



QUEST 29 PROJECT

ENVIRONMENTAL ASSESSMENT REPORT AND RECOMMENDATIONS

by the
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and
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DEPARTMENT OF MINES AND ENERGY

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ABBREVIATIONS

ARD	Acid Rock Drainage
CGME	Chief Government Mining Engineer
CIL	Carbon in Leach
DLPE	Department of Lands, Planning and Environment
DME	Department of Mines and Energy
HDPE	High Density Poly Ethylene
MEMP	Mine and Environmental Management Plan
NOI	Notice of Intent
PER	Public Environment Report
TD2	Tailings Dam 2
WQ	Water Quality

EXECUTIVE SUMMARY

This report assesses the environmental impact of Stage 1 of a proposal by Sirocco Resources NL to commence open cut mining for gold at Quest 29. The proposed development (Stage 1) comprises open cut mining of three pits at Quest 29 (Koolpin, Zamu and Taipan Hill), in-situ dump leach treatment of low grade oxide ore, construction of a haul road to Tom's Gully minesite, transportation of high grade oxide ore to Tom's Gully minesite for processing and the re-commissioning of the existing CIL processing facility at Tom's Gully. Both sites are located on an active pastoral property.

Any proposal for development of Stages 2 and 3 must be submitted to the Department of Mines and Energy for assessment within the meaning of *the Environmental Assessment Act*.

This Report reviews the Public Environment Report (PER) and public comments and incorporates information and advice provided by Northern Territory Government agencies.

Environmental impact assessment is the process of defining those elements of the environment which may be affected by a development proposal and of determining the significance, risk and consequences of the potential impacts of the proposal.

Major Issues

The principal environmental issues identified with the proposal for Quest 29 Stage 1 and the construction of associated infrastructure to support the project are:

1. Potential acid generation from mine wastes at Quest 29;
2. Management of cyanide used in the proposed dump leach processing at Quest 29;
3. Water management;
4. Tailings containment;
5. Rehabilitation; and
6. Disturbance to pastoral activities

The potential benefits associated with the proposal include:

1. Increased employment opportunities; and
2. Economic returns for the local community.

Conclusion

It is considered that the environmental issues associated with the proposed project have been adequately identified. Some of these issues have been resolved through the assessment process, while others will be addressed through the MEMP and additional surveys.

Initially, the PER and the recommendations detailed in this Assessment Report will form the basis for proponent's management and monitoring commitments. Mine and Environmental Management Plans (MEMPs) for the Quest 29 operation will be working documents for the operation and will require continual review and updating in the light of operational experience and changed circumstances.

Provided that the environmental commitments and safeguards detailed in the PER are implemented, the recommendations in this Assessment Report are adopted and regular auditing and reporting are undertaken, long term environmental impacts should be minimised.

SUMMARY OF RECOMMENDATIONS

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the Quest 29 Project Public Environment Report (summarised at Appendix 1) and as recommended in this assessment report.

Recommendation 2

A Mine and Environmental Management Plan shall be submitted to the Department of Mines and Energy within 12 months of commencement of operations for approval and at 12 monthly intervals thereafter. This plan is to include details of post-production rehabilitation strategies for the mine site.

Recommendation 3

The proponent should consider becoming, if not already, a signatory to the Australian Minerals Industry Code for Environmental Management.

Recommendation 4

A waste characterisation plan is to be submitted to the Department of Mines and Energy, prior to mining potentially acid forming material.

Recommendation 5

Waste dump location adjacent to pits should be determined only after the slope stability analysis has been assessed and a report given to the Department of Mines and Energy for approval.

Recommendation 6

The final outer batters of the waste dumps should be established as early as possible in the construction of waste dumps.

Recommendation 7

Waste rock should not remain in-situ above ground post mining and should be returned to the pits prior to flooding.

Recommendation 8

The proponent should prepare a waste rock management plan to include but not be limited to:

- Waste rock dump site preparation
- Methods of waste rock characterisation
- Selective handling of material
- Waste dump construction design
- A monitoring system for:
 - ⇒ checking on waste rock placement
 - ⇒ compaction and

⇒ potential acid production

This waste rock management plan should be incorporated into the Mine and Environmental Management Plan for review by the Department of Mines and Energy.

Recommendation 9

Precautions should be taken to prevent the potential for puncture of the leach dump HDPE liner.

Recommendation 10

Reporting of any potentially environmentally significant spill or discharge of water shall be made within 24 hours of the event to the Department of Mines and Energy and a written report shall be submitted within 7 days detailing the extent of impact and remedial measures.

Recommendation 11

The proponent shall apply for a Waste Discharge License under the *Water Act* for any off-site contaminated water discharge.

Recommendation 12

A comprehensive minesite water management plan should be prepared as soon as possible for endorsement by the Department of Mines and Energy. This plan should be incorporated into the Mine and Environmental Management Plan for review by the Department of Mines and Energy.

Recommendation 13

The proponent should submit a water quality management program to the Department of Mines and Energy as soon as possible for endorsement. Water quality programs for baseline and ongoing monitoring are to be conducted in accordance with an agreed program set out by the Department.

Recommendation 14

Flooding of worked out “wet” pits should be done rapidly, for example, through creek diversion activities, to minimize the potential for acid generation.

Recommendation 15

It is recommended that water balance figures be reviewed annually by the proponent prior to the wet season at a date to be fixed by the Department of Mines and Energy. Details of the state of the minesite water balance and the potential for freeboard to be compromised during the wet season are to be presented to the Department for assessment.

Recommendation 16

The proponent should specify in more detail, to the satisfaction of the Department of Mines and Energy, erosion hazard controls for the proposed creek diversion channels and the siltation structure. These controls should become part of the Mine and Environmental Management Plan.

Recommendation 17

Reporting of any potentially environmentally significant spill of tailings shall be made within 24 hours of the event to the Department of Mines and Energy and a written report shall be submitted within 7 days detailing the extent of impact and remedial measures.

Recommendation 18

Sufficient freeboard is to be maintained in Tailings Dam 2 to withstand a 1:100 72 hour storm event. The tailings dam must also be certified to the satisfaction of the Department of Mines and Energy as being structurally sound prior to use. Regular audits by a geotechnical engineer should be part of requirement to indicate the dam is performing within the design specification.

Recommendation 19

An inspection schedule of the tailings circuit should be incorporated into the Mine and Environmental Management Plan.

Recommendation 20

The proponent should provide a Site De-Commissioning and Rehabilitation Plan to the Department of Mines and Energy. This plan should include an itemised estimate of the cost of full, post mining, minesite rehabilitation. This plan should become part of the Mine and Environmental Management Plan.

Recommendation 21

The proponent should consult with the landholder on all aspects of the operations that may impact on the pastoral activities of Perpetual Pastoral Lease 1163. The proponent should ensure that high activity and potentially hazardous areas such as the haul road, mine workings, leach pads and process areas are suitably fenced to exclude cattle from these areas.

Recommendation 22

The proponent shall ensure contaminated waters are polished prior to discharge.

Recommendation 23

If a wetland filter is chosen to polish contaminated water releases, the proponent shall submit a wetland filter management plan that includes, but is not limited to:

- Design specifications (size, vegetation, detention time etc.);
- Flow regime;
- Water Quality;
- Maintenance;
- Monitoring;
- Decommissioning and Rehabilitation.

This wetland filter management plan should be incorporated into the Mine and Environmental Management Plan for review by the Department of Mines and Energy.

Recommendation 24

The proponent should develop a fire management plan in consultation with the land holder and submit this to the Parks and Wildlife Commission for approval. This plan should become part of the Mine and Environmental Management Plan.

Recommendation 25

The proponent should establish procedures, based on Australian Standards and in accordance with the *Dangerous Goods Act*, for the handling and storage of chemicals, fuels and explosives. These procedures should be included as part of the Mine and Environmental Management Plan.

Recommendation 26

The proponent shall consult with and seek approval from Territory Health Services for the design and installation of ablution facilities at the Quest 29 site.

