Northern Territory Environment Protection Authority

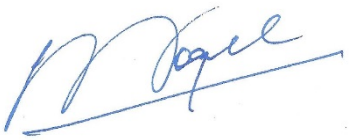
ASSESSMENT REPORT 87

AMMAROO PHOSPHATE PROJECT
Verdant Minerals Ltd

October 2018

Environmental Impact Assessment Process Timeline

Date	Chronology
24/04/2014	Notice of Intent received
19/06/2014	NT EPA decision issued - Environmental Impact Statement (EIS)
22/11/2014	Draft Terms of Reference (ToR) released for public comment
18/12/2014	Final ToR issued to proponent
28/10/2017	Draft EIS released for public comment for 6 weeks
20/12/2017	NT EPA direction to prepare EIS Supplement issued
2/08/2018	EIS Supplement received
2/10/2018	Assessment Report issued



Dr Paul Vogel
Chairman

2 October 2018

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Important Disclaimer

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Contents

List of tables, figures and appendices

Tables

Figures

Appendices

Abbreviations and glossary

Advisory bodies	NTG Agencies having expertise and/or administrative responsibilities in respect of the Proposal
ADWG	Australian Drinking Water Guidelines
AMD	Acid and Metalliferous Drainage
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
ASLP	Australian Standard Leaching Procedure
CHMP	Cultural Heritage Management Plan
DENR	Department of Environment and Natural Resources
Draft EIS	Draft Environmental Impact Statement
EA Act	*Environmental Assessment Act*
EAAP	Environmental Assessment Administrative Procedures
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement (made up of the draft EIS and the Supplement)
Environment	All aspects of the surroundings of man including the physical, biological, economic, cultural and social aspects (Section 3 of the *Environmental Assessment Act*)
EP Act	*Energy Pipelines Act*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESCP	Erosion and Sediment Control Plan
ESIMP	Economic and Social Impact Management Plan
ESD	Ecologically Sustainable Development
FIFO	Fly-in / Fly-out
GHG	Greenhouse gas
MM Act	*Mining Management Act*
MCP	Mine Closure Plan
MMP	Mining Management Plan
NAF	Non-acid forming
NAG	Net acid generation

NOI	Notice of Intent
NORM	Naturally occurring radioactive materials
NTASS Act	*Northern Territory Aboriginal Sacred Sites Act*
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
ROM	Run of mine
SAR	Sodium absorption ratios
The Responsible Minister	Northern Territory Minister for Primary Industry and Resources
The Minister	Northern Territory Minister for Environment and Natural Resources
The Proposal	Ammaroo Phosphate Project
The Proponent	Verdant Minerals Ltd (formerly Rum Jungle Resources Ltd)
The Supplement	Supplement to the Draft EIS
The / this Report	Assessment Report 87, for the Ammaroo Phosphate Project
ToR	Terms of Reference

Units and symbols

%	percent
>/<	greater than/less than
°C	degrees Celsius
Bq/g	Becquerel per gram
GL	gigalitre (billion litres)
GL/y	gigalitre per year
ha	hectare
km	kilometre
L	litre
L/s	litres per second
m	metre
m^3	cubic metre
ML	megalitre (million litres)
mm	millimetre
mm/y	millimetres per year
mSv/y	millisievert per year
Mt	mega tonne (million tonnes)
Mt/y	mega tonne per year
MW	megawatt
MW/hr	megawatts per hour
P_2O_5	Phosphorus pentoxide
PJ/y	peta joule per year
ppm	parts per million
kPa	kilopascal
t Co_2-e	tons of carbon dioxide equivalent

Summary and recommendations

Environmental impact assessment (EIA) is a process for identifying the potential environmental impacts and risks of a proposed action, evaluating the significance of those impacts and risks, and determining appropriate avoidance, minimisation and mitigation measures to reduce those impacts and risks to acceptable levels.

This Assessment Report (this Report) evaluates the environmental impacts and risks of the Ammaroo Phosphate Project (the Proposal), proposed by Verdant Minerals Ltd (the Proponent). This Report marks the end of the assessment process by the Northern Territory Environment Protection Authority (NT EPA).

The Report is provided to the Northern Territory Minister for Environment and Natural Resources (the Minister) and to the Minister for Primary Industry and Resources (the Responsible Minister) for approvals and conditioning that would be required for the Proposal under the *Mining Management Act* (MM Act) and any subsequent approvals. This Report is not intended to provide an environmental approval although it will guide the decision for authorisation (by the Responsible Minister).

The Proponent is proposing to develop and operate the Proposal, consisting of a phosphate mine and ancillary infrastructure, located in the Northern Territory (NT) approximately 220 km south-east of Tennant Creek and 270 km north-east of Alice Springs. The Proposal includes open-cut strip mining and on-site beneficiation producing up to 2 Mt/y of 32% phosphate rock concentrate over a 25 year mine life, targeting a portion of the known phosphate deposit in the area. This product would be transported by rail to the Port of Darwin for export.

The Proposal comprises:

- the mine site, including a processing plant and a surface tailings storage facility
- an infrastructure corridor accommodating a 105 km rail spur (connecting to the Adelaide to Darwin railway line) and a 137 km underground gas pipeline (connecting to the Amadeus gas pipeline)
- a bore field accessing the nearby Georgina Basin carbonate aquifer and a 12 km pipeline for water supply
- supporting infrastructure such as roads, a power station, an administration building and an accommodation village
- realignment of approximately 12 km of the Murray Downs Road (a public road) to bypass the mine site.

The Proposal would require clearing of approximately 3775 ha of native vegetation over the proposed 25 year mine life. Rehabilitation, including revegetation, would be progressive.

Based on the Notice of Intent, the NT EPA identified the following potential impacts and risks to the environment that may arise from implementation of the Proposal:

- impacts to users and groundwater dependent ecosystems as a result of groundwater drawdown from water abstraction
- contamination of surface waters, groundwater and soils
- impacts on biodiversity values and threatened species
- impacts to social, economic and cultural surroundings.

These potential impacts and risks contributed to the decision to assess the Proposal at the level of an Environmental Impact Statement (EIS).

In making this Report, the NT EPA had regard to the information provided by the Proponent, public submissions, specialist advice from advisory bodies across the NT Government, and relevant guidelines and standards. The NT EPA identified the following key environmental factors that may be significantly impacted by the Proposal:

- Hydrological processes
- Inland water environmental quality.

The Proposal is in an arid zone of Australia where water is a scarce and valuable resource, and the efficient use of surface and groundwater and the maintenance of water quality are of high importance. The proposed 3.6 GL/y of groundwater abstraction is substantial. This represents more than a third of the water abstracted to supply reticulated water to the town of Alice Springs, making the Proposal the second largest groundwater user in the region.

The Proponent's modelling predicts proposed water extraction from the nearby Georgina Basin carbonate aquifer will result in groundwater drawdown that could reduce the availability of water to other users in the long term.

To ensure groundwater drawdown is appropriately managed, the NT EPA recommends the development of a Water Abstraction Management Plan (WAMP) separate to a Water Management Plan. The WAMP should focus on issues associated with the management of groundwater abstraction and the monitoring of groundwater hydrology. Complementary to the WAMP, the Water Management Plan should focus on all other issues associated with water use on the Proposal site, operational water management and water quality.

The Proponent committed to ensuring that there will be no reduction in water availability to other users because of mining and presented a range of monitoring and mitigation measures to address potential impacts to other users of groundwater. In order to further mitigate and manage the potential impacts, the NT EPA recommends that all recommendations from the peer review and commitments made by the proponent are incorporated into the WAMP, that groundwater levels at nearby stock and community bores are monitored and that hydrological baseline data are established for all groundwater abstraction monitoring bores.

The NT EPA recommends further transparency for managing groundwater abstraction, including consultation with stakeholders on the Proponent's use of groundwater. The NT EPA also recommends that the Proponent demonstrates continual improvement in water use efficiency to minimise groundwater abstraction and best practice water management in line with the International Council on Mining and Metals water stewardship framework (ICMM 2014). This would include implementation of a WAMP and being publicly accountable through public disclosure of the WAMP, the WMP and annual Water Management Reports.

The Proponent's investigations indicated it is unlikely that saline drainage, and acid and metalliferous drainage (AMD) would be generated from mined and processed materials, and that any leachate is unlikely to significantly impact on groundwater and surface water quality. Initial chemical assays indicated that the waste rock is low in sulfur and potentially toxic metals and is non-acid forming, typical of highly oxidised and weathered material above the long-term water table.

Nevertheless, the NT EPA recommends that the proposed tailings leachate seepage monitoring and mitigation program should be implemented as a precautionary measure, recognising that further characterisation of tailings and waste rock geochemistry will continue to inform knowledge of the composition of seepage. The NT EPA recommends that all learnings be used to improve the existing hydrogeological model for the mine site, and the findings reported in the annual Water Management Report. In order to

ensure the seepage monitoring program is appropriate and scientifically robust, NT EPA recommends an independent external audit of the program should be undertaken after four and ten years of tailings deposition.

There are no surface water features within the proposed mine site. The primary pathway for potential contamination of surface waters downgradient of the mine site would be through an accidental spill or an uncontrolled discharge. The NT EPA assessed the risk of these as low with the implementation of the proposed preventative measures, monitoring programs and contingency plans.

The NT EPA supports the Proponent's commitment for progressive rehabilitation as a key feature of their conceptual mine closure plan. In order to ensure best practice is applied to rehabilitation and that revegetation is developing towards self-sustaining ecosystems, the NT EPA recommends an independent external audit is undertaken of rehabilitation, including revegetation, every five years and at closure. The NT EPA has made recommendations to ensure that mine closure planning is thoroughly considered prior to authorisation of the Proposal and on an ongoing basis throughout the mine life, including appropriate stakeholder consultation and an agreed post-mining land use. The NT EPA expects the learnings from research, site investigations and rehabilitation monitoring to be integrated into progressive updates of the Mine Closure Plan.

The NT EPA has made 12 recommendations as an outcome of the EIA of the Proposal. These recommendations are primarily for the Proponent to address through the approval process and during the implementation of the proposed action.

The NT EPA emphasises that the environmental commitments, safeguards and recommendations outlined in the EIS, this Assessment Report and in the final management plans, must be implemented by the Proponent and oversighted and enforced by the relevant regulator throughout the life of the Proposal to deliver acceptable environmental outcomes.

The NT EPA considers that, subject to the implementation of the recommendations and the Proponent's commitments, the Proposal can be managed in a manner that is likely to meet the NT EPA's objectives and avoid significant or unacceptable environmental impacts and risks.

List of recommendations

Recommendation 1

That the Proponent ensures that the Ammaroo Phosphate Project is implemented in accordance with all environmental commitments and safeguards:

- **identified in the final Environmental Impact Statement for the Ammaroo Phosphate Project (draft Environmental Impact Statement and Supplement to the draft Environmental Impact Statement)**
- **recommended in this Assessment Report 87**
- **to the satisfaction of the relevant regulator.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent.

Recommendation 2

That the Proponent provide written notice to the Northern Territory Environment Protection Authority and the Responsible Minister if it alters the Ammaroo Phosphate Project and/or commitments, safeguards or mitigation measures in the Environmental Impact Statement in such a manner that the environmental significance of the action may have changed, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

Recommendation 3

That approvals and decisions for the Proposal have conditions that require the Proponent to provide a Water Abstraction Management Plan to the relevant regulator prior to mining that:

- **includes a framework identifying the location, timing, methods and parameters for the collection of further groundwater information**
- **incorporates the recommendations of the independent peer review to improve identification of natural recharge processes and extraction rates of other users; characterisation of flow and flow directions; and robustness of the water level baseline by capturing seasonal changes**
- **incorporates a program to monitor groundwater levels at nearby stock and community bores**
- **is based on robust groundwater level baseline data capturing seasonal changes over at least 12 months at all proposed groundwater abstraction monitoring bores, including borefield and nearby stock and community bores**
- **incorporates all relevant commitments made by the Proponent in the Environmental Impact Statement, including a zero reduction in water availability to other users from mining activities**
- **is developed in consultation with relevant stakeholders, including other groundwater users**

- **actively and continuously seeks to improve knowledge of aquifers and groundwater tables affected by the Proposal and incorporates these into the model**
- **is independently peer reviewed by a suitably qualified independent professional**
- **is developed and implemented to the satisfaction of the relevant regulator**
- **is to be updated at least annually**
- **reports all water monitoring data with an assessment of the impacts on groundwater hydrology in an annual Water Management Report.**

Public disclosure of the annual Water Management Report and each updated Water Abstraction Management Plan should be provided on the websites of (as applicable) the Proponent, the Operator and relevant authorities.

Recommendation 4

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **allocate clear responsibilities and accountabilities for water use and management**
- **provide regular updates of the projected water balance for the Proposal in the Water Management Plan, including detailed estimates for the various phases of the Proposal and specifying the source and quantity of the water to be used**
- **demonstrate how water saving considerations are integrated in Proposal planning including final design and technologies**
- **report on continual improvement initiatives in water use efficiency including the provision of relevant water use targets**
- **provide details on how water will be effectively managed during proposed operations, including minimising water consumption, maximising water reuse and minimising waste water**
- **abstract water from bores only when equipped with operating flow meters**
- **record the volume of water abstracted from the borefield and the corridor construction bores**
- **report water use performance in relation to target, and any change to targets in an annual Water Management Report to stakeholders**

Public disclosure of the Water Management Plan and annual Water Management Report should be provided on the websites of (as applicable), the Proponent and relevant regulatory authorities.

Recommendation 5

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **update the seepage monitoring program in the Water Management Plan to include recommendations of the peer review**
- **annually review and, if required, update the seepage model.**

Findings of the review and updates should be reported in the annual Water Management Report.

Recommendation 6

That approvals and decisions for the Proposal have conditions that require the Proponent to provide an updated Acid and Metalliferous Drainage Management Plan to the relevant regulator prior to mining that:

- **incorporates the recommendations of the independent peer review and all commitments made by the Proponent in the Environmental Impact Statement including further testing in the pre-production phase (geochemical testing of tailings and ore, identification of suitable capping/encapsulation material and additional NAG and NAPP testing)**
- **includes aggressive leach testing of tailings prior to mining with the results to be reported to the relevant regulator for assessment and, if required, identification of appropriate mitigation measures**
- **incorporates a program to analyse in-situ extracts of tailings seepage and decant water during the first 12 months of operation with the results to be reported to the relevant regulator for assessment and, if the seepage composition exceeds the agreed threshold levels, then mitigation options such as lining the tailings storage or additional tailings treatment must be implemented immediately**
- **includes a program for regular geochemical testing of all materials scheduled for mining or in constructed landforms (including ore stockpiles and tailings), including the frequency of monitoring, methods to be used, and number of samples to be tested**
- **includes a contingency plan outlining trigger levels for actions, specific responses and mitigation measures, and consequences for operational, rehabilitation and closure activities.**

The Acid and Metalliferous Drainage Management Plan should be developed and implemented to the satisfaction of the relevant regulator.

Recommendation 7

That the Acid and Metalliferous Drainage Management Plan, referenced at Recommendation 6, include a program for regular radiological testing of all materials scheduled for mining or in constructed landforms (including ore stockpiles and tailings), including the frequency of monitoring, methods to be used, and number of samples to be tested.

