Murrin Murrin Nickel-Cobalt Project Stage 2 Expansion, 60 km east of Leonora

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Anaconda Operations Pty Ltd

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

This report provides the Environmental Protection Authority's (EPA's) advice to the Minister for the Environment on the proposal by Anaconda Operations Pty Ltd for the Stage 2 expansion of the Murrin Murrin Nickel-Cobalt Project.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

In the EPA's opinion, the following are the environmental factors relevant to this proposal:

(a) subterranean fauna — loss of habitat through calcrete quarrying;

(b) groundwater — effects of groundwater abstraction on other beneficial uses;

(c) gases (SO_2, NO_x, and NH_3) — health impacts of process plant emissions;

(d) greenhouse gases — contribution to global warming;

(e) waste disposal facilities (Tailings Storage Facility / evaporation ponds) — impacts on surface and groundwater systems;

(f) Aboriginal heritage and culture — clearing and disturbance of land; and

(g) community liaison — local Aboriginal communities of Laverton, Leonora, and Mt Margaret.

The EPA has also provided advice in relation to ammonia transport noting that risks associated with the transport of this reagent would either be reduced by this proposal, or managed under an existing transport management plan by CSBP.

Conclusion

The EPA has considered the proposal by Anaconda Operations Pty Ltd and concluded that the proposal can be managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors as set out in Section 3;

2. That the Minister notes that the EPA has concluded that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 1 and summarised in Section 4, including the proponent's commitments.

3. That the Minister imposes the conditions and procedures recommended in Appendix 1 of this report.

4. That the Minister notes the advice on the transport of ammonia provided in Section 5.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by Anaconda Operations Pty Ltd for the Stage 2 expansion of the Murrin Murrin Nickel-Cobalt

Project is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions;

(b) that borefield management plans be prepared for each new borefield in order to address local impacts of the borefields and to protect existing beneficial uses of groundwater resources (including ecosystem maintenance);

(c) that a survey and management programme be implemented for subterranean fauna to ensure the conservation of any subterranean fauna species within the calcrete mining areas;

(d) that should the central thickened discharge tailings option be chosen, then further detailed plans and modelling of this option be provided to the EPA for consideration prior to implementation;

(e) that the role and functioning of the Murrin Murrin Aboriginal Environmental Liaison Committee be formalized;

(f) that continued investigation and implementation of "no regrets" and "beyond no regrets" measures be undertaken to reduce greenhouse gas emissions;

(g) that decommissioning strategies for the mine be considered and adopted early in the life of the project; and

(h) that the environmental performance of the project be subject to an intensive review every six years.

Contents

Tables

Figures

Appendices

1. Recommended Environmental Conditions and proponent's consolidated commitments
2. List of submitters
3. References
4. Proponent summary of environmental issues and their management
5. Issues arising out of informal meetings with Anaconda Nickel and the Aboriginal Communities from Laverton, Leonora and Mt Margaret Mission
6. Summary of public submissions and the proponent's response

1. Introduction

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the environment on the environmental factors relevant to the proposal by Anaconda Operations Pty Ltd for the Stage 2 expansion of the Murrin Murrin Nickel-Cobalt Project.

The proposal was referred to Environmental Protection Authority (EPA) in July 1998 and the level of assessment was set at "Public Environmental Review" (PER). This level of assessment was set by the EPA in recognition of the proposed substantial increase in the size of the existing Murrin Murrin Project and the large area over which the proposed expansion extends.

The Murrin Murrin Project has previously been assessed by the EPA on two occasions. In May 1996 the initial Murrin Murrin Nickel-Cobalt Project was assessed (EPA 1996a). In November 1996 a number of site alternatives and project changes to the initial project were assessed (EPA 1996b). In each case the EPA found the proposals to be environmentally acceptable. The existing Murrin Murrin project (the Stage 1 project) is currently subject to a number of environmental conditions under the approval issued by the Minister for the Environment on 5 May 1997.

The proponent's PER document was made available for public comment for a period of approximately eight weeks from 31 October 1998 to 24 December 1998.

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses environmental factors relevant to the proposal. The Conditions and procedures to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides Other Advice by the EPA. Section 6 presents the EPA's Conclusions and Section 7, the EPA's Recommendations.

Appendix 1 contains the recommended environmental conditions and the proponent's commitments; people and organisations who made submissions are listed in Appendix 2; and references are listed in Appendix 3. The proponent summary of environmental issues and their proposed management is included in Appendix 4, and a summary of issues arising out of the EPA's meetings with local Aboriginal communities is provided in Appendix 5.

Appendix 6 contains a summary of the public submissions and the proponent's response. The summary of public submissions and the proponent's response is included as a matter of information only and do not form part of the EPA's report and recommendations. The EPA has considered issues arising from this process relating to identifying and assessing relevant environmental factors.

2. The proposal

The Murrin Murrin Nickel-Cobalt Stage 2 expansion is a proposal to increase the processing and production of the existing Murrin Murrin Nickel-Cobalt project to approximately 250% of its current level.

The existing Murrin Murrin Nickel-Cobalt project, located 60 km east of Leonora (Figure 1), has environmental approval to mine and process 4 Mtpa (million tonnes per annum) of ore, producing approximately 45 000 tpa of nickel, 3 000 tpa of cobalt, and 145 000 tpa of ammonium sulphate.

The proposed expansion would involve mining the Murrin Murrin East ore bodies located 45 km southeast of the current project area, increasing the rate of mining of the Murrin Murrin North and South ore bodies, transporting the ore to the existing Murrin Murrin processing plant, and processing the ore within an expanded plant. The expanded project will also require the development of additional borefields, further calcrete quarry capacity, and extended transport infrastructure. The main aspects of the proposed expansion are listed below (refer to Figure 2):

- mining of the Murrin Murrin East Orebodies, located approximately 45 km to the southeast of the Murrin Murrin Plant Site and adjacent to the western edge of Lake Carey;

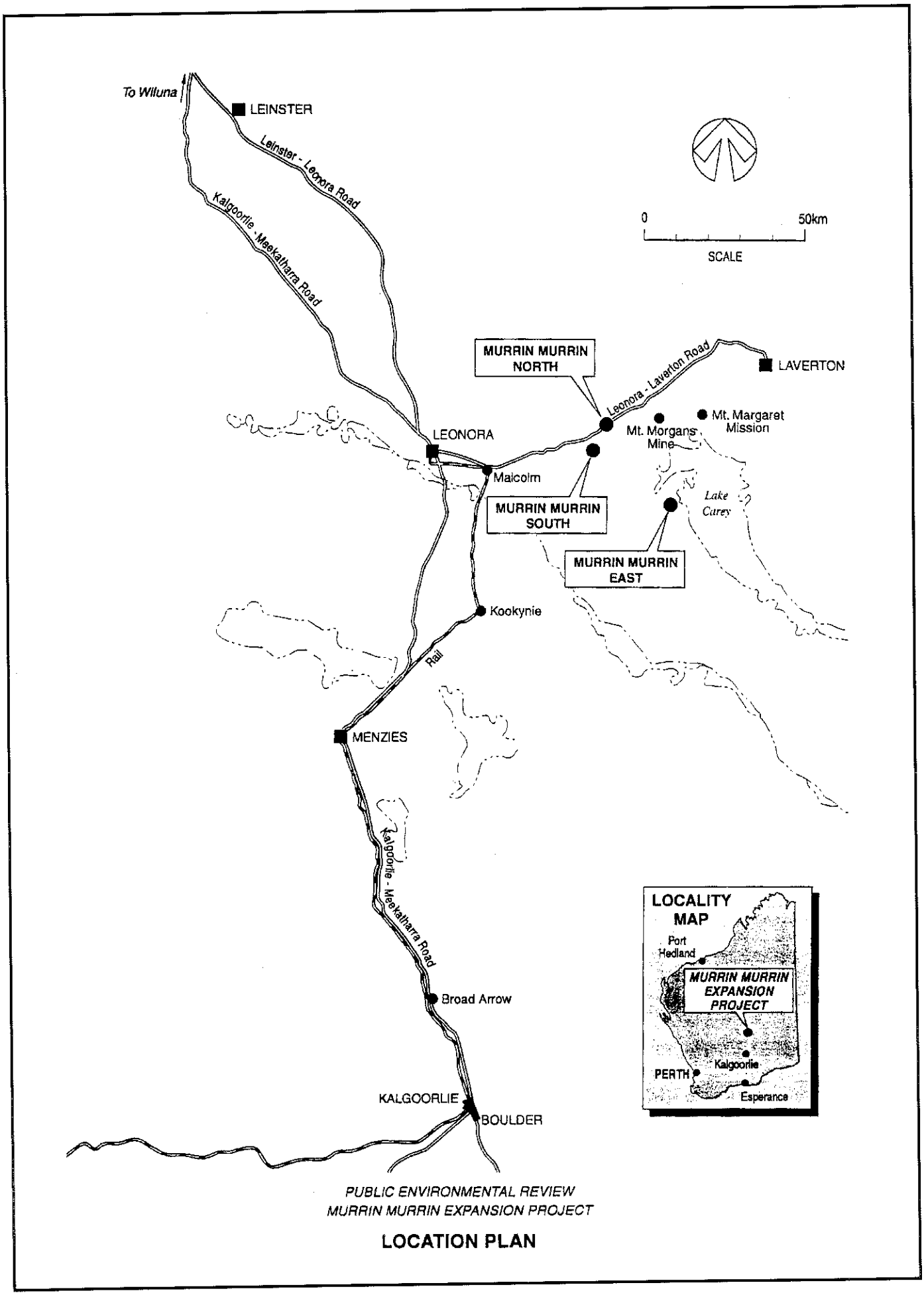

Figure 1. Location Plan (Source: Dames & Moore, 1998).

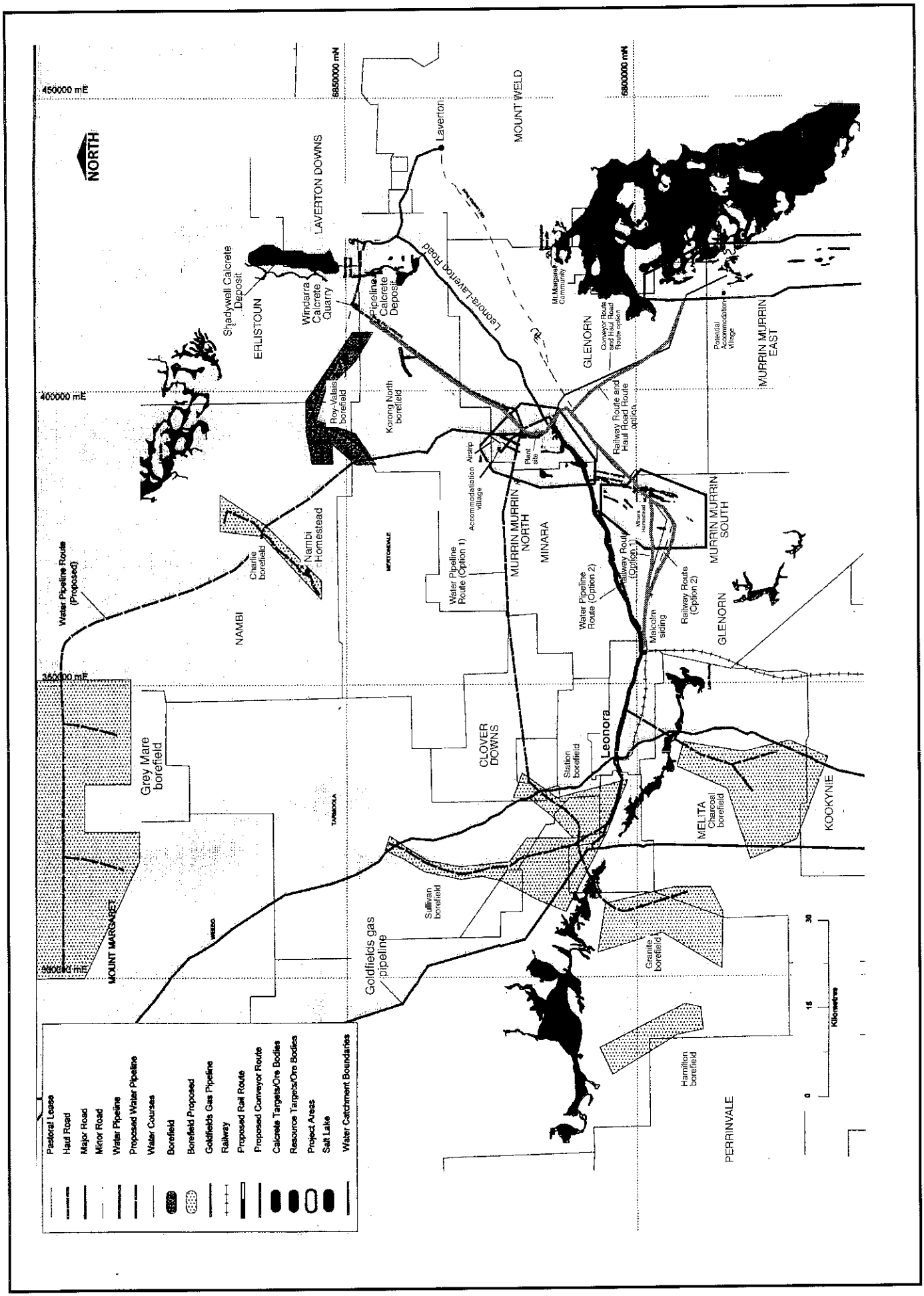

Figure 2. Project Layout (Source: Dames & Moore, 1998).

- an increase in the mining rate at the Murrin Murrin site from 4.5 Mtpa to 10 Mtpa with associated scaling up of other aspects of the operation (processing, tailings storage etc);
- either a conveyor, haul road or rail line to transport the ore from the Murrin Murrin East run-of-mine stockpile and mining areas to the existing Murrin Murrin Processing Plant;
- expansion of the processing plant and some alternative processing options (Figure 3);
- a number of groundwater borefields to supply process water;
- option to produce ammonia on-site rather than transport it from Kwinana; and
- option to develop rail infrastructure in the area to rail goods, products, and ore to and from the processing plant rather than the current road transport.

A summary of the key characteristics of the proposal is presented in Table 1. A detailed description of the proposal is provided in Section 3 of the PER (Dames and Moore, 1998).

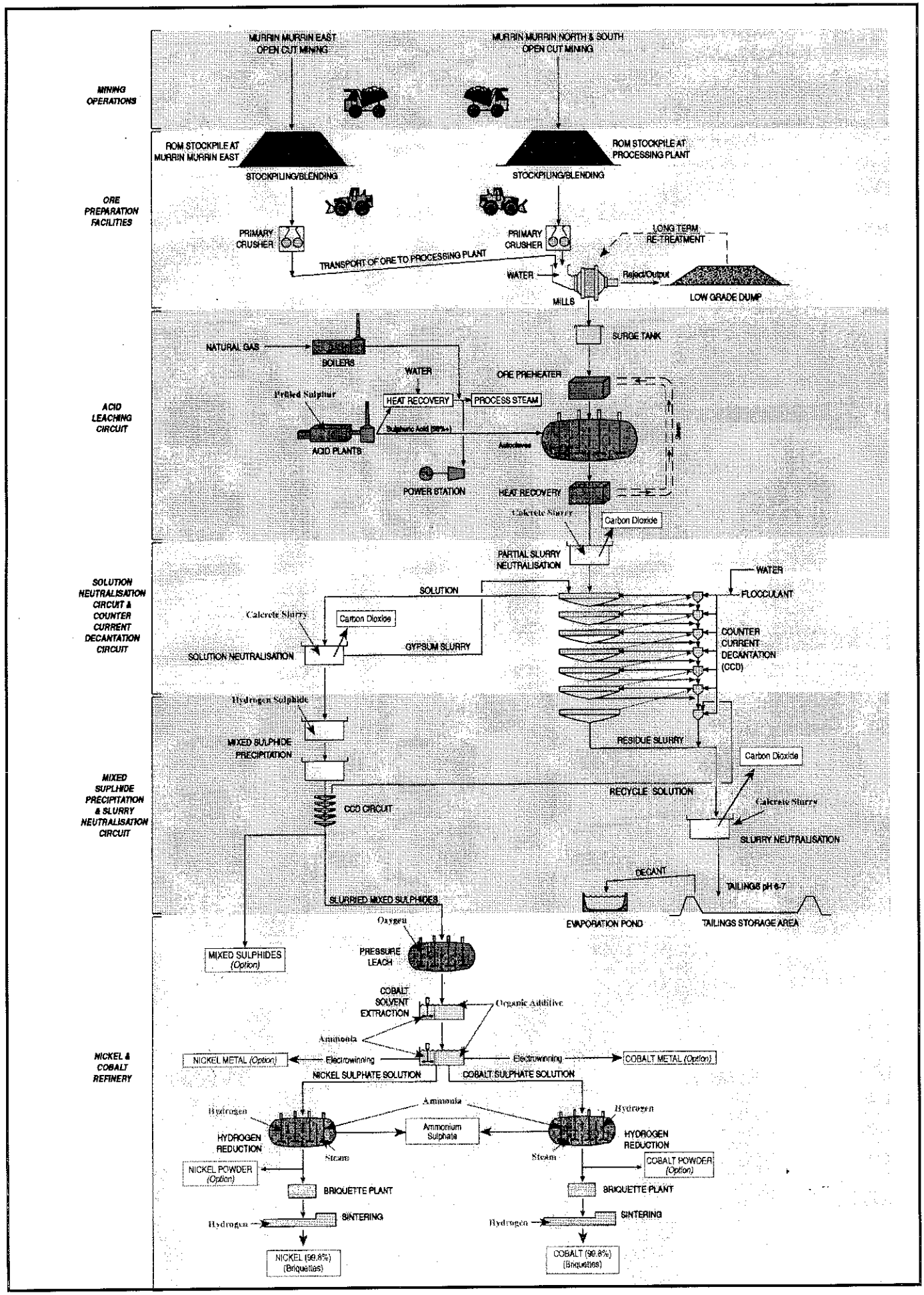

Figure 3. Process Flow Diagram (Source: Dames & Moore, 1998).

Table 1 - Summary of key proposal characteristics

	MM Stage 1 Project		Overall Project	
	Design	**Maximum Capacity**	**Design**	**Maximum Capacity**
Life of Project(Indicative)	~30 years		~30 years	
Inputs				
Nickel Cobalt Ore (Mtpa)	4.0	4.5	10	11
Calcrete[1] (Mtpa)	1.3	1.5	3.9	4.3
Elemental Sulphur (Mtpa)	0.54	0.62	1.4	1.9[2]
Process Water (ML/d)	35	40	Up to 88	Up to 97[3]
Natural Gas (TJpd) (with Ammonia Plant in Expanded Project)	8	25	40	90
Outputs[4]				
Products				
Nickel Metal Briquettes (tpa)	45,500	50,000	115,000	126,500
Cobalt Metal Briquettes (tpa)	3,000	3,800	11,000	12,000
Cobalt Powder (tpa)	3,000	3,800	11,000	12,000
Cobalt Cathode (if electrowinning is used) (tpa)	3,000	3,800	11,000	12,000
Cobalt Sulphate Crystals (tpa)	8,200	8,200	22,000	24,000
Mixed Nickel Cobalt Sulphide Powder (tpa)	29,000	100,000	250,000	275,000
Nickel Powder (tpa)	20,000	20,000	115,000	126,500
Nickel Cathode (if electrowinning is used) (tpa)	0	0	115,000	126,500
Ammonium Sulphate Crystals (tpa)	145,000	160,000	400,000	440,000
Wastes and Emissions				
Tailings Solids (Mtpa) (including gypsum)	4.8	5.4	13.3	14.5
Water from Dewatering Operations (kL/d)	-	-	Up to 500	Up to 500
Sulphur Dioxide[5] (g/s)	189	ND	329	ND
Oxides of Nitrogen[5] (g/s)	20.0	ND	27.3	ND
Carbon dioxide (Mtpa)	0.38	ND	1.14	ND
Waste Dumps - Indicative Characteristics				
Area disturbed by waste dumps and ore stockpiles at Murrin Murrin East (km^2)			25	
Area disturbed by waste dumps and ore stockpiles at Murrin Murrin North and South (km^2)			15	
Height of waste dumps			20m	
Tailing Storage Facility and Evaporation Ponds – Indicative Characteristics				
Area of disturbance TSF (km^2)			Up to 23	
Area of Disturbance Evaporation Ponds (km^2)			Up to 12	
Groundwater criteria			Designed to: • Comply with the DMA Guidelines; • Prevent surface breakout of saline liquors; and • Prevent the water table outside of the facility from rising to a level shallower than 8m below the ground surface at a distance greater than 250m from the TSF and evaporation ponds	
Pits - Indicative Characteristics				
Area to be disturbed at Murrin Murrin East (km^2)			17	
Area to be disturbed at Murrin Murrin North and South (km^2)			8.5	
Depth of pits			estimated maximum depth of 50m	
Calcrete Quarry – Indicative Characteristics				
Area of disturbance (km^2)			15	

Notes: Figures presented in this table for waste dumps, pits, calcrete quarry and the TSF and evaporation ponds are indicative only and final figures will be determined during detailed engineering in consultation with the DME.

1 The quantity of calcrete required will vary as a function of its calcium carbonate content. A high calcium carbonate content will mean that a smaller quantity of calcrete will enable the Project to meet its neutralisation requirements. The estimated value of 3.9Mtpa is based on an average calcium carbonate content of 52%.

2 Maximum capacity is based on the option of two 4,400tpd sulphuric acid plants for the Expansion Project to enable supply to third party users.

3 Maximum capacity is based on the option of a 350,000tpa ammonia plant for the Expansion Project to enable supply to third party users.

4 The product masses listed as the outputs represent the maximum production rates for each product in isolation from other related products.

5 A full break down of the sources of these emissions is provided in Tables 5 and 6.

ND Not defined.

Since release of the PER, a number of modifications to the proposal have been made by the proponent. These include:

- the deletion of an alternative metal processing option involving the roasting of mixed sulphides; and
- the addition of one borefield (Grey Mare) and the identification of other prospective borefields.

The potential impacts of the proposal initially predicted by the proponent in the PER document (Dames and Moore, 1998) and their proposed management are summarised in Appendix 4.

3. Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the relevant factors is summarised in Table 2.

Having considered appropriate references, public and government submissions and the proponent's response to submissions, in the EPA's opinion, the following are the environmental factors relevant to the proposal:

(a) subterranean fauna — loss of habitat through calcrete quarrying;

(b) groundwater — effects of groundwater abstraction on other beneficial uses;

(c) gases (SO_2, NO_x, and NH_3) — health impacts of process plant emissions;

(d) greenhouse gases — contribution to global warming;

(e) waste disposal facilities (Tailings Storage Facility / evaporation ponds) — impacts on surface and groundwater systems;

(f) Aboriginal heritage and culture — clearing and disturbance of land; and

(g) community liaison — local Aboriginal communities of Laverton, Leonora, and Mt Margaret.

Detail on the relevant environmental factors and their assessment is contained in Sections 3.1 - 3.7. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal.

The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

A summary of the assessment of the environmental factors is presented in Table 7.

Table 2 - *Identification of Relevant Environmental Factors*

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
BIOPHYSICAL			
Vegetation communities	Murrin Murrin East area has a number of vegetation communities which are significant due to the presence of Priority flora within them. Communities which could potentially be affected by clearing are 1q, 2y, 2f, 3g, and 7k. The Sullivan Borefied has *Eucalyptus camaldulensis* woodlands which may be affected by groundwater drawdown as a result of the borefield operation. Two significant vegetation communities could be affected by the additional orebodies at Murrin Murrin North and South. 2f is significant due to the presence of *Hemigenia exilis* and 2A is unique to this immediate area although widespread outside the Anaconda leases.	**Government:** DEP • Contingency plan to remedy any adverse effects on vegetation of the borefield operation should be in place prior to any impact occurring. WA Museum • There is the potential for groundwater abstraction to alter salinity of groundwater in the lower part of the palaeodrainage channels and so affect vegetation far removed from the borefields. Environment Australia • What specific measures, other than those provided in Section 7 and Appendix E of the PER, are proposed for the fringing vegetation of Lake Carey? **Public:** • The proponent should be required to describe methods to be used to control environmental degradation arising as a result of clearing vegetation off land such as: death of trees, raising the watertable, loss of plant communities and associated fauna, and soil erosion. • Anaconda's use of the Sullivan Borefield could potentially cause a substantial decrease in water levels and have a serious impact upon the borefield environment, in particular *Eucalyptus camaldulensis*.	It is noted that none of the vegetation communities to be affected are of regional significance, but that there are a number of local significance. The existing EMS/EMP for the stage 1 project addresses the management of significant vegetation communities and will be updated for the Stage 2 area incorporating issues raised in agency and public comments. Anaconda has prepared a satisfactory vegetation monitoring programme for the Roy-Valais Borefield and has committed to develop similar programmes for new borefields. It should be noted that the details of vegetation monitoring of specific borefields will need to recognise special vegetation communities where they occur. Due to generally poor understanding of mulga water dependency this community will require baseline monitoring. *Eucalyptus camaldulensis* woodlands may also be more vulnerable than most species and therefore require special attention. The potential impacts of the Sullivan Borefied on *Eucalyptus camaldulensis* woodlands and on vegetation in general, is given further consideration under the factor "Groundwater". It is expected that Aboriginal people will be able to make Factor does not require further evaluation as addressed by proponent's commitments and other legislation.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Declared Rare and Priority Flora	Murrin Murrin East Project Area Some of the orebodies lie under populations of *Hemigenia exilis* (Priority 4) and will result in destruction of these populations. *Acacia kalgoorliensis* (Priority 3) is found in a number of vegetation communities in the area, however, the majority of plants are located in the northern end and are unlikely to be disturbed by the project. Just south of the central cluster of Murrin Murrin East orebodies there is a population of *Halosarcia* "Angel Fish Island" ms (new species). Although it is unlikely this population will be disturbed, there is little knowledge about the distribution of this species around Lake Carey. Water pipeline (Option 1) Crosses through vegetation community 2b in which *Chthonocephalus multiceps* (Priority 2) has been recorded.	**Government:** CALM • Recommends that specific searches for *Eremophila annosocaule* ms be carried out in areas of Land Type 1 that will be disturbed and that the proponent consult with CALM as to the management of any *Eremophila annosocaule* ms that will be disturbed. Environment Australia • *Hemigenia exilis* is still listed as "Vulnerable" under the Commonwealth *Endangered Species Protection Act 1992.* • A copy of the management plan for *Hemigenia exilis* is requested. • The Environmental Education Programmes for employees and contractors should specifically address requirements of the threatened species. • Complete results of surveys should have been supplied as appendices to the PER. • Where threatened species are to be removed, seed should be collected for use in rehabilitation. **Public:** • A licence condition should be applied which requires CALM to be informed before the removal of populations of declared rare flora, priority or significant species. • A licence condition should be applied which requires CALM to be informed of any intended removal of species notified by CALM as being significant to Aboriginal people as and by the way of "bush tucker".	The existing EMS/EMP for the Stage 1 project addresses the management of significant vegetation communities (which are associated with most of the priority flora) and will be updated for the Stage 2 area incorporating issues raised in agency and public comments. A management plan for *Hemigenia exilis* is in place. The proponent has given an undertaking that further investigations will occur to determine if *Halosarcia* "Angel Fish Island" ms occurs at additional locations within the Murrin Murrin East Area. This may be done as part of a larger Lake Carey study and would increase the knowledge of this species. Searches for significant flora species, including *Eremophila annosocaule* ms were carried out as part of the vegetation surveys. This particular species was not found during these searches. Additional information requested by Environment Australia has been provided by the proponent. Proponent is required to comply with *Wildlife Conservation Act 1950.* The Aboriginal people should have a forum in which to bring issues, such as impacts on "bush tucker", to the attention of the proponent and Government agencies. This is addressed later under the environmental factor "Community liaison". Factor does not require further evaluation as issues are addressed by proponent's commitments and other legislation.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Terrestrial Fauna	There will be loss of habitat through clearing which will be required, to varying degrees, in all project areas. It should be noted that no habitats of regional significance occur within the project area but some locally significant habitats have been identified. Borefield operation may affect permanent pools and mature trees in Sullivan Creek which are considered highly significant for arid zone fauna. Access roads, pipelines, and conveyor will impede the movement of fauna across these structures.	**Government:** <u>Environment Australia</u> • Commitment 18 to undertake additional fauna studies is supported and it is requested the results of these surveys be submitted to the Biodiversity Group for review. • The PER does not address the potential for bird deaths associated with the operation of the evaporation ponds. • Removal of mature River Gums should be avoided wherever possible due to the important role these play in provision of food and habitats for fauna. **Public:** • Monitor the tailings dam and evaporation ponds for trapped animals, and if the construction proves to be a danger to animals, consider a remedy such as fencing these facilities. • A licence condition should be applied which requires CALM to be informed of any intended removal of species notified by CALM as being significant to Aboriginal people as and by the way of "bush tucker".	Proponent commits to undertake additional fauna studies to ensure that adequate information is available for the purposes of managing the project as well as educating the workforce. The existing EMS/EMP for the Stage 1 project will be updated for the Stage 2 area. The tailings do not contain toxic components and so are unlikely to be a cause of animal deaths. Regular inspections of the tailings dam and evaporation pond will detect any trapped animals and appropriate actions will be taken. Potential impacts on permanent pools and mature trees in Sullivan Creek as a result of borefield operation are given further consideration under the factor "Groundwater". The Aboriginal people should have a forum in which to bring issues, such as impacts on "bush tucker", to the attention of the proponent and Government agencies. This is addressed later under the environmental factor "Community liaison". Factor does not require further evaluation as proponent's commitments are adequate.
Subterranean Fauna	Preliminary surveys have detected stygofauna within the Windarra Calcrete Quarry. Calcrete mining would affect stygofauna through direct removal of habitat and indirect changes to groundwater levels and quality.	**Government:** <u>WA Museum</u> • Potential hydrological impacts on stygofauna need to be analysed, and where necessary, appropriate fauna surveys need to be conducted to establish a baseline from which to monitor any impacts. <u>Environment Australia</u> • No information is provided as to what action will be taken should significant subterranean fauna be found at the calcrete quarry site.	**Considered to be a relevant factor.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Specially Protected (Threatened) Fauna	The overall Granite borefield area contains a Malleefowl (*Leopoa ocellata*) nest. This particular site will not be directly disturbed by the borefield operation. (endangered species) The northernmost orebodies of the Murrin Murrin East area lie within a potential habitat for the Mulgara (*Dasycerus cristicauda*). Pits and waste rock dumps would therefore result in the destruction of a small portion of this potential habitat. (rare species) Habitats of the Woma python (*Aspidites ramsayi*) and the Worm-lizard (*Aprasia picturata* ms) occur within the areas of the additional orebodies (Murrin Murrin North and South) and the Murrin Murrin East area. Although loss of habitat could have some local impact on these species, the main impact is expected to be road casualties on tracks and grid-lines. (rare species)	**Government:** Environment Australia • The Environmental Education Programmes for employees and contractors should specifically address requirements of the threatened species. • A map showing the location of the potential Mulgara habitats is requested. • Expansion of the evaporation ponds may attract migratory bird species listed on international agreements/conventions. **Public:** • A licence condition should be applied which requires compliance with the Wildlife Conservation Act 1950.	Proponent commits to undertake additional fauna studies to ensure that adequate information is available for the purposes of managing the project as well as educating the workforce. The existing EMS/EMP for the Stage 1 project will be updated for the Stage 2 area incorporating issues raised in agency and public comments. Additional information requested by Environment Australia has been provided by the proponent. The proponent is required to comply with the *Wildlife Conservation Act 1950*. The tailings have no toxic components and are therefore unlikely to result in bird deaths. The facilities will be regularly inspected and any bird deaths would be investigated to determine the cause of death and outline how future deaths may be prevented (such as through the use of hazing techniques). Factor does not require further evaluation as addressed by proponent's commitments and other legislation.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Watercourses	The mine pits at Murrin Murrin East will require the diversion of some local surface water flows. The embankments of rail lines, conveyor, and haul roads have the potential to cause drainage shadow effects on the downstream side. Mine pits, Tailing Storage Facility, and evaporation ponds will reduce the runoff flows across the project area by less than 4%.	**Government:** CALM • CALM considers the effect on the hydrology and biology of Lake Carey and the secondary impacts on vegetation due to changes in surface flows are the most important issues. The proponent's commitments to addressing these issues in their EMS are appropriate.	Modification of existing drainage patterns will be reduced as far a practicable through appropriate design of culverts and diversion channels. The EPA notes that the potential for drainage shadow effects would be reduced by choosing the rail alignment option (Option 2) which follows the existing embankment and is therefore already impacted. Factor does not require further evaluation as proposed management detailed in PER is adequate and will be incorporated in the proponent's EMS.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Salt lakes(Lake Carey)	A number of the Murrin Murrin East orebodies are located adjacent to the edge of Lake Carey. Some redirection of drainage lines in the vicinity of pits and waste dumps may have local impacts on the lake. At the completion of mining, final voids in the vicinity of the lake will fill with saline groundwater. However, the clayey soils of the area implies there are unlikely to be any direct impacts on the lake as a result.	**Government:** CALM • CALM considers the effect on the hydrology and biology of Lake Carey and the secondary impacts on vegetation due to changes in surface flows are the most important issues. The proponent's commitments to addressing these issues in their EMS are appropriate. Environment Australia • Requested details on the buffer zones between the orebodies and Lake Carey. • Proponent should undertake studies to investigate potential impacts on Lake Carey associated with orebodies MM26, MM28, MM29, MM30, and bunds around these orebodies, prior to mining these orebodies. • Proponent should give a commitment not to discharge any solid or liquid waste into Lake Carey or any other lake systems in the area. WRC • The proponent needs to provide an explanation of the consequences of the abandoned pit voids near Lake Carey filling with groundwater (i.e. that they will represent pockets of hypersaline water/saltbrines). **Public:** • Anaconda to discharge no liquid from Murrin Murrin East ore mine into Lake Carey.	The proponent is considering a number of options to increase the possibility of backfilling pits. Special consideration is being given to those pits near Lake Carey which are expected to fill with saline water. The proposal has been designed so that there will not be any discharge of solid or liquid waste from the expansion project into Lake Carey or any other lake system in the area. Additionally, the proponent has given a commitment in its response to submissions that it will not discharge any solid or liquid waste from the Expansion project into lake Carey or any other lake system in the area. Factor does not require further evaluation as proponent's commitments are adequate.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Groundwater	The Stage 2 expansion requires an additional 53 ML/d of process water which is to be extracted from a number of borefields. Exploiting these groundwater resources at this scale may affect other uses of the groundwater resources and ecosystems dependent either directly, or indirectly, on these resources.	**Government:** WA Museum • The use of such large quantities of 'high quality groundwater' requires greater justification. WRC • The information supplied in the PER is insufficient for the WRC to assess the proponent's claims that approximate doubling of the water requirements can be sustainably met over the lifetime of the project from the borefields identified in the PER. • Groundwater reports will need to demonstrate that there is no connection between the Water Corporation alluvial borefield at Station Creek and the proposed palaeochannel Station Borefield. Environment Australia • Insufficient information is provided to assess the effects of exploitation of the groundwater resource. • Information demonstrating the lack of connection between the Water Corporation's water supply and the proposed Station Borefield needs to be provided. • Impacts on groundwater flow need to be considered, specifically in regard to maintenance of flow for environmental purposes. • Insufficient information is provided on other current and future groundwater users including, pastoralists, mine, towns, and industry. • The use of substantial amounts of good quality groundwater over such a large area is not sufficiently justified in the PER. The proponent should carry out research with a view to developing methods to reduce the consumption of water.	**Considered to be a relevant factor.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Groundwater (cont'd)		**Public:** • There is major concern regarding the use of groundwater by the proponent and the effect on the aquifer. The proponent should undertake a full hydrogeological study to support the application for the groundwater abstraction licence. • It is recommended that the proponent adopt a method for groundwater management based on aquifer classification and six prescribed levels of action (Guidelines for Groundwater Protection in Australia 1995). • The proponent should undertake a survey to identify the extent of use of aquifers in the proposed region. • Consideration should be given to alternative sources of water. • The Tarmoola Gold Mine is reliant on its Sullivan Borefield and any disruption to its water supply would result in substantial losses to its operator. • The proponent's use of the Sullivan Borefield could affect *Eucalyptus camaldulensis* woodlands in Sullivan Creek. • There is concern that operation of the Station Borefield may disrupt Leonora's water supply.	

