearly intervals, from the completion of the report referred to above
- c) provide each report to the administering authority within 90 days of its completion.

3.0 ENVIRONMENTAL VALUES AND MANAGEMENT MEASURES

The EA amendment application supporting report provided a detailed description of the baseline environment and an assessment of the potential environmental and social impacts of the Project on environmental values (as required by Section 226 of the EP Act). The EP Act also required that the application include a description of the proposed measures for minimising and managing waste generated by each relevant activity and details of any site management plan that relates to the land the subject of the application.

The EP Act defines how the objective of the Act (to protect Queensland's environment while allowing for development) will be achieved. The Project is required to comply with the regulatory requirements for an environmental management decision under the EP Act relating to a resource activity.

In making an environmental management decision, an environmental objective assessment against the environmental objective and performance outcomes in Schedule 5, Part 3, Table 1 and 2 of the EP Reg will be carried out by DES.

This EMP provides the proposed mitigation and management measures that are applicable to the protection of environmental values during construction, operation and decommissioning of the Project and details how the Project meets the environmental objectives and performance outcomes for each environmental value.

3.1 General Description of the Environment

The Project lies within range country on the eastern margin of the Barkly Tableland. Relief throughout the area is low, though rugged with nearby hills being up to 50 m above the valley bases. The surface overlying both the north and south deposits is relatively flat with the highest point of 350 m Australian Height Datum (AHD) being in the southern area and the lowest 310 m AHD in the north.

The region is best described as sparsely vegetated with low, very open woodland on gravelly plains and slightly undulating areas primarily around rock outcrops. Denser vegetation occurs along ephemeral watercourses however all areas have been significantly impacted by cattle grazing and pest plant species invasion is evident, particularly throughout all riparian areas.

The Project area is sparsely populated, with the closest permanent resident from the mine site being the Ardmore homestead, located approximately 15 km northwest of the proposed Project site.

The next closest permanent sensitive receptors are the residents living in the town of Dajarra located 23 km east and motorists of the Boulia-Mount Isa Highway. The township of Duchess is located 88 km from the site. There are also two homesteads (Ashover Station and Stanbroke Homestead) adjacent to the road between Dajarra and Duchess located along the haulage route (Figure 4).

3.2 Air

This section describes the existing air quality conditions and potential impacts to air quality from the proposed mining activities and Centrex's approach to mitigation and management measures to reduce the potential impacts.

In Queensland, environmental impacts associated with air emissions are regulated under the EP Act, EP Reg and the Environmental Protection (Air) Policy 2008 (EPP Air). The EPP Air identifies the environmental values for the air environment and outlines the air quality objectives for different types of sensitive receptors.

3.2.1 Baseline Environment and Environmental Values

Existing air quality is characteristic of a remote rural area, with no significant anthropogenic sources of air quality emissions at the site. Due to the semi-arid climate, wind-blown dust is expected to be generated from exposed surfaces typical of the local area. Bushfires could also alter the air quality in the region.

Baseline deposited dust monitoring was conducted by Golder from September 2017 – March 2018 at three locations to characterise existing baseline conditions at the site. Monitoring locations were selected to represent the northern and southern areas of the Mining Lease and near the township of Duchess at the rail siding line. Average dust concentrations were similar at each location and were measured between 20 – 30 mg/m²/day.

Representative background concentrations of particulate matter (PM₁₀ and PM_{2.5}) at the site are not available. The closest publicly available data is from The Gap ambient air quality monitoring station (AQMS), operated by the Department of Science, Information Technology and Innovation (DSITI) and located in the township of Mount Isa. The Gap AQMS is situated approximately 100 km from the site in an industrial/residential area.

Using data from this station to represent the site is considered conservative, as the Project area is located in a remote rural area surrounded by less emission sources than found in Mount Isa. The 75th percentile concentration of PM₁₀ at The GAP AQMS in 2016 (19.5 µg/m³) has been used to characterise the existing air environment at the Project area.

In accordance with the EPP (Air), the environmental values in and around the Project area include:

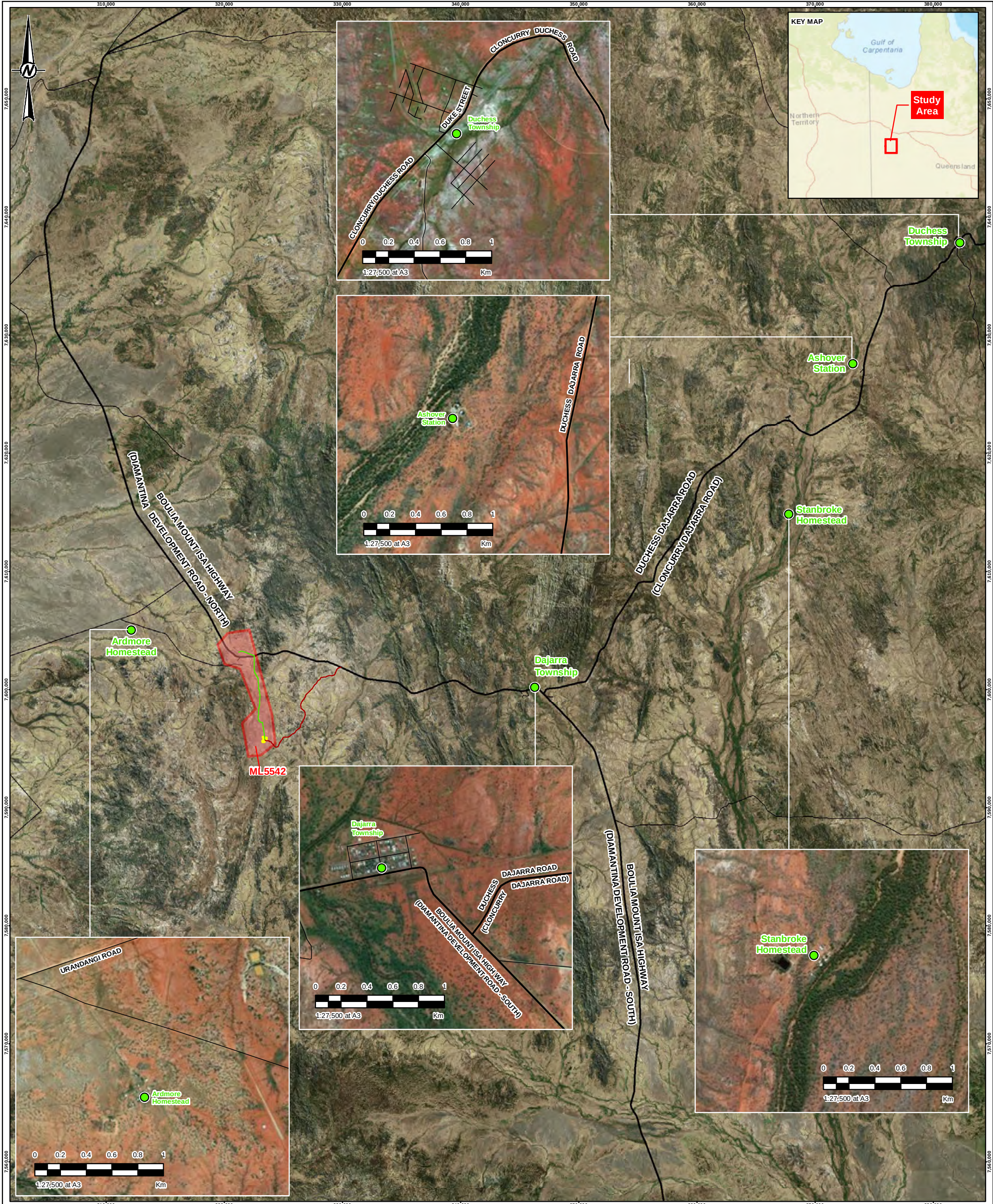
- The qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems.
- The qualities of the air environment that are conducive to human health and wellbeing.
- The qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property.
- The qualities of the air environment that are conducive to protecting agricultural use of the environment.

The EPP Air prescribes objectives for a number of pollutants which aim to protect environmental values. For the Project the relevant indicators are PM₁₀ and PM_{2.5} and dust deposition. Table 3 provides the Project air quality criteria based on the EPP Air environmental objectives and recommendations from the DEHP for dust deposition.

Table 3: Project Air Quality Criteria

Indicator	Air quality criteria	Period	Days	Environmental value
PM ₁₀	50 µg/m ³	24 hours		Health and wellbeing
PM _{2.5}	25 µg/m ³	24 hours	5 days each year	Health and wellbeing
PM _{2.5}	8 µg/m ³	1 year		Health and wellbeing
Dust deposition *	120 mg/m ² /day	1 month	NA	NA

* A dust deposition guideline of 120 mg/m²/day is widely used in Queensland to avoid the impacts of nuisance dust and has been recommended by the DEHP as a suitable design objective.



LEGEND

- Sensitive Receptors
- Water Pipeline and Access Track
- Start-up Operation Access Track
- Start-up Operation
- Centrex Mining Lease
- ML5542

Coordinate System: GDA 1994 MGA Zone 54
Projection: Transverse Mercator
Datum: GDA 1994

CLIENT

CENTREX PHOSPHATE PTY LTD

CONSULTANT	DD/MM/YYYY	27/07/2018
	DESIGNED	DC
	PREPARED	DC
	REVIEWED	JR
	APPROVED	JR



NOTE(S)
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

REFERENCE(S)
Sensitive Receptors: © State of Queensland (Department of Natural Resources, Mines and Energy) 2018
Roads: © State of Queensland (DNRM) 2017.
Mining Lease: © State of Queensland (DNRM) 2018 .
Start-up Operation, Water Pipeline and Access Track, Start-up Operation Access Track: Provided by Centrex 2018.