Recommendation 8

That approvals and decisions for the Proposal have conditions that require the Proponent to develop a Water Management Plan to the satisfaction of the relevant regulator prior to mining. The plan should include:

- **an assessment of chemicals added during water treatment and the beneficiation process, including an assessment of their behaviour and breakdown products in tailings and tailings decant/seepage and potential to contaminate the environment. In particular:**
    - **clearly identifying the type of polyacrylamide and polymer flocculants**
    - **polyacrylamides with more than 0.05% of the neuro-toxin acrylamide monomer are not to be used**
- **recommendations of the independent peer review to monitor seepage during the early stages of mine development**
- **robust pre-mining groundwater quality baselines to be used as trigger levels for mitigation measures, or should no groundwater be present, livestock drinking water guidelines to be used as trigger thresholds**
- **in line with the program to monitor potential contamination sources (Recommendation 6) potential contaminant concentrations in waste rock and tailings leachate should be identified and used as trigger thresholds for management actions to mitigate the source of contamination**
- **contingency measures to mitigate the source of contamination, if trigger values are exceeded**
- **a robust groundwater quality monitoring program that can quantify the extent and quality of any potential seepage from the proposed mine site**
- **a requirement for an independent external audit of the seepage monitoring program by a suitably qualified and experienced professional after four and ten years of tailings deposition. The auditor is to report to the relevant regulator.**

All water quality monitoring data, trigger values, audit reports and an assessment of impacts should be made publicly available in an annual Water Management Report on the websites of (as applicable) the Proponent, the Operator and relevant regulatory authorities.

Recommendation 9

That the Proponent rehabilitate and revegetate all sections of the infrastructure corridor not required during the operational phase shortly after construction has been completed. Revegetation is to use local native plant species.

Recommendation 10

That approvals and decisions for the Proposal have conditions that require the Proponent to provide a Mine Closure Plan to the relevant regulator prior to mining. The Mine Closure Plan must:

- **be of a standard equal to or better than the Western Australian guidelines for preparing mine closure plans (DMP, 2015)**
- **address all aspects of rehabilitation and mine closure, including post-mining land use agreed with stakeholders, rehabilitation objectives, schedules for progressive rehabilitation, completion criteria and monitoring of rehabilitation success**
- **include predicted landform designs that are consistent with current standards and best practice**
- **include plans and a schedule for post-construction rehabilitation of all areas of the infrastructure corridor that would no longer be required after construction**
- **demonstrate that all rehabilitated areas would be safe to humans and animals, geotechnically stable, non-polluting and non-contaminating, and capable of sustaining the agreed post-mining landuse**
- **include details of the research trials and investigations that would inform, guide and support appropriate landform covers and ecosystems for all rehabilitation, including progressive rehabilitation and closure**
- **investigate the long term settling process of tailings and waste rock to inform construction of appropriate landform covers and avoidance of significant depressions and pooling of water**
- **provide details of a program for regular monitoring and reporting on the performance of progressive rehabilitation works**
- **provide for results from monitoring the performance of progressive rehabilitation to inform decision-making to ensure long-term successful rehabilitation**
- **outline a strategy for appropriate consultation with stakeholders on rehabilitation objectives and post-mining land use**
- **provide for ongoing monitoring and maintenance of the site post-mining, in accordance with an approved monitoring and maintenance program, until such time as the relevant regulator directs**
- **require reporting to the relevant regulator on progressive rehabilitation works and performance**
- **require independent external audits by suitably qualified and experienced professionals of the progressive rehabilitation, including revegetation, at least every five years and at closure.**

The Mine Closure Plan is to be peer-reviewed by an appropriately qualified independent professional prior to submission to the relevant regulator.

Recommendation 11

That approvals and decisions for the Proposal have conditions that require future iterations of the Mine Closure Plan to include:

- **alternative rehabilitation options that identify a range of closure scenarios and strategies for the mine pit and associated infrastructure and provide justification that the preferred closure option minimises environmental risks**
- **identification and management of knowledge gaps relating to closure-specific technical information (including environmental baseline data, waste characterisation, and review of monitoring data) to inform sustainable mine closure**
- **details of pre-closure research trials, investigations and modelling aimed at addressing knowledge gaps to inform detailed rehabilitation design. These are to include, but are not limited to, vegetation, final cover materials, capping design, and surface water runoff.**

Recommendation 12

That approvals and decisions for the Proposal include conditions that require the Proponent to demonstrate appropriate engagement with native-title holders, and to establish a Community Consultation Group with Aboriginal, pastoral, and other relevant stakeholders to provide a forum to:

- **inform (in an appropriate manner) local residents of key aspects of the Proposal that may impact on their values, including amenity and cultural practices**
- **consult with local residents and relevant agencies on matters relating to the proposed workforce, to maximise benefits for local employment, and to manage cumulative impacts on demand for local workers and overall employment opportunities**
- **undertake ongoing stakeholder consultations on agreed post-mining land use and rehabilitation objectives.**

1 Introduction

1.1 Purpose of this Report

Verdant Minerals Ltd (the Proponent) proposes to develop and operate the Ammaroo Phosphate Project (the Proposal), comprising a phosphate mine and ancillary infrastructure.

The Proposal has been assessed by the Northern Territory Environment Protection Authority (NT EPA) at the level of an Environmental Impact Statement (EIS) under the *Environmental Assessment Act* (EA Act). The NT EPA has prepared this Assessment Report (this Report) in accordance with section 7(2)(g) of the EA Act and clause 14(3) of the Environmental Assessment Administrative Procedures (EAAP).

The purpose of this Report is to ensure that matters with the potential to affect the environment to a significant extent are fully examined and reported. This Report is provided to the Northern Territory Minister for Environment and Natural Resources (the Minister) who will provide the report to the Minister for Primary Industry and Resources (the Responsible Minister) to be taken into account in decisions made by the Northern Territory (NT) Government.

This Report it is not intended to provide an environmental approval although it will guide the decisions and conditions of approvals, authorisations and other matters.

1.2 Scope of the assessment

The NT EPA assessed the potentially significant environmental impacts and risks associated with the Proposal in line with the NT EPA's environmental factors and objectives and in accordance with the requirements of the EA Act. The matters relating to the environment that the NT EPA considered necessary to be dealt with in the EIS for the Proposal were identified in the Terms of Reference (NT EPA, 2014 b), which were developed in accordance with clauses 8(3) to (6) of the EAAP.

Based on the Notice of Intent, the NT EPA identified the following potential environmental impacts and risk categories that contributed to the decision to assess the Proposal at the level of an EIS:

- uncertainty of proposal configuration
- impacts to users and groundwater dependent ecosystems resulting from groundwater drawdown from water abstraction
- contamination of surface waters, groundwater and soils
- impacts on biodiversity values and threatened species
- impacts to social, economic and cultural surroundings.

1.3 Information before the NT EPA

In making this report, the NT EPA had regard to:

- the Notice of Intent
- the Terms of Reference
- the Draft EIS
- the Supplement to the Draft EIS
- comments from NT Government agencies on the draft Terms of Reference, Draft EIS and Supplement to the Draft EIS

- comments from the public on the draft Terms of Reference and Draft EIS
- technical and other reports and guidelines that are noted in the References (section 7) to this Report.

1.4 Regulatory framework

The Proposal will require approval and regulation by the NT and Australian governments. The framework for approval and regulation of the Proposal is provided at Chapter 3 of the Draft EIS and is summarised below, with an emphasis on the obligations and requirements of the NT Government.

The NT EPA provides this Report to the Minister. The Minister is required to provide a copy of this Report to the Responsible Minister, together with any written comments made by the Minister in relation to this Report. If the Minister makes a comment in relation to this Report, the Minister must comply with reporting obligations to the NT EPA, under section 8B of the EA Act.

1.4.1 Primary approval

The *Mining Management Act* (MM Act) is the primary legislation for the authorisation of mining activities and the regulation of mining sites in the Territory. The Responsible Minister, taking into consideration this Report, will decide whether to grant an authorisation under the MM Act and the conditions that may be applied.

Section 8A(2) of the EA Act requires the Responsible Minister to give the NT EPA notice of the decision as soon as practicable, but within seven days, after making the decision. Alternatively, if the decision by the Responsible Minister is contrary to this Report, the Responsible Minister must comply with reporting obligations to the NT EPA and the Legislative Assembly in accordance with section 8A(3) of the EA Act.

The provision of this Report to the Minister marks the completion of the examination of the EIS by the NT EPA. The EIS and supporting documents can be viewed on the NT EPA website at: https://ntepa.nt.gov.au/environmental-assessments/register/ammaroo-phosphate-project.

1.4.2 Other approvals

The proposed gas pipeline will require an energy pipeline licence under the *Energy Pipelines Act* (EP Act) if pressures will exceed 1050 kPa. The EP Act is the primary legislation for the construction, operation, maintenance and cessation of use or abandonment of pipelines for the conveyance of energy-producing hydrocarbons, and for related purposes, in the Territory.

1.4.3 Environment Protection and Biodiversity Conservation Act 1999

In 2014 the Australian Government Minister for the Environment determined that the Proposal was a controlled action and required assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) at the level of Preliminary Documentation under section 95A of the EPBC Act. As no bilateral agreement between the NTG and the Australian Government was in place at the time, the Proposal was assessed separately by the Australian Government Minister for the Environment and Energy. Approval was granted under the EPBC Act on 14 May 2018 subject to seven conditions (DoEE, 2018).

2 The Proposal

2.1 Proponent

The Proponent is Verdant Minerals Ltd (formerly Rum Jungle Resources Ltd), an Australian company listed on the Australian Securities Exchange. The Proponent's portfolio includes the Karinga Lakes Potash Project and the Patanella Phosphate Project.

The Proponent has been actively exploring for phosphate in the area since 2009. It considers the Ammaroo deposit to be the largest undeveloped Joint Ore Reserves Committee-compliant rock phosphate resource in Australia.

2.2 Proposal description

The Proposal consists of three main activities:

- open-cut strip mining of shallow phosphate deposits of up to 25 Mt/y
- beneficiation and production of up to 2 Mt/y of 32% P_2O_5 phosphate rock concentrate
- transport of phosphate rock concentrate via rail to Port of Darwin for export to international markets.

The infrastructure of the Proposal comprises:

- the mine site, including open-cut pits, a processing plant and a surface tailings storage facility (surface TSF)
- an infrastructure corridor accommodating a 105 km rail spur (connecting to the Adelaide to Darwin railway line) and a 137 km underground gas pipeline (connecting to the Amadeus gas pipeline)
- a borefield and a 12 km pipeline for water supply
- supporting infrastructure such as roads, a power station and an accommodation village
- realignment of approximately 12 km of the Murray Downs Road to bypass the mine site.

A detailed description of the Proposal is presented in Chapter 2 of the Draft EIS.

2.2.1 Location

The Proposal is located in the Northern Territory approximately 220 km south-east of Tennant Creek and 270 km north-east of Alice Springs (Figure 1). The closest settlement to the mineral leases is the community of Ampilatwatja, approximately 12 km to the south-east. The closest settlements to the infrastructure corridor are the community of Ali Curung and outstations at Imperrenth and Imangara, approximately 17 to 25 km to the north. The geographic coordinates of the Proposal are presented in Appendix 1.

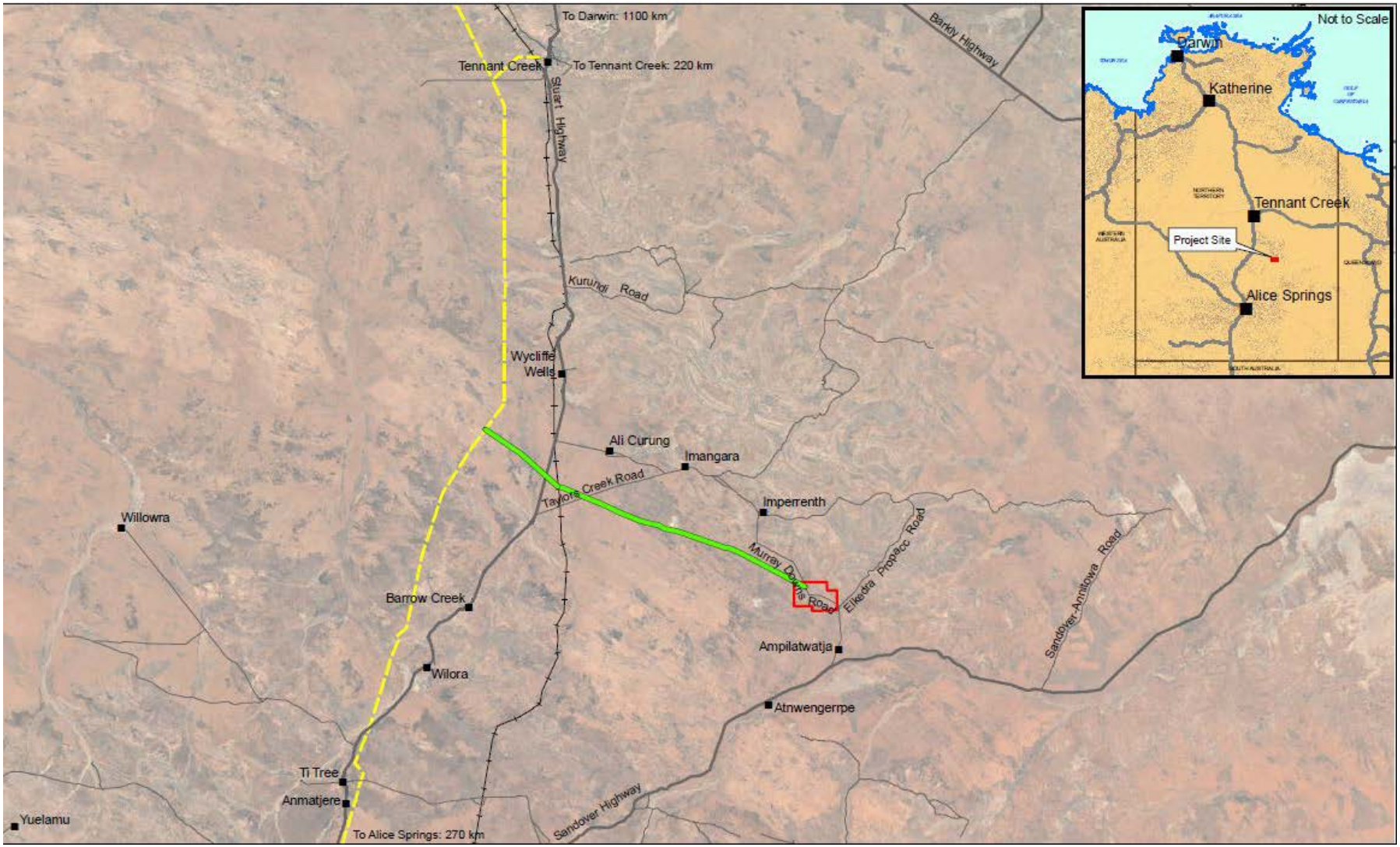

Figure 1. Ammaroo Phosphate Proposal location. Legend: mineral lease (red), access corridor (green), Amadeus gas pipeline (yellow), roads (grey). Source: Draft EIS.

2.2.2 Regional context

The climate is arid with infrequent and unpredictable rainfall, wide temperature extremes and low average humidity. Although the mean annual rainfall is about 315 mm and mostly associated with the summer months, there is high variability and extended periods with minimal rainfall. The area has high summer maximum temperatures (average 37°C) and low minimum winter temperatures (average 8°C). Sub-zero temperatures occur occasionally during July and August with frosts and surface water freezing at night. Annual pan evaporation is almost ten times higher than annual rainfall.

Regional topography is dominated by the Davenport and Murchison Ranges. The ranges are located approximately 15 km north of the proposed mine site and form a large system of rugged rocky hills rising approximately 100 m above the surrounding plains. Within the ranges, sheltered gorges support permanent and near-permanent waterholes. The ranges are bounded to the west and south by the Tanami bioregion which consists mainly of relatively featureless sand plains with small areas of alluvial plains, low ridges and stony rises. The entire Proposal falls within the Tanami bioregion.