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Landform	The mine pits, waste dumps, Tailings Storage Facilities, and evaporation ponds will destroy ~75 $(km)^2$ of existing natural landforms. However, landforms of the project area are either not classed as especially significant, or will be not be greatly reduced in a regional context. Some land systems are highly susceptible to erosion. Disturbance through mining and infrastructure construction may cause erosion in these areas.	**Government:** Environment Australia • A specific management plan is required for the protection of those land systems that are poorly represented in the Eastern Goldfields region. • The proponent should commit to preparing a rehabilitation plan early in the life of the mine in consultation with the relevant WA authorities and in accordance with the Environment Australia publication *Landform Design for Rehabilitation.* • The proponent should be committed to provide technical, financial, and personnel resources necessary to achieve satisfactory rehabilitation and monitoring following decommissioning. • It appears the project is not designed to use comprehensive backfilling. This will lead to an increased impact on the landscape. • The proposed intention to leave pits to fill with saline water can hardly be considered to be best practice. **Public:** • What is the design of the waste dumps and how will these dumps be rehabilitated? • As part of the licence conditions the company should be required to provide decommissioning plans which would include landform information and land use options for all people who would inhabit the region and utilise the environment. Such documented proposals and information would be essential to provide some degree of assistance for local indigenous inhabitants who, with their future generations, do now and will rely on the local environment for their physical, cultural, and spiritual sustenance.	The management of landforms susceptible to erosion is addressed in the EMS/EMP for the Stage 1 project and will be updated for the Stage 2 area. The proponent is considering a number of options to increase the possibility of backfilling pits. Special consideration is being given to those pits near Lake Carey which are expected to fill with saline water. In addition, the proposal would be subject to a decommissioning condition routinely applied to substantial mining operations (Refer to draft condition 8.) which requires plans to be prepared within five years of commencing operation. The proposal will be required, as a condition of its Mining Lease, to lodge unconditional performance bonds for areas of land which will be disturbed. Aboriginal Community input into decommissioning plans and other environmental aspects of the proposal, is considered further under the factor "Community Liaison". Factor does not require further evaluation as proponent's commitments and standard condition are adequate.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
POLLUTION			
Odour	H_2S is produced for use in the processing plant as a reagent. Therefore the potential exists for fugitive emissions of this gas causing the plant site to be a source of unpleasant odour.	**Government:** DEP • The proponent should provide additional modelling results for ground level concentrations of H_2S. • Can the proponent confirm that there will be a net reduction in H_2S emissions even though there will be a 250% increase in production?	The only emissions of H_2S that are not captured are those associated with occasional emergency pressure release of vessels. Therefore emissions are not significant under normal operation and typical upset conditions. The nearest residence is the accommodation village located approximately 7 km from the plant site. Construction and operation of the processing plant will require works approvals and licences under Part V of the *Environmental Protection Act 1986*. Factor does not require further evaluation as proponent commitments and Part V approvals address this issue.
Particulates / Dust	The Tailings Storage Facility, waste dumps, sulphur stockpiles, conveyors, haul roads, and other exposed surfaces have the potential to generate dust.	No comments received.	Appropriate dust suppression measures will be applied to dust generating components of the project. These are described in the Dust Management Programme of the EMS/EMP which will be updated for the Stage 2 expansion. Factor does not require further evaluation as proponent's commitments are adequate.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Gases (SO_2, NO_x, and NH_3)	Various components of the processing plant will be sources of gaseous emissions. SO_2 will be emitted primarily from the sulphuric acid plant and the power station during normal operations, and by the hydrogen sulphide plant under upset conditions. Modelling indicates that under normal operations the NEPM guidelines will be met outside of the project boundary and at the accommodation village. Upset conditions give rise to a very small possibility of exceedences outside the project boundary. NO_x will be emitted primarily from the power station and the ammonia plant. Modelling indicates that the NEPM guidelines will easily be met outside the project boundary and at the accommodation village. NH_3 will be emitted form the cobalt reduction circuit during normal operations and the ammonia plant during upset conditions. Preliminary modelling indicates relevant occupational and design ground level concentrations will be met.	**Government:** DEP • The proponent should provide additional modelling results for ground level concentrations of NH_3.	**Considered to be a relevant factor.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Greenhouse gases	The major greenhouse gas emission for this project is CO_2. The main generator of CO_2 within the project is the neutralisation of process streams using calcrete. Other components which contribute to the overall CO_2 emissions are: the power station; hydrogen plant; and ammonia plant. Overall emissions of CO_2 are calculated to be 1.14 Mtpa (or an increase of 0.28% of Australia's total emissions based on 1994 estimates).	**Government:** <u>Environment Australia</u> • The proponent should consider and evaluate options for offsetting arrangements that would decrease its greenhouse gas emissions. • Addition information supporting the comparative efficiency calculations for this proposal is requested. **Public:** • A licence condition should be applied which requires the proponent to provide calculations of greenhouse gas emissions and the logs of gas emissions.	**Considered to be a relevant factor.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Groundwater and surface water quality	The processing plant and infrastructure will involve considerable use of reagents and hydrocarbons. Spillage and migration of these materials off-site could affect groundwater and surface water quality. Water quality impacts associated with Tailings Storage Facilities and Evaporation Ponds are discussed below.	**Government:** DEP • What impacts will the disposal of excess saline/hypersaline water from pit dewatering (Murrin Murrin East) into starter pits have on the superficial aquifer beneath the starter pits? • The feasibility of using lined evaporation ponds should be investigated. Health Department • In addition to Cement Creek, all water bodies capable of being affected by poor quality surface runoff from the mine should be monitored. • Continued monitoring of wastewater quality from the wastewater treatment plant is considered essential. It is suggested that copies of monitoring results be provided to the Shire of Laverton and the Executive Director of Public Health. **Public:** • The proponent should consider monitoring the freshwater swimming pool near Lake Carey at the end of Cement Creek for the information of the Aboriginal Community on the understanding that any changes in the water quality of the pool need not necessarily be as a result of activity by the Murrin Murrin Project. • What is the quality of the waste effluent produced on a day-to-day basis and how will this effluent be disposed of? • The proponent should undertake a study on the potential sources of contamination.	Construction and operation of the processing plant, including the wastewater treatment facility, will require works approvals and licences under Part V of the *Environmental Protection Act 1986*. Conditions requiring monitoring of water quality and contingency plans in the case of any deterioration in water quality are included in works approvals and licences. Stage 2 processing plant facilities will be located within the existing plant site. Appropriate structures and management for the prevention of water pollution from this site are already in place. The existing EMS includes water quality monitoring programmes for Cement and Katata Creeks. Factor does not require further evaluation as proponent commitments and Part V approvals address this issue.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Waste Disposal Facilities (Tailings Storage Facility / evaporation ponds)	The project expansion involves a substantial increase in the area of the TSF and evaporation ponds and a corresponding increase in the final mass of material stored in them. Two options are proposed for the Tailings Storage Facility. One is an extension of the currently approved facility to an area of 1 400 ha. The other is to use a facility similar to the Mt Keith Nickel Project, which uses a central thickened discharge and would require an area of 2 300 ha. The evaporation ponds will cover an area of up to 1 200 ha. The water entering the ponds will be highly saline (TDS 140 000 mg/L) and contain $MgSO_4$.	**Government:** Environment Australia • The proponent should evaluate the environmental, engineering and economic feasibility of waste disposal options, including the disposal of tailings into mined out pits. **Public:** • More details were requested on: the proposed construction of the tailings storage facility and evaporation ponds; the composition of tailings and process wastewater; and monitoring of the tailings disposal facility. • A licence condition should be applied requiring investigation of potential contaminant transport through the soil in the case of leakage of the tailings dam. This should also provide remedial and contingency plans and be used a basis for a monitoring programme. • It is suggested that a review of soil type be undertaken and used to plan for appropriate sites for tailings dams.	**Considered to be a relevant factor.**
Noise	Mining activities, operation of the processing plant, and transport of raw materials and product will generate noise. However, the project area and any new transport routes are remote from residences.	**Government:** Environment Australia • It would be appropriate for the proponent to make a commitment to monitor noise levels in sensitive areas, particularly the Yundamindra homestead, accommodation village, and other infrastructure, to ensure compliance with prescribed levels under the WA *Environmental Protection (Noise) Regulations 1997*.	Nearest residences to the proposed mine site are greater than 7 km away and hence noise levels are not expected to exceed levels set in WA State noise regulations. Project will be subject to State noise regulations, which are at this time the *Environmental Protection (Noise) Regulations 1997*. Factor does not require further evaluation as issue adequately covered by noise regulations.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
SOCIAL SURROUNDINGS			
Public health and safety (risk and hazard)	Operation of a processing plant of this size always involves some increase in the level of risk to the public, mainly as a result of low probability catastrophic events. In this case, the inclusion of a plant which produces a poisonous gas (NH_3) is the most significant change to the existing proposal. Depending on the transport option chosen the proposed expansion could increase the amount of traffic and the transport of hazardous substances along the Laverton-Leonora road.	**Government:** DEP • Additional information is required to demonstrate that the ammonia plant will meet the EPA's individual risk criteria. **Public:** • Considering the off-site risk associated with the transport of ammonia, the proposal to produce ammonia on-site is endorsed.	The Hazards and Operability Studies carried out for the existing processing facilities will be reviewed for the expanded proposal. The proponent has made a commitment that hazardous chemicals and fuel storage areas will be bunded and constructed in accordance with AS 1940-1933. Transport of hazardous materials by road is covered by relevant legislation. Transport of ammonia to the project at rate required for the expanded proposal has already been addressed through a separate process. Transport would be in accordance with the management plan for the transport of anhydrous ammonia from Kwinana to the Goldfields which was prepared in consultation with the DEP and the DME. Comparison with similar ammonia plants indicate that the EPA's individual fatality criteria can be met at distances of the order of 600 m. The nearest residence (accommodation village) is greater than 7 km away. Factor does not require further evaluation as issue addressed by proponent commitments, existing approvals, and other legislation.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Aboriginal culture and heritage	Two significant ethnographic sites occur within the Murrin Murrin East Project Area. 67 archaeological sites of low to moderate significant will need to be disturbed in the Murrin Murrin East Project Area. A few other sites of low or negligible significance occur along transport and infrastructure corridors.	**Government:** AAD • Although the proponent has satisfactorily addressed Aboriginal heritage issues, not all heritage reports have been completed for the proposed areas of expansion. It is understood that these reports will be submitted once the option for transport of ore to the plant site has been determined. Environment Australia • There is insufficient information provided in the PER in relation to Aboriginal heritage values. It is unclear to what extent Aboriginal communities' view of what is a significant site has been taken into consideration, significant seems to have been decided on the basis of archaeological value of the sites. **Public:** • The proponent should make sure that anthropological and archaeological studies/reports are written clearly and in a way that makes sense to the contributor of the information, and that such reports are being referred back to the contributors for verification and sign-off — not as a requirement under the *Aboriginal Heritage Act*, but as a matter of courtesy. • Aboriginal comment on the site clearance process has not been favourable. It is suggested that a separate study be undertaken to fully document the sites which have been cleared [approved for disturbance] and the environmental implications.	**Considered to be a relevant factor.** (See also the factor of "Community Liaison")

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
OTHER			
Community Liaison	The Murrin Murrin Project Stage 2 expansion extends over a distance of ~150 km and will affect a land area of ~120 km^2. Given the Aboriginal people's special relationship to the land, the development of a project extending over such large distances and affecting such large areas of land, is of some concern to the Aboriginal communities of the area.	**Public:** • The proponent should keep the Aboriginal Communities better informed of the water issues, particularly the quality of groundwater upstream and downstream of the tailings dam and evaporation ponds, and any effects on flora and fauna and the water table level as a result of borefield extraction. • The proponent should involve the Aboriginal Communities in the water monitoring of the tailings dam and evaporation ponds, and Cement Creek catchment area, as a means of aiding the communication process. • The proponent should report the results of water monitoring to the Aboriginal Community in a simple and clear manner, and assist in interpreting the information and understanding the issues. • If Anaconda decides upon the conveyor belt rather than railway line as the means of transporting ore from Murrin Murrin East to the Plant Site, it should inform the Aboriginal Community about the size, construction, operation, and route of the conveyor belt and include the specifications for crossing points for both people and animals. • The proponent should simplify reports and ensure communications are understood at Aboriginal Liaison Committee meetings, and invite wider Aboriginal Communities to attend for information purposes. It should consider inviting contributing officers from government departments to attend. • The proponent should consider, on the basis of a goodwill gesture, rather than because of any perceived or potentially real effect on the swimming hole, building a swimming pool for the Mt Margaret Mission Community. • Problems have been referred to the Minister for the Environment regarding the proponent's commitment to genuine consultation with sections of the Aboriginal Community through the Liaison committee. However, the continuation of the committee with the addition of appropriate review and monitoring mechanisms, should be a condition of approval.	**Considered to be a relevant factor.**

3.1 Subterranean fauna

Description

The additional calcrete deposits of this proposal (Shadywell and Pipeline calcrete deposits) are likely to contain subterranean fauna and hence there is the potential for calcrete mining operations to affect subterranean fauna populations within these deposits, either through direct loss of habitat or indirect impacts on groundwater quality and quantity.

Subterranean fauna includes both troglobites (terrestrial) and stygofauna (aquatic). Both of these are important because of their species richness, evolutionary history and adaptations, and the evidence they can provide for continental drift. Hence they are significant in terms of Australian faunal biodiversity (EPA, 1997).

At this stage only preliminary survey work on subterranean fauna has been carried out, but the indications are that the calcrete deposits will contain subterranean fauna. Stygofauna sampling of the Roy-Valais Borefield, the Korong North Borefield, and the Windarra Calcrete Quarry has been carried out by the proponent with the assistance of the Western Australian Museum of Natural Science (W. F. Humphreys, 1998). These surveys utilised existing boreholes developed as part of the Stage 1 project. It is expected that the results of this sampling can be extrapolated to the Stage 2 project areas. No stygofauna were found in the aquifers of the borefields and it is considered that this environment is unlikely to provide sufficient nutrients for the maintenance of stygal ecosystems. Sampling of the Windarra Calcrete Quarry found two previously unknown species of eyeless water beetles, amphipods, and several microcrustaceans. Given the limited sampling programme the survey report concludes that the area is undoubtably richer in subterranean fauna than was recorded.

The recommendations of the draft report from the preliminary survey were that:

- the taxonomic status of the macrofauna be investigated and that the broader distribution of the stygofauna be ascertained to ensure that it is present in areas outside of the impact of the proposed or projected mining operations; and
- an early integration should occur of the requirements for stygofaunal monitoring with resource assessment and geotechnical investigation for future operations.

Submissions on the PER

The Western Australian Museum of Natural Science submitted that the potential hydrological impacts on stygofauna need to be analysed, and where necessary, appropriate fauna surveys need to be conducted to establish a baseline from which to monitor any impacts.

Environment Australia noted that the PER seemed deficient in that no information was provided as to what action would be taken should significant subterranean fauna be found at the calcrete quarry site.

Assessment

The areas considered for assessment of this factor are the Stage 2 calcrete deposits (Shadywell and Pipeline).

The EPA's environmental objective for this factor is to maintain the abundance, species diversity and geographical distribution of subterranean fauna; and to ensure that subterranean fauna are adequately protected, in accordance with the Wildlife Conservation Act 1950.

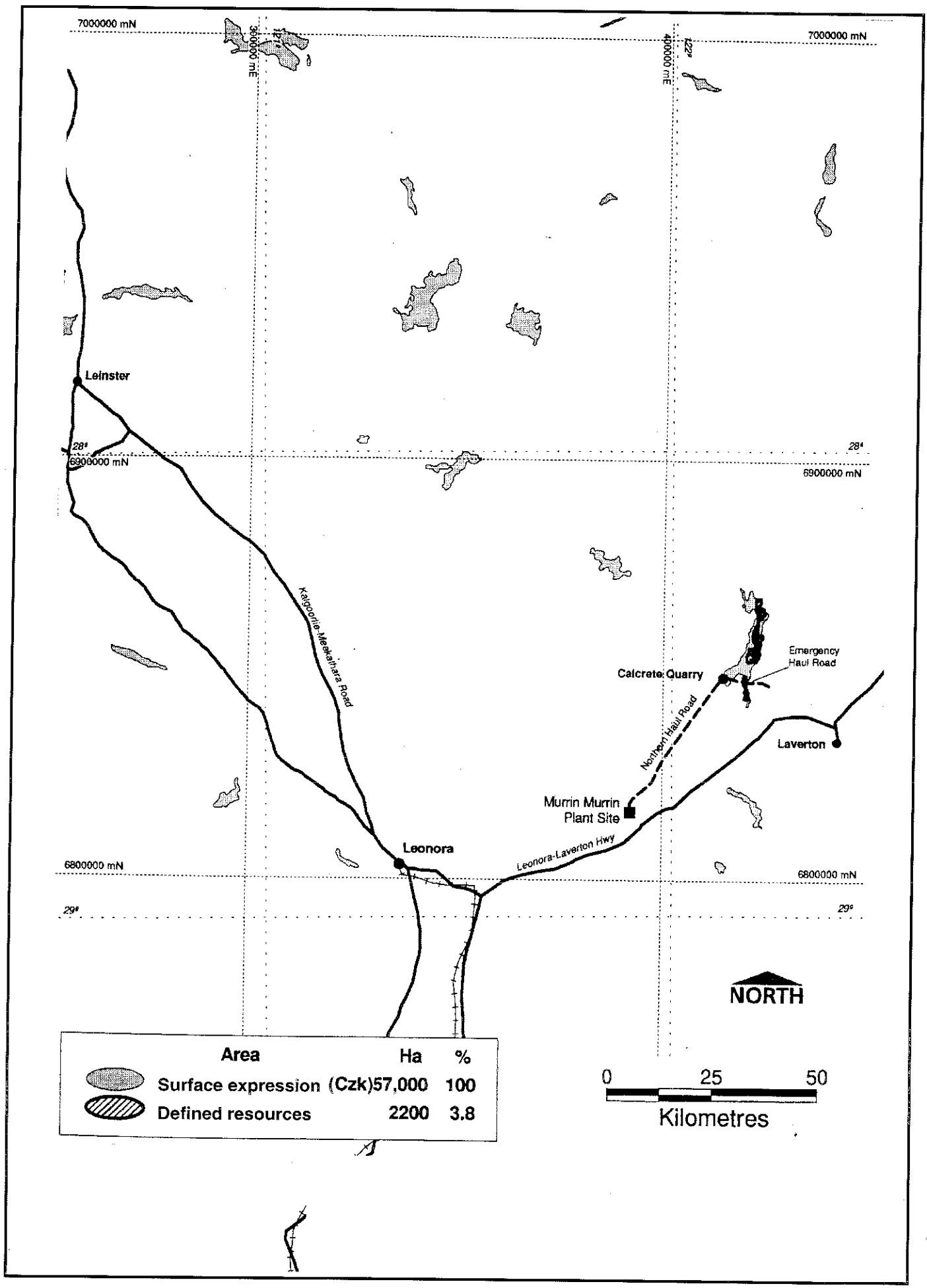

Figure 4. Calcrete Resources of the Northeast Goldfields (Source: Proponent's response to submissions).

In its response to submissions the proponent provided a regional map (Figure 4) of the calcrete surface expressions and noted that the calcrete resources defined for the project cover only 3.8% of this potential habitat for subterranean fauna.

The proponent has also given a commitment to undertake additional fauna studies (including subterranean fauna surveys) to ensure that adequate information is available for the purpose of managing the project.

The EPA notes the findings and recommendations of the preliminary survey work and agrees with the principal recommendation, that further studies are required to establish the broader distribution of stygofauna in these areas. While the EPA notes that the preliminary work identified a subterranean fauna community not known from any other location, it believes that this to some extent is an indication of the present limited knowledge of subterranean fauna in the region. The EPA is concerned about the lack of information regarding subterranean fauna species and their distribution throughout the proposed calcrete areas. Subterranean fauna was included in the EPA's guidelines for the preparation of the PER and it was expected that baseline surveys of potential habitats would be carried out to a standard comparable to that which the proponent has applied to non-subterranean fauna. The preliminary work carried out so far provides only limited information on fauna which may be affected by the proposal and must therefore be extended before new calcrete areas are developed. The second recommendation of the preliminary survey suggests how this might be incorporated into the development of the project.

With reference to Figure 4, it is clear that the proposed new calcrete quarries comprise a small fraction of the potential regional stygofauna habitat and therefore it might be expected that the impacts on subterranean fauna will not be significant provided species are widely distributed at a regional scale. As the proponent has noted, the proposed quarries cover only 3.8% of the potential habitat of the region. However, the wider distribution of subterranean fauna species is unproven at this time and in other locations subterranean populations are known to be highly localised. It will therefore be necessary to restrict impacts within the local area until the conservation status of subterranean fauna species within this area is better understood as a result of further studies.

The EPA notes that the proposed quarries do not cover the entire local habitat and therefore should any species or communities be restricted to this local habitat, there is scope within an appropriate management plan to leave sufficient habitat to conserve such species or communities. Figure 4 shows that the two deposits the proponent has included in this proposal do not cover the entire calcrete surface expression of the area within which they lie. Based on the results of further surveys to determine the regional and local distribution of subterranean fauna, it should be possible to protect representative areas of habitat and manage the indirect impacts on this habitat.

The EPA is advised that it will be some years before the Shadywell or Pipeline quarries will need to be developed and so there is sufficient time for the necessary studies to be carried out and management plans prepared.

Summary

Having particular regard to:

(a) the results of preliminary survey work;

(b) the extent of potential habitat for subterranean fauna outside the proposed quarry areas; and

(c) the fact that the proposed calcrete areas need not be developed immediately,

it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's objectives for subterranean fauna, provided more information on the distribution of subterranean fauna species is obtained and management practices are modified in response to this information (refer to draft condition 4).

3.2 Groundwater

Description

The Stage 2 expansion will require the exploitation of groundwater resources on a regional scale in order to provide the water required for the increased size and throughput of the processing plant.

The increase in the throughput of the ore processing plant requires a proportional increase in the already substantial water requirements of this project. Up to an additional 53 million litres of water per day (ML/d) with a Total Dissolved Solids (TDS) content of less than 4 000 milligrams per litre (mg/L) will be required throughout the life of the project. This water is to be extracted from a regional borefield system tapping deep (~60 m) palaeo-drainage channels. The borefields currently identified in the PER and in subsequent modifications of the proposal are (refer to Figure 2):

- Charcoal borefield;
- Charlie borefield;
- Station borefield;
- Granite borefield;
- Sullivan borefield;
- Hamilton borefield; and
- Grey Mare borefield.

In addition, two other potential borefields have been referred to as possible contingency borefields. These are Bummer Creek and Wilson borefields.

It should be noted that while the water required by the proposal is not of high quality in terms of its potential uses, it is of relatively good quality when compared with the overall groundwater resources of the area. The processing plant can tolerate water up to 4 000 mg/L TDS. For comparison, water for human consumption should be < 1 000 mg/L TDS, water of > 3 500 mg/L is generally unsuitable for irrigation, and the maximum concentration for the healthy growth of livestock is ~6 000 mg/L. In this context the brackish water targeted by the proponent is of poor quality. However, the groundwater of the region is generally hypersaline, but varies from 800 mg/L to greater than 200 000 mg/L, and so the proponent is targeting some of the better quality water of the region.

Within the borefields described in the PER the known beneficial uses which may be affected by the proposed water supply scheme are: the maintenance of a *Eucalyptus camaldulensis* woodland and pools in Sullivan Creek; the use of groundwater by the Tarmoola Gold Mine in the Sullivan Creek area; and the water supply for the town of Leonora in the Station borefield area. It is understood that generally, vegetation is not dependent on groundwater since the natural groundwater levels are much further below the surface than the roots of most of the vegetation. However, the proponent has implemented a vegetation monitoring programme for the existing borefields in order to confirm this through measurement. A commitment has been made to implement similar monitoring for all additional borefields. It is recognised that the vegetation of Sullivan Creek is different to that of the existing borefield (Valais borefield).

Submissions on the PER

The WA Museum felt that the use of such large quantities of 'high quality groundwater' required greater justification.

The Water and Rivers Commission (WRC) initially expressed the view that the information supplied in the PER was insufficient for the WRC to assess the proponent's claims that approximate doubling of the water requirements can be sustainably met over the lifetime of the project from the borefields identified in the PER. The additional hydrological reports which the proponent would need to provide in order to supply this information would also need to demonstrate that there is no connection between the Water Corporation alluvial borefield at Station Creek and the proposed palaeochannel Station Borefield.

Environment Australia also believed that insufficient information was provided in the PER to assess the effects of exploitation of the groundwater resource and that, in particular, more information demonstrating the lack of connection between the Water Corporation's water supply and the proposed Station Borefield needed to be provided. The impacts on groundwater flow need to be considered, specifically in regard to maintenance of flow for environmental purposes. Insufficient information is provided on other current and future groundwater users including, pastoralists, mines, towns, and industry.

Environment Australia also felt that the use of substantial amounts of good quality groundwater over such a large area was not sufficiently justified in the PER and that the proponent should carry out research with a view to developing methods to reduce the consumption of water.

Amongst the public submissions the following points were raised.

- There is major concern regarding the use of groundwater by the proponent and the effect on the aquifer. The proponent should undertake a full hydrogeological study to support the application for the groundwater abstraction licence.
- It is recommended that the proponent adopt a method for groundwater management based on aquifer classification and six prescribed levels of action (Guidelines for Groundwater Protection in Australia 1995).
- The proponent should undertake a survey to identify the extent of use of aquifers in the proposed region.
- Consideration should be given to alternative sources of water.
- The Tarmoola Gold Mine is reliant on its Sullivan Borefield and any disruption to its water supply would result in substantial losses to its operator.
- The proponent's use of the Sullivan Borefield could affect *Eucalyptus camaldulensis* woodlands in Sullivan Creek.
- There is concern that operation of the Station Borefield may disrupt Leonora's water supply.

Assessment

The areas considered for assessment of this factor are the groundwater systems of the Laverton-Leonora region.

The EPA's environmental objective for this factor is to maintain the quantity and quality of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

Since the public review period the proponent has provided additional information regarding the water supply scheme to the WRC and the EPA through briefings and provision of results of feasibility studies for prospective borefields. It is the proponent's belief that the expanded project's water requirements could be met from the existing Valais Borefield and the proposed Sullivan, Station, and Grey Mare borefields. Three other borefields, Charlie, Charcoal, and Granite, are proposed as the first choice contingency borefields should the others prove to be unable to deliver

the expected quantities of water, however, there are other potential borefields which could also be considered further if necessary (Bummer Creek, Hamilton, and Wilson). The proponent has also provided a conceptual model of the interaction between Sullivan Creek and the targeted aquifer to support its argument that the pools in Sullivan Creek and the eucalyptus woodlands of the Creek will not be affected by the proposed Sullivan Borefield.

After considering this additional information the WRC has advised that if the proponent includes Grey Mare catchment, then it is likely to believe that the quantity of water required by the Stage 2 expansion would be available. However, there may be a need for the proponent to explore further afield if the required volumes of water at less than 4 000 mg/L TDS prove not to be available from Grey Mare.

With regard to exploitation of a regional groundwater resource on a large scale the EPA takes the view that provided that all practical water conservation measure are adopted and that the water usage does not significantly affect existing beneficial uses, including the environment, then use of the resource at this scale is environmentally acceptable. The EPA understands that the proposed total project water requirement of 88 ML/d is a conservatively high estimate and that it is in the proponent's interest to reduce the process water requirement as much as possible, due to the cost of establishing and maintaining borefields. For this and other reasons, the proponent is investigating a number of options, including the use of indirect heating in ore processing (refer to Section 3.4), which would reduce water requirements. A number of beneficial uses have been identified at the level of individual borefields. These beneficial uses, and any others subsequently identified through more detailed investigations, can be protected through the development of management plans for each borefield. Such management plans can ensure the protection of other beneficial uses by adjusting the design and rate of abstraction from the borefield and providing contingency plans in the case of any unexpected impacts detected through monitoring. The EPA therefore recommends the development of borefield management plans for each borefield identified in the PER (refer to draft condition 3).

In addition, if other borefields to those described in the PER are necessary, as seems likely, then additional information relating to the environmental values of the borefield area should also be provided for the EPA's consideration when approving the proposed management plan.

The borefield management plans recommended by the EPA would complement the water allocation and licences process of the WRC. The EPA sees the water allocation and licensing process of the WRC as the primary mechanism for determining a fair allocation of water resources between competing human uses and protecting the rights of supply of existing users. The EPA also understands that the WRC will require the proponent to demonstrate that all practical water conservation measures have been adopted. Development of each borefield will require a water abstraction licence to be issued under the *Rights in Water and Irrigation Act 1914*. It is expected that the management plans submitted to the EPA will also include all the information which the WRC will require and that therefore the same plan will meet the WRC's needs. The EPA's aim in requiring these plans is to ensure that potential impacts on local beneficial uses, including the environment, will be given further detailed consideration by the EPA, and to incorporate the management of the borefields within the environmental management system of the overall Murrin Murrin project.

Summary

Having particular regard to:

(a) the advice of WRC;

(b) the proponent's commitment to extend vegetation monitoring; and

(c) the fact that borefield development is subject to the licensing requirements of the WRC which will consider, amongst other things:

- the sustainable yield;
- other existing and future groundwater resource uses;
- environmental maintenance; and
- monitoring,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for groundwater, provided that the individual borefields are developed in accordance with management plans which address potential local impacts on other beneficial uses, in particular, ecosystem maintenance (refer to draft condition 3).

3.3 Gases (SO_2, NO_x, and NH_3)

Description

Sulphur dioxide (SO_2) is a colourless gas which has a pungent odour and can irritate and be absorbed in the respiratory tract. The sensitivity of humans to SO_2 varies considerably and asthmatics may suffer adverse reactions at quite low levels.

SO_2 gas also dissolves in moisture forming dilute sulphurous acid, which then forms sulphuric acid and sulphates, which can be readily absorbed onto small airborne particles. This increases the potential for adverse effects on human and for environmental impacts such as leaf damage to plants and reduced water quality in wetlands.

SO_2 will be emitted primarily from the sulphuric acid plant and the power station during normal operations, and by the hydrogen sulphide plant under upset conditions. The SO_2 emissions from the project are expected to be 329 g/s during normal operations.

The sum of nitric oxide (NO) and nitrogen dioxide (NO_2) is generally referred to as NO_x for the reason that under normal conditions NO is rapidly oxidised to NO_2 which has potential environmental and health effects. NO_2 is a reddish brown gas which is soluble in water and is a strong oxidant. The major sources of man-made emission to the atmosphere derive from the combustion of fossil fuels. At low concentrations, NO_2 can cause irritation of the mucous membranes and may cause or exacerbate respiratory problems such as asthma and bronchitis.

NO_x will be emitted primarily from the power station and the ammonia plant. The NO_x emissions from the project are expected to be 27.3 g/s during normal operations.

Ammonia (NH_3) is a colourless acrid-smelling gas which is an irritant to the eyes, nose, and throat at low concentrations and is lethal at high concentrations. Concentrations of 280 mg/m^3 produce throat irritation and concentrations in excess of 1 700 mg/m^3 are life-threatening.

NH_3 will be emitted from the hydrogen reduction component of the refinery during normal operations and the ammonia plant during upset conditions. Discharge of NH_3 from the hydrogen reduction circuits are intermittent but it is expect that the average emission from each autoclave will be less than 0.048 g/s.

Submissions on the PER

The DEP stated that the proponent should provide additional modelling results for ground level concentrations of NH_3.

Assessment

The area considered for assessment of this factor is the surrounding Laverton-Leonora region outside of the Project's lease area.

The EPA's objective in regard to this environmental factor is that SO_2, NO_x, and NH_3 emissions meet relevant air quality standards/guidelines and requirements of Section 51 of the Environmental Protection Act 1986 (all reasonable and practicable measures are taken to minimise pollutant discharge).

The National Environment Protection Council has developed a draft National Environment Protection Measure (NEPM) for ambient air quality which addresses SO_2 and NO_2. Table 3 presents a summary of the NEPM air quality standards for SO_2 and NO_2.

Table 3. Ambient Air Quality Guidelines

Pollutant	National Environment Protection Standards in Populated Areas		
	Averaging Time	Maximum Concentration	Goal: (10 years) Maximum Number of Allowable Exceedances per year
Nitrogen Dioxide	1 hour	256 µg/m^3	1
	1 year	62 µg/m^3	0
Sulphur Dioxide	1 hour	570 µg/m^3	1
	1 day	228 µg/m^3	1
	1 year	57 µg/m^3	0

Although compliance with these standards applies specifically to performance monitoring stations to be specified in jurisdictional monitoring plans, the standards do provide a basis from which the EPA can assess the significance of proposed emissions, and from which proponents can demonstrate whether project emissions will be managed to regionally acceptable levels.

The proponent has carried out air dispersion modelling for emissions of SO_2 and NO_x. The results under normal operations are presented in the Table 4 below.

Table 4. Maximum Predicted Ground Level Concentrations — Normal Operations

Pollutant	Units	Averaging Time	Location	
			Outside of the Project's Lease Boundary	Project's Accommodation Village
Nitrogen Dioxide	µg/m^3	1 hour	20	17.2
		1 year	0.4	0.5
Sulphur Dioxide	µg/m^3	1 hour	412	185
		1 day	87	30.5
		1 year	7.7	0.5

The above results and additional analysis provided in the PER indicate that under normal operations the NEPM standards will be met for SO_2 outside of the project boundary and at the accommodation village. Upset conditions give rise to a very small possibility of exceedances outside the project boundary (one exceedance every 426 years).

The results for NO_x show expected concentrations to be well below NEPM standards therefore emissions of NO_x are not expected to have any unacceptable impacts.

In its response to submissions the proponent has provided additional information on the expected ammonia emissions and predicted ground level concentrations. The predicted maximum ground level concentration from a single autoclave (3-minute average) is 32 $\mu g/m^3$ at the accommodation village. As a comparison, the Victorian EPA design criterion for ammonia sources is 600 $\mu g/m^3$ or less outside the project boundary. Therefore it is unlikely that there would be any unacceptable impacts arising from ammonia emissions.

The construction and operation of the expansions to the processing plant and the power station will require Works Approvals and Licences under Part V of the *Environmental Protection Act 1986*.

The EPA considers that gaseous emissions from the project are unlikely to have any significant environmental impact and that all reasonable measures have been taken to limit emissions. The proponent's modelling of predicted ground level concentrations indicate that the expanded proposal will meet appropriate standards. In addition, the proposed design of the expanded processing plant, sulphuric acid plant, and power station is similar to those of the existing project which are based on appropriate modern technology which reduces gaseous emissions. Both the sulphuric acid plant and the power station will meet the National Health and Medical Research Council emissions guidelines for new stationary sources (AEC/NH&MRC, 1986).

Production of sulphuric acid as part of this proposal may have some additional indirect effects on SO_2 emissions within the Goldfields region, but the EPA considers that there are mitigating factors which make this acceptable. The EPA understands that the DEP is encouraging sulphide smelting operations in the region to capture all their SO_2 emissions through the addition of facilities to produce sulphuric acid from these emissions. Clearly, in the absence of other factors, it would be preferred that the proponent obtained as much sulphuric acid as possible from these sources before installing additional acid generating capacity of its own. Instead, this proposal would allow the proponent to produce surplus sulphuric acid which may be sold to other uses in the region, and may discourage the development of pollution reducing sources of sulphuric acid. To support this decision the proponent has pointed out in Section 3.4.3 of the PER that there are operational and environmental disadvantages to using external sources of sulphuric acid. The EPA notes that external sources would be incapable of meeting the project's acid requirements and therefore the proponent will need to generate some of the acid it requires. It also notes that any reduction in acid production would increase greenhouse gas emissions from the project, since much of the project's energy supply is derived from the burning of sulphur in the sulphuric acid plant. After consideration of the advantages and disadvantages discussed above, the EPA concludes that there is no definitive case against this aspect of the proposal.

Summary

Having particular regard to:

(a) modelling which indicates appropriate standards can be met at the project's lease boundary and at the accommodation village; and

(b) the fact that emissions will be subject to management via Part V of the *Environmental Protection Act 1986*;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for gases (SO_2, NO_x, and NH_3), provided that the proponent's commitments are made legally enforceable.

3.4 Greenhouse gases

Description

The major greenhouse gas emission for this project is CO_2. The main generator of CO_2 within the project is the neutralisation of process streams using calcrete (0.58 Mtpa). Other components which contribute to the overall CO_2 emissions are: the power station (0.17 Mtpa); the hydrogen plant (0.19 Mtpa); and the ammonia plant (0.18 Mtpa).

Overall emissions of CO_2 are calculated to be 1.14 Mtpa (or an increase of 2.7% of Western Australia's total emissions based on 1990 estimates).

The overall Murrin Murrin Project has been designed to maximise energy efficiency thereby reducing greenhouse gas emissions. Over 70% of the project's energy requirements are to be supplied by the burning of sulphur in the sulphuric acid plant. In addition, the proponent continues to investigate mechanisms to further reduce its greenhouse gas emissions. The main focus of these investigations are the use of indirect heating (rather than direct injection of steam into the processing stream) to reduce acid consumption and hence CO_2 from neutralisation, and tree planting trials aimed at offsetting greenhouse gas emissions through the establishment of tree farming.

Submissions on the PER

Environment Australia believed that the proponent should consider and evaluate options for offsetting arrangements that would decrease its greenhouse gas emissions. It also requested additional information supporting the comparative efficiency calculations.

The Goldfields Land Council suggested that a licence condition should be applied which requires the proponent to provide calculations of greenhouse gas emissions and the logs of gas emissions.

Assessment

The context for greenhouse gas emissions is global, while the assessment of this factor is primarily at the state and national level.

The EPA considers that this proposal will be a significant contributor to Western Australia's greenhouse gas emissions and therefore its environmental objectives for this factor are:

(a) to minimise greenhouse gas emissions for the project and reduce emissions per unit product to as low as reasonably practicable; and

(b) to mitigate greenhouse gases emissions in accordance with the Framework Convention on Climate Change 1992, and in accordance with established Commonwealth and State policies.

The greenhouse effect is a natural phenomenon that warms the earth and enables it to support life. Greenhouse gases are those gases which contribute to the greenhouse effect. Over the past 200 years, human activity has dramatically increased the amount of greenhouse gases in the atmosphere and this increase continues today. While there is dissension within the scientific community over the climatic and environmental effects of increasing levels of greenhouse gases, the view of the Intergovernmental Panel on Climate Change is that there is a discernible effect on climate.

In response to the predicted impact of increasing levels of greenhouse gases National and International targets limiting the emissions of these gases have been set. At the Kyoto Climate Change Conference in December 1997 the developed countries agreed to a collective target of a 5%

decrease in greenhouse gas emissions from 1990 levels by 2010. Within this agreement Australia's target allows for an 8% increase in emissions over 1990 levels by 2010. The target represents a 25% reduction from "business as usual" predictions of greenhouse gas emission for the year 2010.

In the absence of measures to reduce emissions of greenhouse gases, Australia's emissions have been predicted to be approximately 552 Mt of CO_2 (equivalent) in the year 2010 or a 43% increase from the 1990 levels. This is the figure which is shown in Table 5 below as the "business as usual" case. It is also expected that companies producing greenhouse gas will accept the Greenhouse Challenge and implement "no regrets" improvements in their emissions, which it has been predicted will reduce the increase to 28% from the 1990 levels. "No regrets" is a term used for measures that can be implemented by a company which are effectively cost neutral to a company, in other words it provides the company with returns in savings which offset the initial capital and operating expenditure that can be incurred.

In the Prime Minister's statement prior to the Kyoto meeting and with the approval of the Commonwealth Cabinet, the Australian position that industry is being asked to do more than they may otherwise be prepared to do, that is, to go beyond a "no regrets" minimal cost approach where this is sensible in order to achieve effective and meaningful outcomes. This can be achieved by taking action both on-site and off-site.

The National Greenhouse Strategy (Commonwealth of Australia, 1998) includes some information pertaining to the implementation of the strategy. There are no project-specific requirements in the National Strategy. Detailed implementation plans are to be developed by States and Territories as subsidiary documents to the National Strategy. These detailed plans are to be guided by the same principles which have guided the National Strategy, namely:

- the need to have a greenhouse response which is tailored to Australia's national interests;
- the need to integrate greenhouse considerations with other government commitments;
- the pursuit of greenhouse action consistent with equity and cost-effectiveness and with multiple benefits;
- recognition of the importance of partnerships between governments, industry, and the community in delivering an effective greenhouse response; and
- the need for action to be informed by research.

Table 5. National Greenhouse Benchmarks

National Greenhouse Strategy Benchmarks	Predicted Increase (based on 100 for 1990) by the Year 2010	Percentage reduction from 1990 "Business as Usual" needed to achieve targets
"Business as Usual"	143	
Implementation of "no regrets"	128	10.5%
PM Statement of beyond "no regrets"	118	17.5%
Inclusion of land use and trading - Kyoto target	108	24.5%
No change on 1990 emission level	100	

The proponent is commended for providing to the EPA a categorisation of its greenhouse gas reduction measures and estimates of the ensuing reductions from the "business as usual" case. Due to the very recent development of nickel laterite processing projects within Western Australia, the 1990 "business as usual" case has been taken to be the more established method of nickel sulphide processing. This information is summarised in Table 6 below. The range in estimated reductions are a result of uncertainties in the baseline greenhouse gas efficiency of the nickel sulphide processes being used today.

Table 6. Summary of Greenhouse Gas Emissions Reductions

Scenario/Component	Estimated Emission of CO_2 per tonne of Nickel Metal Produced	Percentage reduction from "Business as Usual"
Business as Usual (nickel sulphide processing)	10 - 12	0%
No Regrets (nickel laterite processing)	9	10 - 25%
Beyond No Regrets		
• indirect heating	8.6	14 -28%
• rail transport	Not quantifiable at this stage	
• tree farm	8.4	16-30%

The proponent has given a commitment to report greenhouse gas emissions on an annual basis and is currently in the process of entering the Commonwealth Government's Greenhouse Challenge Programme.

From the information presented above, the EPA considers that the proposal is consistent with the goals of the National Greenhouse Strategy (Commonwealth of Australia, 1998). The proponent has designed an efficient project utilising "no regrets" measures and has committed resources to the investigation of "beyond no regrets" measures with the potential to ultimately reduce greenhouse gas emissions from 16-30% of the "business as usual" case. The EPA is encouraged by the proponent's initiative in investigating measures to reduce emissions and seeks to promote continuation of such investigations, and eventual implementation of the measures, through a Greenhouse Gas Emissions Management Plan (refer to draft condition 7).

Summary

Having particular regard to:

(a) the application of new energy efficient technology by the project;

(b) comparative reductions in CO_2 emissions already achieved through "no regrets" measures; and

(c) potential reductions through "beyond no regrets" measures,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for greenhouse gases, provided that the proponent continues to investigate and implement as appropriate both "no regrets" and "beyond no regrets" measures to further reduce CO_2 emissions throughout the life of the project as part of a Greenhouse Gas Emissions Management Plan.

3.5 Waste disposal facilities (Tailings Storage Facility / evaporation ponds)

Description

The project expansion involves a substantial increase in the area of the Tailings Storage Facility (TSF) and evaporation ponds and a corresponding increase in the final mass of material stored in them.

Two options are proposed for the Tailings Storage Facility. One is an extension of the currently approved facility from an area of approximately 500 ha to an area of 1 400 ha. This would involve the construction of additional storage cells similar in design and adjacent to those already constructed. The other is to use a facility similar to the Mt Keith Nickel Project, which uses a central thickened discharge and would require an area of 2 300 ha. In this type of facility the tailings are thickened and most of the excess liquor is removed before discharge. The tailings are then discharged from a number of central outlets and the thickened paste settles at a beach angle of approximately 2%. Containment walls are constructed not so much to contain the tailings, but to divert upstream runoff around the facility and collect any runoff from within the facility. New containment walls are progressively constructed further out from the centre as the tailings footprint expands. The advantages of the central thickened discharge type of facility are that the low beach angle results in a final landform which is: more consistent with the surrounding landscape; more stable; and easier to rehabilitate, than traditional tailings storage facilities.

The evaporation ponds will be extended from a current size of about 320 ha to an area of up to 1 200 ha. The water entering the ponds will be highly saline (TDS 140 000 mg/L) and contain $MgSO_4$.

Submissions on the PER

Environment Australia submitted that the proponent should evaluate the environmental, engineering and economic feasibility of waste disposal options, including the disposal of tailings into mined out pits.

The Goldfields Land Council requested more details on: the proposed construction of the tailings storage facility and evaporation ponds; the composition of tailings and process wastewater; and monitoring of the tailings disposal facility. It also believed that a licence condition should be applied requiring investigation of potential contaminant transport through the soil in the case of leakage of the tailings dam. This should also provide remedial and contingency plans and be used a basis for a monitoring programme.

The Goldfields Land Council also suggested that a review of soil type be undertaken and used to plan for appropriate sites for tailings dams.