Recommendation 27

The proponent must apply to the Department of Transport and Works for approved access from the Arnhem Highway.

Recommendation 28

Haul road construction design details, incorporating effective erosion control measures, are to be submitted to the Chief Government Mining Engineer (CGME) for approval prior to construction.

Recommendation 29

In consultation with the land holder the proponent should submit a Weed Management Plan, to the Department of Primary Industry and Fisheries for approval prior to the commencement of operations. This plan should be included in the Mine and Environmental Management Plan.

Recommendation 30

Monitoring for mosquito larvae shall be conducted in consultation with Medical Entomology Branch, Territory Health Services.

1. INTRODUCTION AND BACKGROUND

This report assesses the environmental impact of Stage 1 of a proposal by Sirocco Resources NL to commence open cut mining for gold at Quest 29. The proposed development (Stage 1) comprises open cut mining of three pits at Quest 29 (Koolpin, Zamu and Taipan Hill), in-situ dump leach treatment of low grade oxide ore, construction of a haul road to Tom's Gully minesite, transportation of high grade oxide ore to Tom's Gully minesite for processing and the re-commissioning of the existing CIL processing facility at Tom's Gully. Both sites are located on an active pastoral property.

1.1 *Environmental Assessment Process*

Environmental impact assessment is based on adequately defining those elements of the environment which may be affected by a proposed development, and on quantifying the significance, risks and consequences of the potential impacts of the proposal at a local and regional level.

The PER provides a description of the existing environment in the area and the proposed operations, and evaluates the environmental impacts and proposed mitigating measures to minimise the expected impacts.

This report assesses the adequacy of the PER in achieving the above objectives, and evaluates the undertakings and environmental safeguards proposed by the proponent to mitigate the potential impacts.

The safeguards may be implemented at various levels within the planning framework of a project. These include, but are not limited to:

1. Site selection;
2. Design and layout of facilities;
3. Management of construction activities;
4. Processes used in operations and facilities (i.e. inputs and outputs); and
5. Management of operations, processes and facilities.

The contents of this report form the basis of advice to the Northern Territory Minister for the Environment on the environmental issues associated with the project.

1.2 *Environmental Assessment History*

The proponent lodged a Notice of Intent (NOI) with the Department of Mines and Energy (DME) on 22 June 1998, proposing the development of open cut mining operations at Quest 29 and associated facilities. The NOI was examined by the Policy and Assessment Group of DME. The development proposal met the guidelines for referral to the Department of Lands, Planning and Environment (DLPE) and the proposal was submitted to the Project Assessment Committee, an inter-departmental committee comprising representatives from DLPE and DME. It was considered that the environmental issues associated with the proposal were sufficiently significant to warrant assessment under the NT *Environmental Assessment Act 1982* at the level of a PER.

On 28 October 1998, the Minister for the Environment directed that a PER be prepared for the proposal.

Draft guidelines for the preparation of a PER were advertised for public comment from 21 December 1998 to 4 January 1999 and circulated to NT Government advisory bodies. Final guidelines were prepared, taking into account the comments received from the public and government agencies. The

Minister issued the final guidelines and a direction to the proponent to prepare the PER on 28 January 1999.

The PER was submitted on 25 February 1999 and placed on public review for 4 weeks from 1 March to 26 March 1999. It was also circulated to the following government advisory bodies for review and comment:

Department of Mines and Energy
Aboriginal Areas Protection Authority
Department of the Chief Minister
Parks and Wildlife Commission of the Northern Territory
Department of Lands, Planning and Environment
Power and Water Authority
Department of Transport and Works
Territory Health Services
Department of Primary Industry and Fisheries

On 25 March 1999 the Minister directed that additional information was required to enable proper assessment of the potential impacts of the proposal. This effectively halted the assessment process until the requested information was received on 6 April 1999.

1.3 Scope of the Assessment

This report assesses the environmental impacts of Stage 1 of the proposed Quest 29 development only, as detailed below in 2. The Proposal.

Any proposal for development of Stages 2 and 3 must be submitted to DME for assessment within the meaning of the *Environmental Assessment Act*.

It should be noted that previous assessment recommendations for operations at the Tom's Gully minesite were made in respect of the operations specified at the time and are, therefore, not necessarily relevant to the current proposal. Any proposal for additional development at the Tom's Gully minesite beyond that detailed below should be submitted to DME for assessment within the meaning of the *Environmental Assessment Act*.

2. THE PROPOSAL

The proposed Stage 1 development comprises open cut mining of three pits at Quest 29 (Koolpin, Zamu and Taipan Hill), in-situ dump leach treatment of low grade oxide ore, construction of a haul road to Tom's Gully minesite, transportation of high grade oxide ore to Tom's Gully minesite for processing and the re-commissioning of the existing CIL processing facility at Tom's Gully.

Tom's Gully minesite is located approximately 14 km to the north of the proposed Quest 29 site. Gold has been mined at the site previously in an open cut operation. Infrastructure at the site includes a crushing plant, CIL processing plant, offices and tailing dams and retention ponds.

The major components of the proposed Stage 1 development for the Quest 29 site and the Tom's Gully site are listed below.

Quest 29

1. Land clearing of about 33.5 Ha (to allow for the establishment of proposed pits; waste dumps; dump leach site; high grade ore stockpile area; haul roads; siltation pond and diversion berm walls; and the office, mine workshop and associated facilities)
2. Open cut mining using drill and blast, truck/excavator operations
3. Waste dumps

4. Pit bunding
5. Pit dewatering
6. Creek diversion to avoid pit flooding
7. Siltation dam downstream of mining operations to control runoff
8. Establishment of a wetland filters downstream of the siltation dam
9. Trucking of high grade ore from Quest 29 to Tom's Gully for processing
10. Construction and upgrading of haul roads between Quest 29 and Tom's Gully
11. Power, water, office, workshop reagent storage and dump leach facilities
12. Monitoring – water monitoring and waste

Tom's Gully

13. Construction and Re-commissioning of a crushing plant
14. Re-commissioning of the Tom's Gully CIL process facilities
15. Pumping of tailings, from the processing of high grade ore from Quest 29, to existing tailings dams
16. Trucking of loaded carbon from the dump leach facility back to Tom's Gully for stripping
17. Monitoring – water monitoring and waste

3. ENVIRONMENTAL ASSESSMENT

3.1 Introduction

The information provided in the PER has been assessed and then used, along with submissions from advisory bodies and public comment on the PER, to determine the adequacy of the information provided by the proponent and the accuracy and acceptability of predicted impacts and safeguards. Comments and recommendations, based on submissions and comments from Government advisory bodies, are then made.

It is acknowledged that during implementation of proposals outlined in the PER, flexibility is necessary and desirable to allow for minor and non-substantial changes to the design and specifications which have been examined as part of this assessment. It is considered that subsequent statutory approvals for this project could make provisions for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

It is important for interpretation purposes that the recommendations (in **bold**) are not considered in isolation, as the text identifies concerns, suggestions and undertakings associated with the project.

Safeguards and mitigation measures undertaken by the proponent in the PER are summarised at Appendix 1. All safeguards and mitigation measures outlined in the PER are considered to be commitments by the proponent.

Subject to decisions which permit the project to proceed, the primary recommendation of this assessment is:

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the Quest 29 Project Public Environment Report (summarised at Appendix 1) and as recommended in this assessment report.

3.2 Issues

3.2.1 Major Environmental Issues

The principal environmental issues identified with the proposal for Quest 29 Stage 1 and the construction of associated infrastructure to support the project are:

1. Potential acid generation from mine wastes at Quest 29;
2. Management of cyanide used in the proposed dump leach processing at Quest 29;
3. Water management;
4. Tailings containment;
5. Rehabilitation; and
6. Disturbance to pastoral activities

3.2.2 General

Mine and Environmental Management Plan (MEMP)

Recommendation 2

A Mine and Environmental Management Plan shall be submitted to the Department of Mines and Energy within 12 months of commencement of operations for approval and at 12 monthly intervals thereafter. This plan is to include details of post-production rehabilitation strategies for the mine site.