After heavy rain events, ephemeral streams flow from the ranges onto the plains and flood out rather than feed into other major drainage features. The eastern portion of the proposed mine site generally drains to the south-east towards the Sandover River. The western side, including the infrastructure corridor, generally drains to the west and north-west towards Thring Swamp. During intense rain events, out-of-bank flow occurs as sheet wash, leading to short-term flooding.

The current land use at the proposed mine site and surrounding areas is cattle grazing, and the proposed mine site is situated on the Ammaroo pastoral lease. The proposed infrastructure corridor traverses the Ammaroo, Murray Downs and Neutral Junction pastoral leases.

The area surrounding the Proposal is sparsely populated with communities, outstations and homesteads that are serviced by the regional towns of Tennant Creek, Ti Tree and Alice Springs. Water for domestic and stock use is sourced from the Georgina Basin carbonate aquifer. Four wheel drive tourists following the Binns Track to access the Iytwelepenty/Davenport Ranges National Park travel along Murray Downs Road past the proposed mine site.

Existing infrastructure in the broader region includes the Amadeus Gas Pipeline, Northern Gas Pipeline, Austral-Asia Railway and the Stuart Highway.

There are also a number of proposed developments in the region at various stages of planning, including Chandler Facility (salt mine and waste storage), Nolans Project (rare earth elements mine), Mount Peake Project (titanium, vanadium, iron mine), Molyhil (tungsten and molybdenum), Bigryli (uranium) and Jervois Base Metal Project (copper and other base metals mine) (Figure 2).

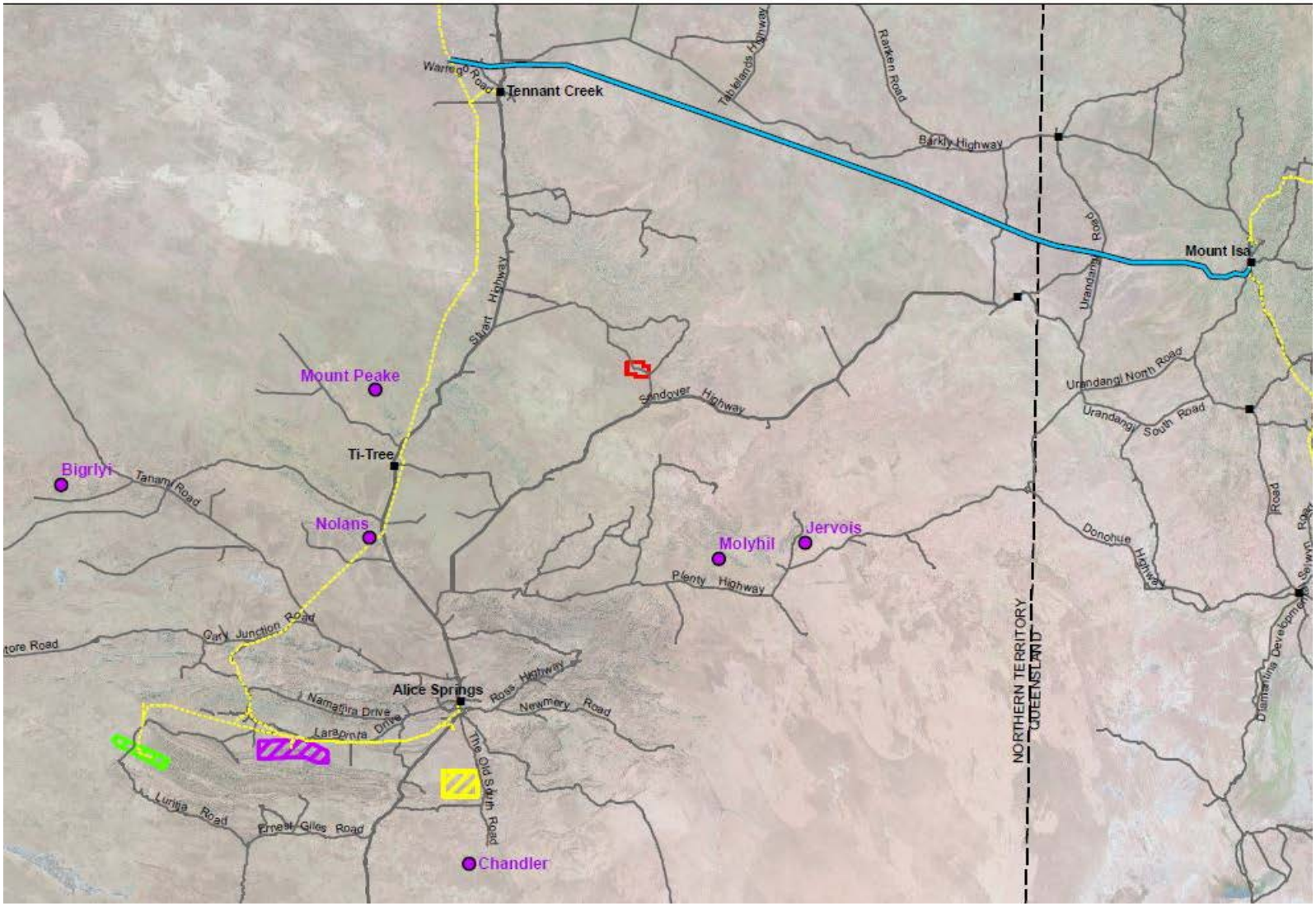

Figure 2. Other developments and infrastructure in the region. Legend: mineral lease (red), Dingo gas field (yellow hatched), Palm Valley Gas Field (purple hatched), Amadeus gas pipeline (yellow), Mereenie oil gas field (green hatched), Northern pipeline project (blue), roads (grey). Source: Draft EIS.

2.2.3 Overview of components

The Proposal footprint covers four areas: the mine site; the bore field and water pipeline; the infrastructure corridor; and the realignment of Murray Downs Road (Figure 3 and Figure 4).

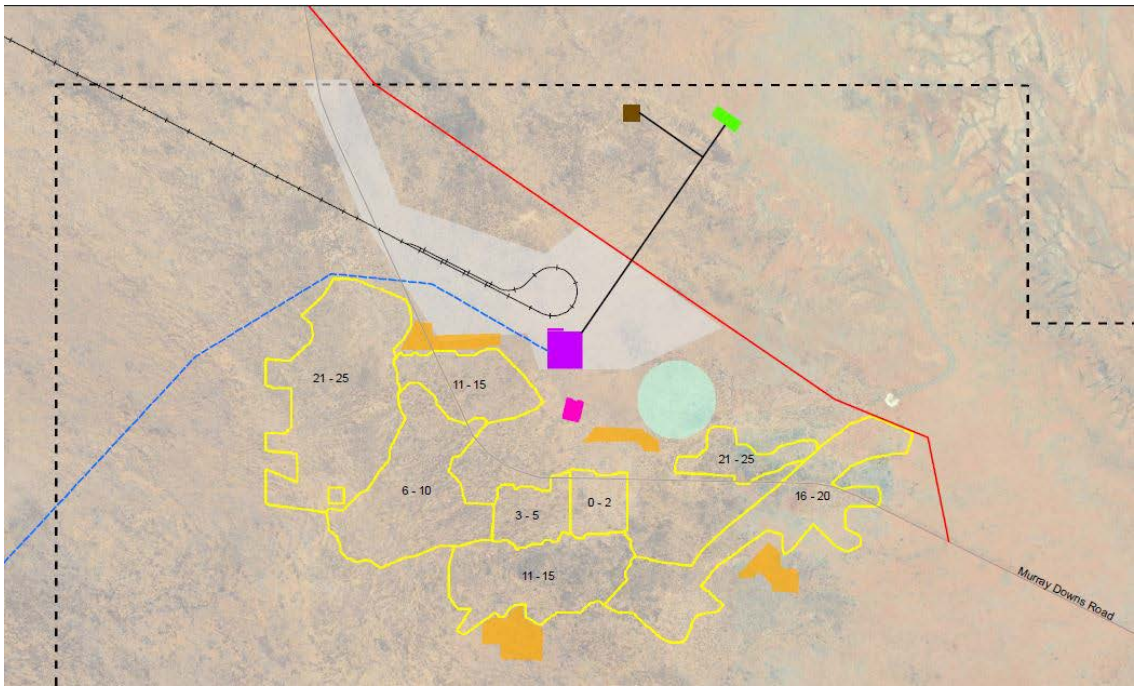

Figure 3. Mine site layout. Legend: beneficiation plant (purple), ROM (pink), pit with proposed mining years (yellow), surface TSF (light cyan), accommodation camp (green), landfill (brown), temporary waste rock stockpiles (orange), road alignment (red), water supply pipeline (blue), access corridor (black), mineral lease (black). Source: Draft EIS.

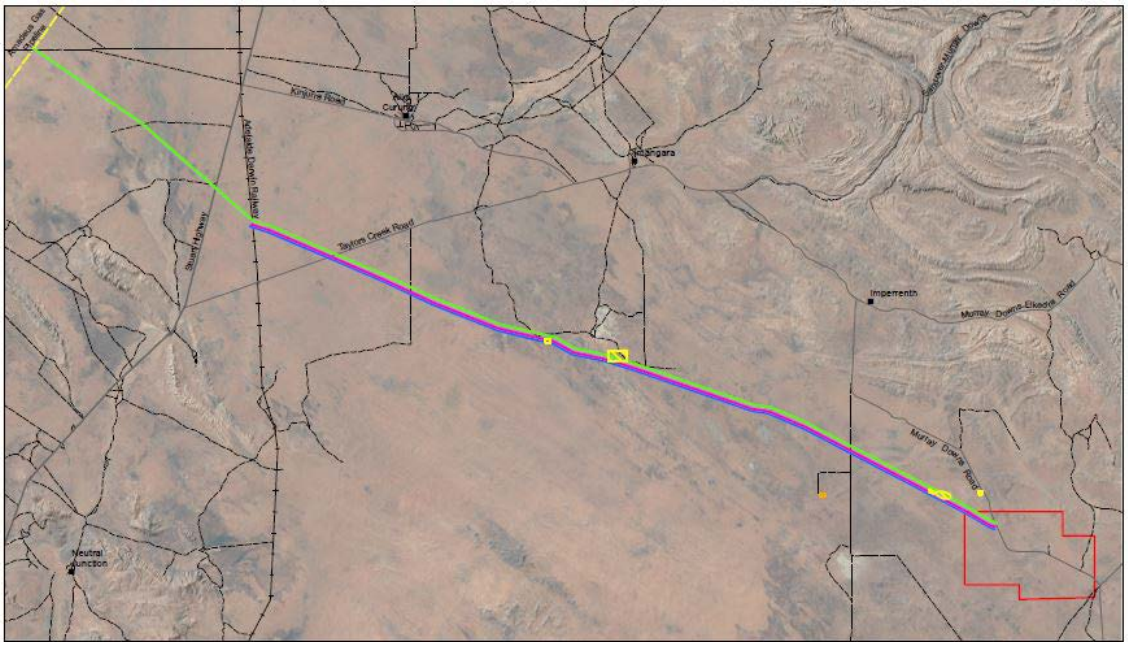

Figure 4. Infrastructure corridor layout. Legend: mineral lease (red), gas pipeline (green), rail spur (blue), maintenance track (pink), Amadeus gas pipeline (yellow), ballast quarry (orange), borrow pit (yellow hatched), roads and tracks (grey). Source: Draft EIS.

The components of the Proposal are summarised in Table 1.

Table 1: Key components and footprint of the Proposal.

	Component	Size/capacity
Whole of proposal	Maximum area of disturbance over 25 year mine life	3775 ha
	Life of mine (LOM) Construction period (included in LOM) Rehabilitation Final rehabilitation and closure	25 years (2 years) progressive 2 years
Mine site	Open pit (23 m average depth, 60 m maximum depth)	1500 ha
	Surface TSF	90 ha 3 m high 530 m radius
Mine infrastructure	Processing plant, power station, accommodation village, administration buildings and other ancillary infrastructure	650 ha
	Gas-fired power station	24 000 kW
	Fuel storage facility	417 t
Water supply - mining	A new borefield accessing the Georgina Basin carbonate aquifer	3+ bores 38 L/s per bore
	Water pipeline, including maintenance track	12 km
	Total annual abstraction (for 2 Mt/y P_2O_5 production)	3.6 GL/y
Workforce	Operational: Construction:	165 workers up to 300 workers
Other infrastructure	105 km infrastructure corridor (including rail, rail loop at mine site, maintenance track and low pressure gas pipeline) with a width of 70 m during construction and 50 m during operation.	800 ha
	32 km additional gas pipeline, beyond railway corridor (gas pipeline - 137 km in total)	115 ha
	Borrow pits (5 pits and access tracks)	550 ha
	Murray Downs Road alignment, approx.12 km	50 ha
	Total area of corridor disturbance	1515 ha

2.2.4 Construction

The construction period for mine infrastructure is expected to be up to two years, with processing to start in year one. Construction during the pre-production phase would focus on essential infrastructure required for mining such as haul roads, water production wells and pipeline, Murray Downs Road realignment and sufficient ore feed stock for commissioning of the processing plant. Suitable overburden from the pits would be used in the construction of infrastructure such as road bases, foundation pads, tailings dam embankments, surface water diversion berms. Construction materials for Murray Downs Road would be sourced locally.

A 137 km long underground, low pressure, carbon fibre gas pipeline is proposed to supply gas from the Amadeus gas pipeline to the proposed mine. The pipeline will be installed using “Mole Ploughing” whereby a temporary trench of approximately 350 mm width and 1050 mm depth will be ploughed, while at the same time a 5 inch diameter carbon fibre pipeline will be rolled off a spool and laid at the bottom of the temporary trench. Hydrostatic testing of the pipeline will be conducted in accordance with Australian Pipeline Industry Association’s Code of Environmental Practice: Onshore Pipelines (APGA, 2017) and an approved Hydrostatic Testing Management Plan. A maximum of 1.4 ML of water with no additives will be required. It is proposed to dispose of the hydrostatic test water in the process water ponds at the proposed mine site.

A 105 km rail line would be constructed to the mine site from the main Adelaide to Darwin railway. The rail line will cross Taylors Creek Road, pastoral tracks and stock crossings. Construction of level crossings ('at grade' crossings) using passive controls (e.g. stop or give way signs) is proposed. The rail embankment would be constructed to withstand a 25 year average recurrence interval (ARI) flood event. Culverts would be installed to manage surface water flows and scour protection would consist of placed rock (rip-rap).

Water for the construction of infrastructure on the mine site would be sourced from the mine's borefield 12 km south-west of the mine site.

Water for the construction of the infrastructure corridor would be sourced from existing local bores and four new bores constructed approximately every 20 km along the corridor.

Potable water for consumption and camp use will be supplied by tanker.

Access to the Proposal site is from the Stuart Highway via the unsealed Sandover Highway and Murray Downs Road from the south, or via the unsealed Murray Downs Road (via Kinjurra Road) from the north. A realignment of approximately 12 km of the Murray Downs Road is proposed to avoid the mine site. Traffic between the mine site and the accommodation camp would need to cross Murray Downs Road.

Light vehicle traffic includes movement of construction workforce and service vehicles supplying accommodation camps. The Proponent assumes the majority (85%) of light vehicle traffic would originate from the south (Alice Springs) and anticipates 34 vehicle trips per week. Heavy vehicles would be required to transport plant, equipment and materials. The Proponent expects the majority (70%) would originate from the north (Darwin). Within a 12 month peak construction period, 850 truck movements would be required on public roads (assuming rail would be used to transport the majority of the rail line and sleepers). Detailed descriptions of expected transport requirements are presented in Chapter 13 and Appendix M of the Draft EIS.

