

## ***CHAPTER 5 – Risk assessment***

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This risk assessment describes the process and presents results of an assessment of the risks associated with identified aspects and potential impacts of the Twin Bonanza project. It is designed to identify the potential hazards that affect human health, the socio-cultural environment, and the natural environment. The approach is systematic and congruous with international best practice standard methodologies including:

- AS/NZS ISO 31000:2009: Risk management— Principles and guidelines (Standard)
- HB 203:2006: Environmental risk management — Principles and process (Guide)
- HB 158:2010: Delivering assurance based on ISO 31000:2009 — Risk management – Principles and guidelines (Guide)

A full risk management plan for the mine will be written as a standalone document following the submission of this EIS. Until that time this chapter will serve as a risk management plan for the company. Existing risk management plans for exploration and bulk sampling are already in place.

## 5.1 Environmental management structure

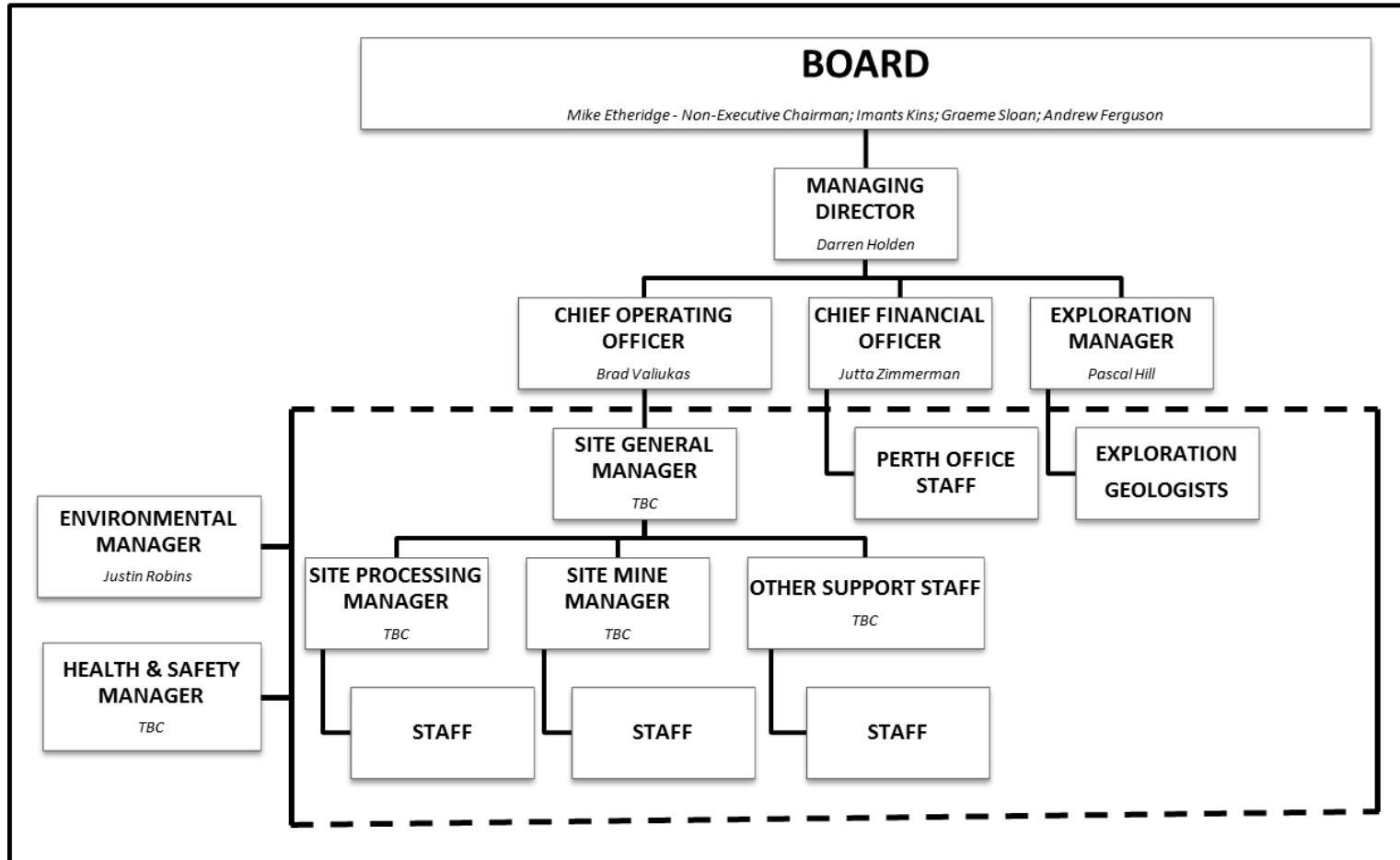


Figure 5-1. ABM management structure.

### **5.1.1 Environmental policy**

ABM Resources NL (ABM) recognises its responsibility to conduct its operations in an environmentally responsible manner. The company is committed to environmentally acceptable and sustainable activities, to be achieved through consultation with the various regulatory bodies, the community and other stakeholders. ABM's environment policy is detailed below.

ABM, its employees and contractors are collectively accountable for preservation of the natural environment and minimisation of any impact their activity may have on the surrounds of the locations in which the Company has a presence.

It is ABM policy that it shall tread lightly when undertaking all of its exploration and mining activities maintaining a constant regard for all others who depend upon the preservation of the surrounding environment and it will maintain an awareness of rehabilitation obligations.

Training, awareness and management materials shall be provided to all relevant staff and contractors.

ABM's corporate environmental and community policy is as follows:

ABM Resources NL acknowledges that it conducts exploration on land owned by Traditional Owners and that ABM's access to this land is guided through process with Central Land Council. ABM is committed to a close working relationship with the Central Land Council, the communities and the Traditional Owners. ABM is committed to offer employment opportunities to people in local communities and the promotion of knowledge, understanding and respect for Indigenous Australians Traditions and Culture.

"ABM is committed to responsible exploration and development, operations and closure. ABM is focused on conducting its business in harmony with stakeholders' and the wider community's desire to conserve and protect the natural environment and community interests.

To deliver on ABM's commitment to stakeholders and the environment, ABM will:

- comply with legislative and regulatory requirements for the environment
- proactively develop and maintain management systems to measure and continually improve environmental performance
- operate in a responsible manner to minimise impacts on the environment and prevent pollution
- care for the environment and its heritage value
- work closely with the community and governing bodies to ensure that a good approach is always followed relating to environmental protection

- encourage employees to value the heritage and the environment in which we work
- reduce waste, recycle and recognise the by-product of our consumables
- maintain an open consultation process with regulators, the community and stakeholders
- minimise workplace exposure to hazards, ecosystem disturbance or degradation
- re-establish disturbed areas as sustainable ecosystems and community assets
- facilitate the training of employees and contractors in relation to their roles and responsibilities to environmental management
- periodically audit ABM's environmental systems and performance to further improve environmental outcomes.

### **5.1.2 Risk management strategy**

ABM has an existing Mining Management Plan (MMP) for the bulk sample at the Old Pirate deposit which is a component of the Twin Bonanza project (stage 1). The risk assessment and management plans associated with the MMP take into account risks and hazards of the trial project which includes but is not limited to the following:

- climatic, environmental and economic conditions which are variable and unpredictable
- risks and hazards to humans and facilities;
- hazards to the environment identified in each relevant chapter, along with mitigation measures where required
- both natural and man-made hazards
- hazardous materials used, transported or stored during the life of the project, as well as the potential for adverse effects on members of the community.

For the expanded project, which is undergoing an EIS assessment, the risk profile of the project is outlined in tables 5-4 to 5-9. Upgrades to existing risk management systems in place for bulk sampling and exploration activities include the:

1. full scope of the intended project
2. specific mining concerns raised by the NTEPA and stakeholders
3. establishment of systems to enable continuous improvement and updates to reflect any changes to the risk profile that may occur over time.

ABM already has a number of comprehensive plans in place for the existing bulk sample trial mine to minimise risk. These include the following:

- a. Mining Management Plan
- b. Water Management Plan
- c. Ground Disturbance Management Plan

- d. Erosion and Sedimentation Control Plan
- e. Hazardous Substances Management Plan
- f. Weed Management Plan
- g. Emergency Response Management Plan

These plans have been updated for the project in order to minimise any potential environmental impacts. In addition, further management plans are in place for:

- biodiversity
- cultural heritage
- social environment
- fire
- noise
- air quality
- biting insects
- closure

### **5.1.3 Reporting**

Records of all applications, subsequent approvals and agreed upon commitments are kept at ABM's Perth head office. During operations regular environmental audits are undertaken with details of compliance with approvals forwarded to the Northern Territory Department of Mines and Energy (DME) as part of the annually submitted MMP.

Consultation with DME is also undertaken under the requirements of the *Mining Management Act 2001*. A MMP is submitted to DME annually which includes proposed activities, calculation and payment of a security against environmental liabilities.

### **5.1.4 Audits**

An inspection of all sites and rehabilitated areas within the Twin Bonanza is carried out regularly by delegated environmental/operational staff as part of on-going operations and rehabilitation. The finding of these audits is used to continually improve environmental performance and ensure regulatory compliance. Additionally;

- 1 All procedures and completed JSA's (Job Safety Analyses') must be filed, catalogued and reviewed quarterly.
- 2 All new hazards must be catalogued with risk rating and controls implemented.
- 3 Outcomes of investigations and hazard analysis must be communicated to onsite personnel via safety presentations, changes to procedures / policies and further training.

### **5.1.5 Environmental incident reporting and non-compliance**

Employees and contractors are required to report all environmental incidents. These include, but are not limited to:

- spills of hydrocarbons, chemicals and any other potentially toxic substance greater than 5 litres
- significant discharge of saline water
- injury to, or deaths of, native fauna caused by activities (including light vehicles)
- wildfires caused by ABM
- the occurrence of declared weeds
- disturbance beyond approved vegetation clearing envelopes.

In addition to reporting any wildlife deaths, personnel are asked to photograph the animal to assist in species identification.

Any significant environmental incidents/accidents or major breaches of undertakings during mining are to be reported to DME as per the *Mining Management Act 2001*.

An incident register is kept and maintained as required under *the Mining Management Act 2001*, all reported incidents for the reporting period applicable to this document shall be noted in successive MMP's.

#### **5.1.5.1 Environmental training and education**

All new employees, contractors and visitors to ABM sites are inducted using an induction checklist. Adherence to company environmental policies and procedures is required and best practice is also emphasised with respect to requirements of both Deeds for Exploration, ILUA's and Mining Agreements administered by the Central Land Council (CLC).

The induction includes the following items:

- ABM's environmental policy and commitments
- relevant legislation and discussion of the consequences of breaching legislative requirements
- significant fauna of the Tanami Region
- flora and vegetation management
- storage and handling requirements for chemicals, fuels and other potentially polluting substances
- waste disposal requirements
- spill management procedures
- environmental incident reporting

Employees and contractors entering areas of environmental significance will be briefed prior to commencing work to outline other specific environmental issues and special requirements. A requirement for operation of vehicles and equipment, including the need to keep to cleared tracks and nominated routes, is included in the induction.