Assessment

The area considered for assessment of this factor is the proposed Tailings Storage Facility, evaporation pond, and surrounding surface and groundwaters.

The EPA's environmental objective for this factor is to ensure that wastes are contained and isolated from ground and surface water surrounds and treatment or collection does not result in long term impacts on the natural environment.

The proponent has previously given a commitment for the Stage 1 project to investigate alternative tailings disposal options, including a provision to re-examine in-pit disposal five years after the commencement of operations. The proponent's current testwork and consideration of the central thickened discharge option is a preliminary step towards fulfilling this commitment. Should central thickened discharge prove viable this would give the proponent the ability to discharge tailings directly into disused mined pits and so facilitate further consideration of in-pit disposal.

Design and operation of Tailings Storage Facilities within Western Australia are regulated under both the *Mining Act 1978* and Part V of the *Environmental Protection Act 1986*. The DME requires a Notice of Intent to be prepared for a TSF including a signed certificate of compliance for tailings storage facility design. Aspects of design to be assessed for compliance are detailed in the DME's *Guidelines on the Safe Design and Operating Standards for Tailings Storages*. In addition, due to the potential for such facilities to cause pollution, they also require Works Approvals and Licences to be issued by the DEP. Conditions of DEP licences require monitoring of water quality surrounding the facility and contingency plans in the case of any deterioration in water quality.

The proponent has already met the above regulatory requirements for the construction of the Stage 1 project. This included providing a geotechnical assessment of the site which confirmed that it was a suitable site for such facilities and that there was no necessity for an engineered liner. The expanded area will be in a geologically similar area and, assuming detailed surveys confirm this, the proposed site will also be suitable. Detailed information confirming the suitability of the site will be provided in support of an application for a Works Approval to construct the facilities.

Application of the same design criteria and monitoring programmes to the proposed expansion as already applies to the existing project should ensure that there are no unacceptable impacts on Cement Creek. In its meetings with the local Aboriginal communities the EPA has been made aware of the importance of Cement Creek to these communities. Diversion structures have been constructed for the existing project which will be adequate for the proposed expansion. The existing facilities have also been designed so that modelling predicts there will be no surface breakout of saline liquors and that the water table will not rise closer than 8 m to the surface at a distance greater than 250 m from the TSF and evaporation ponds. These design criteria will be applied to the expanded facilities. In addition, a water quality monitoring programme has been established for Cement Creek which will detect any changes attributable to the project.

Although little detail on the Central Thickened Discharge option has been provided at this time, the EPA notes its similarity to the Mt Keith proposal which it has previously assessed. The Mt Keith tailings storage upgrade was assessed by the EPA in 1996 (EPA, 1996c) and found to be environmentally acceptable. While the EPA is confident that an environmentally acceptable facility can be designed based on this option, it considers that due to limited experience in this type of facility, details of the proposed design will need to be reviewed by the EPA should this option be chosen. This requirement is intended to provide the EPA with the same level of information regarding design and expected performance as was provided by the proponent as part of its previous commitments for the existing Tailings Storage Facility.

Summary

Having particular regard to:

(a) the design of the Stage 1 facilities;

(b) the significance of Cement Creek;

(c) the fact that construction and operation of these facilities will be subject to management under Part V of the *Environmental Protection Act 1986*; and

(d) previous limited experience with the Central Thickened Discharge type of facility,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for waste disposal facilities, provided that more detailed information on the design of the Central Thickened Discharge option is provided for review prior to implementation if this option is chosen.

3.6 Aboriginal heritage and culture

Description

The Murrin Murrin Stage 2 expansion extends over a large area and as a result includes areas which have previously been inhabited by Aboriginal people and where some physical evidence of this prior occupation remains. These are referred to as archaeological sites. It also includes some areas which have a living cultural significance to Aboriginal people today, by virtue of being sacred, ritual, or ceremonial sites of importance and special significance. These are referred to as ethnographic, or anthropological sites. Such sites are subject to the *Aboriginal Heritage Act 1972*. In accordance with the definition of the environment in the *Environmental Protection Act 1986* the EPA can also consider impacts related to Aboriginal culture and social surroundings to the extent that those surroundings directly affect, or are affected by, the physical or biological surroundings.

Sixty seven archaeological sites reported to be of low to moderate significance will need to be disturbed in the Murrin Murrin East Project Area as a result of this proposal. A few other sites reported to be of low or negligible significance also occur along transport and infrastructure corridors (Dames & Moore 1998).

Two significant ethnographic sites occur within the Murrin Murrin East Project Area which will also be affected.

There may also be other impacts on Aboriginal culture due to the operation of a large mining project in an area used by Aboriginal communities. In this assessment such impacts are mainly dealt with under the relevant environmental factor "Community liaison" of Section 3.7. In discussions held between the EPA and local Aboriginal communities during a visit to the site on 23-24 November 1998, the community expressed their need: to be informed of potential impacts; to be provided the opportunity to comment on how these impacts are likely to affect them; and for these comments to be given proper consideration by the proponent.

Submissions on the PER

Environment Australia believed that insufficient information was provided in the PER in relation to Aboriginal heritage values. It believed that it was unclear to what extent Aboriginal communities' view of what was a significant site had been taken into consideration. It noted that significance seems to have been determined only on the basis of archaeological value of the sites.

The Aboriginal Affairs Department noted that although the proponent has satisfactorily addressed Aboriginal heritage issues, not all heritage reports have been completed for the proposed areas of expansion. It is understood that these reports will be submitted once the option for transport of ore to the plant site has been determined.

The Goldfields Land Council noted that Aboriginal comment on the site clearance process had not been favourable. It was suggested that a separate study be undertaken to fully document the sites which have been cleared [approved for disturbance] and the environmental implications.

The local Aboriginal communities felt that the proponent should make sure that anthropological and archaeological studies/reports are written clearly and in a way that makes sense to the contributor of the information, and that such reports should be referred back to the contributors for verification and sign-off — not as a requirement under the *Aboriginal Heritage Act*, but as a matter of courtesy.

Assessment

The areas considered for assessment of this factor are all project areas of the Stage 2 expansion of the Murrin Murrin Nickel-Cobalt Project and related areas which establish the regional context for Aboriginal heritage and culture.

The EPA's environmental objective for this factor is to ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*; and to ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.

The EPA notes that the project is subject to the requirements of the *Aboriginal Heritage Act* 1972 and that Aboriginal Heritage site clearance have been obtained for most of the project area and surveys have been completed for all other areas. As part of the site clearance process, the proponent, under the guidance of the Aboriginal Affairs Department, has conducted archaeological and ethnographic site surveys of all project areas. The purpose of these surveys was to identify both archaeological sites and sites of cultural significance.

Apart from concerns about processes under the *Aboriginal Heritage Act* 1972, discussions with Aboriginal communities at the Murrin Murrin site on 23-24 November 1998 did not raise any specific issues in relation to Aboriginal heritage and culture which are not given further consideration under the relevant environmental factor "Community liaison" of Section 3.7 or are considered under other environmental factors.

With regard to submissions concerning the reporting of surveys and site clearance process, the EPA considers that these matters are being satisfactorily dealt with by the Aboriginal Affairs Department. Since making its submission, the Aboriginal Affairs Department has been provided with additional information and has reiterated its satisfaction with the proponent's compliance with the requirements of the *Aboriginal Heritage Act 1972*. One submission refers to concern with the site clearance process under this Act, although no specific instances have been brought to the attention of the EPA for it to consider. The EPA understands that the Aboriginal Affairs Department is shortly to release documents entitled *Aboriginal Heritage and Development in Western Australia: Advice for Developers* and *Aboriginal Heritage and Development in Western Australia: Advice for Aboriginal People*. These will provide a clear description of the process, and the roles and responsibilities of developers and Aboriginal people within the process. The EPA also understands that these guidelines will provide guidance as to appropriate feedback of information to the Aboriginal people who assist developers in conducting archaeological and ethnographic surveys. The EPA supports this initiative by the Aboriginal Affairs Department to endeavour to improve the understanding and reporting of surveys, and the site clearance process. The EPA also considers that the concerns regarding the site clearance process for the Stage 2 project should be discussed by the Liaison Committee referred to in Section 3.7.

The EPA has provided a range of opportunities, including meetings on site, during this assessment for issues to be raised by the local Aboriginal communities. In addition, there will be ongoing opportunities for consultation for the communities throughout the life of the project. The proponent and the community have established a liaison committee which will provide a forum for community concerns to be raised. Also, under the conditions of approval for the Stage 1 project, the proponent must undertake a Social Impact Study. This will provide further opportunity for the communities to raise additional matters and have the proponent give them proper consideration.

Summary

Having particular regard to:

(a) the proponent's compliance with the requirements of the *Aboriginal Heritage Act 1972*, but acknowledging the limitations of that Act;

(b) the fact that there were no specific impacts on cultural associations within the area brought to the EPA's attention during its meetings with the local Aboriginal communities which are not addressed through its consideration of other environmental factors; and

(c) the ongoing process for community consultation now established by the proponent and the community,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Aboriginal heritage and culture.

3.7 Community liaison

Description

The overall Murrin Murrin project is a large and extended proposal. Borefields and mining areas in the Stage 2 expansion extend over a distance of approximately 150 km. Mine pits, waste dumps, tailings disposal facilities, and evaporation ponds will disturb approximately 120 km^2 (12 000 ha) of land. Given the Aboriginal people's special relationship to the land, the development of a project extending over such large distances and affecting such large areas of land, will be of some concern to the Aboriginal communities of the area.

There are three main Aboriginal communities in the area, at Laverton, Leonora, Mt Margaret, as well as communities at a number of smaller locations.

In recognition of potential community interest in this proposal, the EPA met with the Aboriginal communities of the region in order to hear their concerns first-hand and to discuss these concerns with the proponent. These meetings were held on the 23 and 24 November 1998 at the Murrin Murrin Nickel-Cobalt Project site. A summary of issues arising out of these meetings is included in Appendix 5. A majority of the issues are referred to below as submissions on this relevant environmental factor, and the remainder appear elsewhere under other environmental factors.

Submissions on the PER

The following are issues arising out of the EPA's meeting with the Aboriginal communities:

(a) The proponent should keep the Aboriginal communities better informed of the water issues, particularly the quality of groundwater upstream and downstream of the tailings dam and evaporation ponds, and any effects on flora and fauna and the water table level as a result of borefield extraction.

(b) The proponent should involve the Aboriginal communities in the water monitoring of the tailings dam and evaporation ponds, and Cement Creek catchment area, as a means of aiding the communication process.

(c) The proponent should report the results of water monitoring to the Aboriginal communities in a simple and clear manner, and assist in interpreting the information and understanding the issues.

(d) If Anaconda decides upon the conveyor belt rather than railway line as the means of transporting ore from Murrin Murrin East to the Plant Site, it should inform the Aboriginal communities about the size, construction, operation, and route of the conveyor belt and include the specifications for crossing points for both people and animals.

(e) The proponent should simplify reports and ensure communications are understood at Aboriginal Liaison Committee meetings, and invite wider Aboriginal communities to attend for information purposes. It should consider inviting contributing officers from government departments to attend.

(f) The proponent should consider, on the basis of a goodwill gesture, rather than because of any perceived or potentially real effect on the swimming hole, building a swimming pool for the Mt Margaret Mission Community.

The proponent's response to each of these issues is summarised below:

(a) The proponent has established with the community an environmental working group (the Murrin Murrin Aboriginal Environmental Liaison Committee) which is to be, among other things, a forum for passing information to the Aboriginal communities. Water quality data and issues from the tailings dams and borefields would be included in this information.

(b) A local Aboriginal has been employed in a position which involves collection of water samples from these areas. In addition, results will be provided to the liaison committee to be passed on to the communities.

(c) The proponent will make every effort to present water monitoring information in a simple, clear, and concise manner.

(d) At this stage a conveyor is not likely to be chosen as best option for transporting ore. However, if this changes, the Aboriginal communities will be provided with the information they seek.

(e) The proponent will make every effort to provide simple, clear, and concise reports to the liaison committee. The wider community will be invited to attend meetings when issues of general concern are likely to be discussed. Government agencies will be invited when appropriate.

(f) The proponent is currently looking at the feasibility of constructing a swimming pool and has entered into discussions with the community.

The Goldfields Land Council noted that problems have been referred to the Minister for the Environment regarding the proponent's commitment to genuine consultation with sections of the Aboriginal Community through the Liaison committee and that the continuation of the committee with the addition of appropriate review and monitoring mechanisms, should be a condition of approval.

Assessment

The area considered for assessment of this factor is the Laverton-Leonora region.

The EPA's environmental objective for this factor is to ensure that local communities are adequately consulted in regard to environmental impacts likely to be of concern to the communities.

In this particular case, the EPA believes that adequate consultation would be any process which ensures the local Aboriginal communities:

(a) are kept informed about the potential and actual environmental impacts of the Murrin Murrin Project;

(b) are able to make their concerns in regard to environmental impacts known to the proponent; and

(c) are able to have meaningful input into the proponent's management of environmental impacts.

These objectives have arisen out of discussions between the proponent and a representative committee known as the Murrin Murrin Aboriginal Environmental Liaison Committee, and therefore have a high degree of acceptance between the proponent and the local Aboriginal communities as being appropriate to this proposal and these local communities.

In regard to problems with Stage 1 referred to the Minister about previous commitments to consultation, the EPA understands that the DEP is responsible for this matter and has it in hand. The DEP has facilitated meetings between community representatives and the proponent which have resulted in an agreement to continue the Murrin Murrin Aboriginal Environmental Liaison Committee and an agreement on processes and issues the committee will address. The EPA has therefore limited its consideration to issues related to the proposed Stage 2 Expansion. The

commitments referred to are the Supplementary Commitments 1-5 which form part of the statement of environmental approval for the Stage 1 Murrin Murrin project, issued by the Minister for the Environment on 6 May 1997. These commitments apply only to those parts of the Murrin Murrin project which have already been approved. The DEP, which is responsible for monitoring compliance with these commitments, has advised the EPA that good progress has been made towards reaching agreement between all parties regarding these commitments. Considering this advice and the fact that the Liaison Committee will cover both Stages 1 and 2 of the project, the EPA is satisfied that an acceptable process for community liaison is being put in place.

To ensure that the current process is followed through to a satisfactory conclusion, the EPA recommends that the role and functioning of the committee is formalized in consultation with the committee members and that the proponent reports on this to the EPA within six months of commissioning the Stage 2 expansion (refer to draft condition 6).

Summary

Having particular regard to:

(a) the issues raised by local Aboriginal communities and the proponent's response to these issues; and

(b) the establishment of an Aboriginal Environmental Liaison Committee and present endeavours to improve its effectiveness,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for community liaison, provided that the role and functioning of the committee is formalized in consultation with the committee members.

Table 7. ***Summary of Assessment of Relevant Environmental Factors***

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Subterranean Fauna	Calcrete deposits (Shadywell and Pipeline)	Maintain the abundance, species diversity and geographical distribution of subterranean fauna. Ensure that subterranean fauna are adequately protected, in accordance with the Wildlife Conservation Act 1950.	**Proponent Commitments:** • Undertake additional fauna studies (including subterranean fauna surveys) to ensure that adequate information is available for the purposes of managing the project as well as educating the workforce. The EPA understands that preliminary surveys indicate the calcrete deposits are a habitat for a subterranean fauna community which is presently not known to occur elsewhere. However, to some extent this is an indication of the present limited knowledge regarding subterranean fauna of the region. In addition, there are substantial areas of similar calcrete habitat both contiguous with the proposed quarry areas and elsewhere throughout the region. The EPA is concerned about the lack of information regarding subterranean fauna species and their distribution throughout the proposed calcrete areas, and considers that more work is required. Given that the proposed quarry areas need not be developed for a number of years, there is time available to extend knowledge on subterranean fauna of the area though drilling programmes which would occur for resource definition.	Having particular regard to: • the results of preliminary survey work; • the extent of potential habitat for subterranean fauna outside the proposed quarry areas; and • the fact that the proposed calcrete areas need not be developed immediately. it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's objectives, provided more information on the distribution of subterranean fauna species is obtained and management practices are modified in response to this information.
Groundwater	The groundwater systems of the Laverton-Leonora region.	Maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	After being provided with additional information on the results of the proponent's groundwater investigations in the region the WRC provided the following advice: • the proponent has identified sufficient groundwater resources in order to conclude that the project's water supply requirements could be met without adversely affecting other beneficial uses; • however, detailed plans necessary to support groundwater abstraction licences would need to be provided in order to evaluate and regulate impacts at a local level. **Proponent Commitments:** • A vegetation monitoring programme will be extended to additional borefields as they are developed. • Groundwater monitoring programmes will be extended	Having particular regard to the: • the advice of WRC; • the proponent's commitment to extend vegetation monitoring; and • fact that borefield development is subject to the licence requirements of the WRC, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for groundwater, provided that the individual borefields are developed in

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			to additional borefields as they are developed. The EPA notes that the aquifer targeted by the proponent does not directly support any other beneficial uses, including ecosystem maintenance. However, in some areas there is the potential for indirect effect on vegetation of local significance, specifically *Eucalyptus camaldulensis* woodlands. The proponent has given a commitment to further vegetation surveys and monitoring, and a reasonable argument as to why it believes *Eucalyptus camaldulensis* woodlands will not be affected by the borefield operation. In addition, remedial measures would be available should impacts be detected. Development of the borefields is also subject to licence requirements of the WRC.	accordance with management plans which address potential local impacts on other beneficial uses, in particular, ecosystem maintenance (refer to draft condition 3).
Gases (SO_2, NO_x, NH_3)	The surrounding Laverton-Leonora region outside of the Project's lease area.	Ensure that SO_2, NO_x, and NH_3 emissions meet acceptable standards and requirements of Section 51 of the Environmental Protection Act 1986; and All reasonable and practicable measures are taken to minimise SO_2, NO_x, and NH_3 discharge.	**Proponent Commitments:** • Emission criteria will be specified when ordering equipment. Compliance testing will be carried out during commissioning to confirm that emissions from plant equipment are within the specified limits. The proponent has provided additional information on the predicted emissions of NH_3 and modelling of ground level concentrations. Expansion of the sulphuric acid plant may indirectly affect regional emissions of SO_2 in that generation of excess sulphuric acid through the capture of otherwise fugitive SO_2 emissions from other projects may become less viable. However, the EPA accepts that this project requires a dedicated acid supply and that there are other emission benefits due to larger scale acid production, primarily, energy efficiency and reduced CO_2 emissions. Construction and operation of the expanded processing plant will require works approvals and licences under Part V of the *Environmental Protection Act 1986*.	Having particular regard to: • modelling which indicates appropriate standards can be met at the projects lease boundary and at the accommodation village; and • the fact that emissions will be subject to management via Part V of the *Environmental Protection Act 1986*; it is the EPA's opinion that the proposal can be managed to meet the EPA's objective, provided that the proponent's commitments are made legally enforceable.
Greenhouse gases	The context for greenhouse gas emissions is global, while the assessment of this factor is primarily	To minimise greenhouse gas emissions in absolute terms and reduce emissions per unit product to as low as	**Proponent Commitments:** • The total carbon dioxide emission for the project will be calculated by the proponent on an annual basis and reported to the DEP. The proponent will explore	Having particular regard to: • the application of new energy efficient technology; • comparative reductions in

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE

	at the state and national level.	reasonably practicable.
		To mitigate greenhouse gases emissions in accordance with the Framework Convention on Climate Change 1992, and in accordance with established Commonwealth and State policies.
			mechanisms to minimise greenhouse gas emissions on an ongoing basis.
			• The proponent will consider entry into the Federal Government's Greenhouse Challenge Programme.
			The EPA notes that:
			• The proposal would contribute an additional 0.28% to Australia's greenhouse gas emissions (based on 1994 figures).
			• The proponent has implemented a number of "no regrets" measures to reduce CO_2 emission, principally maximising the energy efficiency of the project.
			• The proponent is actively pursuing a couple of "beyond no regrets" measures to further reduce the net CO_2 emissions of the project, namely:
			  • indirect heating to reduce acid consumption; and
			  • tree planting trials with a view to the establishment of tree farms.
				CO_2 emissions already achieved through "no regrets" measures; and
				• potential reductions through "beyond no regrets" measures;
				it is the EPA's opinion that the proposal can be managed to meet the EPA's objective, provided that the proponent continues to investigate and implement as appropriate measures to further reduce CO_2 emissions which can be achieved in the design and operation of the project, as part of a Greenhouse Gas Emissions Management Plan.

Waste Disposal Facilities (Tailings Storage Facility / evaporation ponds)	The proposed Tailings Storage Facility, evaporation pond, and surrounding surface and groundwaters.	Ensure that wastes are contained and isolated from ground and surface water surrounds and treatment or collection does not result in long term impacts on the natural environment.	**Proponent Commitments:** • Facilities will be designed and operated in accordance with EPA and DME requirements to ensure the facilities do not result in unacceptable impacts to the existing groundwater regime. • Implement a groundwater monitoring programme for the facilities. • Undertake rehabilitation trials on tailings as the storage facility is developed. • Report on the development and performance of waste disposal facilities after five years. The EPA notes that these facilities are close to Cement Creek and that this creek is of some significance to the local communities. The EPA considers that the Stage 1 facilities have been designed in a way to prevent unacceptable impacts on the creek and that there is a suitable monitoring programme in place. The EPA notes the similarity of the Central Thickened Discharge option to the Mt Keith proposal which it has	Having particular regard to: • design of the Stage 1 facilities; and • the significance of Cement Creek; • the fact that construction and operation of these facilities will be subject to management via Part V of the *Environmental Protection Act 1986*; and • the previous limited experience in the Central Thickened Discharge type of facility; it is the EPA's opinion that the proposal can be managed to meet the EPA's objective, provided that more detailed information on the design of the Central Thickened

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			previously assessed. While the EPA is confident that an environmentally acceptable facility can be designed based on this option, it considers that the details of the proposed design will need to be reviewed by the EPA should this option be chosen. The EPA notes that the Tailings Disposal Facility and evaporation pond will require a Works Approval and Licence under Part V of the *Environmental Protection Act 1986*.	Discharge option is subject to review prior to implementation of this option.
Aboriginal heritage and culture	All project areas of the Stage 2 expansion of the Murrin Murrin Nickel-Cobalt Project and related areas which establish the regional context for Aboriginal heritage and culture.	Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972; and Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.	Aboriginal Heritage site clearance have been obtained for most of the project area and surveys have been completed for all other areas. The EPA notes that the project is subject to the requirements of the *Aboriginal Heritage Act 1972* and that Aboriginal Heritage site clearance have been obtained for most of the project area and surveys have been completed for all other areas. The EPA also acknowledges that there may be impacts on the biophysical environment as they affect social surroundings, which are beyond the scope of the *Aboriginal Heritage Act 1972* but which can be considered within the *Environmental Protection Act 1986*. With regard to comments on the community's satisfaction with processes under the *Aboriginal Heritage Act 1972* and the appropriate feedback of information to the informants after surveys, the EPA understands that the AAD is preparing guidance notes for the public to inform both proponents and Aboriginal people of their roles and responsibilities through the process. It is the EPA's view, formed through its meetings with the local Aboriginal Communities, that there are no specific impacts on cultural associations with the area which are not addressed through its consideration of other environmental factors.	Having particular regard to: • the proponent's compliance with the requirements of the *Aboriginal Heritage Act 1972*, but acknowledging the limitations of that Act; • the fact that there were no specific impacts on cultural associations with the area brought to the EPA's attention which are not addressed through its consideration of other environmental factors; and • the ongoing process for community consultation now established by the proponent and the community, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Community Liaison	The Laverton-Leonora region.	Ensure that local communities are adequately consulted in regard to environmental impacts likely to be of concern to the communities.	As part of this assessment the EPA met with the local Aboriginal Communities at the project site to receive the communities' input into the assessment process. The EPA notes the issues which were raised at these meetings (refer to Appendix 5). Many of these issues dealt with the need for there to be an effective exchange of information between the communities and the proponent on environmental aspects of the project of concern to the communities.	Having particular regard to: • the issues raised by local Aboriginal communities and the proponent's response to these issues; and • the establishment of an Aboriginal Environmental

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			The EPA notes the proponent's initiative in establishing the Murrin Murrin Aboriginal Environmental Liaison Committee in an attempt to met the communities' need to be consulted. The EPA understands that the proponent and representatives of the communities are in the process of discussing ways in which the operation of the liaison committee may be improved. This approach is supported by the EPA. In regard to problems with Stage 1 referred to the Minister about previous commitments to consultation, the EPA understands that the DEP is responsible for this matter and has it in hand. Considering this advice and the fact that the Liaison Committee will cover both Stages 1 and 2, the EPA is satisfied that an acceptable process for community liaison is being put in place.	Liaison Committee and present endeavours to improve its effectiveness, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective, provided that the role and functioning of the committee is formalized in consultation with the committee members.

4. Conditions and commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal, and following discussion with the proponent the EPA may seek additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable. They do, however, provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure that they are enforceable, then form part of the conditions to which the proposal should be subject if it is to be implemented.

The EPA may, of course, also recommend conditions additional to that relating to the proponent's commitments.

4.1 Proponent's commitments

The proponent's commitments as set in the PER and subsequently modified, as shown in Schedule 2 of Appendix 1, should be made enforceable conditions.

4.2 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which the EPA recommends should be imposed if the proposal by Anaconda Operations Pty Ltd for the Stage 2 expansion of the Murrin Murrin Nickel-Cobalt Project, is approved for implementation. These conditions are presented in Appendix 1. Matters addressed in the conditions include:

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions;

(b) that borefield management plans be prepared for each new borefield in order to address local impacts of the borefields and to protect existing beneficial uses of groundwater resources (including ecosystem maintenance);

(c) that a survey and management programme be implemented for subterranean fauna to ensure the conservation of any subterranean fauna species within the calcrete mining areas;

(d) that should the central thickened discharge tailings option be chosen, then further detailed plans and modelling of this option be provided to the EPA for consideration prior to implementation;

(e) that the role and functioning of the Murrin Murrin Aboriginal Environmental Liaison Committee be formalized;

(f) that continued investigation and implementation of "no regrets" and "beyond no regrets" measures be undertaken to reduce greenhouse gas emissions;

(g) that decommissioning strategies for the mine be considered and adopted early in the life of the project; and

(h) that the environmental performance of the project be subject to an intensive review every six years.

5. Other Advice

The EPA notes that the Stage 2 substantially increases the project's consumption of anhydrous ammonia and that the option of producing ammonia on-site would eliminate the risks associated with transport of this reagent through populated areas. In addition, should the proponent develop an ammonia plant with surplus capacity, it would also have the potential to reduce the risks associated with transport of ammonia to the Goldfields region.

However, should the ammonia plant option not be developed, then the risks associated with transport from Kwinana to the site will be managed by the supplier, CSBP, in accordance with its management plan for the transport of anhydrous ammonia from Kwinana to the Goldfields. The EPA understands that a quantified risk assessment was carried out in the formulation of this plan and that the plan meets the EPA's objectives for the management of individual risk and societal risk.

6. Conclusions

The EPA has considered the proposal by Anaconda Operations Pty Ltd and concluded that the proposal can be managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

7. Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors as set out in Section 3;
2. That the Minister notes that the EPA has concluded that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 1 and summarised in Section 4, including the proponent's commitments.
3. That the Minister imposes the conditions and procedures recommended in Appendix 1 of this report.
4. That the Minister notes the advice on the transport of ammonia provided in Section 5.

Appendix 1

Recommended Environmental Conditions and proponent's consolidated commitments

Statement No.

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

MURRIN MURRIN NICKEL-COBALT PROJECT STAGE 2 EXPANSION, 60 KM EAST OF LEONORA

Proposal: The Stage 2 expansion of the Murrin Murrin Nickel-Cobalt mining and processing operation (Stage 1), 60 km east of Leonora, as documented in schedule 1 of this statement.

The Stage 2 expansion of the project includes the mining of additional ore; an expansion of the processing plant to process additional ore; and the development of additional infrastructure associated with mining and processing of the ore.

Proponent: Anaconda Operations Pty Ltd

Proponent Address: Level 12, Quay Side
2 Mill Street
PERTH WA 6000

Assessment Number: 1229

Report of the Environmental Protection Authority: Bulletin 931

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Borefield Development Plans

3-1 Prior to commencement of construction of each borefield, the proponent shall prepare a Borefield Development Plan to achieve the following objective:

- to ensure that the beneficial uses (including ecosystem maintenance) of the groundwater are not adversely impacted by the operation of the proposal.

Each Plan shall be prepared to the requirements of the Environmental Protection Authority on advice of the Water and Rivers Commission, and the Department of Environmental Protection, and shall address:

1 the design of and rate of abstraction from the borefield;

2 aquifer modelling and predicted response to abstraction over the proposed life of the borefield;

3 identification of beneficial uses (including ecosystem maintenance) of associated groundwater and surface water of the area;

4 potential impacts on beneficial uses (including ecosystem maintenance);

5 appropriate liaison with the local Aboriginal communities in order to meet the objectives of condition 6-1 in relation to the borefield in question; and

6 monitoring and management of any impacts on beneficial uses, and monitoring to confirm and revise modelling;

7 a description of the existing environment and predicted construction impacts (which will require fauna, flora, vegetation, archaeological, and ethnographic surveys) where this information has not already been provided to the Environmental Protection Authority.

3-2 The proponent shall implement each Borefield Development Plan required by condition 3-1 subject to any modifications under condition 3-3.

3-3 If in operation, any borefield developed pursuant to a plan under condition 3-1 has any impact on beneficial uses (including ecosystem maintenance) which is considered unacceptable by the Environmental Protection Authority on advice of the Water and Rivers Commission and the Department of Environmental Protection, then the proponent shall modify the appropriate plan/s to the requirements of the Environmental Protection Authority on advice of the Water and Rivers Commission and the Department of Environmental Protection.

3-4 The proponent shall extract groundwater from all borefields at total rate not exceeding 53 ML per day.

3-5 The proponent shall make all Borefield Development Plans required by condition 3-1 and as modified under condition 3-3 publicly available, to the requirements of the Environmental Protection Authority.

3-6 Prior to commissioning of the proposal, the proponent shall prepare a contingency plan to the requirements of the Environmental Protection Authority on advice of the Water and Rivers Commission and the Department of Environmental Protection outlining areas of additional prospective borefield development in the event that borefields approved under condition 3-1 cannot sustain the proposal's water requirement. The plan shall also include a programme of investigation for these borefields.

4 Subterranean Fauna Management Plan (Calcrete Quarry Areas)

4-1 Prior to quarrying either calcrete deposit (Shadywell or Pipeline), the proponent shall develop a Subterranean Fauna Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Western Australian Museum.

The objective of this Plan is:

- to conserve and protect subterranean fauna species in the calcrete quarry areas.

This Plan shall address:

1 subterranean fauna surveys of the calcrete areas, and possibly outside these areas, to establish the conservation significance of any species within the calcrete quarry areas;

2 mapping of the local and regional distribution of species identified by the surveys; and

3 measures to limit the impacts on any localised species until the known range of these species is extended by additional surveys of other calcrete areas of the region and there is no significant risk of any species of subterranean fauna becoming extinct as a result of that mining;

4-2 The proponent shall implement the Subterranean Fauna Management Plan required by condition 4-1.

4-3 The proponent shall make the Subterranean Fauna Management Plan required by condition 4-1 publicly available, to the requirements of the Environmental Protection Authority.

5 Tailings Storage Facility Option (Central Thickened Discharge)

5-1 If the proponent adopts the "Central Thickened Discharge" option, then prior to construction of the Tailings Storage Facility, the proponent shall provide further details and modelling of the proposed facility, to the requirements of the Environmental Protection Authority on advice of the Department of Minerals and Energy, the Water and Rivers Commission and the Department of Environmental Protection.

The objectives of this requirement are:

- to protect groundwater surrounding the facility;

- to protect vegetation surrounding the facility;
- to protect surface water quality in nearby creeks; and
- to manage implications for migratory birds and other fauna.

Details and modelling shall address:

1 the detailed design of the facility;

2 assessment of the predicted particle form and geotechnical characteristics of the tailings, including settling characteristics, and settled and compacted permeabilities;

3 modelling of seepage from the facility and its affect on the local groundwater system throughout its life and for a number of decades afterwards; and

4 management of large rainfall events.

5-2 If the proponent adopts the "Central Thickened Discharge" option, the proponent shall construct and operate the facility in accordance with the details and modelling required by condition 5-1.

6 Community Liaison

6-1 Prior to commissioning the Stage 2 expansion, the proponent shall, in consultation with the current members of the Murrin Murrin Aboriginal Environmental Liaison Committee, formalize the role and functioning of the committee.

The objectives of this condition are to ensure that through the committee the local Aboriginal communities:

- are kept informed about the potential and actual environmental impacts of the Murrin Murrin Project;
- are able to make their concerns in regard to environmental impacts known to the proponent; and
- are able to have meaningful input into the proponent's management of environmental impacts.

6-2 Within six months following commissioning, the proponent shall report on how the objectives referred to in condition 6-1 are to be achieved through the Murrin Murrin Aboriginal Environmental Liaison Committee, to the requirements of the Environmental Protection Authority on the advice of the Department of Environmental Protection.

7 Greenhouse Gas Emissions Management Plan

7-1 Prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan:

- to ensure that "greenhouse gas" emissions from the project are adequately addressed and best available efficient technologies are used in Western Australia to minimise Western Australia's "greenhouse gas" emissions; and

- to mitigate "greenhouse gas" emissions in accordance with the Framework Convention on Climate Change 1992, and consistent with the National Greenhouse Strategy,

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall include:

1 calculation of the "greenhouse gas" emissions associated with the proposal, as indicated in "Minimising Greenhouse Gas Emissions, Guidance for the Assessment of Environmental Factors, No. 12" published by the Environmental Protection Authority;

2 specific measures to minimise the "greenhouse gas" emissions associated with the proposal;

3 monitoring of "greenhouse gas" emissions;

4 estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product;

5 an analysis of the extent to which the proposal meets the requirements of the National Strategy using a combination of:
- "no regrets" measures;
- "beyond no regrets" measures;
- land use change or forestry offsets; and
- international flexibility mechanisms.

7-2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 7-1.

7-3 The proponent shall make the Greenhouse Gas Emissions Management Plan required by condition 7-1 publicly available, to the requirements of the Environmental Protection Authority.

8 Decommissioning Plan

8-1 Within five years following commissioning, or at such later time considered appropriate by the Minister for the Environment on advice of the Department of Environmental Protection, the proponent shall prepare a Decommissioning Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Minerals and Energy, the Water and Rivers Commission, and the Department of Conservation and Land Management.

This Plan shall:

1 describe the processes for decommissioning and rehabilitation of the project area;

2 provide for the long term management of ground and surface water systems affected by the tailings storage facility and evaporation pond;

3 provide for the development of a 'walk away' solution for the decommissioned mine pit, process plant, tailings dam, evaporation pond, and all associated infrastructure;

4 identify all contaminated areas, including provision of evidence of notification to relevant statutory authorities; and

5 investigate and report on the potential for backfilling pits, as a means of rehabilitating pits for the remainder of the project life.

Note: A 'walk away' solution means that the site shall either no longer require management at the time the proponent ceases operations, or if further management is deemed necessary, the proponent shall make adequate provision so that the required management is undertaken with no liability to the State.

8-2 The proponent shall implement the Decommissioning Plan required by condition 8-1 until such time as the Minister for the Environment determines that decommissioning is complete.

8-3 The proponent shall make the Decommissioning Plan required by condition 8-1 publicly available, to the requirements of the Environmental Protection Authority.

9 Performance Review

9-1 Each six years following the commencement of construction, the proponent shall submit a Performance Review to the Department of Environmental Protection:

- to document the outcomes, beneficial or otherwise;
- to review the success of goals, objectives and targets; and
- to evaluate the environmental performance over the six years;

relevant to the following:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 931;

2 proponent's consolidated environmental management commitments documented in schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement;

3 environmental management system environmental performance targets;

4 environmental management programs and plans; and/or

5 environmental performance indicators;

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review.

10 Proponent

10-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has

exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

10-2 Any request for the exercise of that power of the Minister referred to in condition 10-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

10-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

11 Commencement

11-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

11-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

11-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 11-1 and 11-2.

11-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

12 Compliance Auditing

12-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

12-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal written advice that the requirements have been met.

12-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Note

1 The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

2 Nickel-Cobalt ore mining and processing at Murrin Murrin for the Stage 1 project has already been approved (Statement Nos 418, 444, and 445).

Schedule 1

The Proposal

The Murrin Murrin Nickel-Cobalt Stage 2 expansion is a proposal to increase the processing and production of the existing Murrin Murrin Nickel-Cobalt project (Stage 1) to approximately 250% of its current level.

The existing Murrin Murrin Nickel-Cobalt project, located 60 km east of Leonora (Figure 1), has environmental approval to mine and process 4 Mtpa (million tonnes per annum) of ore, producing approximately 45 000 tpa of nickel, 3 000 tpa of cobalt, and 145 000 tpa of ammonium sulphate.

The expansion will involve mining the Murrin Murrin East ore bodies located 45 km southeast of the current project area, increasing the rate of mining of the Murrin Murrin North and South ore bodies, transporting the ore to the existing Murrin Murrin processing plant, and processing the ore within an expanded plant. The expanded project will also require the development of additional borefields, further calcrete quarry capacity, and extended transport infrastructure (refer to Figure 2).

The Murrin Murrin Expansion Project will affect the Stage 1 Project as follows:

- increase in the mining rate and the development of new orebodies at the Murrin Murrin North and South Project Areas;
- expansion of the Stage 1 processing plan to process an additional 6 Mtpa of ore (giving a total throughput of 10 Mtpa);
- option to produce ammonia on-site rather than transport it from Kwinana;
- option to produce a zinc byproduct;
- additional tailings storage facilities;
- additional area for evaporation ponds; and
- option to develop rail infrastructure in the area to rail goods, products, and ore to and from the processing plant rather than the current road transport.

In addition to these effects, the following components will be added to the Stage 1 Project as part of the Stage 2 expansion:

- mining of the Murrin Murrin East Orebodies, located approximately 45 km to the southeast of the Murrin Murrin Plant Site and adjacent to the western edge of Lake Carey;
- a Run Of Mine (ROM) stockpile area at the Murrin Murrin East Project Area;
- crushing and blending of ore at the Murrin Murrin East Project Area;
- either a conveyor, haul road or rail line to transport the ore from the Murrin Murrin East ROM stockpile and mining areas to the existing Murrin Murrin Processing Plant;
- the development of new calcrete quarries located initially 5 km west of the decommissioned Windarra mine site and extending northwards;
- transportation of the calcrete by road, rail or slurry pipeline to the Plant Site;
- discharge water from pit dewatering operations to the starter pits at Murrin Murrin East and/or use for dust suppression;
- development of additional borefields (Sullivan, Station, Granite, Charcoal, Hamilton, and Grey Mare Borefields); and

- establishment of infrastructure facilities at Murrin Murrin East to support construction, operation and mining activities.

A simplified process flow diagram for the Stage 2 expansion is provided in Figure 3.

Key Characteristics Table

	MM Stage 1 Project		Overall Project	
	Design	**Maximum Capacity**	**Design**	**Maximum Capacity**
Life of Project(Indicative)	~30 years		~30 years	
Inputs				
Nickel Cobalt Ore (Mtpa)	4.0	4.5	10	11
Calcrete[1] (Mtpa)	1.3	1.5	3.9	4.3
Elemental Sulphur (Mtpa)	0.54	0.62	1.4	1.9[2]
Process Water (ML/d)	35	40	Up to 88	Up to 97[3]
Natural Gas (TJpd) (with Ammonia Plant in Expanded Project)	8	25	40	90
Outputs[4]				
Products				
Nickel Metal Briquettes (tpa)	45,500	50,000	115,000	126,500
Cobalt Metal Briquettes (tpa)	3,000	3,800	11,000	12,000
Cobalt Powder (tpa)	3,000	3,800	11,000	12,000
Cobalt Cathode (if electrowinning is used) (tpa)	3,000	3,800	11,000	12,000
Cobalt Sulphate Crystals (tpa)	8,200	8,200	22,000	24,000
Mixed Nickel Cobalt Sulphide Powder (tpa)	29,000	100,000	250,000	275,000
Nickel Powder (tpa)	20,000	20,000	115,000	126,500
Nickel Cathode (if electrowinning is used) (tpa)	0	0	115,000	126,500
Ammonium Sulphate Crystals (tpa)	145,000	160,000	400,000	440,000
Wastes and Emissions				
Tailings Solids (Mtpa) (including gypsum)	4.8	5.4	13.3	14.5
Water from Dewatering Operations (kL/d)	-	-	Up to 500	Up to 500
Sulphur Dioxide[5] (g/s)	189	ND	329	ND
Oxides of Nitrogen[5] (g/s)	20.0	ND	27.3	ND
Carbon dioxide (Mtpa)	0.38	ND	1.14	ND
Waste Dumps - Indicative Characteristics				
Area disturbed by waste dumps and orestockpiles at Murrin Murrin East (km^2)			25	
Area disturbed by waste dumps and orestockpiles at Murrin Murrin North and South (km^2)			15	
Height of waste dumps			20m	
Tailing Storage Facility and Evaporation Ponds – Indicative Characteristics				
Area of disturbance TSF (km^2)			Up to 23	
Area of Disturbance Evaporation Ponds (km^2)			Up to 12	
Groundwater criteria			Designed to: • Comply with the DMA Guidelines; • Prevent surface breakout of saline liquors; and • Prevent the water table outside of the facility from rising to a level shallower than 8m below the ground surface at a distance greater than 250m from the TSF and evaporation ponds	
Pits - Indicative Characteristics				
Area to be disturbed at Murrin Murrin East (km^2)			17	
Area to be disturbed at Murrin Murrin North and South (km^2)			8.5	
Depth of pits			estimated maximum depth of 50m	
Calcrete Quarry – Indicative Characteristics				
Area of disturbance (km^2)			15	

Notes: Figures presented in this table for waste dumps, pits, calcrete quarry and the TSF and evaporation ponds are indicative only and final figures will be determined during detailed engineering in consultation with the DME.