MEMP guidelines are available from the Department of Mines and Energy. A accurate map of the site lay out is to be included and indicating map orientation, scale, tenure – both mining and pastoral, topography, drainage pathways, control pond, wetland filter, containment pond, access and haul road locations.

Australian Minerals Industry Code for Environmental Management

The Australian Minerals Industry Code for Environmental Management is an effort by the industry to improve the environmental performance and reputation of the industry as a whole.

Recommendation 3

The proponent should consider becoming, if not already, a signatory to the Australian Minerals Industry Code for Environmental Management.

3.2.3 Waste Rock Management

A significant potential impact of this proposal is the formation of acid rock drainage (ARD). ARD occurs through the formation of acid when unweathered sulphide containing rock is exposed to oxygen and then water. This acid then has the potential to mobilise heavy metals and lower the pH of drainage lines and watercourses with detrimental effects on aquatic flora and fauna.

The waste rock management strategies adopted by the proponent will be critical to the performance of the minesite which is in an area noted for its historical ARD problems. The waste rock characterisation outlined in the PER is of a preliminary nature only. Ongoing geochemical test work will be required during the mining of all three pits to quantify the exact location and volume of potentially acid producing waste.

It is important that the initial acid base account tests completed for the PER are not taken too literally. As a preliminary indicator they are sufficient, but tend to overestimate the neutralising capacity of a

sample when fast-weathering silicates (e.g. dolerite) are present. This is because the tests are undertaken using unnaturally aggressive solutions (high temperatures and strong oxidants). In addition, the samples are crushed, increasing reactive surface area.

While dolerite has the capacity to neutralise acid, its reaction is so slow, that effectively the acid neutralising capacity from such a source can be discounted. This means non acid forming waste from dolerite may still be acid forming. It must be remembered that high sulfide concentrations tend to be located preferentially along fractures which are exposed when blasting, and are therefore comparably more exposed than silicate minerals. The waste appears to have a reasonable likelihood to generate acid.

Recommendation 4

A waste characterisation plan is to be submitted to the Department of Mines and Energy, prior to mining potentially acid forming material.

Construction of waste dump design and location of waste rock in the final rehabilitated landform are also key issues in managing ARD and landform stability.

Dumping waste as close as possible to the pit makes economic sense to minimise haulage cost. If the dumps are too close to the pit crest, it will act as surcharge at the crest and decrease the stability of the pit wall. The minimum distance from the crest should be determined only after the slope stability analyses are undertaken to get a reasonable factor of safety.

Recommendation 5

Waste dump location adjacent to pits should be determined only after the slope stability analysis has been assessed and a report given to the Department of Mines and Energy for approval.

The outer slope of the dump is suggested at 27° (at the angle of repose) during the construction phase and it will be reshaped during the rehabilitation. This practice creates extra work for machinery and delays the progressive rehabilitation. Instead, if the size of the dump is known from the known quantity of waste, the outer wall can be made permanent at reasonably stable slope (usually 15°) and the rehabilitation can take place from the beginning of the dump construction. Also it gives early opportunity to assess the success of any trial rehabilitation work.

Recommendation 6

The final outer batters of the waste dumps should be established as early as possible in the construction of waste dumps.

It is preferable that all waste material is placed into the worked out pits rather than in above ground waste rock dumps. Placement of waste rock in the pits and then subsequent flooding should reduce the oxidation potential of sulphides and hence the potential for acid development.

Recommendation 7

Waste rock should not remain in-situ above ground post mining and should be returned to the pits prior to flooding.

It is expected that mining operations will generate approximately 1 x 10⁶ m³ of waste rock, and that internal haul roads are to be upgraded using in-situ material.

The Department of Transport and Works strategic plan provides for the upgrading of the Arnhem Highway. If waste rock proves to be suitable as road building material, there may be an opportunity to utilise it for road construction.

It would therefore be of some interest to the Department of Transport and Works and possibly of economic benefit to the proponent if the evaluation of the waste rock was to include testing for road material properties.

As indicated from the limited test work the potential for ARD is moderate to high. The compaction of each layer and limiting the exposure of problematic waste during the wet season is important. The quantity of potential acid forming rock is not known yet. Waste rock modeling is recommended for quantifying the different waste category and planning strategically the handling and placement of the potential acid producing waste within the waste dump.

Recommendation 8

The proponent should prepare a waste rock management plan to include but not be limited to:

- **Waste rock dump site preparation**
- **Methods of waste rock characterisation**
- **Selective handling of material**
- **Waste dump construction design**
- **A monitoring system for:**
 - ⇒ **checking on waste rock placement**
 - ⇒ **compaction and**
 - ⇒ **potential acid production**

This waste rock management plan should be incorporated into the Mine and Environmental Management Plan for review by the Department of Mines and Energy.

Drainage of acidic waste dump runoff to pits could become an issue (and more particularly if the pit is acidic also), if the pit overflows.

3.2.4 Management of Cyanide Used in the Proposed Dump Leach Processing at Quest 29

Cyanide (HCN) poses a potential hazard to the environment and to human health. Under normal closed circuit process conditions, this hazard is confined to the mill and tailings dam areas. Heap and dump leach operations expose HCN directly to the environment through aerosols and the potential for leakage through and over the leach pads. It is acknowledged however, that if well managed through the provision of appropriate safeguards and practices, the process can be safe.

The provision for protection of the HDPE liner against dent and puncture needs to be considered. A cushion of sand or similar should be in place under the liner. As the liner is usually exposed above the banded part of the pad, a stronger liner (1.5 mm thick HDPE) should be considered.

Recommendation 9

Precautions should be taken to prevent the potential for puncture of the leach dump HDPE liner.

3.2.5 Water Management

By far the most significant environmental issue concerning the proposed Quest 29 development is the water management of both the Quest 29 site and the Tom's Gully process site. The preliminary water management information given in the PER indicates that discharges from the water management system may occur under extreme climatic conditions.

Recommendation 10

Reporting of any potentially environmentally significant spill or discharge of water shall be made within 24 hours of the event to the Department of Mines and Energy and a written report shall be submitted within 7 days detailing the extent of impact and remedial measures.

Any runoff from Tom's Gully and Quest 29 eventually flows into the Mary River, a valuable recreational and commercial fishing resource. The proponent is required to obtain a Waste Discharge License under the *Water Act* and to meet conditions applied should any off site discharge be necessary. It is likely that a Waste Discharge License will apply to the siltation pond that marks the control point of discharge from the mine site to the natural system. The details of the Waste Discharge License will be determined on receipt a minesite water management plan.

The discharge design for ponds at other mine sites has been an immensely important factor in determining the success of discharge events. As conditions of a water discharge license, details of the likely capacity and spillway design for the siltation pond will be required to be submitted prior to construction.

Recommendation 11

The proponent shall apply for a Waste Discharge License under the *Water Act* for any off-site contaminated water discharge.

Recommendation 12

A comprehensive minesite water management plan should be prepared as soon as possible for endorsement by the Department of Mines and Energy. This plan should be incorporated into the Mine and Environmental Management Plan for review by the Department of Mines and Energy.

Water quality is of importance in this region as the environmentally sensitive Mary River system is situated downstream

Acid drainage constitutes a potential surface water impact, as does increased metal loads from pit de-watering, pond overflow and dump runoff.

Recommendation 13

The proponent should submit a water quality management program to the Department of Mines and Energy as soon as possible for endorsement. Water quality programs for baseline and ongoing monitoring are to be conducted in accordance with an agreed program set out by the Department.

Flooding of sulphide bearing pits is a strategy aimed at reducing the potential for exposure of sulphides to oxygen and hence the potential for acid production. Passive filling of voids at other sites has not been sufficiently fast to prevent acid generation in pits. Acid generation has only been controlled when creek diversion activities have been undertaken, enabling rapid filling of the pit.