Awareness programs are undertaken as part of the ABM projects, and include all personnel. In addition, daily planning and toolbox meetings are held where specific issues can be raised and information passed on to employees and contractors.

## 5.2 Risk assessment objectives

The objectives of the risk assessment are specifically to:

- identify the hazards and resultant risks from the project and potential threats from aspects to the Project
- rank and prioritise risks through a risk assessment process
- evaluate the risks and identify management measures to mitigate the risks.

Value judgments are involved in determining key assumptions based on existing knowledge of the project and environment as well as determining a level of tolerable risk. During the risk assessment, if levels of uncertainty could not robustly be qualified then the Precautionary Principle was adopted and as such a lack of full scientific certainty was not used as a reason for postponing measures to prevent environmental harm.

The acceptance of residual risk by the traditional owners of the area is an ongoing process through both engagement and the establishment of a Mining Agreement via the CLC. Under the mining agreement there are specific requirements to protect the environment thus limiting risk via leading practice and also financial payments allowing access to the mineral resources. The transfer of monies and managed distribution of funds to the communities provides a mechanism to convert the mineral wealth into social equity in the form of:

- Infrastructure investment.
- equipment supplies and vehicles
- education initiatives
- health initiatives

None the less as the mine develops and the uncertainty diminishes ongoing engagement is required to ensure mine closure meets the local community expectations and the level of residual risk and liability reflects integration back into the proposed end land use.

The tolerable risk approach using the 'As Low As Reasonably Practicable' (ALARP) concept in line with AS/NZS ISO 31000:2009 helps identify and rank potential risks according to the ability of the operation to manage the risk. This method identifies risks that are either:

- intolerable



- risk cannot be justified or managed
- tolerable
  - risk can be managed
  - acceptable
  - risk is minimal and requires little if any intervention or management.

Risk management measures to be implemented aim to reduce significantly the likelihood, and seek to eliminate any potentially extreme or high risks to people and the environment.

A regular review of risk assessment will also be conducted during the operational phase of the Project to ensure that it remains appropriate and to incorporate any project design changes.

### **5.2.1 Hazard and risk management definitions**

Risk is defined as the chance of something happening that will have an impact on objectives. The first step in the risk assessment process was to identify the hazards (defined as anything that will cause harm and can affect meeting of outcomes and objectives). Each hazard was analysed for likelihood and consequence and a risk ranking was developed for the inherent value. Management programs were considered for each hazard and a new likelihood, consequence and risk ranking (now the residual risk) was defined.

Terminology used in this chapter is defined below:

Risk management process	process of identifying hazards, assessing the risks that may result from the hazard, deciding on control measures, monitoring and reviewing the effectiveness of measures
Hazard	potential source of harm/damage to life, health, property and environment
Likelihood	assessment of the probability of occurrence
Consequence	outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.
Risk rating matrix	matrix used to combine consequence and likelihood to a single value of risk

Risk score	single numerical, priority value obtained from the risk rating matrix
Risk	chance of unwanted negative consequences from an injury, damage, near miss or hazard. It is measured in terms of likelihood and consequence.
Hierarchy of control	process of implementing control methods in a formalised manner to ensure that the most disciplined controls are completed first
Residual risk	remaining level of risk after risk treatment measures have been taken
ALARP	“As Low As Reasonably Practicable” a concept that helps identify and rank potential risks according to the ability of the operation to manage the risk
JSA	a Job Safety Analysis is a task oriented documented risk assessment which can be applied by a work team prior to undertaking a potentially hazardous task

## 5.2.2 Potential hazard categories

The risks associated with the project identified by the Northern Territory EPA in the EIS guidelines were:

- change to socio-economic environment
- damage and degradation of cultural heritage values
- fragmentation and degradation of threatened fauna species habitat
- reduction in the quality and quantity of surface and ground water
- liability and negative legacy at closure.

Hazard categories for the project’s construction, operational and decommissioning phases are based upon the failure of control of the environment, people and machinery in potentially hazardous situations. Further assessment by ABM identified a number of site specific hazard categories during construction, operations and decommissioning that can be documented as below:

### 5.2.2.1 Surface and ground water

- Overtopping of tailings dam
- Liberation of sediment from waste dump
- Liberation of leachates from waste dump

- Position of waste dump inhibits surface water flow
- Liberation of sediment from processing area
- Liberation of sediment from airstrip
- Liberation of hydrocarbons and other chemicals from processing plant
- Uncontrolled waste disposal - solid waste & sewerage
- Liberation of waste water from processing plant
- Extraction of groundwater beyond sustainable yields
- Inappropriate storage and disposal of solid waste
- Improper design of roads leading to surface water flows
- Inappropriate flood management leading to inundation

#### **5.2.2.3 Biodiversity (including threatened species)**

- Vegetation clearing beyond approvals
- Reduction and/or fragmentation in threatened species habitat
- Failure to implement mitigation and management measures
- Improper driving practices leading to fauna deaths, increased risk of vehicle collisions outside of the disturbance area
- Driving off designated tracks leading to flora and fauna damage
- Liberation of sediment from mine infrastructure and waste dumps
- Discharges of process water
- Inappropriate management of process water and sewerage dam
- Failure to implement fauna egress matting
- Poorly managed site leading to incursion of weeds
- Improper disposal of putrescible and general waste
- Poor waste management leading to incursion of feral animals
- Improper practices leading to unsuitable fire regimes

#### **5.2.2.4 Community / employees - cultural & health safety**

- Failure to protect cultural heritage and aboriginal archaeological sites
- Unauthorised access to the site
- Inappropriate staff activities leading to environmental incidents
- Inappropriate staff activities leading to health and safety incidents
- Aviation accident
- Unplanned economic social impacts on local communities
- Inadvertent impact on aesthetic values for local communities
- Operations inhibit traditional land management practices
- Poor implementation of the environmental management and mitigation measures

- Failure for contractors and consultants to adhere to environmental management and mitigation requirements

#### **5.2.2.5 Air quality and noise / vibration**

- Unacceptable levels of dust generated
- Staff exposed to unacceptable level of dust and atmospheric pollutants
- Disturbance to fauna and/or people associated with excessive noise and vibration
- Inappropriate operation of vehicles, plant and equipment
- Indirect disturbance to heritage sites associated with excessive vibration and dust from construction and operating activities

#### **5.2.2.6 Cyanide**

- Poor management and usage of cyanide during intensive leach of gravity concentrate

#### **5.2.2.7 Rehabilitation**

- Poor management and scheduling of rehabilitation resources including topsoil and clearing beyond approvals
- Poor life of mine planning
- Failure to undertake progressive rehabilitation
- Inappropriate resourcing for rehabilitation
- Poor closure implementation
- Ineffective rehabilitation
- Premature mine closure

### **5.3 Risk assessment, management and controls**

#### **5.3.1 Risk management process**

When considering risk mitigation for safety hazards including those in the mining industry, the hierarchy of controls provides a useful guide for determining appropriate controls. This is a commonly used set of control principles, applied across the industry in the mitigation of safety hazards. In the case of ABM these principles have been extended to environmental hazards. The hierarchy applies a prioritised order ranging from elimination, (the most desirable strategy), to personal protective equipment, (the least desirable strategy).

The more significant the risk, the higher the control strategy from the hierarchy, or combination of control strategies should be applied. The ultimate aim is to eliminate

hazards and their subsequent risk or, if this is not possible, to minimise exposures to as low as reasonably practicable.

1. ELIMINATION - Remove or avoid the hazard completely, i.e. cease using a device, tool, practice etc.
2. SUBSTITUTION - Replacing with a safer alternative.
3. ISOLATION - Separating the hazard from the person, environment or process at risk by isolation, guarding, barricading, alternate duties etc.
4. ENGINEERING CONTROLS - Constructing new devices to reduce risk, e.g. ergonomic devices, shock absorbent mats, robotics, etc.
5. ADMINISTRATIVE CONTROLS - Promote awareness of hazards. Delineation - signage, procedures, training etc.
6. PERSONAL PROTECTIVE EQUIPMENT (PPE) - Personal protective equipment is considered only when other controls are not practical or to increase protection.

### **5.3.2 Risk methodology**

The ranking for event consequence is shown in Table 5-1. The likelihood of an event occurring provides a measure of the known or anticipated frequency of occurrences (Table 5-2). Combining likelihood with consequence provides guidance on risk levels of each aspect and enables ranking of priorities (Table 5-3).

Table 5-1. Risk matrix measure of consequence.

<b>Consequence</b>		
1	Insignificant	Limited/rectifiable impact within project boundary Contained and recoverable minor environmental incident <10m <sup>2</sup> Very small number of individuals (1%) in local population of non-significant or significant species may be affected First aid attendance / no lost time Internal process delay < 1 day, <\$2k loss Will not affect a critical or high value asset
2	Minor	Minor reversible short term impact at local level Small environmental footprint (<20m <sup>2</sup> ), area easily rehabilitated with no lasting effects. Small number of (<10%) of individuals in the local population of non-significant or significant species may be affected First aid treatment lost time injury < 2 days Internal business impacts, <\$20k Loss, < 2 day delay in operation A minor affect to a critical or high value asset
3	Moderate	Major but reversible short term impact. Little/no impact on ecosystem function. Offsite/regional disturbance Large environmental footprint (100m <sup>2</sup> ), no lasting effects, good outlook for recovery. A significant species is affected but not significantly. Disturbance, but reversible, short term impact to <50% of individuals in the local population Medical treatment and/or impairment, lost time injury > 2 days Damage to business reputation, > \$40k loss. Reduced ability to operate (stop work). A critical asset is affected but not significantly. A high value asset is significantly affected.
4	Major	Serious long term impact at regional level Large environmental footprint (<=500m <sup>2</sup> ), long term effects, medium outlook of recovery. Major loss to significant species at the local level. Disturbance with long term impact to >50% of individuals in the local population Permanent disability Damage to business reputation, <= 2 million dollar loss. Temporary suspension of authorization. Critical asset is significantly affected
5	Catastrophic	Irreversible impact at regional level Largest environmental footprint (>500m <sup>2</sup> ), lasting effects, poor outlook on recovery. Extinction of species regionally Fatality Lasting damage to business reputation, > 2 million dollar loss.

<b>Consequence</b>		
		Operations shut down. Loss of major portion of critical asset at the regional level

Table 5-2. Qualitative measures of likelihood.

<b>Probability/Likelihood</b>			<b>Likelihood Criteria</b>
A	Rare:	Practically impossible, will only occur in exceptional circumstances. Has never occurred in the industry.	0-1%
B	Unlikely:	Will probably not occur in most circumstances. Could occur at some time but highly unlikely. Has occurred in the industry previously.	1-10%
C	Moderate:	Might occur at some time. Has occurred in associated companies previously.	11-50%
D	Likely:	Known to occur or will probably occur in most circumstances. Has occurred several times/year in associated companies.	51-90%
E	Almost Certain:	Common or repeating occurrence. Is expected to occur several times/year in any associated business. Imminent – or expected in near future.	91-100%

Table 5-3 Risk rankings from combined consequence to likelihood.