1 The quantity of calcrete required will vary as a function of its calcium carbonate content. A high calcium carbonate content will mean that a smaller quantity of calcrete will enable the Project to meet its neutralisation requirements. The estimated value of 3.9Mtpa is based on an average calcium carbonate content of 52%.

2 Maximum capacity is based on the option of two 4,400tpd sulphuric acid plants for the Expansion Project to enable supply to third party users.

3 Maximum capacity is based on the option of a 350,000tpa ammonia plant for the Expansion Project to enable supply to third party users.

4 The product masses listed as the outputs represent the maximum production rates for each product in isolation from other related products.

5 A full break down of the sources of these emissions is provided in Tables 5 and 6.

ND Not defined.

Schedule 2

Proponent's Consolidated Environmental Management Commitments

31 March 1999

MURRIN MURRIN NICKEL-COBALT PROJECT STAGE 2 EXPANSION, 60 KM EAST OF LEONORA (1229)

ANACONDA OPERATIONS PTY LTD

Table 17

Summary of Proponent's Environmental Management Commitments

Issue	Objective	Commitment	To Whose Satisfaction	Status
Previous Commitments Made During the EIA Process				
Environmental Management Programme	To develop and implement an Environmental Management Programme to ensure sound environmental management of the Project's construction phase.	Commitment 1 Prior to commencement of the Project, the Proponent will prepare and implement an Environmental Management Programme for the construction phase, in consultation with the DEP, DME, CALM and other relevant agencies to meet the requirements of the EPA. Further, the Proponent will ensure that its contractors comply with the environmental management strategies and procedures described in the EMP.	Developed in consultation with the DEP, DME, CALM and other relevant agencies to meet the requirements of the EPA.	Complete for currently MM Stage 1 Project. The EMP will be updated as required for the Expansion Project.
Environmental Management System	To develop and implement an Environmental Management System to ensure sound environmental management of the Project's operations and decommissioning phase.	Commitment 2 The Proponent will develop and implement an Environmental Management System for the operation of the Project prior to the start of operations. This EMS will be developed in consultation with the DEP, DME and CALM, and to the satisfaction of the EPA. Further, the Proponent will ensure that its contractors comply with the environmental management strategies and procedures described in the EMS.	Developed in consultation with the DEP, DME and CALM to meet the requirements of the EPA	In progress and likely to be in place by November 1998.
Protection of flora and vegetation	To minimise disturbance of the general flora and vegetation of the Project Area.	Commitment 3 The Proponent will progressively rehabilitate disturbed areas to minimise disturbance of biological communities. The rehabilitation will be completed to the satisfaction of the EPA in accordance with the approved EMP and EMS.	EPA	Ongoing.
Protection of significant flora	To minimise disturbance of known *Hemigenia exilis* populations within the Project Area, where possible.	Commitment 4 The Proponent will undertake the construction, operation and decommissioning of the Project in a manner that minimises disturbance to significant flora populations. Further the Proponent will require its contractors to comply with this commitment. This will be undertaken to the satisfaction of the EPA and CALM, in accordance with the approved EMP and EMS.	EPA, CALM	Management Plan for *Hemigenia exilis* approved by CALM. Ministerial Approval "to take" *Hemigenia exilis* at Murrin Murrin South obtained. Ongoing research being undertaken. *Hemigenia exilis* removed from the Declared Rare Flora List and now categorised as Priority Four Species. Commitment has been updated to reflect the new status of *Hemigenia exilis*. EMP to be updated for the Expansion Project.

Table 17 (*cont'd*)

Issue	Objective	Commitment	To Whose Satisfaction	Status
Erosion control	To minimise the risk of erosion and sedimentation.	Commitment 5 The Proponent will minimise erosion by minimising the extent of land disturbance and progressively rehabilitating disturbed areas. This will be undertaken to the satisfaction of the EPA and DME in accordance with the approved EMP and EMS.	EPA, DME	Ongoing.
Potential water quality impacts due to surface runoff	To minimise the off-site transport of sediments.	Commitment 6 The Proponent will minimise the off-site transport of sediments by minimising exposed surfaces, identifying and treating on-site areas prone to erosion and progressively rehabilitating disturbed areas. The Proponent will also undertake a water quality monitoring programme for Cement Creek and Katata Creek. These monitoring programmes will be developed and implemented to meet the requirements of the EPA. DME and WRC. If adverse impacts on water quality are observed through monitoring, the proponent will develop and implement management measures to rectify these impacts.	EPA, DME, Water & Rivers Commission	Monitoring programme for Cement Creek has been established. Ongoing programme.
Dust control – construction phase	To control any dust generated as a result of construction phase activities.	Commitment 7 The Proponent will implement dust mitigation measures including containment and suppression during construction to the satisfaction of the EPA and DME.	EPA, DME	Ongoing.
Dust control – operations phase	To minimise dust generation during the operations phase.	Commitment 8 The Proponent will minimise dust generation during operation of the facility by the following measures: • regular cleaning of areas likely to accumulate dust; • sealing of major roadways within the Plant Site; and • use of water sprays on mine areas, ore and calcrete haulage routes, stockpiles and other Project Areas, as required. This programme will be completed to the satisfaction of the EPA and DME.	EPA, DME	Dust control measures incorporated into the Project design and implementation.
Greenhouse Gas Emissions	To comply with the State and Federal Government Greenhouse Policies.	Commitment 9 The total carbon dioxide emission for the Project will be calculated by the Proponent on an annual basis and reported to the DEP. The Proponent will explore mechanisms to minimise greenhouse gas emissions on an ongoing basis. The Proponent will consider entering into the Federal Government's Greenhouse Challenge Programme.	EPA	Methods of minimising carbon dioxid emissions are being explored on an ongoing basis. The Proponent is currently having discussions with the Federal Government's Greenhouse Challeng Office.

Table 17 (*cont'd*)

Issue	Objective	Commitment	To Whose Satisfaction	Status
Noise	To minimise the impact of noise generated by the construction and operation of the Project.	Commitment 10 The Proponent will ensure that noise from the Project will comply with the requirements of the State's noise regulations. If noise levels attributable to the Project exceed EPA criteria, the Proponent will take measures to reduce the impact.	EPA	No unacceptable noise impacts observed to date.
Overburden waste dumps	To ensure that the final overburden dumps are stable and support a self-sustaining ecosystem.	Commitment 11 The Proponent will design and operate the overburden waste dumps such that they are stable and resistant to erosion, to the satisfaction of the EPA and DME.	EPA, DME	DME approval of waste dump design via approved NOI.
Tailings Storage Facility	To design, construct and operate an environmentally sound TSF.	Commitment 12 The Proponent will design and operate the tailings storage facility in accordance with the requirements of the EPA and DME to ensure that the tailings storage facility and evaporation ponds do not result in unacceptable impacts to the existing groundwater regime.	EPA, DME	Technical details on the design of TSI and evaporation ponds approved by the DME, DEP and WRC for the MM Stage 1 Project. The design of these facilities will be modified due to the Expansion Project. The modified design will be submitted to DME, DE and WRC for approval.
Design of the solid and liquid waste disposal facilities.	To ensure the integrity of the solid and liquid waste disposal facilities.	Commitment 13 Prior to the construction and operation of the tailings dam and the evaporation pond, the Proponent will undertake the following: • A more detailed assessment of tailings solids and liquids geochemistry, including predicted compositions relevant to environmental guidelines and standards. This assessment will focus on Total Dissolved Solids, major ions and metals (via an elemental analysis). • An assessment of the predicted particle form and geotechnical characteristics of the tailings, including settling characteristics, and settled and compacted permeabilities. • A more detailed evaluation of potential alternative tailings storage options.	EPA, DME, WRC	Considerable amount of work was undertaken during the detailed design of the tailings dams and evaporation ponds for the MM Stage 1 Project. This work addressed all of the issues covered by this commitment and has been reviewed and approved by the DME, DEP and WRC. This work is being reviewed and updated to incorporate the Expansion Project.

Table 17 (*cont'd*)

Issue	Objective	Commitment	To Whose Satisfaction	Status
Groundwater monitoring	To monitor the impacts of the construction and operation of the waste disposal facilities on local groundwater resources.	Commitment 14 The Proponent will design and install a groundwater monitoring programme up- and down-gradient of the tailings dam and the evaporation ponds prior to the construction of these facilities. The monitoring programme will be designed and operated to the satisfaction of the DME, DEP and WRC.	EPA, DME, Water & Rivers Commission	Groundwater monitoring programme have been established in the vicinity of the TSF, evaporation ponds, borefields and calcrete quarry for the MM Stage 1 Project. These programmes have been reviewed and approved by DME, DEP and WRC as part of the Project's EMP. Continuing compliance with the WRC Groundwater Well Licence Conditions. These programmes will be reviewed and updated to incorporate the Expansion Project.
Pastoral activities	To minimise the impact on existing pastoral activities.	Commitment 15 The Proponent will minimise the impact of the Project on pastoral activities and ensure that pastoral water supplies in the Project Area are maintained.	Pastoral lease holders, Water & Rivers Commission	Ongoing.
Aboriginal heritage	To avoid disturbance of Aboriginal sites.	Commitment 16 The Proponent will comply with the provisions of the *Aboriginal Heritage Act* 1972-1980.	Department of Aboriginal Affairs	Ongoing.
Operation Risks	To minimise the risks associated with plant operations.	Commitment 17 The following commitments are made relating to the plant operations: • hazardous chemicals and fuel storage areas will be bunded, and constructed in accordance with AS1940 – 1933; • systems will be installed (either as procedures or by design) that would ensure shutdown following a release of either hydrogen or natural gas; • rigorous procedures will be in place to prevent air ingress into vessels containing either natural gas or hydrogen, at either plant start-up or shutdown; • the flare exhaust stack will be sited such that there is no potential for off-site thermal radiation effects and at a height sufficient to ensure adequate dispersion of toxic emissions; and • a hazard and operability study (HAZOP) will be conducted during the detailed design of the plant processing facilities.	EPA and DME	The design of the MM Stage 1 plant has incorporated these safety features. Numerous hazard and operability studies have been conducted during the design and current commissioning. This work will be reviewed and updated to incorporate the Expansion Project. Ongoing review of safety.

Table 17 (*cont'd*)

Issue	Objective	Commitment	To Whose Satisfaction	Status
Fauna	To ensure that adequate information is available for the purposes of managing the Project, workforce education and workforce induction.	Commitment 18 The Proponent will undertake additional fauna studies (including subterranean fauna surveys) to ensure that adequate information is available for the purposes of managing the Project as well as educating the workforce. The scope of these studies will be determined prior to the commencement of the construction phase in consultation with the DEP, CALM and the WA Museum, and will be undertaken to meet the requirements of the EPA. Survey results will also be provided to Environment Australia.	EPA with advice from CALM	Studies of the approved MM Stage 1 Project Area have been completed and approved by CALM. Further studies of the areas to be affected by the Expansion Project have been completed. Surveys for subterranean fauna to be undertaken in November 1998. The survey results and any required management measures will be supplied to the DEP as soon as possible following the completion of the survey.
Atmospheric Emissions	To ensure that atmospheric emissions comply with specified criteria.	Commitment 19 The Proponent will specify emissions criteria in tender documents for the supply of equipment for the Plant. Compliance testing will be carried out by the Proponent during the commissioning of the Plant to confirm that the emissions from plant equipment are within the specified limits. This commitment will be implemented to meet the requirements of the EPA.	EPA	Emissions criteria have been specified in tender documents. Ongoing.
Solid and Liquid Waste Disposal Facilities	To ensure review of the operation of the TSF and evaporation ponds.	Commitment 20 The Proponent will prepare a report on the development and performance of the waste disposal facilities (i.e. TSF and evaporation ponds) after five years of operation.	EPA	Facilities are yet to be commissioned.
New Commitments				
Murrin Murrin Aboriginal Environmental Liaison Commitee	To ensure community concerns are known and that the community can assist with the development of suitable environmental management practices.	Commitment 21 The Murrin Murrin Aboriginal Environmental Liaison Committee will continue to meet at a frequency determined by the Committee until the Committee considers that it is no longer required.	EPA	New Commitment.
Significant Fauna	To ensure the protection of significant fauna in the borefields.	Commitment 22 The Proponent will undertake the construction, operation and decommissioning of the Project in a manner that minimises disturbance to the Malleefowl nest in the Granite Borefield. This will be undertaken in consultation with CALM.	EPA, on advice from CALM	New Commitment.

Table 17 (*cont'd*)

Issue	Objective	Commitment	To Whose Satisfaction	Status
Vegetation	To minimise the impact of the borefield operation on the surrounding vegetation.	Commitment 23 The Proponent will conduct a vegetation monitoring programme for the additional borefields from which the water for the Expansion Project will be sourced as these borefields are developed. This will be undertaken to the satisfaction of the EPA, on advice from CALM, DEP and WRC.	EPA, on advice from DEP and CALM	New Commitment.
Groundwater	To minimise the impact of the borefield operation on other users in the region	Commitment 24 The Proponent will progressively extend the groundwater monitoring programme currently being implemented at the Roy Valais Borefield to include the Sullivan, Station, Charlie and Granite Borefields as they are developed. This will be undertaken in accordance with the WRC Groundwater Well Licence Conditions and to the satisfaction of the EPA on advice from WRC and DEP.	EPA	New Commitment.
Rehabilitation	Optimise rehabilitation of the TSF.	Commitment 25 The Proponent will set aside an area of tailings to use for rehabilitation trials, with the aim of testing methods of rehabilitating the tailings. These trials will be undertaken in consultation with DME, DEP and CALM and will commence following the selection of the final tailings storage method and the production of sufficient tailings for the trails.	EPA, DME	New Commitment.
Lakes	To minimise impacts on lake systems.	Commitment 26 The Proponent will not discharge any solid or liquid waste from the Expansion project into Lake Carey or any other lake system in the area.	EPA	New Commitment
Lake Carey - fringing vegetation	To ensure that adequate information is available for the purposes of managing the Project.	Commitment 27 The Proponent will undertake further investigations to determine if *Halosarcia* "Angel Fish Island" ms occurs at any additional locations within the Murrin Murrin East project Area. These investigations may be undertaken in cooperation with other mining companies operation in the vicinity of Lake Carey.	EPA, on advice from DEP and CALM	New Commitment

Issue	Objective	Commitment	To Whose Satisfaction	Status
Vegetation	To minimise the impact of the borefield operation on the surrounding vegetation.	Commitment 28 Prior to the borefields being developed, the Proponent will: • review the vegetation mapping for the proposed borefield areas; • identify significant vegetation communities which have the potential to be affected by groundwater drawdown; • design and implement a vegetation monitoring programme for these communities; and • develop contingency measures to minimise any impacts on these communities should the monitoring programme identify that the borefield operation is resulting in unacceptable impacts on these communities.	DEP, WRC and CALM	New Commitment

Appendix 2

List of submitters

Organisations:

Aboriginal Affairs Department
Department of Conservation and Land Management
Environment Australia
Goldfields Land Council on behalf of the Wongatha People
Health Department of Western Australia
Heritage Council of Western Australia
PacMin Mining Corporation Limited
Waters and Rivers Commission
Western Australian Museum

Individual:

Mr Geoff Taylor

Appendix 3

References

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Appendix 4

Proponent summary of environmental issues and their management

Table 1
Summary of the Issues and Management of the Murrin Murrin Expansion Project

Category	Topic	Aspects of Concern	EPA Environmental Objective	Present Status of Environment	Proposed Action	Proposed Management	Predicted Outcome
Biophysical Environment	Vegetation	Loss or degradation of vegetation communities.	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities.	The vegetation types present in the Project Area, borefields and associated transport corridors are common in the Region. However a number of vegetation communities have been identified as having local or regional significance.	Vegetation will be disturbed or cleared from a number of areas during the construction of Expansion Project. Vegetation may be disturbed as a result of changes to the drainage patterns and off-road activities. Weeds may be introduced to, or spread from, the Project Area. Vegetation along Sullivan Creek, particularly *Eucalyptus camaldulensis*, may be affected by groundwater drawdown as a result of the operation of the borefield.	• Design the Project layout, and continue to implement construction procedures, to minimise the disturbance to vegetation and flora. • Weed Control. • Continue to progressively rehabilitate disturbed areas. • Avoid significant vegetation communities where possible. • Implement a vegetation monitoring programme to identify any impacts to the vegetation in the borefields.	No unacceptable impacts anticipated.
	Significant Flora	Protection of Priority species.	Protect Declared Rare and Priority Flora consistent with the provisions of the *Wildlife Conservation Act* 1950.	The Priority species *Hemigenia exilis* (formerly a Declared Rare Flora species), *Chthonocephalus multiceps* and *Acacia kalgoorliensis* occur within the Project Area. Population of *Halosarcia* "Angel Fish Island" ms known to occur south of orebody MM26 on the edges of Lake Carey. The extent of the distribution of this species is unknown. No DRF species are known to occur in the area.	Populations of *Hemigenia exilis* on the orebodies will need to be cleared for mining. Significant populations are known to occur outside of the Project Area. Some populations of *Chthonocephalus multiceps* may be disturbed during construction of the water pipeline if the northern option is chosen. Populations of *Acacia kalgoorliensis* are unlikely to be disturbed by the Project. Populations of *Halosarcia* "Angel Fish Island" ms may be indirectly impacted by the Expansion Project.	• Inform CALM prior to removing any populations of Priority or significant species. • Continue to implement management measures outlined in the Declared Rare Flora Management Plan prepared for the construction of the Murrin Murrin Project. • Continue to support current research projects involving *Hemigenia exilis*. • Undertake further investigations to determine the extent of *Halosarcia* "Angel Fish Island" ms within the Project Area. • Comply with the *Wildlife Conservation Act* 1950.	Some loss of priority flora species. Continued support for increasing the knowledge base relating to distribution, habitat preferences, and rehabilitation of *Hemigenia exilis* populations.
	Fauna	Protection of significant fauna habitats.	Maintain abundance, species diversity and geographical distribution of terrestrial fauna.	Most habitats are well represented within the region. However some habitats were considered to have local significance.	Clearing of vegetation for the Project will result in the localised loss of fauna habitats. Most species occurring in the Project Area are highly mobile and are not likely to be restricted to these habitats.	• Minimise disturbance of vegetation. • Progressively rehabilitated disturbed areas. • Minimise barrier effects of the transport corridors.	No unacceptable impacts on fauna habitats.

Table E1 (*cont'd*)

Category	Topic	Aspects of Concern	EPA Environmental Objective	Present Status of Environment	Proposed Action	Proposed Management	Predicted Outcome
Biophysical Environment (*cont'd*)	Significant fauna	Protection of Malleefowl nesting area.	Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the *Wildlife Conservation Act* 1950.	Active nest of the Malleefowl observed in the Granite Borefield.	No disturbance to the Malleefowl nesting area is anticipated.	• Consult with CALM regarding the implementation of a fox baiting program. • Increasing the awareness of the workforce through the induction program and information sheets.	No unacceptable impacts to threatened fauna species.
	Subterranean fauna	Protection of subterranean fauna and their habitats.	• Maintain the abundance, species diversity and geographical distribution of subterranean fauna. • Ensure subterranean fauna are adequately protected in accordance with the *Wildlife Protection Act* 1950.	Unknown, but potential for subterranean fauna to occur in the calcrete mining areas and the borefields where cavities exist.	Mining in the calcrete mining areas and abstraction of water from the borefields may impact on subterranean fauna.	• Discussions have commenced with the WA Museum and a subterranean fauna survey will be undertaken by the Museum in November 1998. • Management measures to be incorporated in to the construction phase EMP and operational EMS. • Management measures to be prepared in consultation with WA Museum and the DEP.	Impacts currently unknown. The WA Museum reports, detailing the survey results and any required management measures, will be supplied to the DEP as soon as they are available.
	Land Systems	Loss of land systems.		Most land systems affected by the Project are well represented in the region. However, five land systems are not common locally.	Construction of the Project will result in localised disturbance to land systems.	• Protection of vegetation • Minimisation of erosion potential. • Management of surface drainage impacts. • Rehabilitation of disturbed areas.	No unacceptable impacts on the land systems of the region.
	Groundwater	Effect on existing pastoral bores and surrounding vegetation.	• Maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected. • Ensure that the groundwater resources used for public water supply are protected in accordance with NHMRC guidelines and that land uses which could affect both the quantity and quality of groundwater are appropriately controlled.	The water supply for the Expansion Project will be sourced from the Sullivan, Station and Charlie borefields with backup supplies from Granite and Charcoal borefields. Leonora town water supply is sourced from a tributary of Station Creek which is not connected to the borefield proposed for use for the Expansion Project. Vegetation in Sullivan Creek is dominated by *Eucalyptus camaldulensis* which is reliant on groundwater for survival.	The Proponent has exploration licences on nominated borefields in the region and is currently undertaking testwork and borefield design. An additional 53ML/d of water, with a total dissolved solids concentration of less than 4,000mg/L, is required for the Expansion Project. Associated drawdown may impact on existing water users and vegetation in the area.	• Minimise water consumption in the Processing Plant by recycling of water wherever possible and continuing to research water saving techniques. • Monitor groundwater levels and quality in the vicinity of the borefields in accordance with the WRC Groundwater Well Licences. • Expand or modify the existing vegetation monitoring program to include the new borefields as they are developed. • Where the Project water supply has an effect on the existing bores, the Proponent will make up the shortfall from its supplies as required by the WRC's Groundwater Well Licences. • Continue to investigate other groundwater resources in the region.	The available data indicated that the Project water can be supplied without any unacceptable impacts, although further test work is currently being undertaken and monitoring programmes will be implemented to identify any adverse impacts should they occur. If unacceptable impacts are found to occur, the Proponent will develop other borefields in the region in consultation with WRC.

Table E1 (*cont'd*)

Category	Topic	Aspects of Concern	EPA Environmental Objective	Present Status of Environment	Proposed Action	Proposed Management	Predicted Outcome
Background Environment (*cont'd*)	Surface Hydrology	Potential modification of surface drainage patterns, downstream flows and water quality.	• Maintain the integrity and functions and environmental values of watercourses, ephemeral streams and lakes. • Ensure that alterations to surface water drainage do not adversely impact indigenous vegetation.	The Murrin Murrin East Project Area is located between Lake Raeside and Lake Carey. The majority of the surface drainage from the Project Area tends to be eastwards towards Lake Carey.	Localised modification of catchments and streams through the construction and operation of the Project. Potential for interruption of sheet flow runoff in some areas as a result of the rail line and/or conveyor embankments.	• Construct water diversionary structures where required. • Construct protection bunds around the pits located adjacent to Lake Carey. • Monitor downstream water flow. • Undertake stabilisation and rehabilitation procedures.	• Modified drainage patterns will be established due to the Project and a new stream/channel equilibrium will result. • Minor sedimentation impacts in the short term, but very low sedimentation in the long term.
	Wetlands (Lake Carey)	Potential changes to the Lake environment.		The Murrin Murrin East Project Area is located adjacent to the northwestern edge of Lake Carey.	No mining activity is proposed on Lake Carey. Waste water or other waste materials will not be disposed of to Lake Carey. Some localised impacts may occur as a result of redirection of drainage lines. Final voids in the vicinity of Lake Carey will eventually fill with saline water. However, the clayey nature of the soil in the pit areas will minimise any hydraulic connection with the Lake's watertable and subsequent environmental impacts.	• Protection of fringing vegetation. • Bund pits to prevent inflow of water from Lake Carey into the pits. • Groundwater levels in the vicinity of Lake Carey will be monitored. • Participate in an Environmental Working Group with other users of Lake Carey.	No unacceptable impacts to Lake Carey.
Pollution Prevention	Evaporation Ponds	Impacts on groundwater resources due to seepage.	• Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected. • Ensure that the beneficial uses of groundwater can be maintained.	Evaporation ponds for the MM Stage 1 Project have been constructed. The area is located on a pastoral lease.	The evaporation ponds will be expanded for the Expansion Project to cover a total area of up to 900ha.	• Designed to control seepage to the agreed design objectives to protect the environment. • Monitor groundwater depth and quality up - and down-gradient of the evaporation ponds.	No unacceptable changes in the depth or quality of groundwater.
		Impacts of a breach of the evaporation pond on the surface hydrology of the area.	Maintain the quality of surface water so that existing and potential uses including ecosystem maintenance are protected.	As above	As above	Comply with the DME requirements relating to the design, construction and operation of the pond.	No unacceptable impacts are anticipated.

Table E1 (*cont'd*)

Category	Topic	Aspects of Concern	EPA Environmental Objective	Present Status of Environment	Proposed Action	Proposed Management	Predicted Outcome
Pollution Prevention (*cont'd*)	Tailings Storage Facility (TSF)	Impacts on groundwater resources due to potential leakage.	• Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected. • Ensure that the beneficial uses of groundwater can be maintained.	Two cells of the TSF have been constructed for the MM Stage 1 Project. The area is located on a pastoral lease.	The TSF will be expanded for the Expansion Project. Two methods of storage (either conventional subaerial deposition or Central Thickened Discharge) are currently being considered.	• Decant supernatant liquor from the TSF to the evaporation ponds to maximise the final solids density in the dams. • Continue to research other methods of tailings storage including in pit disposal. • Monitor groundwater depth and quality up- and down- gradient of the TSF. • Comply with the requirements of the DME relating to the design, construction and operation of the RSF.	No unacceptable impacts are anticipated.
	Particulates/ Dust	Impact of fugitive particulate emissions.	Ensure that dust levels generated by the proposal do not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards.	Natural emissions of dust in the region (e.g. dust storms, bushfires) can be significant. No significant dust issues have arisen during the construction of the MM Stage 1 Project. The ore has a high moisture content (approximately 30%) and is not prone to dusting.	Particulate emissions will be generated from vehicle movements and from exposed areas such as stockpiles, TSF evaporation ponds and waste dumps.	• High standard of maintenance including: - Sealing of major roadways within the plant area; and - Regular cleaning of areas likely to accumulate dust. • Use of water sprays to minimise potential dust lift-off from operational areas as required. • Use of water sprays dust extraction systems and chemical surfactants to control fugitive dust from the operations associated with the transport and stockpiling of sulphur as required.	Small localised short-term impacts may occur periodically.

Table E1 (*cont'd*)

Category	Topic	Aspects of Concern	EPA Environmental Objective	Present Status of Environment	Proposed Action	Proposed Management	Predicted Outcome
Pollution Prevention (*cont'd*)	Air Quality	Impacts of the emissions of sulphur dioxide, oxides of nitrogen and greenhouse gases.	• Ensure that gaseous emissions do not adversely affect the environment or health, welfare and amenity of nearby land users by meeting the statutory requirements (including Section 51 of the *Environmental Protection Act* 1986) and acceptable standards. • Ensure that gaseous emissions both individually and cumulatively, meet appropriate criteria and do not cause any environmental or human health problem. • Use all reasonable and practicable measures to minimise the discharge of gaseous emission. • Ensure that sulphur dioxide emissions meet the air quality requirements of the Section 51 of the *Environmental Protection Act* 1986. • All reasonable and practicable measures are taken to minimise sulphur dioxide discharge. • Ensure that oxides of nitrogen emissions meet acceptable standards and requirements of Section 51 of the *Environmental Protection Act* 1986. • All reasonable and practicable measures are taken to minimise oxides of nitrogen discharge. • Use all reasonable and practicable measure to minimise the discharge of greenhouse gases.	Good air quality with no known point source emissions currently in the vicinity of the Project other than those associated with the MM Stage 1 Project.	Emissions of sulphur dioxide, oxides of nitrogen and carbon dioxide from the Processing Plant.	• Specific plant and process design to limit gaseous emissions. • Process gases containing hydrogen sulphide will be flared and efficiently combusted prior to discharge. • Greenhouse gas emissions to be minimised through efficient use for energy, waste heat recovery and control of neutralisation circuits to minimise the use of calcrete. • Monitoring of the emission rates of key pollutants (either by direct measurement or by calculation from process data) from major sources.	• Air dispersion modelling indicates that the Project's emissions of sulphur dioxide and oxides of nitrogen will result in acceptable ground level concentration at or beyond the Proponent's mining lease boundary (as shown on Figure 18) and at the Project's accommodation village. • Greenhouse gas emissions will be minimised. The Proponent is discussing entering the Commonwealth Governments' Greenhouse Challenge Programme.

Table E1 (*cont'd*)

Category	Topic	Aspects of Concern	EPA Environmental Objective	Present Status of Environment	Proposed Action	Proposed Management	Predicted Outcome
Pollution Prevention (*cont'd*)	Noise	Potential noise impacts from construction and operation activities.	Protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet statutory requirements and acceptable standards.	• Construction is currently being undertaken on-site for the Murrin Murrin Project. • Closest resident is >15km from the Processing Plant and >11km from the Murrin Murrin East mining area.	• Expansion of the Processing Plant to allow for processing of the additional ore. • Mining at Murrin Murrin East.	• Large buffer area around the proposed activities will minimise noise impacts on the closest residence. • No known impact associated with construction of the existing plant. • Review of operational practices and equipment to reduce noise impacts in the event of complaints.	No significant off-site impacts expected from either construction or operational activities.
	Transport of Materials	Impact of increased vehicle movement on the Leonora-Laverton Road		The Leonora-Laverton Road is currently under utilised on the basis of historical traffic counts.	If road transport is chosen between Malcolm Siding and the processing plant approximately 110 road train movements per day will be required for the Overall Project.	All materials transported to and from the site by road or rail will be transported, handled and stored in accordance with regulations and standards administered by DME, Main Roads and Westrail.	No unacceptable impacts are anticipated.
Social Surroundings	Socio-economic Environment	Local and regional benefits of the Project.		Nearest settlements are Leonora, Laverton, Mt Margaret Aboriginal Community, Mt Morgans mining camp and various station homesteads.	• Influx of a large transient workforce during construction. • Influx of a smaller, more permanent workforce during operation.	• Instigation of an Aboriginal Employment Commitment to ensure that at least 20% of the workforce is from local Aboriginal Communities. • Providing training and employment opportunities for local Aboriginal communities. • Education of workforce through an induction program to minimise the impact on the surrounding communities. • House workforce in a self-contained accommodation village. • Maintain open communication with local communities.	Positive economic benefits to the region and state.

Table E1 (*cont'd*)

Category	Topic	Aspects of Concern	EPA Environmental Objective	Present Status of Environment	Proposed Action	Proposed Management	Predicted Outcome
Social Surroundings (*cont'd*)	Aboriginal Heritage	Potential impacts on archaeo-logical and ethnographic sites.	• Ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act* 1972. • Ensure that changes to the biological and physical environment resulting from the Project do not adversely affect cultural associations with the area.	The Project Area includes a number of Aboriginal sites and site complexes of low to moderate significance.	A number of sites will be disturbed by the Project. Borefields and transport corridors have been designed to avoid Aboriginal sites, where possible.	• Obtain site clearances under Section 18 of the *Aboriginal Heritage Act* 1972 to disturb sites located in areas of proposed disturbance. • Careful protection of sites that are not to be disturbed by carefully supervising the activities of field personnel, recording the location of these sites and delineating these sites in the field, where necessary. • Continue consultation with Aboriginal people in relation to the planning and management of the Project to minimise the risk of unintentional intrusion or damage to Aboriginal sites.	Aboriginal interests and heritage will be protected.
	European Heritage	Impact on sites of European heritage.	Comply with statutory requirements in relation to areas of cultural or historical significance.	No listed European heritage sites known to occur in the Project Area.	Not an issue.	Not applicable.	Unaffected
	Pastoral Activities	Potential disruption to pastoral activities.		The Project Area is located on portions of Nambi, Melite, Sturt Meadows, Tamoola, Clover Downs, Mertondale, Erlistoun, Minara, Laverton Downs and Glenorn Stations.	Impacts may include: • Disruption to stock, watering or mustering activities. • Temporary obstruction of tracks. • Loss of stock water through lowered water tables. • Loss of pasture.	• Implementation of management procedures for the protection of native fauna. • Maintenance of fences. • Avoidance of construction near water holes. • Shortfalls in existing pastoral bores will be made up from the Proponent's water supply as per the requirements of the WRC Groundwater Well Licence.	Minimal disruption to pastoral activities.

Appendix 5

Issues arising out of informal meetings with Anaconda Nickel and the Aboriginal Communities from Laverton, Leonora and Mt Margaret Mission

23 & 24 November 1998

Murrin Murrin Nickel Project

Issues arising out of informal meetings with Anaconda Nickel and the Aboriginal Communities from Laverton, Leonora and Mt Margaret Mission 23 & 24 November 1998

Anaconda to:

1. Keep the Aboriginal Communities better informed of the water issues, particularly the quality of groundwater upstream and downstream of tailings dam and evaporation ponds, and any effects on flora and fauna and the water table level as a result of borefield extraction.

2. Involve the Aboriginal Communities in the water monitoring of the tailings dam and evaporation ponds, and Cement Creek catchment area, as a means of aiding the communication process.

3. Report results of water monitoring to the Aboriginal Community in a simple and clear manner, and assist in interpreting the information and understanding the issues.

4. Consider monitoring the freshwater swimming pool near Lake Carey at the end of Cement Creek for the information of the Aboriginal Community, on the understanding that any changes in the water quality of the pool need not necessarily be as a result of activity by the Murrin Murrin project.

5. Monitor tailings dam and evaporation ponds for trapped animals, and if the construction proves to be a danger to animals, consider a remedy such as fencing the tailings dam and evaporation ponds.

6. Discharge no liquid from Murrin Murrin East ore mine into Lake Carey.

7. If Anaconda decides upon conveyor belt rather than railway line as the means of transporting ore from Murrin Murrin East to the Plant Site, to inform the Aboriginal Community about the size, construction, operation and route of the conveyor belt, and include in the specifications crossing points for both people and animals.

8. Simplify reports and ensure communications are understood at Aboriginal Liaison Committee meetings, and invite wider Aboriginal Communities to attend for information purposes; consider inviting contributing officers from Government Departments to attend.

9. Ensure that anthropological and archaeological studies/reports are written clearly and in a way that makes sense to the contributor of the information, and that such reports are being referred back to the contributors for verification and sign-off, not as a requirement under the Aboriginal Heritage Act, but as a matter of courtesy.

10. Consider, on the basis of a goodwill gesture, rather than because of any perceived or potentially real effect on the swimming hole, building a swimming pool for the Mt Margaret Mission Community.

Appendix 6

Summary of public submissions and the proponent's response

DAMES & MOORE PTY LTD

A DAMES & MOORE COMPANY

Proponent's Response to Submissions
Public Environmental Review
Murrin Murrin Expansion Project

for

Anaconda Operations Pty Ltd

DAMES & MOORE
Ref: KMF/31059-015-071/DK:444-F737.1/DOC/PER
19 January 1999

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

PROPONENT'S RESPONSE TO SUBMISSIONS MURRIN MURRIN EXPANSION PROJECT

for

Anaconda Operations Pty Ltd

1. INTRODUCTION

This report presents a summary of the issues raised by Decision Making Authorities (DMAs), members of the public and other interested parties during the eight week public review of the Public Environmental Review (PER) for the Proposed Murrin Murrin Expansion Project. The PER was prepared for the Proponent, Anaconda Operations Pty Ltd (Anaconda), by Dames & Moore (1998).

Some of the submissions were summarised by the Department of Environmental Protection (DEP) while others were supplied in full. The submissions included issues related to:

- groundwater abstraction;
- groundwater quality;
- salt lakes;
- terrestrial flora;
- subterranean fauna;
- gaseous emissions;
- risk and hazard; and
- Aboriginal heritage and culture.

These issues and the Proponent's responses are presented in this report.

2. STATE GOVERNMENT AGENCY COMMENTS

2.1 DEPARTMENT OF ENVIRONMENTAL PROTECTION

2.1.1 Borefield Vegetation

Contingency plans to remedy any adverse effects on vegetation of the borefield operation should be in place prior to any impact occurring. In Table E1 ("Groundwater", "Predicted Outcomes") a commitment is given to monitor for adverse impacts and if significant impacts are noted then alternative borefields will be developed. This would be too late. Suitable contingency plans should be in place prior to any impact occurring. It is understood that the Proponent has some contingency plan in mind at this stage. These should therefore be presented as part of this assessment.

The Proponent proposes to expand or modify the existing vegetation monitoring programme to include the new borefields as they are developed. This monitoring programme was presented to both the DEP and the Department of Conservation and Land Management (CALM) prior to implementation. The programme has been modified according to comments made by CALM and the DEP and both agencies have signed off on the programme.

The objectives of the existing monitoring programme are to:

- identify if any changes in the condition of the vegetation occur in the vicinity of the borefield over time; and
- ascertain if these changes are the result of the borefield operation or other factors.

The programme has been designed to monitor tree stress (rather than death) and includes measurements on vegetation and groundwater parameters. It is expected that this programme would provide an early indication of possible impacts on vegetation, due to the abstraction of groundwater in the borefields, prior to the occurrence of tree mortality. It is also anticipated that significant changes in the water table will be identified through a groundwater monitoring programme enabling the Proponent to identify at an early stage, potential for tree stress

Additional borefields have been identified in the region and it is intended that these will be developed if any unacceptable impacts are detected by the monitoring programme. The Proponent is also considering options to reduce water consumption within the Plant.

2.1.2 Dewatering of Murrin Murrin East

In Section 3.5.3 it is stated that excess saline/hypersaline water generated from mine dewatering operations which cannot be used for dust suppression is proposed to be disposed of in starter pits. The Proponent should clarify what impacts seepage of this saline water will have on the superficial aquifer beneath the starter pits, especially if it is of a quality that supports downstream beneficial uses. The feasibility of directing the water to existing or additional line evaporation ponds should be investigated.

The zone of groundwater occurrence beneath the starter pits is developed within weathered basement materials, typically clays with residual texture and secondary structures, as well as decomposed and fractured rock materials. These rocks are mainly granite and mafic to ultramafic types. Water is generally present at the base of the saprolitic zone, and within the saprock profile, grading into unweathered rock. The water table varies according to ground elevation and is mostly between 10 m and 20 m below ground level. The water quality varies between 20,000 mg/L and 120,000 mg/L total dissolved solids (TDS) and is classified as saline to hypersaline.

There is no beneficial users of the water form the dewatering operation as a result of its saline nature. Therefore, excess mine water will be disposed of to starter pits, which will provide a mechanism for substantial water losses via evaporation, as well as minimal seepage back into the ground. The impact of ground seepage will be contained to a slight mounding of water beneath the disposal pits. This will rapidly assimilate with the regional saline water to produce a groundwater of similar quality to that which already exists.

Further feasibility studies into directing water into lined ponds to prevent infiltration is not considered necessary due to the highly saline nature of the existing groundwater and the minimal volumes of water (after evaporation) that will infiltrate into the local groundwater system.

2.1.3 Air Quality

Whilst Anaconda has initiated atmospheric modelling studies to determine ground level concentrations of NO_x, SO_x, and H_2SO_4 mist, it appears no work has been done for emissions of H_2S and NH_3, both of which are generated on a regular basis from the plant processes. NH_3 emissions may be especially prevalent with the proposed ammonia plant as part of the expansion proposal. The Proponent should conduct additional modelling exercises for each of these emissions. The modelling should be based on stack emissions under normal and upset conditions (including pressure relief situations) and the outcomes should include predicted ground level concentrations which should be compared with relevant/available guidelines.

The Proponent has undertaken air dispersion modelling studies for the emissions of hydrogen sulphide (H_2S) and ammonia (NH_3). This modelling was undertaken during the engineering feasibility studies to ensure that both the occupational and ambient air quality standards would be met during the plant's operation. These modelling results were not presented within the PER as the Proponent considered that emissions of sulphur dioxide and oxides of nitrogen were more significant.