PROJECT

CENTREX ARDMORE PHOSPHATE

TITLE

SENSITIVE RECEPTORS

PROJECT NO.	CONTROL	REV.	FIGURE
1782517	016	0	4

3.2.2 Potential Impacts

The main potential air quality issue that will result from construction and operation of the Project will be the generation of airborne dust (particulate matter). Dust has the potential to decrease the air quality within proximity to the source. More details are provided below:

- **Decrease in Air Quality at Sensitive Receptors.** Dust emissions from the Project are unlikely to impact the Ardmore homestead 15 km to the northwest and Dajarra residents and motorists of the Boulia-Mount Isa Highway. There may be limited dust emissions at the Ashover Station that is located approximately 750 m from the road between Dajarra and Duchess (see Figure 4). However, the limited number of trucks during the Start-up Operation and the 750 m separation distance means there is unlikely to be a significant impact.
- **Decrease in Air Quality Due to Ore Transport.** Motorists of the Boulia-Mount Isa Highway and an unnamed State controlled single lane gravel road between Dajarra and Duchess may be affected by dust due to haulage of ore through Duchess to Cloncurry. Motorists that travel on the section of these roads are transient receptors, would have short-term exposure to any emissions from the Project and may experience temporary dust nuisance and amenity impacts such as reduced driving visibility.

3.2.3 Management

Table 4 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 4: Management Relating to Air Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> ■ Decrease in air quality at sensitive receptors. ■ Decrease in air quality due to ore transport through Duchess.
EA conditions (currently draft)	<ul style="list-style-type: none"> ■ The holder of the environmental authority must not cause an unreasonable release of dust.
Environmental objectives	<ul style="list-style-type: none"> ■ The activity will be operated in a way that protects the environmental values of air.
Performance outcome	<ul style="list-style-type: none"> ■ There is no discharge to air of contaminants that may cause an adverse effect on the environment or nuisance compliant from the operation of the activity.
Avoidance, mitigation and management measures	<p>Centrex intends to employ industry standard practice dust mitigation measures where practicable and appropriate including:</p> <ul style="list-style-type: none"> ■ Maintaining adequate separation distance from sensitive receptors. The recommended separation distances for a mine that includes crushing, screening, stockpiling and conveying of other minerals is 250 m, from the mining activities to the sensitive receptor (taken from the EPA Victoria publication 1518, <i>Recommended separation distance for industrial residual air emissions</i> (EPA VIC 2013)).

Aspect	Details
	<ul style="list-style-type: none"> ■ Community consultation and direct contact with the landowners adjacent to the haul route to inform them prior to the Start-up Operation. ■ Using water or polymer spraying on roads on the ML and stockpiles only if required, to reduce dust emissions when appropriate.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Complaints will be managed according to the Community Enquiries and Complaints Procedure. ■ Regular inspection of physical control or management strategies. ■ Any other prescribed monitoring and reporting in accordance with the conditions of the relevant EA.

3.3 Noise

This section describes the existing noise conditions and potential impacts to the acoustic environment from the proposed mining activities and Centrex's approach to mitigation and management measures to reduce the potential impacts.

In Queensland, environmental impacts associated with noise emissions are regulated under the EP Act, EP Reg and the Environmental Protection (Noise) Policy 2008 (EPP Noise).

3.3.1 Baseline Environment and Environmental Values

The site is in a remote rural area with no significant sources of existing noise. The Boulia Mt Isa Highway traverses the northern section of the Mining Lease area, however traffic on this road is not considered a significant source of existing noise at the Project site. Vegetation in the area is sparse, and ecological noise (i.e., birds, insects) is likely to be minimal.

Representative background noise measurements within the Tenant Creek to Mount Isa area indicate the median L_{A90} , dB(A) 1-hour averages are:

- Day time (7am – 6pm) = 30 dB(A).
- Evening (6pm – 10pm) = 42 dB(A).
- Night (10pm – 7am) = 32 dB(A).

The sensitive receptors that may be affected by noise emissions from the Project include the Ardmore Homestead 15 km to the northwest, the residents along the haul road from the mine site through Duchess, including the Dajarra residents, motorists of the Boulia-Mount Isa Highway and residents of the Ashover Station and Stanbroke Homesteads (see Figure 4).

The environmental values to be enhanced or protected under this policy are:

- The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems.
- The qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following:
 - (i) sleep

- (ii) study or learn
- (iii) be involved in recreation, including relaxation and conversation.
- The qualities of the acoustic environment that are conducive to protecting the amenity of the community.

The EPP Noise proposes objectives which aim to protect environmental values. Table 5 provides the acoustic quality objectives relevant to this assessment for the site. The EPP Noise establishes goal noise levels to be achieved at the noise receptors (dwellings). The EPP Noise does not provide night-time criteria outside of dwellings, which can be useful when screening for noise impacts using noise attenuation calculations. To include an assessment for the health and wellbeing related to sleep, an adjustment of 10 dB¹ has been made to the indoor criteria to allow for noise reduction through a typical dwelling facade.

Table 5: Project Noise Criteria

Sensitive Receptor	Time of day	Acoustic quality objectives (measured at the receptor) dB(A)			Environmental value
		L _{Aeq,adj,1hr}	L _{A10,adj,1hr}	L _{A1,adj,1hr}	
Dwelling (for outdoors)	Daytime and evening	50	55	65	Health and wellbeing
Dwelling (for indoors)	Daytime and evening	35	40	45	Health and wellbeing
	Night-time	30 (+10 dB for outdoor)	35 (+10 dB for outdoor)	40 (+10 dB for outdoor)	Health and wellbeing, in relation to the ability to sleep
Protected area, or an area identified under a conservation plan under the <i>Nature Conservation Act 1992</i> as a critical habitat or area of major interest	Anytime	The level of noise that preserves the amenity of the existing area or place.			Health and biodiversity of ecosystems

3.3.2 Potential Impacts

Potential impacts relate to noise emissions from the Project contributing to an exceedance of the noise limits at sensitive receptors, which may result in annoyance, stress, sleep disturbance and reduced wellbeing. The

¹ EPA NSW guideline, *Noise guide for local government* (EPA NSW 2013) recommends an adjustment of 10 dB for attenuation across a building façade with an open window.

total estimated noise level at the Ardmore Homestead 15 km northwest from the mine site is 35 dB, which is below the Project noise criteria for day, evening and night time noise levels. Therefore, at this residence and other sensitive receptors the estimated noise level is not predicted to exceed the Project criteria.

3.3.3 Management

Although the risk of noise impact on the environmental values is low prior to implementing mitigation measures, Centrex will consider the use of best practice noise mitigation measures to minimise noise emissions in accordance with the noise management hierarchy outline in the EPP (Noise).

Table 6 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 6: Management Relating to Noise Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> Noise levels exceeding noise criteria at sensitive receptors due to mining operations.
EA conditions (currently draft)	<ul style="list-style-type: none"> The holder of the environmental authority must not cause unreasonable noise at a noise sensitive place.
Environmental objectives	<ul style="list-style-type: none"> The activity will be operated in a way that protects the environmental value of the acoustic environment.
Performance outcome	<ul style="list-style-type: none"> Sound from the activity has not caused a nuisance at a sensitive receptor.
Avoidance, mitigation and management measures	<p>Centrex intends to employ standard industry practice noise mitigation measures where practicable and appropriate including:</p> <ul style="list-style-type: none"> Community consultation and direct contact with the landowners adjacent to the haul route to inform them prior to the Start-up Operation Reduce vehicle speed on site. Mobile equipment is turned off when not in use. Equipment maintenance in accordance with manufacturer's specifications. Use of mufflers on mobile plant. Maintenance of haul roads on the ML.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> Regular inspection of construction and operational activities against the EMP and EA Conditions to review compliance. Complaints will be managed according to the Community Enquiries and Complaints Procedure. Regular inspection of construction and operational activities.

Aspect	Details
	<ul style="list-style-type: none"> ■ Regular inspection and review of management strategies. ■ Any other prescribed monitoring and reporting in accordance with the conditions of the relevant EA.

3.4 Land and Rehabilitation

This section describes the existing soils and land conditions and potential impacts to the land from the proposed mining activities. It also provides proposed mitigation and management measures to reduce the potential impacts.

3.4.1 Baseline Environment and Environmental Values

The existing soil in the area is mainly chromosols and kandosols, with the Project area dominated by chromosol soils. This soil is characterised as saline with high electrical conductivity and elevated concentrations of chloride. The topsoil layer is either not existent or very thin (<10 cm) with limited humus organic matter present. Two of the three soil test pit sites had high concentrations of sulphates in the subsoils, with gypsum the likely source at these locations.

Topsoil is thin to non-existent at the site however where it is recoverable, it will be stockpiled separately for use in rehabilitation activities. It will be stored no higher than 2 m and will be formed in shapes that aid the capture of incident rainfall and encourage continuing biological activity within the soil.

The geochemical properties of the rock to be disturbed have been assessed and there are no predicted problems such as acid mine drainage from the storage of overburden over the life of the mine or post closure.