Based on AS/NZS 4360: 2004 5 X5 Risk Matrix					Consequence descriptors ( risks may present consequences to multiple descriptors)								
					Extent of Impact	Environmental	Species / Biodiversity	Health and Safety	Business	Critical Test			
15	19	22	24	25	Consequence ↑	5	Catastrophic	Irreversible impact at regional level	Largest environmental footprint (>500m <sup>2</sup> ), lasting effects, poor outlook on recovery.	Extinction of species regionally	Fatality	Lasting Damage to business reputation, > 2 million dollar loss. Operations shut down.	Loss of major portion of the regional level
10	14	18	21	4		Major	Serious long term impact at regional level	Large environmental footprint (<=500m <sup>2</sup> ), long term effects, medium outlook of recovery.	Major loss to significant species at the local level. Disturbance with long term impact to >50% of individuals in the local population	Permanent disability	Damage to business reputation, <= 2 million dollar loss. Temporary suspension of authorization.	Critical asset is significantly affected.	
6	9	13	17	3		Moderate	Major but reversible short term impact. Little/no impact on ecosystem function. Off site/regional disturbance	Large environmental footprint (100m <sup>2</sup> ), no lasting effects, good outlook for recovery	A significant species is affected but not significantly. Disturbance, but reversible, short term impact to <50% of individuals in the local population	Medical treatment and/or impairment, lost time injury > 2 days	Damage to business reputation, > \$40k loss. Reduced ability to operate (stop work).	A critical asset is affected significantly. A high significant asset affected.	
3	5	8	12	2		Minor	Minor reversible short-term impact at local level	Small environmental footprint (<20m <sup>2</sup> ), area easily rehabilitated with no lasting effects.	Small number of (<10%) of individuals in the local population of non-significant or significant species may be affected	First aid treatment lost time injury < 2 days	Internal business impacts, <\$20k Loss, <2 day delay in operation	A minor affect to a critical asset	
1	2	4	7	1		Insignificant	Limited/rectifiable impact within project boundary	Contained and recoverable minor environmental incident <10m <sup>2</sup>	Very small number of individuals (1%) in local population of non-significant or significant species may be affected	First aid attendance / no lost time	Internal process delay < 1 day, <\$2k loss	Will not affect a critical asset	
Likelihood →													
A	B	C	D	E	Likelihood scale								
Rare	Unlikely	Moderate	Likely	Almost Certain	Likelihood descriptor								
0-1%	1-10%	11-50%	51-90%	91-100%	Probability (%)								
Practically impossible, will only occur in exceptional circumstances. Has never occurred in the industry.	Will probably not occur in most circumstances. Could occur at some time but highly unlikely. Has occurred in the industry previously.	Might occur at some time. Has occurred in associated companies previously.	Known to occur or will probably occur in most circumstances. Has occurred several times/year in associated companies.	Common or repeating occurrence. Is expected to occur several times/year in any associated business. Imminent – or expected in near future.	Likelihood definition								

RISK LEVEL	AS/NZS 4360: 2004 Guideline	Risk Treatment
Extreme	In-tolerable - Immediate action required	Potentially unacceptable, major modification of proposal required
High	Intolerable or tolerable -Senior management accountability	Substantial modification and/or mitigation required
Moderate	Tolerable or acceptable -Management responsibility specified	Some mitigation required
Low	Acceptable - Manage by routine procedures	Minor mitigation may be required but usually adequately addressed in EMP as routine controls



### **5.3.3 Existing operations**

ABM's risk management procedures require the maintenance of a site hazard and risk register to ensure that any potential risk to the safety, health, environmental and business aspects of the operation are minimised. The register is formally reviewed by systematically identifying the potential hazards during all aspects of operations and putting in place measures to mitigate hazards. Steps taken to achieve this are detailed below:

1. assessing the risks
2. documenting how they are to be controlled
3. identifying any actions required.

The constant updating of the register provides a mechanism to keep a track of developing issues and hazards. This in turn allows management to be adaptive in mitigating future hazards. Additionally, continuously reviewing the register will ensure final detailed design and operating plans are specifically evaluated prior to commencement to confirm mitigation measures are suitable.

### **5.3.4 The project**

Tables 5-4 through to 5-9 detail the key risks and hazards associated and identified with the project. These tables also give brief details on the management measures to mitigate risks and hazards, with the column titled "Applicable EIS section and management plan" referencing sections of the EIS that provide further management detail.

Table 5-4. Risk Assessment ABM Resources Twin Bonanza 1 Project – Surface and Groundwater.

