CHAPTER 4 – Project rationale and alternatives

4.1 Introduction

This chapter addresses the rationale, benefits and alternatives to carrying out the Twin Bonanza 1 mine development. The project is designed to achieve best production portfolio (via staged approach), whilst reducing negative environmental and social impacts. Alternatives considered as part of the process are also discussed in this chapter.

4.2 Project rationale and benefits

The development of the Twin Bonanza mine presents many benefits:

- Direct employment opportunities:
- Indigenous employment programs
- decreased overall unemployment
- increased income tax and payroll tax contributions.
- Increasing gold production as contribution to the economy of Australia including:
- increased GDP and net exports of Australia
- increased GSP and net exports of the Northern Territory.
- Increased contractor / business opportunities to regional centres including Alice Springs.
- Increased revenues to the Central Land Council (CLC)/ Traditional Owners (as key stakeholders).
- Increased revenues to the Northern Territory Government through the *Mineral Royalty Act 1982* (NT).
- Return to ABM shareholders on exploration and development investment in the region.
- potential for increasing share price and dividends.

The above benefits (a) to (e) are also detailed in the social impact assessment in Chapter 14 and the detail of the staged approach is also described in Chapter 3.

4.2.1 Market opportunities

Based on stage 2 and stage 3 developments the project will be a low-cost / high-grade gold project. The staged approach involves capital development spread over several years. The project is estimated to produce 50,000 to 100,000 ounces per annum.

Gold uses, applications and demand

Gold is an internationally traded commodity with principal uses as:

1. investment / monetary instrument
2. jewellery
3. electronics

4.2.1.1 Global and national gold production

Global gold production in 2012 was 2700 tonnes (approximately 86 million ounces) (source www.kitco.com). Australia's gold production in 2012 was 250 tonnes (8 million ounces) making Australia the second largest gold producer in the world (after China). Australia's gold production has, however, been in decline since its peak of 312 tonnes in 1998. This is principally due to lower grades and depleting resource / reserve basis.

The gold production from the Old Pirate deposit, within the Twin Bonanza project, stage 2 to stage 3 is forecast to be approximately 0.6 to 1.0% of Australia's national production.

Given that gold is a free-traded commodity it has large demand and is classed as one of the most liquid commodities in the world. Over the past 10 years the world has generally been in a gold 'bull' market where prices have been steadily increasing. This has been driven by demand from burgeoning middle class in emerging economies (e.g China and India) and investment demand driven by a response to world-wide government quantitative easing since the 2009 global financial crisis.

In April 2013 gold experienced one of its largest corrections in price (on a percentage basis) ever where its value fell from over $1600 per ounce to $1220 per ounce. However, since then and with the weakening Australian dollar the gold price has recovered in Australian dollar terms.

In the recent gold price environment Australia has seen a number of mines close or be put on care and maintenance. The main reason for closure is that many of Australia's mines have depleting resources/reserves and the projects have only survived due to a high gold price. As the higher grade zones have generally been depleted in the past the mining has followed lower and lower grades. The Old Pirate deposit does not suffer from grade legacies and is a 'never before developed' discovery at surface and hence has considerable advantages for economic recovery and low-costs compared to other operations. Nevertheless, the Twin Bonanza 1 operations will still be affected by the vagaries of the global gold market.

Figure 4-1. Ten year gold price in Australia and US dollars per ounce. Source: www.goldprice.org.

4.2.2 Consequences of not proceeding with the proposed project

Although the project not proceeding would eliminate any environmental impact associated with the mine, the development of the project has the potential to provide social and economic benefits to the Traditional Owners (via the CLC) of the land on which the project is to be developed. These benefits will take the form of payments, royalties, direct employment and potential infrastructure development. Further details of these aspects are provided in the Chapter 13. In a more regional context the project will provide opportunities for businesses and individuals in regional centres to provide labour, goods and services to the project. During the life of the project all levels of government to varying degrees will collect taxes, rates and royalties from the project as required under law. These monies may be assigned to infrastructure projects or social programs that benefit the wider community.

Development of the project would highlight that the Northern Territory is a region that encourages resource investment and money generated from the project would fund ABM to conduct ongoing exploration. Exploration in the region has the potential to discover further economic resources for potential development. If the project was not to proceed the above social and economic benefits would not be realised.