Recommendation 14

Flooding of worked out "wet" pits should be done rapidly, for example, through creek diversion activities, to minimize the potential for acid generation.

Most theoretical minesite water balances in the wet/dry monsoonal tropics rely heavily on the water balance aggregate within the system at the start of each wet season. Water balance figures presented in the PER rely on water deficit leading up to December of each year. As the true minesite water regime will not be clear until operations have commenced, a review of the figures prior to each wet season will provide evidence that freeboard within the water management system will be met or to what extent discharge from the site may occur under extreme circumstances.

Recommendation 15

It is recommended that water balance figures be reviewed annually by the proponent prior to the wet season at a date to be fixed by the Department of Mines and Energy. Details of the state of the minesite water balance and the potential for freeboard to be compromised during the wet season are to be presented to the Department for assessment.

Siltation of watercourses downstream of the mine poses a significant hazard to benthic flora and fauna. The design of erosion hazard control structures and their constructed form needs to be assessed to ensure effective containment of the erosion hazards.

Recommendation 16

The proponent should specify in more detail, to the satisfaction of the Department of Mines and Energy, erosion hazard controls for the proposed creek diversion channels and the siltation structure. These controls should become part of the Mine and Environmental Management Plan.

3.2.6 Tailings Containment

Gold process tailings consist of fine grained material containing sulphides, heavy metals and quantities of cyanide and arsenic. These components pose a potential hazard to the environment if allowed to enter waterways. Sulphidic tailings have the potential to oxidise and become acid. It is acknowledged however, that if well managed through the provision of appropriate safeguards and practices, it should not pose a significant hazard.

Recommendation 17

Reporting of any potentially environmentally significant spill of tailings shall be made within 24 hours of the event to the Department of Mines and Energy and a written report shall be submitted within 7 days detailing the extent of impact and remedial measures.

As the Quest 29 project utilises existing facilities at Tom's Gully, DME needs to be assured that the proposed repository, Tailings Dam 2, is still structurally sound. DME also needs to be assured that the proponent will maintain sufficient freeboard in Tailings Dam 2 to withstand a 1:100 72 hour storm event (as well as contingency measures). This is particularly relevant given the proximity of Tailings Dam 2 to both Mt Bunday Creek and the Arnhem Highway.

Recommendation 18

Sufficient freeboard is to be maintained in Tailings Dam 2 to withstand a 1:100 72 hour storm event. The tailings dam must also be certified to the satisfaction of the Department of Mines and Energy as being structurally sound prior to use. Regular audits by a geotechnical engineer should be part of requirement to indicate the dam is performing within the design specification.

Tailings transfer lines can be a potential source for discharge into the environment if not properly maintained.

Recommendation 19

An inspection schedule of the tailings circuit should be incorporated into the Mine and Environmental Management Plan.

3.2.7 Rehabilitation.

The rehabilitation information provided in the PER is of a preliminary nature. It is important that

rehabilitation of disused areas is undertaken progressively as the mining operations continue. This will aid the reduction of site erosion and can utilise resources whilst they are present on site. The environmental and economic benefits of progressive rehabilitation whilst operating have been proven at other sites.

The rehabilitation objectives are not stated in the PER. These, as well as evidence of these being agreed to by the landowner, should be included in the MEMP.

It appears that rehabilitation of the pre-existing landscape is contemplated. If that is the case, then trials to determine *the most appropriate or suitable plant species* are unnecessary. The final species mix should reflect that of the surrounding countryside which thus determines what species should be planted. Sufficient work has been undertaken elsewhere to draw upon in respect to techniques. Also seeding is best undertaken late in the wet season rather than *in the late 'dry' season* to ensure sufficient soil moisture during the critical early seedling stage.

If the site is to be used for on-going pastoral activities, agreement needs to be made with the pastoralist regarding the appropriate seed mix.

Recommendation 20

The proponent should provide a Site De-Commissioning and Rehabilitation Plan to the Department of Mines and Energy. This plan should include an itemised estimate of the cost of full, post mining, minesite rehabilitation. This plan should become part of the Mine and Environmental Management Plan.

3.2.8 Disturbance to Pastoral Activities

The minesite is located within Perpetual Pastoral Lease 1163. Stock will be grazing within the vicinity of mining activities. The proponent should attempt to ensure that the two land uses do not conflict through consultation with the land holder. The proponent should also ensure that mining activities do not exacerbate pre-existing erosion problems.

Recommendation 21

The proponent should consult with the landholder on all aspects of the operations that may impact on the pastoral activities of Perpetual Pastoral Lease 1163. The proponent should ensure that high activity and potentially hazardous areas such as the haul road, mine workings, leach pads and process areas are suitably fenced to exclude cattle from these areas.

3.2.9 Operation of the Wetland Filter

Wetland filtration is seen as a successful and important water management tool for the polishing of contaminated waters prior to discharge. Wetland filtration uses the natural processes of a wetland to remove contaminants into the sediments and vegetation under reducing conditions.

Recommendation 22

The proponent shall ensure contaminated waters are polished prior to discharge.

If managed well a wetland filter could be used successfully in this project to filter out contaminants. If however the wetland filter is allowed to dry, the contaminants can oxidise and remobilise during the next flush of water. It is important that the proponent should have a management plan for the commissioning, monitoring, operation and decommissioning of the wetland filter.

Recommendation 23

If a wetland filter is chosen to polish contaminated water releases, the proponent shall submit a wetland filter management plan that includes, but is not limited to:

- **Design specifications (size, vegetation, detention time etc.);**
- **Flow regime;**
- **Water Quality;**
- **Maintenance;**
- **Monitoring;**
- **Decommissioning and Rehabilitation.**

This wetland filter management plan should be incorporated into the Mine and Environmental Management Plan for review by the Department of Mines and Energy.

3.2.10 Fire Management

The objectives of fire management have not been addressed in the PER. It is important with joint land users that a consistent and cooperative fire management plan is adhered to by both parties. This will ensure that neither land use will impact unnecessarily on, or place in danger, the other through uncontrolled or unplanned burning, or through the build up of fuel.

Recommendation 24

The proponent should develop a fire management plan in consultation with the land holder and submit this to the Parks and Wildlife Commission for approval. This plan should become part of the Mine and Environmental Management Plan.

3.2.11 Materials Handling

Materials handling issues have not been covered in the PER. There are handling issues associated with the use of hydrated lime (Ca(OH)_2), quicklime (CaO) and cyanide. These substances are hazardous and should be handled in accordance with the *Dangerous Goods Act*. The storage of diesel should be in accordance with Australian Standard AS 1940-1993.

Recommendation 25

The proponent should establish procedures, based on Australian Standards and in accordance with the *Dangerous Goods Act*, for the handling and storage of chemicals, fuels and explosives. These procedures should be included as part of the Mine and Environmental Management Plan.

3.2.12 Infrastructure

Waste from ablation facilities at Quest 29 will drain into installed septic systems utilising absorption trenches. Due to many factors such as existing creek systems throughout the development area, sheet flooding during the wet season, the close proximity of the water table and the diversity of soil types, documentary evidence that the proposed sites are suitable for accommodating standard septic tank effluent system is to be provided. The installations of ablation facilities are to be appropriate for the site.

Recommendation 26

The proponent shall consult with and seek approval from Territory Health Services for the design and installation of ablation facilities at the Quest 29 site.

3.2.13 Transport

It is noted that internal access roads are to be upgraded and there is no haulage of mine ore proposed on the Arnhem Highway. However, in view of increased traffic demand generated by this development approval may be subject to upgrading of the intersection and would need to be obtained prior to the commencement of any work on the Quest 29 site.

Recommendation 27

The proponent must apply to the Department of Transport and Works for approved access from the Arnhem Highway.

Recommendation 28

Haul road construction design details, incorporating effective erosion control measures, are to be submitted to the Chief Government Mining Engineer (CGME) for approval prior to construction.