2.1.3.1 Hydrogen Sulphide

The processing plant has been designed to maximise the efficiency of the usage of hydrogen sulphide, thereby minimising the emissions from the process. As discussed in Section 3.6 of the PER, the emissions of hydrogen sulphide that do occur from the process are captured and flared prior to release. The flare combusts the hydrogen sulphide to form sulphur dioxide with a very high efficiency. The consequent emission of sulphur dioxide has been accounted for within the air dispersion modelling.

The only emissions of hydrogen sulphide that are not captured are associated with occasional emergency pressure relief of vessels. These situations would result in a small instantaneous release (typically less than one second in duration) of gas containing hydrogen sulphide. It is expected that these emission may result in extremely short term and highly localised odours that will not affect the

accommodation village (closest residence) or result in any on-site exceedence of the occupational standards.

The processing plant has ambient hydrogen sulphide monitors located within the major hydrogen sulphide consuming areas. These monitors have been incorporated into the design to ensure that the occupational standards are not approached. The outputs from the hydrogen sulphide monitors are linked to the plant's interlock (safety) system which will automatically cut off the supply of hydrogen sulphide to any area of the plant where high levels of hydrogen sulphide are recorded.

Therefore, the emission of hydrogen sulphide from the plant are not considered to be significant under normal operating and typical upset conditions.

2.1.3.2 Ammonia

The Expansion Project has two primary emission sources of ammonia:

- the hydrogen reduction components of the nickel cobalt refinery; and
- the proposed ammonia plant.

Refinery

The emissions of ammonia from the hydrogen reduction circuits (nickel and cobalt) occur as the autoclaves are discharged and water vapour (steam) containing small quantities of ammonia are released via the reduction flash tank condensers. The emissions from the flash tank condensers are intermittent and vary as a function of the process stage. Table 1 summarises the emission cycles for the cobalt reduction flash tank on autoclave number 1. The emissions presented in Table 1 are believed to be very conservative (ie. over estimated) and monitoring will be undertaken during the operation of the MM Stage 1 plant (currently being commissioned) to provide a more reliable estimate of the emissions.

Table 1

Atmospheric Emission Characteristics
Flash Tank Condenser for Autoclave 1
Cobalt Reduction Circuit

Source ID	WA 219_1					
Description	Single vent, 100 mm diameter, 9 m above grade.					
Process Stage	Densification Discharge		Nucleation Discharge		Plate Leach Discharge	
Condition	Normal	Peak	Normal	Peak	Normal	Peak
Flow rate (Am^3/hr)		325		310		810
Max. Temp (°C)		50		50		50
Exit Velocity (m/s)		14		10		26
Frequency (once per)		65 minutes		37 hours		4.6 days
Duration (minutes)		20		30		30
Ammonia (g/s)	0.043	0.22	0.002	0.165	0.003	0.79
Comments	• Normal values are the average emissions expected throughout one year. • The frequency of the peak emissions assumes that the autoclave is operating at its design capacity. • The peak emission discharge is the maximum emission rate which occurs at the start of the discharge cycle. The emission rate decreases in an exponential manner (ie. very rapid initial decreases) and approaches zero at the end of the discharge cycle. • The peak emission flowrate and velocity data are average values over the duration of the autoclave discharge. • The initial exit velocity will be greater than stated and decrease exponentially as the autoclave discharges.					

The DEP's worstcase model MAXMOD has been used to estimate the maximum predicted ground level concentration of ammonia that may be expected from the cobalt reduction flash vent condenser for each of the peak discharge rates. The maximum 3-minute average concentrations were predicted to occur for the Plate Leach Discharge cycle (see Table 1) and are presented in Table 1, along with the relevant air quality guidelines. The modelling results presented in Table 2, show that the maximum predicted concentrations of ammonia during the Plate Leach Discharge cycle are well below the Occupational Short Term Exposure Level (STEL) guideline in the immediate vicinity of the emission point. The maximum predicted three minute average ground level is also predicted to be well below the Victorian EPA (VEPA) 3-minute design criteria at the accommodation village for the worst case meteorological conditions.

Table 2

Air Quality Guidelines
Predicted Maximum 3-minute Average Groundlevel Concentrations of Ammonia
Flash Tank Condenser for Autoclave 1 - Cobalt Reduction Circuit

Air Quality Guidelines	Concentration ($\mu g/m^3$)
Occupational Short Term Limit (15-minute average)	24,000
Victorian EPA 3-minute design criteria	630
Predicted Maximum Concentration (3-minute average)	
Immediate Vicinity	745
Accommodation Village	32

Once the Expansion Project is operational, there will be approximately five autoclaves for cobalt hydrogen reduction and four autoclaves for nickel hydrogen reduction. The autoclaves will be sequenced such that they are not all going through the Plate Leach Discharge cycle at the same time, although this is theoretically possible. It is more likely however, that two of the nickel and two of the cobalt autoclaves may discharge simultaneously, although the frequency of this occurrence is also be expected to be low. If this were to occur the maximum predicted ground level concentrations would still be well below the Occupational STEL and VEPA criteria. Therefore, on the basis of the conservative assumptions used in deriving the emission estimates, the Proponent does not believe that there will be any exceedences of the occupational (on-site) or ambient (at the closest residence [accommodation village]) criteria due to the refinery emissions of ammonia.

Ammonia Plant

The ammonia plant is not expected to result in any emissions of ammonia during normal operations. However, fugitive emissions may occur during upset conditions, such as pressure relief venting. Wherever possible these emissions will be captured and directed to the flare.

Other emissions of ammonia that may arise during the operation of the ammonia plant will be considered as part of a risk study that will be undertaken for the plant.

2.1.4 Hydrogen Sulphide Emissions

Can the Proponent confirm that there will be a net reduction in H_2S emissions even though there will be a 250% increase in production as a result of the expansion.

Section 7.16 of the PER states:

> "The Proponent will minimise the atmospheric emissions from its project through plant design and operational and maintenance practices. For example, the quantity of

hydrogen sulphide that will be flared during the operation of the Overall Project is expected to be reduced from that expected for the MM Stage 1 Project as the excess hydrogen sulphide has been recycled wherever possible."

As discussed in Section 2.1.3 of this document, during the engineering design phase of the Project every effort has been made to reduce the Project's emissions to the environment. This commitment has resulted in significant refining of the Project and has, in some cases, resulted in lower emission rates being expected.

It should be noted that the hydrogen sulphide is not emitted, but directed to the flare where it is combusted (resulting in the formation of sulphur dioxide) prior to discharge. However, the Proponent confirms that it is expected that there will be a net reduction in the mass of hydrogen sulphide which is directed to the flare.

2.1.5 Sulphur Dioxide Emissions

In reviewing the emissions in response to the above, a typographical error in the Key Characteristics Table (Table 2) of the PER was noted. The total emission rate of sulphur dioxide was incorrectly listed as 124 g/s. In fact the total emission rate should be approximately 329 g/s. The sulphur dioxide emission rates presented elsewhere in the PER and used in the air dispersion modelling are correct.

2.1.6 Risk Assessment

Additional information on the option to produce ammonia on-site is required. Although Section 7.21 "Risk Assessment" concludes that there are not expected to be any unacceptable off-site risks associated with the Expansion Project, the effect of the possible addition of a 350,000 tpa ammonia plant does not appear to have been addressed in sufficient detail. The Proponent should provide further risk analysis to demonstrate that the EPA's individual risk criteria will be met by the proposed Murrin Murrin Project. (EPA Guidelines for a preliminary Risk Analysis and EPA guidance statement No. 2 Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant, are provided as guidance for the additional information required.

The Proponent has not yet undertaken a quantitative risk assessment of the proposed ammonia plant. This assessment would be undertaken once details on the plant (eg. size, ammonia storage capacity) are finalised. This study would be completed to the reasonable requirements of the DME and the DEP, and would primarily be undertaken to assess the potential on-site risks.

The Proponent believes that the off-site risk associated with the ammonia plant is minor due to the following factors:

- the quantitative risk assessment presented in Wesfarmers CSBP's Consultative Environmental Review for a 225,000 tpa ammonia plant at Kwinana (CSBP, 1997) demonstrated that the EPA's individual fatality criteria of 1 x 10^{-6} would be met within approximately 600 m of the proposed plant;
- the closest residence (the Project's accommodation village) is more than 7 km from the plant;
- the Proponent owns Minara Station and has a sublease over Glenorn Station which are in the vicinity of the Plant Site. These stations provide a significant safety buffer;
- the ammonia plant will be designed and operated to high safety standards to minimise the risks associated with uncontrolled releases of ammonia or hydrogen explosions; and
- the operational risks associated with the ammonia plant will be managed via the Project's Safety Management System which includes emergency response planning.

The Proponent is committed to designing and operating the proposed ammonia plant to minimise the on-site and off-site risks. The design of the plant (including safety interlock systems), strict operating guidelines, the Safety Management System and the long distance to the nearest residence should ensure that off-site risks associated with the ammonia plant are well below the EPA acceptable levels.

2.2 ENVIRONMENTAL PROTECTION AUTHORITY

The following issues were raised during information meetings with the EPA, Anaconda Nickel and the Aboriginal Communities from Laverton, Leonora and Mt Margaret Mission held on the 23 and 24 November 1998.

2.2.1 Keep Aboriginal Communities Better Informed

Keep the Aboriginal Communities better informed of the water issues, particularly the quality of groundwater upstream and downstream of tailings dam and evaporation ponds, and any effects on flora and fauna and the water table level as a result of borefield extraction.

Anaconda Nickel has established an environmental working group (the Murrin Murrin Aboriginal Environmental Liaison Committee [MMAELC]), consisting of Aboriginals and Anaconda's personnel. The MMAELC provides a forum for the dissemination of information, concerns to be raised and discussions to be held regarding the Murrin Murrin Project.

Anaconda will provide information to the Aboriginal communities through the MMAELC and this will include information of water quality and the results of monitoring programmes undertaken around the borefields.

2.2.2 Involve Aboriginal Communities

Involve the Aboriginal Communities in the water monitoring of the tailings dam and evaporation ponds, and Cement Creek catchment area, as a means of aiding the communication process.

A local Aboriginal person has been employed on the Murrin Murrin Project to undertake environmental technician activities, which will include water sampling and monitoring of the tailings dam and evaporation ponds. In addition, the results from these monitoring progarmmes will be disseminated to the Aboriginal community through the MMAELC.

In addition, the Proponent has made exhaustive efforts to involve local Aboriginal communities in the Murrin Murrin Project. Approximately 105 to 110 local Aboriginal people have been working onsite during the construction phase of the Project. Construction contracts have also be awarded to nine Aboriginal and Aboriginal Affiliated Groups or Enterprises.

2.2.3 Report Results to Aboriginal Communities

Report results of water monitoring to the Aboriginal community in a simple and clear manner, and assist in interpreting the information and understanding the issues.

Anaconda will report the result of the water monitoring programmes to the Aboriginal communities via the MMAELC. This forum will allow the Aboriginal participants an opportunity to ask questions and discuss the results of the surveys in details. Anaconda will make every effort to ensure that the information is presented in a simple, clear and concise manner. In addition, Anaconda will provide an interpretation of the results to the MMAELC and provide an opportunity to discuss these interpretations.

2.2.4 Monitoring Swimming Pool Near Lake Carey

Consider monitoring the freshwater swimming pool near Lake Carey at the end of Cement Creek for the information of the Aboriginal Community on the understanding that any changes in the water quality of the pool need not necessarily be as a result of activity by the Murrin Murrin Project.

The Proponent will monitor the water quality at the freshwater swimming pool near Lake Carey on a monthly basis and after every major rainfall event. This information will be provided to the MMAELC for its information and verification. This monitoring will be undertaken by the Environmental Technician employed on site who is also a member of the local Aboriginal Community.

2.2.5 Monitoring of Tailings Dams and Evaporation Ponds

Monitor the tailings dam and evaporation ponds for trapped animals, and if the construction proves to be a danger to animals, consider a remedy such as fencing the tailings dam and evaporation ponds.

There will be no cyanide in the tailings and the tailings will have a pH of between 6 and 7. Generally mass animal deaths in tailings dams result from the presence of poisons such as cyanide in the tailings. As the tailings have no toxic components it is unlikely that the disposal of tailings and liquor will result in animal deaths as a result of poisoning.

However, the Proponent will undertake regular checks of the tailings dams and evaporation ponds and this will include an inspection for dead animals. Should an animal be found dead in the tailings, the incident will be further investigated to determine the cause of death and outline how further deaths could be prevented (such as through the use of hazing techniques or fencing).

2.2.6 Discharge into Lake Carey

Anaconda to discharge no liquid from Murrin Murrin East ore mine into Lake Carey.

No liquid, other than storm water, will be directed from the Murrin Murrin East mining area into Lake Carey. In addition, no tailings or liquor from the Processing Plant will be disposed of into Lake Carey.

2.2.7 Conveyor vs Rail Line

If Anaconda decides upon conveyor belt rather than railway line as the means of transporting ore from Murrin Murrin East to the Plant Site, to inform the Aboriginal Community about the size, construction, operation and route of the conveyor belt and include in the specifications crossing points for both people and animals.

At this stage in the Project design, it is unlikely that a conveyor belt will be used to transport the ore from Murrin Murrin East to the Plant Site. However, should a conveyor be chosen as the most appropriate method of transporting the ore, the Aboriginal Community will be informed about the size, construction, operation and route of the conveyor through the MMAELC and crossings will be provided for both animals and humans.

2.2.8 MMAELC Meetings

Simplify reports and ensure communications are understood at Aboriginal Liaison Committee meetings, and invite wider Aboriginal Communities to attend for information purposes. Consider inviting contributing officers from Government Departments to attend.

Anaconda will make every effort to provide simple, clear and concise reports to the MMAELC. The results of the reports will be presented to the MMAELC and discussed at these meetings to ensure that any queries can be addressed and discussed at the time of the presentation.

Anaconda will invite the wider Aboriginal Community to attend the meetings, particularly when results of monitoring programmes or other information of interest to the wider community is likely to be discussed. Similarly, Anaconda will consider inviting representatives from Government Departments when issues relating to that Department are to be discussed.

2.2.9 Archeological and Ethnographic Reports

Ensure that anthropological and archaeological studies/reports are written clearly and in a way that makes sense to the contributor of the information, and that such reports are being referred back to the contributors for verification and signoff, not as a requirement under the Aboriginal Heritage Act, but as a matter of courtesy.

Due to the political sensitivity of Aboriginal issues in the area, Anaconda went to great lengths to carry out appropriate archaeological and ethnographic surveys of all Project Areas. The surveys were carried out by suitably qualified and experienced consultants working directly with local Aboriginal people.

Aboriginal Heritage together with environmental approvals have become interwoven with the Native Title process and are often used as a lever to angle for more compensation than might otherwise be negotiated by Native Title Claimants. In order to limit this distortion and misuse of Aboriginal heritage and environmental legislation by Native Title Claimants and their legal representatives, Anaconda ensures that all Aboriginal heritage and environmental surveys are performed very thoroughly in order not to provide opportunity for the misuse of information or delay to statutory approval processes.

Anaconda is unable to provide the reports of the heritage surveys to the contributors because the information is highly sensitive to local Aboriginal people within and without their community and the general population. Anaconda observes a strict protocol in the handling of this information in order to avoid any conflict or breach of confidence with the local Aboriginal people who provided the material in the first instance.

This information is highly sensitive within each Aboriginal Tongue Group as there is information passed that may only be known to a select few Aboriginal Law Men and Elders within the Group. There is secret men and women's business and therefore a need to restrict passage of the information on a gender basis even within the same group. In addition there are cultural songs that are unique to one Tongue Group that may not be made known to Aboriginal people of another Tongue Group as these songs are the equivalent, in Aboriginal Lore, to modern day land title deeds.

Due to the extreme sensitivities outlined above Anaconda does not wish to have any part in disseminating any of this information and will in every instance defer to the Aboriginal Affairs Department (AAD) as the most appropriate administrative body in the circumstances.

All reports are lodged with the AAD, except for a copy which is held securely in the Anaconda Technical Report library. Any requests for the information from a third party are deferred to the AAD for decision.

2.2.10 Swimming Pool for Mt Margaret

Consider, on the basis of a goodwill gesture, rather than because of any perceived or potentially real effect on the swimming hole, building a swimming pool for the Mt Margaret Mission Community.

Anaconda is currently looking at the feasibility of constructing a swimming pool for the Mt Margaret community through discussion with the MMAELC. Anaconda is currently discussing site selection, construction and management of such a facility.

2.3 ABORIGINAL AFFAIRS DEPARTMENT

2.3.1 Aboriginal Heritage Issues

Although Anaconda has satisfactorily addressed Aboriginal Heritage issues, not all heritage reports have been completed for the proposed areas of expansion. It is understood that these reports will be submitted once the option for transport of ore to the Plant site has been determined.

All Aboriginal Heritage reports have now be provided to the AAD.

2.4 WESTERN AUSTRALIAN MUSEUM

2.4.1 High Quality Water

The use of such large quantities of 'high quality water' requires much greater justification. The use of low quality is only discounted on the basis that it 'may' result in corrosion.

The use of the phrase "high quality water" is comparative to the availability of highly saline water in the region. The water proposed to be used for the Expansion Project contains up to 4000 mg/L TDS. This water is termed brackish. It is not suitable for human consumption and is marginal for stock use. As a result its use for process purposes is not of major consequence to the potable resources in the region.

2.4.2 Impact of Groundwater Drawdown

There is no discussion of the likely consequences, outside of the area of project drawdown, of this large scale and extensive water abstraction. There is potential for abstraction to produce a much reduced flow in the palaeodrainage system resulting in a marked increase in salinity in the lower parts of the palaeodrainage channels, where the groundwater calcretes occur, as the drainage approaches the salt lakes. This would impact on vegetation far removed from the borefields and may eliminate any stygofauna which comprises freshwater lineages.

Such potential hydrological impacts need to be analysed and, where necessary, the appropriate vegetation and faunal surveys need to be conducted to provide a baseline from which to monitor any potential impacts.

Hydraulic testing and numerical modelling have indicated that the resultant drawdown from groundwater abstraction will be confined to the up-gradient catchment areas. As a consequence, there will be no marked increase in salinity in the main parts of the palaeodrainage system, and no impact on the calcrete aquifers. These surficial aquifers are a separate aquifer system and are recharged as a function of direct rainfall and run off, not as a product of regional palaeo-tributary discharge.

In the Sullivan Creek area, where creek vegetation is well developed the relationship between alluvial aquifers and the deep buried palaeo-tributary aquifer system is presently being studied. This investigation will help define the interdependance of shallow rooting species on rainfall and surface runoff. In addition, it will determine the methods by which vegetation acquire, store and release water in semi arid environments. It is noted that baseline flora and fauna surveys have been carried out in all catchments with aquifer potential.

2.5 HERITAGE COUNCIL OF WESTERN AUSTRALIA

While the Heritage Council of Western Australia notes that no sites are expected to be affected by the proposal, new places are being included in the Register on a monthly basis. The Council therefore recommends that it be included as a Decision Making Authority and that the Heritage of Western Australia Act 1990 be recognised as legislation relevant to the Project.

Prior to disturbance of an area, Anaconda will consult the Heritage Council of Western Australia to determine if any new sites have been added to the Register. In the case of a site of heritage value being identified within the area to be disturbed, the Proponent will comply with the *Heritage of Western Australia Act* 1990.

2.6 DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

2.6.1 Lake Carey

CALM considers the effect on the hydrology and biology of Lake Carey and the secondary impacts on vegetation due to changes in surface flows are the most important issues. The Proponent's commitments to addressing these issues in their EMS are appropriate.

The Proponent acknowledges this statement.

2.6.2 Priority Flora Species

Section 4.6.3 – Priority 1 (CALM listed) species Eremophila annosacaule (ms) is known to occur in Land Type 1 in the immediate vicinity of the Project Area. Significant areas of this land type occur within the Project Area and there is some potential that this species could occur. CALM recommends specific search of areas that are proposed for disturbance within this land system and consultation with CALM as to the management of any Eremophila annosocaule (ms) proposed for disturbance.

A search of the CALM Declared Rare and Priority Flora databases was undertaken prior to conducting the vegetation survey of the Project Area. *Eremophila annosocaule* ms was noted as being previously recorded in the region in Land Type 1 as defined by Pringle *et al.* (1994). Detailed vegetation surveys of the Project Areas were undertaken in May, June and August 1998 by Mattiske Consulting Pty Ltd. This survey included searching for any DRF, Priority Flora or other significant species (including *Eremophila annosocaule* ms) and potential habitats for such species. Several significant species were collected during these surveys (Section 4.6.2 of the PER), however *Eremophila annosocaule* ms was not discovered in the Project Areas, during these surveys.

2.6.3 Brush-tailed Possum

Section 4.7.3 – There are a number of historical records for Brush-tailed Possum across much of inland Australia. The assertion that the jawbone record is the first for the Goldfields is incorrect.

The Proponent acknowledges that the Brush-tailed Possum jawbone found in the Project Area may not have been the first record for this species in the Goldfields.

2.6.4 Sandalwood and Timber Salvage

Section 7.5 – CALM understands that the Proponents have discussed the issue of salvage of sandalwood and timber from the Project Area with CALM contractors. Salvage should be encouraged to ensure this valuable resource is not lost.

Salvage of sandalwood and other timber from the Project Area is currently being undertaken by CALM contractors as part of the Murrin Murrin (MM) Stage 1 Project. Timber and sandalwood will continue to be salvaged for the Murrin Murrin Expansion Project.

2.7 WATER AND RIVERS COMMISSION

2.7.1 Provisions of Reports to WRC

The Water and Rivers Commission (WRC) needs to be provided with the Proponent's hydrogeological reports in order to make informed comment on the claims made in the PER with regard to sustainable groundwater abstraction. The information supplied within the PER is insufficient for the WRC to assess the Proponent's claims that the approximate doubling of the water requirements of the Project can be sustainably met over the lifetime of the Project from the borefields identified in the PER. Without this information the WRC cannot provide the DEP with the assurances that are required in processing the PER.

All hydrogeological reports will be forwarded as soon as they are available. Presently, drilling and hydraulic testing is being finalised, while vegetation monitoring studies, recharge assessment and long term aquifer response to pumping are being completed. These studies have been undertaken on advice from the WRC, after regular briefing sessions on the progress of field activities and data collection. It is anticipated that the reports will be forwarded to the WRC towards the end of February 1999.

Numerical modelling has indicated that groundwater withdrawal from either the Sullivan/Station aquifer or a combination of all defined aquifers can provide the Project water requirements over a 30 year time period. Preliminary reporting undertaken in September 1998 has been forwarded to the WRC for its appraisal.

2.7.2 Impact on Public Water Supply

The groundwater consultant's reports will have to clearly demonstrate that there is no connection between the existing Water Corporation borefield and the proposed Station Borefield.

The investigations to date clearly demonstrate that, with appropriate allocation and management, pumping groundwater for mineral processing purposes will not impact on other groundwater users. The proximity of Station Creek alluvial borefield to the palaeodraiange channel is being addressed using techniques such as hydraulic testing, gradient analysis and numerical modelling.

Depressurisation maps indicate that the water table response to pumping from the palaeo-draiange system will only marginally extend towards Station Creek alluvials, due to very low and indirect hydraulic connection. As a result, seasonal variations in shallow water levels will substantially mask any minor impacts due to groundwater pumping from the deep, hydraulically distinct palaeo-channel system.

No abstraction would commence that would allow adverse impact on public water supply schemes such as the Station Creek alluvial aquifer system, or other existing groundwater supply systems. The Proponent has already committed to "make good" any pastoral water supplies or Public water supplies which are adversely impacted during production pumping of groundwater for processing purposes.

2.7.3 Disposal of Water from Dewatering Operations

Section 3.5.3 of the PER states that excess water from mine dewatering will be disposed of in starter pits. This statement needs to be supported by an assurance that the starter pits will have the capacity to dispose of the predicted volumes of discharge water.

The impact of disposal of excess mine water to starter pits will provide a mechanism for substantial water losses via evaporation, as well as minimal seepage back into the ground. As there is no beneficial uses of the water due to its saline nature, the impact of ground seepage will be contained to a slight mounding of water beneath the disposal pits. This will rapidly assimilate with the regional saline water to produce a groundwater of similar quality to that which already exists. Starter pits will have sufficient capacity to store the water from dewatering operations. Bunding can also be created around the pit perimeters if evaporation and seepage are substantially less than indicated during hydraulic testing.

2.7.4 Abandoned Voids

Section 7.22.7 requires an explanation of the consequences of the abandoned mine voids filling with groundwater (ie that they will represent pockets of hypersaline water/saltbrines).

The eventual abandonment of the mining pits will result in open voids. Where the pits do not intersect the water table, it is anticipated that they will remain dry and not fill with water on a permanent basis. This is due to the fact that any rainfall or surface runoff which does collect in the void will either infiltrate or evaporate. Where the mining pits penetrate the water table, a residual water level will be exposed and subjected to evaporation as well as input from rainfall. Evaporation will tend to concentrate the contained saline water during the summer months. When rainfall occurs, the residual pits revert from groundwater sinks (concentration of salts and losses from the water table) to sources, whereby pit water may recharge into the local groundwater system. The net impact of these process will be a loss of water and the creation of pockets of hypersaline groundwater. However, given the highly saline nature of the existing groundwater, it is considered very unlikely that any net change to groundwater quality will be measurable at any significant distance from the mining areas. The Proponent proposes to establish a series of groundwater observation points at prescribed distances away from those pits which intersect groundwater during the mining process. This will allow both short and long term monitoring of the impact of mining within highly saline groundwater environments.

2.8 HEALTH DEPARTMENT

2.8.1 Monitoring of Water Bodies

It is recommended that, in addition to monitoring Cement Creek, all water bodies capable of being affected by poor quality surface runoff from the mine should be monitored.

Cement Creek is the major creek downstream of the Murrin Murrin North Project Area and, as such, the current surface water monitoring programme has focused on this creek. There are not expected to be any direct or indirect impacts on any water bodies in which swimming occurs.

However, as a result of issues raised during the community consultation programme, the Proponent is considering extending the monitoring programme to include periodic monitoring of the water quality in the swimming hole near Lake Carey.

2.8.2 Sewage Disposal

Given that the volume of water used has exceeded original estimates and that sewage disposal problems were encountered during the first stage of the Project, it is considered essential that

appropriate permanent arrangements for disposal of the treated sewage be provided to the satisfaction of the Executive Director, Public Health prior to the Expansion Project being approved.

While the results to date indicate the wastewater treatment plant itself is coping with the greater than expected wastewater volumes, ongoing monitoring of wastewater quality is also considered essential. It is suggested that copies of the monitoring results should be provided to the Shire of Laverton and the Executive Director Public Health.

As stated, the MM Stage 1 Project experienced early problems with its sewage disposal system due to the size of the construction workforce and the large volume of water that was used, both of which exceeded the initial estimates. These problems have been addressed by a number of measures including:

- reducing water consumption by replacing shower roses with more water efficient models;
- educating the workforce about conserving water; and
- implementing alternative disposal methods.

The Proponent has been working with the DEP and the Health Department to achieve a more permanent solution to the issues associated with sewage disposal. The currently preferred option is disposal to the tailings storage facility.

The Expansion Project will primarily use the existing facilities installed on-site, although a slight expansion may be required for the additional construction workforce.

The Proponent continues to regularly monitor the quality of the treated wastewater from the wastewater treatment plant. These data are currently provided to the DEP in the form of an Annual Monitoring Report. These reports will be provided to the Shire of Laverton and the Executive Director Public Health.

2.8.3 Radionuclide Content of Feedstock

It would be prudent, during the operation to check the radionuclide content (particularly for uranium and thorium) of the feed-stock and investigate the likelihood of build-up of NORM (Naturally Occurring Radioactive Material) in any susceptible areas. This will possibly need to be done only on a "one-off" basis.

The Proponent does not believe that there is any significant potential for the build-up of NORM for any areas associated with the Project. Therefore, there does not appear to be any requirement to undertake a survey for NORM.

3. COMMONWEALTH GOVERNMENT AGENCY COMMENTS

3.1 ENVIRONMENT AUSTRALIA

Where possible, the submissions made by Environment Australia have been summarised in the following sections. Environment Australia members will attend a two day site visit on 20 and 21 January 1999, which should clarify many of the issues raised here.

3.1.1 Lake Carey

- *Provide details on the extent of the buffer zones between the orebodies and Lake Carey.*

No mining activities will be undertaken within the Lake and no infrastructure associated with the Expansion Project will be located on the Lake bed. The width of the buffer zones between Lake Carey and the orebodies, waste dumps and the bunds varies but will generally be greater than 100 m. However, the boundary of Dump 9 will be less than 10 m from Lake Carey for a distance of approximately 60 m due to the extension of a small arm of the Lake.

The buffer zone for each orebody, bund and dump is indicated in Table 2 and in Figure 1.

Table 2

Buffer Distances Between Lake Carey and Mine Activity

Pit, Bund or Dump Number	Buffer Zone[1]
Pit MM26	220
Bund 3	130
Pit MM28	350
Bund 4	280
Pit MM29	90
Bund 5	10
Pit MM30	80
Bund 6	30
Dump 7	510
Dump 9	100[2]

[1] The buffer zone is given as the closest point to Lake Carey.
[2] Except for 60 m where the lake edge lies within 10 m of the waste dump.

- *Provide details of the potential impacts on Lake Carey of constructing 400m high bund walls on the northwest bank of Lake Carey*

The Proponent will not be conducting 400m high bund walls. Page 50 of the PER states that:

> "Protection against flooding from Lake Carey will be required around the pits located adjacent to the Lake (MM26, MM28, MM29 and MM30) presented on Figure 10.

This flood protection will be in the form of bunds to a level of approximately 400 mAHD (i.e. approximately 3m above the lake surface)."

The surface of the lake is approximately 397 mAHD (Australian Height Datum). Therefore, the bunds will only be approximately 3m high.

- *What specific measures, other than those already provided in Section 7.0 and Appendix E, are proposed for the protection of fringing vegetation which also includes species of significance.*

At this stage it is unknown if the fringing vegetation around Lake Carey and in the vicinity of the mine site, does support significant species. *Halosarcia* "Angel Fish Island" ms has been located on the edges of Lake Carey further south around the Red October Project. One population has been discovered south of MM26. At this stage, the extent of the distribution of *Halosarcia* "Angel Fish Island" is unknown. The Proponent will undertake further surveys along the edges of Lake Carey to determine the distribution of the species within the Murrin Murrin East Project Area and its immediate surrounds (Page 94 of the PER). The Proponent will notify CALM of the results of this survey. Should populations of *Halosarcia* "Angel Fish Island" be found within the Project Area, the Proponent will avoid disturbing these areas where possible. The Proponent will implement the management strategies outlined on page 94 of the PER to minimise the impact to *Halosarcia* "Angel Fish Island" populations in the Project Area.

Impacts on fringing vegetation of Lake Carey will be restricted to indirect impacts. Approximately 1.8% of the total lake edge is within 500 m of the Expansion Project. Therefore only a small proportion of the total lake edge may be indirectly impacted by the Expansion Project. The proposed mine pits located near Lake Carey will have a buffer zone between the Lake and any disturbance (see above; Figure 1) and no fringing vegetation will be cleared. Indirect impacts associated with changes in the surface hydrology of the area as a result of the construction and operation of the Expansion Project are expected to be relatively localised, as the catchments around Lake Carey are themselves relatively small and localised.

- *The Proponent should make it a commitment not to discharge any solid or liquid waste into Lake Carey or any other lake system in the area.*

The Proponent will not discharge any solid or liquid waste from the Expansion Project into Lake Carey or any other lake system in the area.

- *The Proponent should be committed to undertake adequate scientific studies to investigate the potential impacts on Lake Carey, specifically associated with the mining of orebodies MM26, MM28, MM29 and MM30 and the construction of 400m high bund walls.*

As noted above, the bund will be 3m above the lake bed, not 400m high as suggested by Environment Australia. The Proponent and other mining companies operating around Lake Carey are in the process of establishing the Lake Carey working group, which will co-ordinate studies undertaken on the Lake. It will ensure that there is a cooperative approach to management of mining around Lake Carey by sharing information relating to the Lake.

3.1.2 Mining of MM26, MM28, MM29 and MM30

The Proponent should be committed not to undertake mining of orebodies MM26, MM28, MM29 and MM30 until the outcome of the studies [undertaken by the Lake Carey Working Group] are made available.

There will be no direct impacts associated with the Expansion Project on Lake Carey. Minor indirect impacts may occur to the lake and the fringing vegetation as a result of construction and operation of the Expansion Project. These impacts may include:

- impacts on the surface hydrology;
- impacts on water chemistry; and
- impacts to fringing vegetation

Changes to surface hydrology in and around the Lake will be very localised as the catchments around Lake Carey are themselves relatively small and localised. Mining of the orebodies is unlikely to change the water chemistry of Lake Carey and there will be no waste material deposited in the Lake. Further, any indirect impacts of the Project would only affect a very small proportion of the total lake edge.

The Proponent believes that mining of these orebodies will not significantly impact on Lake Carey and therefore is not prepared to postpone mining of these orebodies until after the studies are complete. However, the Proponent will undertake studies, and work with the Lake Carey Working Group to obtain relevant data. Should any unacceptable impacts associated with the operation of the Expansion Project be observed, further studies will be undertaken and management measures implemented.

3.1.3 Transport

The Proponent to immediately undertake a feasibility study of the rail system. If the rail is found to be feasible, to commence implementation within a year of granting approval for the Expansion Project. The feasibility study should take into account, amongst other potential impacts, greenhouse gas emissions from different options.

The Proponent commenced an extensive feasibility study of the various transport options, prior to preparing the PER, which involved extensive consultation with the State Government. This study is continuing, and to date, rail is the Proponent's preferred option because it presents operational and environmental advantages. If rail is used for transportation of materials and products within and around the Project Area, it will be implemented as soon as possible following receipt of environmental approvals

3.1.4 Occupational Health and Safety

The Proponent should be committed to provide appropriate protective gear for the workers, who will be working in an environment where exposure to asbestos dust cannot be avoided and provide details of implementation in the OHSP.

The management of asbestos will be undertaken according to the Department of Minerals and Energy guidelines (Management of Asbestos in Mining, 1992) (page 134 of the PER). These guidelines outline information and training that is required for all employees required to work in, or near, asbestiform minerals. Such training will include providing information on the potential effects of asbestos, identification and use of appropriate protective gear, and work practices to be implemented. The Proponent will also supply all employees with a copy of the Worksafe Australia document "Asbestos – Code of Practice and Guidance Notes" (August 1988) and the DME Guidelines, as is required in the DME guidelines.

A comprehensive Occupational Health and Safety Plan (OHSP) has been developed for the MM Stage 1 Project as part of the Project Management Plan. This OHSP outlines potential risks associated with asbestos and details work procedures and conditions to ensure that all relevant health and safety standards are met. The OHSP will be updated to include the Murrin Murrin Expansion Project.

3.1.5 Noise Emissions

Page 111 of the PER document provides information on expected noise levels near noise sensitive premises within 15 m from the noise emitting source. It is also reported that a homestead (Yundamindra) is located approximately 11 km west of the Murrin Murrin East Project. A 40 dB(A) standard is proposed for this location. Does the Proponent propose to carry out monitoring of noise to ensure compliance with the proposed standards?

It would be appropriate for the Proponent to make a commitment to monitor noise levels in sensitive areas, particularly the Yundamindra homestead, accommodation village and other infrastructure to ensure compliance with prescribed levels under the WA Environmental Protection (Noise) Regulations 1997.

The original Commitment 10 should be expanded to include monitoring of noise emissions, for both constructional and operational phases of the Project.

The information referred to on Page 111 of the PER relates to the maximum allowable noise levels based on the Western Australian *Environmental Protection (Noise) Regulations 1997*, **not** the expected noise levels near noise sensitive premises. Table 25, on page 112 of the PER shows that, conservatively, the noise levels expected at distances of greater than 7 km from the noise generating equipment will be below 25 dB(A). This predicted level is well below the proposed standard of 40 dB(A) and monitoring is therefore not considered to be required or warranted. The noise levels predicted at the closest homestead are lower than 25 dB(A).

Mining activities have been undertaken in the Murrin Murrin North Project Area for the MM Stage 1 Project. This mining has been undertaken within 6 km of the accommodation village and no issues associated with noise from these activities have been raised. Therefore, the current mining activities have confirmed that noise from the Project is not presenting a problem. However, the Proponent will undertake monitoring and remedial action (as per Commitment 10) should noise complaints relating to the Project occur.

3.1.6 Land Systems

The PER should provide details on the potential extent of disturbance to the significant land systems. A specific management plan will be required for the protection of those land systems that are poorly represented in the eastern Goldfields region.

Based on the evaluation above, it is suggested that the Proponent makes it a commitment to prepare a separate environmental management plan for the protection of significant land systsms and implement it to the satisfaction of the WA Department of Conservation and Land Management, and the Australian and World Heritage Group of Environment Australia.

Table 3 outlines the areas of significant land systems which will be directly impacted as a result of the Expansion Project.

Table 3

Significant Land Systems in the Project Area

Land System	Percentage of Land System in the Northeastern Goldfields Region	Percentage of Land System to be disturbed by the Expansion Project.
Duketon	0.3% (318 km^2)	0.13% (0.4 km^2)
Felix	0.2% (241 km^2)	0% (0 km^2)[1]
Hootanui	0.3% (327 km^2)	0.41% (1.33 km^2)
Steer	0.6% (581 km^2)	0.008% (0.05 km^2)
Sunrise	0.4% (362 km^2)	0.01% (0.04 km^2)

Note: 1 The Felix land system occurs in the Sullivan Borefield but will not be disturbed by the Project.

The disturbance of each of the significant land systems as a result of the Expansion Project is less that 0.5% in all cases.

As only a very small percentage of the significant land systems are going to be directly impacted by the Project, the Proponent does not consider it necessary to prepare a separate Environmental Management Plan for protection of the significant land systems. However, it should be noted that the disturbance of these significant land systems will be avoided, where possible. Temporary facilities, such as borrow pits, vehicle parking areas and storage areas for equipment and bulk materials, will not be located on these land systems wherever practical.

In addition, the implementation of management measures to ensure the protection of flora, prevention of erosion, management of surface drainage and progressive rehabilitation of disturbed areas will minimise impacts on signficant land systems.

3.1.7 Rehabilitation

The Proponent should extend the original Commitment No. 25 to include the following:

A mine site rehabilitation plan will be prepared early in the life of mine in consultation with the relevant WA authorities. Reference will be made to the information provided in the publication "Landform Design for Rehabilitation" under the Best Practice Environmental Management in Mining Series published by Environment Australia. The rehabilitation plan will be implemented to the satisfaction of the Western Australian Department of Minerals and Energy, Department of Conservation and Land Management and the Department of Environmental Protection.

The Proponent should be committed to provide the technical, financial and personnel resources necessary to achieve the planned rehabilitation targets including monitoring of rehabilitation following decommissioning of the Project.

A rehabilitation plan for the construction phase of the MM Stage 1 Project for the operational phase of the Project has been outlined in the construction phase EMP, which has been approved by the relevant DMAs. This EMP will be updated for the Expansion Project and will detail rehabilitation measures to be implemented.

A detailed rehabilitation plan for the operational phase of the Project will be prepared as part of the operational phase EMS and the decommissioning plan, and this will reference up-to-date information from different sources (including the Best Practice in Environmental Management in Mining series). It will also outline monitoring of the rehabilitated areas that will be undertaken.

Ministerial Condition 6 of the Ministerial Approval for the MM Stage 1 Project requires the Proponent to prepare a plan which:

- describes the process for the decommissioning and rehabilitation of the Project Area;
- provides for the long term management of ground and surface water systems affected by the tailings disposal area and evaporation pond area; and
- provides for the development of a "walk away" solution for the decommissioned mine pits, the process plant, the tailings dam and the evaporation pond ,and all associated infrastructure.

This plan will be prepared for both the MM Stage 1 Project and the Murrin Murrin Expansion Project.

Commitment 25 specifically addresses rehabilitation of the tailings dam in recognition of the specific site conditions likely to be experienced on the tailings. It specifies that trials will be undertaken on the tailings, because tailings are often difficult to rehabilitate and it is recognised that early investigations into rehabilitation success can have significant benefits in regards to achieving the rehabilitation objectives at an early stage in the rehabilitation process.