In planning the project, ABM has paid particular emphasis to minimising impacts on heritage and environmental values in the area. Additionally, closure planning has been integrated into mine planning which has resulted in the early identification and proposed management of suitable rehabilitation material. It is anticipated that by mitigating the key environmental risks and ensuring successful rehabilitation the project's environmental liabilities will be minimised.

4.2.3 Viability of the project

Given the high-grades and the open pit mining techniques to be applied at Twin Bonanza, it is anticipated that the project will be initially break-even at gold prices of $500 to $600 per ounce or more. The project is modelled to be one of the lowest cost producers in Australia and as a result will be able to endure short to medium term fluctuations in the gold price. Whilst the project has a relatively short mine-life (Stage 2 = 2 years, Stage 3 = 3 to 4 years) the company will embark on near-mine exploration with the intention of discovering other nearby near-surface resources.

Economic forecasts for future gold price are notoriously difficult. Many commentators see the potential of increasing inflation in the Western world driving gold prices beyond $2000 per ounce. Other commentators see slowing growth in emerging economies resulting in a drop in global gold market. The value of the Australian dollar to the US dollar also plays an important part in viability.

4.3 Environmental objectives

ABM is committed to operating in a responsible manner, which minimises impact on the environment. In addition to its obligations to the traditional landowners, ABM will meet all of the requirements of the Northern Territory and the Commonwealth in the establishment and operations of this project. A detailed Mining Management Plan (MMP) will be completed that will utilise findings of the EIS. Environmental contingencies will be covered in detail by this process.

4.3.1 Corporate environmental statement

ABM's corporate environmental statement is as follows below (ABM 2013):

"ABM Resources is committed to responsible exploration and development. ABM conducts its exploration to minimize impact of the environment and has ongoing programs of environmental rehabilitation.

ABM acknowledges its responsibilities to conduct its business in harmony with the stakeholder's and wider community's desire to protect the natural environment. ABM recognizes 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 of the areas in which it works.

Exploration discovery by ABM is for the benefit of both the shareholders and stakeholders including the Traditional Owners."

ABM is committed to operating in a responsible manner, which minimises impact on the environment and will do it's best to:

- 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 ABM work.
- reduce waste, recycle and recognise the by-product of ABM's 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.

4.3.2 Sustainable development policy

Mining of finite resources is by definition not 'sustainable'. However, throughout ABM's operations ABM intend to grow the company with on-going investment in exploration and acquisition (as well as returns to shareholders) for the future of the company, the Central Desert, the Traditional Owners, the Northern Territory and Australia as a whole.

The company constantly reviews, develops, implements and maintains management systems for sustainable development that drives continual improvement. ABM will ensure that operations at Twin Bonanza 1 will:

- operate safely and constantly strive to minimise health and safety risk to employees, contractors and visitors to ABM's areas of business
- identify, assess and manage other risks to employees, contractors and the communities in which ABM operate

- support and encourage ABM's employees to not only be a contributor to the company but to be contributors to the well-being of their own families and communities
- conduct ABM's business ethically and honestly and within the legal frameworks of local, territory and federal government
- operate under the process of equality with equity – (treating all people fairly)
- acknowledge and uphold human rights respecting Traditional Owners and indigenous Australians along with the other races, religions and diversity of multi-cultural Australia
- strive to review ABM's performance and report progress to shareholders and the wider populous
- always strive for energy efficiency and to limit greenhouse gas intensity reducing and preventing pollution.
- strive to protect and even enhance biodiversity with emphasis on the native flora and fauna and reducing the negative effects of introduced species where possible
- engage openly and honestly with the governments, their representatives and the statutory offices and authorities.

4.4 Project alternatives

4.4.1 Introduction

A number of project alternatives were considered for the various aspects of the project. ABM conducted scoping studies which incorporated those alternatives. Scoping studies took into account economics, technical feasibility and environmental aspects of the project.

Table 4-1 details the project alternatives and discusses the exploration of the alternatives by ABM Resources.