The construction workforce is estimated to be an average of 150 direct jobs and up to 300 at peak times. The Proposal aims to employ up to 20% of staff from the local area and 25% from Alice Springs. The remaining workforce would be on a fly in / fly out (FIFO) arrangement. The construction workforce would be housed in a combination of temporary and permanent camp accommodation at the mine site and along the infrastructure corridor.

2.2.5 Operation

Mining is expected to be in half production from years one to five and in full production from years six to 25.

The mining method would be open-cut strip mining in defined pit areas using truck and shovel operations to remove overburden (waste rock) and to transport ore to the processing plant. Waste rock would be temporarily stored near the pits. Drilling and blasting is not proposed.

Processing of the mined ore is undertaken on-site in a beneficiation plant producing phosphate rock concentrate for load out. A surface TSF would be constructed to hold the first three years of tailings, after which time tailings would be placed in mined-out pits, capped with waste rock and progressively rehabilitated. The base of the surface TSF as well as the pits would not be lined. Tailings placed in the surface TSF would not be removed, but rehabilitated similarly to the mined-out pits.

Water for mining operations would be sourced from a borefield approximately 12 km south-west of the mine site. The Proponent estimates the water requirements to be

3.6 GL/y at full production. The borefield would access the Georgina Basin carbonate aquifer and is outside of a Water Control District.

The bore field comprises one existing and two new high-flowing water bores equally spaced over a distance of 1.5 – 2 km. The main water requirements would be:

a) treated water for the processing plant, power station and wash down requirements

b) potable water for domestic use and safety showers

c) raw water for dust suppression and primary ore processing.

The water balance model (Supplement, Appendix 4) indicates all water extracted from the bore field will be treated on-site. Chemicals used in water treatment include sodium hypochlorite, ferric chloride (coagulant), polymer (flocculant), sodium metabisulphite, Hydrex 4104 (scale inhibitor), sodium chloride, and caustic.

An on-site gas power plant with a 24 MW capacity would supply an average load of approximately 16 MW at full mining production. Approximately 3.2 PJ/y of gas would be sourced from the Amadeus gas pipeline. Dual fuel capacity with an option to use diesel as a backup and solar power would be incorporated into the configuration. Transporting gas (either LNG or CNG) to site by road or rail is proposed as an option, particularly at the 1 Mtpa production rate.

At the beneficiation plant, the ore would undergo a process of wet screening, scrubbing, grinding, classification, flotation, thickening, filtration and drying. Chemicals used in the flotation circuit would include fatty acid (collector), polyacrylamide (flocculant), sodium silicate (silicate depressant) and soda ash (pH regulator). The processing plant would be designed to operate continuously over a 25 year design life and with a closed water circuit.

Process water from the beneficiation plant would be collected in lined ponds before being reused in the plant. Water separating from tailings in mined-out pits or in the surface TSF will be pumped to lined ponds and reused in the beneficiation plant, with a small fraction used for dust suppression.

Transport of ore is proposed by rail via the proposed 105 km rail spur connected to the Adelaide-Darwin rail to Port of Darwin. Train movements are anticipated to be 120 per year for years 1 to 5, and 240 per year for years 6 to 25.

Ship movements from Port of Darwin to international market are anticipated to be 20 per year for years 1 to 5, and 40 per year for years 6 to 25.

The Proposal would provide approximately 165 jobs at full operation and approximately 80 jobs during the first 3-5 years. The Proposal aims to employ up to 20% of staff from the area and 25% from Alice Springs. The workforce would be on a fly in / fly out (FIFO) arrangement and would be accommodated in a camp north of the mine site.

2.2.6 Closure

One of the objectives of mine closure is to reinstate natural habitat compatible with pastoral use (should this be the agreed post-mining land use). At closure, all mine site infrastructure and equipment would be removed and the site rehabilitated. Rehabilitation would be progressive, with mined-out pits being backfilled with tailings and waste rock. After tailings have settled, the surface TSF would be capped with a 1 m thick layer of waste rock. All areas, including backfilled pits and surface TSF, would be covered with at least 100 mm stockpiled soil and revegetated with local seeds. The final landform over the rehabilitated (backfilled) pits and surface TSF would consist of low convex shaped domed structures of about 1-2 m height with radial surface drainage.

The proposed Murray Downs Road realignment would be permanent and other infrastructure such as bores, the infrastructure corridor and access tracks may be left intact following consultation with landowners.

An updated Closure Report was included in the Supplement (Appendix 1). A detailed Rehabilitation Plan, including completion criteria and monitoring programs, would be developed to be incorporated into a Mine Closure Plan (MCP). Once prepared, the MCP would be regularly revised and updated as part of the Mining Management Plan (MMP) during the planning, construction and operation of the Proposal.

3 Consultation

The Draft EIS for the Proposal was on public exhibition for six weeks between 28 October and 8 December 2017. A total of 12 submissions were received. These included submissions from 10 NTG advisory agencies and two public submissions. All submissions were forwarded to the Proponent.

In preparing this Report, the NT EPA has considered each submission in relation to the Proposal's potential environmental impacts and risks.

3.1 Consultation with government agencies

The Proponent consulted with government agencies during the preparation of the Supplement. The issues raised and Proponent's responses are detailed in the Supplement and made available to the public on the NT EPA's website.

3.2 Public submissions

Public submissions were received from the Central Land Council (CLC) and the Arid Lands Environment Centre (ALEC).

The key issues raised by the CLC relate to:

- establishing a comprehensive Native Title Agreement
- ensuring appropriate sacred sites clearances
- ensuring communities benefit from the project (e.g. employment opportunities)
- ensuring appropriate consultation, with particular regard to access, archaeological sites and sacred sites
- concern about potential impacts to potable water supplies, both from drawdown and contamination, and ensuring appropriate monitoring
- concern about potential impacts to significant fauna, and ensuring appropriate monitoring
- concern about potential radiological impacts
- road safety, dust and deterioration of the roads due to increased traffic by heavy vehicles.

The key issues raised by Arid Land Environment Centre relate to:

- groundwater monitoring for potential adverse effects on the quality of domestic and stock bores
- chemical composition and volumes of tailings
- protection for migratory birds, including measures to cover wastewater and to line tailings dams

- 50% of the mine's energy demand should be sourced from renewable sources
- the land should be rehabilitated to a condition that enhances and restores environmental values instead of returning the land to a degraded pre-mining state.

The Proponent provided responses to the issues raised in the public submissions in the Supplement. The responses clarified the Proponent's intention to engage with traditional title holders and provided additional technical information to respond to concerns about potential impacts to groundwater and biodiversity; and additional clarity around operational matters and rehabilitation. This information was made available to the public on the NT EPA's website.

The NT EPA notes the Proponent has engaged with the CLC over a number of years, and acknowledges that the Proponent proposes a program of future engagement with relevant stakeholders. The NT EPA considers that consultation by the Proponent has been appropriate for the purposes of the EIA, which occurs early in the development of Proposals. The NT EPA makes recommendations for appropriate ongoing engagement with traditional title holders in Section 6.2.

The NT EPA has considered relevant environmental issues raised by the community and stakeholders in making this Report.

4 Key environmental factors

Having regard to the Notice of Intent, the EIS and comments from the public and advisory bodies during the EIS review, the NT EPA assessed the Proposal for its potential impacts on the NT EPA's factors (NT EPA, 2018). The NT EPA identified the following key environmental factors that may be significantly impacted by the Proposal:

- Hydrological processes
- Inland water environmental quality.

The NT EPA has considered the importance of other environmental factors during the course of its assessment. Those factors that were not identified as key environmental factors or that were addressed through consideration of the above factors are summarised at Appendix 2 of this Report. The key environmental factors are assessed in Section 4 of this report. The description of each factor shows why it is relevant and how it would be affected by the Proposal. The assessment of each environmental factor concludes with a judgement by the NT EPA about whether or not the Proposal can meet the NT EPA's environmental objective for each factor, with implementation of recommended management measures where required.

5 Assessment of environmental factors

This section evaluates the Proposal and presents the views of the NT EPA on the environmental acceptability of the Proposal. The environmental acceptability of this Proposal was considered with regard to the principles of Ecologically Sustainably Development (ESD), through analysis of:

- the Proposal (particularly which components or activities are likely to significantly impact the environment)
- the existing environment (particularly environmental values and sensitivities)
- the potential environmental impacts and risks of the Proposal and the evaluation of the significance of those impacts and risks

- the proposed avoidance or minimisation / mitigation measures to reduce potential impacts and risks to acceptable levels and to meet NT EPA objectives.

Conclusions drawn and recommendations made in this Report are drawn from consultation on the EIS with advisory bodies, the NT EPA's examination of the EIS and responses from the Proponent to comments and consultation. Recommendations are also made in this Report to add, emphasise or clarify any commitments made by the Proponent, where the avoidance or minimisation/mitigation measures proposed in the EIS are considered insufficient or where a safeguard is deemed particularly important.

In this Report, the recommendations (in **bold**) are preceded by text that identifies issues and undertakings associated with the Proposal. For this reason, the recommendations should not be considered or read in isolation.

The NT EPA acknowledges that detailed design and operational plans for the Proposal have not been finalised. Minor and insubstantial changes are expected in the design and specifications of the Proposal following the conclusion of the EIA process. It is necessary for approval mechanisms to accommodate subsequent changes to the environmental safeguards described in the final EIS and recommendations in this Report.

If the Proponent is able to demonstrate that any changes are unlikely to significantly increase potential impacts on the environment, then an adequate level of environmental protection could be achieved by modifying the conditions through relevant statutory approvals governing the Proposal. Otherwise, further environmental assessment may be required.

Recommendation 1

That the Proponent ensures that the Ammaroo Phosphate Project is implemented in accordance with all environmental commitments and safeguards:

- **identified in the final Environmental Impact Statement for the Ammaroo Phosphate Project (draft Environmental Impact Statement and Supplement to the draft Environmental Impact Statement)**
- **recommended in this Assessment Report 87**
- **to the satisfaction of the relevant regulator.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent.

Recommendation 2

That the Proponent provides written notice to the Northern Territory Environment Protection Authority and the Responsible Minister if it alters the Ammaroo Phosphate Project and/or commitments, safeguards or mitigation measures in the Environmental Impact Statement in such a manner that the environmental significance of the action may have changed, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

The remainder of this section identifies and discusses the key environmental factors and potential impacts and risks to associated environmental values based on likely significance, the Proponent's investigations and studies, and commitments to identify, avoid, mitigate, monitor and manage the potential impacts and risks.

For each key environmental factor, the NT EPA assesses whether or not the proposal is likely to meet the environmental objective set for each factor. In defining its environmental objectives, the NT EPA also had regard to the principles of ESD

articulated in the Intergovernmental Agreement on the Environment (Australian Government, 1992):

- the precautionary principle
- the principle of intergenerational equity
- conservation of biological diversity and ecological integrity
- improved valuation, pricing and incentive mechanisms such as the “polluter pays” principle.

The NT EPA has summarised its consideration of ESD in Appendix 3.

5.1 Hydrological processes

5.1.1 Environmental objective

Maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.

5.1.2 Environmental values

5.1.2.1 Groundwater hydrology

The Proposal is located in a hot, arid climate characterised by low rainfall and high evaporation. In an environment with scarce water resources, the efficient use of water and protection of groundwater resources is of high importance.

The mine will source its water supply from the nearby Georgina Basin carbonate aquifer, with the bore field being located approximately 21 km west of the boundary of the Western Davenport Water Control District. The Georgina Basin carbonate aquifer is unconfined, connected to the broader Georgina Basin to the east and infilling the Wiso Basin to the west. The Georgina Basin is the most extensive groundwater aquifer in the region, underlying approximately one quarter of the NT and extending into south-west Queensland. Reported groundwater recharge estimates for the region range from 0.2 mm to 5-12 mm per year. The carbonate aquifer has value as a water source for human and stock consumption. Current users are pastoralists (the nearest stock bore is 15 km and the nearest pastoral station is 30 km from the bore field), and communities (the nearest bores for Ampilwatja are 22 km from the bore field).

Groundwater in aquifers may have value for groundwater dependent ecosystems including vegetation and subterranean fauna.

The EIS stated that groundwater underneath and adjacent to the mine site is in a fractured rock aquifer located in the low-yielding Proterozoic basement aquifer approximately 60 to 80 m below the proposed mine site. Recent information provided by the Proponent indicated that there is no aquifer below the mine, stating that no groundwater was intersected by 3700 drill holes used for the identification of the phosphate resource, and four deep (approximately 100 m) bore holes searching for groundwater on the mineral leases. The Proponent stated 11 bores encountered igneous basement rocks, which have a very low potential for groundwater to occur underneath them.

5.1.2.2 Surface water hydrology

Surface water features in the region are ephemeral, supporting flora and fauna and recharging groundwater resources across the region.

The Proposal is located in the Diamantina-Georgina Rivers Basin, with Taylor Creek being the closest watercourse to the Proposal. Three tributaries of the creek’s drainage system intersect the western end of the proposed infrastructure corridor. Several

ephemeral swamps are scattered in the vicinity of the central section of the infrastructure corridor. While the corridor alignment avoids the individual swamps, it crosses a linkage between two swamps.

While the proposed mine site does not have any surface water features, one drainage floor exists to the north-east and is currently dammed for pastoral purposes.

5.1.3 Potential impacts

5.1.3.1 Groundwater hydrology

The Proposal may impact on environmental values that depend on the existing hydrological groundwater regime through:

a) long term groundwater abstraction from the nearby Georgina Basin aquifer, potentially leading to groundwater drawdown, which may

- contribute to a reduction in the volume of groundwater available to current and future users of regional aquifers; and
- impact significant groundwater dependent ecosystems, such as subterranean fauna and groundwater dependent vegetation communities

b) seepage from mining activities, potentially increasing the water table of the basement aquifer underneath the mine site.

5.1.3.2 Surface water hydrology

The Proposal has the potential to impact on ephemeral swamps and drainage floors along the infrastructure corridor by altering runoff pathways and flood regimes, and increasing sedimentation as a result of erosion.

Potential impacts on water quality are discussed in section 5.2 under inland water environmental quality.

5.1.4 NT EPA assessment

5.1.4.1 Groundwater hydrology

Groundwater drawdown

The proposed volume of water abstraction is substantial. By way of comparison, the Proposal would abstract more than a third of the water abstracted annually to supply reticulated water to the town of Alice Springs, making the Proposal the second largest groundwater user in the region.

An estimated 3.6 GL/y of groundwater will be extracted from the nearby Georgina Basin carbonate aquifer. At that rate, the Proponent's modelling predicts drawdown (by year 25 of mining) of up to 3.7 m at the closest pastoral stock bore, up to 2.7 m at the closest community water supply bore and up to 0.5 m within a 25 km radius The Proposal concluded the predicted drawdown would not affect water availability due to the extent and substantial vertical extent of the aquifer (at least 185 m at the bore field and 283 m at a bore 15 km south-east of the bore field).

Drawdown from construction bores is expected to be negligible due to the low extraction rate and short duration.

While the potential for the Georgina Basin aquifers to yield the required amounts is recognised as feasible, the proposed groundwater operation is largely based on limited local and inferred data. The potential for production bores to produce the required amount is not yet demonstrated. The Proponent has recognised the risk that bores may not yield the design capacity and proposed to install additional bores, if necessary, to

meet the proposed mine's water requirements. The NT EPA recommends to that monitoring of baseline water hydrology commence as soon as feasible to provide greater certainty of water yields.

The Proponent has committed to a zero reduction in water availability due to mining to other users. The Proponent presented a Water Management Plan (WMP), which included a program to monitor groundwater levels at a network of observation bores, and monitor the volume of groundwater extracted from the bore field. The Proponent committed to seek endorsement for the WMP from the relevant regulator prior to implementation.