The DME requires the Proponent to lodge non-performance bonds to ensure that the mine site is successful rehabilitated and a "walk away" solution is provided. The Proponent has lodged bonds in the order of $26 million for the MM Stage 1 Project. Bonds of a similar amount will be required for the Expansion Project. It is in the Proponent's best interest that the mine site is rehabilitated to the standards required by the regulatory authorities to ensure the release of the bonds. Therefore the Proponent will provide the technical, financial and personnel resources necessary to achieve the planned rehabilitation targets including monitoring.

3.1.8 Groundwater

The Proponent should provide adequate information to clarify the following issues.

- *The information provided in the PER about the hydrogeology of the aquifers, the groundwater resources and the extraction and use of the water is not detailed enough to assess the effects of exploitation of the groundwater resource.*

The information provided in the PER is only a summary of groundwater investigations undertaken to the time of submission of the document. Hydrogeological field activities have been ongoing over the past 12 months and will be substantially completed towards the end of January 1999. At that stage, a comprehensive report will be compiled and forwarded to the WRC in Western Australia for review and granting of a production licence to abstract groundwater at the quantities required for mineral ore processing.

- *It appears that there has been no regional assessment of groundwater quality. It is not possible to obtain an understanding of the amount of groundwater available and the distribution of the quality of groundwater in the borefield areas.*

A substantial regional hydrogeological assessment of the Northeastern Goldfields, and within a 100 km radius of the Murrin Murrin Project Area in particular, has been carried out by the Proponent, on a continual basis since 1994. This regional survey has identified all major users of groundwater, including mining companies, public water supply systems, pastoralists and potential irrigation schemes. In addition, the survey has provided a complete understanding of the types and nature of aquifers developed in the area as well as the distribution of salinity associated with each aquifer occurrence. Borefield salinity has been reproduced as a number of maps, which help to define the recharge and discharge areas of the local palaeo-drainage systems.

The WRC have also recently undertaken a regional assessment of groundwater resources and quality in the Northeastern Goldfields.

- *No geological or hydrogeological information is provided to confirm the statement that the shallow alluvial aquifer currently used by the Water Corporation has no hydraulic connection with the palaeo-drainage aquifer from which the water for the Project will be drawn. The influence of the shallow alluvial aquifer and the deeper aquifers in the palaeo-drainage system on each other need to be clarified and the impact of extraction from the borefields on the shallow aquifer needs to be modelled and assessed.*

The investigations to date clearly demonstrate that, with appropriate allocation and management, pumping groundwater for mineral process purposes will not impact on other groundwater users. The proximity of Station Creek alluvial borefield to the palaeodraiange channel is being addressed by techniques which include hydraulic testing, gradient analysis and numerical modelling. Depressurisation maps indicate that the water table response to pumping from the palaeo-draiange system will only marginally extend towards to Station Creek alluvials, due to very low and indirect hydraulic connection. As a result, seasonal variations in shallow water levels, will substantially mask

any minor impacts due to groundwater pumping from the deep, hydraulically disinct palaeo-channel system.

No abstraction would commence that would allow adverse impact on public water supply schemes such as the Station Creek alluvial aquifer system, or other existing groundwater supply systems. The Proponent has committed to make up the shortfall to any pastoral or Public water supply bores which are adversely impacted by production pumping of groundwater for process purposes.

- *The Proponent should provide adequate information on the aquifers, their hydrogeological characteristics and any results from groundwater model applications and their predictions on the effects of borefield extractions. This would enable assessment of the influence and results of the groundwater extractions and the drawdowns to be produced in the borefield areas and the regional aquifers. In addition, the requirement of maintaining regional groundwater flow for environmental purposes needs to be considered.*

As discussed an updated and more comprehensive report is currently being prepared, however the Proponent can forward an interim report produced in September 1998 to Environment Australia, if this is required.

Groundwater pumping from the palaeo-tributary aquifer systems is not expected to influence the surface aquifer used by some native vegetation. The main regional palaeo-channel drainage contains water resources which are many orders of magnitude greater than contained in the smaller and less significant feeder palaeo-tributaries. In addition, detailed numerical modelling has indicated that a significant proportion of groundwater throughflow is maintained during pumping of the aquifer systems.

- *No information is given in the PER about the distribution and location of other groundwater users in the region, including towns, pastoral station, mines and processing plants and the requirements and extraction by the present and future users. It is only after the assessment of these factors that it can be determined if the proposed water extractions are sustainable.*

Other groundwater users in the Charcoal and Granite catchments are limited to pastoral wells and bores. These structures draw water from the near surface, shallow perched aquifer systems, which are not connected directly to the deeper buried palaeo-drainage systems. Groundwater users in the Sullivan and Station catchments include a public water supply scheme for the town of Leonora, plant water usage by Sons of Gwalia Gold Mine and processing water usage by Tarmoola Gold Mine. The Proponent has made a commitment that water supplies to these existing users will not be adversely impacted, and has prepared a policy to provide alternate water supplies for any perceived impact on pastoral bores or wells in the immediate region.

- *It is clear that withdrawals of substantial amounts of good quality groundwater from several borefields over an area of up to 120 km across in the arid region, will have a significant effect on the groundwater conditions in the region for the duration of the Project. Effects are also likely to continue after the Project, during the recovery of groundwater levels. In order to minimise significant impacts of the current and proposed groundwater extraction a maximum reduction in the demand for water by the Project and other users is required, which means elimination of any wastage, the use of highly efficient practices and application of recycling systems. No information is provided whether the water quality could be improved using a purification process, which would allow other low quality water to be used in addition to high quality water. The adequacy of the proposed water use minimisation strategies in the PER is questionable, as the only reference to water conservation is in processing.*

The use of the phrase "high quality water" is comparative to the availability of highly saline water in the region. The water proposed to be used for the Expansion Project contains up to 4,000 mg/LTDS. This water is termed brackish, is not suitable for human consumption and is marginal for stock use. As a result its use for process purposes is not of major consequence to the potable resources in the region.

Water quality will be improved for various sections of the plant which require boiler feed water, demineralised water and potable water. Waste minimisation strategies have been largely restricted to process water within the plant as this uses 80% of the supplied resource. However, recent initiatives have also involved the use of water treatment reject water for dust suppression on roads and in the mining process, so as not to require additional groundwater resources.

There is no information in the PER about the existence of, or the preparation of a strategic groundwater resources management plan for the region.

The Proponent has prepared a strategic groundwater management plan. This involves the hydrogeological definition of aquifers in the region which contain water resources of sufficient volume and quality to be of use for general community purposes. Water quality varies from approximately 800 mg/L TDS (identified in a small area to the north west of the Project Area) to over 200,000 mg/L in the main palaeo-drainage channels. All users of water have been identified, the aquifers categorized and allocations reserved for their specific purposes. A comprehensive monitoring programme has been developed to observe the impact of pumping from the various borefields and provide a quantitative assessment of the impact of groundwater abstraction by the Proponent and others in the region. This is a similar system that already exists within the WRC which requires owners and operators of groundwater pumping schemes to be monitor and record all abstraction figures, water levels and groundwater chemistry levels. It is envisaged that with time both groundwater management plans may be integrated to better manage the resources of the region.

- *The Proponent should carry out research with a view to developing methods to reduce consumption of water.*

This comment is acknowledged and will be addressed by both plant management staff and water resource management staff. This research has been carried out by Fluor Daniel as part of a Project Value Added (PVA) review process undertaken in September 1998. The results of the PVA indicated potential water reduction via use of indirect heating techniques, covering of tanks and vessels, recovery of blowdown reject water and recycling of water treatment discharge water.

3.1.9 Fly in/Fly out operations

The arguments provided under Section 8 do not present a clear socio-economic benefit to the Project Area under the proposed fly in/fly out operation. The socio-economic study should have focused upon identifying matters of regional concern and finding ways to maximise benefits from the Project to the regional economy and quality of life (a community benefit package). It appears that better socio-economic benefits, on a regional basis, could be derived from a non fly in/fly out operation and would contribute positively towards the proposed regional development plans.

The Proponent should provide supporting information in the context of the above for making the decision to implement the fly in/ fly out operation for the majority of the workforce. A decision in this regard should be make in close consultation with the relevant Shires, the local community and other relevant authorities responsible for the regional development.

Anaconda uses a fly in / fly out (FIFO) option for its workforce and has selected this mode of option for three reasons:

- Workforce attraction,
- Project viability, and
- International Competitiveness

Workforce Attraction and Retention.

In order to attract and retain a workforce of sufficient skill and experience to operate the Murrin Murrin plant safely, a FIFO component of the remuneration package is essential in today's employment market for operations in remote areas.

Anaconda is competing in an international labour market for qualified, skilled and experienced plant personnel. There is an international trend for FIFO accommodation. To remain internationally competitive Anaconda must offer internationally competitive remuneration packages to its employees. FIFO based employment is a key requirement in that package.

Features of today's labour market are that:

- they are more transient (ie employees have a greater preparedness to go to where the money and conditions are better [no longer is there the mentality of a "job for life" which town based Company's attracted]); and
- there is a resultant skills specialisation/shortage as the labour market fights to keep up with leading edge technology being adopted by companies competing in an international market, hence people possessing these skills are more prepared to shop around (across industries and across borders).

For example the Murrin Murrin Processing Plant has been compared more to a petrochemical plant rather than a traditional mining plant. This has meant that in the search for appropriately skilled personnel Anaconda have had to attract persons from a petrochemical background. These people have little recent history of or interest in town based work within a remote community. Their experiences and preferences are for an even time work cycle commuting from a nominated point. It is not atypical for these persons and their families to reside in another State.

Unless Anaconda offered this form of employment it would not be possible to acquire the necessary human resources to run the plant in a safe and proper manner. Anaconda must stress that the Murrin Murrin plant is a complex chemical plant and must be run by the very best people. There are health and safety risks posed by not employing the best people for the job.

FIFO is extremely popular with the workforce as it enables people to work in a remote area and enjoy a capital city lifestyle as well. While a remote outback lifestyle may appeal to a certain segment of the population, the fact is that most people prefer to live in a capital city due to the range of goods, services, sophistication and lifestyle opportunities that a large city offers.

Of all the studies and research that has been carried on the subject of employment in remote areas, one commonality between them is that spouse support and choice is a key determinant of the sustainability of the accommodation solution chosen. The fact is that the majority of spouses do not prefer to live permanently in remote area locations for extended periods, especially when their children are of upper school age.

While it may be desirable to populate Australia's less attractive regional areas, it is not popular nor practical to do so.

The Murrin Murrin region has an arid climate with cool winters and hot, dry summers (Table 4). The highest maximum temperatures are recorded during the summer months of December, January and February. The lowest minimum temperatures are recorded in July.

Rainfall is generally erratic but is more common during autumn and early winter than in spring and summer (Table 4). On average there are 41 days of the year during which rain is received. The average rainfall in Leonora is slightly above average rainfall for the region, which is approximately 240 mm per year (Pringle *et al*, 1994). The average evaporation at Leonora is approximately 3,300 mm per annum (Pringle *et al*, 1994) which is much greater than the average rainfall received in the region.

Table 4

Climatic Data for Leonora

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Daily Maximum Temperature (°C)	37.0	35.4	33.0	27.9	22.6	18.8	18.3	20.4	24.7	28.7	32.3	35.5	27.9
Mean Daily Minimum Temperature (°C)	21.6	20.8	18.7	14.7	10.0	7.5	6.0	6.9	10.0	13.5	16.9	20.0	13.9
Mean Monthly Rainfall (mm)	22.1	27.4	27.8	20.5	24.9	26.3	18.4	16.1	9.3	7.8	10.6	15.5	277.0

Source: Bureau of Meteorology Internet Site (1998).

On an annual basis, the region most frequently experiences east to south-easterly winds. East-northeast to south southeasterly winds occur most frequently in summer and north-westerly winds occur most frequently in winter.

On a macro economic scale it is a far more efficient use of national resources to concentrate facilities within larger urban areas than to construct the same in sparsely populated country areas. It is economically inefficient to construct new small towns in remote regional areas as the threshold levels for public and community facilities is not reached, services such as schools, hospitals and recreation facilities remain under-utilised. The marginal rate of return per head of population for a facility in a small country town is very poor compared to the same facility constructed in a city.

The threshold level for a viable self supporting urban centre is some 20,000 people, unfortunately there is no town of such size adjacent to Murrin Murrin to tap into in this way.

While there seems to be a negative government policy response to FIFO operations, this response does not seem to be based on sound economic rationale and indeed is largely a response to local political pressure.

There is a strategic defense rationale (which overrides strict economic considerations) for populating the northern portions of the Australian continent, however the strategic defense argument is not applicable to the North East Goldfields.

Even in large towns, such as Karratha and Port Hedland, where conventional housing has been implemented, as part of a major resource project, an employee age range consistency anomaly has

developed. Permanently accommodated employees tend to be either relatively young or relatively older with a gap in the age profile in between. Workers tend to move away to cities when their children are at high school to college age.

This anomaly means that employees are lost to the organisation at time when they are reaching their professional peak and can contribute the most in the workplace. This is not an anomaly that Anaconda wishes to be exposed to.

Project Viability

As has been stated, Anaconda currently operates a FIFO operation for its existing plant. The existing operation consists of some 480 workers. The Expansion Project will see this number swell to some 900 people. It is a practical impossibility to distinguish a person employed on the Expansion Project from any other employee on the Project and to say that one must live in the region permanently while the other should FIFO.

The Project would not have gone ahead to construction and operation if FIFO had been made a condition of approval in the first instance, for Government to raise the matter at this late stage is unconscionable.

Apart from the operational factors mentioned above, there are similar matters with regard to safety and roster cycles. These are outlined below.

The Murrin Murrin operation has been designed around a two shift system that rotates every 12 hours.

The campsite is located 8 km from the plant and it takes less than 15 minutes for a worker to commute between them. At the camp essential requirements such as food and washing are provided for the worker. Apart from working and commuting the worker does not have to spend time on any domestic support activities, such as cooking or cleaning.

If the worker were based in either Leonora or Laverton, within conventional housing, the following time commitment would apply:

12 hours shift
2 hours travelling.
0.5 hours shift handover.
1 hour prior preparation.
15.5 hour work related commitment.

The standard shift is 12 hours, allowing for travel to and from town, shift handover time and prior preparation it is not practical to base a workforce permanently in town. If the shifts are shorter then the number of employees to be housed increases by one third.

There is only 8.5 hours free time available for meals, rest and recreation, a significant portion of this time would be spent on household duties such as meal preparation, shopping, washing and cleaning. It would be impractical to expect people to work to such a routine and would lead to fatigue and unsafe work practice, injury and possible fatalities.

The cost of providing conventional housing for 400+ people within Leonora, Laverton or a combination of both is prohibitively expensive to the viability of the Project as a whole enterprise.

At a unit cost of $200,000 (this is conservative given the remote location) for a standard house and land package, conventional housing would cost upwards of $80 million to construct. Allowing for a standard 10% per annum maintenance allowance an additional cost of some $8 million per annum would be required to maintain the housing.

Workers in remote areas generally expect power and water subsidies. An allowance of some $10,000 per annum for power and water is standard in similarly harsh climates such as at Karratha and Port Hedland. This equates to a further cost of some $4 million per annum.

On top of the costs listed above the Federal Government also applies Fringe Benefits Tax. At the rate of 98% in the dollar for non cash benefits received by the employee, this would equate so some $4 million per annum for the power and water subsidy and a further $4 million per annum if no rent were charged for use of a company owned house. It is not usual to charge employees for use of a company house.

The magnitude of these costs are far in excess of what can be viably sustained by this Project. Conventional housing in remote areas is an option that is only open to multi billion dollar projects such as the North West Shelf Oil and Gas consortiums and the Iron Ore companies of the 1960s iron ore boom.

By way of comparison, the Murrin Murrin accommodation village had a capital cost of some $20 million and has an operation cost of some $4 million per annum (inclusive of air travel). This is fully one order of magnitude less than the conventional housing option.

The cost of conventional housing does not stop at the houses, a full suite of medical, educational and recreational facilities would be also be required (and demanded by Government and workers) thus making further substantial contribution to capital and operational expenditure.

International Competition.

Anaconda is competing within an international market dominated by larger overseas companies. The nickel and cobalt markets are both depressed with nickel at its lowest real value in over twenty years.

In order to be competitive in this depressed market, as a low cost producer, Anaconda must have an internationally competitive operation run by the best people available.

In order to attract the best people Anaconda must recruit internationally and to do this must offer an internationally attractive remuneration package. Attracting a workforce takes more than monetary remuneration, FIFO is a guarantee that a city lifestyle can also be maintained, without this guarantee money alone could not attract a workforce on a sustainable basis.

Politically, Australia has very strong views and policies on international competition. Australia is leading the Asia Pacific region in removing trade barriers, quotas and tariffs in order that all nations are able to trade on an equal footing on the world stage. Part of the Commonwealths competition policy is for Australian industries to compete to the best of their ability with overseas players.

Australian industry will not be able to compete to the best of its ability if its Government impose artificial controls that require that it house its workforce in anything less than the most efficient mode possible. If Government were to impose such conditions on Industry then those conditions would be at odds with its stated competition policy.

The overseas trend is toward FIFO accommodation in regional areas. Australia must follow that trend if it is to remain (or become) internationally competitive and if it is to comply with its own stated international competition policy.

Other operations that utilise a FIFO operation are presented in Tables 5 and 6.

Table 5

Comparative Data on FIFO

Company	Mine	Location
ROCHE BROTHERS	Sons of Gwalia Brockman Yarrie Fimeston	5km W Leonora 50km NW Mt Newman Kalgoorlie/Boulder township
THEISS	Laverton Peak Hill Marvel Loch Davyhurst Kambalda	6km E Laverton 120km N Meekatharra (Drive in - drive out) ~13km N Kalgoorlie Kambalda
LEIGHTON CONTRACTORS	Paddington Henning Ora Banda Windy Gully Gidgee Gold Mine Mt Keith (WMC) Leinster (WMC) Lawlers (Plutonic) Plutonic	
RESOLUTE SAMMANTHA	Marymia Challice Bullabulling Higginsville	200km NE Meekatharra 110km S Kalgoorlie 25km W Coolgardie 115km S Kalgoorlie
WILUNA GOLD MINES	Wiluna CONTRACTORS Barminco Minesite (catering)	5km S Wiluna
WMC RESOURCES	Mt Keith	70km SSE Wiluna
PLACER PACIFIC & DELTA GOLD	Granny Smith CONTRACTORS Brambles AWP/CSR	20kms S Laverton
PLUTONIC	Darlot Lawlers Mt Morgans CONTRACTORS Winchester Earthmoving Peabody Resources Leightons Brandrill	125km N Leonora 30kms SW Leinster 50kms WSW Laverton
GWALIA	Sons of Gwalia CONTRACTORS Cooks Construction	5km W Leonora

Table 5 (Continued)

Company	Mine	Location
LYNAS GOLD	Lynas Find CONTRACTORS McMahom Minesite Catering	90km SSE Port Hedland
NORMANDY	Big Bell Golden Grove	30km NW Cue 50km S Yalgoo
CAMELOT RESOURCES	Tarmoola CONTRACTORS Minepower Skilled Engineering Comlec Target Drilling McMahons AWP/CSR	29km NW Leonora
FORRESTANIA	Bounty	110km S Southern Cross
GOLD MINES OF AUST.	Reedy CONTRACTORS ATSCO Youanmi	55km NE Cue
AWP/CSR	Bannockburn Menzie's Sunrise Dam Grany Smith (Placer Pacific) Binduli New Celebration (Newcrest) Ora Banda (Great Central) Greenbushes (Sons of Gwalia) Tanami	67km MW Leonora Menzies 60km S Laverton 20km S Laverton 8km SW Kalgoorlie 32km S Kalgoorlie 65km NW Kalgoorlie Greenbushes 25km SE The Granites
ACACIA RESOURCES	Sunrise Dam CONTRACTORS Skilled Engineering AWP/CAREY	60km S Laverton
ARIMCO	Gidgee Gold Mine CONTRACTORS Leightons Cardinals Catering Minepro (U/G)	120km SE Meekatharra
ARGYLE DIAMONDS	Argyle Diamond Mines	

Table 6

Comparative Data on FIFO Hydrocarbon Companies

Company	Location
APACHE ENERGY	North West Shelf
ATWOOD OCEANICS	North West Shelf
BHP PETROLEUM	North West Shelf
READING & BATES	North West Shelf
TRANSFIELD WORLEY	North West Shelf
WOODSIDE	North West Shelf
WA PETROLEUM PTY	North West Shelf

Anaconda's FIFO accommodation solution has been discussed and approved by Local, State and Federal government for the existing Project. The Expansion Project has been thoroughly consulted through the same levels of Government during this current round of project approvals. At all times Anaconda has made it clear to Government that it proposed to continue to use a FIFO operation as the most suitable option in the circumstances.

Anaconda is of the opinion that it is making the best contribution possible to the local and regional economy given the cost constraints that it has to work under. If Anaconda were to be somehow forced to implement a conventional housing accommodation system then there would be no Project and no benefits to anybody whether they be locally, regionally or internationally based. The optimum "Regional Benefits Package" has been developed and is working well for the benefit of both Australia and Anaconda.

There are substantial benefits to the local and regional economy in providing services to the mine site and plant that would not otherwise exist were it not for the Murrin Murrin Project.

3.1.10 Waste Disposal

It appears that the Project is not designed to use comprehensive backfilling using overburden material from mining operations, waste from crushing and blending operations and tailings from the tailings disposal facilities.

This will lead to a large number of waste dumps and tailings storage facilities which will have a significant impact upon the landscape and potentially upon the hydrology and ecology of the area. It is unclear if this has been considered in the Project planning, although there is some reference to the possible use of a CTD system. The proposed intention to leave pits to fill with saline water can hardly be considered best practice.

The Proponent should evaluate the environmental, engineering and economic feasibility of waste disposal options, including tailings from the process operations, treated sewerage from sewerage treatment plants, in the mined out pits and provide this information in the PER document.

The Proponent continues to consider mechanisms to facilitate backfilling of the mine pits. However, the stratified nature of the ore bodies (essentially high grade ore on the top, medium grade in the middle and low grade at the bottom) makes this difficult as the Project will target the higher grade ores first. It is not expected that the low grade ores will be extracted until well into the Project's life. Backfilling prior to the extraction of the low grade ore is not practical as the future resource would be lost.

The Proponent is considering a number of options to increase the possibility of backfilling occurring. These include the early mining and stockpiling of low grade ore from selected pits to make these pits available for backfilling. This involves the consideration of many factors including environmental (clearing of additional areas for low grade stockpiles) and economic (multiple handling of ore). Only the proposed mine pits near Lake Carey are expected to fill with saline water and special consideration to backfilling these to above the water table is being given.

The use of Central Thickened Discharge (CTD) is being considered as an alternative mechanism for tailings storage. The option of CTD improves the possibility of in-pit disposal in the future as the thickened tailings are much more appropriate for this type of disposal. As stated within the PER, the use of CTD will be subject to detailed engineering and piloting studies using tailings produced by the MM Stage 1 Project. Should CTD be feasible (reliable and economic), the existing tailings handling systems would be replaced with CTD. It should be noted that the Proponent is committed to, and has a requirement placed on it by the Minister for the Environment, to regularly evaluate the alternatives for tailings disposal.

The Proponent believes that, in general, backfilling can result in environmental and economic benefits. Therefore, all reasonable efforts are being made to pursue this option.

3.1.11 Impact on Pastoral Activities

The Proponent is committed to (Commitment No 15) minimise the impact of the Project on pastoral activities and ensure that pastoral water supplies in the Project Area are maintained. This commitment should be expanded to include provision of pastoralists for any unfavorable impacts occurred on pastoral activities and/or loss of income etc from pastoral activities as a result of the implementation of the Project.

The Proponent controls the Minara and Glenorn Stations on which the majority of the Project occurs. It is also currently in negotiation for the purchase of Yundamindra Station. The Proponent has been actively improving these stations through de-stocking and feral animal control programmes.

The Proponent actively consults with pastoralists potentially affected by the Project's development and will continue to do so. Any issues raised by the pastoralists are addressed and rectified wherever possible, either through impacts "being made good" or through financial compensation.

3.1.12 Employment Opportunities

The information provided in Ssection 8.1.1 is too brief to assess adequately the benefits claimed by the Proponent. "Direct" and "indirect" employment should be defined and effects should be separated in the analysis. For example:

- *How many of the direct jobs claimed will be created during the construction phase and how many will be ongoing?*
- *How many directly created jobs will be locally based jobs and how many will be based outside the Project Area?*
- *For the indirectly created jobs, how many of these will be locally based and how many will be based outside the Project Area?*
- *How may indirectly created jobs will be created during the construction and during the production phase?*
- *The document "Presentation to Regional Decision Making Authorities", contains some breakdown of employment effects in table form, but does not explain how these figures were derived. Was a model used to calculate these figures? If so, which model was used and what assumptions were made?*
- *The PER claims (Page 125) income from direct and indirect jobs associated with the overall Project to be $109 million. How was this figure derived, and over what time period?*
- *The Proponent should provide further information in the PER document to adequately address the above issues.*

Table 7 presents a summary of the anticipated employment benefits generated by the existing Murrin Murrin Project and those of the proposed Expansion Project.

Table 7

Summary of Anticipated Employment Benefits

	Murrin Murrin		MM Expansion		Total for All Projects	
Employment (Number)	**Construction**	**Operation**	**Construction**	**Operation**	**Construction**	**Operation**
Direct	585	600	292	350	877	950
Indirect	1,200	1,800	600	900	1,800	2,700
Total New Jobs	**1,785**	**2,400**	**892**	**1,250**	**2,677**	**3,650**

Notes:

Employment Multiplier (average)	
Construction	3.00
Production	4.00

Source: UWA Economic Research Centre, Grant Samuel & Assoc. Pty Ltd

The employment numbers are broken up according to construction/operations and direct/indirect. A brief explanation of these categories follows:

- **Construction Employment**: this form of employment is the number of personnel employed in the construction of the new plant and mine at Murrin Murrin. The figure is an average in that it is the number of full time equivalent people employed over the two year construction period. The true number of construction personnel onsite during the construction period is highly elastic in that in the beginning there were only a several hundred construction personnel onsite and then during the peak of construction the number increase to over 2,200.

  The construction workforce has been reported separately from the operational workforce because it is of a temporary nature (two years) and because the employment multiplier that applies to construction work is different to that which applies to the production stage.

  The employment multiplier for the construction industry is 3.00. This means that for every person employed directly at the construction site a further three jobs are created offsite, within the economy generally, as a result of the income flow generated by the construction job.

  The employment multiplier was taken from the publication "Agriculture and the Western Australian Economy: An Input Output Analysis" as published by The University of Western Australia.

  The actual number of employees for the original Murrin Murrin Project have been taken from actual employment records whilst the Expansion Project predictions are based on estimates prepared for Anaconda by independent economic analyst Grant Samuels Pty Ltd.

- **Operational Employment**: this employment is the number of personnel directly employed by Anaconda to run the plant and mine at Murrin Murrin. The numbers stated for the original Project are based on actual manning schedules whilst the Expansion Project figures are based on projections produced by the Anaconda Human Resources Department.

  Operational employment has been reported separately in view of the fact that it is permanent (30 year mine life) and because the multiplier that applies to the mineral sector is different to that which applies to the construction industry.

  In this instance the multiplier is a factor of 4. This means that for every one job created at Murrin Murrin by Anaconda a further 4 jobs are indirectly created offsite within the general economy. The multiplier was taken from the publication "Agriculture and the Western Australian Economy: An Input Output Analysis" as published by The University of Western Australia. The category of "Metallic Minerals" and "Other Mining" was selected and a weighted multiplier of 4 derived by combining and averaging the two categories by the proportionate number of employees in each category.

Anaconda has a target of 20% local employment content and so at least that proportion of the direct employment will be of local origin. Anaconda has no control at all over the type and location of indirect employment generated by its Project but can make the statement that by its very nature it will be located offsite.

Income figures in the PER are quoted at $109 million for both direct and indirect employment. Table 8 provides more information on the subject.

Table 8

Estimated Income Figures for Direct and Indirect Employment

Income ($millions per annum)	Murrin Murrin		MM Expansion		Total for All Projects	
	Construction	Operation	Construction	Operation	Construction	Operation
Direct	$110m	$74m	$60m	$35m	170	109
Multiplied	$341m	$152m	$186m	$109m	527	260

Notes:

Income Multiplier (average) 3.10

Source: UWA Economic Research Centre, Grant Samuel & Assoc. Pty Ltd

The income figures are disaggregated into direct and indirect categories.

The direct numbers are calculated from actual records of wages, salaries and supplements paid to Anaconda employees and contractors. The figures quoted for the Expansion Project are estimates prepared by independent economic analyst Grant Samuels Pty Ltd.

Figures have been provided for both construction and production. As before construction has a two year life whilst operations are for a period of 30 years.

The indirect figures are generated by applying the income multiplier determined by the publication "Agriculture and the Western Australian Economy: An Input Output Analysis" as published by The University of Western Australia. The average income multiplier for the construction and metallic metals industry, weighted for proportion of employees in each, is 3.1. The income multiplier is a measure of the effect of a unit change in wages, salaries and supplements paid in an industry, stimulated by an increase in final demand for the industry's output, on the total change in income earned in all the industries in the economy. Every dollar earned by an Anaconda employee or contractor causes a $3.10 increase other wages, salaries and supplements paid to people in other sectors of the economy.

3.1.13 Economic Benefits

This section (8.1.2) is too brief to assess adequately the benefits claimed by the Proponent.

- *Was a model used to calculate the claimed benefits? If so, details of the modelling work such as the name of the model, the underlying assumptions, data used, etc should be provided.*

- *Table 26 presents direct annual revenue as a result of the Expansion Project and the Overall Project. Are these figures discounted total revenues?*

- *The Proponent should provide necessary information in the PER document.*

Table 9 summarises the revenue benefits to the economy contributed by the Project.

Table 9

Estimated Revenue Benefits Resulting from the Murrin Murrin Project

	Murrin Murrin per Annum	MM Expansions per Annum	Total for All Projects per Annum
Gross Output			
Gross State Product (%)	0.70%	1.05%	1.75%
Exports ($million)	$554m	$831m	$1,385m
Imports ($million)	$46m	$69m	$115m

These figures are gross revenues. Gross State Product is the proportion of the 1997/98 WA Gross Domestic Product that the value of Anaconda production will contribute.

Export Revenues are calculated by multiplying the total amount of product produced (nickel, cobalt and ammonium sulphate) by the market price of those products at the time that the PER was written. The pricing assumptions for the analysis were: US $3.50lb nickel, US $12.50lb cobalt and A$120 tonne ammonium sulphate. Nickel and cobalt prices have weakened considerably since the PER analysis was prepared.

The Import Revenues are calculated by multiplying the total amount of inputs required by the plant by the contract price of the input. There is too wide a variety of products consumed by the plant to list all these individually though the major inputs by proportion are sulphur and ammonia.

The benefits to Government listed in the PER are presented in Table 10.

Table 10

Benefits to Government Resulting from the Murrin Murrin Project

	Murrin Murrin		MME Expansions		Total for All Projects	
	Construction 2yrs	Operations per Annum	Construction 2yrs	Operations per Annum	Construction 2yrs	Operations per Annum
State Business Enterprises ($million)						
Total direct revenues	$1m	$20m	$1m	$30m	**$2m**	**$50m**
State Government ($million)						
Total direct revenues	$5m	$15m	$5m	$23m	**$10m**	**$38m**
Federal Government ($million)						
Total direct revenues	$16m	$77m	$16m	$116m	**$32m**	**$193m**

The benefits summarised above are derived by calculating Anaconda's tax burden as a proportion of its revenues. The types of fees and charges that have been calculated under each heading are presented in Table 11.

Table 11

Fees and Charges used to Estimate Government Revenues

Federal Government	State Government	State Government Enterprises
Company Tax	Nickel Royalties	Westrail
Employee Income Tax	Cobalt Royalties	Fremantle Port Authority
Fuel Excise	Payroll Tax	
Import Duty	License Fees	
Fringe Benefits Tax	Financial Institutions Duty	
	Fuel Levy	

Table 12 presents an estimate of Anaconda's total value of revenue injection into the economy. The direct output figures are calculated by multiplying the sum of Anaconda's products by the market price of those products at the time the PER was prepared. All figures are per annum with the construction phase having a duration of 2 years whilst production has a duration of 30 years. None of the figures are discounted in any way.

Table 12

Estimated Total Revenue Injection into the Economy

Output ($millions)	Murrin Murrin		MM Expansion		Total for All Projects	
	Construction	Production	Construction	Production	Construction	Production
Direct	$973m	$554m	$700m	$831m	1,673	1,385
Multiplied	$1,995m	$1,136m	$1,435m	$1,704m	3,430	2,839

Notes:

Output Multiplier (average) 2.05
Source: UWA Economic Research Centre, Grant Samuel & Assoc. Pty Ltd

The output multiplier is a measure of the flow on effects of an exogenous change in the final demand for the output of an industry on the output of all industries in the economy. The multiplier is a factor of 2.05 for the weighted average of the Metallic Mineral Processing Industry and the Construction Industry over the relative time and proportion of output from both the construction and operation phase. The multiplier was derived from the publication "Agriculture and the Western Australian Economy: An Input Output Analysis" as published by The University of Western Australia.

3.1.14 Heritage

There is insufficient information provided in the PER in relation to both Aboriginal and European heritage values. It appears that the significance of the many Aboriginal archaeological sites in the Project Area was determined only on the archaeological value of these sites. It is unclear if the Aboriginal communities have agreed that the sites are of low to moderate significance to them, or whether the decision was made by the Proponent or the consultant. It is also unclear whether the Proponent has considered any alternatives to avoid disturbance to heritage sites. The Proponent should provide results of all heritage surveys as an appendix to the PER.

Due to the political sensitivity of Aboriginal issues in the area, Anaconda went to great lengths to carry out appropriate archaeological and ethnographic surveys of all Project Areas. The surveys were carried out by suitably qualified and experienced consultants working directly with local Aboriginal people.

Aboriginal Heritage together with environmental approvals have become interwoven with the Native Title process and are often used as a lever to angle for more compensation than might otherwise be negotiated by Native Title Claimants.

In order to limit this distortion and misuse of Aboriginal heritage and environmental legislation by Native Title Claimants and their legal representatives, Anaconda ensures that all Aboriginal heritage and environmental surveys are performed very thoroughly in order not to provide opportunity for the misuse of information or delay to statutory approval processes.

European heritage sites have been researched with the Australian Heritage Commission, WA Heritage Council, National Trust and local Councils and there are no listed sites in the area. Given that this is an arid region that has never sustained a large permanent population there is no reason to suppose that there are any sites that remain undiscovered. Similarly every portion of the Project Area has been inspected and/or explored by Anaconda, its consultants and by former tenement holders, in that time no site of European Heritage value have been discovered.

Archaeological and ethnographic surveys and inspections have been carried out over all Project Areas by Anaconda and its consultants in consultation with local Aboriginal people.

The classification of Aboriginal heritage sites as being of low to moderate significance was agreed with local Aboriginal groups and accepted by the Aboriginal Cultural Materials Committee (ACMC), upon which the local Aboriginal people have an elected representative.

Anaconda has considered every alternative in order to avoid disturbance to Aboriginal heritage sites. Of all the Project Areas covered by the PER it is only in the areas in or near the pits and dumps of the mine that archaeological sites are to be disturbed, this is only because such disturbance is totally

unavoidable. This disturbance has been approved and sanctioned by the AAD on approval from the ACMC and all required Section 18 clearances and salvage work have been issued and carried out. The AAD has congratulated Anaconda on the quality of its heritage studies (see Appendix A for Section 18 approvals and letter from AAD).

Anaconda is unable to provide heritage surveys as an appendix to the PER because the information is highly sensitive to local Aboriginal people within and without their community, and the general population. Anaconda observes a strict protocol in the handling of this information in order to avoid any conflict or breach of confidence with the local Aboriginal people who provided the material in the first instance.

This information is highly sensitive within each Aboriginal Tongue Group as there is information passed that may only be known to a select few Aboriginal Law Men and Elders within the Group. There is secret men and women's business and therefore a need to restrict passage of the information on a gender basis even within the same group. In addition there are cultural songs that are unique to one Tongue Group that may not be made known to Aboriginal people of another Tongue Group as these songs are the equivalent, in Aboriginal Lore, to modern day land title deeds.

Due to the extreme sensitivities outlined above Anaconda does not wish to have any part in disseminating any of this information and will in every instance defer to the AAD as the most appropriate administrative body in the circumstances.

All reports are lodged with the AAD, except for a copy which is held securely in the Anaconda Technical Report library. Any requests for the information from a third party are deferred to the AAD for decision. The AAD is the custodian of the information and is the most appropriate body, apart from the local Aboriginal people themselves, to hold and distribute the material on the behalf of Aboriginal people. We therefore recommend that Environment Australia request a copy of the Aboriginal heritage reports from the AAD.

Environment Australia has requested a copy of evidence to show that Aboriginal communities have been consulted in regard to disturbance to Aboriginal heritage sites. The evidence is embodied in the reports and Section 18 application approved and held by the AAD. For the reasons stated above Environment Australia is advised that this consultation has occurred and that the evidence can be obtained directly from the AAD in line with the agreed protocol.

3.1.15 Cumulative Impacts

The PER does not provide any information on the possible cumulative impacts of mining and associated developments in the region or adequate information with regard to other resource users in the region which would enable one to gain some idea of regional impacts.

Mining represents one of the major activities on the Northeastern Goldfields. However, the area of disturbance required for mining projects and associated infrastructure, is generally small and disturbance highly localised. This area typically represents a very small proportion of the regional area.

Therefore, providing that the Project does not result in any unacceptable long-term environmental impacts, the cumulative impacts of the Project on the regional environment is expected to be small.

The Proponent is also involved with the Lake Carey Working Group to help assess and manage the cumulative impacts of mining activities on and around the lake. The co-operative approach to the study and management of the lake should ensure that cumulative impacts are acceptable.

3.1.16 Greenhouse Gas Emissions

From the information provided the Project would contribute about 0.27% in the total emissions of CO_2 estimated for Australia in 1994. The Proponent has made a comparison of its nickel operations to conventional nickel sulphide smelting and refining process. It estimated that its operations emit about 9.91 tonnes of CO_2/tonne of nickel produced compared with between 10 to 12 tonnes for WMC operations. It noted that previous work by Dames & Moore (1996) has shown that per unit emissions is similar for all of the nickel laterite projects currently under construction in Western Australia. Could we get a copy of this work which may assist in further assessing the efficiency of this Project compared to other similar projects.

The Proponent should consider and evaluate options for offsetting arrangements that would decrease its greenhouse gas emissions. The outcomes of these investigations should be provided as additional information.

The comparison of carbon dioxide emissions with other nickel laterite projects in Western Australia was presented in the Proponent's CER/Section 46 for Project Changes and Site Alternatives prepared in 1996 and the associated Proponent's response to submissions. These documents will be supplied to Environment Australia.

It should be noted that the contribution of approximately 0.28% of the total Australian 1994 carbon dioxide emissions is for the Overall Project (ie. the existing MM Stage 1 Project and the Expansion Project).

As noted within the PER, the Proponent is currently in discussions with the Federal Greenhouse Challenge Office with regards to entering to Greenhouse Challenge Programme and a letter of intent has been submitted. The Proponent will continue to investigate mechanisms to reduce its greenhouse gas emissions throughout the operation of the Project. While this will primarily focus on the neutralisation circuit (e.g. optimisation of the sulphuric acid consumption to reduce carbon dioxide

emitted during neutralisation), all other areas of the Project will be closely reviewed on an ongoing basis to identify potential greenhouse gas emission reductions. Consideration will also be given to any offsetting options that are available to reduces the Project's net greenhouse gas emissions.

3.1.17 Fauna and Flora

- *There is no reference to the Commonwealth Endangered Species Protection Act 1992 (ESP Act) under relevant legislation, nor the schedules under this Act. There are three threatened species list under the ESP Act, present on the site or nearby. They are:*

  Hemigenia exilis - Vulnerable
  Leopa ocellata (Malleefowl) – Vulnerable
  Dasycercues cristicaudata (Mulgara) – Vulnerable

- *Although Hemigenia exilis has been downgraded under Western Australian legislation this State status has not yet been reflected at the national level. Environment Australia requested a copy of the Management Plan for Hemigenia exilis for review and comment.*

- *Environment Australia recommend that the Environmental Education Programme for employees and contractors specifically addresses the requirements of this species, particularly aspects of mining operations that constitute disturbance factors.*

- *A map showing the location of the potential Mulgara habitats was requested.*

As noted by Environmental Australia, no reference was made in the PER to the ESP Act in relation to *Hemigenia exilis* or the Mulgara. However, it was noted in Table 12 and on Page 63 of the PER that the Malleefowl is listed as vulnerable under the ESP Act. The Proponent acknowledges that both *Hemigenia exilis* and the Mulgara are also listed on the ESP Act as vulnerable and as such, warrant special protection.