3.2.14 Weeds

The description of the existing weed species in the PER was not sufficient to determine a management plan. Further advice should be sought from the Department of Primary Industries and Fisheries on weed management.

Weed management must be integrated into all land management, and the introduction and spread of weeds should be avoided or minimised. It is essential that all machinery brought on site be washed down prior to entry to and exit from the site.

Recommendation 29

In consultation with the land holder the proponent should submit a Weed Management Plan, to the Department of Primary Industry and Fisheries for approval prior to the commencement of operations. This plan should be included in the Mine and Environmental Management Plan.

3.2.15 Biting Insects

A commitment to a monitoring program for biting insects was not included in the PER. Monitoring of any impoundment's of water for the presence of mosquito larvae should be included in the environmental monitoring program. Any concentrations of mosquito larvae will need to be controlled with an appropriate management programs as advised by Territory Health Services (THS). Water impoundment's should be constructed to prevent mosquito breeding as per THS recommendations.

Recommendation 30

Monitoring for mosquito larvae shall be conducted in consultation with Medical Entomology Branch, Territory Health Services.

4. Conclusion

It is considered that the environmental issues associated with the proposed project have been adequately identified. Some of these issues have been resolved through the assessment process, while others will be addressed through the MEMP and additional surveys.

Initially, the PER and the recommendations detailed in this Assessment Report will form the basis for proponent's management and monitoring commitments. Mine and Environmental Management Plans

for the Quest 29 operation will be working document for the operation and will require continual review and updating in the light of operational experience and changed circumstances.

Provided that the environmental commitments and safeguards detailed in the PER are implemented, the recommendations in this Assessment Report are adopted and regular auditing and reporting are undertaken, long term environmental impacts should be minimised.

Appendix 1

Company Environmental Policy (pg 4-1)

The Company seeks to achieve environmental sustainability by the vigorous pursuit of its environmental policy. This policy is as follows:

- To integrate economic, environmental, social and cultural considerations into all decision making and management activities in a manner consistent with sustainable development;
- To develop an environmentally responsible culture through a dynamic Environmental Management System (EMS);
- To provide resources to train employees and contractors in all relevant facets of the EMS
- To maintain honest, open and co-operative relationships with all interested parties of the community in which the Company operates;
- To ensure all activities are consistent with avoiding or mitigating adverse environmental impact.;
- To set environmental performance objectives to improve procedures and maintain best practice; and
- To report on a regular basis, the Company's environmental performance internally, to our shareholders, government, industry bodies and the community.

Commitments made in Table 5.3

Potential Impacts	Commitments
Acid Generation from Waste Rock	<ul style="list-style-type: none"> · Ongoing waste characterization study · Ongoing characterization of wastes during mining to enable selective handling · Selective handling of waste material and placement in safe areas · Monitoring and control of runoff and seepage from waste dumps
Water Management	<ul style="list-style-type: none"> · Dump leach and tailings systems designed as non-release systems · Dump leach storm pond sized for worst case rainfall scenario · Tailings pipe designed for easy monitoring for leakage · Borehole monitoring at Dump Leach facility to detect leakage
Soils	<ul style="list-style-type: none"> · Minimize clearing · Undertake bulk earthworks in the dry season · Stabilize drainage against erosion and implement erosion controls · Implement progressive rehabilitation/re-vegetation
Flora	<ul style="list-style-type: none"> · Minimize clearing and report any observed plant collection · Implement progressive rehabilitation · Workforce education · Retention, where possible, of existing vegetation

Fauna	<ul style="list-style-type: none"> · No firearms, traps or pets will be allowed on site · Use of non toxic herbicides in weed control · Fencing of specified areas
Weeds	<ul style="list-style-type: none"> · Weed program to be determined with appropriate authorities · Seed used for rehabilitation will be certified weed-free. · Regular inspections of site area
Biting Insects	<ul style="list-style-type: none"> · Biting insect program to be determined with appropriate authorities · Workforce education · Monitoring of ponded water areas and appropriate remediation · Sealing of septic systems
Fire	<ul style="list-style-type: none"> · Control program to be developed (appropriate authorities and landowner)
Cultural and Heritage	<ul style="list-style-type: none"> · Obtain necessary certificates · Workforce education · Secure sites of cultural and/or heritage significance
Waste	<ul style="list-style-type: none"> · Use of approved disposal methods and areas · Re-cycling will be undertaken where possible · Approved hazardous waste management program
Dust	<ul style="list-style-type: none"> · Minimize clearing · Water roads
Noise	<ul style="list-style-type: none"> · Natural vegetation and landform buffers to distant nearest habitation · No on-site accommodation · Appropriate mufflers fitted to equipment · Supply of appropriate safety equipment and workforce education.

Commitments taken directly from the PER text

Reference	Commitments
PER Feb 99 pg 3	The responsibility for the environmental performance of the Company at the Quest 29 and Tom's Gully sites rests with all employees (permanent or contract) of the Company. The Site Manger or his nominee will undertake management of the Company's environmental policy.
PER Feb 99 pg 3	Monitoring and management will be undertaken as follows: <ul style="list-style-type: none"> · monitoring of water quality in the water management system; · leak detection in the dump leach facility; · management of ongoing waste characterisation; · monitoring of leachates form the waste rock dump; · dust control; and · management of re-vegetation and rehabilitation
PER Feb 99 pg 2-4	2.1.2 Site design layout and options. A siltation dam will be constructed downstream of the mining area to control runoff and allow water quality to be monitored prior to controlled release. A wetland filter will be planted downstream of the siltation dam as an added precaution.
	Loaded carbon from the dump leach operation will be trucked to Tom's Gully for stripping at regular intervals in a stripping column designed for the purpose. This column

	will be sufficiently robust that it will not be substantially damaged in the event of an accident during transportation.
	A secure reagent storage and mixing area will be constructed at Quest 29.
	All fuel storage areas will be bunded to adequately contain spillage in accordance with permitting requirements in the unlikely event of a complete spillage.
	Progressive rehabilitation at the Quest 29 site will commence as soon as practicable and will continue throughout the life of the operation. Final rehabilitation will be undertaken at the end of the overall operation, as well as at the end of individual pit operations.
	2.2.3 Standards, site management and supervision All site works will be built to the relevant Australian Standard. Relevant testing of materials will be undertaken using NATA certified laboratories.
PER Feb 99 pg 2-8	Sirocco's OH&S manual and site procedures manual will be issued to all employees and contractors and enforced by the Mine Manger or his nominee.
	2.2.4 Site preparation and erosion control Any road materials will be sourced from existing borrow pits.
	Haul roads will be constructed on the site using inert oxide material from the open pits where possible. This material will also be used to construct the planned dams and diversion berm.
	Earthmoving will be undertaken after topsoil stripping and stockpiling for rehabilitation.
	Haul roads and the site access road will be constructed to ensure that soil erosion is minimised. Re-vegetation of stripped areas will be encouraged to reduce potential erosion. Catch drains and other devices will be used to ensure any runoff is properly controlled.
	2.2.5 Construction wastes and disposal methods <ul style="list-style-type: none"> · Waste material from construction activities will be transported to the proposed waste dump sites for subsequent burial upon commencement of mining activities; · Combustible material will be burnt prior to waste rock being dumped; and · All waste oils and solvents will be removed from site for recycling.
	2.4.3 Process Route tailings will be disposed of in existing tailings dam No 2 with water re-cycled from the dam to the plant re-cycled water tank.
PER Feb 99 pg 2-14	2.4.4. Inputs and Outputs minimal reagent stocks as determined for efficient operation will be stored at Quest 29.
PER Feb 99 pg 2-15	2.5.2 Location of Dumps in order to minimize disturbance to the local environment a catchment has been selected to contain all site works, apart from the access road and the dump leach facility.
PER Feb 99 pg 2-18	Any acid rock drainage will be controlled in a number of ways, by direct control via a catch drain and dam at the toe of the dump. Secondary control will be via a downstream 'siltation pond' designed to control water flows off the site. Downstream control will be effected by the placement of a reed bed filter downstream of the siltation pond to remove any small amounts of toxicity from the water.
	Surface water flows, during the wet season will be diverted around the dumps and pits and directed into the 'siltation pond' before being released through the spillways from the siltation pond.
PER Feb 99 pg 2-19	The dump(s) will be constructed in such a way that acid-forming material can be encapsulated within non acid-forming material. As an alternative consideration will be given to dumping this type of material in worked out pits.
PER Feb 99 pg 2-19	2.6.3 Tailings Characteristics Proposed cyanide levels in the dam will not exceed 50 ppm cyanide in wad (Weakly Acid Dissociable).
PER Feb 99 pg 2-20	Water balance calculations show that operations will be directed to optimizing recovery of water to minimize the requirement for make-up water from other sources. Adequate storage is provided for a 1:100 return period 72 hour storm.
	2.7.1 Water Requirements Dust suppression water will also come from pit dewatering bores pumped to a header tank standpipe arrangement controlled by the Mining contractor.
	2.7.3 Control Strategies