The Proponent proposes the following mitigation measures to be implemented if drawdown exceeds the model prediction:

- re-assessment of predicted drawdown at receptors
- make-good measures at receptors to ensure water availability, e.g. deepening of bores and/or upgrading of pumps
- investigation and implementation of increased water efficiencies
- modification of pumping regimes.

An independent peer review (Supplement, Appendix 7) endorsed the groundwater monitoring program with the following improvements:

- identify the target aquifers/formations at each of the proposed monitoring locations
- identify that water level observations from proposed bores > 30 km from the site would be used to identify natural recharge
- define water level monitoring methods and measurement interval for each monitoring bore
- water levels should be logged daily and supported by quarterly manual readings and downloads
- estimate annual extraction rates of other users (e.g. pastoralists)
- survey all monitoring and production bores to a common height datum (MAHD) to ± 0.1 m vertical accuracy to allow for accurate characterisation of groundwater flow directions

The NT EPA supports these recommendations as they provide greater certainty to the identification of impacts on groundwater hydrology.

To ensure the predicted drawdown is appropriately managed, the NT EPA recommends the development of a Water Abstraction Management Plan (WAMP), separate to the Water Management Plan. The WAMP should focus on issues associated with the management of groundwater abstraction and the monitoring of groundwater hydrology. Complementary to the WAMP, the Water Management Plan should focus on all issues associated with water use on the project site, operational water management and water quality.

The NT EPA is of the opinion that there is limited accuracy in the quantitative predictions from preliminary modelling and considers continual model review based on real monitoring data to be the preferred option to assess potential impacts. The NT EPA considers it would be appropriate to update the model frequently to improve its predictive capacity and enable a better assessment of potential environmental impacts of water abstraction and subsequent drawdown. The NT EPA recommends model updates are incorporated into the WAMP to ensure monitoring results and model outputs for groundwater drawdown inform management responses for water abstraction.

Recommendation 3

That approvals and decisions for the Proposal have conditions that require the Proponent to provide a Water Abstraction Management Plan to the relevant regulator prior to mining that:

- **includes a framework identifying the location, timing, methods and parameters for the collection of further groundwater information**
- **incorporates the recommendations of the independent peer review to improve identification of natural recharge processes and extraction rates of other users; characterisation of flow and flow directions; and robustness of the water level baseline by capturing seasonal changes**
- **incorporates a program to monitor groundwater levels at nearby stock and community bores**
- **incorporates a program to monitor drawdown impacts on the groundwater system within the adjacent Western Davenport Water Control District**
- **is based on robust groundwater level baseline data capturing seasonal changes over at least 12 months at all proposed groundwater abstraction monitoring bores, including borefield and nearby stock and community bores**
- **incorporates all relevant commitments made by the Proponent in the Environmental Impact Statement, including a zero reduction in water availability to other users from mining activities**
- **is developed in consultation with relevant stakeholders, including other groundwater users**
- **actively and continuously seeks to improve knowledge of aquifers and groundwater tables affected by the Proposal and incorporates these into the model**
- **is independently peer reviewed by a suitably qualified independent professional**
- **is developed and implemented to the satisfaction of the relevant regulator**
- **is to be updated at least annually**
- **reports all water monitoring data with an assessment of the impacts on groundwater hydrology in an annual Water Management Report.**

Public disclosure of the annual Water Management Report and each updated Water Abstraction Management Plan should be provided on the websites of (as applicable) the Proponent, the Operator and relevant authorities.

Groundwater dependent vegetation

It is unlikely that groundwater dependent vegetation would be impacted by the Proposal. Groundwater in the vicinity of the Proposal is generally deeper than 20 m, which studies in the nearby Ti Tree and Western Davenport Water Control District identified as the critical maximum depth for groundwater dependent vegetation (Cook & Eamus, 2018).

Subterranean fauna – (stygofauna)

Stygofauna have been found in unconfined aquifers elsewhere in central Australia. Investigations have identified that the nearby Wiso Basin, which is connected to the Georgina Basin carbonate aquifer, has a high potential for stygofauna (Moulds & Bannink 2012). It is therefore possible that stygofauna could be present in the proposed bore field aquifer.

Based on current knowledge, there is low potential for an aquifer to be present beneath the mine site (fine grained unsaturated sedimentary rock). As a result, it is highly unlikely suitable habitat for stygofauna will be present.

The Georgina Basin carbonate aquifer of the proposed bore field is more likely to meet suitable habitat requirements for stygofauna as defined by Hose et al. (2015), who stated alluvial, karstic and some fractured rock aquifers are likely to host stygofauna at depths of less than 100 m. If present, stygofauna could be impacted by groundwater drawdown from the bore field in the Georgina Basin carbonate aquifer. The Proponent's modelling predicts drawdown of greater than 1 m to occur within approximately 22 km of the proposed bore field after 25 years of mining operations. This zone represents a very small proportion of the extensive Georgina Basin, in addition to which there is a low probability of endemic species being associated with this specific location, so the modelled drawdown is unlikely to result in a significant reduction of habitat for endemic stygofauna species.

The NT EPA considers it is unlikely that the Proposal would lead to a significant impact on stygofauna. However, verification of groundwater modelling should continue for the life of the mine and, if a significant deviation from modelling is detected, the potential impacts associated with the variance should be reconsidered and referred to the NT EPA where there is potential for a significant impact to the environment.

Water stewardship

The Proposal is located in an arid region where groundwater is a shared resource with high value. While the Georgina Basin is known to be a large groundwater resource, it is not part of a Water Control District. The aquifer storage, sustainable yield and consumptive pool have not been quantified. Mining within the region could affect water availability for other potential uses in the future. The NT EPA considers that the Proponent should minimise groundwater abstraction, maximise water re-use and demonstrate best practice in water stewardship as recommended by the International Council on Mining and Metals (ICMM, 2014). The ICMM water stewardship framework recommends effective management of water at operations, collaboration to achieve responsible and sustainable water use, and the application of strong and transparent corporate water governance.

Recommendation 4

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **allocate clear responsibilities and accountabilities for water use and management**
- **provide regular updates of the projected water balance for the Proposal in the Water Management Plan, including detailed estimates for the various phases of the Proposal and specifying the source and quantity of the water to be used**
- **demonstrate how water saving considerations are integrated in Proposal planning including final design and technologies**
- **report on continual improvement initiatives in water use efficiency including the provision of relevant water use targets**

- **provide details on how water will be effectively managed during proposed operations, including minimising water consumption, maximising water reuse and minimising waste water**
- **abstract water from bores only when equipped with operating flow meters**
- **record the volume of water abstracted from the borefield and the corridor construction bores**
- **report water use performance in relation to targets, and any change to targets in an annual Water Management Report to stakeholders**

Public disclosure of the Water Management Plan and annual Water Management Report should be provided on the websites of (as applicable), the Proponent and relevant regulatory authorities.

Rise in water table due to seepage

The Proponent's groundwater model predicts that seepage from the proposed 25 years of operations would result in a rise in the water table of 3.6 m to 25 m at the mine site. Proposed mitigation measures for water level rises beyond seasonal variation would be to pump and treat seepage from underneath the TSFs and implement underdrainage in subsequent in-pit storage cells to reduce seepage.

The NT EPA notes the seepage modelling was based on limited local bore data and uncertainty remains on the exact location, extent and characteristics of any aquifer underneath the proposed mine site such that the seepage modelling is considered uncertain. As outlined in section 5.1.2.1, recent information provided by the Proponent indicated that there is no aquifer below the mine site.

Nevertheless, the NT EPA recommends that the proposed tailings leachate seepage monitoring program should be implemented, with results used to improve the existing seepage model.

The proposed monitoring network consists of four bores downgradient and one bore up gradient of tailings storage facilities. An independent peer review (Supplement, Appendix 7) endorsed the mine site groundwater monitoring program for tailings leachate seepage with the following improvements:

- survey all monitoring and production bores to a common height datum (MAHD) to ± 0.1 m vertical accuracy to allow for accurate characterisation of groundwater flow directions
- once sufficient monitoring data has been obtained, assess adequacy of the location of each bore to meet its monitoring objective. If the stated objective is not met additional bores should be installed.
- relocate bore AMOBS09 to immediately adjacent to the downgradient side of the 0-2 year pit to monitor potential seepage from in-pit tailings in the early stage of mine development
- commence water level monitoring in AMOBS6 two years prior to mining to establish seasonal variation in groundwater levels

The NT EPA supports these recommendations as they provide greater certainty to the identification of seepage and impacts on groundwater hydrology, should groundwater be present at the mine site.

Recommendation 5

That approvals and decisions for the Proposal have conditions that require the Proponent to:

- **update the seepage monitoring program in the Water Management Plan to include recommendations of the independent peer review**
- **annually review and, if required, update the seepage model.**

Findings of the review and updates to the seepage model should be reported in the annual Water Management Report.

5.1.4.2 Surface water hydrology

The proposed infrastructure corridor would largely avoid surface water drainage systems, except that it would intercept tributaries to Taylor Creek's drainage system at its western end and intercept an ephemeral wetland corridor connecting two swamps in the central section. The construction and operation of the gas pipeline and railway line has the potential to impact on surface water hydrology of intersected drainage systems and their sensitive vegetation communities.

The railway line will be raised above the 25 year ARI flood level with sufficient crossing structures (e.g. culverts) to minimise changes to flood levels within the upslope and downslope environments. Each culvert will have downstream energy dissipation structures.

The proposed mine site will not intersect any surface water features. Flood protection berms will be installed to divert surface water flows away from the mine site. Potential impacts on the mine site with and without these berms were modelled for a 100 year ARI flood event. Based on assessment of the modelling outcomes, the flood protection berms would be installed along the eastern and western sides and partially along the north-eastern and south-eastern sides of the open pits. Infrastructure would be constructed above the 100 year ARI flood level.

The NT EPA supports the Proponent's commitment to implement erosion and sediment controls to minimise the erosion risk associated with the diversion of rain and flood water, and to maintain the integrity of the flood protection berm structures.

5.1.4.3 Summary and Conclusion

The NT EPA's assessment of the key environmental factor - Hydrological processes identified the following potential impacts and risks:

- The proposed water use is substantial
- The proposed groundwater extraction is predicted to cause a drawdown in the Georgina Basin carbonate aquifer that could reduce the availability of water to other users.

In addition to the proposed management, monitoring and mitigation measures, the NT EPA recommends:

- the implementation of continual improvements in water use and water efficiencies to minimise groundwater abstraction and impacts on water availability for other potential uses in the future
- the development of a Water Abstraction Management Plan (WAMP) with a focus on issues associated with the management of groundwater abstraction and the monitoring of groundwater hydrology

- the development of a Water Management Plan (WMP) with a focus on all other issues associated with water use, operational water management and water quality
- the incorporation of all recommendations from the independent peer review and commitments made by the Proponent into the WAMP
- the monitoring of groundwater levels at nearby stock and community bores
- the establishment of hydrological baseline data at all groundwater abstraction monitoring bores
- further transparency for groundwater abstraction, including:
    - consultation with stakeholders on the Proponent's use of groundwater
    - demonstration of best practice water management in line with the International Council on Mining and Metals water stewardship framework (ICMM 2014)
    - public accountability through public disclosure of the WAMP, the WMP and annual Water Management Reports.

With the implementation of the relevant management plans and recommendations identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for hydrological processes is likely to be met.

5.2 Inland water environmental quality

5.2.1 Environmental objective

Maintain the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are protected.

5.2.2 Environmental values

5.2.2.1 Groundwater quality

Groundwater quality at the proposed bore field (Georgina Basin carbonate aquifer) is considered to be marginal for human consumption due to elevated salinity, but is suitable for pastoral use. The chemical composition is strongly influenced by the carbonate rocks of the aquifer.

When present, groundwater quality at the mine site is not potable due to elevated fluoride, nitrate and boron, but is suitable for pastoral use (Draft EIS, Appendix H).

5.2.2.2 Surface water quality

Little information is available on surface water quality due to the lack of permanent surface water in the area and the low frequency of flows in local watercourses. Some local data and data for surrounding catchments indicate generally good water quality (when present) with neutral pH and low salinity (NTG 2018).

5.2.3 Potential impacts

5.2.3.1 Groundwater quality

Construction, operation and closure of the Proposal have the potential to result in direct impacts on groundwater quality from the following sources:

- acid and metalliferous drainage (AMD) and saline drainage from mined materials

- infiltration or leachate of naturally occurring radioactive materials
- infiltration or leachate from tailings facilities
- infiltration or leachate from waste rock dumps.

5.2.3.2 Surface water quality

Construction, operation and closure of the Proposal have the potential to result in the direct impacts on surface water quality from the following sources:

- uncontrolled discharge of process water
- mobilisation of soils/sediment during clearing, mining and closure activities, and from post-closure landforms
- lateral, above-ground seepage from the surface TSF
- recycled process water being used for dust suppression
- surface runoff within the mine site, including runoff from ore and phosphate rock concentrate stockpiles
- fuel and chemical spills.

Contamination of surface water also has the potential to impact groundwater quality indirectly through infiltration to groundwater aquifers.

5.2.4 NT EPA assessment

5.2.4.1 Groundwater quality

Potential acid and metalliferous drainage (AMD) and saline drainage from mined materials

The risk of acid and metalliferous drainage (AMD) and saline drainage from waste rock and tailings was assessed through geochemical analysis (Draft EIS, Appendix I, AMD Assessment and Management Report and Supplement, Appendices 8 to 11) and the initial three months of a long-term leachate study (Supplement, Appendix 12, Barrel Leach Results).

Analysis of 202 waste rock samples (proportionally representing the lithological units to be mined) and two synthetic tailings samples included chemical assays, static AMD tests, leach tests (using the Australian Standard Leaching Procedure (ASLP)), salinity tests and soil stability assessments. In addition, a field barrel leach test (kinetic test) investigated the AMD risk associated with the long-term effects of monthly rain percolating through stockpiles of three common overburden (waste rock) materials, ore and top soil. All five samples were also investigated for the mobilisation of soluble chemicals using ASLP.

The chemical assay showed that the waste rock is low in sulfur, potentially toxic metals and radioactive elements relative to global crustal shale averages. Static net acid generation (NAG) testing indicated that all of the tested material is non-reactive and non-acid-forming (NAF). The NAF classification was also supported by the low total metal and sulfide content, neutral NAG, positive net acid production potential (NAPP), and high neutralisation potential ratio (NPR). The results were consistent with a high level of oxidation and weathering typically found in material above the long-term water table.

ASLP and initial field barrel leach testing indicated waste rock may produce leachate with elevated metals, primarily zinc, relative to 95% aquatic ecosystem or drinking water guidelines. Leachate from the field barrel testing was within levels suitable for livestock and irrigation. Salinity levels were classified as very low to medium (DME QLD, 1995) with high sodium adsorption ratios (SAR) in some ASLP leachates, but not in the field

barrel leachates, indicating that ASLP leach testing may overestimate likely concentrations. Should high SAR be encountered, mitigation options include using a clayey soil amendment with crushed limestone or gypsum to raise soluble calcium concentrations.

The two synthesised tailings samples contained total and leachable element analyte concentrations similar to the waste rock.

The initial geochemical assessment of the waste rock indicates that the salinity and AMD risk would be very low and the material could be managed as non-acid-forming, non-saline, non-metalliferous and non-radioactive waste.

The initial results indicate that leachate from excavated waste rock would be unlikely to present a risk to nearby receptors provided leachate or runoff does not enter surface water bodies undiluted. The results further indicate that waste rock would be suitable for management in unlined waste rock dumps with appropriate monitoring of metals and metalloids in potential receptors, such as groundwater and surface water.