The soil supports ecosystems by providing a suitable growth medium for vegetation (good quality soil which remain stable in-situ). Impairment of either soil availability (quantity) or quality as a result of mining activities may impact terrestrial and aquatic ecosystems, and surface water quality. The environmental value for soil is therefore the provision of good quality soil of a suitable quantity for vegetation growth. For the project area the naturally saline nature soils supports little vegetation. The retention of soils in-situ (non-erosive) is also important to prevent adverse impacts to aquatic ecosystems and surface water quality.

3.4.2 Potential Impacts

Clearing and earthworks expose soils, change landforms and alter drainage. Impacts will likely occur primarily with new ground disturbance as a result of excavation and placement of fill from earthworks. An estimated 11.7 ha of land will be disturbed in some way from Project activities during construction. Clearance of vegetation and excavating the landscape will change natural landscape features. The excavation of the area to develop the mine will result in a temporary change to the landscape. Potential impacts during construction and operation are:

- **Soil Erosion.** The key potential impact relating to soils is erosion (loss of soil) and the subsequent effects of erosion (mainly sedimentation of watercourses). Soil erosion from the site has the potential to cause:
 - Localised erosion during rainfall events which could lead, over time to a permanent loss of substrate for vegetative growth.
 - Loss of soils available to support vegetation and available for vegetation growth during rehabilitation.

- **Soil Compaction.** During mine development disturbed areas such as the carpark, roads and laydown areas will have the soil compacted. Post mining compacted soils may increase water runoff and sheet erosion if not ripped or scarified.
- **Localised Soil Contamination.** It is possible that during the course of mining there could be contamination to soils as a result of minor leaks or accidental spills of liquid hydrocarbons, fuels, lubricants and chemicals, as well as releases caused by accidents (e.g., fuel tank failure, oil spillage).

3.4.3 Management

Table 7 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 7: Management Relating to Land and Rehabilitation Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> ■ Soil erosion (causing sedimentation). ■ Soil compaction. ■ Localised soil contamination from accidental spills and leaks of fuels and chemicals.
EA conditions (currently draft)	<ul style="list-style-type: none"> ■ Land disturbed by mining must be rehabilitated in accordance with Table 8. ■ Rehabilitation must commence progressively in accordance with the plan of operations.* ■ Minimise the potential for contamination of land by hazardous contaminants. ■ Contaminated Land. Before applying for surrender of a mining lease, the holder must (if applicable) provide to the administering authority a site investigation report under the Act, in relation to any part of the mining lease which has been used for notifiable activities or which the holder is aware is likely to be contaminated land, and also carry out any further work that is required as a result of that report to ensure that the land is suitable for its final land use.
Environmental objectives	<ul style="list-style-type: none"> ■ The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna.
Performance outcomes	<ul style="list-style-type: none"> ■ Activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land, and ■ Areas disturbed will be rehabilitated or restored to achieve sites that are: <ul style="list-style-type: none"> i) safe to humans and wildlife ii) non-polluting iii) stable; and iv) able to sustain an appropriate land use after rehabilitation or restoration.

Aspect	Details
	<ul style="list-style-type: none"> ■ The activity will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants. ■ The application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.
Avoidance, mitigation and management measures	<p>Measures to reduce impacts (compaction and erosion) will include the following:</p> <ul style="list-style-type: none"> ■ The Project footprint will be limited during the construction and operations phases where possible. ■ The workforce will be restricted to only those areas that need to be accessed or trafficked on formed roads, tracks and paths, where possible. ■ The overburden dump, indurated storage facility, ROM, TSF and disturbed infrastructure areas will be designed to manage high surface water flows during rainfall events, where possible. <p>Erosion and sediment control measures will be implemented and will include:</p> <ul style="list-style-type: none"> ■ Minimising the extent of vegetation clearance as much as is operationally practicable. ■ Temporarily stockpiling topsoil and subsoil for rehabilitation of disturbed areas. ■ Stabilising topsoil and subsoil stockpiles (using vegetation or other methods). ■ Minimising the duration of soils stockpiled on site will help reduce the risk of soil erosion occurring. ■ Using slope stabilisation techniques on constructed landforms. ■ Immediate reuse of cleared vegetation as revegetation or for stabilisation where possible. ■ Progressively rehabilitating and revegetating (if possible) disturbed areas, as soon as possible after mining or construction activities are completed. <p>Measures to reduce localised soils contamination from spills or leaks of fuels or chemicals:</p> <ul style="list-style-type: none"> ■ Re-fuelling of light vehicles and trucks will be done offsite. ■ Re-fuelling of mining fleet will be onsite within a dedicated re-fuelling area. ■ Bunding will be present around chemical storage areas. ■ Contaminated soils will be cleaned up as soon as practicable after the event occurs.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Regular inspection of construction and operational activities against the EMP and EA Conditions to review compliance. ■ Regular inspection of physical control or management strategies (e.g., sediment control structures, water diversion drains).

Aspect	Details
	<ul style="list-style-type: none"> Any other prescribed monitoring and reporting in accordance with the conditions of the relevant EA. The plan of operations report will be developed prior to the commencement of operations. It will provide details of rehabilitation activities.

*Note. The draft EA condition 'Rehabilitation must commence progressively in accordance with the plan of operations'. The plan of operations states that "As the mining campaign duration is short, progressive rehabilitation and mine closure will not occur until the after a decision is made whether Centrex will proceed with the Full-scale Operation (likely to be within six months of the completion of the Project)."

The rehabilitation requirements for Start-up Operation, based on the EA Conditions are included as Table 8 below. These conditions will only be relevant for the Start-up Operation assuming that the Full-scale Operation is not developed. If the Full-scale Operation Project proceeds, then the footprint area of the Project will be encompassed into the disturbance area and a separate mine closure and rehabilitation plan would be developed for this in the future.

Table 8: Rehabilitation Requirements within Draft EA Conditions

Mine domain	Mine feature name	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
Pit	Pit	1. Safe	Site is safe for humans and animals now and in the foreseeable future.	Safety assessment on backfilled pit.	Evidence that the pit has been backfilled to ensure a safe, non-polluting, stable landform.
		2. Non-polluting	No groundwater or surface water contamination post closure (no connection to groundwater systems).	Physical properties of soil and presence of limited vegetation species, such as gidgee trees with grasses.	Evidence that the pit has been backfilled to ensure a safe, non-polluting, stable landform.
		3. Stable	Pit backfilled and stable, with no benches or high walls remaining.	Physical properties of soil and presence of limited vegetation species, such as gidgee trees with grasses.	Evidence that the pit has been backfilled to ensure a safe, non-polluting, stable landform.
		4. Sustains agreed land use	Pre-mining land use of grazing and limited native grasses re-instated.	Physical properties of soil and presence of limited vegetation species, such as gidgee trees with grasses.	Evidence that the backfilled material is re-instated in the correct soil horizon order to ensure the soil profile available for vegetation regrowth is similar to that of the pre-mining condition.
Tailings Storage Facility	Tailings Storage Facility	1. Safe	Site is safe for humans and animals now and in the foreseeable future.	Safety assessment on backfilled TSF.	Certification that the TSF is backfilled and is a safe, non-polluting, stable landform.
		2. Non-polluting	Rainfall retained on the TSF to aid vegetation growth and surface water runoff limited. Runoff will be unlikely to affect known environmental values.	Physical properties of soil and presence of limited vegetation species, such as gidgee trees with grasses.	Certification that the TSF is backfilled and is a safe, non-polluting, stable landform.

Mine domain	Mine feature name	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
		3. Stable	TSF backfilled and physically and chemically stable.	Physical properties of soil and presence of limited vegetation species, such as gidgee trees with grasses.	Certification that the TSF is backfilled and is a safe, non-polluting, stable landform.
		4. Sustains agreed land use	Pre-mining land use of grazing and limited native grasses re-instated.	Physical properties of soil and presence of limited vegetation species, such as gidgee trees with grasses.	Evidence that the backfilled material is re-instated in the correct soil horizon order to ensure the soil profile available for vegetation regrowth is similar to that of the pre-mining condition. Rehabilitated areas meet the agreed end land use, and these areas can be managed without significant external inputs and ongoing management. Vegetation is minimal but resilient without additional inputs.
Overburden Storage Facility, Indurated Storage Facility and ROM	Overburden Storage Facility, Indurated Storage Facility and ROM	1. Safe	Site is safe for humans and animals now and in the foreseeable future.	Safety assessment of domain area.	Safety assessment that demonstrates that all overburden, and ROM material has been used to backfill the pit and that the site is stable and safe.
		2. Non-polluting	No groundwater or surface water contamination post closure (no connection to groundwater systems). Limited vegetation cover is present and land formed to minimise erosion.	Presence of limited vegetation species, such as gidgee trees with grasses.	Certification that vegetation for grazing purposes is similar to pre-mining reference sites. Rehabilitated areas meet the agreed end land use, and these areas can be managed without significant external inputs and ongoing management.
		3. Stable	Material is used to backfill the pit leaving a relatively flat post-mining landscape	Safety assessment of domain area.	Safety assessment that demonstrates that the area is stable and safe.
		4. Sustains agreed land use	Pre-mining land use of grazing and limited native grasses re-instated.	Physical properties of soil and presence of limited vegetation species, such as gidgee trees with grasses.	Certification that soil is re-instated in the correct soil horizon order and that the natural vegetation for grazing purposes is similar to pre-mining reference sites, which has limited ground cover. Rehabilitated areas meet the agreed end land use, and these areas can be managed without significant external inputs and ongoing management.