	Control strategies to be adopted by the Company will be: Diversinary Berms – To ensure creek flow and floodwaters are diverted around active mining areas. This will achieve two main goals in that Pits will not be subject to excess water from upstream catchments and also this water will be directed away from disturbed areas to minimize sediment transport.
PER Feb 99 pg 2-21	Siltation Dam – To enable suspended solids that are picked up from mining areas to be deposited within the confines of the Dam rather than allowed to disperse over downstream catchment and run-off areas.
	Process Storage – provide sufficient storage capacity to contain all process solutions and run-offs rather than require discharge from this area.
	Wetland Filter – In the event that discharge from the process area is unavoidable or that groundwater discharge from Pit de-watering bores contains unacceptably high concentrations of contaminants the establishment of a Wetland filter is anticipated immediately downstream of the mine site.
	Water Monitoring – The company will devise in conjunction with regulatory bodies a Monitoring regime to effectively assess the mines impact if any on the surrounding environment and allow for early detection of possible changes and/or effects.
PER Feb 99 pg 2-22	2.8.2 Explosives explosives will be stored in an approved magazine to Australian Standards.
PER Feb 99 pg 2-23	Bulk emulsions will be prepared off site and transported to site by the explosives contractor in an approved fashion.
PER Feb 99 pg 2-23	2.8.3 Hazardous Substances Once on site, a secure yard will serve as a cyanide warehouse.
	Cyanide will be transported to site in sea-containers containing 20 individual 1 tonne boxes.
	Quicklime will be store in a silo.
	Quicklime will be brought in by a tanker and pneumatically transferred to the silo.
PER Feb 99 pg 2-23	2.8.4 Fuel oil and lubricant storage The fuel (diesel) supplier will provide the tanks and necessary dispensing apparatus with sufficient storage for 14 days operation to Australian Standards.
PER Feb 99 pg 2-23	2.8.5 Sewage and refuse disposal Sewage disposal from ablution facilities will drain to installed septic systems utilising absorption trenches. These will be designed to approved Northern Territory Health standards.
	Waste oils and solvents will be re-cycled.
	Non-recyclable flammable liquids will be burned in a designated area approved by the DME.
	Domestic refuse will be collected and returned to Tom's Gully for disposal in the designated disposal area.
PER Feb 99 pg 2-23	2.8.6 Communications and security The process plant, leach pad, and ponds as well as the mine contractor's compound and the reagents store will be enclosed by an approximately 1.8m high security fence.
PER Feb 99 pg 2-24	2.9 Transport Corridors Services vehicles will continue to use the existing site access. This will be restricted to vehicles no larger than those currently used by the Boral Quarries Mount Bunday operations.
	(with reference to Rustlers Roost road to Quest 29) The roads will be fenced as already agreed with the landowner to protect both stock and wild animal populations from increased vehicle movement.
PER Feb 99 pg 2-25	2.10.2 Health and Safety A St. John Ambulance Senior First Aid certificate will be a prerequisite to employment of which the company will take responsibility for renewals as they fall due.
	A Health Safety and Environmental Officer will be appointed to implement Company policy with regard to Health and Safety issues.
	Tom's Gully will be set up with a dedicated fully equipped First Aid Room which will be the supply centre for Quest 29 which will have comprehensive First Aid Kits located at

	the Companies site office and also at the Earthmoving contractors Office/Crib room.
	A Company Occupational Health Safety and Induction Manual is to be issued to all employees on commencement.
	Usage of all hazardous and corrosive chemicals will be in accordance with Northern Territory regulations
	The use and storage of explosives on site will be in strict compliance with the Northern Territory Mine Management Act and the Australian Dangerous goods Act.
	All access to the site will be under escort from the Tom's Gully Mine site by Company personnel
PER Feb 99 pg 2-25	2.10.3 Education and Training In accordance with the Northern Territory Mine Management Act, all employees with undertake an induction as part of training.
	As part of the induction, the workforce will be provided with education to ensure that sites of historical and cultural significance are treated appropriately.
	(in reference to sites of Aboriginal or historical significance) No unnecessary access will be granted to these area's and if in Danger of disturbance will be clearly marked or fenced.
	(in reference to sites of Aboriginal or historical significance) The company will request descriptions and where possible a short narrative on identified sites from The Aboriginal Area's Protection Authority or The Department of Lands Planning and Environment (Environment and Heritage Division) to ensure employees understand and respect these sites.
PER Feb 99 pg 2-26	2.10.5 Transportation Light vehicle movements will be strictly controlled on a 'needs only' basis (along the haul road)
PER Feb 99 pg 4-1	4.1.2 Responsibilities The Site Manager or his nominee will undertake management of the Company's Environmental policy.
	The Operations Director will be responsible for internal review of the Company's environmental performance.
PER Feb 99 pg 4-1 to 4-2	4.2.1 Soils <ul style="list-style-type: none"> • Surface soil will be removed progressively to ensure large surface areas are not left exposed; • All areas of proposed development will be stripped of their surface soil and stockpiled for later rehabilitation; • Slope gradients will be controlled to minimise erosion and soil loss; • Diversion channels will be installed as necessary to control local surface water runoff to minimise overland flow and consequential erosion; and • Rehabilitation will be undertaken progressively, where possible, to minimise the stockpile storage period.
PER Feb 99 pg 4-2	4.2.2 Surface Water Quality <ul style="list-style-type: none"> • Rainwater runoff from waste dumps will be collected at the base of the dump(s) in the toe control pond. Perimeter drains will direct all flows to this pond for monitoring and release control; • Upslope diversions from the open pits (especially the Zamu pit) will be collected in the siltation pond, or discharged through a downstream wetland filter to the natural drainage at peak flow events in the wet season; • Pit water ingress from rainfall or groundwater migration will be pumped to the surface and diverted to the siltation pond; • Siltation will be controlled through the siltation pond, as well as the construction of diversion channels through disturbed areas and the provision of sediment traps on these drainage channels; and • Hydrocarbons will be stored in appropriately designed (eg. bunded) areas.
PER Feb 99 pg 4-3	4.2.3 Ground Water Quality <ul style="list-style-type: none"> • Pumping for process water supply and pit dewatering will be minimised to ensure low draw down on the water table;