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value Consequence = C Likelihood = L	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Improper storage and handling of hazardous materials and hydrocarbons (including ammonium nitrate)	<ul style="list-style-type: none"> <li>•Ground water aquifers</li> <li>•Surface water streams</li> <li>•Flora and fauna</li> <li>•Staff</li> </ul>	<ul style="list-style-type: none"> <li>•Contaminated ground water and surface water</li> </ul>	<p><b>12</b>  C=Minor L=Likely</p>	Appropriate management including storage and handling of hazardous material and hydrocarbons aligned with Australian Standards	<ul style="list-style-type: none"> <li>•AS1940-2004 - The storage and handling of flammable and combustible liquids</li> <li>• LPSD - Hazardous Materials Management</li> </ul>	<ul style="list-style-type: none"> <li>• Temporary bunded pallets for small hydrocarbon containers. Concrete bunds and double skinned tanks for bulk storage.</li> <li>• Appropriate storage and handling of hazardous materials and monitoring of storage facilities in accordance with Australian Standards.</li> <li>• Adequate training (e.g. inductions).</li> <li>• Regular inspections to ensure meeting objectives for the management for containment of storage vessels and small containers.</li> </ul>	<p><b>5</b>  C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Processing manager</li> <li>•Camp manager</li> <li>•Environmental manager</li> </ul>	<p>Chapter 7 – Water management</p> <p>Appendix Q - Hazardous Substances Management Plan</p>	
Failure of tailings dam wall and/or concentrate residual dam	<ul style="list-style-type: none"> <li>•Surface water</li> <li>•Flora and fauna</li> <li>•Staff</li> </ul>	<ul style="list-style-type: none"> <li>•Inundation of flora from tailings</li> <li>•Contamination of surface water</li> <li>•Death of any present fauna</li> </ul>	<p><b>17</b>  C=Moderate L=Likely</p>	Tailings dam design, construction and operation in line with Australian Standards to ensure structural integrity	<ul style="list-style-type: none"> <li>•ANCOLD Guidelines - Guidelines on tailings dams; planning, design, construction, operation and closure.</li> <li>•AS 1726-1993 - Geotechnical site investigations</li> <li>•LPSD - Tailings Management</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate design, construction and operation of facility to ensure structural integrity is maintained; in accordance to the principals of the ANCOLD Guidelines.</li> <li>• Regular independent inspections. Quality control during dam construction.</li> <li>• Manage the freeboard of the facility and ensure that the facility not to be used for water storage, to prevent water ponding.</li> </ul>	<p><b>9</b>  C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Chief operating officer</li> <li>•Processing manager</li> </ul>	<p>Chapter 10 – Tailings and waste management</p> <p>Appendix R - Emergency Response Management Plan</p>	
Tailings Pipeline leak	<ul style="list-style-type: none"> <li>•Surface water</li> <li>•Flora and fauna</li> <li>•Staff</li> </ul>	<ul style="list-style-type: none"> <li>•Contamination of surface water</li> <li>•Death or injury of any present fauna</li> </ul>	<p><b>12</b>  C=Minor L=Likely</p>	Tailings dam design, construction and operation in line with Australian Standards to ensure structural integrity	<ul style="list-style-type: none"> <li>•ANCOLD Guidelines - Guidelines on tailings dams; planning, design, construction, operation and closure.</li> <li>•AS 1726-1993 - Geotechnical site investigations</li> <li>•LPSD - Tailings Management</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate design, construction and operation of facility to ensure structural integrity is maintained; in accordance to the principals of the ANCOLD Guidelines.</li> <li>• Regular inspections of pipelines. Quality control during construction.</li> <li>• Pipelines located in earthen bunds.</li> </ul>	<p><b>5</b>  C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Chief operating officer</li> <li>•Processing manager</li> </ul>	<p>Chapter 10 – Tailings and waste management</p> <p>Appendix R - Emergency Response Management Plan</p>	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value Consequence = C Likelihood = L	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Uncontrolled tailings dam, concentrate residual dam and water storage dam seepage - leachates	<ul style="list-style-type: none"> <li>Ground water aquifers</li> <li>Flora fauna</li> </ul>	<ul style="list-style-type: none"> <li>Contamination of ground water</li> <li>Uptake of elements by plants resulting in bioaccumulation</li> </ul>	<p><b>20</b></p> <p>C=Moderate L=Almost Certain</p>	Tailings dam design, construction and operation in line with Australian Standards and managing of seepage to appropriate levels	<ul style="list-style-type: none"> <li>NWQMS - Australian Guidelines for Water Quality Monitoring and reporting 2000</li> <li>LPSD - Tailings Management</li> <li>ANCOLD Guidelines - Guidelines on tailings dams; planning, design, construction, operation and closure.</li> </ul>	<ul style="list-style-type: none"> <li>Design facility in accordance to the chemical test work for AMD and leachates.</li> <li>Position the tailings dam to limit seepage. Constructing a permeability boundary layer. Installation of monitoring bores and if required recovery bores.</li> <li>Lining of the concentrate residual dam and water storage dam.</li> </ul>	<p><b>9</b></p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>Chief operating officer</li> <li>Processing manager</li> <li>Environmental manager</li> </ul>	<p>Chapter 10 – Tailings and waste management</p> <p>Chapter 7 – Water management</p> <p>Appendix R - Emergency Response Management Plan</p>	
Overtopping of tailings dam Concentrate Residual Dam and Water Storage Dam	<ul style="list-style-type: none"> <li>Surface water</li> <li>Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>Contamination of surface water</li> <li>Drowning of fauna</li> <li>Water inundation of flora</li> </ul>	<p><b>17</b></p> <p>C=Moderate L=Likely</p>	Management of tailings dam in line with operating strategy (to be drafted)	<ul style="list-style-type: none"> <li>ANCOLD Guidelines - Guidelines on tailings dams; planning, design, construction, operation and closure.</li> <li>LPSD - Tailings Management (2007)</li> <li>LPSD - Water Management (2008)</li> </ul>	<ul style="list-style-type: none"> <li>Monitor the deposition of tails and freeboard to ensure available capacity and prevent subsequent overtopping; in accordance to ANCOLD Guidelines.</li> </ul>	<p><b>9</b></p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>Processing manager</li> </ul>	<p>Chapter 10 – Tailings and Waste Management</p> <p>Appendix R - Emergency Response Management Plan</p>	
Liberation of sediment from waste dump	<ul style="list-style-type: none"> <li>Surface water</li> <li>Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>Increased turbidity in surface water</li> <li>Smothering of flora and fauna</li> </ul>	<p><b>16</b></p> <p>C=Minor L=Almost Certain</p>	Acceptable levels of erosion	<ul style="list-style-type: none"> <li>International Erosion Control Associations (IECA) Best Practice Erosion and Sediment Control Guidelines (BPESC Books 1-6)</li> <li>Mine Wastes. Characterisation, Treatment and Environmental Impacts (Lottermoser, B., 2007)</li> </ul>	<ul style="list-style-type: none"> <li>Undertake erodibility testing and design outer batters based on physical characteristics of the material.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>Site general manager</li> <li>Environmental manager</li> </ul>	<p>Chapter 10 – Tailings and waste management</p> <p>Chapter 7 – Water management</p> <p>Appendix E -Erosion and Sediment Control Plan</p>	
Liberation of leachates from waste dump	<ul style="list-style-type: none"> <li>Ground water aquifers</li> <li>Surface water streams</li> <li>Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>Contamination of ground water and surface water</li> <li>Flora and fauna exposure to environmental contaminants</li> </ul>	<p><b>12</b></p> <p>C=Minor L=Likely</p>	Acceptable levels of leachates	<ul style="list-style-type: none"> <li>LPSD - Water Management</li> <li>LPSD - Managing Acid and Metalliferous Drainage 2007</li> <li>GARD Guide - best practices and technology to address AMD issues</li> <li>Mine Wastes. Characterisation, Treatment and Environmental Impacts (Lottermoser, B., 2007)</li> </ul>	<ul style="list-style-type: none"> <li>Undertake AMD and water leach tests, and designed the waste dump based on the chemical nature of the material.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>Site general manager</li> <li>Environmental manager</li> </ul>	<p>Chapter 10 – Tailings and waste management</p> <p>Appendix R - Emergency Response Management Plan</p>	
Position of waste dump inhibits surface water flow	<ul style="list-style-type: none"> <li>Surface water</li> <li>Flora</li> </ul>	<ul style="list-style-type: none"> <li>Ponding of surface water and flora water logging</li> <li>Restricting water for downstream flora</li> </ul>	<p><b>12</b></p> <p>C=Minor L=Likely</p>	Appropriate design of infrastructure footprint, in relation to topography	<ul style="list-style-type: none"> <li>Australian Rainfall &amp; Runoff - A Guide to Flood Estimation</li> </ul>	<ul style="list-style-type: none"> <li>Complete surface water modelling and position waste dump according to results.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>Chief operating officer</li> <li>Environmental manager</li> </ul>	<p>Chapter 7 – Water management</p> <p>Appendix F -Water Management Plan</p>	
Liberation of sediment from Processing area	<ul style="list-style-type: none"> <li>Surface water</li> <li>Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>Increased turbidity in surface water</li> <li>Smothering of flora and fauna</li> </ul>	<p><b>16</b></p> <p>C=Minor L=Almost Certain</p>	Minimisation of sediment liberation	<ul style="list-style-type: none"> <li>International Erosion Control Associations (IECA) Best Practice Erosion and Sediment Control Guidelines (BPESC) (Books 1-6)</li> </ul>	<ul style="list-style-type: none"> <li>Establish Erosion and Sediment Control plan that includes the establishment of water diversion structures and sediment ponds.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>Processing manager</li> </ul>	<p>Chapter 7 – Water management</p> <p>Appendix E -Erosion and Sedimentation Control Plan</p>	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value Consequence = C Likelihood = L	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Liberation of sediment from Airstrip	<ul style="list-style-type: none"> <li>•Surface water</li> <li>•Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>•Increased turbidity in surface water</li> <li>•Smothering of flora and fauna</li> </ul>	<p><b>12</b></p> <p>C=Minor L=Likely</p>	Minimisation of sediment liberation	<ul style="list-style-type: none"> <li>•International Erosion Control Associations (IECA) Best Practice Erosion and Sediment Control Guidelines (BPESC) (Books 1-6)</li> </ul>	<ul style="list-style-type: none"> <li>•Ensure the upgrade of the airstrip uses suitable material and is compacted.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Camp manager</li> </ul>	<p>Chapter 7 – Water management</p> <p>Appendix E -Erosion and Sedimentation Control Plan</p>	
Liberation of hydrocarbons and other chemicals from Processing plant	<ul style="list-style-type: none"> <li>•Ground water aquifers</li> <li>•Surface water streams</li> <li>•Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>•Contaminated ground water and surface water</li> <li>•Secondary detrimental impacts on plants</li> </ul>	<p><b>16</b></p> <p>C=Minor L=Almost Certain</p>	Appropriate management including storage and handling of hazardous material and hydrocarbons aligned with Australian Standards	<ul style="list-style-type: none"> <li>•AS1940-2004 - The storage and handling of flammable and combustible liquids</li> <li>•LPSD - Hazard Materials Management</li> </ul>	<ul style="list-style-type: none"> <li>•Appropriate storage and handling of hazardous materials and monitoring of storage facilities in accordance with Australian Standards.</li> <li>•Adequate training (e.g. inductions).</li> <li>•Temporary bunded pallets for small hydrocarbon containers. Concrete bunds and double skinned tanks for bulk storage.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Processing manager</li> </ul>	<p>Chapter 7 – Water management</p> <p>Appendix Q - Hazardous Substances Management Plan</p>	
Uncontrolled waste disposal - solid waste & sewerage	<ul style="list-style-type: none"> <li>•Ground water aquifers</li> <li>•Surface water streams</li> <li>•Flora and fauna</li> <li>•Staff</li> </ul>	<ul style="list-style-type: none"> <li>•Fauna deaths</li> <li>•Potential eutrophication of surface water during rain events</li> <li>•Illness from water borne diseases</li> <li>•Contamination of ground water from solid wastes</li> </ul>	<p><b>17</b></p> <p>C=Moderate L=Likely</p>	No un-controlled waste disposal	<ul style="list-style-type: none"> <li>•Code of practice for small on-site sewage and sullage treatment systems and the disposal or reuse of sewage effluent - NT Department of Health and Families</li> <li>•NT Department of Health - Environmental Health Fact Sheet #700 - Requirements for Mining and Construction Projects</li> <li>•Waste Management and Pollution Control (Administration) Regulations. NT GOVT</li> </ul>	<ul style="list-style-type: none"> <li>•Design and operation of the sewerage facility in accordance to the Code of practice for small on-site sewage and sullage treatment systems and the disposal or reuse of sewage effluent - NT Department of Health and Families.</li> <li>•Water from ablutions will be sent from approved septic tanks to leach system.</li> </ul>	<p><b>9</b></p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Processing manager</li> <li>•Camp manager</li> </ul>	<p>Chapter 9 – Waste management</p>	
Liberation of waste water from Processing plant	<ul style="list-style-type: none"> <li>•Ground water aquifers</li> <li>•Surface water streams</li> <li>•Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>• Potential contamination with hydrocarbons, cyanide, chemicals and sediment liberation in surface water during rain events</li> <li>•Secondary contamination of ground water from solid wastes secondary effects on flora and fauna</li> </ul>	<p><b>12</b></p> <p>C=Minor L=Likely</p>	No un-controlled liberation of waste water	<ul style="list-style-type: none"> <li>•LPSD - Water Management</li> </ul>	<ul style="list-style-type: none"> <li>•Bunds around the processing plant and surface sediment ponds to capture liberated waste water.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Processing manager</li> </ul>	<p>Chapter 9 – Waste management</p>	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value Consequence = C Likelihood = L	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Extraction of groundwater beyond sustainable yields	<ul style="list-style-type: none"> <li>Ground water aquifers</li> <li>Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>Detrimental effect on groundwater dependent ecosystems -flora and fauna</li> </ul>	<b>21</b> C= Major L=Likely	No adverse effects to groundwater through extraction	<ul style="list-style-type: none"> <li>Minimum construction requirements for water bores in Australia - ed 3. Australian Government National Water Commission</li> <li>LPSD - Water Management</li> <li>Australian Guidelines for Water Quality Monitoring and Reporting</li> <li>Australian and New Zealand Guidelines for Fresh and Marine Water Quality</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of water table, with monitoring bores and monitoring of vegetation health; in accordance to ABM's Paleochannel vegetation Monitoring Plan.</li> </ul>	<b>14</b> C=Major L=Unlikely	<ul style="list-style-type: none"> <li>Environmental manager</li> <li>Processing manager</li> </ul>	Chapter 7 – Water management  Appendix D – Biodiversity Plan  Appendix F -Water Management Plan	
Inappropriate storage and disposal of solid waste	<ul style="list-style-type: none"> <li>Ground water aquifers</li> <li>Staff</li> </ul>	<ul style="list-style-type: none"> <li>Contamination of ground water from solid wastes</li> <li>Illness from water bourne diseases</li> </ul>	<b>17</b> C=Moderate L=Likely	Appropriate storage and disposal of solid waste	<ul style="list-style-type: none"> <li>NT Department of Health - Environmental Health Fact Sheet #700 - Requirements for Mining and Construction Projects</li> <li>Code of Practice for Small On-site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent (1996)</li> <li>Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory (2013)</li> </ul>	<ul style="list-style-type: none"> <li>The construction and operation of the landfill to avoid the inappropriate disposal of harmful waste.</li> <li>Certain waste materials (i.e. cardboards and food scraps) will be burnt on site.</li> </ul>	<b>9</b> C=Moderate L=Unlikely	<ul style="list-style-type: none"> <li>Processing manager</li> <li>Camp manager</li> </ul>	Chapter 9 – Waste management	
Improper design of roads leading to surface water flows	<ul style="list-style-type: none"> <li>Surface water</li> <li>Flora</li> </ul>	<ul style="list-style-type: none"> <li>Surface water ponding - detrimental to vegetation</li> <li>Impeded surface water flows affecting vegetation</li> </ul>	<b>12</b> C=Minor L=Likely	Suitably designed roads in relation to topography	<ul style="list-style-type: none"> <li>AGRD - applicable to Rural road design; AGRD02-06, AGRD03-1, AGRD04-09, AGRD04A-10, AGRD06-10, AGRD07-08, and others as necessary</li> </ul>	<ul style="list-style-type: none"> <li>Surface water modelling and subsequent design and construction for roads according to modelling results.</li> </ul>	<b>5</b> C=Minor L=Unlikely	<ul style="list-style-type: none"> <li>Chief operating officer</li> </ul>		
Inappropriate flood management leading to inundation	<ul style="list-style-type: none"> <li>Surface water</li> <li>Flora</li> </ul>	<ul style="list-style-type: none"> <li>Liberate sediment and hydrocarbons into surrounding environment</li> </ul>	<b>13</b> C=Moderate L=Moderate	Appropriate flood management	<ul style="list-style-type: none"> <li>Australian Rainfall &amp; Runoff - A Guide to Flood Estimation</li> </ul>	<ul style="list-style-type: none"> <li>Positioning of infrastructure and water diversion structures to prevent inundation and in addition to separate clean and dirty water.</li> </ul>	<b>9</b> C=Moderate L=Unlikely	<ul style="list-style-type: none"> <li>Chief operating officer</li> <li>Environmental manager</li> </ul>	Chapter 7 – Water management  Appendix G – Surface Water Assessment Memo	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Vegetation clearing activities	•Flora and fauna	<ul style="list-style-type: none"> <li>• Reduction in habitat availability for flora and fauna</li> <li>• Fragmentation of habitat</li> <li>•Increases erosion by wind and water</li> </ul>	<p>17</p> <p>C=Moderate L=Likely</p>	No vegetation clearing beyond approvals especially in vegetation sensitive communities	<ul style="list-style-type: none"> <li>•Northern Territory Land Clearing Guidelines (Department of Natural Resources, Environment, the Arts and Sport. 2010. Land Clearing Guidelines. Technical Report 20/2009D, NT Government, Darwin</li> <li>•Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping. Technical Report No. 02/2007D, NT Government, Darwin</li> <li>•Supplement to the NT Parks and Wildlife Conservation Master plan for bioregional conservation significance</li> <li>•DLRM threatened species fact sheets</li> <li>•Commonwealth's guidelines for the assessment of the significance of impacts on matters of national environmental significance</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to clearing vegetation, a vegetation clearing procedure form is required to be completed. Progressive vegetation clearing practices will be employed.</li> <li>• Vegetation clearance planning will aim to clear the least vegetation as possible.</li> <li>• All approved clearing boundaries are to be shown on maps. All areas to be cleared will be clearly marked.</li> <li>• Clearing will be supervised and the details of the clearing will be conveyed to the machinery operator.</li> <li>• Ensuring no unintended clearing occurs in sensitive vegetation communities</li> <li>• Closure planning suggests good rehabilitation practices to return cleared areas to a sustainable land form similar to original (where possible)</li> <li>• Ensuring that the above commitments are incorporated into the MMP auditing process.</li> </ul>	<p>9</p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>•Environmental manager</li> </ul>	<p>Section 6.7.1, Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
	<ul style="list-style-type: none"> <li>•Paleochannel (sensitive habitat)</li> </ul>	<ul style="list-style-type: none"> <li>• Fragmentation of habitat</li> <li>• Removal of deep rooted species</li> </ul>	<p>17</p> <p>C=Moderate L=Likely</p>	No vegetation clearing beyond approvals especially in vegetation sensitive communities	<p>Northern Territory Land Clearing Guidelines (Department of Natural Resources, Environment, the Arts and Sport. 2010. Land Clearing Guidelines. Technical Report 20/2009D, NT Government, Darwin</p> <ul style="list-style-type: none"> <li>•Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping. Technical Report No. 02/2007D, NT Government, Darwin</li> <li>•Supplement to the NT Parks and Wildlife Conservation Master plan for bioregional conservation significance</li> <li>•DLRM threatened species fact sheets</li> <li>•Commonwealth's guidelines for the assessment of the significance of impacts on matters of national environmental significance</li> </ul>	<ul style="list-style-type: none"> <li>• Positioning water supply bores to limit disturbance and reduce fragmentation</li> <li>• Avoid deep rooted trees where possible (simply includes all trees present within palaeochannel).</li> <li>• Minimise size of drill pads.</li> </ul>	<p>9</p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>•Environmental manager</li> </ul>	<p>Section 6.7.2, Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	
	<ul style="list-style-type: none"> <li>•The greater bilby and brush tailed mulgara</li> </ul>	<ul style="list-style-type: none"> <li>• Accidental injury/ mortality of threatened species that persist on site</li> <li>• Loss and or degradation of threatened species habitat during activities; including construction and operations activities.</li> <li>• Reduction in habitat availability for flora and fauna</li> <li>• Fragmentation of habitat</li> <li>• Increases erosion by wind and water</li> </ul>	<p>17</p> <p>C=Moderate L=Likely</p>	No vegetation clearing beyond approvals	<p>Northern Territory Land Clearing Guidelines (Department of Natural Resources, Environment, the Arts and Sport. 2010. Land Clearing Guidelines. Technical Report 20/2009D, NT Government, Darwin</p> <ul style="list-style-type: none"> <li>•Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping. Technical Report No. 02/2007D, NT Government, Darwin</li> <li>•Supplement to the NT Parks and Wildlife Conservation Master plan for bioregional conservation significance</li> <li>•DLRM threatened species fact sheets</li> <li>•Commonwealth's guidelines for the assessment of the significance of impacts on matters of national environmental significance</li> </ul>	<ul style="list-style-type: none"> <li>• Sighting of infrastructure in areas that will least impact threatened species.</li> <li>• Pre-clearance fauna surveys for all developments that require removal of previously undisturbed native vegetation.</li> <li>• Adhere to agreed clearing boundaries as part of the EIS approvals.</li> <li>• Manage clearing in accordance with the Biodiversity Management Plan.</li> <li>• Monitoring of known burrows in the lead up to vegetation clearing to determine if individuals are active in the area at the time of clearing.</li> </ul>	<p>9</p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>•Environmental manager</li> </ul>	<p>Section 6.7.3, Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Reduction and/or fragmentation in threatened species habitat	•The greater bilby and brush tailed mulgara	•Decline in population dynamics of threatened species	17 C=Moderate L=Likely	Acceptable levels of impact on threatened species habitats.	<ul style="list-style-type: none"> <li>•Northern Territory Land Clearing Guidelines (Department of Natural Resources, Environment, the Arts and Sport. 2010. Land Clearing Guidelines. Technical Report 20/2009D, NT Government, Darwin</li> <li>•Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping. Technical Report No. 02/2007D, NT Government, Darwin</li> <li>•Supplement to the NT Parks and Wildlife Conservation Master plan for bioregional conservation significance</li> <li>•DLRM threatened species fact sheets</li> <li>•Commonwealth's guidelines for the assessment of the significance of impacts on matters of national environmental significance</li> </ul>	<ul style="list-style-type: none"> <li>•Sighting of infrastructure in areas that will least impact threatened species.</li> <li>• Pre-clearance fauna surveys for all developments that require removal of previously undisturbed native vegetation.</li> <li>• Adhere to agreed clearing boundaries as part of the EIS approvals.</li> <li>• Manage clearing in accordance with the Biodiversity Management Plan.</li> <li>• Monitoring of known burrows in the lead up to vegetation clearing to determine if individuals are active in the area at the time of clearing</li> </ul>	9 C=Moderate L=Unlikely	<ul style="list-style-type: none"> <li>•Site general manager</li> <li>•Environmental manager</li> </ul>	<p>Section 6.7.3, Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	
Improper driving practices leading to fauna deaths, increased risk of vehicle collisions outside of the disturbance area	•Fauna	•Fauna fatalities and injury	12 C=Minor L=Likely	Adoption of appropriate driving practices		<ul style="list-style-type: none"> <li>• Imposed specific onsite driving requirements and rules.</li> <li>• Inductions for all site staff and visitors, these are to include: speed restrictions, night driving restrictions or awareness, signage along roads that remind drivers of threatened species presence within the project area, restrictions on off road driving with the focus on areas containing known greater bilby burrows</li> </ul>	5 C=Minor L=Unlikely	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>•Camp Manager</li> <li>•Processing manager</li> </ul>	<p>Section 6.7.3 Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	
Driving off designated tracks leading to flora and fauna damage	•Flora and fauna	•Inadvertent damage to habitats and individuals including damage to bilby burrows.	12 C=Minor L=Likely	Adoption of appropriate driving practices		<ul style="list-style-type: none"> <li>• Imposed specific onsite driving requirements and rules.</li> <li>• Inductions for all site staff and visitors, these are to include: speed restrictions, night driving restrictions or awareness, signage along roads that remind drivers of threatened species presence</li> </ul>	5 C=Minor L=Unlikely	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>•Camp manager</li> <li>•Processing manager</li> </ul>	<p>Section 6.7.3, Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	



Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
						within the project area, restrictions on off road driving with the focus on areas containing known greater bilby burrows				
Groundwater extraction exceeding deep rooted tree species accessibility.	<ul style="list-style-type: none"> <li>• Sensitive vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in tree health</li> <li>• Potential tree mortality due to water stress</li> </ul>	<p><b>17</b></p> <p>C=Moderate L=Likely</p>	Demonstrate that the rate of tree mortality is comparable to the surrounding environment.		<ul style="list-style-type: none"> <li>• Strict groundwater monitoring schedule using standing water bores</li> <li>• Conduct tree health monitoring within water supply area, and also in control sites</li> <li>• If monitoring detects significant drawdown that cannot be rapidly replenished, water extraction will cease at that particular bore and rotate to another bore in a separate system (outside of that specific palaeochannel environment).</li> <li>• Implementation of the Water Management Plan</li> </ul>	<p><b>9</b></p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>• Environmental manager</li> </ul>	<p>Section 6.7.2, Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p> <p>Chapter 7 – Water management</p> <p>Appendix F – Water Management Plan</p>	
Discharges of process water and /or bore water. Including the use of saline water for dust suppression.	<ul style="list-style-type: none"> <li>• Flora</li> </ul>	<ul style="list-style-type: none"> <li>• Water logging</li> <li>• Element/ Chemical Uptake</li> </ul>	<p><b>12</b></p> <p>C=Minor L=Likely</p>	No un-controlled discharge of waste water. Controlled use of water during dust suppression to avoid overspray and runoff.	<ul style="list-style-type: none"> <li>• LPSD - Biodiversity Management</li> <li>• LPSD - Water Management</li> </ul>	<ul style="list-style-type: none"> <li>• Training of staff and mentoring of operations.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>• Camp Manager</li> <li>• Processing manager</li> </ul>	<p>Section 6.7.2 Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	
Inappropriate management of process water and sewerage dam	<ul style="list-style-type: none"> <li>• Migratory Birds</li> </ul>	<ul style="list-style-type: none"> <li>• Bird fatalities or illness</li> </ul>	<p><b>16</b></p> <p>C=Minor L=Almost Certain</p>	Appropriate management of process water and sewerage dam	<ul style="list-style-type: none"> <li>• LPSD - Biodiversity Management</li> <li>• LPSD - Water Management</li> </ul>	<ul style="list-style-type: none"> <li>• Training of staff and monitoring of operations.</li> <li>• Routine inspections to assess performance and evidence of affected wildlife.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>• Processing manager</li> <li>• Camp manager</li> </ul>	<p>Section 6.7.4 Chapter 6 – Biodiversity</p> <p>Chapter 7 – Water management</p> <p>Appendix F – Water Management Plan</p> <p>Chapter 9 – Waste management</p>	
Introduction or spread of weeds	<ul style="list-style-type: none"> <li>• Flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced habitat quality for native flora and fauna</li> <li>• Reduced biodiversity values</li> <li>• Increased fuel load, fire frequency and intensity</li> <li>• Increased</li> </ul>	<p><b>12</b></p> <p>C=Minor L=Likely</p>	Maintain original weed levels	<ul style="list-style-type: none"> <li>• Northern Territory Government (2010) Guidelines for Weed Data Collection in the Northern Territory, Northern Territory Government of Australia.</li> </ul>	<ul style="list-style-type: none"> <li>• Progressive vegetation clearing rather than wide scale clearing at the start of the project.</li> <li>• Vegetation clearance planning will aim to clear the least vegetation as possible.</li> <li>• Implementation and monitoring of the Weed Management Plan</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>• Environmental Manager</li> </ul>	<p>Section 6.7.1, Chapter 6 – Biodiversity</p> <p>Appendix D – Biodiversity Management Plan</p>	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
		presence of out competing weed species								
	•Threatened species	• Loss and degradation of threatened species habitat. • Decline in population dynamics from reduction	12 C=Minor L=Likely	Maintain original weed levels	• LPSD - Biodiversity Management	• Minimise land clearing (thereby reducing soils that are susceptible for weed incursion). • Implementation of the Weed Management Plan	5 C=Minor L=Unlikely	•Environmental manager	Section 6.7.3, Chapter 6 – Biodiversity  Appendix D – Biodiversity Management Plan	
Introduction or spread of pest species	•Flora and fauna	• Increase predation pressure on threatened species by creating suitable conditions for species such as Dingo and feral cats • Increase in dingo, rodent and cat populations placing pressure • Overgrazing by Camels	17 C=Moderate L=Likely	Prevent expansion of feral animal populations	• LPSD - Biodiversity Management	• Properly designed land fill area that includes barrier fencing • All putrescible waste will be burnt on a regular basis to reduce attraction of scavenger species such as feral cats and dingos. • Avoid creation of artificial water points. • Weekly inspections of land fill fencing to ensure that target species cannot enter the area. • Monitoring of feral cats and dingos within the general area • Where practicable, minimise the potential to create artificial habitat for pest species (e.g loose stockpiles that could provide opportunity for Dingo dens). • Camp area will be designed to reduce chance of dingos and cats using structures for shelter (i.e. fencing under dongas etc.). • Education of onsite personnel to make them aware not to feed or “nurse” animals on the site. .	9 C=Moderate L=Unlikely	•Camp manager	Section 6.7.1 and 6.7.3, Chapter 6 – Biodiversity  Appendix D – Biodiversity Management Plan	
Disturbance to fauna and/or people associated with excessive noise, light and vibration	•Fauna	• Changes in behavioural activity of fauna • Populations of threatened species may leave the local area due to	16 C=Minor L=Almost Certain	Minimise disturbance to fauna and/or people associated with excessive noise and vibration	•NOHSC:1007 (2000) - National Standard for Occupational Noise. •AS/NZS 1269.3:2005 - Occupational noise management – hearing protector program •LPSD - Airborne Contaminants,	• Implement Noise Management Plan • Maintenance of equipment to minimise noise emissions as far as possible, avoid activities generating excessive noise and vibration and if required implement	5 C=Minor L=Unlikely	•Chief operating officer •Environmental manager •Health and safety manager	Section 6.7.3, Chapter 6 – Biodiversity  Appendix D – Biodiversity Management Plan  Chapter 16 –	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
		excessive disturbance			noise and vibration • LPSD - Biodiversity Management	mitigation measures (i.e. PPE and hours of work).			Additional environmental impacts Appendix Y- Noise Management Plan	
Habitat modification-changes to fire regime	•Flora and fauna	•Hot fire burns resulting in slow recovery of vegetation and habitats •Potential for fauna deaths and injury •Erosion generated from loss of vegetation	21 C=Major L=Likely	Prevent fires caused by ABM	• LPSD - Biodiversity Management	• Ensure Hot work Permits are applied and Fire Management Plan adhered to. • Smoke only in designated areas and be sure to dispose of extinguished cigarette butt in appropriate matter.	14 C=Major L=Unlikely	• Site general manager •Camp manager •Processing manager	Section 6.7.1, 6.7.2 and 6.7.3, Chapter 6 – Biodiversity Appendix D – Biodiversity Management Plan Appendix Z – Fire Management Plan	
Habitat modification-food source availability	•Fauna	•Increase in dingo and cat populations placing pressure on threatened species	20 C=Moderate L=Almost Certain	Minimise disturbance to fauna	•Guideline for the General Management of Hazardous Waste in the NT •Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites In the Northern Territory - NTEPA January 2013	• Properly designed land fill area that includes barrier fencing • All putrescible waste will be burnt on a regular basis to reduce attraction of scavenger species such as feral cats and dingos.	9 C=Moderate L=Unlikely	•Processing manager •Camp manager	Section 6.7.3, Chapter 6 – Biodiversity Appendix D – Biodiversity Management Plan Chapter 16 – Additional environmental impacts Appendix Z -Fire Management Plan	Fire Management Plan reviewed and approved by CLC (on behalf of traditional owners).
Habitat modification-failure to implement Egress matting	•Fauna	•Fauna deaths	11 C=Insignificant L=Almost Certain	Minimise fauna death	• Fauna Egress Matting and Ramps - Western Australia Department of Mines and Petroleum	• Tasked to environmental manager to ensure completion of Egress matting and ramps.	2 C=Insignificant L=Unlikely	•Environmental manager	Section 6.7.3, Chapter 6 – Biodiversity Appendix D – Biodiversity Management Plan	
Habitat modification-failure to implement mitigation and management measures	•Flora and fauna	•Poor clearing techniques •No recovery of topsoil •Increased wind and water erosion	18 C=Major L=Moderate	Proper implementation of mitigation and management measures		• Inductions for all site staff and visitors and job specific training.	14 C=Major L=Unlikely	•Chief operating officer •Environmental manager	Section 6.7.3, Chapter 6 – Biodiversity Appendix D – Biodiversity Management Plan Chapter 14 – Environmental management system	
Habitat modification-sediment off mine infrastructure and waste dumps	•Flora and fauna	• Smothering of vegetation • Effects on fauna forging and breeding behaviour and habitat	20 C=Moderate L=Almost Certain	No un-controlled liberation of sediment	• LPSD - Biodiversity Management •International Erosion Control Associations (IECA) Best Practice Erosion and Sediment Control Guidelines (BPESC) (Books 1-6)	• Establish Erosion and Sediment Control plan that includes the establishment of water diversion structures and sediment ponds.	9 C=Moderate L=Unlikely	• Site general Manager •Environmental manager	Chapter 6 – Biodiversity Appendix D – Biodiversity Management Plan	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
									Chapter 7 – Water management Appendix E - Erosion and Sedimentation Control Plan	
Improper disposal of Putrescible and general waste	•Fauna	•Increase in dingo and cat populations placing pressure on threatened species	20 C=Moderate L=Almost Certain	Appropriate disposal of Putrescible and general waste.	•Guideline for the General Management of Hazardous Waste in the NT •Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites In the Northern Territory - NTEPA January 2013	•To dissuade dingos and other scavengers from entering camps, food scraps are to be burnt. •Monitoring of waste facilities to ensure appropriate disposal of material.	9 C=Moderate L=Unlikely	•Processing manager •Camp manager	Chapter 6 – Biodiversity Appendix D – Biodiversity Management Plan Chapter 9 – Waste management	
Poor waste management leading to incursion of feral animals	•Flora and fauna	•Increase in dingo, rodent, cat populations placing pressure on threatened species •Overgrazing by Camels	20 C=Moderate L=Almost Certain	Prevent expansion of feral animal populations	• LPSD - Biodiversity Management	•To dissuade dingos and other scavengers from entering camps, food scraps are to be burnt. • Monitoring of waste facilities to ensure appropriate disposal of material.	9 C=Moderate L=Unlikely	•Camp manager	Chapter 6 – Biodiversity Appendix D – Biodiversity Management Plan	