Mine domain	Mine feature name	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
Mine Infrastructure Areas	Mine Infrastructure Areas	1. Safe	Site is safe for humans and animals now and in the foreseeable future.	Removal of infrastructure. Physical properties of soil and presence of limited vegetation species, such as gidgee trees with limited grasses.	Evidence that the mine infrastructure has been removed and the area is safe, non-polluting and stable. Evidence that the land is spread with soil to promote vegetation regrowth for a grazing post mining land use. Rehabilitated areas meet the agreed end land use, and these areas can be managed without significant external inputs and ongoing management.
		2. Non-polluting	After removal of infrastructure - runoff and seepage will be good quality water that is unlikely to affect known environmental values.	Removal of infrastructure. Physical properties of soil and presence of limited vegetation species, such as gidgee trees with limited grasses.	Evidence that the mine infrastructure has been removed and the area is safe, non-polluting and stable. Evidence that the land is spread with soil to promote vegetation regrowth for a grazing post mining land use. Rehabilitated areas meet the agreed end land use, and these areas can be managed without significant external inputs and ongoing management.
		3. Stable	Remove infrastructure and establish a stable landform.	Removal of infrastructure. Physical properties of soil and presence of limited vegetation species, such as gidgee trees with limited grasses.	Evidence that the mine infrastructure has been removed and the area is safe, non-polluting and stable. Evidence that the land is spread with soil to promote vegetation regrowth for a grazing post mining land use. Rehabilitated areas meet the agreed end land use, and these areas can be managed without significant external inputs and ongoing management.
		4. Sustains agreed land use	Pre-mining land use of grazing and limited native grasses re-instated.	Removal of infrastructure. Physical properties of soil and presence of limited vegetation species, such as gidgee trees with limited grasses.	Evidence that the mine infrastructure has been removed and the area is safe, non-polluting and stable. Evidence that the land is spread with soil to promote vegetation regrowth for a grazing post mining land use. Rehabilitated areas meet the

Mine domain	Mine feature name	Rehabilitation goal	Rehabilitation objectives	Indicators	Completion criteria
					agreed end land use, and these areas can be managed without significant external inputs and ongoing management.

3.5 Ecology

This section describes the existing terrestrial and aquatic ecology, the potential impacts from the proposed mining activities and the proposed mitigation and management measures to reduce the potential impacts.

3.5.1 Baseline Environment and Environmental Values

NRC (2017, 2018a and 2018b) undertook two flora and fauna field surveys coinciding with timing for an early dry season survey between 31 May – 6 June 2017 and wet season survey between 19 – 23 March 2018. Aside from Regional Ecosystem (RE) 1.3.7b, all other REs recorded and mapped within the ML have a 'least concern' status under the VM Act, and a 'no concern at present' biodiversity status. The RE 1.3.7b (the River Red Gum (*Eucalyptus camaldulensis*) fringing woodland on Split Creek and some other watercourses and margins) has an endangered biodiversity status, and, therefore, is an ESA and Matter of State Environmental Significance (MSES) under the EP Reg.

Although no areas of regrowth or non-remnant vegetation are mapped within the mining lease, small areas have been cleared and modified to create stock-water dams for cattle. Similarly, small isolated areas of disturbance, from historical and recent exploration activities, are present within the vicinity of the Project area. Essential habitat for the Purple-necked Rock Wallaby is mapped within the ML.

Cattle grazing has greatly reduced the biodiversity of the ground layer of most of the REs through direct grazing, and the introduction of pest plants. The introduced pasture grass, Buffel Grass (*Cenchrus ciliaris*) has invaded all riparian areas within ML5542, and this competition with native species has greatly reduced the biodiversity values of the riparian communities, particularly RE 1.3.7b.

The paucity in habitat diversity is reflected in the fauna species recorded. Twenty species of mammals from ten families, 23 species of reptiles from eight families, three species of amphibian from two families, and 64 species of birds were recorded.

The environmental values present within the direct vicinity of the proposed Start-up Operation location were predominately very sparse with limited to no habitat values, on RE 14.9.12x4a/4.9.10b.

The key environmental values of the area are summarised below:

- Remnant vegetation associated with a state-mapping defined watercourse or drainage feature is classified as a MSES.
- The RE 1.3.7b, a Category B Environmentally Sensitive Areas (ESA) was confirmed within the ML (29.2 ha), has an endangered biodiversity status, therefore is an ESA under the EP Reg.
- Split Creek which supports a substantial River Red Gum community, and more distinct riparian habitat values, including hollow-bearing River Red Gums is the only watercourse feature considered large enough to provide corridor connectivity values at the local scale within the ML.
- Threatened fauna and habitat for the State-listed vulnerable Purple-necked Rock-wallaby. While mapped Essential habitat is located in one area to the north-east of the ML (34.8 ha within the ML boundary),

field-based assessment confirmed a lack of essential shelter habitat factors. Suitable habitat features were identified outside the ML to the east and south that may provide shelter and breeding habitat for the Purple-necked Rock-wallaby. A population was recorded 1.8 km to the northwest of the Project area in an area consisting of outcropping limestone, watercourse and spinifex grasslands, a preferred food source of this species.

3.5.2 Potential Impacts

During the construction, operations, and decommissioning of the Project, all Project features that have a physical footprint, such as the Project infrastructure, access road and water pipeline infrastructure have the potential to affect environmental values. Project activities and features can also create physical barriers that impede or completely obstruct movement for a range of species. Complete barriers to movement can isolate patches of fauna habitat and can also isolate a subset of a population. This is particularly the case for less mobile and fossorial species.

Vegetation clearing and site preparation has potential direct and indirect impacts to MNES and MSES, including:

- Reduction in extent of Category B ESAs within the ML.
- Reduction in extent of State-mapped essential habitat within the ML.
- Reduction in extent of habitat for threatened fauna species.
- Reduction in habitat quality associated with impacts from dust, erosion, changes to habitat suitability and quality.
- Direct mortality of threatened fauna and flora.
- Fragmentation of habitats, and reduction of connectivity in remnant vegetation patches.
- Creation of edge effects, which open up habitat in areas where it was previously continuous, leading to changes in the abiotic conditions and species composition. Depending on the species, edges can have either a positive or negative effect on habitat quality and quantity.
- Creating exposed soils which can create favourable habitats for weed species. Vegetation clearing and the use of earth-moving equipment can spread exotic and/or invasive plant species if equipment is not properly cleaned prior to procurement and mobilisation to the site. It is noted that the condition of vegetation within the local study area is already heavily impacted by cattle grazing and introduced weeds.

Table 9 outlines area of clearance associated with the Project footprint, the RE and the percentage of RE that will be impacted within the ML.

Table 9: Area of Disturbance Associated with Project Footprint

Regional Ecosystem	Total Area within Mining Lease (ha)	Area to be disturbed (ha)	Area to be disturbed as a % of existing RE
RE 4.9.12x4a / 4.9.10b	663.5*	16	2.4%

*Total area of mixed RE 4.9.12x4a / 4.9.10b. Does not include individual RE 4.9.12x4a or 4.9.10b areas (combined total of 867.5 ha).

It is unlikely that a site disturbance caused by the development and operation of the Project will cause any significant residual impacts to the MNES and MSES of the ML. The Project disturbance footprint is minimal and the area is already degraded, with impacts expected to be negligible once the site is rehabilitated.

3.5.3 Management

Table 10 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 10: Management Relating to Ecology Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> ■ Disturbance to Category B ESA State-listed vulnerable Purple-necked Rock-wallaby essential habitat. ■ Disturbance to River Red Gum community.
EA conditions (currently draft)	<ul style="list-style-type: none"> ■ Land disturbed by mining must be rehabilitated in accordance with Table 8. ■ Rehabilitation must commence progressively in accordance with the plan of operations.*
Environmental objectives	<ul style="list-style-type: none"> ■ The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna.
Performance outcomes	<ul style="list-style-type: none"> ■ Activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land, and ■ Areas disturbed will be rehabilitated or restored to achieve sites that are: <ul style="list-style-type: none"> ■ safe to humans and wildlife ■ non-polluting ■ stable; and ■ able to sustain an appropriate land use after rehabilitation or restoration. ■ The activity will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants. ■ The application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.
Avoidance, mitigation and management measures	<p>Location of the Project infrastructure</p> <ul style="list-style-type: none"> ■ Away from the south-west area of the ML where Purple-necked Rock-wallaby were observed utilising rock outcrop habitats, including the associated spinifex grasslands (200 m radius), with no development

Aspect	Details
	<p>planned to take place within the area where Purple-necked Rock-wallaby were observed or the associated spinifex grasslands.</p> <ul style="list-style-type: none"> ■ The temporary water pipeline will predominately be laid on top of ground, and only buried at the highway and three creek crossings with placement to avoid vegetation where practicable. ■ An access track will be formed along the water pipeline route to assist maintenance purposes. ■ Minimising the disturbance footprint, including locating infrastructure in already disturbed and affected habitats. ■ Access and road network has been planned to minimise total length and reduce the width of roads where practicable (limited to 5 m). Existing station tracks will be utilised for ore haulage and upgraded rather than construction of new roads. ■ Clearly marked proposed clearing boundaries to minimise the potential for over-clearing or unnecessary habitat disturbance. ■ Conduct progressive site clearing in a pattern to avoid creating habitat 'islands' within the footprint, and to allow any fauna present in the area to move to areas away from construction activities. ■ Conduct site clearing so that progression of clearing moves animals towards intact habitat. ■ To minimise potential interaction with nocturnal species, vegetation clearing activities will be restricted to daylight hours. <p>Reduction of physical hazards</p> <ul style="list-style-type: none"> ■ Restrict vehicle speeds on site (40 km/h for heavy vehicles, 60 km/h for light vehicles). ■ Minimise the number of vehicles using roads where practicable (e.g., use of buses). ■ Gaps will be left between stockpiles to reduce potential physical barriers and allow fauna passage. ■ Placement of soil stockpiles and bunds to avoid drainage features. <p>Soil management</p> <ul style="list-style-type: none"> ■ Construction activities, including vegetation clearing and soil movement, will work from areas with fewer weed species/smaller infestations towards areas where there is a greater abundance of weeds, where practicable.