Although, these species are protected under the ESP Act, the ESP Act only applies to species located on Commonwealth owned or occupied land. Therefore it is not applicable to the land on which the Murrin Murrin Project is based. However, the Proponent acknowledges that these species are considered to be significant by both State and Commonwealth Governements and, will implement the management measures outlined in the PER and below to ensure the protection and conservation of these species.

3.1.17.1 *Hemigenia exilis*

As was stated in the PER (page 94) the Proponent prepared a Conservation and Management Plan for the management of *Hemigenia exilis* during the construction and operation of the Murrin Murrin (Stage 1) Project. The Proponent has summarised all of the work undertaken on *Hemigenia exilis* since its rediscovery in 1995 and this is presented as Appendix B. The Conservation and Management Plan will be forwarded to Environment Australia. It is the Proponent's intention that the management measures outline in the Conservation and Management Plan continue to be implemented through the construction and operation of the Expansion Project. The Proponent will also inform CALM prior to removing any *Hemigenia exilis* plants or other plants of significance.

3.1.17.2 Mulgara

The Mulgara was not recorded during the fauna surveys undertaken for the Expansion Project. Discussions with CALM indicate that the Mulgara has only ever been recorded in *Triodia* hummock grasslands on sandy ridges. This habitat is not present in the Project Areas. However, there is the potential that the mulga (*Acacia aneura*) over grass communities on sand, which occur in the north of the Murrin Murrin East Project Area (Figure 2), may support similar fauna species to those in *Triodia* hummock grasslands.

This mulga habitat occurs in the northern section of Murrin Murrin East Project Area and extends north and west beyond the Project Area boundary. This habitat will be disturbed by the mining of orebody MM30 and the northern half of orebody MM29, and the construction of two waste dumps and a stockpile adjacent to orebody MM29. The possibility of the Mulgara occurring in these areas is considered low since it is not its preferred habitat, and the areas to be disturbed represent a small proportion of the mulga habitat. The Project is therefore unlikely to impact on the distribution of the Mulgara.

3.1.17.3 Malleefowl

The comment that Environment Australia (Biodiversity Group) supports the commitments made by the Proponent in relation to the Malleefowl, has been noted. The Environmental Education Programme for employees and contractors working on the Project will specifically address the requirements of this particular species, as will the information sheet that is distributed to the employees to raise awareness about this species. The only Malleefowl nest found in the Project Area was located in the Granite Borefield. Borefield design will ensure that the nest is not disturbed and that access tracks are not routed near the nest, thus minimising any impacts on the species. There will be no direct impacts as a result of the Project on the Malleefowl nest at Granite Borefield.

- *We support the Proponent's commitment (Commitment 18) to undertake additional fauna studies and would like the Proponent to submit the results of these surveys to the Biodiversity Group for reviewing. We are concerned that complete results of the flora and fauna survey conducted by Dames & Moore/Ninox Wildlife Consulting have not been presented as an appendix to the PER. It is the normal practice that the results of surveys, additional studies are provided as appendicies to PER or EIS reports.*

The additional fauna studies were undertaken for the MM Stage 1 Project. Further studies have been undertaken for the Expansion Project. It is not anticipated that any further studies will be required unless new Project Areas are developed.

The Proponent understands that technical reports are normally included as Appendices with projects assessed through a PER or EIS report. However, the Murrin Murrin Expansion Project covers large areas and as such numerous surveys and reports have been undertaken and prepared. The large number and size of the reports for flora, fauna and Aboriginal Heritage Studies, would have resulted in prohibitive production costs as substantial document size and as a result these reports were not included in the PER but referred to as separate technical documentation. However, these reports are available as supporting technical reports and Anaconda Operations will liaise directly with Environment Australia regarding the supply of these reports.

- *The PER does not provide information in relation to the potential for bird deaths associated with the operation of evaporation ponds at the site or measures designed to monitor the ponds and record bird and bat fatalities. This would appear to be essential in the light of expansion of the ponds to cover 900 hectares. No details are provided in relation to the safety of the waters that may be ingested by many species of birds and bats in the region or whether the inclines of the pond banks provide insurmountable obstacles to animals that have been foundered.*

- *Expansion of the evaporation ponds may also provide an added attraction to migratory species that are listed on the three international agreements/conventions. Eight species of birds have been identified in the PER that may visit the site and all of these species are potentially at risk if hazards are present. What mitigatory measures are being proposed by the Proponent for the safety of potentially affected migratory species.*

The tailings have a high TDS level. Analysis of the bleed solution produced by the pilot plant for the MM Stage 1 Project indicated that the liquor has a total salinity of approximately 140,000mg/L and includes some metals (eg. nickel, cobalt, iron, aluminum) with concentrations in excess of 10mg/L.

Based on the pilot studies the major components of the liquor are expected to be:

Magnesium	:	27,200 mg/L
Sodium	:	1,040 mg/L
Calcium	:	317 mg/L
Potassium	:	122 mg/L
Bismuth	:	9 mg/L

There will be no cyanide in the tailings and the tailings will have a pH of between 6 and 7. However, the Proponent will undertake regular checks of the tailings dams and evaporation ponds and this will include an inspection for dead animals. Should an animal be found dead in the tailings, the incident will be further investigated to determine the cause of death and outline how further deaths could be prevented (such as through the use of hazing techniques). Generally, mass bird deaths in tailings dams result from the presence of poisons such as cyanide in the tailings although the toxicity of many contaminants to birds is poorly understood (Donato, 1997). As the tailings have no toxic components it is unlikely that the disposal of tailings and liquor will result in bird deaths, however as stated above regular checks of the tailings dams and evaporation ponds will be undertaken.

- *No information is provided as to what action will be taken should significant subterranean fauna be found at the calcrete quarry site.*

Stygofauna, including some un-named species, were detected from WA Museum sampling of open wells and holes in the Windarra calcrete area, and concerns regarding destruction of this habitat have been raised. In order to provide additional data on subterranean fauna, the Proponent is currently preparing a procedure to sample when drilling, have the samples analysed and to report the results of these within it Annual Environmental Report.

Anaconda Nickel Ltd has outlined three calcrete deposits in the Windarra area, from which it proposes to extract approximately 4 Mtpa for 30 years. These deposits are named "Windarra Quarry", "Pipeline" and "Shady Well", and are shown on Figure 3. Windarra Quarry is an operating quarry, providing calcrete to the Murrin Murrin plant. The total combined surface area of the three deposits is 2,200 ha.

Calcrete which outcrops at surface is readily identifiable on published Geological Survey of Western Australia (GSWA) 1: 250,000 scale maps, where it is identified with the code Czk. Figure 4 shows the distribution of these mapped calcrete deposits in part of the North-Eastern Goldfields, including the Windarra deposits. Collectively, the deposits shown in Figure 4 have an outcropping surface area of 57,000 ha. The calcrete resources defined for th Projectcover only 3.8% of this total area. This estimate is considered to be artificially high, since not all of the calcrete present is exposed at surface.

Therefore, the total area disturbed by the calcrete quarrying operations represents a very small fraction of the total calcrete resource and hence the potential stygofauna habitats.

- *Inadequate justification for the development of a new calcrete quarry and associated infrastructure is provided in the PER.*

The high pressure acid leach process requires a significant quantity of sulphuric acid (approximately 400 kg of acid per tonne of ore processed) to ensure that the nickel and cobalt metals are dissolved from the ore. Following the acid leaching, calcrete is used to raise the pH of the waste streams to between 6 and 7 which reflects the natural environmental level. The neutralisation of the acidic wastes in this manner results in a relatively benign waste stream which facilitates handling and disposal. If the acidic waste streams were not neutralised, the tailings and decant liquor would be highly acidic and represent a significant environmental risk, especially to fauna and groundwater.

There are significant calcrete resources available in the region and these provide a suitable and cost effective neutralising agent. The Expansion Project will result in an increased throughput in ore and hence an increase in the requirement for calcrete. In order to provide the additional calcrete over the life of the Project a new calcrete quarry will be required.

The alternative to using calcrete would be to use lime from an external supplier. This is not considered to be practical, economical or environmentally beneficial.

- *The Proponent should address the issues above by providing additional information, and through additional commitments to the satisfaction of the Biodiversity Group of Environment Australia.*

The Proponent believes that these issues have been adequately addressed within the PER supporting documentation and the information supplied above.

- *It is recommended that the Proponent avoid removal of mature River Gums wherever possible due to the extremely important role these trees play in the provision of hollow, roosting sites for bats and birds and food in the form of nectar and pollen.*

It is not proposed to undertake any mass removal of mature river gums for the Expansion Project. These trees do not occur in the parts of the Project Area where clearing will be undertaken. The majority of the river gums in the Project Area occur in the borefields, particularly along Sullivan Creek in the Sullivan Borefield. Some removal of river gums may occur along the pipeline corridor from the borefields to the plant site. However, this removal of large trees will be restricted to a narrow corridor and where possible, the large trees occurring within the corridor will be avoided.

- *The Proponent should be committed to the use of locally provenanced seed and plant stock for rehabilitation of mining sites and suggested that where such threatened species, such as Hemigenia exilis, are to be removed every effort is made to collect seed and propagative material for use in such rehabilitation programmes.*

Detailed rehabilitation plans will be prepared as part of the decommissioning process. However, as stated in the PER (pages 121 and 122), the Proponent will use seed collected from local sources (including from significant species such as *Hemigenia exilis*) for the rehabilitation of disturbed areas. If local seed is not available, the Proponent will consult with CALM prior to determining alternatives.

As part of the Conservation and Management Plan developed for *Hemigenia exilis*, the Proponent and the WA Herbarium undertook a seed collection program to study the seed biology of *Hemigenia exilis*. Germination tests have been undertaken by CALM's Threatened Flora Seed Centre.

In addition, a selection of cutting material has been collected and sent to the Kings Park and Botanic Garden, for propagation trials.

The Proponent proposes to continue funding such research programmes to develop a better understanding of *Hemigenia exilis* and to ensure the conservation of the species. These programmes will also be beneficial in providing information on how to use *Hemigenia exilis* during the rehabilitation programme.

4. NON-GOVERNMENT ORGANISATIONS COMMENTS

4.1 GOLDFIELDS LAND COUNCIL

4.1.1 Hydrogeological Study

- *There is a major concern regarding use of groundwater by the Proponent, and the effect on the aquifer. If not already undertaken, it is recommended that the Proponent undertakes a full hydrogeological study to support the application for groundwater abstraction licence.*

A full hydrogeological report is currently being prepared and will be submitted towards the end of February 1999, in order to support an application for a groundwater production licence. This is a requirement from the WRC of Western Australia.

- *It is suggested that as part of the licence conditions for the abstraction programme an estimate be included as to:*

  -How much water is needed on an annual basis for the duration of the mining operations.
  -The number of bores required for the whole mining operation for the duration of the life of the mine.

The licence application will include an estimate of annual water requirements (estimated at 53 ML/day) and the number of bores (presently estimated at 108) from which this water will be abstracted. This is a requirement from the WRC of Western Australia.

4.1.2 Aquifer Classification Systems and Levels of Action for Groundwater Management

It is recommended that the Proponent includes the method for groundwater management based on aquifer classification and six prescribed levels of action.

The comment is acknowledged and the groundwater classification system will be examined to determine if it has relevance to the groundwater management system already developed for the region. A management plan has been prepared by Anaconda. This involves the hydrogeological definition of aquifers in the region which contain water resources of sufficient volume and quality to be of use for general community purposes. Water quality varies from approximately 800 mg/L TDS (identified in a small area to the north west of the Project Area) to over 200,000 mg/L in the main palaeo-drainage channels. All users of water have been identified, the aquifers categorized and allocations reserved for their specific purposes. A comprehensive monitoring programme has been developed to observe the impact of pumping from the various borefields and provide a quantitative assessment of the impact of groundwater abstraction by Anaconda and others in the region. This is a similar system that already exists within the WRC, which requires owners and operators of groundwater pumping schemes to be monitor and record all abstraction figures, water levels and groundwater chemistry levels. It is envisaged that with time both groundwater management plans may be integrated to better manage the resources of the region.

4.1.3 Aquifer Use Survey

The Proponent should, it is submitted, undertake a survey to identify the extent of use of the aquifers in the proposed region.

An aquifer use survey has been conducted and has identified all groundwater users in the area. These users include Public Water Supply, ore processing and pastoral activities. In addition, future activities such as irrigation and potential horticultural usage have been identified.

4.1.4 Exploration of Alternative Water Sources

In view of the huge amount of water required, we propose that alternative sources of water (for example having it piped in) be considered.

Anaconda has conducted an extensive regional hydrological assessment within a 200 km radius of the Project site. They have not identified any alternate water resources, such as surface water storage, within this study area. It is clear that pumping water from distances greater than 500 km would make the Project unviable. In addition, radical and alternate methods of providing water such as piping, desalination, use of hypersaline water, cloud seeding and hydrogen production were examined. All were discounted due to being impracticable or too costly.

4.1.5 Solid and Liquid Waste Disposals (ES-6)

4.1.5.1 Disposal of Tailing

We propose that site specific methods for the disposal of tailings process wastewater and over-burden waste be provided and would include information of soil types. Presently, there are many aspects which still need to be addressed. These include in regard to tailings:

- *If tailings dams will be used what standards will be followed in planning the design. What are the design features?*

Section 3.5 of the PER presented details on the design objectives and design features of the tailings storage facility and evaporation ponds. These are summarised below.

The main objectives of the tailings storage facility and the evaporation pond design are:

- comply with the DME guidelines published as "Guidelines on the Safe Design and Operating Standards for Tailings Storage"
- to prevent surface breakout of saline seepage liquors; and
- to demonstrate that the rising water table outside of the facility would be no shallower than 8 m below the ground surface at a distance greater than 250 m from the tailings storage area and evaporation ponds.

The latter design objective is to protect the surrounding vegetation from significant impacts due to potential rising salt water levels.

The MM Stage 1 Project tailings storage facility design employs conventional sub-aerial deposition methods and has been based on testwork of the pilot plant residue and detailed geotechnical and hydrogeological investigations of the site conducted for the MM Stage 1 Project. The tailings slurry

will be deposited via spigots into the dams in a cyclic manner to facilitate desiccation of the tailings. Supernatant liquor and any rainfall will be collected via a decant system and discharged into the evaporation ponds. An internal toe drain will be provided around the perimeter embankment to intercept seepage beneath the embankment.

The MM Stage 1 Project tailings storage facility will be unlined due to the low natural permeability of the area where the tailings storage facility is proposed to be constructed. The design was finalised after extensive site investigation work, modelling and technical consultation with Government DMAs.

The tailings will be pumped from the plant site to the tailings storage facility via a carbon steel pipeline which traverses an area that slopes gently down towards the Laverton-Leonora road. The pipeline will be above ground with bunding placed on the down-slope side, and along the length of the pipeline. The pipeline will be fitted with sensors which will be connected to the Distributed Control System (DCS) to sense any breakages of the pipeline. Should a pipeline break occur, MMO would instigate a programme to repair the breakage and clean any spilt tailings which would be put into the tailings area.

The final design and configuration of the tailings storage facility and evaporation ponds will depend upon a number of factors including:

- whether Central Thickened Discharge (CTD) is a viable option for tailings management;
- the possibility of using a thickened tailings stream to backfill pits in the future (if CTD is viable); and
- the quantity of water requiring disposal by evaporation.

It is intended that the Expansion Project will initially utilise the existing MM Stage 1 Project tailings storage facility while further testwork and piloting studies are undertaken. Following this testwork, the tailings storage facility required for the Overall Project (ie. MM Stage 1 Project and the Expansion Project) will be designed. The detailed design will be submitted to the regulators for review and approval prior to construction commencing.

- *What is the expected chemical composition of the tailings and the leachate including the pH and metal composition?*

The expected characteristics of the tailings stream and the neutralised residue (produced by the pilot studies) are presented in Tables 13 and 14.

Table 13

Characteristics of the Tailings Stream

Tailings (Residue and Gypsum)	
Quantity (based on 340 days production)	13.3 Mtpa
Percentage Solids (by weight)	37 %
Specific Gravity (expected)	2.65
Initial Dry Density (expected)	0.65-0.90 t/m^3
Dry Density after Desiccation (expected)[1]	1.1 t/m^3
Discharge Temperature	80 °C
pH	6 to 7
Neutralised Residue (produced by the Pilot Studies)	
Particle Sizing (expected)	90% passing 70.2µm
	50% passing 12.5µm
	10% passing 2.47µm
Permeability Range	5×10^{-6} to 2.8×10^{-7} m/s
	(for vertical stresses between 1 and 250kPa)
Shear Strength	Friction Angle: 35°
	Cohesion: 0kPa

Note: 1 After approximately one month elapsed time based on pilot studies.
Source: Golder Associates (1997).

The concentrations of elements in the residue produced by the pressure acid leach pilot plant studies are presented in Table 14.

Table 14

Concentrations of Elements in Pressure Acid Leach Residue

Element	Co	Ni	Si	Al	Ca	Cr	Fe	Mg	Mn	S
%	0.0075	0.067	23.2	2.32	0.371	0.942	22.9	0.481	0.041	2.00

The bleed solution, which is combined into the tailings, has a high TDS level. Analysis of the bleed solution produced by the pilot plant studies shows that the liquor has a total salinity of approximately 140,000 mg/L, including some metals with concentrations in excess of 10mg/L. The expected major components of the liquor based on the pilot studies results are:

- magnesium: 27,200mg/L
- sodium: 1,040mg/L
- calcium: 317mg/L
- potassium: 122mg/L
- bismuth: 9mg/L

The actual characteristics of the tailings stream will be determined through a measurement programme following the commissioning of the MM Stage 1 Project. Should the actual characteristics vary significantly from those expected, the design of the tailings storage facility would be reviewed to ensure that it remains satisfactory.

- *It is stated that the supernatant will be disposed of in land based evaporation ponds. What are the design features of these ponds? What measures are planned to prevent leaching out of the pond into the surrounding soil and further contaminant transport?*

The evaporation ponds have been designed with the same objectives as those adopted for the tailings storage facility. The modelling that has been conducted for the proposed facilities (tailings dams and evaporation ponds) show that there are not predicted to be any unacceptable off-site impacts due to the operation of the facility.

The Proponent has designed and implemented surface water and groundwater monitoring programmes. The surface water monitoring programme is focussed on assessing the potential impacts of the Project on Cement Creek through the use of a series of rising stage samplers. These samplers collect water and sediment samples during flow events which are analysed for water quality, with particular attention on sediment loading.

The groundwater monitoring programme implemented in the vicinity of the tailings dams and evaporation ponds was presented in Section 7.18 and as Attachment D of Appendix E of the PER (ie. the Project's Construction Phase Environmental Management Plan). This programme is summarised below and more detail can be obtained from the Project's Construction Environmental Management Plan (Appendix E of the PER).

The key potential groundwater impacts which may be associated with the tailings storage facility and evaporation ponds are:

- contamination of the regional groundwater system;
- a rising water table in the area outside of the facilities; and
- surface breakout of the rising water table near the facilities.

The design of the facilities is based on acceptance that seepage will occur but with a limiting criterion that the water table will not rise to a level closer than 8 m from the surface at a distance greater than

250 m from the facilities. A shallower water table would be acceptable closer to the facility but any surface breakout which occurs in that area would be a catalyst for remedial action.

A programme of groundwater monitoring is being undertaken to provide baseline data and to check the ongoing seepage impact during the operational life of the facility. An extensive groundwater monitoring programme has been implemented for the Murrin Murrin Project.

The monitoring programme proposed for the tailings storage facility and the evaporation ponds operational phase can be divided into three components:

- monitoring of the seepage at the facility, to check against predictions;
- monitoring at distances of hundreds of metres from the facility, to check against predicted rates of migration of seepage waters; and
- monitoring at remote locations using existing wells.

The monitoring system includes the following components:

- purpose-constructed monitor bores;
- remote water supply wells;
- surface geophysical traversing (if necessary); and
- systematic visual checks of the ground surface.

The results of the monitoring will be reviewed regularly, probably at more than an annual frequency in the first year or so of operations, and recommendations would be made regarding the details of the programme, the desirable frequency of measurement (which may be changed as the Project evolves) and the desirable frequency of critical review of the data.

The data would be reviewed with respect to the following:

- compliance with planned monitoring and licence requirements; and
- predicted behaviour of the groundwater system.

Significant deviations from the expected groundwater behaviour would trigger further assessment, which may identify a need for remedial action. The remedial action required would depend upon the nature of potential problem which had been detected. The aim of the monitoring and review process is, therefore, to identify any seepage which develops at a rate or in a location which was not predicted by the analysis undertaken during the facility design.

In the event the monitoring results indicate a potential problem, it is envisaged that the investigation and remediation process would be structured as follows:

1. Confirmation of initial indications.
2. More detailed investigation of extent of seepage.
3. Design of remediation programme.
4. Implementation of remediation.
5. Monitoring and analysis of results of remediation programme.

The remediation of undue seepage may consist of pumping from bores or trenches, or the installation of local slurry walls. If necessary, salinised topsoil would be removed and (after control of the problem) new topsoil placed as part of the overall closure and rehabilitation of the facility.

The monitoring data may also be used for periodic recalibration of the seepage and groundwater flow models, depending upon the nature of deviations from the predicted behaviour of the system.

The results of this monitoring programme will be used to provide:

- an early indication of potential seepage problems;
- verification of model predictions;
- recalibration of the model which will, in turn, provide better estimates of seepage; and
- demonstrate the effectiveness of seepage control measures.

The majority of the monitoring sites are used to monitor the performance of the facilities while additional sites are used to monitor the regional groundwater system. Based on the site investigation, residue characteristics and the modelling results, it is considered that this programme provides sufficient coverage and detail to detect any impacts. However, the number of monitoring sites may be varied as additional information becomes available during the construction and operation of the facilities and the bores.

In addition, it is intended to monitor the water quality at the existing wells in the area. The three wells to be sampled are as follows:

- Central Bore, located approximately 0.75 km west of the facilities;
- Aeromotor Well, located approximately 0.5 km east-northeast of the evaporation ponds; and
- Garden Well, located approximately 4 km east of the evaporation pond (3 km east of the Leonora-Laverton Highway).

The frequency of measurements will vary through the Project life according to the results of critical reviews of the data. In general, the following programme would be carried out for the first year for bores inside the lease area with reviews undertaken 6 and 12 months after the commencement of operations:

1. **Weekly** water level measurements.
2. **Monthly** groundwater electrical conductivity measurements (as profiles in any bores with long screened intervals).
3. **Monthly** analysis for total salinity and Magnesium Sulphate ($MgSO_4$).
4. **Six-monthly** surface geophysical traverse.

The groundwater monitoring programme currently implemented for the MM Stage 1 Project will be expanded to meet the requirements of the Expansion Project.

- *How and to what extent will the tailings dams be monitored?*

Once fully operational, the majority of the monitoring associated with the tailings storage facility and the evaporation ponds will be focussed on the surface water and ground water monitoring programmes. However, testing and monitoring will also be undertaken to:

- confirm the deposited dry densities and *in situ* strength of the tailings;
- assess the phreatic conditions within the tailings storage area;
- measure the actual quantity and quality of supernatant liquor recovered from the tailings;
- confirm the effective evaporation rates from the evaporation ponds;
- assess the evaporation area required to dispose of the liquor recovered from the tailings storage area; and
- monitor and evaluate the effect of seepage from the tailings storage facility and evaporation pond on the groundwater regime to assess the need, if any, for further seepage control measures.

4.1.5.2 Disposal of Process Wastewater

As with the disposal of tailings, specific aspects of disposal of process wastewater remain to be addressed. These include:

- *What method will be used to treat and to dispose of the process wastewater?*

As discussed in the PER, process wastewater is either reused within the process (wherever possible), deposited to the tailings storage facility as part of the tailings stream or deposited directly to the evaporation ponds. Some of the supernatant liquor (wastewater) from the tailings is recovered via the decant facilities and directed to the evaporation ponds.

- *What is the quality of the waste effluent produced on a day-to-day basis and how will this effluent be disposed of?*

The Proponent operates wastewater treatment plants which treat sewage from the Project to meet Health Department Regulations. It is proposed to dispose of some of the treated effluent to the tailings storage facility.

- *What is the chemical composition of the sludge and how will it be disposed of?*

The sludge is essentially organic matter which has been treated to meet Health Department Regulations. As stated above, it is intended to dispose of this to the tailings storage facility.

4.1.5.3 Disposal of Overburden and Waste

Likewise, as to disposal of overburden and waste:

- *What is the expected composition of the overburden and waste referred to in ES-6?*

As stated in Section 7.18.2 of the PER, the nature and characteristics of the overburden and wastes generated by the mining activities is such that there is not expected to be any deleterious chemical consequences, such as acid mine drainage, arising from runoff or leaching from the dumps. The overburden and wastes will consist of the sand and clays removed from the pits.

The selective placement of waste materials within the dumps is unlikely to be required except for the outer layers of the dumps. The placement of these layers will be carried out to ensure that clays are encapsulated within the ferruginous material to facilitate the rehabilitation process.

An estimated total of 13km^2 will be required for disposal of overburden material at the Murrin Murrin East Project Area. At least one waste dump will be developed for each deposit and these will be selected with consideration of the available areas between the pits and the lease boundaries, Aboriginal heritage sites, significant flora sites and water courses.

Dumps will be constructed with surface drainage controls as required. The rehabilitation programme will be designed to minimise erosion potential on slopes and ponding on the dump surfaces. The Proponent is not intending to undertake any water harvesting or to design the dumps to contain stormwater. Rehabilitation will be undertaken on a progressive basis. The dumps will be contoured and topsoil will then be respread on the slopes to a minimum depth of 200 mm (depending upon its availability). The dumps will then be deep ripped (approximately 1 m) on the contour with a distance of no more than 2 m to 2.5 m between rip lines. If ripping is not possible due to the batter angle, then

the scalloping (moonscaping) technique presented in DME (1996) will be utilised. Seeding and fertiliser application will then be carried out. This process will be repeated on the subsequent lifts.

- *What is the design of the waste dumps referred to in ES-6?*

The parameters used in the design of the waste dumps are listed in Table 15.

Table 15
Proposed Waste Dump Design Criteria

Project Component	Specification
Maximum Height	30 m
Bench Height	10 m
Berm Width	5 m-8 m
Initial Slope	35°
Final Slope	18-20°
Access Ramp Width	35 m
Access Ramp Gradient	1:10
Placement	100 m from 30 year pit outline

At least one waste dump will be developed for each deposit.

- *How will these dumps be rehabilitated, ie what is specifically meant by current industry practice?*

The general methods that will be used for rehabilitation of the waste dumps are presented in Section 7.22 and Table E20 in Appendix E (ie. the Project's approved Environmental Management Plan) within the PER.

The dumps will be contoured with a final batter angle of less than 20° and topsoil will then be respread on the slopes to a minimum depth of 200 mm (depending upon its availability). The dumps will then be deep ripped (approximately 1 m) on the contour with a distance of no more than 2 m to 2.5 m between rip lines. If ripping is not possible due to the batter angle, then the scalloping (moonscaping) technique presented in DME (1996) will be utilised. Seeding and fertiliser application will then be carried out, and the dumps will be seeded with local native species which will be selected in consultation with CALM. This process will be repeated on the subsequent lifts.

The design, management and rehabilitation of the waste dumps will be further addressed in the EMS.

4.1.5.5 Greenhouse Gases

It is suggested that a licence condition would require the Proponent to provide calculations of greenhouse gas emissions and the logs of gas emissions.

The Proponent has committed (Commitment 9) to calculate and report the total emissions of carbon dioxide resulting from the Project. Further, Ministerial Condition 5 of Statement 444 for the MM Stage 1 Project states the following:

> Greenhouse gas emission should be addressed in the Environmental Management Plan.
>
> 5-1 At appropriate times the Proponent shall address, in the Environmental Management Plan to be prepared under Commitment 1, the following additional matters relating to greenhouse gas emissions:
>
> - calculation of the greenhouse gas emissions associated with the proposal (using generally accepted methods).
> - indication of the measures adopted to limit greenhouse gas emissions for the Project; and
> - estimation of the greenhouse gas efficiency of this Project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product;
>
> to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.
>
> 5-2 The Proponent shall consider entry (whether on a project-specific basis, company wide arrangement or within an industrial grouping, as appropriate) into the Commonwealth Government's "Greenhouse Challenge" voluntary co-operative agreement programme.
>
> The agreement would include an inventory of emissions; opportunities for abating greenhouse gas emission in the organisation; a greenhouse gas mitigation action plan; regular monitoring and reporting of performance; and independent performance verification.

As noted within the PER, the Proponent is currently in discussions with the Federal Greenhouse Challenge Office with regards to entering to Greenhouse Challenge Programme and an initial letter of intent has been submitted by the Proponent. The Proponent will continue to investigate mechanisms

to reduce its greenhouse gas emissions throughout the operation of the Project. While this will primarily focus on the neutralisation circuit (e.g. optimisation of the sulphuric acid consumption to reduce carbon dioxide emitted during neutralisation), all other areas of the Project will be closely reviewed on an ongoing basis to identify potential greenhouse gas emission reductions. Consideration will also be given to any offsetting options that are available to reduces the Project's net greenhouse gas emissions.

The Proponent will continue to undertake these functions for the Project.

4.1.6 The Vulnerability of Aquifer to Contamination, Vulnerability Mapping and Risk Assessment

The Proponent should undertake a study on the potential sources of contamination.

Anaconda acknowledge that any contamination of the aquifer system may impact its own operations as well as those of other users. Anaconda have developed a comprehensive quality assurance programme and Environmental Management System, as well as detailed HAZOP studies and Safety Management System requirements, to adequately cover the risk to and assessment of potential contamination as a result of both industrial activities, as well as groundwater abstraction for process purposes. This data is under constant review and will form the basis for all assessment of potential aquifer impact. Regulatory control lies within the domain of both the DEP and the WRC. These agencies have comprehensive legislation to adequately ensure compliance to all current health and environment standards.

4.1.7 Clearing of Vegetation

The Proponent should be required to describe the methods to be used to control environmental degradation arising as a result of clearing vegetation off land such as: death of trees, raising the watertable, loss of plant communities and associated fauna, soil erosion

An Environmental Management Plan (EMP) has been developed for the construction phase of the MM Stage 1 Project and is presented in Appendix E of the PER. This EMP has been reviewed and approved by DEP, DME and CALM. The EMP specifies the steps which must be followed to achieve an acceptable level of environmental performance. This EMP will be updated to include the Expansion Project.

Details on procedures relating to management of vegetation, groundwater, fauna and soil erosion are presented in the following sections of the EMP:

- flora and vegetation (Table E1)
- fauna (Table E3)
- erosion (Table E4)
- groundwater (Table E5)

An Environmental Management System (EMS) has been developed for the operational phase of the MM Stage 1 Project and this has recently been approved by the DEP. This EMS is structured to facilitate changes including the Expansion Project. The EMS provides detailed management procedures for managing the issues outlined above. It includes the setting of targets and objectives for significant impacts.

It is suggested that licence conditions require that CALM be informed before the removal of populations of priority or significant species, declared rare flora, disturbances of significant fauna habitats, subterranean fauna and their habitats, disturbances of wetlands (Lake Carey).

As quoted in the PER the Proponent will:

> "inform CALM prior to disturbing any significant (flora) species;" (page 94)
>
> "undertake the construction, operation and decommissioning of the Project in a manner that minimises disturbance to the Malleefowl nest in the Granite Borefield. This will be undertaken in consultation with CALM." (Commitment 22, Table 17); and
>
> "undertake additional fauna studies (including subterranean fauna surveys) to ensure that adequate information is available for the purposes of managing the Project as well as educating the workforce. The scope of these studies will be determined prior to the commencement of the construction phase in consultation with the DEP, CALM and the WA Museum, and will be undertaken to meet the requirements of the EPA." (Commitment 18, Table 17)

It is suggested that licence conditions require suitably qualified scientists and specialists to undertake environmental management programmes, rehabilitation and rehabilitation monitoring, scientific studies of communities and populations.

An Environmental Management Programme (EMP) has been prepared by Dames & Moore and is presented in Appendix E of the PER. A rehabilitation programme will be prepared as part of the

Environmental Management Strategy (EMS) and will include monitoring of rehabilitation undertaken. An outline of this EMS has been included in the EMP.

- *It is suggested that a licence condition requires compliance with the Wildlife Conservation Act 1950.*

This is a legal requirement and which will be met by the Proponent.

- *It is suggested that a licence condition requires the control of weeds.*

As stated on page 95 of the PER:

> "The Proponent currently implements a weed control programme as specified by the construction phase EMP (Appendix E). These management measure will continue to be implemented during the construction of the Expansion Project."

Commitments 1 and 2 make this a legally binding requirement.

- *It is suggested that a review of soil types be undertaken and used to plan for appropriate sites for tailings dams.*

The Proponent considered a large number of environmental factors when the site for the tailings dams and evaporation ponds was selected. These included consideration of:

- soil characteristics, particularly permeability;
- potential impacts on groundwater;
- surface water management; and
- the long term integrity of the structures.

On the basis of these factors, the site chosen for the MM Stage 1 facilities is considered appropriate. The Expansion Project would result in an expansion of the MM Stage 1 facilities.

4.1.8 Bush Tucker

A licence condition be made that CALM is to be advised of intended removal of any flora and fauna species notified by CALM as being significant to Aboriginal people as and by the way of "bush tucker". CALM will need to assess same in consultation with the local Aboriginal community for notification purposes.

The Proponent currently utilises members of the Mount Margaret Community to collect local seeds for use with the rehabilitation programmes. The members of this community are local to the region and are actively involved in the Project's rehabilitation programmes. Planting of suitable "bush tucker" species is considered as part of the rehabilitation programme. The clearing/removal of "bush tucker" will be minimised wherever practicable.

The Proponent does not intend to remove any native fauna from the region, although there will be some localised disturbance and natural relocation due to the loss of habitat as a result of learing undertaken by the Project.

4.1.9 Land Systems Study

It is suggested that a comprehensive scientific study of the significant land systems in the area be undertaken by the Proponent and plans for post mining land use be undertaken as an on-going programme during the operational phase.

The long-term use of the land and water systems in the region should be assessed as against Aboriginal and other population profiles to assist in attaining stability of their living environment.

Table 16 outlines the areas of significant land systems which will be disturbed as a result of the Expansion Project.

Table 16

Significant Land Systems in the Project Area

Land System	Percentage of Land System in the Northeastern Goldfields Region	Percentage of Land System to be disturbed by the Expansion Project.
Duketon	0.3% (318 km^2)	0.13% (0.4 km^2)
Felix	0.2% (241 km^2)	0% (0 km^2)[1]
Hootanui	0.3% (327 km^2)	0.41% (1.33 km^2)
Steer	0.6% (581 km^2)	0.008% (0.05 km^2)
Sunrise	0.4% (362 km^2)	0.01% (0.04 km^2)

Note 1 The Felix land system is located in the Sullivan Borefield but will not be disturbed by the Project

The disturbance of each of the significant land systems as a result of the Expansion Project is less that 0.5% in all cases.

As only a very small percentage of the significant land systems are going to be directly impacted by the Project (Table 16), the Proponent does not consider it necessary to prepare a separate Environmental Management Plan for protection of the significant land systems. A comprehensive study of land systems in the Northeastern Goldfields was undertaken by Pringle *et al* (1994) and the information in the PER and this response to submissions, has been taken from this report. Plans for

post mining land use will be included in rehabilitation plans and the decommissioning plan that will be prepared for the Project. The plans will be developed as part of the EMS.

However, it should be noted that the disturbance of significant land systems will be avoided, where possible. Temporary facilities, such as borrow pits, vehicle parking areas and storage areas for equipment and bulk materials, will not be located on these land systems wherever practical.

In addition, the implementation of management measures to ensure the protection of flora, prevention of erosion, management of surface drainage and progressive rehabilitation of disturbed areas will minimise impacts on significant land systems.

The Proponent will be undertaking a Social Impact Assessment (SIA) in accordance with Supplementary Commitment 6 of the MM Stage 1 Project. The SIA will be completed by the end of 1999 and will include investigations into Aboriginal usage of land and water systems in the region.

4.1.10 Waste Emissions

- *It is suggested that monitoring waste emissions to the environment according to statistically supported scientific methods be a licence condition.*

As part of the MM Stage 1 approvals, the DEP, DME and WRC have all placed monitoring requirements on the Project. The Proponent expects that similar conditions will be placed on the Expansion Project.

- *It is suggested that a licence condition requires compliance with the ANZECC Guidelines for the Assessment and Management of contaminated sites.*

Dames & Moore understands that the National Environment Protection Council (NEPC) is currently preparing a National Environment Protection Measure (NEPM) to provide national guidelines for contaminated site assessment and management. Therefore, the ANZECC Guidelines may not be appropriate. The Environmental Management of the Project will take account of this.

The licence conditions for the Project will be negotiated between the DEP and the Proponent following the receipt of environmental approvals and prior to the commissioning of the Project's components.

4.1.11 Continuation of the Aboriginal Environmental Liaison Committee (ES-7)

Problems have been referred to the Hon Minister regarding the Proponent's commitment to genuine consultation.with the Aboriginal Environmental Liaison Committee required of it previously. These should be addressed and rectified. The continuation of the Committee should, however, be continued as a condition, with the addition of appropriate monitoring and review mechanisms.

The Proponent is committed to the successful implementation of the Aboriginal Environmental Liaison Committee and the consideration of issues raised by the Committee within the Project's design and operation. To date, three meetings have been held within the past six months and will generally occur on a quarterly basis.

The Proponent has committed (Commitment 21) to the continued operation of the Aboriginal Environmental Liaison Committee for as long as the Committee considers that it is required. This commitment will become legally binding in the event that the Minister for the Environment approves the Expansion Project.

4.1.12 Aboriginal Sites

Sixty seven Aboriginal sites have been given approval to be disturbed through section 18 AHA processes (ES-7).

Aboriginal comment on the site clearance process has not been favorable. It is suggested that a separate study be undertaken to fully document the sites which have been cleared and the environmental implications. This study to be carried out be an anthropologist nominated by the Goldfields Land Council at the cost of the Proponent and made available for the use of the Committee, the EPA and the Aboriginal Cultural Materials Committee.

Anaconda has considered every alternative in order to avoid disturbance to Aboriginal heritage sites. Of all the Project Areas covered by the PER it is only in the areas in or near the pits and dumps of the mine that archaeological sites are to be disturbed, this is only because such disturbance is totally unavoidable. This disturbance has been approved and sanctioned by the AAD on approval from the ACMC and all required Section 18 clearances and salvage work have been issued and carried out. The AAD has congratulated Anaconda on the quality of its heritage studies (see Appendix A for Section 18 approvals and letter from AAD).

4.1.13 Management Plans – Table at ES 9-15

It is suggested that the extent of implementation of the EMS be subject to review by the EPA at set intervals following public consultation, to ensure that the EMS is appropriate and being implemented to the satisfaction of the EPA and the public.

The MM Stage 1 Project EMS has recently been approved by the DEP and Section 7.4 of the PER outlined its approach and structure which is summarised below.

As required under Ministerial Conditions for the MM Stage 1 Project, the draft EMS is based on the Australian and International Standard ISO 14001:1996. This standard describes a structure for:

- setting and implementing an environmental policy which includes a commitment to regulatory compliance;
- environmental planning by:
  - identification of environmental aspects and impacts;
  - setting of objectives and targets to manage significant impacts;
  - establishing and maintaining an EMP for achieving objectives and targets; and
  - identification of legal requirements;
- implementation of environmental management by development of capabilities and support mechanisms to achieve the objectives and targets of the environmental policy. These mechanisms include organisational structure and responsibilities, training, communication, documentation, identification and planning of activities associated with significant environmental aspects, and emergency response and preparedness;
- measuring and monitoring key characteristics of operations and activities that can have a significant impact on the environment in accordance with the EMP. This includes identification and investigation of any nonconformance, and implementation of corrective and preventative action;
- management of environmental information and records;
- conduct of EMS audits; and
- review of the EMS and continual improvement.

The Proponent's EMS addresses all the main components of the ISO 14001 standard. The structure of the EMS is designed to facilitate inclusion of changes to the Proponent's activities at Murrin Murrin including changes such as the Expansion Project. Such inclusion is achieved by undertaking the following in accordance with management procedures specified in the EMS:

- identification of aspects and impacts associated with the changes;
- setting of objectives and targets to manage significant impacts; and
- inclusion of these aspects, impacts, objectives and targets in the EMP.

4.1.14 Future Generations and Inter-generation Equity

As part of the licence conditions the company should be required to provide decommissioning plans which would include land form information and land use options for all people who would inhabit the region and utilise the environment. This should address natural resources including ground and surface water bodies, flora and vegetation, fauna and soil. Such documented proposals and information will be essential to provide some degree of assistance for local indigenous inhabitants who, with their future generations, do now and will rely on the local environment for their physical, cultural and spiritual sustenance.