Table 5-6. Risk assessment ABM Twin Bonanza 1 Project – Community / employees (cultural & health safety).

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Failure to protect cultural heritage and aboriginal archaeological sites	•Traditional Owners	•Destruction of cultural and scientific values •Lead to prevention of traditional practices	<b>17</b> C=Moderate L=Likely	No unapproved cultural heritage sites disturbed	•Social Impact Assessment: Guideline to preparing a social impact management plan - Queensland Government •LPSD - Community Engagement •LPSD - Working with Indigenous Communities	•Pre-disturbance surveys and subsequent marking out of aboriginal heritage and cultural sites. •Implementation and monitoring of Cultural Heritage Risk Management Plan. If required approvals for disturbance of the site.	<b>9</b> C=Moderate L=Unlikely	•Chief operating officer •Environmental manager	Chapter 13 –Social, economic, cultural and heritage risks  Appendix U - Cultural and Heritage Management Plan  Appendix U - Social Impact Management Plan	Chapter 13, Cultural and Heritage Management Plan and Social Impact Management Plan reviewed and approved by CLC (on behalf of traditional owners).
Unauthorised access to the site	•Public	•Unauthorised camping leading to potential bushfires, vegetation destruction and erosion •Health and safety risks to individuals	<b>12</b> C=Minor L=Likely	No unauthorised access to site	•Social Impact Assessment: Guideline to preparing a social impact management plan - Queensland Government •LPSD - Community Engagement	•Clear signage indicating the site is an active mining area. Direction of potential visitors to site office.	<b>5</b> C=Minor L=Unlikely	•Camp manager	Chapter 3 – Project description	
Inappropriate staff activities leading to environmental incidence	•Staff and supervisors	•Vegetation destruction •Fauna deaths and injury •Uncontrolled chemical / hydrocarbon spills	<b>12</b> C=Minor L=Likely	Adoption of appropriate activities	•Social Impact Assessment: Guideline to preparing a social impact management plan - Queensland Government •LPSD - Community Engagement	•Training, inductions and supervision of staff.	<b>5</b> C=Minor L=Unlikely	•Chief operating officer •Environmental manager	Chapter 14 – Environmental management plan	
Inappropriate staff activities leading to health and safety incidence	•Staff and supervisors	•Staff injury and illness	<b>16</b> C=Minor L=Almost Certain	Adoption of appropriate health and safety activities	•Social Impact Assessment: Guideline to preparing a social impact management plan - Queensland Government •LPSD - Community Engagement	•Training, inductions and supervision of staff.	<b>5</b> C=Minor L=Unlikely	•Health and safety manager	ALL management plans	
Aviation accident	•Staff	•Staff injury and death •Bushfires & hydrocarbon contamination	<b>14</b> C=Major L=Unlikely	No accident	•CASA - Advisory Publication 92-1(1) Guidelines for Aeroplane landing areas	•Ensuring all aviation operators is compliant with CASA. •Maintain the airstrip in good standing in accordance to CASA guidelines.	<b>10</b> C=Major L=Rare	•Health and safety manager	Chapter 12 – Road transport and traffic management	
Unplanned economic social impacts on local	•Local Community	•Positive and negative Expectation of	<b>13</b> C=Moderate	Prevention of unplanned economic social	•Social Impact Assessment: Guideline to preparing a social	•Ongoing consultation with underlying	<b>9</b> C=Moderate	•Managing director •Chief	Chapter 13 –Social, economic, cultural and heritage risks	Chapter 13 and Social Impact Management Plan reviewed and approved by CLC (on behalf of