Aspect	Details
	<ul style="list-style-type: none"> ■ Inspection of vehicles and equipment brought onto site to ensure they are free of dirt and other material that may contain weed seeds. ■ Regular monitoring of disturbance sites and stockpiles for establishment of weed species. New weed species will be assessed, and appropriate control measures implemented. <p>People management</p> <ul style="list-style-type: none"> ■ Clearly marking the boundary of ESAs, buffer zones and essential habitat to prohibit entry and prevent unnecessary disturbance. ■ Mandatory environmental training for all workers and contractors that highlights conservation issues and species-specific sensitivities. <p>Dust, light and noise</p> <ul style="list-style-type: none"> ■ Water spraying on crushing plant, stockpiles, and mobile plant on-site, when appropriate, to reduce fugitive dust emissions. ■ Stripping of topsoil limited to the immediate area to be extracted. ■ Soil stockpiles limited to 2 m in height to reduce wind-blown dust. ■ Overburden stockpiled separately for future use. ■ Covered truck loads, and stockpiles where appropriate. ■ Assessing weather forecasts and planning disturbance activities to avoid high wind conditions, where practicable. ■ Selection of equipment with lower sound power levels. ■ Mobile equipment is turned off when not in use. ■ Equipment maintenance in accordance with manufacturer's specifications. ■ Manage light sources including using the minimum number and brightness of lights required for safety, not using bare light bulbs or any lighting pointing upward or outwards, particularly at the periphery of the Project footprint. <p>Reclamation and rehabilitation</p> <ul style="list-style-type: none"> ■ All disturbed areas will be returned to their original levels and stockpiled top soil spread after completion of the Project (limited vegetative groundcover).
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Regular inspection of construction and operational activities. ■ Regular inspection physical control or management strategies.

Aspect	Details
	<ul style="list-style-type: none"> ■ Environmental monitoring of activities over time and at mine closure (e.g., photo-monitoring and audits). ■ Any other prescribed monitoring and reporting in accordance with the conditions of the relevant EA. ■ The plan of operations report will be developed prior to the commencement of operations. It will provide the details of progressive rehabilitation.

*Note. The draft EA condition 'Rehabilitation must commence progressively in accordance with the plan of operations'. The plan of operations states that "As the mining campaign duration is short, progressive rehabilitation and mine closure will not occur until the after a decision is made whether Centrex will proceed with the Full-scale Operation (likely to be within six months of the completion of the Project)."

3.6 Surface Water

This section describes the existing (baseline) surface water values, potential impacts to surface water from the proposed Project and the proposed mitigation and management measures to reduce the potential impacts.

3.6.1 Baseline Environment and Environmental Values

The Project is situated in the Georgina River Basin, which is based around the Georgina, Burke, and Hamilton Rivers. The basin is approximately 325 000 km² in area and extends from north-western Queensland and into the Northern Territory. The main surface water resource of the Georgina River Basin is the Georgina River. Split Creek, a tributary of Georgina River, flows east to west through the centre of the ML, and within the ML, a smaller drainage line flows southward from the southern catchment which flows into Sulieman Creek, into the Burke River, and eventually into the Georgina River.

Due to the pronounced wet and dry seasons the majority of streamflow occurs in the summer months often associated with monsoonal activity. For runoff to occur the precipitation needs to be significant or prolonged enough to fill the soil surface stores and generate runoff. A significant amount of this runoff will also then infiltrate to the alluvium of the ephemeral streams.

NRC (2018) completed a baseline wet season receiving environmental monitoring program (REMP) within the ML. This consisted of surface water quality sampling at three sites, as well as stream sediment quality sampling at 11 sites. Note that due to the intermittent nature of flow on the site, only one round of surface water samples was collected. Only three of the eleven sites had sufficient water for surface water quality sampling. Sites with water were included and there were two on Split Creek (ARD4 and ARD6), and one on its tributaries (ARD5). A summary of surface water quality results is presented below.

- pH was above the ANZECC trigger values for toxicants for the protection of slightly to moderately disturbed systems (pH 6.0 – 7.5) at ARD4 (pH 7.6).
- Electrical Conductivity (EC) was above the QWQG salinity guideline (200 µS/cm) at ARD4 (398 µS/cm).
- Dissolved Oxygen (DO) was below ANZECC guideline range (90 – 120 %saturation) at all sites sampled (69.1, 6.8, 20.9 %saturation at ARD4, ARD5, ARD6 respectively).
- Filterable reactive phosphorus (FRP) was above the ANZECC guideline (0.005 mg/L) at all of the sites sampled (0.016, 0.049, 0.015 mg/L at ARD4, ARD5, ARD6 respectively).

- Total aluminium concentration was elevated above the guideline value (0.055 mg/L) at ARD5 (0.15 mg/L).
- Total and dissolved uranium concentrations were below the LOR at all sites; however, the LOR (1 µm/L) was higher than the relevant guideline value (0.5 µm/L).
- All other physico-chemical parameters and metal concentrations were below published guideline values.

The Environmental Protection (Water) Policy 2009 (EPP Water) defines the environmental values and water quality objectives for the surface water environment in Queensland. The Project tenure is situated in the Georgina River Basin. There are no water quality objectives prescribed in the EPP Water for the Georgina River Basin.

In accordance with the EPP Water, if there are no prescribed specific environmental values or water quality objectives for the waters on, or adjacent to, the site, then the water quality objectives are the set of water quality objectives that will protect all environmental values for the water. These are, in order of preference: site specific documents for the water, any Queensland water quality guidelines or any Australian water quality guidelines. Local water quality objectives can also be derived using the Queensland water quality guidelines procedures.

3.6.2 Potential Impacts

The Project infrastructure footprint is a small development relative to the area of the ML, and to the catchment on which the Project is located. The potential impacts to surface water include:

- Reduction in water quality due to accidental spills and leaks of fuels and chemicals.
- Reduction in water quality due to sedimentation from erosion (from land disturbance caused by the development of the Project).

The potential impacts and effect on the water quality will be short in duration (at the most 6 months for the Start-up Operation). The volume of fuels and chemicals on site will be minor, therefore if any accidental leaks or spillages occur, the impact will be reversible. Mitigation is adequate and achievable for all potential impacts which reduces the intensity or magnitude of the impact (if it occurred).

The mining of sand within Split Creek to aid in the processing of phosphate could potentially alter the flow of the watercourse and disturb the stream bank if not undertaken appropriately.

3.6.3 Management

Table 11 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 11: Management Relating to Surface Water Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> ■ Reduction in water quality due to accidental spills and leaks of fuels and chemicals. ■ Reduction in water quality due to sedimentation from erosion.
EA conditions (currently draft)	<ul style="list-style-type: none"> ■ The holder of the environmental authority must not directly or indirectly release waste from the project area to any watercourse, waterway, groundwater, wetland or lake.

Aspect	Details
	<ul style="list-style-type: none"> ■ The holder of the environmental authority must operate, maintain and decommission all dams in accordance with the criteria outlined in the 'Criteria for dams' within the Eligibility Criteria and Standard Conditions for Mining Lease Activities. The holder of the environmental authority must build all dams, other than dams commenced before 1 January 2001, in accordance with the design and construction criteria outlined in 'Criteria for dams'. ■ Contaminants that will, or have the potential, to cause environmental harm must not be released directly or indirectly to any waters as a result of the authorised mining activities, except as permitted under the conditions of this environmental authority.
Environmental objectives	<ul style="list-style-type: none"> ■ The activity will be operated in a way that protects the environmental values of waters.
Performance outcomes	<ul style="list-style-type: none"> ■ The storage and handling of contaminants will include effective means of secondary containment to prevent or minimise releases to the environment from spillage or leaks. ■ Contingency measures will prevent or minimise adverse effects on the environment due to unplanned releases or discharges of contaminants to water. ■ The activity will be managed so that stormwater contaminated by the activity that may cause an adverse effect on an environmental value will not leave the site without prior treatment. ■ Any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland. ■ The activity will be managed so that adverse effects on environmental values are prevented or minimised.
Avoidance, mitigation and management measures	<p>Spill control procedures:</p> <ul style="list-style-type: none"> ■ Ensure that all plant and equipment used in the construction and operation of the Project is maintained appropriately to minimise spills and leaks of contaminants. ■ Any activities that may carry a high risk of spills or leaks should be managed to minimise the risk. ■ Management of ore loading, transport, and unloading should be undertaken by trained personnel. ■ Implement spill emergency response procedures.