The project alternatives and options considered in the project include:

- alternative Location
- non-traditional development path – staged approach versus full feasibility
    - open pit optimisation and mining schedules, to enable sustainable production in a controlled manner
- proceeding to mining without further exploration
- on site processing
    - run-of-mine (ROM) ore handling, preparation and processing
    - bulk concentrate handling and transportation
- processing method
- a range of mining methodologies, including improvements in energy consumption and efficiencies

- on site treatment of concentrate
- methods of tailings storage
- mining method – selective versus bulk
- open pits vs underground
- optimisation and efficiency of water usage
    - raw water supplies for construction and operations
    - improved water storages to capture and reuse mine affected water
- location of processing facilities
- disposal of general waste after all recycling options have been exhausted
- disposal of sewage
- power supply during construction and operations
    - distribution of site power
    - energy use and efficiencies
- open pit size
- overburden and tailings disposal for long-term, stable landforms
- accommodation options
- methods to transport the construction and operations workforce
- rehabilitation methods
- environmental management techniques
- final void management
- no project.

4.4.2 Alternative location

The nature of the Old Pirate Gold deposit and the nature of high-grade gold mining require that the operations must be located at fixed locations close to the deposit. There are no feasible options in relocating the mining operation. Prior to the trial bulk sampling an alternative location for the processing of the ore was considered, however due to the installation of infrastructure including a mill and processing plant changing the location of the processing plant is not financially viable. In addition processing offsite may increase environmental impacts regionally due to increased traffic volumes, dust issues, disposal of tailings and waste on another site etc.

ABM has devised the following mitigation measures to prevent the need to move the site to an alternative location, whilst reducing environmental impact:

1. backfilling pits – as practicable
2. locating the infrastructure to avoid low lying areas and reduce flooding risk and shallow groundwater issues
3. positioning tailings dam over areas of already naturally anomalous arsenic soils to reduce environmental impact of tailings

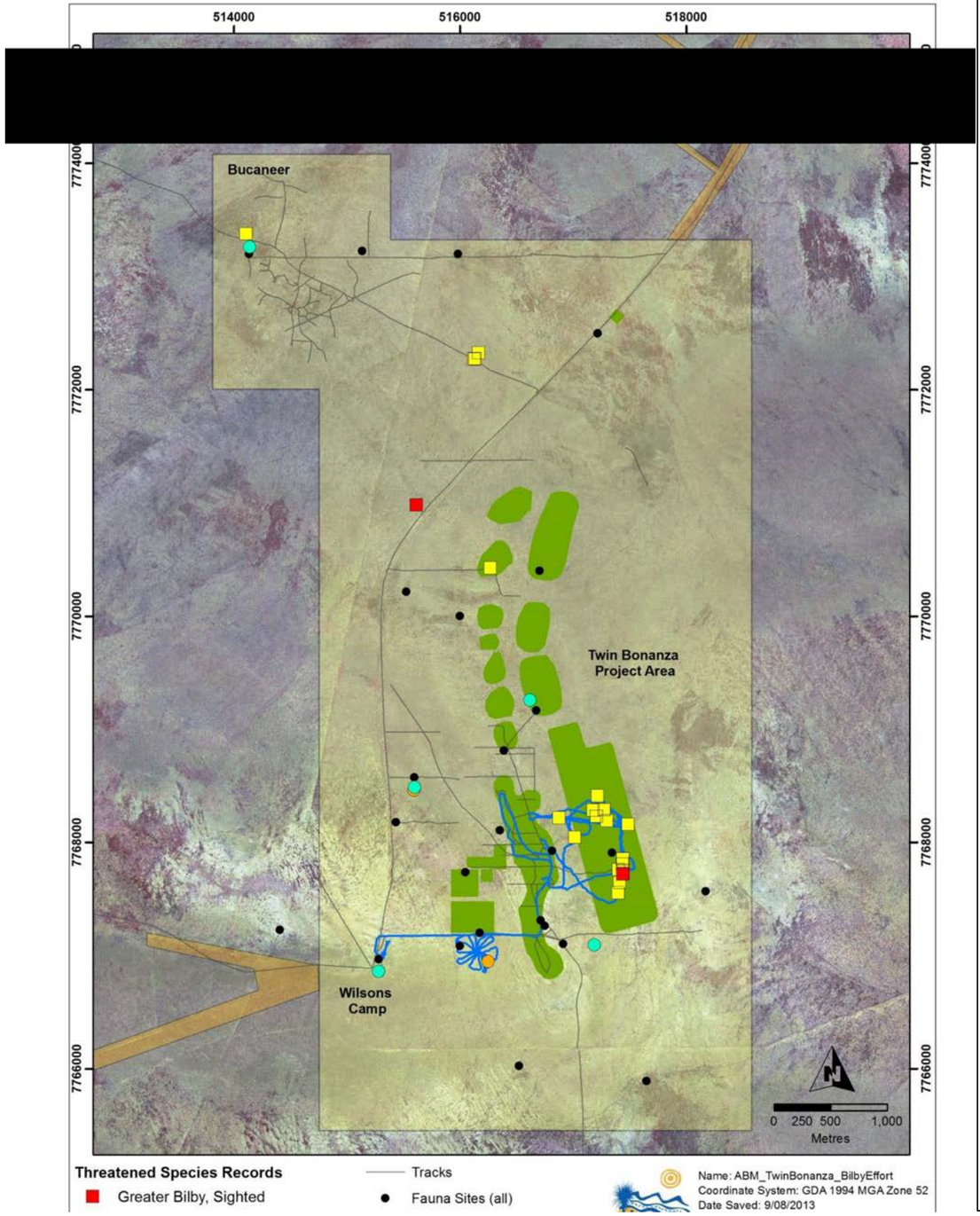
4. moving infrastructure to avoid bilby and other marsupial habitats and prevent disturbance