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
community		monetary returns	L=Moderate	impacts on local community	impact management plan - Queensland Government •LPSD - Community Engagement	landholder, through the CLC, under the Aboriginal Land rights Act 1976.	L=Unlikely	operating officer	Appendix T -Social Impact Management Plan	traditional owners).
Inadvertent impact on aesthetic values for local communities	•Local Community	•Traditional Owners cultural activities and land use affected	17 C=Moderate L=Likely	Maintaining aesthetic values for local communities	•Social Impact Assessment: Guideline to preparing a social impact management plan - Queensland Government •LPSD - Community Engagement •LPSD - Working with Indigenous Communities	• Designing of waste rock dumps and tailings dams to intergrade in to the surrounding environment upon closure.	m	•Chief operating officer •Environmental Manager	Chapter 13 –Social, economic, cultural and heritage risks  Appendix U -Cultural and Heritage Management Plan  Appendix T- Social Impact Management Plan	Chapter 13, Cultural and Heritage Management Plan and Social Impact Management Plan reviewed and approved by CLC (on behalf of traditional owners).
Operations inhibit traditional land management practices	•Traditional Owners	•Restriction of access to sites of cultural significance and land use	17 C=Moderate L=Likely	No adverse effect to traditional land management practices	•Social Impact Assessment: Guideline to preparing a social impact management plan - Queensland Government •LPSD - Community Engagement •LPSD - Working with Indigenous Communities	• Ongoing consultation with underlying landholder, through the CLC, under the Aboriginal Land rights Act 1976.	9 C=Moderate L=Unlikely	•Chief operating officer	Chapter 13 –Social, economic, cultural and heritage risks  Appendix U - Cultural and Heritage Management Plan  Appendix T - Social Impact Management Plan	Chapter 13, Cultural and Heritage Management Plan and Social Impact Management Plan reviewed and approved by CLC (on behalf of traditional owners).
Poor implementation of the environmental management and mitigation measures	•Flora and Fauna •Surface water •Ground water •Community	•Environmental Degradation across the entire ecosystem	17 C=Moderate L=Likely	Appropriate implementation of the environmental management and mitigation measures	•LPSD - Evaluating Performance: monitoring and auditing • LPSD - Biodiversity Management •LPSD - Community Engagement •LPSD - Working with Indigenous Communities	• Training, inductions and supervision of staff. Environmental Manager to oversee all Environmental Aspects.	9 C=Moderate L=Unlikely	•Environmental manager	Chapter 13 –Social, economic, cultural and heritage risks  Chapter 14 – Environmental management system	Chapter 13 reviewed and approved by CLC (on behalf of traditional owners).
Failure for contractors and consultants to adhere to Environmental management and mitigation requirements	•Flora and Fauna •Surface water •Ground water •Community	•Environmental Degradation across the entire ecosystem	17 C=Moderate L=Likely	Appropriate implementation of the environmental management and mitigation measures and communication to contractors / consultants	•LPSD - Evaluating Performance: monitoring and auditing • LPSD - Biodiversity Management •LPSD - Working with Indigenous Communities	• Details of Environmental Management and mitigation requirements specified within contracts, inductions and training.	9 C=Moderate L=Unlikely	•Chief operating officer •Camp manager •Processing manager •Environmental manager	Chapter 13 –Social, economic, cultural and heritage risks  Chapter 14 – Environmental management systems	Chapter 13 reviewed and approved by CLC (on behalf of traditional owners).

Table 5-7. Risk Assessment ABM Twin Bonanza 1 Project – Air quality and noise / vibration.

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Unacceptable levels of dust generated	<ul style="list-style-type: none"> <li>•Staff</li> <li>• Flora and Fauna</li> </ul>	<ul style="list-style-type: none"> <li>•Staff health issues</li> <li>•Vegetation smothering and secondary effects on fauna</li> </ul>	<b>16</b> C=Minor L=Almost Certain	Minimise dust generation	<ul style="list-style-type: none"> <li>•LPSD - Airborne Contaminants, noise and vibration</li> <li>• LPSD - Biodiversity Management</li> <li>•International Erosion Control Associations (IECA) Best Practice Erosion and Sediment Control Guidelines (BPESC) (Books 1-6).</li> </ul>	<ul style="list-style-type: none"> <li>• In accordance to the EMP monitoring and inspections and if required suppression techniques to be employed (i.e. water spray).</li> </ul>	<b>5</b> C=Minor L=Unlikely	<ul style="list-style-type: none"> <li>• Site general manager</li> </ul>	Chapter 8 – Air quality and greenhouse gas emissions  Appendix K – Air Quality Management Plan	
Staff exposed to unacceptable level of dust and atmospheric pollutants	<ul style="list-style-type: none"> <li>•Staff</li> </ul>	<ul style="list-style-type: none"> <li>•Staff health issues</li> </ul>	<b>16</b> C=Minor L=Almost Certain	Minimise dust and atmospheric pollutant generation	<ul style="list-style-type: none"> <li>•LPSD - Airborne Contaminants, noise and vibration</li> <li>•International Erosion Control Associations (IECA) Best Practice Erosion and Sediment Control Guidelines (BPESC) (Books 1-6).</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance of equipment to minimise air emissions as far as possible, avoid activities generating excessive dust and if required implement dust mitigation measures ( i.e. watering and PPE)</li> </ul>	<b>5</b> C=Minor L=Unlikely	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>•Health and safety manager</li> </ul>	Chapter 8 – Air Quality  Appendix K – Air Quality Management Plan	
Disturbance to fauna and/or people associated with excessive noise and vibration	<ul style="list-style-type: none"> <li>•Fauna</li> <li>•Staff</li> </ul>	<ul style="list-style-type: none"> <li>•Changes in behavioural activity of fauna</li> <li>•Staff fatigue and injury including hearing loss</li> </ul>	<b>12</b> C=Minor L=Likely	Minimise disturbance to fauna and/or people associated with excessive noise and vibration	<ul style="list-style-type: none"> <li>•NOHSC:1007 (2000) - National Standard for Occupational Noise.</li> <li>•AS/NZS 1269.3:2005 - Occupational noise management – hearing protector program</li> <li>•LPSD - Airborne Contaminants, noise and vibration</li> <li>• LPSD - Biodiversity Management</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance of equipment to minimise noise emissions as far as possible, avoid activities generating excessive noise and vibration and if required implement mitigation measures (i.e. PPE and hours of work).</li> </ul>	<b>5</b> C=Minor L=Unlikely	<ul style="list-style-type: none"> <li>•Chief operating officer</li> <li>•Environmental manager</li> <li>•Health and safety manager</li> </ul>	Chapter 16 – Additional environmental impacts  Appendix Y -Noise Management Plan	
Inappropriate operation of vehicles, plant and equipment	<ul style="list-style-type: none"> <li>•Flora and Fauna</li> <li>•Staff</li> </ul>	<ul style="list-style-type: none"> <li>•Flora and Fauna deaths and injury</li> <li>•Staff injury and deaths</li> </ul>	<b>16</b> C=Minor L=Almost Certain	Adoption of appropriate vehicle practices	<ul style="list-style-type: none"> <li>•LPSD - Airborne Contaminants, noise and vibration</li> <li>• LPSD - Biodiversity Management</li> <li>•International Erosion Control Associations (IECA) Best Practice Erosion and Sediment Control Guidelines (BPESC) (Books 1-6).</li> </ul>	<ul style="list-style-type: none"> <li>• Training, inductions and supervision of staff.</li> </ul>	<b>5</b> C=Minor L=Unlikely	<ul style="list-style-type: none"> <li>• Site general manager</li> <li>•Camp manager</li> <li>•Processing manager</li> </ul>	Chapter 6 –Biodiversity  Appendix S – Vehicle Management Plan	

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Indirect disturbance to heritage sites associated with excessive vibration and dust from construction and operating activities	<ul style="list-style-type: none"> <li>Local Community</li> <li>Traditional Owners</li> </ul>	<ul style="list-style-type: none"> <li>Loss of scientific and cultural value</li> </ul>	<p><b>8</b> C=Minor L=Moderate</p>	No adverse disturbance to heritage sites associated with excessive vibration and dust from construction and operating activities	<ul style="list-style-type: none"> <li>LPSD - Airborne Contaminants, noise and vibration</li> </ul>	<ul style="list-style-type: none"> <li>Avoidance if practicable and design activities to minimise vibration and dust.</li> </ul>	<p><b>5</b> C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>Chief operating officer</li> <li>Environmental manager</li> </ul>	<p>Chapter 8 – Air quality and greenhouse gas emissions</p> <p>Appendix K – Air Quality Management Plan</p> <p>Chapter 16 – Additional environmental impacts</p> <p>Appendix Y -Noise Management Plan</p> <p>Appendix U - Cultural and Heritage Management Plan</p>	<p>Cultural and Heritage Management Plan reviewed and approved by CLC (on behalf of traditional owners).</p>



Table 5-8. Risk Assessment ABM Twin Bonanza 1 project – Cyanide.

Potential events	Receptor / surrounding environment	Potential environmental impacts	Gross risk value	Environmental objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS section / Management Plan	Stakeholder feedback
Poor management and usage of cyanide during small scale concentrate leaching.	<ul style="list-style-type: none"> <li>Staff</li> <li>Fauna</li> <li>Surface water</li> <li>Ground water</li> </ul>	<ul style="list-style-type: none"> <li>Staff injury or death</li> <li>Fauna injury or death</li> <li>Degradation of surface and ground water quality.</li> </ul>	<p><b>8</b> C=Minor L=Moderate</p>	No incidents of poor management and usage	<ul style="list-style-type: none"> <li>International Cyanide Management Code - International Cyanide Management Code For the Manufacture, Transport, and Use of Cyanide In the Production of Gold</li> <li>LPSD - Hazardous Materials Management</li> <li>LPSD - Cyanide Management</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of the Cyanide code where practicable.</li> <li>Training of staff in handling and usage.</li> <li>Secondary containment of storage facility, pipes and mixing facility.</li> <li>Installation of a recycling and detoxification module in the Concep Acacia Refinery System.</li> </ul>	<p><b>5</b> C=Minor L=Unlikely</p>	<ul style="list-style-type: none"> <li>Processing manager</li> </ul>	<p>Chapter 10 – Tailings and waste management</p> <p>Appendix I – Tailings Storage Facility Geotechnical Conceptual Design report</p>	