The Proponent committed to implement a peer-reviewed and regulator-endorsed Water Management Plan, which would include monitoring of changes in groundwater and surface water quality.

Although the proponent considered the AMD risk as low, as a precautionary measure, the proposed AMD Management Plan (Draft EIS, Appendix I) presents a testing and monitoring regime consistent with that required for materials of high AMD risk. Monitoring would focus on in-situ material scheduled for mining, constructed landforms (waste rock dumps, ROM pad and mineralised waste stockpiles inside or outside of pits) and water (surface and groundwater).

Based on the outcomes of the initial geochemical assessment and the conservative approach of the AMD Management Plan, the Proponent's AMD risk assessment (Draft EIS, Appendix I) concluded that the risk is likely to be low. The Proponent committed to undertake additional testing in the pre-production phase for suitable capping/encapsulation material, additional NAG and NAPP testing, and additional tailings sampling, in order to increase certainty in the geochemical characteristics of the mined materials.

An independent peer review (Supplement, Appendix 3) endorsed the general findings of the AMD Assessment and Management Report (Draft EIS, Appendix I). The review supported the Proponent's commitment to additional tailings testing and recommended the inclusion of ore in future geochemical testing. The NT EPA supports these recommendations.

As a precautionary approach and to minimise the risk associated with unlined permanent tailings storage facilities, the NT EPA also recommends the Proponent conduct aggressive tailings leach testing prior to mining. In addition, The NT EPA recommends the Proponent extract and analyse actual tailings seepage and decant water during the first 12 months of operation. The results will inform any requirement for mitigation options such as lining and tailings treatment. If tailings seepage exceeds the agreed threshold levels then mitigation options such as lining of the tailings storage or additional tailings treatment must be implemented immediately. If the exceedance changes the environmental significance of the Proposal, the altered Proposal should be referred to the NT EPA in accordance with Recommendation 2.

Recommendation 6

That approvals and decisions for the Proposal have conditions that require the Proponent to provide an updated Acid and Metalliferous Drainage Management Plan to the relevant regulator prior to mining that:

- **incorporates the recommendations of the independent peer review and all commitments made by the Proponent in the Environmental Impact Statement including further testing in the pre-production phase (geochemical testing of tailings and ore, identification of suitable capping/encapsulation material and additional NAG and NAPP testing)**
- **includes aggressive leach testing of tailings prior to mining with the results to be reported to the relevant regulator for assessment and, if required, identification of appropriate mitigation measures.**
- **incorporates a program to analyse in-situ extracts of tailings seepage and decant water during the first 12 months of operation with the results to be reported to the relevant regulator for assessment and, if the seepage composition exceeds the agreed threshold levels, then mitigation options such as lining the tailings storage or additional tailings treatment must be implemented immediately**
- **includes a program for regular geochemical testing of all materials scheduled for mining or in constructed landforms (including ore stockpiles and tailings), including the frequency of monitoring, methods to be used, and number of samples to be tested**
- **includes a contingency plan outlining trigger levels for actions, specific responses and mitigation measures, and consequences for operational, rehabilitation and closure activities.**

The Acid and Metalliferous Drainage Management Plan should be developed and implemented to the satisfaction of the relevant regulator.

Naturally occurring radioactive materials

ASLP leachate tests of the waste rock indicated a low radiation risk with maximum concentrations of uranium (44.9 ppm) and thorium (30.2 ppm) below the threshold concentrations for naturally occurring radioactive materials (NORM) of 80 ppm and 246 ppm respectively, which are equivalent to the specific activity of 1 Bq/g (DME, 2008; DNRM QLD, 2014; IAEA, 2004). Uranium concentrations of one historical tailings sample (16 ppm) and three export phosphate rock concentrate samples (maximum 22 ppm) were also below the NORM threshold. A conservative estimate of exposure through dust inhalation was less than 0.1 mSv/y and occupational doses (above natural background) were calculated to be less than the national standard public dose limit of 1mSv per year (NDRP, 2017) (Draft EIS, Appendix K).

Based on the initial sampling, the radiological impact assessment of the Draft EIS (Appendix K) concluded potential radiation exposure is very low and no special radiation protection controls are required. Further, the Ammaroo ore is not radioactive and therefore not subject to regulatory control in accordance with the criteria for radioactive material (IAEA, 2004). The assessment indicated general health and safety requirements (such as dust controls) will be adequate for ensuring that potential workers doses remain negligible.

In order to verify the initial radiation exposure estimates, the Proponent committed to establish a passive gamma, radon and thorium monitoring network (Draft EIS; Supplement). The location of these environmental monitoring sites will be identified in consultation with the relevant regulator. Radon and gamma baseline data would be collected for at least one year prior to the start of operations.

The NT EPA supports the Proponent's commitment to a monitoring program to measure actual radiological exposure. In addition, the NT EPA has recommended that regular radiological testing of potential sources be undertaken.

Recommendation 7

That the Acid and Metalliferous Drainage Management Plan, referenced at Recommendation 6, include a program for regular radiological testing of all materials scheduled for mining or in constructed landforms (including ore stockpiles and tailings), including the frequency of monitoring, methods to be used, and number of samples to be tested.

Infiltration or leachate from tailings facilities

Since tailings would be permanently stored in unlined facilities, the chemistry of the tailings at the source and pathways of the tailings and tailings leachates need to be fully understood to enable effective management of any potentially significant, short- or long-term impacts to environmental values, including ecological health, land uses and human health welfare and amenity.

The chemistry of tailings and tailings leachate was investigated as part of the AMD risk analysis (Draft EIS, Appendix I) for one synthetic tailings sample (see above). Additional testing of a second synthetic tailings sample comprised geochemical analysis of acid rock drainage and contaminant mobility potential (Supplement, Appendix 8); analysis of likely tailings decant water for a range of metals and metalloids (Supplement, Appendix 9); and metallurgical testing of the tailings solids (Supplement, Appendix 10).

Analysis of the two synthesised tailings samples indicated total and leachable element analyte concentrations similar to waste rock, comprised primarily of silicates with minor to moderate amounts of calcium, aluminium, phosphorous and iron. The tailings were not potentially acid-generating due to a lack of acid-generating sulfur and an excess of acid neutralising capacity.

Results of both samples were compared to Australian Drinking Water Guidelines (ADWG) (NHMRC, NRMMC, 2011) for aesthetic and health-based guideline values; the ANZECC & ARMCANZ 2000 guidelines for long-term irrigation, livestock drinking water, and the protection of slightly to moderately disturbed freshwater aquatic ecosystems at the 95% of species level; and average Ammaroo groundwater concentrations (Supplement, Appendix 9).

The tailings leachate and decant analyses were generally within drinking water guidelines, except for arsenic, lead and nickel, which exceeded the guidelines by a factor of less than two. Fluoride exceeded the drinking water guidelines in the first three leaching cycles but was below guidelines in the following cycles, indicating it would be removed in initial flushes.

Compared to the ANZECC & ARMCANZ 2000 irrigation guidelines, tailings leachate and decant showed slightly alkaline pH and slightly elevated SAR, fluoride, phosphorous and molybdenum, which may increase soil dispersion and impact crop yield and nutrient load when used in an agricultural setting. If used for dust suppression, tailings leachate and decant water do not present a significant risk to the environment unless used on a large scale adjacent to waterways.

With the exception of pH and fluoride, all samples were within drinking water guidelines for sensitive livestock. Similarly to ADWG, only the first flush exceeded fluoride levels.

The 95% freshwater aquatic ecosystem guideline values (FAE95%) were exceeded for several metals and nutrients with aluminium, copper and phosphorus exceeding the guideline by more than a factor of 10. If a direct discharge of high volumes of leachate occurred, the elevated phosphorous may present a risk to surface water, but is unlikely to present a risk to groundwater as it is readily adsorbed in the soil column.

Analysis results indicated that the synthesised tailings sample had a low AMD and toxicity risk, with some slightly elevated metals and fluoride but low salinity. Uranium

concentrations were below the NORM threshold. Based on tailings particle size distribution and hydraulic conductivity of the fractured rock aquifer, it was estimated that tailings seepage could cause a rise in the water table beneath the mine site (see section 4.2). The Proponent's modelling indicated that the seepage plume would move 400 m downgradient in 100 years and would be diluted to a 10% fraction of leachate in 90% groundwater (Supplement). There are currently no receptors within this distance and preliminary characterisation of tailings seepage indicates that beneficial use of the water would be unchanged. As discussed in section 5.1.3 recent information provided by the Proponent indicated that there is no aquifer below the mine site.

The proponent committed to additional tailings testing pre-production, including bulk leach testing. The NT EPA notes that all testing prior to mining would be undertaken on synthetic tailings. The NT EPA considers it necessary there be ongoing regular testing of tailings during operations, and has specified in Recommendation 6 that tailings be included in a program of regular geochemical testing.

The NT EPA's preferred approach is to avoid or mitigate contamination at the source rather than to manage resultant significant environmental impacts. The ongoing characterisation and monitoring of potential contamination sources are addressed in Recommendation 6. In addition, the NT EPA has recommended the identification of potential 'indicator' contaminants and concentrations in waste rock and tailings leachates that could be used as trigger thresholds for management and mitigation actions. Due to the large volumes of water being treated, the NT EPA has recommended an assessment of chemicals added for water treatment and beneficiation, especially flocculants, be undertaken and reported in the Water Management Plan. The Proponent committed to use the non-toxic anionic form of polyacrylamides. The type of polyacrylamide and polymer flocculants should be clearly identified and polyacrylamides with more than 0.05% of the neuro-toxin acrylamide monomer should be avoided (Sojka & Surapaneni, 2000). The assessment should consider the potential of these chemicals and their breakdown products to contaminate receiving environments.

The Proponent committed to construct the surface TSF to Australian National Committee on Large Dams Inc. guidelines (ANCOLD, 2012) and that an independent and appropriately qualified Certified Engineer would oversee the design, construction, operation, rehabilitation and closure of the surface TSF. The NT EPA supports this approach.

At closure, surface tailings would remain within the unlined surface TSF. The final landform of the rehabilitated surface TSF and the infilled pits would allow infiltration of rainwater to occur.

The following preventative measures are proposed by the Proponent to reduce the quantity of water, especially poor quality water, infiltrating the groundwater:

a) The proposed mining, processing and rehabilitation operations are designed to recycle all process water and tailings decant water by storing it in lined ponds for reuse in the processing plant.

b) Water recovery from, and hence dewatering of, the tailings (40 – 50 % water content) would be facilitated by the design of the tailings storages encouraging accumulation and extraction of decant water. Geotechnical testing (Supplement) indicated that most of the settlement occurs within the first 24 hours, reaching approximately 0.9 t/m^3 dry density, with 30% of the total tailings water being discharged.

c) Exposure to high evaporation rates in the arid environment would further reduce moisture in the tailings.

The Proponent has stated that emergency measures, such as pumping of excess water into pits, would be in place to avoid uncontrolled surface discharge to the surrounding environment.

Infiltration and leachate from tailings will be monitored through a groundwater monitoring program, which would be part of a peer-reviewed and regulator-endorsed Water Management Plan. Four of the 18 monitoring bores will be placed downgradient of the surface TSF and in-pit tailings storages to target tailings seepage. They will be monitored quarterly for water quality and logged daily for water levels. In order to ensure the monitoring program is appropriate and scientifically robust, NT EPA recommends an independent external audit of the seepage monitoring program should be undertaken after four and ten years of tailings deposition and the auditor report to the relevant regulator. The NT EPA recommends the monitoring data and audit report should be made publicly available through an annual Water Monitoring Report.

The Proponent proposes to establish a water quality baseline, if groundwater is present, over at least 12 months prior to mining and has also proposed that any exceedance of this baseline will trigger mitigation measures such as extracting existing seepage and reducing seepage from subsequent in-pit storage through underdrainage.

Should no groundwater be present, the NT EPA has recommended the use of livestock drinking water guidelines (ANZECC & ARMCANZ, 2000) as pastoralists are beneficial users of the downstream aquifer that may be impacted by the modelled plume. Initial tailings leachate and decant water analysis were within these guidelines, with the exception of a slightly elevated pH and fluoride (during the initial flush).

The significance of exceedances should be assessed by the relevant regulator. Measures to mitigate the source of contamination may include treatment of tailings and/or lining of tailings storage facilities and should be implemented immediately. Exceedances that change the environmental significance of the Proposal must be referred to the NT EPA in accordance with Recommendation 2.

Recommendation 8

That approvals and decisions for the Proposal have conditions that require the Proponent to develop a Water Management Plan to the satisfaction of the relevant regulator prior to mining. The plan should include:

- **an assessment of chemicals added during water treatment and the beneficiation process, including an assessment of their behaviour and breakdown products in tailings and tailings decant/seepage and potential to contaminate the environment. In particular:**
    - **clearly identifying the type of polyacrylamide and polymer flocculants**
    - **polyacrylamides with more than 0.05% of the neuro-toxin acrylamide monomer are not to be used**
- **recommendations of the independent peer review to monitor seepage during the early stages of mine development**
- **robust pre-mining groundwater quality baselines to be used as trigger levels for mitigation measures, or should no groundwater be present, livestock drinking water guidelines to be used as trigger thresholds**
- **in line with the program to monitor potential contamination sources (Recommendation 6) potential contaminant concentrations in waste rock and tailings leachate should be identified and used as trigger thresholds for management actions to mitigate the source of contamination**
- **contingency measures to mitigate the source of contamination, if trigger values are exceeded**

- **a robust groundwater quality monitoring program that can quantify the extent and quality of any potential seepage from the proposed mine site**
- **a requirement for an independent external audit of the groundwater quality monitoring program by a suitably qualified and experienced professional after four and ten years of tailings deposition. The auditor is to report to the relevant regulator.**

All water quality monitoring data, trigger values, audit reports and an assessment of any impacts should be made publicly available in an annual Water Management Report on the websites of (as applicable) the Proponent, the Operator and relevant regulatory authorities.

Infiltration or leachate from waste rock dumps

The Proposal outlines that waste rock would be stored in unlined stockpiles in various locations around the mine site until required for progressive rehabilitation. Infiltration of run-off would mainly occur after rain.

The geochemical assessment of the waste rock indicates that the risk of AMD would be low and the material could be managed as non-acid-forming, non-saline, non-metalliferous and non-radioactive waste. Although phosphorous was highly elevated in the waste rock, it was not elevated in the ASLP waste rock leachate, which is consistent with the low solubility of phosphate minerals.

The results indicate that waste rock would be suitable for management in unlined waste rock dumps with appropriate monitoring of metals and metalloids in potential receptors, such as groundwater (as per Recommendation 8) and surface water.

5.2.4.2 Surface water quality

The NT EPA accepts the difficulty of establishing a robust baseline for surface water quality conditions due to the ephemeral flows present in the region. Surface water quality is also likely to vary over the course of flow or flood events. This makes assessment of likely or actual impacts difficult and the implementation of reactive management measures more problematic. In the view of the NT EPA, this reinforces the importance of preventative measures.

Uncontrolled discharge of process water

An uncontrolled discharge, whether unplanned (e.g. due to structural failure) or caused by rain and flooding, was identified as the primary pathway for potential contamination of surrounding surface waters. In the EIS, the Proponent assessed the residual significant impact would be low due to:

- the absence of surface waters, including ephemeral drainages, in the immediate vicinity and downgradient of the proposed mine site
- the implementation of preventative measures such as a nil-discharge mine site design, process water ponds with a 100 year ARI freeboard capacity, flood protection berms, emergency procedures and ANCOLD construction standards for the surface TSF
- the implementation of audited erosion and sediment controls (IECA, 2008), including an ESCP, to maintain the integrity of the infrastructure, such as surface TSF and flood protection berms
- the implementation of a Hazardous Substances Management Plan and an Emergency Response Management Plan for the prevention and mitigation of accidental spills of hazardous materials

- the implementation of a water quality monitoring program for ephemeral surface waters in the region
- the adoption of appropriate trigger values for mitigation options. The 95% freshwater aquatic ecosystems species survival trigger values (ANZECC & ARMCANZ, 2000) would be used until site specific trigger values, based on at least 30 months baseline data, are developed.

