Environmental Risk Assessment 4

CONTENTS

Tables

Graphs

4 ENVIRONMENTAL RISK ASSESSMENT

4.1 INTRODUCTION

This section describes the assessment of environmental and social risks that was undertaken for the project. It describes the risk assessment methodology, and presents the results of the assessment. This section presents the project's risks in the absence of mitigation measures, as well as after taking into account the application of mitigation measures. The objective of the risk assessment process is to ensure that significant risks are identified and evaluated in order to ensure an appropriate level of risk treatment is applied to mitigate such risks.

4.2 METHODOLOGY

4.2.1 Introduction

Risk assessment and management is a key part of the proponent's business. Risk management is integrated into business processes to ensure that, on a day-to-day basis, both strategic and operational decisions are risk-based. The proponent's risk management system provides a consistent framework for risk management, which includes a structured methodology and the tools to identify both opportunities and threats. The system then initiates a process whereby resources are effectively allocated in order to treat risks. Requirements of the system include implementation of structured and systematic hazard identification, risk assessment and risk recording processes. There is a requirement for the ongoing review of risks, and review of the effectiveness of controls. The system is informed by AS/NZS ISO 31000:2009 *Risk Management – Principles and Guidelines*. In the context of a project, the proponent's risk management system includes requirements for risks to be identified early in the project lifecycle to ensure that appropriate controls can be applied to the planning and design of the project.

The key features and outcomes of the risk management process include:

- It is part of decision making;
- It is an integral part of the proponents organisational process;
- It is based on the best available information;
- It addresses uncertainty;
- It takes into account human, cultural as well as environmental aspects;
- It is transparent and inclusive;
- It is tailored, dynamic, and responsive to change;
- It facilitates continual improvement; and
- It creates and protects value both for the proponent and key stakeholders.

This section describes the risk assessment methodology that was adopted for the Eastern Leases Project (the project) for environmental and social risks. Occupational health and safety risks are described in Section 18 – Health and Safety.

Consistent with AS/NZS ISO 31000:2009, the approach to risk assessment involved:

1 Establishment of context;

2 Risk identification;

3 Risk analysis;

4 Risk evaluation;

5 Risk treatment;

6 Monitoring and review; and

7 Communication and consultation.

This section describes the work that was undertaken to establish the context of risks, and the process for risk identification, analysis, evaluation and treatment. Section 19 – Environmental Management Plan describes the monitoring and review procedures that will adopted in relation to environmental risks. The proponent's risk management system requires that a risk register, containing health, safety and environmental risks, be maintained and be reviewed over the life of the project, including at all stages of the development of the project (construction, operations, decommissioning). Section 5 – Consultation describes communication and consultation for the project.

4.2.2 Establishment of Context

The context of environmental risks is determined by the environmental setting of the project and the project elements.

Environmental Setting

The project setting is described in various technical studies, as outlined in Table 4-1. The environmental setting was carefully considered by the proponent and all specialists working on the project when identifying, analysing and evaluating the project's risks.

Table 4-1 Environmental Setting

FEATURE OF ENVIRONMENT	EIS VOLUME 1 REFERENCE	EIS SPECIALIST REPORT REFERENCE
■ Overview of Setting	Section 3 – Project Description	-
■ Terrestrial Ecology	Section 7 – Terrestrial Ecology	Appendix C – *Terrestrial Ecology Report*
■ Aquatic Ecology	Section 8 – Aquatic Ecology	Appendix D – *Aquatic Ecology Report*
■ Groundwater	Section 9 – Groundwater	Appendix F – *Groundwater Report*
■ Surface Water	Section 10 – Surface Water	Appendix H – *Baseline Surface Water Monitoring Report*
■ Social environment, including:		
– Air Quality	Section 12 – Air Quality	Appendix I – *Air Quality Report*
– Acoustic (Noise) Environment	Section 13 – Noise and Vibration	Appendix J – *Noise and Vibration Report*
– Visual Amenity	Section 14 – Visual Amenity	-
– Socio-economics	Section 15 – Socio-economics	Appendix K – *Socio-economics Report*
– Cultural Heritage	Section 16 – Archaeology	Appendix L – *Archaeology Report*

Project Elements

The project is a proposed open cut mine located within the Eastern Leases, east of the existing mine. It involves developing a number of quarries to extract ore, the handling and storing overburden, constructing haul roads and minor infrastructure, and transporting ore to the existing mine.

In order to appropriately plan and design the project, an unconstrained version of the project was initially assessed. This unconstrained version of the project assumed extraction of all of the ore within the Eastern Leases, with mining undertaken in an economically efficient manner, unconstrained by environmental issues. This unconstrained version of the project formed the basis of an initial assessment of unmitigated environmental risks. Assessing the risks associated with the unconstrained project, in the absence of mitigation measures, allowed significant risks to be identified early in the project planning process. The project design could then be modified to eliminate risks where possible, or to reduce risks to acceptable levels. The unconstrained project design involves the following activities, which would allow for maximum extraction of ore:

- Diversion of watercourses to allow mining of the full resource beneath the watercourses;
- Leaving remnant final voids as part of the final landform at the end of the mine life;
- The permanent emplacement of overburden in landforms which are elevated well above the natural pre-mining surface levels;
- Routine discharge of mine-affected water into watercourses; and
- Designing the mine to avoid double-handling of material (overburden, topsoil). Although this is economically and logistically efficient, it results in the project disturbance footprint expanding beyond the minimum area required to be disturbed.

Once the environmental and social risks associated with the unconstrained project were understood, an integrated, multi-disciplinary approach was adopted to ensure that the project design eliminated or limited risks as far as possible. The design process was guided by the risk assessment, and included input from various specialist areas, such as water management and mine planning. This process was facilitated by the proponent through a number of multi-criteria/risk assessment workshops. The project description provided in Section 3 – Project Description is the result of this process, and the project description therefore incorporates the design elements intended to reduce environmental risks. These design elements include:

- A project design that avoids mining of watercourses;
- A mine plan that addresses the requirements for long term closure planning and eliminates the need for final voids and elevated overburden emplacements in the post-mining landform;
- A project design which allows for storage and reuse of mine-affected water; and
- Mine planning and scheduling which places a priority on minimising the project disturbance footprint as far as possible.