Aspect	Details
	<ul style="list-style-type: none"> ■ Dust suppression measures over the ore stockpile, when appropriate. ■ Drainage and water management systems for stockpile areas. <p>Erosion and sediment control measures:</p> <ul style="list-style-type: none"> ■ Minimise disturbance and retain natural vegetation. ■ Schedule works to minimise soil exposure during rainy season. ■ Vegetate and mulch areas disturbed areas where possible. ■ Minimise slope steepness and slope length by using benches, terraces, contour furrows or diversion ditches. ■ Stockpiles to be located outside limits of drainage lines. ■ Keep sediment on-site by using sediment traps, bunding, or sediment barriers. ■ Monitor and inspect sites frequently and correct problems promptly. <p>Sand extraction mitigation measures:</p> <ul style="list-style-type: none"> ■ Minimising the extent of the area required to carry out the activity to be limited to the minimum area necessary to reasonably carry out the works. ■ Disturbed banks will be returned to a profile similar to the pre-disturbance condition. ■ Natural stream bed controls or features that create natural waterholes (e.g., riffles, logs, sediment or rock bars) will not be lowered or removed.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Regular inspection of construction and operational activities. ■ Regular inspection of physical control or management strategies (e.g., sediment control structures, water diversion drains). ■ Environmental monitoring of activities over time and at mine closure (e.g., photo-monitoring and audits). ■ Any other prescribed monitoring and reporting in accordance with the conditions of the relevant EA.

3.7 Groundwater

This section describes the existing (baseline) groundwater values, potential impacts to groundwater from the proposed Project and the proposed mitigation and management measures to reduce the potential impacts

3.7.1 Baseline Environment and Environmental Values

The Queensland Globe database shows 510 registered bores within 75 km of the Project, including 266 yielding bores. The majority of the high yielding bores are located in close proximity to the Phosphate Hill Mine Site, approximately 75 km from the ML. Four bores were identified within 10 km of the Project area. The nearest third-party production bore (Ardmore bore, RN5496) is located outside of the search area, about 11 km northwest of the project area. The drilling and installation of the bore was conducted early 1919 and the bore depth is 186.5 m below ground level.

Groundwater quality was assessed based on the results of two sampling rounds carried out in the monitoring bores installed in 2017 as well as in the landowner bore (Frank's bore). Field and laboratory analysis suggest that groundwater in the fractured rock aquifer of the Beetle Creek Formation in the northern portion of ML5542 is generally brackish to saline, with laboratory Electrical Conductivity measurements ranging between 5,800 $\mu\text{S}/\text{cm}$ to 22,500 $\mu\text{S}/\text{cm}$. The groundwater in this formation is generally neutral to slightly basic and is typically sodium-chloride dominant. Small concentrations of some metals, including As, Cd, Cu, Ni, Pb, and V, as well as TRH were found.

Field analysis collected during the development of monitoring bore MB03 indicate that groundwater in the Thornton Limestone formation in the vicinity of this monitoring bore is neutral with a pH value of 7.47 to 7.64 and highly saline with laboratory Electrical Conductivity measurements ranging between 16,500 to 16,800 $\mu\text{S}/\text{cm}$. The groundwater in this formation is generally neutral to slightly basic and is typically sodium-chloride dominant.

The Environmental Protection (Water) Policy 2009 (EPP Water) lists the environmental values and water quality objectives of groundwater for some waterway basins and areas of Queensland. The ML is in a waterway basin for which values have not been defined in the EPP Water. Regardless of this, the following environmental values have been identified to be relevant to the site:

- Users of groundwater indicated by registered groundwater bores.
- Groundwater Dependent Ecosystems (GDEs).

3.7.2 Potential Impacts

It is unlikely that the Project will affect other groundwater users as a result of water extraction from groundwater from bores in the northern area of the ML. Two pumping wells are proposed for the purposes of the Project, with pumping rates of 7.5 L/s per well for the short-term duration (approximately 12 weeks) of the operation. Preliminary drawdowns for various distances to the extractions wells after 90 days of pumping were calculated using Theis equation for non-leaky confined aquifers. The drawdown were calculated for two cases considering the most and least conservative values of transmissivity and storativity. In all cases, the 2 m drawdown cone is within 50 m of the pumping wells, due to the high formation transmissivity and short pumping duration. For the most conservative case, a 1 m drawdown contour extends approximately 820 m from the pumping wells at the end of the 90-day pumping period.

There are no GDEs mapped in the area of the Project. The findings are summarised below:

- **Subterranean GDEs.** The Australian GDE Atlas indicates an area of "Derived GDE – Unknown Confidence" along the western border the northern half of the ML outside of the Start-up Operation project area.
- **Terrestrial GDEs.** The potential terrestrial GDEs nominated on the ML relate to the "*Eucalyptus spp* low open woodlands often with *Triodia* dominated ground layer". The Queensland GDE Atlas defines it as a moderate potential GDE. The groundwater table in the area containing this potential terrestrial GDE occurs between 8 and 19 m below ground level and as such is not sustaining these plants.

- **Aquatic GDEs.** The desktop search from Atlas GDE identified Split Creek as being having potential for an aquatic GDE. The aquatic GDE dataset expresses the potential for groundwater interaction for rivers, springs, and wetland ecosystems across Australia. It shows the ecosystems that potentially rely on groundwater that has been discharged to the surface, for example, as baseflow or spring flow. The field activities carried out onsite included a walkover of the entire site and the drilling of a monitoring bore close to Split Creek (MB002). Split Creek has been identified as an ephemeral creek and a recharge area for the aquifer, with the water table within the BCF in the vicinity of Split Creek being 8 m below ground level. Split Creek is sustained by rainfall and not groundwater, therefore it is not an aquatic GDE.

3.7.3 Management

Table 11 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 12: Management Relating to Groundwater Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> ■ Reduced quantity of water available to third party groundwater users due to groundwater extraction.
EA conditions (currently draft)	<ul style="list-style-type: none"> ■ The holder of this environmental authority must not release contaminants to groundwater. ■ Monitoring and reporting. All determinations of groundwater quality and biological monitoring must be performed by an appropriately qualified person. ■ Bore construction and maintenance and decommissioning. The construction, maintenance and management of groundwater bores (including groundwater monitoring bores) must be undertaken in a manner that prevents or minimises impacts to the environment and ensures the integrity of the bores to obtain accurate monitoring.
Environmental objectives	<ul style="list-style-type: none"> ■ The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems.
Performance outcomes	<ul style="list-style-type: none"> ■ There will be no direct or indirect release of contaminants to groundwater from the operation of the activity. ■ There will be no actual or potential adverse effect on groundwater from the operation of the activity.
Avoidance, mitigation and management measures	<ul style="list-style-type: none"> ■ No specific mitigation measures are proposed.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Regular inspection of construction and operational activities. ■ All determinations of groundwater quality and biological monitoring will be performed by an appropriately qualified person.

Aspect	Details
	<ul style="list-style-type: none"> Any other prescribed monitoring and reporting in accordance with the conditions of the relevant EA.

3.8 Cultural Heritage

This section describes the known and potential historical cultural heritage values of the Project area, potential impacts to these values resulting from the proposed mining activities and the proposed mitigation and management measures to reduce the potential impacts.

3.8.1 Baseline Environment and Environmental Values

A search of the Department of Aboriginal and Torres Strait Island Partnerships (DATSIP) Cultural Heritage Register of the ML area did not identify any Aboriginal cultural heritage sites. As ML5542 is “pre-1996 grant”, the lease area is not subject to matters related to the *Native Title (Queensland) Act 1993*. The determination recognised the rights and interests of the holders of ML5542 as falling predominantly within the 2014 determined Bularnu Waluwarra and Wangkayujuru People (BWW) Native Title area. Approximately 99 ha of the lower southern portion of the ML extends into an area not covered by currently registered or determined native title claims. Consultation with Queensland South Native Title Services (QSNTS) legal officers identified the last registered claim on this area being from the Kalkadoon people (RBC Environmental, 2017).

No non-indigenous recorded/protected historical sites or places were identified within the ML. The Moonah Creek ‘Hanging Tree’, a tree with historical significance for encounters between indigenous and non-indigenous peoples in the 1870s-1890s, is identified on the Queensland Heritage Register as being located within the Ardmare Station property, however does not fall within the ML boundary (DES, 2016).

An aboriginal cultural and historic heritage assessment of the lease area was undertaken by RBC Environmental together with traditional owner representatives on behalf of Centrex in June 2017, in accordance with the Queensland Heritage Act 1992 and Aboriginal Cultural Heritage Act 2003 (ACHA) Duty of Care guidelines.

While some areas of the site were found to be highly disturbed, the ground surveys have identified Aboriginal archaeological sites consisting of a series of knapping and ‘assaying’ sites associated with outcropping chert and/or exposed nodules. Though many of these artefacts are largely considered to be of low significance given the type and abundance of isolated artefacts throughout the area. There was one high significance artefact site location within the wider area, however this is outside of the area of disturbance for the Start-up Operation.

An additional targeted field survey was conducted in August 2017 over the Project area. Two artefact sites from the earlier survey were found to be within proximity to the Project’s area of disturbance – a chert knapping and worked silcrete outcrop. No areas or sites of historical significance were identified during field assessments.