	<ul style="list-style-type: none"> • All leach pads and ponds will be lined with welded high density polyethylene (HDPE); • Monitoring systems will be installed to alert operators to any leakage during the life of the operation; and • A contingency plan is being developed for cleanup in the unlikely event of leakage.
PER Feb 99 pg 4-3	<p>4.2.4 Flora</p> <ul style="list-style-type: none"> • Programmes of re-seeding and re-planting disturbed areas with local species will be undertaken as part of the rehabilitation programme; • Clearing will be minimised; • Annual controlled mosaic bushfire burning will be undertaken in consultation with the Bushfire Council and the local landowner(s); • Weeds will be controlled through prevention, monitoring and early eradication. A plan will be prepared in conjunction with the Northern Territory Government Controller of Weeds and other relevant experts; and • The Company will minimise any trafficking away from made roads to minimise any potential vehicle borne spread of weed species.
PER Feb 99 pg 4-4	<p>4.2.5 Fauna</p> <ul style="list-style-type: none"> • The Dump Leach pad and ponds area will be securely fenced; • No domestic animals or firearms will be allowed on site; • Hunting will not be allowed in the Company's Project area; • Clearing will be minimised.
PER Feb 99 pg 4-4	<p>4.2.6 Biting Insects and Disease Vectors</p> <ul style="list-style-type: none"> • The project's employees will be educated about mosquito-borne diseases and control of breeding areas; • In consultation with Territory Health Services design of any facilities to reduce mosquito breeding areas will be undertaken. This includes minimising vegetation around rawwater ponds, ensuring borrow pits are free draining, minimising ponding, varying water levels, maximising the steepness of slide slopes, and preventing rainwater storage in vessels.
PER Feb 99 pg 4-5	<p>4.2.7 Heritage and Archaeological Sites</p> <ul style="list-style-type: none"> • Significant sites will be identified and protected (eg. fenced) to avoid unnecessary disturbance of those areas; and • Employees will be trained to ensure that the Company's policy is maintained at all times.
PER Feb 99 pg 4-5	<p>4.2.8 Socio-Economic</p> <ul style="list-style-type: none"> • Ore transportation will not be undertaken along the Arhem Highway; • The access road will be fenced as agreed with the landowner to control stock movements; • Employment opportunities will be advertised locally; and • Provision of services will be advertised locally.
PER Feb 99 pg 4-6	<p>4.2.9 Air Quality</p> <ul style="list-style-type: none"> • Emissions will be reported as part of the National Pollutant Inventory; • Roads will be regularly watered to control dust as warranted; • Re-vegetation will occur systematically ongoing during the project to reduce fugitive dust to a minimum level; and • Slight cyanide emissions will be controlled using standard industry practice for this type of operation as approved by the DME.
PER Feb 99 pg 4-6	<p>4.2.10 Noise</p> <ul style="list-style-type: none"> • Blasting will occur at regular intervals during daylight hours only; • Mobile equipment will be maintained to manufacturers standards; and • The diesel power generator will be properly muffled.
PER Feb 99 pg 4-6 to 4-7	<p>4.2.11 Visual</p> <ul style="list-style-type: none"> • Limited project access; • Contouring of dumps to blend in with the natural topography; • Containment ponds will be rehabilitated as natural wetlands or water bodies or removed if required; and • Areas of land clearing and disturbance will be minimised.

PER Feb 99 pg 5-2	5.1.1 Characterisation Studies Any PAF material with high NAG values (such as primary WKZ material) will either be encapsulated in the dump(s) in NAF material or placed in the mined out Taipan Hill pit.
	Grade control sampling will be routinely analysed to develop comparisons to existing waste characterisation studies so that 'alert' thresholds can be developed.
PER Feb 99 pg 5-2	5.1.2 Dump Construction The waste dump(s) will be constructed in sequentially built lifts. Initially the dump(s) will be built by 'valley fill' methods and then raised to the target height of 20 -25 m. Dump trucks will end dump each approximately 2.0 m lift at the angle of repose (37°). The maximum overall slope of the sides of the dump will be 26° (1 in 3). Trafficking over the dump(s) during dumping will ensure that the dump(s) are compacted to reduce water inflows through the dump.
PER Feb 99 pg 5-2	5.1.3 Waste rock dump runoff/seepage Runoff/seepage from the waste rock dump will be directed to the containment pond at the toe of the dump.
	The dump(s) will comprise primarily oxidised waste rock that has been classified as NAF or PAF with a low NAG capacity.
PER Feb 99 pg 5-3	Transitional and sulphide waste that is PAF with a moderate or higher NAG will either be encapsulated in the other waste or retained in or returned to the open pit(s).
PER Feb 99 pg 5-3	5.2.1 Dump Leach Process The water storage will be designed to contain run-off solution from the 1 in 100 year, worst month statistic.
	Free board in the pond system will be maintained such that at all times a 1 in 100 year storm event can be contained.
	Each pond will be constructed with an internal spillway such that in the event of excessive flow, ponds will overflow into each other prior to any possibility of overflow into the surrounding environment.
	In general practice, water is managed in the process system by continuous recirculation to the active heaps. During the wetter months, a back-up generator and pumps will be installed in the unlikely event of equipment failure.
PER Feb 99 pg 5-3	5.3 Tailings Management The Company aims to maintain a maximum level of 50 ppm cyanide wad.
PER Feb 99 pg 5-4	Tailings are pumped along an aboveground HDPE pipe to the tailings dam. The pipe will be regularly inspected for leakage. In the unlikely event that this occurs, the discoverer will instigate emergency response procedures.
	The No 2 tailings dam was designed to contain approximately 350,000 tonnes of tailings. When the dam nears capacity the Company proposes to increase capacity of the No 1 tailings dam. Designs will be submitted for approval from the relevant authorities at the appropriate time.
PER Feb 99 pg 5-4	5.4 oil Management The Company will undertake the following soil management programmes: <ul style="list-style-type: none"> • Routinely (monthly) inspect infrastructure and roads with respect to soil stability. • Routinely inspect all soil stockpiles for erosion and/or disturbance; • Manage progressive rehabilitation; and • Check erosion after significant rainfall events. The Company will undertake appropriate remediation programmes if significant soil erosion is observed during these routine inspections.
PER Feb 99 pg 5-4	5.5 Flora and Fauna Management and Conservation The Company will undertake the following Flora and Fauna management programmes: <ul style="list-style-type: none"> • Ensure land clearing is minimised; • Assess effectiveness of revegetation programmes annually; and • Inspect vegetation along creeks within the project areas annually.
PER Feb 99 pg 5-4	5.6 Weeds and Feral Animal Control The Company will undertake the following management programmes: <ul style="list-style-type: none"> • Routinely inspect all infrastructure and haul and access roads to monitor any noxious weeds and undertake appropriate remedial action if necessary after consultation with

	<p>appropriate authorities;</p> <ul style="list-style-type: none"> • Monitor any illegal hunting, trapping and plant collecting activities and report as soon as practicable to the appropriate authorities; and • Record and report sightings of feral animals to the appropriate authorities.
PER Feb 99 pg 5-4	<p>5.7 Cultural and Heritage Management</p> <p>The Company will undertake the following management programmes:</p> <ul style="list-style-type: none"> • Ensure by regular monitoring that any identified sites have not been disturbed or destroyed; and • Workforce education programme.
PER Feb 99 pg 5-4 to 5-5	<p>5.8 Biting Insect Control</p> <p>The Company will undertake the following management programmes:</p> <ul style="list-style-type: none"> • Consult with appropriate authorities prior to the wet season about a mosquito breeding and monitoring programme; • Inspect site for unplanned ponded water and undertake effective remediation; and • Ensure all employees undertake appropriate education programmes with respect to health issues of biting insects.
PER Feb 99 pg 5-5	<p>5.9 Waste Management</p> <p>The Company will undertake the following management programmes:</p> <ul style="list-style-type: none"> • Routinely inspect the effectiveness of planned pollution prevention and appropriate waste collection and disposal; • Routinely inspect chemical and hydrocarbon storage and distribution areas for safe management and contamination. Undertake appropriate remedial action including if necessary emergency response procedures; and • Undertake surface soil tests as necessary to ensure all wastes are contained within the site.
PER Feb 99 pg 5-5	<p>5.10 Emergency Response</p> <p>The plan for responding to emergencies in the event of a major release or significant spill from the water management system outlines the actions which will be initiated and by whom. The water management system for the dump leach includes the following:</p> <ul style="list-style-type: none"> • the process recovery area (the columns) with associated piping, pumps and vessels • the process liquor and storm surge ponds • the primary and secondary liners and the leak detection system • all other pipes, pumps and ditches connecting the system elements.
PER Feb 99 pg 5-5	<p>Specific spill procedures for dangerous chemicals will be handled in accordance with the requirements of the Australian Dangerous Goods Act.</p>
PER Feb 99 pg 5-5	<p>5.10.1 Notification</p> <p>The discoverer of a chemical or petroleum spill or an accidental discharge from the water management system will immediately notify the Health, Safety and Environmental (HSE) manager or designate. The HSE manager will be responsible for notifying all other appropriate personnel and coordinating the emergency response following the procedures outlined below:</p> <ul style="list-style-type: none"> • Discoverer notifies HSE Manager or designated alternative • HSE Manager or designate notifies Mine Manager and Operations Director at any time • Standby notification to Metallurgist and Senior Mine Geologist • Mine Manager or Operations Director notifies DME of spills within statutory timeframes
PER Feb 99 pg 5-5 to 5-6	<p>5.10.2 Action</p> <p>The following action will be taken in the event of a significant chemical or petroleum spill or a major failure of the water management system:</p> <ul style="list-style-type: none"> • Discoverer notifies HSE Manager or designated alternative with details on location, and magnitude • Discoverer immediately takes all possible safe action to contain the release • HSE Manager or designate notifies Mine Manager and Operations Director • HSE Manager immediately assesses the incident at the scene, furnishes technical and other assistance at the site as required and assesses the environmental impact of the