The risk assessment presented in this section provides an assessment of risks associated with the unconstrained project (as described above), as well as risks associated with the preferred project design (as per Section 3 – Project Description). Presenting the risks in this way allows the reader to understand the effect of the mitigation measures that have been incorporated into project design.

4.2.3 Risk Identification, Analysis and Evaluation

Environmental risk assessment was undertaken through a series of workshops and review sessions at various stages during project design and EIS development. The principles in AS/NZS ISO 31000:2009, as well as the proponent's internal risk assessment documentation, guided the risk assessment.

Individual risks were identified through:

- Considering proposed project elements in relation to the project setting;
- Making use of the proponent's knowledge and experience from the operation of the existing mine, as well as the experience of the EIS study team with other similar projects;
- Feedback from stakeholder consultation (as described in Section 5 – Consultation); and
- Consideration of the preliminary risks identified in the EIS Terms of Reference (TOR) prepared by the NT Environment Protection Authority (NT EPA).

Risks were systematically identified taking into consideration the full range of project activities in relation to individual aspects of the existing environment. The following aspects of the environment were considered as part of the risk assessment:

- Groundwater;
- Surface water;
- Ecology (including biodiversity issues relating to air quality and noise); and
- Social (including social issues relating to air quality, noise, visual amenity, socio-economics and cultural heritage).

It should be noted that the risk assessment did not include activities undertaken at the existing mine, given that these activities are undertaken in accordance with existing approvals and procedures (subject to their own risk assessment processes) and in accordance with existing environmental management procedures. The project will not give rise to any changes to these activities.

Once all risks had been identified, the consequence and likelihood of each individual risk was then analysed using the proponent's risk assessment matrix. Table 4-2 and Table 4-3 present the ratings for consequence and likelihood, respectively.

Table 4-2 Ratings for the Assessment of Consequence Levels

CONSEQUENCE LEVEL	ENVIRONMENT	COMMUNITY
1	Low level impact/s to land, biodiversity, ecosystem services, water resources or air	Low-level social impacts. Low-level infringement of cultural heritage or minimal disturbance to heritage structures. Minimal impact on human rights.
2	Minor impact/s to land, biodiversity, ecosystem services, water resources or air	Minor medium-term social impacts on small number of people. Repairable damage or disturbance to property, structures or items. Minor infringement of cultural heritage. Minor, temporary human rights impacts.
3	Moderate impact/s land, biodiversity, ecosystem services, water resources or air	Moderate medium-term social impacts or frequent social issues. Moderate damage to structures/items of local cultural heritage significance/sacred locations. Moderate, temporary human rights impacts.
4	Significant impact/s (>20 years) land, biodiversity, ecosystem services, water resources or air	A breakdown of social order. Widespread damage to items of global cultural significance. Highly offensive infringements of cultural heritage. Company directly responsible or complicit in severe, long-term impacts on human rights.

CONSEQUENCE LEVEL	ENVIRONMENT	COMMUNITY
5	Permanent, severe impact/s to land, biodiversity, ecosystem services, water resources or air	Complete breakdown of social order. Widespread desecration of items of global cultural significance. Company directly responsible or complicit in severe and widespread long-term impacts on human rights.

Table 4-3 Ratings for the Assessment of Likelihood

LIKELIHOOD	ENVIRONMENT
Almost Certain	Could be incurred more than once in a year
Likely	Could be incurred over a 1-2 year timeframe
Possible	Could be incurred within a 5 year timeframe
Unlikely	Could be incurred in a 5-20 year timeframe
Rare	Less than once in 20 years

The overall risk category was determined by making use of a risk matrix provided in Table 4-4 which considers both consequence and probability.

Table 4-4 Risk Assessment Matrix

LIKELIHOOD	CONSEQUENCE				
	Level 1 Low level impact	**Level 2** Minor impact	**Level 3** Moderate impact	**Level 4** Significant impact	**Level 5** Severe impact
Almost Certain	**High (11)**	**High (16)**	**Extreme (20)**	**Extreme (23)**	**Extreme (25)**
Likely	**Moderate (7)**	**High (12)**	**High (17)**	**Extreme (21)**	**Extreme (24)**
Possible	**Low (4)**	**Moderate (8)**	**High (13)**	**Extreme (18)**	**Extreme (22)**
Unlikely	**Low (2)**	**Low (5)**	**Moderate (9)**	**High (14)**	**Extreme (19)**
Rare	**Low (1)**	**Low (3)**	**Moderate (6)**	**High (10)**	**High (15)**

Section 4.3 presents the results of the risk assessment.

The risk assessment approach is not designed to identify and evaluate positive impacts associated with the project. It is, nevertheless, important to consider these impacts to ensure that benefits are maximised and in order to obtain a full understanding of the project. Positive impacts are therefore listed in Section 4.3, but risk ratings are not assigned to positive impacts.

4.2.4 Risk Treatment

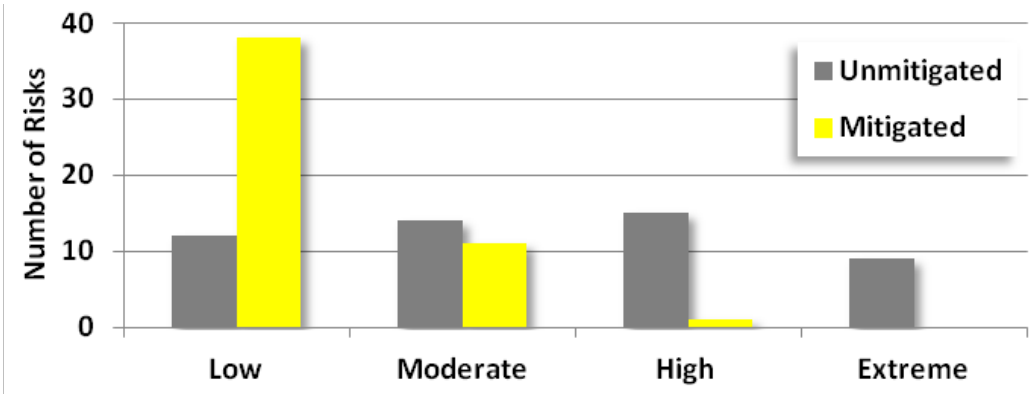
As noted in Section 4.2.2, the project design reflects a number of measures that have been taken to eliminate project risks where possible, or reduce risks. In addition to project design elements which will reduce the environmental risks associated with the project, various mitigation measures will be applied to the operation of the project (e.g. dust suppression watering, environmental awareness training for the workforce). These mitigation measures are described in Section 19 – Environmental Management Plan.