The resource, processing plant, key infrastructure and mine personnel need to be located within relatively close proximity of each other in order for the project to be profitable and sustainable. Every additional kilometre of haulage and employee travel, decreases efficiency, thus increasing energy consumption, emissions and environmental impacts which ultimately decreases the project's economic value. The refinement of the project design and location has resulted in a reduced impact on local bilby a species defined as a matter of national environmental significance, with protection afforded under the controlling provisions of Part 3 of the *EPBC Act 1999*.

The changes to site infrastructure position can be illustrated in Figure 4-2, whereby the original infrastructure including waste rock dumps located to the east of the pits would disturb and truncate an area of known bilby activity. By moving all infrastructure west of the pits the following outcomes have been achieved:

1. minimal clearing within a habitat prospective for bilby
2. limited habitat fragmentation as surveys to the west of the pits have not identified any bilby activity
3. a demarcation between active bilby areas and mine infrastructure has significantly reduced the potential for vehicle and bilby interaction on the eastern margin of the project.

In the situation of access roads that cut across habitat preferred by bilbies, there is limited to no ability to relocate the road to avoid vehicle and bilby interaction. The existing access tracks have been established for many years and no incidents have occurred, to ABM's knowledge, to this point in time. ABM proposes to manage vehicle and bilby interaction and potential collisions by regulating speeds through these areas to afford both the vehicle driver and bilby time to adjust so that a collision can be avoided. Further details are provided in Chapter 6.