3.8.2 Potential Impacts

Construction and operation of the Project will involve the excavation and movement of soil within the proposed footprint area, including removal and storage of topsoil, excavation for the pit and for the widening to the existing access track. These activities have the potential to affect any potential sites of archaeological significance that have not yet been identified by either disturbing or destroying them. Potential impacts include:

- **Disturbance of Identified Archaeological Sites or Objects.** A targeted archaeological survey identified archaeological sites or objects adjacent to the Project area of largely low significance. No archaeological sites or objects identified and entered on the DATSIP Cultural Heritage Register lie within the Project area and as such will not be impacted by mining activities.
- **Disturbance or Destruction of Unidentified Archaeological Sites of Significance.** There is potential for the Project to disturb cultural places that are as yet unidentified and their significance unassessed ('unexpected finds'), in particular areas where surveys may have impeded by ground cover.

Given the relative abundance and type of cultural heritage material located within the ML both on a local and regional scale, the proposed management and mitigation methods Centrex will employ will reduce the intensity of potential impacts on the cultural heritage areas of significance, and residual impacts are considered to be minor.

3.8.3 Management

Table 13 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 13: Management Relating to Cultural Heritage Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> ■ Disturbance to identified archaeological sites of significance ■ Disturbance to unidentified archaeological sites of significance
EA conditions	Nil
Environmental objectives	<ul style="list-style-type: none"> ■ To protect all identified and potential heritage values within the ML from adverse impacts caused by project related activities by avoiding disturbance to known cultural heritage values, and where this is not possible, managing disturbances in accordance with agreed procedures. ■ To ensure the requirements of the ACHA are complied with throughout all project phases. ■ To ensure procedures for identifying and managing identified and potential cultural heritage values are successfully implemented.
Performance outcomes	Nil
Avoidance, mitigation and management measures	<p>Ongoing baseline assessment of cultural heritage will be undertaken to further assess areas identified for future activities involving significant ground impacts. In areas where cultural heritage sites have been identified, the following measures are likely to be implemented:</p> <ul style="list-style-type: none"> ■ A Work Program Notice identifying activity type and areas to be disturbed should be arranged or representative present for ground breaking activities associated with the Project.

Aspect	Details
	<ul style="list-style-type: none"> ■ Avoid all identified cultural heritage sites wherever practical, maintaining a minimum 5 m buffer. ■ Flag or otherwise mark identified cultural heritage sites within close proximity to the Project disturbance areas to ensure no unintended impacts from construction or associated access. ■ Ensure all site procedures and contractor inductions include cultural heritage awareness and avoidance measures. ■ Prior to any ground disturbance activities at the Project site, a procedure should be in place detailing the appropriate steps if an unexpected find is encountered. This procedure should encompass the following steps: <ul style="list-style-type: none"> ■ Cease work in the immediate area and secure the find. ■ Do not remove or further disturb the find, erecting a temporary buffering fence if required. ■ Report the find directly to the site supervisor/manager. ■ Consult the Aboriginal Party(s) for further assessment and recommendations for management.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ If disturbance to sites of significance (previously unknown) is unavoidable, Centrex will seek to mitigate the disturbance by recording or removing the material to a secure place in accordance with an CHMA.

3.9 Waste

The waste types likely to be generated by the proposed activities include construction materials waste, green waste, putrescible and domestic waste. These wastes will be removed from the site to the Dajarra waste disposal site that is lawfully able to accept the waste under the EP Act. There is some capacity to dispose of waste on site as the current EA permits a limit of no more than 50 tonnes of general waste to be disposed of within ML5542 per annum.

Limited 'regulated waste' generated on site such as oils and tyres will be removed and transported from site by a person who holds a current authority to transport such wastes to the waste handling facility at Mount Isa. This facility is lawfully able to accept the regulated waste under the EP Act.

Waste tracking for the Project will be undertaken in accordance with the EP Regulations.

3.9.1 Management

Table 14 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 14: Management Relating to Waste Aspects

Aspect	Details
EA conditions (currently draft)	<ul style="list-style-type: none"> ■ The holder of the environmental authority must not directly or indirectly release waste from the project area to any watercourse, waterway, groundwater, wetland or lake. ■ Unless otherwise permitted by the conditions of this environmental authority or with prior approval from the administering authority and in accordance with a relevant standard operating procedure, waste must not be burnt. ■ The holder of this environmental authority may burn vegetation cleared in the course of carrying out extraction activities provided the activity does not cause environmental harm at any sensitive place or commercial place. ■ The holder of the environmental authority must operate, maintain and decommission all dams in accordance with the criteria outlined in the 'Criteria for dams' within the Eligibility Criteria and Standard Conditions for Mining Lease Activities. The holder of the environmental authority must build all dams, other than dams commenced before 1 January 2001, in accordance with the design and construction criteria outlined in 'Criteria for dams'.
Environmental objectives	<ul style="list-style-type: none"> ■ Any waste generated, transported, or received as part of carrying out the activity is managed in a way that protects all environmental values. ■ Design the mine layout and operations to minimise the generation of waste; ■ Minimise the generation of waste through applying the avoidance, minimisation and mitigation principles to reduce, reuse, recycle, recover, treat and dispose of waste; and ■ Ensure safe management and disposal of waste that cannot be reused or recycled.
Performance outcomes	Nil
Avoidance, Mitigation and Management Measures	<ul style="list-style-type: none"> ■ Ensure systems and procedures relating to waste management are being fully implemented and complied with during construction, operations and decommissioning. ■ Conduct of waste management facilities audits during construction and operations stages of the Project. ■ Inspect the mine site and surrounding environment for general waste containment.

Aspect	Details
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Regular inspection of construction and operational activities.

3.10 Traffic

This section describes the existing traffic of the Project area and potential impacts to traffic, road users and the community resulting from the proposed Project mining activities. It also provides proposed mitigation and management measures to reduce the potential impacts.

3.10.1 Baseline Environment and Environmental Values

The Project ML is approximately 23 kms from Dajarra by road via the Diamantina Developmental Road (also known as Mount Boulia Highway), that is a state-controlled road under the authority of DTMR. The Project ML can be accessed from Mt Isa along that same single-lane bitumen sealed road for two-way traffic, the Diamantina Development Road which joins Boulia and Mt Isa. This road passes through the northern end of the lease. An unused section of the original gazetted, unsealed Urandangi South Road also traverses a section of the ML in the north. Several private station tracks pass through parts of the ML. The local road network provides access to surrounding properties.

The DTMR supplied 2017 Traffic Analysis and Reporting System (TARS) data, with the Annual Average Daily Traffic (AADT) and heavy vehicle percentage for the road segments proposed for the haulage route (Table 15). TARS data also indicates that the Diamantina Development Road has declining traffic volumes over the last year (-13.24%) and 10 years (-2.55%), while the Cloncurry Dajarra Road data indicates increasing traffic volumes over the last year (18.52%) and 10 years (7.6%).

Table 15: TARS Base Traffic Volume

Road	Annual average daily traffic (AADT)	Heavy Vehicle %
Diamantina Development Road (north)	59 vpd	25%
Cloncurry Dajarra Road	64 vpd	22%
Diamantina Development Road (south)	79 vpd	19%

Note. 'North' and 'South' refer to section of Diamantina Development Road relative to the intersection with the Cloncurry Dajarra Road

3.10.2 Potential Impacts

During the construction and operational phase of the Project the volume of vehicle traffic will increase between the site and Cloncurry. Traffic volumes will also increase on the Diamantina Development Road from light vehicles accessing the site from Mt Isa and from Dajarra to the site access track. Potential impacts relating to project-related traffic include:

- Increased traffic volume and change in traffic composition.
- Members of the community being exposed to traffic hazards or traffic accidents.
- Potential noise and air impacts from increased heavy vehicle traffic to sensitive receptors at Dajarra and Duchess from increased heavy vehicle traffic to Cloncurry. The noise impacts will be similar to existing levels of trucks travelling along existing roads with the difference being the increased traffic volume

through the construction and operational phases of the Project. The air (dust) impacts will be caused by increased traffic volumes leading to potentially larger levels of dust produced that may linger in the air environment longer.

The primary issue relating to traffic is the greater volume of project-related traffic and change in the traffic composition (i.e., minor increase in the proportion of heavy vehicles associated with haulage activities to Cloncurry).

The increase in traffic will be short term for the Project, but it may result in a decrease in road safety, particularly at the intersection from the site access track to the Diamantina Development Road turning to and from the Dajarra to Duchess Road. The limited increase in heavy vehicle traffic during the start-up operation is unlikely to degrade the road surfaces and cause delay to other users of the road from slow haulage vehicles.

3.10.3 Management

Table 16 provides the potential impacts, the management measures to reduce impacts from the Project, objectives, performance outcome and any proposed monitoring.