4.3 ENVIRONMENTAL RISK ASSESSMENT

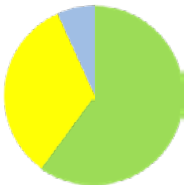
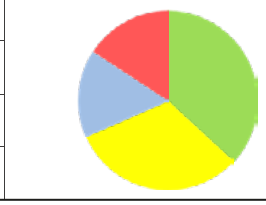
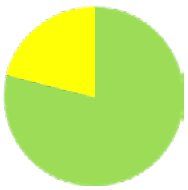
Table 4-5 presents the environmental risk assessment undertaken for the project. It includes a description of environmental and social risks associated with various project activities. The consequence and likelihood of each risk is provided in accordance with the rating system provided in Table 4-2 and Table 4-3 respectively, and an overall risk rating is provided in accordance with the matrix presented in Table 4-4. Risk ratings are provided for the activity both with and without mitigation, allowing the reader to understand the effect of the mitigation measures. Table 4-5 describes the mitigation measures that will be applied to the project. It also provides an assessment of the degree of certainty in relation to the mitigation measures being effective in reducing the risk rating.

A total of 50 risks were identified for the project, in addition to a number of positive impacts. Graph 4-1 shows the total number of risks and the risk ratings, both prior to the application of mitigation measures and taking into account mitigation measures. Graph 4-2 provides risk ratings for the various environmental aspects.

Graph 4-1 Total Risk Ratings Before and After Mitigation



Graph 4-2 Risk Ratings for Environmental Aspects

ENVIRONMENTAL ASPECT	UNMITIGATED RISK			MITIGATED RISK		
GROUNDWATER	Low	1		Low	4	
	Moderate	1		Moderate	-	
	High	1		High	-	
	Extreme	1		Extreme	-	
SURFACE WATER	Low	1		Low	10	
	Moderate	3		Moderate	2	
	High	6		High	-	
	Extreme	2		Extreme	-	
ECOLOGY	Low	3		Low	9	
	Moderate	4		Moderate	5	
	High	5		High	1	
	Extreme	3		Extreme	-	
SOCIAL	Low	7		Low	15	
	Moderate	6		Moderate	4	
	High	3		High	-	
	Extreme	3		Extreme	-	
Risk Ratings:	Low		Moderate	High		Extreme

As demonstrated in Graphs 4-1 and 4-2, risks were significantly reduced through the application of mitigation measures, primarily the adoption of a project design intended to eliminate or significantly reduce risks. Following mitigation, the majority of risks (38) are rated as being low risk, with 11 moderate risks and one high risk. No extreme risks are predicted following the application of mitigation measures.

The only risk which remains high, even after mitigation, is the potential for the transport of materials and personnel required for the project to exacerbate the risk of Cane Toads being introduced to Groote Eylandt. This risk is a function of the project's location on Groote Eylandt. The consequence of this risk is considered to be extreme, meaning that even though the likelihood is very low (rated as Rare), the resultant risk for flora and fauna remains high. A number of actions are already in place to prevent the introduction of the Cane Toad to Groote Eylandt. The proponent has a Cane Toad Management Plan and an associated quarantine procedure. This plan details monitoring, reporting and disposal procedures in the event of a Cane Toad being found. The Anindilyakwa Land Council (ALC) also has a number of measures in place to prevent the introduction of the Cane Toad. As an additional mitigation measure to be implemented for the project, the proponent will introduce formal quarantine audits, undertaken by trained and experienced quarantine officers. The annual audits of quarantine procedures would confirm the adequacy of the quarantine measures and make recommendations for continual improvement.