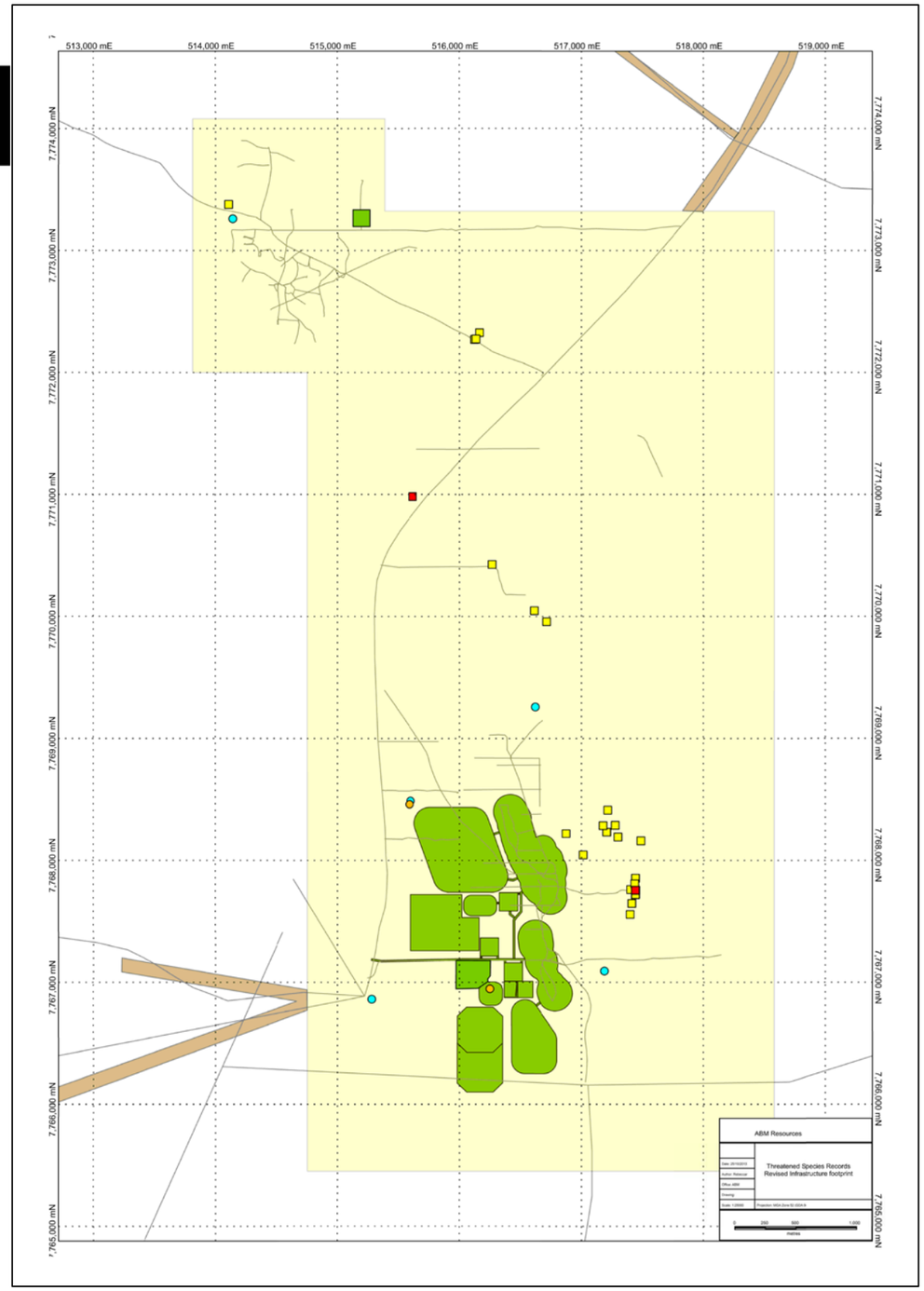


Figure 4-2. Left: Flora and fauna survey threatened species locations in relation to proposed infrastructure May 2013 (EcOz 2013). Right: Revised infrastructure footprint in relation to flora and fauna threatened species locations October 2013.

4.4.3 Internal project alternatives

Alternatives within the project site itself, such as the location of components of infrastructure and the choice of technologies and methodologies to be utilised become very important for maintaining the project's profitability and reducing potential environmental impacts. These alternatives are discussed in Table 4-1.

Potential adverse and beneficial effects of the project's alternatives will have little effect at a national level, however as detailed in Table 4.1 a number of alternatives have been assessed in respect to a territory, regional and local context. The proposed options reflect a balance between robust environmental outcomes, successful closure and project viability. The original location environmental management and design of the project as illustrated in Figure 4-2 adversely:

1. impacted on matters of national environmental significance
2. limited closure success by not managing rehabilitation materials
3. affected the likelihood of fragmenting habitats
4. more surface water catchments.