The NT EPA supports these measures.

Mobilisation of soils/sediment during clearing, mining and closure activities, and from post-closure landforms

The Proponent has committed to implement best-practice erosion and sediment controls (IECA, 2008), including an erosion and sediment control plan ESCP developed by a Certified Professional in Erosion and Sediment Control and approved by the regulator, for all aspects and stages of the mine's operation and closure. These would form part of the MMP and implementation of the ESCP will be regularly monitored by a suitably qualified third party auditor, to the satisfaction of the relevant regulator. Post-closure monitoring will include assessment of the physical and geotechnical stability of post-closure landforms and the success of rehabilitation and revegetation.

The construction of the gas pipeline and railway line has the potential to impact on intersected drainage systems and their sensitive vegetation communities through sedimentation.

In order to maintain surface water quality the NT EPA recommends all sections of the infrastructure corridor not required during the operational phase, to be rehabilitated and revegetated with local native plant species immediately after construction has been completed. The proposed delayed rehabilitation of these sections at mine closure, estimated to be at least 300 ha in size, was deemed an unacceptable environmental risk by the NT EPA.

The NT EPA supports the Proponent's commitment to implement appropriate erosion and sediment controls to minimise the erosion risk.

Recommendation 9

That the Proponent rehabilitate and revegetate all sections of the infrastructure corridor not required during the operational phase shortly after construction has been completed. Revegetation is to use local native plant species.

Lateral, above-ground seepage from surface TSF

The surface TSF will be constructed to ANCOLD standard (ANCOLD, 2012) and walls will be lined to prevent above-ground seepage.

Recycled process water being used for dust suppression

Chemical analysis of two synthetic tailings samples indicated that tailings leachate and decant would have a slightly alkaline pH and slightly elevated SAR, fluoride, phosphorous and molybdenum, which may increase soil dispersion and impact crop yield and nutrient load when used in an agricultural setting. If used for dust suppression, tailings leachate and decant water do not present a significant risk to the environment unless used on a large scale adjacent to waterways. The latter would be unlikely to occur as there is no surface water within the vicinity of mining operations. Construction of the infrastructure corridor would use groundwater and not process water, which is unlikely to impact ephemeral wetlands if used for dust suppression in the small sections adjacent to these wetlands.

Surface runoff within the mine site, including runoff from ore and phosphate rock concentrate stockpiles

Stockpiles of phosphate rock concentrate will be covered and therefore rarely produce runoff. Runoff from ore stockpiles will have elevated metal concentrations relative to the 95% aquatic ecosystem protection levels (see section 5.2.4). There are no surface water bodies within the proposed mine site, and any contact with surface waters would be through an uncontrolled discharge (see discussion above).

Fuel and chemical spills

The risk of spills of hazardous material, including fuel and chemicals, contaminating surface waters was assessed in the EIS as low and mainly associated with the construction of the infrastructure corridor, transport and other mining-related activities offsite, as there are no surface waters within or downgradient of the mine site. The risk will be managed through appropriate handling, storage and transport of hazardous materials outlined in the Hazardous Substances Management Plan and in compliance with relevant legislation and standards. Accidental spills will be managed in accordance with the Emergency Response Management Plan and the Environmental Investigation Procedure.

Potential impacts to soils are discussed in Appendix 2 (terrestrial environmental quality).

The NT EPA reminds the Proponent of its obligation not to cause environmental harm. Any uncontrolled discharge or spill must be reported to the relevant regulator.

5.2.4.3 Summary and conclusion

The Proponent proposes to deposit tailings permanently in unlined facilities. The justification not to line these was based on preliminary geochemical characterisations of two synthesised tailings samples and about 200 waste rock samples. Chemical assays indicated that mined and processed materials are unlikely to generate saline, acid and metalliferous drainage, and that any leachate is unlikely to significantly impact groundwater quality.

Overall, the NT EPA assessed the risk of groundwater contamination from unlined tailings storage facilities as low, based on:

- a low likelihood for mined and processed materials and their leachates to generate saline, acid and metalliferous drainage and hence a limited inventory of potentially leachable contaminants
- deep groundwater levels in the region, including underneath the mine site, with the potential for leachable materials to be attenuated in the regolith overlying the groundwater table
- a multi layered precautionary management approach to avoid, monitor, audit and mitigate any remaining risks of contamination
- the regulatory controls in place should seepage exceed the agreed thresholds.

However, the NT EPA acknowledged there is some uncertainty about the geochemical composition of tailings, due to the limited number of synthesised tailings samples investigated and that actual tailings have not been analysed. The NT EPA is of the opinion that a precautionary approach should be used, especially in the early stages, to decrease the risk for environmental harm to occur. In addition to the proposed management, monitoring and mitigation measures, the NT EPA recommends:

- the Proponent conduct aggressive tailings leach testing prior to mining and extract and analyse actual tailings seepage and decant water during the first 12

months of operation. The results will inform the requirement for any mitigation options such as lining and tailings treatment

- frequent geochemical and radiological testing of the waste rock, tailings, ore and their leachates as potential sources for groundwater contamination
- the incorporation of all recommendations from the independent peer review and the commitments made by the Proponent into the respective management plans
- an assessment of the contamination potential of chemicals added during water treatment and beneficiation process, in particular of the flocculants
- the development of an AMD contingency plan recognizing that if tailings seepage exceeds the agreed threshold levels then mitigation options such as lining of the tailings storage or additional tailings treatment must be implemented immediately
- independent external audits of the groundwater quality monitoring program.

The NT EPA assessed the contamination risks to surface waters as low based on:

- an absence of surface water drainage features within the proposed mine site
- appropriate preventative measures, monitoring programs and contingency plans to prevent contamination of downgradient surface waters through an accidental spill or unplanned discharge.

With the implementation of the relevant management plans and recommendations identified above, the NT EPA considers the Proposal could be conducted in such a manner that its objective for inland water environmental quality is likely to be met.

6 Whole of environment considerations

The purpose of this section is to evaluate other important matters relating to the potential impacts of the Proposal on the environment that are fundamental to the environmental acceptability of this Proposal.

6.1 Rehabilitation and closure

The Proponent has provided a conceptual Closure Report (updated in the Supplement, Appendix 1) that outlines closure concepts and tasks. The Proponent committed to the development of a detailed Rehabilitation Plan, including completion criteria, which would inform the content of a Mine Closure Plan (MCP) to be incorporated into the MMP required as part of the authorisation process under the *MM Act*.

A key component of the closure concept is progressive rehabilitation of mined-out pits, that would commence after year one and continue throughout the life of the mine. The NT EPA supports this concept and emphasises the importance of early planning for mine rehabilitation and closure. The NT EPA considers that closure plans should align with leading practice (e.g. (DIIS, 2016); DMP, 2015) and satisfy the principles of the International Council of Mining and Metals Mine Closure Guidelines (ICMM 2015).

The Proponent acknowledges that the phosphate deposit is much larger than the resource being targeted in this Proposal. Consequently, the NT EPA considers that some of the proposed infrastructure and mine components may be present in the landscape for substantially longer than described in the current Proposal, subject to future assessment. The NT EPA considers that closure planning should require such components be managed for long-term persistence, with appropriate rehabilitation of surrounding areas.

The NT EPA supports the proposed progressive rehabilitation and expects it to be an integral part of the Mine Closure Plan to ensure sustainable rehabilitation and closure are thoroughly considered prior to authorisation of the Proposal. The NT EPA

recommends that rehabilitation outcomes, including revegetation, to be audited every five years to ensure best practice is applied to rehabilitation and revegetation is developing towards self-sustaining ecosystems.

Recommendation 10

That approvals and decisions for the Proposal have conditions that require the Proponent to provide a Mine Closure Plan to the relevant regulator prior to mining. The Mine Closure Plan must:

- **be of a standard equal to or better than the Western Australian guidelines for preparing mine closure plans (DMP, 2015)**
- **address all aspects of rehabilitation and mine closure, including post-mining land use agreed with stakeholders, rehabilitation objectives, schedules for progressive rehabilitation, completion criteria and monitoring of rehabilitation success**
- **include predicted landform designs that are consistent with current standards and best practice**
- **include plans and a schedule for post-construction rehabilitation of all areas of the infrastructure corridor that would no longer be required after construction**
- **demonstrate that all rehabilitated areas would be safe to humans and animals, geotechnically stable, non-polluting and non-contaminating, and capable of sustaining the agreed post-mining landuse**
- **include details of the research trials and investigations that would inform, guide and support appropriate landform covers and ecosystems for all rehabilitation, including progressive rehabilitation and closure**
- **investigate the long term settling process of tailings and waste rock to inform construction of appropriate landform covers and avoidance of significant depressions and pooling of water**
- **provide details of a program for regular monitoring and reporting on the performance of progressive rehabilitation works**
- **provide for results from monitoring the performance of progressive rehabilitation to inform decision-making to ensure long-term successful rehabilitation**
- **outline a strategy for appropriate consultation with stakeholders on rehabilitation objectives and post-mining land use**
- **provide for ongoing monitoring and maintenance of the site post-mining, in accordance with an approved monitoring and maintenance program, until such time as the relevant regulator directs**
- **require reporting to the relevant regulator on progressive rehabilitation works and performance**
- **require independent external audits by suitably qualified and experienced professionals of the progressive rehabilitation, including revegetation, at least every five years and at closure.**

The Mine Closure Plan is to be peer-reviewed by an appropriately qualified independent professional prior to submission to the relevant regulator.

The NT EPA recognises that mine rehabilitation and closure planning would continue to evolve through the life of the mine. The Mine Closure Plan should be subject to regular

review, development and improvement throughout the life of the mine including any period of care and maintenance, as specified in Recommendation 11. The NT EPA considers the Proponent should provide alternative rehabilitation options in future iterations of the Mine Closure Plan as relevant site-specific information is collected and technology and management techniques evolve over time. It should include a comparison of the long term or residual environmental risk between the current conceptual closure plan and other alternatives that may address long-term risks to the environment.

Recommendation 11

That approvals and decisions for the Proposal have conditions that require future iterations of the Mine Closure Plan to include:

- **alternative rehabilitation options that identify a range of closure scenarios and strategies for the mine pit and associated infrastructure and provide justification that the preferred closure option minimises environmental risks**
- **identification and management of knowledge gaps relating to closure-specific technical information (including environmental baseline data, waste characterisation, and review of monitoring data) to inform sustainable mine closure**
- **details of pre-closure research trials, investigations and modelling aimed at addressing knowledge gaps to inform detailed rehabilitation design. These are to include, but are not limited to, vegetation, final cover materials, capping design, and surface water runoff.**

6.2 Community engagement

The NT EPA considers that stakeholder and community engagement should be ongoing through the life of the mine, from the early planning phases to mine closure and relinquishment. All members of the community who are likely to affect, to be affected by, or to have an interest in the Proposal should be identified and appropriately consulted.

The Proponent identified a range of stakeholders in the Proposal and indicated in the EIS that some community consultation had taken place between 2013 and 2017. The NT EPA notes that a submission from the Central Land Council (CLC) on the Draft EIS expressed concern regarding the level of consultation undertaken by the Proponent, especially with local Aboriginal people (Supplement).The CLC represents the native title holders of areas that would be affected by the Proposal, who may negotiate an Indigenous Land Use Agreement.

The NT EPA considers that ongoing stakeholder engagement between the Proponent and the local and broader community is essential to ensure post mining land uses, closure and rehabilitation objectives, and completion criteria are agreed in accordance with leading practice (DIIS, 2016; ICMM 2015; ICMM, 2016).

The Proponent has stated its commitment to develop and/or maintain relationships with stakeholders, including indigenous communities, for the life of the mine. The Economic and Social Impact Management Plan (ESIMP) outlines a community advisory group to facilitate this. The NT EPA considers that engagement with the local and broader community, in an open and transparent manner, to be important to establish a social licence for mine operations. The NT EPA considers that a consultation group should be formalised, with all parties understanding the purpose of consultation and their own role in it.

Recommendation 12

That approvals and decisions for the Proposal include conditions that require the Proponent to demonstrate appropriate engagement with native-title holders, and to establish a Community Consultation Group with Aboriginal, pastoral, and other relevant stakeholders to provide a forum to:

- **inform (in an appropriate manner) local residents of key aspects of the Proposal that may impact on their values, including amenity and cultural practices**
- **consult with local residents and relevant agencies on matters relating to the proposed workforce, to maximise benefits for local employment, and to manage cumulative impacts on demand for local workers and overall employment opportunities**
- **undertake ongoing stakeholder consultations on agreed post-mining land use and rehabilitation objectives.**

7 Conclusion

The NT EPA's assessment of the proposed Ammaroo Phosphate Project identified potentially significant environmental impacts and risks associated with the proposed water abstraction, the limited geochemical characterisation of tailings, and rehabilitation and closure.

The NT EPA considers that, subject to the implementation of the 12 recommendations in this Assessment Report and the commitments and safeguards listed by the Proponent in the EIS, the Proposal can be implemented and managed in a manner that is likely to meet the NT EPA's objectives and avoid significant or unacceptable environmental impacts and risks.

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Appendix 1 - Geographic coordinates defining the Proposal Area

Geographic coordinates defining the Proposal area:

Location point	Latitude	Longitude
MLA 29854		
1	21° 27' 0.000" S	135° 5' 0.000" E
2	21° 32' 0.000" S	135° 5' 0.000" E
3	21° 32' 0.000" S	135° 9' 0.000" E
4	21° 27' 0.000" S	135° 9' 0.000" E
ML29463		
1	21° 27' 0.000" S	135° 9' 0.000" E
2	21° 32' 52.613" S	135° 9' 0.000" E
3	21° 32' 52.228" S	135° 14' 29.188" E
4	21° 28' 38.525" S	135° 14' 28.766" E
5	21° 28' 38.708" S	135° 12' 9.767" E
6	21° 27' 0.000" S	135° 12' 9.630" E
Transport Corridor		
1	21° 11' 56.714" S	134° 8' 26.508" E
2	21° 13' 56.400" S	134° 7' 34.746" E
3	21° 15' 50.123" S	134° 13' 54.857" E
4	21° 27' 19.116" S	134° 44' 55.209" E
5	21° 26' 31.173" S	134° 56' 54.139" E
6	21° 29' 41.617" S	135° 7' 41.554" E
7	21° 28' 57.564" S	135° 8' 42.785" E
8	21° 27' 45.064" S	135° 8' 19.213" E
9	21° 24' 21.571" S	134° 57' 16.172" E
10	21° 25' 8.265" S	134° 45' 10.692" E
11	21° 13' 48.390" S	134° 14' 43.890" E
12	21° 11' 56.714" S	134° 8' 26.508" E

Appendix 2 – Assessment of the NT EPA's environmental factors

The NT EPA assessed the environmental impact of the Proposal in line with its environmental factors and objectives (NT EPA, 2018). The following table presents environmental factors for the Proposal which, based on current knowledge, were assessed as not significant. The NT EPA considers it unlikely that implementation of the Proposal would have a significant impact on these factors and they can be managed to meet the NT EPA's environmental objective.