Table 4-5 Environmental Risk Assessment

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
GROUNDWATER											
1	■ Construction of quarries, and ongoing pit dewatering.	■ Drawdown of aquifers, giving rise to impacts on: – Groundwater users (bores at outstations); – Vegetation dependent on shallow groundwater; and – Watercourses via reduction in groundwater contributions to flows in watercourses.	■ Project involves mining of watercourses (and shallow aquifer associated with them). ■ Mine plan will involve final voids that remain beyond mine life.	**3**	**AC**	**E**	■ No mining of watercourses or watercourse buffers. ■ Mine design which avoids final voids, allowing for a full recovery of groundwater levels, similar to pre-mining groundwater levels. ■ Groundwater modelling, informed by a groundwater monitoring program, to understand impacts (modelling shows very limited potential impacts). ■ Ongoing monitoring of drawdown extents (to confirm consistency with EIS predictions).	**2**	**U**	**L**	*High Certainty:* ■ Elimination of final voids in mine plan is the key mitigation. Groundwater modelling is informed by recent monitoring data and a thorough understanding of the site hydrogeology.
2	■ Construction of quarries.	■ Deterioration of water quality over time in the final voids.	■ Mine plan will involve final voids that remain beyond mine life.	**3**	**P**	**H**	■ Mine design which avoids final voids, allowing for a full recovery of groundwater levels, similar to pre-mining groundwater levels.	*Risk eliminated through mine design which avoids final voids*			*High Certainty:* ■ Elimination of final voids in mine plan is the key mitigation.
3	■ Storage and handling of overburden.	■ Potentially acid forming (PAF) material in overburden giving rise to acidic runoff, with resultant impacts on groundwater or surface water quality.	■ No special handling techniques for overburden. ■ No experience of PAF material at existing mine. Geology weathered lateritic deposit) has a low risk for the presence of PAF material.	**3**	**U**	**M**	■ Geochemical study undertaken ahead of mining (as part of this EIS) to identify any PAF material. Determined that project overburden has significant excess buffering capacity and is considered to be non-acid forming. ■ Selective handling of the small, isolated quantity of PAF material that was located during the study. ■ Ongoing monitoring of the geochemistry of the overburden material.	**3**	**R**	**M**	*High Certainty:* ■ Based on 50 years experience at existing mine, known geological setting and geochemical testing carried out at the project site.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
4	■ Transport, use, storage of hazardous materials (e.g. diesel).	■ Spills from transport, storage or use of hazardous materials giving rise to impacts on groundwater quality.	■ Small volumes of diesel to be transported, used or stored. ■ Transport, use and storage of hazardous materials as per standard procedures outlined in relevant Australian standards (and in use at existing GEMCO mine).	2	U	L	■ Ongoing groundwater and surface water monitoring programs to identify any groundwater contamination issues. ■ Transport, use and storage of hazardous materials will be as per standard procedures outlined in relevant Australian Standards.	2	U	L	*High Certainty:* ■ The key factor reducing the severity of the risk is the small quantity of hazardous materials to be used. Proposed procedures for transport, use and storage of material are industry standard, and in use at existing mine.
SURFACE WATER											
5	■ Construction and use of haul road watercourse crossings.	■ Ongoing sedimentation and associated impacts on water quality (impact on values in relation to aquatic biology, drinking water and aesthetics).	■ No specific scour and sedimentation controls.	3	L	H	■ Watercourse crossings with engineered culverts, with inlet and outlet scour protection. ■ Culverts have been sized based on a detailed hydrology study (as part of this EIS) to inform appropriate sizing of culverts to mitigate significant impacts on erosion and sediment impacts. ■ Appropriate engineering design of culverts, and design undertaken by suitably qualified and experienced engineer. ■ Erosion and sediment control measures implemented during construction and operation. ■ Proponent has committed to installing stream gauging on the Emerald River at the proposed haul road crossing.	3	U	M	*High Certainty:* ■ Culvert design and construction will be as per standard engineering practice.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
6	■ Vegetation clearing as part of the construction and operation of the mine.	■ Erosion and sedimentation issues and associated impacts on surface water quality (impacts on values in relation to aquatic biology, drinking water and aesthetics).	■ Mining activities (and associated vegetation clearing) undertaken within and in close proximity to watercourses. ■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint.	2	AC	H	■ Key objective in mine design is to limit the project disturbance footprint, with only one third of the project site subject to clearing. ■ No mining (and associated vegetation clearing) within watercourse buffer areas. ■ Clearing activities undertaken in accordance with a Permit to Clear process in order to manage clearing activities and limit clearing to the smallest practicable area for safe work. ■ Clearing undertaken in accordance with an Erosion and Sediment Control Plan, which will describe erosion and sediment controls and monitoring requirements. ■ Construction of appropriate drainage and sediment control measures to manage runoff and treat sediment-laden waters. ■ Ongoing monitoring quality.	3	R	M	*High Certainty:* ■ Mine design which avoids mining of watercourses is key mitigation measure.
7	■ Storage and handling of overburden.	■ Erosion and sedimentation of overburden emplacements, and associated impacts on surface water quality (impacts on values in relation to aquatic biology, drinking water and aesthetics).	■ Mining activities (and associated vegetation clearing) undertaken within and in close proximity to watercourses. ■ Mine plan will involve elevated overburden emplacements that remain beyond mine life. ■ No specific erosion controls.	3	L	H	■ No mining within watercourse buffer. ■ Progressive rehabilitation. ■ Mine design ensures no elevated overburden emplacements as part of the post-mining landform, significantly reducing the potential for erosion. ■ Implementation of an Erosion and Sediment Control Plan, including capturing runoff from overburden emplacements in collection drains and directing it through sediment traps and sediment dams to control suspended sediment prior to discharge from sites.	2	U	L	*High Certainty:* ■ The key mitigation measures are a mine design which avoids elevated overburden emplacements, and avoids mining of watercourses.
8	■ Watercourse diversion to enable the full ore body to be mined.	■ Erosion and sedimentation, and associated impacts on surface water quality (impacts on values in relation to aquatic biology, drinking water and aesthetics).	■ Construction of watercourse diversions to enable extraction of full resource (including resource beneath watercourses).	3	L	H	■ Forego mining of ore beneath watercourses, avoiding the need for diversions.	*Risk eliminated through mine design, which eliminates the need for diversions.*			*High Certainty:* ■ Diversions do not form part of the project design.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
9	■ Watercourse diversion to enable the full ore body to be mined.	■ Geomorphological changes to watercourses and alteration of flood regime (e.g. secondary channels forming, instability of banks and floodplain, altered bed characteristics, changes in the flood envelope). Geomorphological changes to watercourses giving rise to impacts on aquatic biology and cultural heritage (watercourses have high value in Anindilyakwa culture).	■ Construction of watercourse diversions to enable extraction of full resource (including resource beneath watercourses).	**4**	**P**	**E**	■ Forego mining of ore beneath watercourses, avoiding the need for diversions.	*Risk eliminated through mine design, which eliminates the need for diversions.*			*High Certainty:* ■ Diversions do not form part of the project design.
10	■ Construction of quarries, and ongoing pit dewatering.	■ Impacts on surface water flows due to groundwater drawdown.	■ Project involves mining of watercourses (and shallow aquifer associated with them). ■ Mine plan will involve final voids that remain beyond mine life.	**3**	**AC**	**E**	■ No mining of watercourses or watercourse buffers. ■ Mine design which avoids final voids, allowing for a full recovery of groundwater levels, similar to pre-mining groundwater levels. ■ Groundwater modelling, informed by a groundwater monitoring program, to understand impacts (modelling shows very limited potential impacts). ■ Ongoing monitoring to drawdown extents are as per EIS predictions.	**2**	**U**	**L**	High Certainty: ■ Elimination of final voids in mine plan is the key mitigation. Groundwater modelling is informed by recent monitoring data and a thorough understanding of the site hydrogeology.
11	■ Storage and handling of overburden.	■ Potentially acid forming (PAF) material in overburden giving rise to acidic runoff, with resultant impacts on surface water quality.	■ No special handling techniques for overburden. ■ No experience of PAF material at existing mine. Geology (weathered lateritic deposit) has a low risk for the presence of PAF material.	**3**	**U**	**M**	■ Geochemical study undertaken ahead of mining (as part of this EIS) to identify any PAF material. Determined that project overburden has significant excess buffering capacity and is considered to be non-acid forming. ■ Selective handling of small quantity of PAF material that was located during the study. ■ Ongoing monitoring of the geochemistry of the overburden material.	**3**	**R**	**M**	*High Certainty:* ■ Based on 50 years experience at existing mine, and geochemical testing.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
12	■ Storage and handling of overburden.	■ Turbid site runoff from areas of exposed dispersive clay materials impacting downstream water quality.	■ No special handling techniques for overburden, and no testing for presence of dispersive clays within overburden materials.	2	P	M	■ Geochemical study undertaken ahead of mining (as part of this EIS) to identify and analyse any fine clays. It determined that smectite and kaolinite clays are present only sporadically and that they are non-dispersive and are therefore not predicted to give rise to surface water impacts. ■ Selective handling of any dispersive materials that are encountered. ■ Design of mine water management system to avoid routine discharges of quarry water.	2	R	L	*Moderate Certainty:* ■ Based on geochemical testing.
13	■ Excavation of pits and storage of overburden.	■ Permanent reduction in contributing catchment areas and catchment yields, with resultant impacts on surface water flows (impacting surface water users and aquatic and terrestrial ecology).	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint and limit reduction in contributing catchment areas. ■ Mine plan will involve final voids and elevated overburden emplacements that remain beyond mine life.	2	AC	H	■ Key objective in mine design is to limit the project disturbance footprint, with only one third of project site subject to clearing. Site drainage management involves diverting drainage of undisturbed areas around active mining areas and discharge of drainage from active areas following control of suspended sediment. This will reduce the loss of catchment yields during the operation of the mine. ■ Absence of final voids and elevated overburden emplacements in the post-mining landform means that the project will not give rise to any reduction in contributing catchment areas and downstream catchment yields post-mining.	2	U	L	*High Certainty:* ■ Mine design which limits disturbance footprint and avoids final voids is the key mitigation measure.