Table 16: Management Relating to Traffic Aspects

Aspect	Details
Potential impacts	<ul style="list-style-type: none"> ■ Increase in community health and safety risk from heavy vehicle use of haul route. ■ Increase in dust and noise from heavy vehicle use of haul route.
EA conditions (currently draft)	<ul style="list-style-type: none"> ■ The holder of the environmental authority must not cause an unreasonable release of dust. ■ The holder of the environmental authority must not cause unreasonable noise at a noise sensitive place.
Environmental objectives	<ul style="list-style-type: none"> ■ To ensure the health and safety risk to the community from increased traffic is minimised to acceptable levels. ■ To minimise the nuisance and disturbance to the community and residence sensitive receptors from air (dust) and noise impacts is minimised to acceptable levels and ensure that any complaints are responded to in a timely manner.
Performance outcomes	Nil
Avoidance, mitigation and management measures	<ul style="list-style-type: none"> ■ Health and safety and environmental controls with trucking contractor / drivers through community areas such as Dajarra and Duchess e.g., speed limits to conditions, driver behaviour, school drop-off and pick-up times, noise minimisation of exhaust breaking. ■ Community (Dajarra and Duchess) communication prior to starting construction equipment and product haulage to inform of increased

Aspect	Details
	levels of heavy vehicle traffic along the Diamantina Development Road and Cloncurry Dajarra Road, Dajarra and Duchess towns.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Regular inspection of construction and operational activities. ■ Complaints will be managed according to the Community Enquiries and Complaints Procedure.

3.11 Socio-economic

This socio-economic section identifies predicted Project related changes to employment, local businesses and industry.

3.11.1 Baseline Environment and Environmental Values

Established in the early 20th century, Dajarra began as a railway construction camp for the Great Western Railway, extending the train line from Cloncurry in the 1920s. Being the most western-point of the Queensland rail system, it rapidly became strategically significant as one of the world's largest cattle-trucking depots, as it provided access to the east coast markets and ports for international export (RBC Environmental, 2017; O'Rourke, 2011).

While the introduction of road-trains for cattle transport in the late 1950s-early 1960s lead to a decline in opportunities in Dajarra township, beef cattle farming remains the dominant industry of employment within Dajarra (ABS, 2016; Dajarra State School, 2017). By Australian demographic standards, Dajarra has an unusually high proportion of Aboriginal residents and it is considered to be an important social and service town for Aboriginal people from the local area as it is located an equal distance between Boulia and Mt Isa (Long, 2007).

The provision of services to local residents of the region is difficult due to the isolated nature of its geographic location, particularly potable water supply, which has been a problem for Dajarra with the bore water and rainwater both lacking in quantity and quality (O'Rourke, 2011).

The community services are typical of a small town and include the Dajarra Roadhouse (including fuel, food, accommodation and mail centre), Jimberella Housing Cooperative (the Aboriginal Community's corporate body), Dajarra State School, Parent and Community organisation, Dajarra Sports committee, Cloncurry Shire Council, Centerlink, Legal Aid, Queensland Police, Queensland Health clinic, Allied Health, Aboriginal Health, Royal Flying Doctor Service, Home and Community Care, Catholic Church, Protestant Church, Aboriginal and Islander Catholic Council, Church of the Latter-Day Saints, State Emergency Service (SES), employment agency and Dajarra Hotel (O'Rourke, 2011).

There were 191 people living in Dajarra at the time of the 2016 Australian census (ABS, 2016). ABS census information indicated the median age of the population of both Dajarra and Mount Isa (27 and 31 years respectively) was comparatively young given the Queensland median age of 37.

ABS census data from 2016 reports 9.0% unemployment rates in Dajarra, however community consultation undertaken by Centrex indicated high levels of unemployment is an issue for the town, therefore it is unknown if the ABS census employment statistics are reflective of the town's true unemployment figures.

3.11.2 Potential Impacts

The Project will have a positive influence on elements of the socio-economic environment. There will be a minor injection into local and regional economy as a result of the Project expenditure and a possible increase in employment. Potential negative impacts were determined to be negligible.

During the construction and operational phase of the Project positive effects relating to the socio-economic environment include:

- **Direct and indirect employment opportunities for the local community.** Centrex will aim to use local community (Mt Isa – Dajarra – Cloncurry) where possible for direct Project employment should appropriately skilled workers be available, where possible. Use of local businesses for accommodation and other services may result in small increases of local community in-direct employment opportunities.
- **Local economy injection.** It is likely that the Project workforce will use local businesses at Dajarra for accommodation and for services at the roadhouse, petrol station and hotel/pub.

3.11.3 Management

Table 17 provides the potential positive effects, the management measures to maximise positive effects from the Project, objectives, performance outcome and any proposed monitoring.

Table 17: Management Relating to Socio-economic Aspects

Aspect	Details
Potential positive effects	<ul style="list-style-type: none"> ■ Direct and indirect employment opportunities for the local community ■ Local economy injection
EA conditions	Nil
Environmental objectives	<p>To ensure Project workforce management practices:</p> <ul style="list-style-type: none"> ■ Prioritise recruitment of workers from local and regional communities and workers who will live in regional communities, however this is dependent upon the type of skills and experience available. ■ Reduce the proportion of workers engaged in fly in fly out arrangements, where operationally feasible. <p>To ensure Project procurement practices:</p> <ul style="list-style-type: none"> ■ Maximise opportunities for competitive and capable local businesses to provide goods and services to the Project. ■ Reduce barriers to entry for local businesses where feasible.
Performance outcomes	<ul style="list-style-type: none"> ■ Nil
Measures to maximise positive effects	Centrex will aim to maximise the positive effects from the Project by:

Aspect	Details
	<ul style="list-style-type: none"> ■ Maximising employment opportunities for the local community where possible, however this is dependent upon the type of skills and experience available. ■ Reducing the proportion of workers engaged in fly in fly out arrangements, where operationally feasible. ■ Sourcing goods and services locally wherever practicable, based on local capacity, ability to supply, quality and cost competitiveness. ■ Continuing stakeholder engagement activities with the local community to ensure that if any negative impacts on the socio-economic environment arise as a result of the Project that they are monitored and, if required, managed.
Inspection, monitoring or reporting	<ul style="list-style-type: none"> ■ Complaints will be managed according to Community Enquiries and Complaints Procedure.

4.0 SUMMARY

This EMP provides a summary of the environmental values in the Project area, the potential impacts associated with the project and the management measures that Centrex will implement during the construction and operation of the Start-up Operation.

It is a stand-alone document for reference during all phases of the Start-up Operation to ensure environmental compliance with legislation and policies and the EA conditions. The roles and responsibilities for environmental management activities have been identified (Section 2.2) and the ongoing management activities provided in Section 3.0. These management activities will be used as a high-level guidance for the mining contractor to develop site specific SOPs to be provided to on-ground mining personnel.

Implementation of the EMP and SOPs will aim to ensure environmental impacts are adequately managed during construction, operation and decommissioning of the Project.

5.0 REFERENCES

- Australian Bureau of Statistics (ABS) (2016). *Dajarra General Community Profile*. Available from: http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/communityprofile/SSC30794?op=endocument. Viewed 16 April 2018.
- Centrex Metals (2017). *Ardmore Phosphate Rock Project – Maiden Mineral Resource Announced*. ASX Announcement, 6 July 2017. Available from: <http://www.centrexmetals.com.au/wp-content/uploads/2017/07/20170706-Maiden-Mineral-Resource-for-Ardmore-Phosphate-Project.pdf>. Viewed 3 April 2018.
- Centrex Metals (2018). *Ardmore Phosphate Rock Project – Updated Mineral Resource Estimate Complete*. ASX Announcement, 1 June 2018. Available from: <https://www.asx.com.au/asxpdf/20180601/pdf/43vgxdjlpqgcwb.pdf>. Viewed 27 June 2018.
- Department of Environment and Science (DES) (2016). *Queensland Heritage Register – Moonah Creek ‘Hanging Tree’*. Available from: <https://environment.ehp.qld.gov.au/heritage-register/detail/?id=600040>. Viewed 4 April 2018.
- EPA VIC (2013) EPA Victoria publication 1518, *Recommended separation distance for industrial residual air emissions*.
- Long, S. (2007). *Power, water, shelter and connection to country – too much to ask for? Demand responsive services to desert settlements: Case studies from North West Queensland and eastern Northern Territory*. Unpublished annual research report, Desert Knowledge Cooperative Research Centre, Alice Springs.
- Northern Resource Consultants (NRC) (2017). *Ardmore Phosphate Project – Terrestrial Flora and Fauna Technical Report*. Version 3 dated 17 July 2017. Northern Resource Consultants Pty Limited.
- Northern Resource Consultants (NRC) (2018a). *Ardmore Phosphate Project – Baseline Aquatic Ecology Survey – Wet Season 2018*. Version 2 dated 4 May 2018. Northern Resource Consultants Pty Limited.
- Northern Resource Consultants (NRC) (2018b). *Ardmore Phosphate Project – Terrestrial Flora and Fauna Report*. Version 2 dated 4 May 2018. Northern Resource Consultants Pty Limited.
- O'Rourke T. (2011). *Delivering drinking water to Dajarra, North West Queensland*. DKCRC Report 64. Ninti One Limited, Alice Springs.
- RBC Environmental (2017). *Ardmore Phosphate Mine Mining Lease 5542 Aboriginal Cultural and Historic Heritage Assessment*. Dated June 2017.

Signature Page

Golder Associates Pty Ltd



Jayne Rutter
Senior Environmental Consultant



Lochlan Gibson
Manager - Environment

JR/LG/jr

A.B.N. 64 006 107 857

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/1782517/1782517/6.deliverables/016_emp_trial_mining/rev1/1782517-016-r-rev1-emp-start-up-operations.docx



golder.com