	<p>spill</p> <ul style="list-style-type: none"> • The Mine Manager immediately organises the timely dispatch of the required equipment, manpower and materials to the site • The HSE Manager will supervise the final containment and clean-up operation.
PER Feb 99 pg 5-6	<p>5.10.3 Containment and Mop-up Operations</p> <p>The containment and mop-up operations will be designed to contain the spill, dispose of any polluted material in an appropriate manner and to remediate the contaminated site as agreed with the appropriate authorities. Specific spill procedures will depend upon the circumstances of the spill.</p>
PER Feb 99 pg 5-6	<p>5.10.4 Reporting</p> <p>A significant spill from the water management system will be reported orally to the DME by 5.00 pm of the next regular working day after the release has occurred. A written summary will be provided to the DME within 10 working days of the oral report. The written report will contain a description of the release and it's cause, the periods of release, whether the release has been corrected and if not, the expected time it will be corrected and the steps taken or the plan to reduce, eliminate and prevent recurrence of the release.</p>
PER Feb 99 pg 5-7	<p>5.11 Decommissioning</p> <p><i>Temporary Closure</i></p> <p>Temporary closure will be reported to the DME as follows:</p> <ul style="list-style-type: none"> • Less than 72 hours duration – in the half yearly report • More than 72 hours but less than 144 hours duration – telephone notification to the DME and in the half yearly report • More than 144 hours – telephone report to the DME and a written report within 30 days
PER Feb 99 pg 5-7	<p><i>Permanent Closure</i></p> <ul style="list-style-type: none"> • Open pit(s) – Water inflow and quality will return to its pre-mining level once mining ceases. The pit(s) will be allowed to rapidly fill to preclude the development of acid leachate. Any sulphide or transitional waste in the bottom of the pits will be capped with 5m of oxide waste prior to filling with water • Waste Rock Dump(s) – The dump(s) will be progressively re-vegetated according to the rehabilitation plan. During active waste rock disposal, the dump will not be reclaimed. • The top of the dump will be slightly sloped and will provide a level surface for re-vegetation. • The side slopes will be less than the angle of repose and will also be re-vegetated • Leach Pad – Residual cyanide will be reduced in the spent heaps until WAD cyanide levels in the rinsate reaches the levels required by the DME. The perimeter berms and ditches will be graded to prevent water ponding. If possible, the top of the heap will be re-vegetated • Ponds – All rinse and residual process liquids will be contained within the ponds and evaporated. The liner will be folded around the evaporate and buried. The ponds will be backfilled and graded to prevent water ponding. Re-vegetation of the pond area will be undertaken in accordance with the rehabilitation plan • Miscellaneous Facilities – All process chemicals and petroleum products and their containers will be removed from site. The process plant will be removed from site. • Roads not required for access will be ripped. All buildings will be progressively removed from site. Disturbed areas will be re-vegetated in accordance with the rehabilitation plan.
PER Feb 99 pg 5-7	<p>5.11.3 Post Closure Monitoring</p> <p>Post closure monitoring of the leach pads will be undertaken until the cyanide WAD levels meet the requirements of the DME.</p>
PER Feb 99 pg 5-8	<p>5.12 Rehabilitation</p> <p>The Company will rehabilitate the project site to standards acceptable to the relevant authorities.</p>
	<p>The Company will attempt to retain within or backfill to the open pit all PAF waste with</p>

	moderate or high NAG values rather than place the material in the waste dump.
	Continuing characterisation studies will be undertaken during mining operations to provide further information for long term prevention of acid drainage.
PER Feb 99 pg 5-8	<p>5.12.3 Erosion control and surface soil stockpiling</p> <p>The main soil management programme will be as follows:</p> <ul style="list-style-type: none"> • Progressive soil removal to reduce large surface areas from exposure to reduce erosion; • Perimeter bunding to reduce erosion and siltation; and • Stockpiles will be maintained for as short a period as possible by progressive rehabilitation to prevent seedstock loss and deterioration.

<p>PER Feb 99 pg 5-8</p>	<p>5.12.4 Re-vegetation The Company will re-vegetate with appropriate local native species as well as local easily established approved native ground covers. The following programme will be undertaken:</p> <ul style="list-style-type: none"> • Rehabilitation trials during year 1 of operations to determine the most appropriate or • suitable plant species; and • Re-vegetation will commence in the late 'dry' season to benefit from the 'wet; season • rains.
<p>PER Feb 99 pg 5-8</p>	<p>5.12.5 Waste Rock Dumps The Company plans to progressively rehabilitate the waste rock dumps although the actual mining sequence will dictate its timing. Long term waste dump stabilisation will be a primary emphasis and will be achieved as follows:</p> <ul style="list-style-type: none"> • The outer slopes will be shaped as required to ensure stabilisation although the benches formed during construction will most likely suffice; • The upper surface will be capped with a minimum 0.5m loose layer of oxide waste and stockpiled surface soil, if available; and • Re-vegetation of the upper surface will be completed.
<p>PER Feb 99 pg 5-9</p>	<p>5.12.6 Leach Pad The leach pad will be progressively rehabilitated following its washing and rinsing cycle as follows:</p> <ul style="list-style-type: none"> • Surface soil (if available) will be used to cap the new surface and re-vegetation will be started; and • The side slopes of the leach pad will be stabilised as required and the dump surface will be contoured to enhance drainage off the leach pad.
<p>PER Feb 99 pg 5-9</p>	<p>5.12.7 Mine open pit(s) At the completion of mining the Company will undertake the following to leave the open pits(s) as a safe landform:</p> <ul style="list-style-type: none"> • The upper bench will be bulldozed to form a scree slope for limited surface soil to attract pioneering plants • All road access points will be blocked in an appropriate manner to prevent vehicular access in to the pit(s) • Vehicular access to the pit(s) perimeters will be hindered by the construction of bunds and/or diversions • The pit(s) may be allowed to rapidly flood with natural waters.
	<p>5.12.8 General Site The Company will rehabilitate the general site following the decommissioning operations and facilities removal. These areas include the process plant and facilities site(s), the workshop and office site(s), any borrow sources and haul roads. The following works will be undertaken:</p> <ul style="list-style-type: none"> • Minimisation of erosion through the use of spoon drains to divert water runoff; • Ripping of compacted surface to loosen the sub-base prior to surface soil replacement; and • Re-vegetation of all areas that contain replaced surface soil with appropriate, approved native species through seeding and/or allowing pioneering to occur.