14	■ Mine water management.	■ Discharge of mine affected water, resulting in impacts on surface water quality (impacts on values in relation to aquatic biology, drinking water and aesthetics, as well as recreational value at locations such as Leske Pools).	■ Limited water storages.	1	AC	H	■ Design of water management system with sufficient capacity to avoid routine discharge of quarry water. ■ Design based on water balance modelling, which models 124 years of climate data. ■ Discharge conditions, as a contingency measure, based on ANZECC guidelines for pristine systems and designed to ensure no detectable change in the ecosystem beyond natural variability. Conditions have been developed based on monthly water quality monitoring.	2	U	L	*High Certainty:* ■ Water balance modelling included 124 years of climatic scenarios. Contingency conditions are based on ANZECC Guidelines and have been developed based on surface water monitoring data.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
15	■ Transport of ore.	■ Spills of ore into watercourses.	■ Haul roads designed without sediment traps.	**2**	**P**	**M**	■ Speed limits for haul trucks reduced to 30km/hr. ■ Routine maintenance of vehicles. ■ Procedures and driver training in relation to road safety. ■ Design of haul roads includes sediment traps.	**2**	**U**	**L**	*High Certainty*
16	■ Transport, use, storage of hazardous materials.	■ Spills from transport, storage or use of hazardous materials giving rise to impacts on surface water quality.	■ Small volumes of materials to be transported, used or stored. ■ Transport, use and storage of hazardous materials as per standard procedures outlined in relevant Australian standards (and in use at the existing mine).	**2**	**U**	**L**	■ Transport, use and storage of hazardous materials will be as per standard procedures outlined in relevant Australian Standards. ■ Ongoing surface water monitoring programs to identify any contamination issues.	**2**	**U**	**L**	*High Certainty:* ■ The key factor reducing the severity of the risk is the small quantity of hazardous materials to be used. Proposed procedures for transport, use and storage of material are industry standard, and in use at existing mine.
ECOLOGY											
17	■ Construction and use of haul road watercourse crossings.	■ Ongoing sedimentation and associated water quality issues, with resultant impacts on aquatic biology and associated potential requirement for dredging.	■ No specific scour and sedimentation controls.	**3**	**L**	**H**	■ Watercourse crossings with engineered culverts, with inlet and outlet scour protection. ■ Culverts have been sized based on a detailed hydrology study (as part of this EIS) to inform appropriate sizing of culverts to mitigate significant impacts on erosion and sediment impacts. ■ Appropriate engineering design of culverts, and design undertaken by suitably qualified and experienced engineer. ■ Erosion and sediment control measures implemented during construction and operation. ■ Proponent has committed to installing a stream gauging on the Emerald River at the proposed haul road crossing.	**3**	**U**	**M**	*High Certainty:* ■ Design and construction of culverts will be undertaken using standard engineering techniques.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
18	■ Construction and use of haul road watercourse crossings.	■ Restrict or prevent movement of fish and other fauna.	■ Watercourse crossings constructed as causeways.	3	L	H	■ Watercourse crossings constructed as culverts, rather than causeways, and designed to not restrict fish passage. ■ Crossings have been sited within ephemeral reaches of watercourses, rather than perennial reaches.	2	U	L	*High Certainty:* ■ Design and construction of culverts will be undertaken using standard engineering techniques.
19	■ Vegetation clearing as part of the construction and operation of the mine.	■ Clearing of vegetation within the project site, leading to a loss of habitat for the threatened Northern Quoll, Masked Owl (northern), Yellow-spotted Monitor and Mertens' Water Monitor, leading to a significant, residual impact on these species.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ Mine plan will involve final voids and elevated overburden emplacements that remain beyond mine life (limiting the potential for successful rehabilitation).	4	AC	E	■ Key objective in mine design is to limit the project disturbance footprint, with only one third of project site subject to clearing. ■ Clearing activities undertaken in accordance with a Permit to Clear process in order to control clearing activities and limit clearing to the smallest practicable area for safe work. ■ No final voids or elevated overburden emplacements, allowing the full extent of the project site to be rehabilitated and made available as habitat post-mining. ■ Progressive rehabilitation with native species, monitoring of rehabilitation to confirm recolonisation by threatened species.	3	U	M	*High Certainty:* ■ Design of mine to limit disturbance footprint is a key mitigation measure. ■ Rehabilitation methods are as per the methods used at the existing mine, where rehabilitation has been shown to provide habitat for several threatened species.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
20	■ Vegetation clearing as part of the construction and operation of the mine.	■ Clearing of vegetation within the project site, leading to a loss of habitat for the threatened Brush-tailed Rabbit-rat and Northern Hopping-mouse, leading to a significant, residual impact on these species.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ Mine plan will involve final voids and elevated overburden emplacements that remain beyond mine life (limiting the potential for successful rehabilitation).	**4**	**AC**	**E**	■ Key objective in mine design is to limit the project disturbance footprint, with only one third of project site subject to clearing. ■ Clearing activities undertaken in accordance with a Permit to Clear process in order to control clearing activities and limit clearing to the smallest practicable area for safe work. ■ No final voids or elevated overburden emplacements, allowing the full extent of the project site to be rehabilitated and available as habitat post-mining. ■ Progressive rehabilitation with native species, monitoring of rehabilitation to confirm presence of threatened species. ■ Biodiversity offsets will be provided specifically for the purpose of ensuring that the project does not give rise to significant, residual impacts on these species.	**3**	**U**	**M**	*Moderate Certainty* ■ Design of mine to limit disturbance footprint is a key mitigation measure. ■ There will be a monitoring and reporting function as part of the implementation of biodiversity offsets to confirm their effectiveness.
21	■ Vegetation clearing as part of the construction and operation of the mine.	■ Reduction in diversity of flora and fauna species, including migratory species.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ Mine plan will involve final voids and elevated overburden emplacements that remain beyond mine life (limiting the potential for successful rehabilitation).	**3**	**L**	**H**	■ Key objective in mine design is to limit the project disturbance footprint, with only one third of project site subject to clearing. ■ Clearing activities undertaken in accordance with a Permit to Clear process in order to control clearing activities and limit clearing to the smallest practicable area for safe work. ■ No final voids or elevated overburden emplacements, allowing the full extent of the project site to be rehabilitated and available as habitat post-mining. ■ Progressive rehabilitation with native species. ■ Weed and feral animal control.	**2**	**P**	**M**	*High Certainty:* ■ Design of mine to limit disturbance footprint is a key mitigation measure, as is progressive rehabilitation. The proponent has extensive experience with rehabilitation and monitoring has shown it to be successful in establishing woodland vegetation, similar to the pre-mining vegetation.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
22	■ Vegetation clearing as part of the construction and operation of the mine.	■ Loss of connectivity within the landscape due to loss of riparian vegetation.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ Project involves mining of watercourses.	3	L	H	■ No mining of watercourses or watercourse buffers, and mine design involves very limited clearing of riparian vegetation.	1	L	M	*High Certainty:* ■ Design of mine to avoid mining of watercourses is the key mitigation measure.
23	■ Vegetation clearing, and ongoing earthmoving activities within the project site.	■ Introduction of weeds, leading to impacts on threatened species.	■ No specific weed controls.	2	P	M	■ Implementation of a weed management program.	2	U	L	*High Certainty:* ■ There are only limited weeds present on Groote Eylandt. The weed management program will be consistent with existing procedures at the GEMCO mine.
24	■ Vegetation clearing, and ongoing earthmoving activities within the project site.	■ Introduction of weeds, leading to impacts on biodiversity values.	■ No specific weed controls.	2	P	M	■ Implementation of a weed management program.	2	U	L	*High Certainty:* ■ There are only limited weeds present on Groote Eylandt. The weed management program will be consistent with existing procedures at the GEMCO mine.
25	■ Transport of materials and personnel to Groote Eylandt, as part of the development and operation of the project.	■ Introduction of Cane Toad, impacting overall biodiversity value of project site and threatened species.	■ Existing Cane Toad quarantine and controls.	5	R	H	■ The project requires very limited material and personnel movements, and does not necessitate additional freight movements (although it will extend the period of freight movement associated with the existing mine by four years). ■ Existing Cane Toad quarantine measures will be applied. In addition to this, an annual audit of quarantine procedures is proposed to confirm their adequacy and make recommendations for continual improvement.	5	R	H	*Moderate Certainty:* ■ The very limited material and personnel movements associated with the project are the key mitigation measure. Nevertheless, other parts of Australia have been unsuccessful in preventing the introduction of this invasive species.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
26	■ Vegetation clearing, and construction of haul roads and tracks.	■ Increase in feral animal numbers (e.g. cats) within the project site.	■ No specific controls for feral animals.	**2**	**P**	**M**	■ Feral animal control program to be implemented for project site, including feral cat control. ■ The proponent will continue current restrictions on cat ownership amongst its employees on Groote Eylandt.	**2**	**U**	**L**	*Moderate Certainty:* ■ Feral cat control has proved difficult elsewhere in Australia.
27	■ Vehicle movements associated with project.	■ Vehicle strike resulting in loss of fauna species.	-	**1**	**L**	**M**	■ Speed limits for haul trucks reduced to 30km/hr. ■ Procedures and driver training in relation to road safety.	**1**	**P**	**L**	*Moderate Certainty*
28	■ Construction and operation of the mine, including use of earthmoving equipment and blasting.	■ Noise from project activities reducing quality of habitat for fauna.	-	**1**	**P**	**L**	■ Noise emissions are likely to be localised, close to operational quarries and haul roads. ■ Noise impacts will diminish within rehabilitated areas and return to pre-mining levels following cessation of mining.	**1**	**P**	**L**	*High Certainty*
29	■ Construction and operation of the mine, including use of earthmoving equipment and blasting.	■ Dust from project activities reducing quality of habitat for fauna.	■ No specific dust control measures.	**1**	**P**	**L**	■ Dust suppression watering of haul roads and active mining areas. ■ Survey of dust effects from the existing mine on vegetation was undertaken as part of this EIS. It did not identify any impacts on vegetation.	**1**	**U**	**L**	*High Certainty*
30	■ Artificial light, predominantly from operation of quarries at night.	■ Artificial light reducing quality of habitat for fauna.	-	**1**	**U**	**L**	■ Night lighting will be restricted to active working areas, and there will be no lighting following mine closure.	**1**	**U**	**L**	*High Certainty*