Table 4-1. Project alternative's explored by ABM

Item	Proposed process	Alternative Process	Discussion
Development path	Staged approach	Full feasibility	A risk analysis of the project and the reasons why other projects fail is due to incomplete risk analysis. The trial mining (stage 1 – currently underway) is equivalent of a feasibility study, but costs considerably less than a standard feasibility study and provides better quality information. Further, stage 2 is designed for low environmental impact / low capital costs as an alternative to building a larger scale plant for a larger mine-plan. The staged approach takes advantage of 3 key engineering advantages: 1. The project is at surface (no pre-strip / overburden removal required) 2. The project is open-pit (no capital intensive underground development required). 3. The project is high-grade at 5 times the average open pit grade in Australia.
Proceeding to mining without further resources / exploration	To proceed to small scale mining	Further exploration or consider incorporating other deposits	The project has enough existing resources to rapidly pay back capital investment and provide profit for on-going exploration. ABM considered combining Old Pirate with the nearby / large scale Buccaneer deposit within the Twin Bonanza project area; however; this would have required a larger scale plant. These alternatives will be considered in the future, however do not form part of the EIS.
On site processing	On site processing with small scale plant	Approach nearby operations for toll treatment of ores.	This was considered seriously, and is still possibly an option depending on the outcome of the trial mining (stage 1) and studies around stage 2. This relies on being able to successfully negotiate access. Offsite processing would result in increased traffic volume or require construction of haul roads posing risks to the flora and fauna.
Processing method	Gravity processing with small scale cyanide leaching of concentrates	Installing cyanide based processing.	Cyanide based processing will likely recover more gold than gravity only methods. However, cyanide processing 1. requires more capital expenditure 2. has more environmental hazard risks 3. may not be required subject to results of the trial mining.

			Cyanide processing may be considered in the future but is not part of the immediate plan.
On site treatment of concentrate	Producing gold dore	Producing gold rich concentrate	Producing gold dore means that the final product from the mine can be flown out. Producing gold concentrate will require road transport and thus increases traffic flow and security risks.
Tailings storage	Above and below ground dams. Small leach concentrate residual dam.	Below ground dams / lined with HDPE	Assessment of the tailings dam design and location included consideration of tailings characterisation, the staged development approach, positioning close to rehabilitation resources and minimising upstream surface water catchments. The tailings dam is located in: 1. an area that will have a limited catchment area due to the locations of the pits 2. a mineralised soil that is characterised by elevated arsenic Due to the potential for arsenic in the tailings, thus reducing the potential contrast 3. an area that allows for up scaling during the staged approach while retaining the ability to rehabilitate at any stage of the project. Using a Knelson concentrator, or equivalent, to recover fine gold from the tailings will also remove heavier minerals including sulphides. Subsequently the sulphides contained in the bulk tailings is less with the residual leach concentrate reporting to a separate lined concentrate residual dam. The company is proposing the bulk tailings dam permeability will be 1 x 10-8. The area for disposal is situated on an un-fractured granite body with high-natural clay content and low permeability. To achieve the permeability the dam will either have the insitu material conditioned to the required permeability or be lined with clay.
Mining method (selective vs bulk)	Selective mining of narrow gold bearing quartz veins.	Bulk mining taking material between veins as dilution / inter-burden.	Selective mining involves removing minimal ore material but also increases the ratio of ore to waste removed. Bulk mining methods increase the amount of material being processed leading to increased tailings volumes. Bulk mining will require a larger footprint including larger processing facility and tailings dams.
Open pit vs underground	Open pit	Underground	The Old Pirate gold deposit starts at surface. Underground mining is not practical in the oxide environment due to risk of geotechnical failure. Below the oxide (>60 to 100m)