Potential Events	Receptor / surrounding environment	Potential environmental impacts	Gross Risk value	Environmental Objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS Section / Management Plan	Stakeholder Feedback
Poor management and scheduling of rehabilitation resources including topsoil and clearing beyond approvals	•Flora and Fauna	•Non-sustainable ecosystem	<b>13</b> C=Moderate L=Moderate	Adoption of appropriate rehabilitation practices	•LPSD - Mine Rehabilitation (2006) •LPSD - Evaluating Performance: monitoring and auditing	<ul style="list-style-type: none"> <li>•Prior to clearing vegetation clearing procedure form is required to be completed.</li> <li>•All areas to be cleared will be clearly marked.</li> <li>•Clearing will be supervised and the details of the clearing will be conveyed to the machinery operator.</li> <li>•Adhere to management of topsoil procedure as detailed in Land Clearing Procedure.</li> </ul>	<b>9</b> C=Moderate L=Unlikely	•Environmental manager	Chapter 11 Mine closure and rehabilitation  Appendix O - Mine Closure Plan  Appendix P - Conceptual Care and Maintenance Plan	Mine Closure Plan and Conceptual Care and Maintenance Plan reviewed and approved by CLC (on behalf of traditional owners).
Poor life of mine planning	•Flora and Fauna •Local Community	•Failure to optimise rehabilitation leading to environmental degradation	<b>13</b> C=Moderate L=Moderate	Planning throughout life of mine	•LPSD - Mine Rehabilitation (2006) • LPSD - Mine Closure and completion	•Incorporate into operations via dynamic closure plan.	<b>9</b> C=Moderate L=Unlikely	•Chief operating officer •Environmental manager		
Failure to undertake progressive rehabilitation	•Flora and Fauna •Local Community	•Increasing economic , social and environmental liabilities	<b>8</b> C=Minor L=Moderate	Where practicable implement progressive rehabilitation	•LPSD - Mine Rehabilitation (2006)	• Practicable and appropriate scheduling of rehabilitation in accordance to closure plan requirements.	<b>5</b> C=Minor L=Unlikely	•Environmental manager	Chapter 11 Mine closure and rehabilitation  Chapter 6 – Biodiversity  Appendix O - Mine Closure Plan	Mine Closure Plan and Care and Maintenance Plan reviewed and approved by CLC (on behalf of traditional owners).
Inappropriate resourcing for rehabilitation	•Flora and Fauna •Local Community	•Failure to optimise rehabilitation leading to environmental degradation	<b>13</b> C=Moderate L=Moderate	Appropriate resourcing levels for rehabilitation	•LPSD - Mine Rehabilitation (2006)	• Ensuring resources are available and management are aware of environmental commitments.	<b>9</b> C=Moderate L=Unlikely	•Chief operating officer •Environmental manager	Appendix P -Conceptual Care and Maintenance Plan  Appendix D – Biodiversity Management Plan	
Poor closure implementation	•Flora and Fauna •Local Community	•Increasing economic , social and environmental liabilities	<b>8</b> C=Minor L=Moderate	Provide for appropriate closure implementation	•Mine closeout objectives NT DME Advisory Note: CA7-011 • Guidelines for Preparing Mine Closure	• Mine Closure plan and subsequent activities supervised by suitably qualified	<b>5</b> C=Minor L=Unlikely	•Environmental manager		

Potential Events	Receptor / surrounding environment	Potential environmental impacts	Gross Risk value	Environmental Objectives	Standards/ Codes of Practice adhered to	Management, mitigation and controls	Net risk after controls	Responsibility	Applicable EIS Section / Management Plan	Stakeholder Feedback
					Plans - Western Australia •LPSD - Mine Closure and Completion (2006)	people.				
Ineffective rehabilitation	<ul style="list-style-type: none"> <li>•Flora and Fauna</li> <li>•Local Community</li> </ul>	<ul style="list-style-type: none"> <li>•Erosion, non sustainable ecosystems and downstream effects</li> <li>•Loss of aesthetic values</li> </ul>	<p><b>8</b></p> <p>C=Minor L=Moderate</p>	Effective rehabilitation	•LPSD - Mine Rehabilitation (2006)	<ul style="list-style-type: none"> <li>• Complete appropriate studies incorporating waste rock, tailings, water management and vegetation.</li> <li>• Ensure appropriate levels of resourcing and machinery.</li> </ul>	<p><b>5</b></p> <p>C=Minor L=Unlikely</p>	•Environmental manager		
Premature mine closure	<ul style="list-style-type: none"> <li>•Flora and Fauna</li> <li>•Local Community</li> <li>•Regulatory agencies</li> </ul>	<ul style="list-style-type: none"> <li>•Erosion, non sustainable ecosystems and downstream effects</li> <li>•Loss of aesthetic values</li> <li>•Increased cost to regulatory agencies and community for appropriate rehabilitation</li> </ul>	<p><b>13</b></p> <p>C=Moderate L=Moderate</p>	Provide for premature mine closure	<ul style="list-style-type: none"> <li>•Mine closeout objectives NT DME Advisory Note: CA7-011</li> <li>• Guidelines for Preparing Mine Closure Plans - Western Australia</li> <li>•LPSD - Mine Closure and Completion (2006)</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure a clear Care and Maintenance Plan and Mine Closure Plan, are resourced.</li> </ul>	<p><b>9</b></p> <p>C=Moderate L=Unlikely</p>	<ul style="list-style-type: none"> <li>•Managing director</li> <li>•Chief operating officer</li> </ul>		

## 5.4 Risk management plans

ABM environmental management plans for the proposed project are outlined below and can be found in detail in Chapter 14: Environmental management system and the following management plans:

- a. Biodiversity Management Plan
- b. Water Management Plan
- c. Mine Closure Plan
- d. Care and Maintenance Plan
- e. Ground Disturbance Management Plan
- f. Erosion and Sedimentation Control Plan
- g. Hazardous Substances Management Plan
- h. Weed Management Plan
- i. Social Impact Management Plan
- j. Cultural Heritage Management Plan
- k. Fire Management Plan
- l. Noise Management Plan
- m. Biting Insects Management Plan
- n. Air Quality Management Plan
- o. Emergency Response Management Plan

The MMP will be completed for the proposed project during the EIS assessment and once the Mineral Lease has been granted. The MMP will incorporate the risk management detailed in the EIS particularly chapters 5 and 14, and the elements of the project that will be implemented over the period as part of the staged development approach at the Twin Bonanza project.

## 5.5 Incident management

Incident management aims to identify hazards, system deficiencies to prevent recurrence of the incidents. Moreover, findings from investigations will be used to take corrective action and implement measures to prevent future occurrence.

At the Twin Bonanza project the incident management process will involve:

1. incident reporting
2. incident investigations
3. development and implementation of corrective actions
4. documenting incidents in the incident register
5. statutory incident reporting if required

6. communicating incidents across operational staff and the organisation.

In the event of an incident within the project, ABM will implement the following:

- on-going maintenance of the register for personnel to identify and report hazards and incidents.
- establishing and maintaining a process for the investigation of all incidents. Additionally, a process for follow-up, close-out, and feedback of information to relevant personnel will be undertaken on the success of any implemented corrective actions.
- priority given to corrective and preventive actions
- establishing and maintaining a process to ensure all legislative recording and reporting requirements are met
- recording and investigating internal and external complaints related to safety, health and environmental aspects of the operations
- using findings from incidents and non-conformance to improve systems, procedures and processes.

### **5.5.1 Incident notification**

(Work Health and Safety (NUL) Act 2011 s.35 to s.39)

Notifiable incident means the death of a person; a serious injury or illness of a person; or a dangerous incident.

The site general manager must keep a record where a person suffers an injury or illness that requires immediate medical attention at the mine or in the surrounding area. Depending on the nature of the incident, NT Work Safe Regulator should be notified as soon as practicable but no longer than 24 hours after the incident has occurred. These are further defined below.

#### **5.5.1.1 Dangerous incidents**

A dangerous incident is defined as an incident in a workplace that exposes a worker or any other person to a serious risk to a person's health or safety emanating from an immediate or imminent exposure to a serious injury or illness, including but not limited to:

1. an uncontrolled escape, spillage or leakage of a substance
2. an uncontrolled implosion, explosion or fire
3. an uncontrolled escape of gas or steam

4. an uncontrolled escape of a pressurised substance
5. electric shock
6. the fall or release from a height of any plant, substance or thing
7. the collapse, overturning, failure or malfunction of, or damage to, any plant that is required to be authorised for use in accordance with the regulations
8. the collapse or partial collapse of a structure
9. the collapse or failure of an excavation or of any shoring supporting an excavation
10. any other event prescribed by the regulations.

#### **5.5.1.2 Serious injury or illness**

A serious injury or illness is defined as an injury or illness requiring a person to have:

1. immediate treatment as an in-patient in a hospital
2. immediate treatment for any of the following: the amputation of any part of his or her body, a serious head injury, a serious eye injury, a serious burn, the separation of his or her skin from an underlying tissue, a spinal injury, the loss of a bodily function or serious laceration
3. medical treatment within 48 hours of exposure to a substance
4. any other injury or illness prescribed by the regulations.

All accidents/injuries must be reported to a supervisor and a written report must be submitted. Reports of “occurrences” must be submitted to NT Work Safe and will be prepared by the site general manager in consultation with the managing director.

#### **5.5.2 Environmental incidents**

Similarly “significant” environmental incidents and spills must be reported to the Department of Mines and Energy (DME) and in some situations reported to the Department of Land Resource Management (DLRM). All environmental events/incidents/near misses and investigation reports must be documented in the site environmental register.

### **5.6 Emergency management**

ABM has an Emergency Response Management Plan (ERMP) which has been written as a component of the ABM safety management system for the Twin Bonanza project and surrounds. The ERMP details the:

- emergency preparedness, and prevention
- resources and measures
- response procedures and recovery
- post-emergency activities specific to mining activities.

The ERMP applies to all personnel working with, or under contract to, ABM at the Twin Bonanza project, and is a requirement of the *Work Health and Safety (National Uniform Act) 2011* under Division 2 Primary Duty of Care.

The aims of the ERMP are to:

- 1 prevent subsequent injury or loss of life
- 2 minimise property loss, damage to equipment and the environment
- 3 provide a chain of command to ensure that there is a prompt and coordinated approach to emergency situations
- 4 ensure all necessary equipment, personnel and other resources are available for effective control of an emergency situation
- 5 ensure all personnel are aware of their responsibilities in the event of an emergency.

The EMRP covers the following emergency events:

- 1 injury / medical emergency / fatality
- 2 fire
- 3 explosion
- 4 pit wall failure
- 5 flood / sediment dam failure and overflow of ponds
- 6 tailings pipeline leak
- 7 hazardous chemical / material spills or releases
- 8 vehicle accident

The ERMP provides step-by-step guidance for the management of any emergency such as fire, flood, dam collapse, fuel spill and explosion, which can impact the site. Emergency procedures are reviewed annually for relevance and effectiveness. Changes arising at any time are communicated to all employees and contractors through regular safety meetings. All areas of the operation are required to undertake regular evacuation drills.

An annual review of the procedures is undertaken. Any changes made to the operation, which will impact on emergency response, are included in this review process. Changes will also be made as necessary throughout the year. Updated procedures are made available to all managers in hard copy form, with copies kept in other locations. Copies are made available for all staff. A copy of ERMP has been provided at Appendix R.