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
31	■ Construction of quarries, and ongoing pit dewatering.	■ Drawdown of aquifers giving rise to impacts on vegetation dependent on groundwater.	■ Project involves mining of watercourses (and shallow aquifer associated with them). ■ Mine plan will involve final voids that remain beyond mine life.	3	AC	E	■ No mining of watercourses or watercourse buffers. ■ Mine design which avoids final voids, allowing for a full recovery of groundwater levels, similar to pre-mining groundwater levels. ■ Groundwater modelling, informed by a groundwater monitoring program, to understand impacts (modelling shows very limited potential impacts). ■ Ongoing monitoring of drawdown extents(to confirm consistency with EIS predictions).	2	U	L	*High Certainty:* ■ Elimination of final voids in mine plan is the key mitigation. Groundwater modelling is informed by recent monitoring data and a thorough understanding of the site hydrogeology.
SOCIAL											
32	■ Vehicle movements associated with project.	■ Impacts on public safety due to haul road crossing the Emerald River Road.	■ Intersection constructed as a level crossing, controlled by boom gates.	2	P	M	■ Haul road will be constructed as an overpass so that there is no interaction between mine vehicles and Emerald River Road.	2	R	L	*High Certainty:* ■ Construction of an overpass is the key mitigation measure.
33	■ Construction and operation of the mine.	■ Access track to Dalumba Bay permanently closed, given its location within the proposed mining area.	■ No reinstatement of track to Dalumba Bay.	3	AC	E	■ Access track to Dalumba Bay will be realigned, ensuring no loss of access.	*Risk eliminated due to realignment of access track*			*High Certainty:* ■ Realignment of the access track is the key mitigation measure.
34	■ Transport of materials and personnel for the project along the Rowell Highway (a public access road, owned by the proponent).	■ Road safety issues due to increase in vehicle movements.	-	2	R	L	■ The project requires very limited goods and personnel movement (construction deemed to be the main period where there will be transport of materials - modelled as being a low level of traffic density). ■ Routine maintenance of vehicles. ■ Procedures and driver training in relation to road safety. ■ Vehicles transporting over dimensional loads will be escorted. ■ There will be routine alerts and communications with the ALC in relation to the transport of heavy loads.	2	R	L	*High Certainty:* ■ Existing procedures, shown to be successful at the existing GEMCO mine, will be used.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
35	■ Blasting associated with open cut mining.	■ Flyrock from blasting causing safety issues for the community/road users.	■ No controls on blasting.	2	U	L	■ The project is located in a remote area, with no nearby residences. ■ Blasts will be designed to minimise the potential for flyrock. ■ There will be controls on access to areas that are located in close proximity to mining activities. ■ Blasting procedures will be adopted, which will involve notifying the ALC of proposed blasting. At the time of blasting there will be road closures, signage and sentries placed along roads (e.g. the access track to Dalumba Bay).	2	R	L	*High Certainty:* ■ Existing procedures, shown to be successful at the existing GEMCO mine, will be used.
36	■ Blasting associated with open cut mining.	■ Damage to structures (e.g. outstations) or impacts on residential amenity at sensitive receptors (e.g. outstations, recreation areas).	■ No controls on blasting.	2	R	L	■ The project is located in a remote area, with no nearby residences. ■ Blast modelling has been undertaken and no impacts on sensitive receptors are predicted.	2	R	L	*High Certainty:* ■ The significant distance between proposed open cut mining areas and sensitive receptors is the key mitigation measure.
37	■ Construction of quarries, overburden emplacements and construction of infrastructure.	■ Impacts on the visual amenity at sensitive receptors.	■ Mine plan will involve elevated overburden emplacements that remain beyond mine life.	1	P	L	■ Mine design ensures that there are no elevated overburden emplacements as part of the post-mining landform. Absence of elevated landform and revegetation of mined areas results in a very low visual effect post-mining. ■ Very limited night lighting associated with the project. ■ Screening from existing intervening topography and vegetation between the project site and potential receptors.	1	R	L	*High Certainty:* ■ Screening from existing topography and vegetation, along with a mine plan that does not involve elevated overburden emplacements, is the key mitigation.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
38	■ Construction and operation of the mine, including use of earthmoving equipment and blasting.	■ Noise from the project giving rise to impacts on residential amenity at sensitive receptors (outstations, recreation areas).	-	2	U	L	■ The project is located in a remote area, with no nearby residences. ■ Noise modelling has been undertaken and no exceedances of noise criteria are predicted (with the exception of short term impacts at an infrequently occupied outstation). The proponent will undertake discussions with the ALC to resolve any issues that may arise from noise levels at this outstation.	2	U	L	*High Certainty:* ■ The significant distance between proposed open cut mining areas and sensitive receptors is the key mitigation measure.
39	■ Construction and operation of the mine, including use of earthmoving equipment and blasting.	■ Dust from the project giving rise to impacts on residential amenity at sensitive receptors (outstations, recreation areas).	-	2	U	L	■ The project is located in a remote area, with no nearby residences. ■ Dust modelling has been undertaken and no exceedances of air quality criteria are predicted. ■ Dust suppression watering.	2	U	L	*High Certainty:* ■ The significant distance between proposed open cut mining areas and sensitive receptors is the key mitigation measure.
40	■ Construction and operation of the mine.	■ Loss of Aboriginal rock art sites due to clearing associated with the mine.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint.	5	R	H	■ Comprehensive archaeological survey (as part of this EIS) to identify Aboriginal rock art sites. ■ Design of project, including haul road, avoids areas that are known to contain Aboriginal art.	*Impact eliminated due to mine design*			*High Certainty:* ■ Design of project avoids areas that contain known Aboriginal art (and avoids rocky outcrops that have potential to contain art).
41	■ Construction and operation of the mine.	■ Clearing of Aboriginal sites as part of the development of the mine. This excludes Aboriginal rock art sites, which are addressed in Issue No. 40.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint.	2	P	M	■ Comprehensive archaeological survey (as part of this EIS) to identify Aboriginal rock art sites. ■ Design of project, including haul road, avoids significant archaeological sites. ■ Single site (manuport that is used as a marker) is within the project disturbance footprint. The proponent will consult with the ALC in relation to management (relocation of this site). All necessary approvals under the *Heritage Act* will be obtained.	2	R	L	*High Certainty*