			underground mining may become a better alternative due to less waste moved and stored above ground.
Alternative water sources	Bore water from multiple sources or bore fields	Bore water from 2 sources	The potential water sources in the area are characterised by palaeochannel systems and fractured rock aquifers. With the small plant the project requires only a small amount of water relative to many other deposits in Australia. Nonetheless, using multiple sources will allow flexibility in water extraction to manage the drawdown effect on the paleochannels as those areas have be identified as containing higher biodiversity. In additional water recycling will be implemented.
Mine affected water	Recycling / evaporation	Disposing of water into paleo channels	All water used will be recycled or evaporated by nature processes thus reducing risk of contamination into natural channels.
Inert rubbish disposal	On site disposal	Offsite disposal	For most inert items such as general waste, the rubbish will be disposed on site. Off-site disposal will involve trucking waste >800 kilometres to Alice Springs thus increasing road use, emissions and costs of the project. Where practicable ABM will recycle and reuse when the process is a viable option.
Sewage disposal	Septic tanks	Other disposal methods	Septic tanks are considered safe with low risk of contamination into ground water systems that are present in the proposed location of the accommodation village.
Power generation	Diesel generators	Solar or other renewable sources	The project is not located within distance of grid power or gas pipelines. Diesel generators offer the lowest cost alternative. However, the region is also subject to some of the highest solar generating capacity in Australia. Hence the company is considering solar options for generating power and has a research project being defined with SunTrof Pty Ltd for direct solar thermal technologies.
Location of Processing facilities	Location proximal to deposit	Location off-site or further distance.	The processing facilities have been located based on the following factors , with the aim to optimise a processing operations and reduce environmental impact: 1. close to operations 2. in a location with soils that are naturally high in arsenic 3. low flooding risk 4. no heritage sites 5. does not directly affect bilbies in direct proximity.

Waste rock disposal for long term stable landform	Two 10 metre lifts with batters of 15 degrees and a berm at 10 metres.	Single slope of 15 degrees	Erosion modelling demonstrated that within the first 100 years that sediment would be contained in the waste dump footprint and that over 1000 years a vegetated waste dump would be stable, safe and sustainable. (Further information is provided in Appendix AB: Topsoil characterisation and erosion analysis.)
Waste-rock location	Waste dumps located west of the open-pits	Waste dumps located east of the open-pits.	Surveying of bilby burrows and potential habitat has documented the eastern side of the pits has a high level of bilby activity whereas no active has been identified on the western side of the pit. In addition the location of the waste dumps on the eastern side reduces the environmental impact by: • being located within mineralised soils with similar element enrichment as the waste • intersecting smaller upstream catchments • no heritage sites • minimising the effect on brush-tailed mulgara • by relocating the infrastructure potential bilby and brush-tailed Mulgara habitat fragmentation is minimised • no surface water diversion structures required.
Accommodation options	Extending existing camp location	Building new camp location	Expanding the existing camp location reduces environmental impact by: 1. reducing the clearing of vegetation as existing disturbances utilised 2. not affecting bilby or brush-tailed mulgara as none identified in the area 3. can use existing bores for water source 4. located 1km from the operation to encourage staff to walk to site.
Rehabilitation resources	Selective handling and storage of rehabilitation material including pisolites/gravels, siltstone and sandstone	Source at closure	Selective handling and stockpiling of pisolites/gravel, siltstone and sandstone will result in a larger footprint. However this will be offset by preservation and positioning of the material closer to the site of rehabilitation leading to reduced costs.

Bilby management	Avoid the more prospective bilby habitat and regulate speed limits	Construct infrastructure over bilby habitat and translocate individuals	A review of the bilby conservation literature and after discussions with individuals familiar with bilby ecology. Bilby translocation has met with limited success. The better option is to avoid where practicable preferred bilby habitat, demarcate preferred habitat and manage vehicle speeds. In addition, a focus on management measure to control threatening processes on bilby survival would aid in maintaining a health local population.
Final void management	Back filling when and where economically practicable	No back-filling	As the project develops investigation will be undertaken to assess the prospect of back filling the disused pits where economically practicable. This provides a balance between minimising the footprint and keeping the viability of future mining opportunities.
No project	Project proceeds	Project does not proceed	The key effects of this project not proceeding are: 1. reduced revenue for the NT Government 2. reduced revenue for the CLC 3. flow on effect as the NT becomes identified as a region that discourages resource investment 4. increased unemployment 5. ABM will suffer reduced revenues and significant drop in share price and will not be able to continue with regional exploration activities.
Roadways / access tracks - flooding	Low pass	Use of causeways across low areas	The main access roads and tracks are well established and have been existing in the environment for many years. There is limited erosion from these roads, to ABM's knowledge; therefore the requirement of causeways is deemed not necessary or practical. Low pass is a better option as it is similar the existing road base and has less potential to erode during flood events unlike causeways. In addition there have been no identified creeks crossing the roads and the majority of the flooding along the main access track is sheet wash.