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
LAND		
Terrestrial Flora and Fauna	1. Clearing of 3775 ha of native vegetation. 2. The grey falcon, is likely to occur in the Proposal area. 3. Discovery of threatened species	1. The proposed clearing is unlikely to have a significant impact on fauna or flora for the following reasons: • The vegetation communities that would be cleared are relatively common in the region. • No threatened fauna or flora species were recorded within the areas to be cleared, and expert advice was that the areas to be cleared are unlikely to be important habitat for threatened species. • A small area (size inferred from mapping) of ephemeral wetlands and drainage floors (sensitive vegetation as per definition in DLRM, 2017 and NRETAS, 2010) would be cleared. • No groundwater dependent vegetation occurs in the Proposal area. 2. The grey falcon is widespread in low densities across the arid and semi-arid area of Australia. The vegetation to be cleared is suitable foraging habitat for the grey falcon, but contains very little suitable nesting habitat. The NT EPA considers the risk of impact to this species from habitat removal to be minimal, especially due to the staged mining approach with progressive rehabilitation. 3. Should a threatened species be sighted or found within or near the proposed mine site and infrastructure corridor, the finding should be reported to the Department of

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
	4. Fauna entrapment There is some potential for fauna mortality from entrapment in trenches required for the gas pipeline construction. 5. Contaminated water Standing water associated with the tailings storage facility and in-pit tailings disposal could contain contaminants that could impact native fauna species by contact or consumption. 6. Vehicle strikes Fauna may be killed or injured by strikes from vehicles used for the Proposal on roads and rail.	Environment and Natural Resources (DENR) and appropriate mitigation measures should be implemented to the satisfaction of DENR. 4. The Proponent outlined a number of commitments in the EIS that would avoid impacts to fauna during pipeline construction. These would be included in the Biodiversity Management Plan to be implemented as part of the Mining Management Plan (MMP) to be authorised under the *Mining Management Act* (MM Act). As the measures are proven to be effective at other trenching developments in the NT, the NT EPA considers these would be appropriate for managing this potential impact. However, the Mole Ploughing method now proposed for laying the pipeline does not leave any open trench. 5. The Proponent committed to periodically remove free standing water, design the TSF to discourage wildlife, monitor wildlife visitation, and develop management responses if necessary. Additionally, preliminary testing indicated that most water quality parameters would be within drinking water guidelines for sensitive livestock, with the exception of pH and fluoride (see section 4.3 for further detail). The NT EPA considers that these commitments are adequate and appropriate for preventing, mitigating or managing this potential impact. The NT EPA expects this to become a standard operational control of the mine. 6. The Proponent's Biodiversity Management Plan and Traffic Management Plan would be part of an EMP, and would include reporting of injured and killed fauna species and limiting the movement of vehicles at night when fauna are more likely to be active. The Proponent also committed to updating the plan to provide additional traffic management protocols should susceptible threatened species (e.g. greater bilby) be found on or near the site. The NT EPA considers that implementation of the EMP would adequately mitigate this potential impact on most fauna and expects it to become standard practice, noting that additional mitigation measures may be required if threatened fauna are detected

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
	7. Introduction and spread of weeds The Proponent identified 13 weed species in the Proposal area, including the declared weed *Calotropis procera* (rubber bush), as well as the invasive pasture grass *Cenchrus ciliaris* (buffel grass) (DoE, 2015). Implementation of the Proposal could assist the distribution of these species or introduce new species. Any weed species can alter the composition of native vegetation (and thereby potentially alter fauna habitat suitability) by competition and/or other mechanisms such as changing the fire regime. 8. Competition/predation from introduced fauna The Proposal would introduce new sources of water (and potentially food) to the landscape that may increase the density of non-native fauna that compete with, or predate on, native fauna.	7. The Proponent committed to develop a Weed Management Plan, which would require implementation as part of the MMP. The NT EPA considers that this is appropriate for managing this potential impact and expects it to become standard practice. 8. The Proponent committed to the inclusion of monitoring and control of feral species in the Biodiversity Management Plan. The NT EPA considers that this is appropriate for mitigating this potential impact and expects it to become standard practice. <u>Conclusion</u> The NT EPA considers that the risks to threatened fauna or flora, fauna biodiversity, and significant vegetation communities are generally low, and potential impacts can be further avoided, mitigated or managed through the implementation of commitments and management plans that would be regulated under the MM Act.

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
Terrestrial environmental quality	1. Soil contamination	1. Contamination of soils would occur through similar pathways to contamination of groundwater and surface waters, assessed in section 5.2. The NT EPA considers that the proposed monitoring and management programs are appropriate for preventing and mitigating this potential impact and expects it to become standard practice.
	2. Erosion and sediment movement	2. The Proposal would implement erosion and sediment controls, including a regulator-endorsed and audited ESCP, for all aspects and stages of the mine's operation and closure. These would form part of the MMP and be subject to a monitoring plan. Post-closure monitoring would include assessment of the physical and geotechnical stability of post-closure landforms and rehabilitation/revegetation success. The NT EPA considers that this is appropriate for preventing and mitigating this potential impact and expects it to become standard practice.
	3. Rehabilitation failure	3. A peer-reviewed Mine Closure Plan and a mining security bond would be required as part of the authorisation process under the MM Act to prevent rehabilitation failure. See section 2.2.6 for an overview of the closure process and section 6 for further discussion of rehabilitation and closure and recommendations. The NT EPA considers that this is appropriate for mitigating this potential impact and expects it to become standard practice. <u>Conclusion:</u> With the implementation of the proposed preventative measures, monitoring programs, mitigation measures and relevant management plans identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for terrestrial environmental quality is likely to be met.
Landforms	There are no distinctive physical landforms in the area of the Proposal.	It is unlikely that implementation of the Proposal will impact on landforms.
WATER		

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
Aquatic Ecosystems	There are no aquatic ecosystems in the Proposal area.	There may be aquatic ecosystems downstream from the Proposal area, but not close enough to be potentially impacted via water flowing from or through the Proposal area. It is unlikely that implementation of the Proposal would impact on aquatic ecosystems. See section 5.2.3.2 for an assessment of potential impacts to surface water quality.
AIR		
Air quality and greenhouse gases	1. Dust generation Dust would be generated by wind over disturbed or cleared areas, mining activities (excavation, loading, grading, hauling), beneficiation, and by vehicle movement on dirt roads. 2. Greenhouse gas emissions Implementation of the Proposal would result in the unavoidable emission of greenhouse gases from land clearing, construction, vehicle emissions, and energy generation.	1. Modelling provided by the Proponent predicted that dust generated by implementation of the Proposal is unlikely to impact on air quality at the nearest offsite sensitive receptors (i.e. unlikely to be detectable over background conditions). These include Ampilatwatja community and Double D outstation, located about 12 km (upwind under the most common conditions) and 25 km (downwind), respectively, from the mineral lease. The Proponent has stated that dust generation would be avoided, minimised and controlled using standard procedures that would be specified in a Dust Management Plan (Draft EIS, Chapter 15.5). The Proponent intends to establish a monitoring site at the proposed accommodation village, about 3.5 km from dust-generating areas of the Proposal. This would enable evaluation of dust modelling predictions. The NT EPA considers that this is appropriate for avoiding or managing potential impacts of dust on air quality and expects dust management to become standard practice. 2. The clearing of 3775 ha of native vegetation (generally sparse vegetation ranging from low woodlands, shrublands to grasslands of low biomass per hectare) will not result in greenhouse gas emissions that are significant on a national or regional scale. Emissions from vehicles will not be significant on a national scale. The largest contribution to greenhouse gas emissions would be from the consumption of energy via gas fired power generation and gas-fired drying of phosphate produce, which is expected to be 3.2 PJ/y. The NT EPA calculated that this equates to GHG emissions of 164 896 t CO_2 –e and represents 1% of the total and 4.34% of the stationary energy GHG emissions produced in the NT in 2016 (DoEE, 2018).

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
		The Proponent has stated that high efficiency gas engines would be used, and solar power would be used if possible for some parts of the Proposal. The Proponent is seeking alternative options for the drying of phosphate product that would reduce energy consumption and result in fewer greenhouse gas emissions. The NT EPA supports the Proponents intention to increase energy efficiencies and the proportion of energy supplied by renewable sources, which would minimise greenhouse gas emissions associated with implementation of the Proposal. <u>Conclusion</u> The NT EPA concluded that there is not likely to be significant impacts to air quality for sensitive receptors. The potential impacts could be avoided, mitigated or managed through the implementation of a Dust Management Plan that would be regulated under the *MM Act*. The assessment also concluded that greenhouse gas emissions from implementation of the Proposal are unavoidable but would be minimised through the use of high-efficiency generators and potentially reduced further by using renewable energy sources.
PEOPLE AND COMMUNITIES		
Social, economic and cultural surroundings	1. Degradation of cultural values associated with sacred sites 2. Degradation of cultural values associated with archaeological sites/artefacts	1. The Proponent has applied for an Authority Certificate to be issued in accordance with the *Northern Territory Aboriginal Sacred Sites Act* (NTASS Act). Issuing of the certificate is a matter for the Aboriginal Areas Protection Authority. The Proponent has committed to conducting works in accordance with the Authority Certificate. If the Proposal is implemented in accordance with a valid Authority Certificate issued under the NTASS Act, the NT EPA considers that this potential impact would be mitigated. 2. The Proponent presented a draft Cultural Heritage Management Plan (CHMP) with commitments to include an Unexpected Heritage Finds Procedure and to have the CHMP endorsed by the Heritage Branch of the Department of Tourism and Culture prior to the commencement of construction. The NT EPA considers that this potential impact would be avoided, mitigated and managed through implementation of the

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
		CHMP, subject to the commitments made by the Proponent. The CHMP will form part of the MMP, to be regulated under the *MM Act.*
	3. Reduced access to land for traditional use by Aboriginal people There is potential for the infrastructure corridor to restrict access to land used for traditional hunting and gathering practices of importance to Aboriginal people	3. The Proponent stated in the Supplement that they would discuss this matter further with Aboriginal people. The NT EPA has further assessed the issue of community consultation in section 6.2 of this Report.
	4. Reduction in local landscape amenity The Proposal would result in increased traffic on roads in the region, with associated dust and noise that could detract from the quiet, relatively natural feel of this remote area and reduce the operational performance of roads.	4. The NT EPA notes that the proposed realignment of Murray Downs Road is currently under discussion and would be subject to the standard assessment and approval processes of the road authority. The Proponent stated that it will develop and implement a Traffic Management Plan and an inspection and maintenance agreement with the relevant road authority. The NT EPA considers that this would enable the mitigation of potential impacts on road-related aspects of the Proposal. Implementation of the Proposal would also result in permanent alteration of the landscape, which could impact on the spiritual and/or cultural value of the landscape to local Aboriginal people (as reflected in the local art movement) and local pastoralists. To manage this impact, the NT EPA considers that community consultation on post-mining land use objectives and closure planning would be essential. This is discussed in section 6 of this Report.
	5. Changes to local socio-economic conditions	5. The NT EPA supports the Proponent's goals to source some workers from the local region, as this could provide economic and social benefits. There is also potential for negative impacts on community cohesion and community resilience due to, for example, inequitable distribution of economic benefits or unmet expectations. To avoid or manage these and other potential economic and social impacts, the Proponent will implement an Economic and Social Impact Management Plan (ESIMP). The draft ESIMP provided in the draft EIS outlined measures such as a

Environmental Factor	Potential impacts	Explanation of why the factor is not a key environmental factor
		community advisory group, workplace and employment plan, grievance register, Local Industry Participation Plan, Code of Conduct and cultural inductions for workers. The NT EPA considers that implementation of the ESIMP would facilitate the mitigation and management of these potential impacts, but also stressed the importance of community consultation in achieving this, as discusses in section 6 of this Report. <u>Conclusion</u> The assessment concluded that some potential social, economic and cultural impacts can be addressed through legislative processes including the implementation of operating plans as part of regulation under the MM Act. Some potential impacts will require effective community consultation for their mitigation and management. This is addressed in section 6 of this Report.
Human health	Implementation of the Proposal could result in potential impacts to human health via water, land, or air contamination, or through decreased community resilience.	The NT EPA considers that these would be avoided or managed through addressing the environmental factors (and achieving their objectives) for Inland water environmental quality; Terrestrial environmental quality; Air quality and greenhouse gases; and Social, economic and cultural surroundings. In addition, potential impacts to human health will be managed through a health and safety management system guided by WorkSafe Australia and AS/NZS 4801:2001 Occupational Health and Safety Management Systems (Standards Australia, 2001). The approach was confirmed by NT WorkSafe, Department of the Attorney - General and Justice.

Appendix 3 – Principles of Ecologically Sustainable Development

Under the NT EPA Act, ecologically sustainable development (ESD) means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life now and in the future can be increased.

In December 1992, the Territory Government endorsed the 'National Strategy for Ecologically Sustainable Development' and agreed, along with all other States and Territories, to the 'Intergovernmental Agreement on the Environment' (IGAE) (Australian Government 1992).

The NT EPA uses the four principles contained in the IGAE to demonstrate that it has considered ESD in its assessment of the Proposal and in fulfilment of its objectives under the NT EPA Act.

ESD Guiding principle	NT EPA assessment
1. The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by:* *a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *b) an assessment of the risk-weighted consequences of various options.*	In considering this principle, the NT EPA notes that Hydrological Processes and Inland Waters Environmental Quality could be significantly impacted by the Proposal. The assessment of these impacts is provided in this report. The Proponent's investigations into the physical, biological and cultural environment provided sufficient scientific certainty to enable assessment of the risks and potential impacts and to identify measures to avoid or minimise those impacts and risks. The NT EPA made recommendations to ensure these measures to prevent environmental degradation recommendations of independent peer reviews are implemented by the proponent, including the use of independent peer reviews. In addition, the NT EPA made recommendations in line with the precautionary principle in order to prevent and minimise impacts, such as water table drawdown at the Georgina Basin carbonate aquifer and seepage to the aquifer underneath the mine site. From its assessment of the Proposal, the NT EPA concluded that if its recommendations are imposed as conditions on the implementation of the Proposal, there is no threat of serious or irreversible damage.
2. The principle of intergenerational equity	The NT EPA notes that only the measured portion of the phosphate deposit is subject to this proposal, with the life of the mine potentially extending beyond the proposed 25 years. While any alterations with significant consequences to the

The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.	environment would require additional assessment, the NT EPA expects that the measures proposed by the proponent to avoid and minimise long term impacts of the Proposal on the environment would be progressively improved as further knowledge becomes available through the proposed monitoring programs and management frameworks. From its assessment of this Proposal, the NT EPA concluded that, provided its recommendations are imposed as conditions on the implementation of the Proposal, environmental values will be protected and that the health, diversity and productivity of the environment will be maintained for the benefit of future generations.
3. The principle of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration*.	In considering this principle, the NT EPA notes that the Proposal will result in impacts and risks to Hydrological Processes and Inland Waters Environmental Quality. In assessing this proposal, the NT EPA has considered these impacts and risks and taken into consideration measures proposed by the proponent to avoid and minimise impacts to the affected values. From its assessment of this proposal the NT EPA has concluded that, provided its recommendations are imposed as conditions on the implementation of the proposal, the proposal will not compromise the biological diversity and ecological integrity of the affected areas.
4. Principles relating to improved valuation, pricing and incentive mechanisms *a) Environmental factors should be included in the valuation of assets and services.* *b) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* *c) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.*	In considering this principle, the NT EPA notes that the Proponent would take responsibility for preventing, managing and mitigating waste and pollution, including contamination of soils, groundwater and surface waters through accidental spills, uncontrolled discharges and tailings seepage. All stages of the Proposal, including rehabilitation, mine closure and decommissioning, would be the responsibility of the Proponent. The NT EPA has had regard to this principle during the assessment of the proposal.

d) *Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimize costs to develop their own solution and responses to environmental problems.*	