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
42	■ Construction and ongoing operation of the project.	■ Increased access to Aboriginal rock art sites, and resultant damage to site.	■ No access controls implemented.	3	U	M	■ Rock art is located in areas that are remote and difficult to access. ■ The proponent will place access restrictions on the sites, and there will be cultural awareness training as part of the workforce inductions. ■ Implementation of a Cultural Heritage Management Plan, which includes ongoing monitoring of the sites.	3	R	M	*High Certainty* ■ The general inaccessibility of the sites is the key mitigation measure.
43	■ Construction and operation of the mine, including use of earthmoving equipment and blasting.	■ Dust from the project giving rise to impacts on Aboriginal rock art sites.	■ No specific dust control measures.	2	P	M	■ Dust suppression watering, and other controls such as speed limits on vehicles. ■ Set back of at least 400 m between project activities and rock art sites (more than 1 km for most sites). ■ Monitoring of rock art sites, and additional dust control measures on the project site or at the art site, if necessary.	2	R	L	*Moderate Certainty*
44	■ Blasting associated with open cut mining.	■ Damage to rock shelters due to blasting.	■ No controls on blasting.	3	P	H	■ Set back of at least 400 m between project activities and rock art sites (more than 1 km for most sites). ■ Undertaking blasting in accordance with a blast management plan, which will involve determining appropriate ground vibration limits for individual sites. ■ Monitoring of the sites to confirm their integrity.	3	R	M	*Moderate Certainty*

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
45	■ Construction and operation of the mine.	■ Permanent loss of access to land and resources including bush tucker.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ Access to the full extent of the project site (rather than just working areas) is restricted for the duration of the project.	**3**	**AC**	**E**	■ Key objective in mine design is to limit the project disturbance footprint, with only one third of project site subject to clearing. ■ Although access to working areas of the project site will be restricted over the life of the project, Traditional Owners will be permitted continued access to the remainder of the project site to the extent that safe access can be provided. ■ Progressive rehabilitation with native vegetation, ensuring that the loss of access is not a permanent impact. ■ Negotiation of a Mining Agreement under ALRA which provides compensation for loss of resources.	**2**	**U**	**L**	*Moderate Certainty*
46	■ Clearing of land for construction and operation of the project.	■ Loss of access to the project site could exacerbate existing issues in relation to loss of connection to place for the Anindilyakwa people, with associated loss of language and cultural traditions. Any loss of sacred sites would exacerbate this impact. However, economic benefits associated with the project will assist in enabling the Anindilyakwa people to continue to live on Groote Eylandt in a manner consistent with their culture, despite the pressures and influences of modern Australian culture.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ A mine plan which includes mining of watercourses.	**3**	**P**	**H**	■ No mining of watercourses (watercourses are highly significant in Anindilyakwa culture). ■ Progressive rehabilitation with native vegetation to ensure that loss of access to land is temporary. ■ Access to areas of the project site that are not subject to mining will continue to be provided (over the life of the mine). ■ Indirect investment by the proponent in the protection of the Anindilyakwa culture.	**2**	**P**	**M**	*Moderate Certainty*

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
47	■ Clearing of land for the construction and operation of the project.	■ Impacts to spirituality and sacred sites.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ A mine plan which includes mining of watercourses.	4	AC	E	■ No mining of watercourses or watercourse buffers (watercourses are highly significant in Anindilyakwa culture). ■ Sacred sites to be identified prior to the commencement of the project and management of sites agreed with the ALC. Management will be agreed as part of the Mining Agreement under the Commonwealth *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA). Mining cannot commence until a Mining Agreement is in place. ■ Application for an Authority Certificate under the *Northern Territory Aboriginal Sacred Sites Act 1989*.	2	P	M	*Moderate Certainty*
48	■ Construction and operation of the project.	■ Anxiety and uncertainty amongst Traditional Owners in relation to the new mining areas.	-	1	P	L	■ No mining of watercourses or watercourse buffers. ■ Ongoing consultation and communication with Traditional Owners in relation to the project (in accordance with the ALC's communication protocols). ■ EIS feedback consultation.	1	P	L	*Moderate Certainty*
49	■ Construction and operation of mine dams.	■ Standing water in dams causing an increase in biting insects, leading to insect borne diseases amongst the workforce and community.	■ No specific controls for mosquitoes, and no consideration of the issue of mosquito breeding in dam design.	2	P	M	■ Dam design with deep, steep sides to discourage macrophyte growth and mosquito breeding. ■ Waterway crossings designed to not impede flow. ■ Post mining landform will be free draining. ■ The proponent will implement a mosquito management program.	2	R	L	*High Certainty* ■ The proponent has experience with mosquito management, and was successful in eradicating the mosquito that carries Dengue Fever from Groote Eylandt.

NO.	PROJECT ACTIVITY	RISK DESCRIPTION	ASSUMPTIONS RELEVANT TO ASSESSMENT OF UNMITIGATED RISK	C[1]	L[2]	R[3]	MITIGATION	C[1]	L[2]	R[3]	CERTAINTY IN RELATION TO EFFECTIVENESS OF MITIGATION[4]
50	■ Vegetation clearing, and ongoing earthmoving activities within the project site.	■ Migration of dangerous species, particularly crocodiles and snakes into surrounding areas, particularly recreational areas.	■ Project disturbance footprint determined primarily by economic considerations, with no attempt to reduce footprint. ■ A mine plan which includes mining of watercourses.	**2**	**P**	**M**	■ No mining of watercourses or watercourses buffers. ■ Key objective in mine design is to limit the project disturbance footprint, with only one third of project site subject to clearing. ■ Progressive rehabilitation with native vegetation. ■ Continued system of alerts in relation to the presence of crocodiles. ■ General awareness program in place for the workforce in relation to crocodiles.	**2**	**U**	**L**	*Moderate Certainty*
-	■ Employment provided by the project.	■ Continuation of employment opportunities, including Aboriginal employment. Given that this is a positive impact, it has not been assigned a risk rating.									
-	■ Economic investment associated with the project	■ Significant economic investment in the form of operational expenditure to Groote Eylandt and NT. Given that this is a positive impact, it has not been assigned a risk rating.									
-	■ Economic investment associated with the project	■ Significant economic investment for Traditional Owners, in the form of royalties and operational expenditure. Given that this is a positive impact, it has not been assigned a risk rating.									
-	■ Social investment associated with the project	■ Ongoing provision of key infrastructure and services to Groote Eylandt. Given that this is a positive impact, it has not been assigned a risk rating.									

1 ***C: Consequence*** *Refer to Table 4-4 for Consequence levels*

2 ***L: Likelihood*** *AC: Almost Certain; L: Likely; P: Possible; U: Unlikely; R: Rare*

3 ***R: Risk*** *E: Extreme; H: High; M: Moderate; L: Low*

4 *Level of certainty in relation to effectiveness of management/mitigation measures in reducing the risks*