The Proponent has committed to preparing a detailed decommissioning plan which will be incorporated into the EMS. The decommissioning plan will be a changing plan that will be modified according to industry best practice at the time. It will provide details on all of the above issues and will be submitted for approval by the EPA and the DME.

4.1.15 Compliance Auditing

It is suggested that at least 6-monthly audits be required to determine environmental performance and compliance.

As part of the EMS, regular internal inspections and audits will be undertaken to assess the compliance of the Project with its environmental objectives. Internal inspections are conducted around the mining areas, plant site and support infrastructure (borefields, camp, sewage plants etc) on a monthly basis. Issues arising from the inspections are reported to the relevant Area Manager for action.

Formal technical audits are to be conducted every quarter (mining areas, ore leach, refinery, and engineering supply logistics and administration) and systems audits will be conducted annually. The first systems audit will be undertaken by an external auditor and, thereafter, every second or third audit will be undertaken by an external auditor to ensure that the internal audits are satisfactory and that the system is operating correctly.

The Proponent is also required to submit a Performance and Compliance Report (PCR) to the DEP in accordance with the requirements of the Audit Table for Ministerial Statement 444 issued by the DEP in September 1997. The DEP requires a PCR to be submitted to demonstrate compliance with Ministerial Conditions and the Proponents Commitments. A PCR is submitted at each stage of the Project (eg pre-construction and construction) and will be submitted on an annual basis once the Project is operational. It is anticipated the PCR will also include the requirements of the DME's Annual Environmental Report.

4.1.16 Conclusion

In conclusion a suggestion is made for a holistic integrated type of approach to be undertaken in the planning phase of an intent to mine, taking into consideration the local communities needs and aspirations including those of the indigenous community, mining interests, environmental and natural resource management, heritage conservation and long term post-mining land use.

The Proponent very conscious of its environmental responsibilities and agrees that the holistic integrated approach is required for the success of the Project. Environmental management strategies and procedures have been developed to minimise environmental impacts and a number of formal commitments have been made by the Proponent in the PER (Table 17). These commitments will be implemented to the satisfaction of the landowner and/or relevant DMAs.

4.2 PACMIN MINING CORPORATION

Some of the issues raised by PacMin Mining Corporation (PacMin) are not environmental issues but are related to licence requirements. These will generally be addressed through the appropriate regulatory authority such as WRC and DME.

4.2.1 Licence Over Sullivan Borefield

Tarmoola Australia Pty Ltd (TAPL) is the registered holder of underlying Groundwater Explortaion and Production Licences for the Tarmoola Gold Mine over the Sullivan Borefield.

The palaeochannel aquifer system associated with the present day expression of Sullivan Creek was not known or hydrogeologically understood by Tarmoola Gold Mine until they were briefed by Anaconda's groundwater consultant. An approach, in principle, was agreed to jointly explore and manage the water resources defined. The Proponent therefore, does not believe that Tarmoola Gold Mine has a production licence to extract water from the Sullivan Creek palaeochannel at the present time.

4.2.2 Economic Impact of Groundwater Abstraction

The Tarmoola operation presently consumes approximately 2ML/d of water (with plans to increase to up to 5ML/d) from the Sullivan Borefield, and is reliant solely on this water supply for the continuation of the Tarmoola Gold Mine (which has a forecast mine life in excess of twelve years).

The Tarmoola Gold Mine is a steady operation with annual revenues of approximately A$100 million and profits of approximately A$20 million. Tarmoola is PacMin's largest operation and its economic performance is very sensitive to operating efficiencies. Any down-time, including down-time due to lack of water supply incurs fixed costs of approximately A$160,000 per day before

accounting for revenue losses of approximately A$275,000 per day. Any disruption to water supply would result in substantial economic losses to PacMin.

TAPL do not presently withdraw water from the Sullivan Creek palaeochannel. They abstract water from fractured rock associated with their mining process as well as abstracting water from the old Tuetonic borefield which hosts water in a fractured environment. Both these aquifers are independent sources of water from the recently proven Sullivan Creek palaeochannel aquifer system. Discussions between Richard Martin and Tarmoola Gold Mine operational staff have been undertaken with a view to jointly managing the resource so as to provided security for both Anaconda and Tarmoola over the long term development of water for both Projects. In addition, there was collaboration on the likely impact of water withdrawal on vegetation associated with Sullivan Creek.

4.2.3 Impact of Drawdown

TAPL's usage of the Sullivan Borefield is undertaken in a responsible and measure manner. TAPL is responsible for continuous analysis of the borefield and to date, based on our monitoring activities, there has been no observed draw-down in water levels or disturbance to vegetation or aquifer volumes.

Tarmoola Gold Mine is currently accessing its water supply from fractured rock associated with their mining process as well as abstracting water from the old Tuetonic borefield which hosts water in a fractured environment. As these water sources are independent sources of water from the recently proven Sullivan Creek palaeochannel aquifer system, it is not possible to determine if impacts to vegetation along Sullivan Creek are apparent.

4.2.4 Impact to Vegetation in the Borefield

Anaconda proposes to draw 25ML/day from the Sullivan Borefield for the expanded Murrin Murrin Project over its 30 year life. This proposed usage is significantly in excess of Tarmoola's current usage. Anaconda's use of the Sullivan Borefield could potentially cause a substantial decrease in water levels and have a serious impact upon the borefield environment. We note that the EPA has identified the Eucalyptus camaldulensis woodlands in the Sullivan Borefield to potentially be susceptible to water drawdown.

Anaconda has identified up to 40 km of buried palaeochannel strike length and has factored the withdrawal of 5 ML/day of water for Tarmoola's use from the aquifer system. Under this management scenario there would be no detrimental impact to the volume of water available for Tarmoola. Anaconda has launched a comprehensive vegetation study involving the Botany Department of the University of Western Australia to determine groundwater usage by vegetation in the area.

4.2.5 Application for a Miscellaneous Licence

TAPL has objected to Anaconda's recent application to the Department of Minerals and Energy for a Miscellaneous Licence covering the Sullivan Creek palaeochannel in the Sullivan Borefield.

It is noted that TAPL is currently in a legal dispute involving a number of tenements in the general region which are not specifically related to water.

4.2.6 Discussions between Tarmoola and Anconda

Anaconda state in the PER in relation to the Sullivan Borefield (Section 4.4.3.2) that "Discussions have been ongoing between Tarmoola and the Proponent". This is incorrect. To date there have been no formal discussions with Anaconda directly – we have only received a courtesy call from a consultant to Anaconda advising us of Anaconda's proposed usage of the Sullivan Borefield.

TAPL are currently receiving advice on its proposed borefield development programme for the buried palaeochannels from Anaconda's groundwater consultant. Discussions regarding Anaconda's development proposal have been undertaken between this groundwater consultant and staff on-site at the Tarmoola Gold Mine.

4.2.7 Impact on Leonora Water Supply

The Tarmoola Gold Mine's employee base resides in Leonora and, as a result over recent years the Tarmoola Mine has developed a strong attachment to the Leonora township. We are concerned that Anaconda's proposed 15ML/day drawdown from the Station Borefield which supplies the Leonora township has the potential to cause severe disruption to Leonora's water supply and hence the town's residents.

As stated in the PER, the water for the Leonora town water supply is drawn from a tributary to Station Creek approximately 15km north of Leonora. This water is drawn from fractured rocks and an alluvium aquifer, which is not connected to the aquifer from which the water for the Expansion Project will be drawn.

Anaconda's proposed development of water supplies from Station Creek will in no way impact or cause disruption to the Leonora Water supply. If there was any suggestion that this may be the case then Anaconda would "make good" any shortfall in quantity.

I refer to pp 9, 11, 15, 167, 19, 32, 38, 117, 120 of the PER in relation to ammonia supply for the Project. The offsite risk assessment referred to on p. 120 presumably is that referenced on p 146, but there has been a subsequent offsite quantitative risk assessment done in 1998.

In view of my submission to the Minister for Environment in August this year on control of, and adequate response to, the low probability but high consequence community risk posed by ammonia transport, I firmly endorse the proposal on p.110 to produce ammonia on-site.

The Proponent acknowledges this submission.

5. CONCLUSION

The Proponent believes it has adequately addressed all the issues raised by the State Government, Commonwealth Government and Non-Government organisations, in the PER and this response to submissions. The Proponent is committed to planning, constructing and operating the Expansion Project in an environmentally and socially acceptable manner and believes that the Expansion Project represents an excellent opportunity for Western Australia to develop its resources in an environmentally responsible manner.

6. REFERENCES

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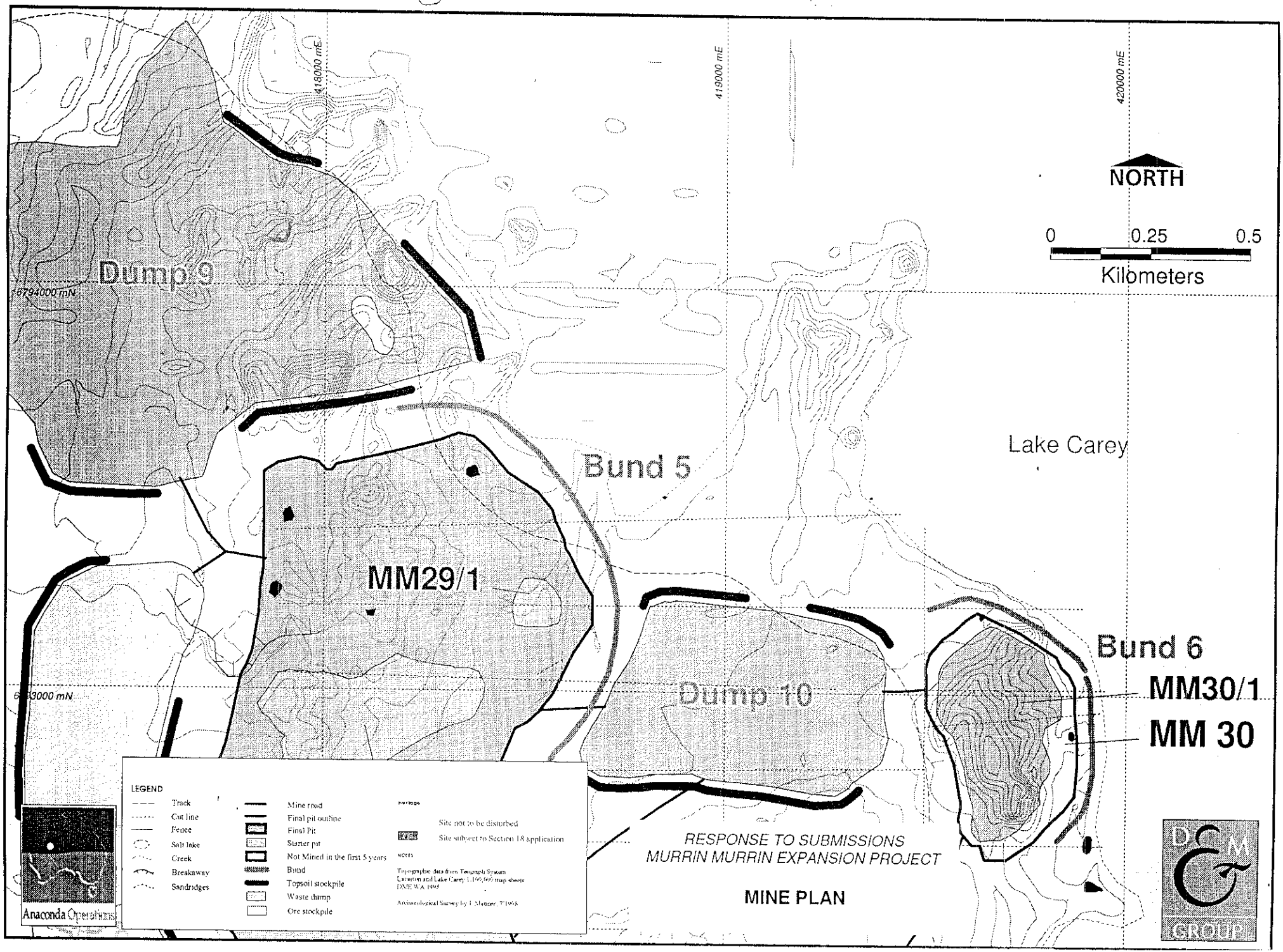
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Dump 9
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Bund 5
Lake Carey
MM29/1
Bund 6
MM30/1
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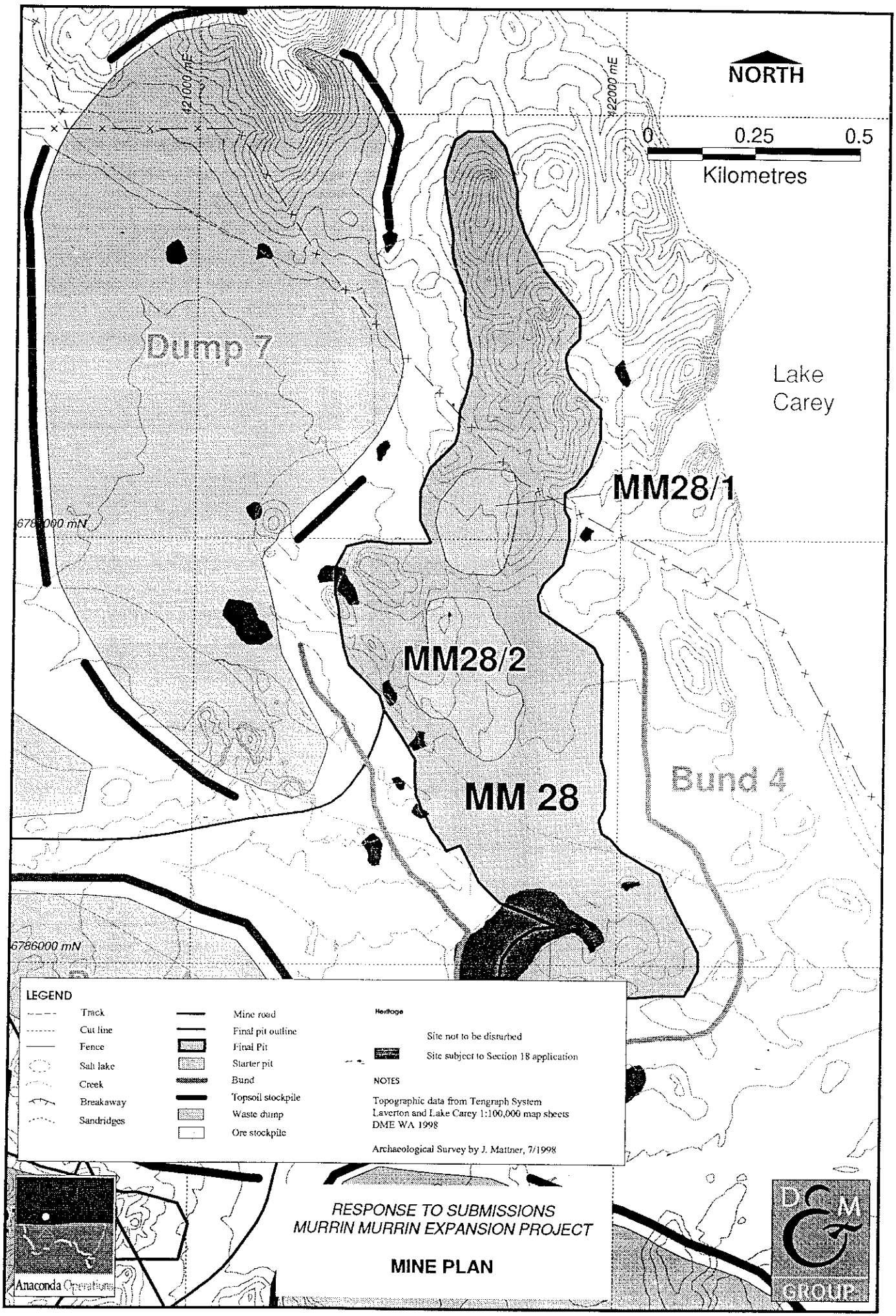
Dump 10
LEGEND
Track
Cut line
Fence
Salt lake
Creek
Breakaway
Sandridges
Mine road
Final pit outline
Final Pit
Starter pit
Not Mined in the first 5 years
Bund
Topsoil stockpile
Waste dump
Ore stockpile
Site not to be disturbed
Site subject to Section 18 application
Anaconda Operations
RESPONSE TO SUBMISSIONS
MURRIN MURRIN EXPANSION PROJECT
MINE PLAN
D&M GROUP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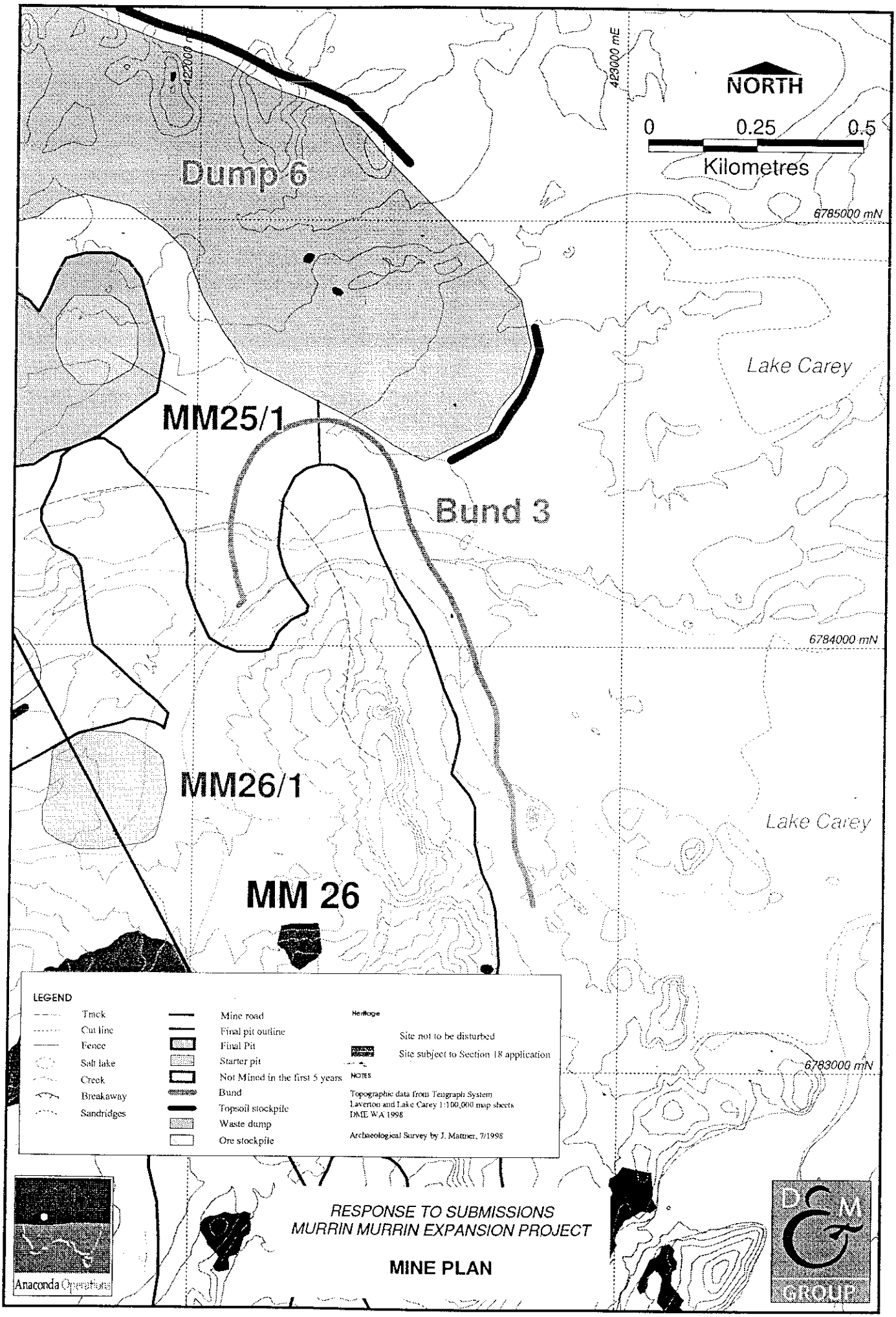
MM28/2
MM 28
Bund 4
LEGEND
Track
Cut line
Fence
Salt lake
Creek
Breakaway
Sandridges
Mine road
Final pit outline
Final Pit
Starter pit
Bund
Topsoil stockpile
Waste dump
Ore stockpile
Heritage
Site not to be disturbed
Site subject to Section 18 application
NOTES
Topographic data from Tengraph System
Laverton and Lake Carey 1:100,000 map sheets
DME WA 1998
Archaeological Survey by J. Mattner, 7/1998
Anaconda Operations
RESPONSE TO SUBMISSIONS
MURRIN MURRIN EXPANSION PROJECT
MINE PLAN
D&M
GROUP

FIGURE 1b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Dump 6
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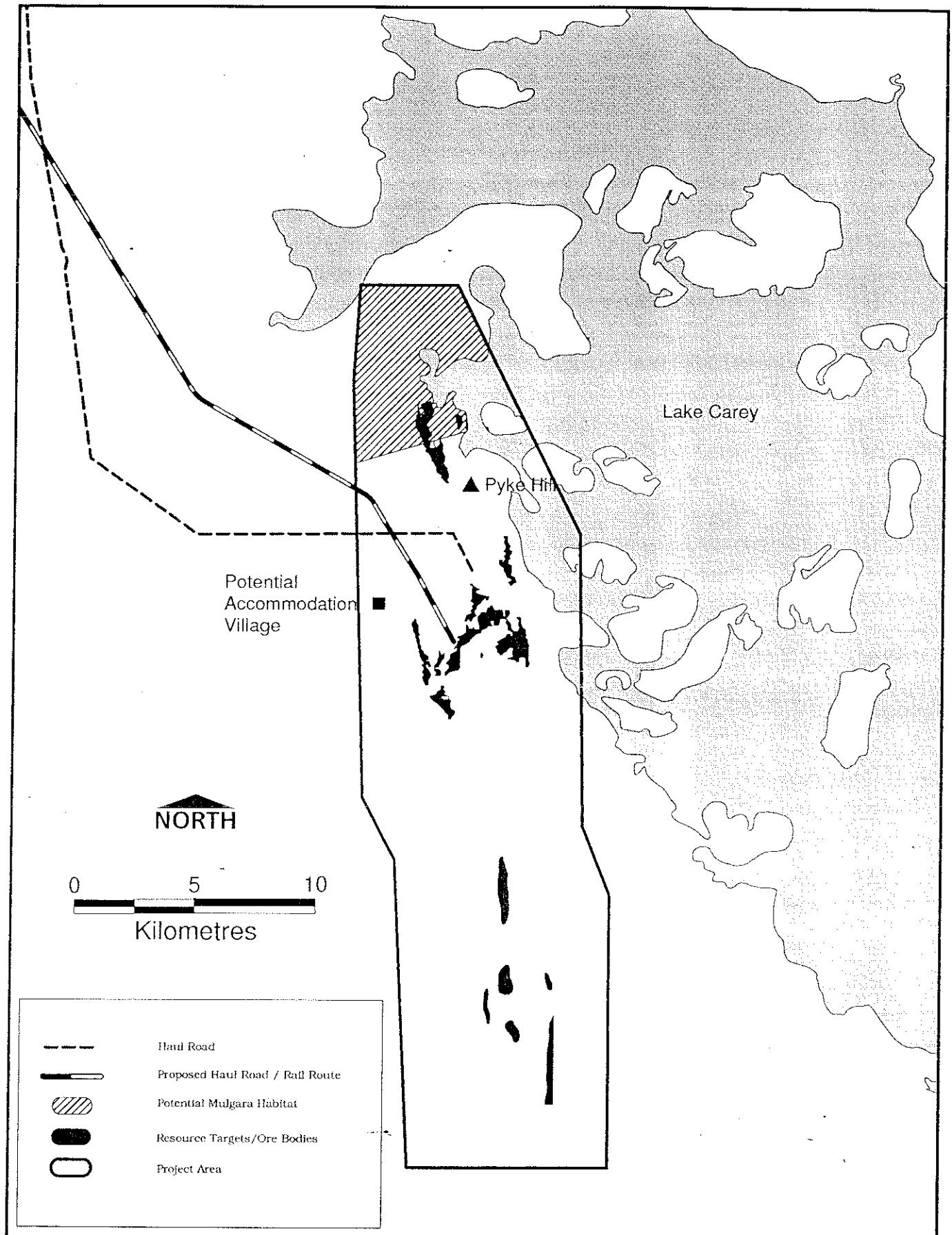
MM26/1
MM 26
Lake Carey
Lake Carey
LEGEND
Track
Cut line
Fence
Salt lake
Creek
Breakaway
Sandridges
Mine road
Final pit outline
Final Pit
Starter pit
Not Mined in the first 5 years
Bund
Topsoil stockpile
Waste dump
Ore stockpile
Heritage
Site not to be disturbed
Site subject to Section 18 application
NOTES
Topographic data from Tengraph System
Laverton and Lake Carey 1:100,000 map sheets
DME WA 1998
Archaeological Survey by J. Mattner, 7/1998
Anaconda Operations
RESPONSE TO SUBMISSIONS
MURRIN MURRIN EXPANSION PROJECT
MINE PLAN
DCM GROUP

FIGURE 1c



Anaconda Operations

RESPONSE TO SUBMISSIONS
MURRIN MURRIN EXPANSION PROJECT

POTENTIAL HABITAT FOR THE MULGARA WITHIN THE PROJECT AREA

DCM GROUP

FIGURE 2

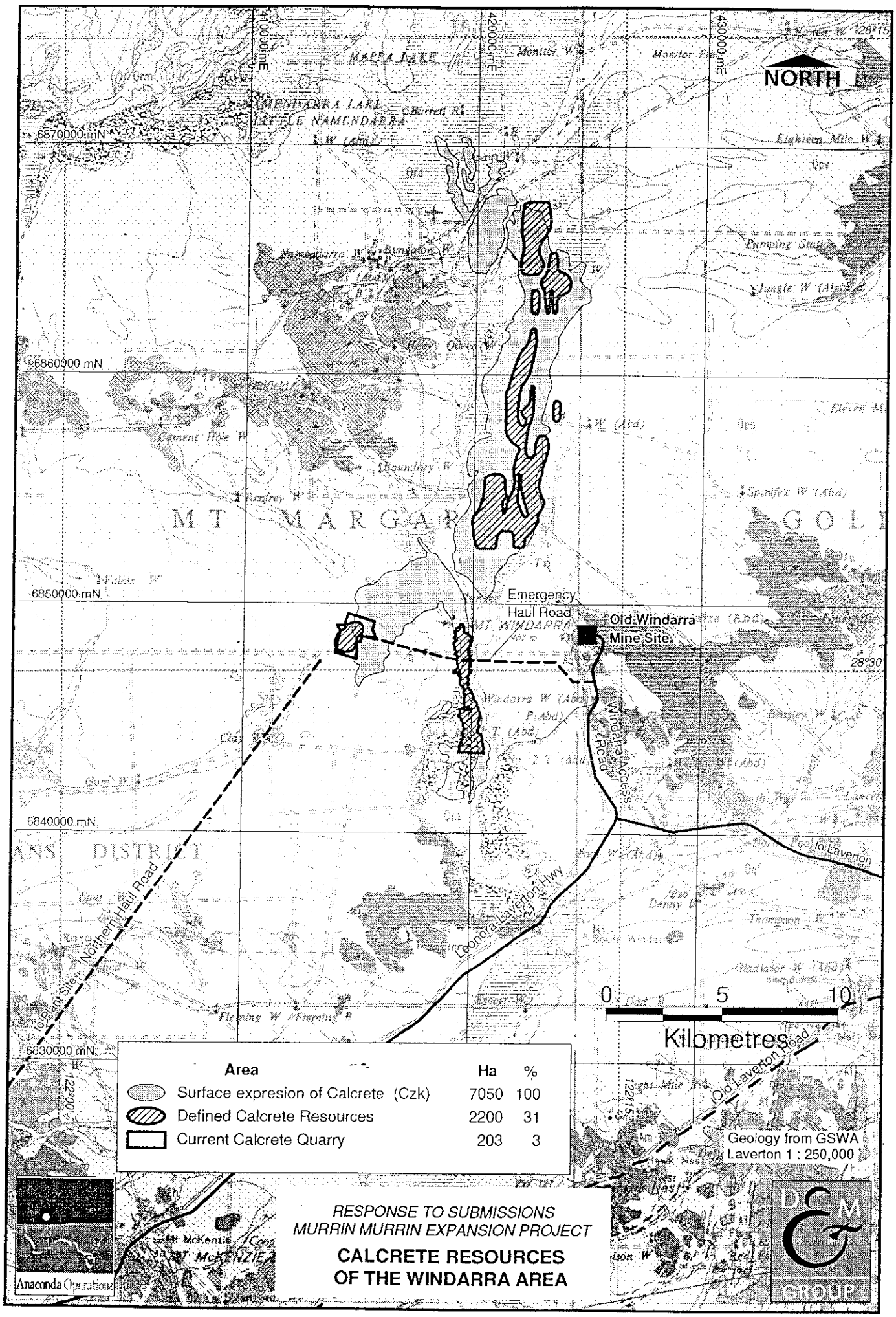

NORTH
410000mE
420000mE
430000mE
6870000 mN
6860000 mN
6850000 mN
6840000 mN
6830000 mN
MT MARGAR
Emergency
Haul Road
Old Windarra
Mine Site
Windarra Access
Road
Northern Haul Road
To Plant Site
Leonora Laverton Hwy
To Laverton
Old Laverton Road
0
5
10
Kilometres
Area
Ha
%
Surface expresion of Calcrete (Czk)
7050
100
Defined Calcrete Resources
2200
31
Current Calcrete Quarry
203
3
Geology from GSWA
Laverton 1 : 250,000
Anaconda Operations
RESPONSE TO SUBMISSIONS
MURRIN MURRIN EXPANSION PROJECT
CALCRETE RESOURCES
OF THE WINDARRA AREA
DCM
GROUP

FIGURE 3

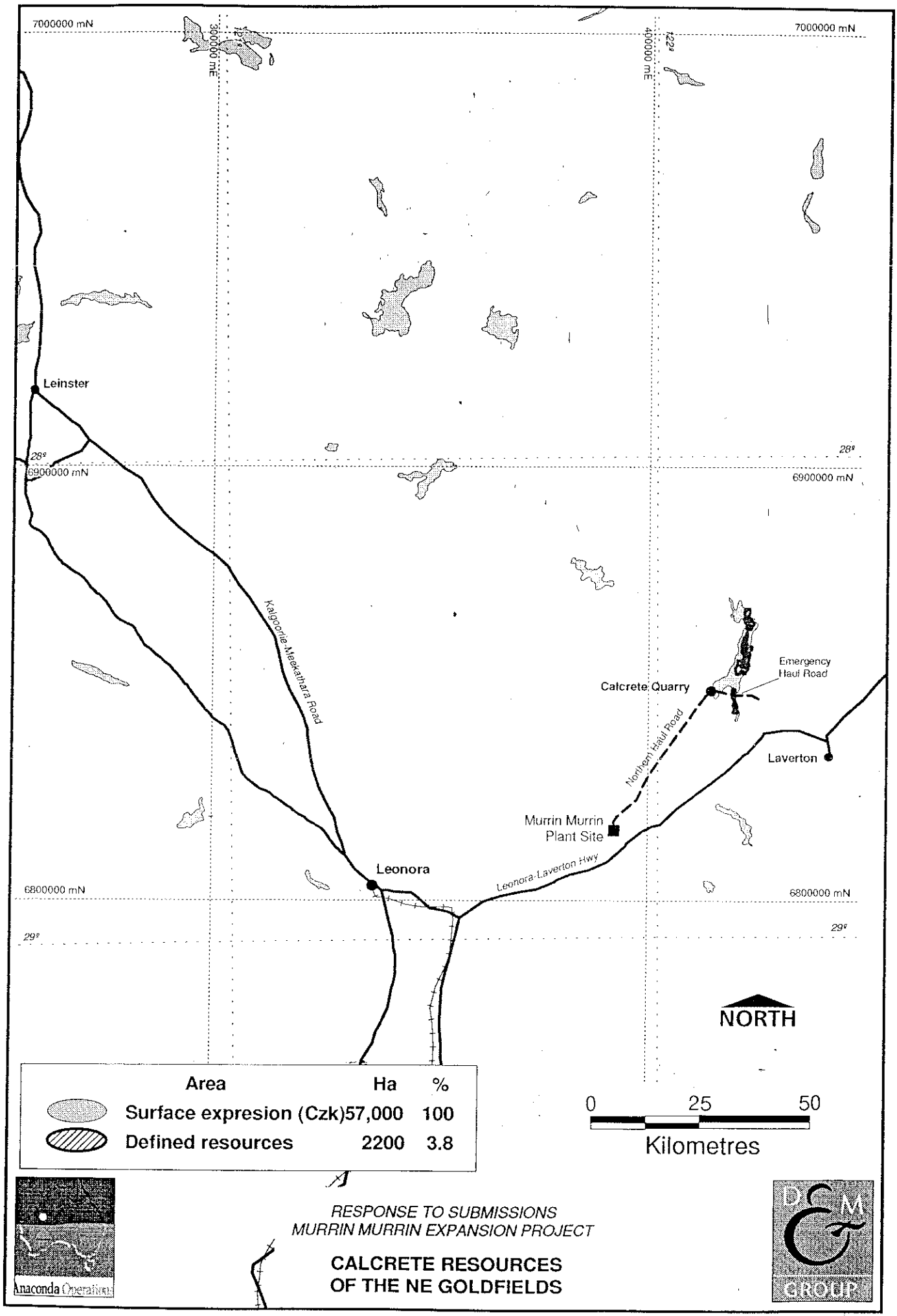

7000000 mN
300000 mE
121°
400000 mE
122°
7000000 mN
Leinster
28°
6900000 mN
28°
6900000 mN
Kalgoorlie-Meekatharra Road
Calcrete Quarry
Emergency Haul Road
Northern Haul Road
Laverton
Murrin Murrin Plant Site
Leonora
Leonora-Laverton Hwy
6800000 mN
29°
6800000 mN
29°
NORTH
Area Ha %
Surface expresion (Czk) 57,000 100
Defined resources 2200 3.8
0 25 50
Kilometres
Anaconda Operations
RESPONSE TO SUBMISSIONS
MURRIN MURRIN EXPANSION PROJECT
CALCRETE RESOURCES
OF THE NE GOLDFIELDS
D&M GROUP

FIGURE 4

APPENDIX A

Appendix A

Approval from the Minister of Aboriginal Affairs

ABORIGINAL AFFAIRS DEPARTMENT

ENQUIRIES: Madge Schwede (08) 9235 8099
OUR REF: 98/0600 I:\idms\open\mls\mls03101.doc
YOUR REF: 402.02.02

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PERTH, WESTERN AUSTRALIA 6
TELEPHONE (08) 9235 8000
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Mr Harry Adams
Major Project Facilitator
Anaconda Nickel Ltd
PO Box 7512
PERTH WA 6850

Dear Mr Adams

ARCHAEOLOGICAL SAMPLING PROGRAM & COMPLIANCE WITH SECTION 18 CONDITIONS - MURRIN MURRIN EAST

Thank you for your letters of 9 and 18 November 1998 in regard to the above.

The report in regard to Aboriginal Consultation, Condition 4 of Anaconda's section 18 approval, was excellent. It is hoped that other companies are as diligent in complying with the conditions and notifying the Aboriginal Affairs Department (AAD) that they have fulfilled their requirements with regard to their section 18 approval.

The Exploration Plan for Hage Bore East 6 & 7 appears manageable, as long as the impact to both sites is kept to a minimum and Joe Mattner's salvage plan is followed closely.

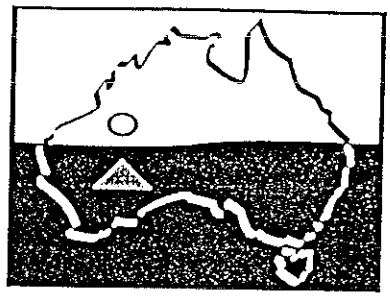
Both Madge Schwede and I would like to thank the Alan Longbon and yourself for inviting us to accompany the Environmental Protection Authority's consultation with the Aboriginal community during the public Review period. The Plant and site visits were most informative and appreciated.

Yours sincerely

IRENE STAINTON
ASSISTANT DIRECTOR, ABORIGINAL
HERITAGE, CULTURE AND POLICY ADVICE

30 November 1998

cc. Mr Alan Longbon, Project Development Coordinator



Anaconda Nickel
ACN 060 370 783 Limited

Date: 09/11/98
Our Ref: 402.02.02

Ms Irene Stainton
Assistant Director
Aboriginal Heritage, Culture & Policy Advice
Aboriginal Affairs Department
1st Floor 197 St Georges Terrace
PERTH WA 6000

Dear Ms Stainton,

RE: COMPLIANCE WITH ABORIGINAL HERITAGE ACT 1972 - SECTION 18 FOR MURRIN MURRIN EAST PROJECT AREA.

Thank you for your letter dated 4th November 1998, in response to your letter I provide the following information on Anaconda's compliance with the conditions set out in the Mininsters approval dated 10th September 1998.

1. *"...the company commission a qualified archaeologist [who] prepares and submits to the Aboriginal Affairs Department a management plan which addresses further detailed recording and analysis of a sample of sites ... including Hage Bore East 6, Hage Bore East 7 and ... Hage Bore East 36"*

   A management plan proposal was submitted to the Aboriginal Affairs Department on Friday 5th November 1998 (Copy attached).

2. *"Aboriginal requests for involvement in a salvage program and the storage and display of collected material be honoured"*

   Aboriginal people are employed on an as required basis for this work. Salvage programs are carried out on a campaign basis and do not provide continuous full time employment.

   A place for the storage and display of collected material is to be set up by Anaconda in consultation and with the direct involvement of Aboriginal people.

Pending the construction of a dedicated display facility material is, for the moment, being stored at Murrin Murrin.

3. *"A representative sample of sites, which are not to be impacted, be protected by marking or fencing the site boundaries as appropriate."*

   It is Anaconda's standard practice to fence all identified Aboriginal Heritage sites, located within its leases, that are not slated for disturbance under a section 18 approval.

   This work is normally carried out by members of the local Aboriginal community under the guidance of the Murrin Murrin Environmental team located onsite.

   Fencing of sites at Murrin Murrin East has already commenced.

4. *"The concerns of members of the Aboriginal community regarding adequate disposal of waste water are addressed"*

   Anaconda has been engaged in a comprehensive Aboriginal liaison program. A report documenting this extensive program is attached to this letter.

I trust that this information closes out your requirements with regard to Section 18 consent conditions for the Murrin Murrin East Project Area.

Should you have any queries please contact the undersigned or Alan Longbon.

Yours faithfully

pp Harry Adams
Major Project Facilitator

Anaconda Nickel
ACN 060 370 783 Limited

REPORT

Murrin Murrin Nickel Cobalt Project
Aboriginal Consultation on Section 18 Ministerial Consent Condition 4 for the Murrin Murrin East Project Area.

Anaconda Nickel Ltd

TABLE OF CONTENTS

Page No.

LIST OF APPENDICES

REPORT

MURRIN MURRIN NICKEL COBALT PROJECT

1. INTRODUCTION

This Report for the Murrin Murrin Nickel Cobalt Project has been prepared to summarise the progress made by Anaconda in complying with the Minister Consent Condition 4 of the Section 18 Approval to Disturb Aboriginal Heritage sites granted by the Minister for Aboriginal Affairs on 10th September. Verification of this progress is presented in Appendices A to C.

Condition 4 reads as follows:

4. *"The concerns of members of the Aboriginal community regarding adequate disposal of waste water are addressed"*

2.1 THE ABORIGINAL COMMUNITY

In addressing Project consultation for the Murrin Murrin Projects the Aboriginal community were contacted by the following means and structure:

1. In person when at attendance at a consultative environmental workshop or other meeting.

2. By mail to both their legal representatives, the Aboriginal Legal Service (ALS), and regional Aboriginal representative peak body, the North East [Goldfields] Independent Body (NEIB), via the Goldfields Land Council (GLC).

3. By telephone and fax to the ALS and the NEIB/GLC.

2.2 CONSULTATION METHODS

2.2.1 Notice of Consultation Meetings

Prior to each consultation meeting, the Aboriginal community were notified by telephone, fax and letter of the date and time of the meetings and requested to confirm attendance and advise of any special requirements. In some instances the Aboriginal Community were also advised in person.

On a number of occasions the meetings were rearranged following advice from the Aboriginal Community that a certain date was not suitable.

2.2.2 Consultation Meetings

In running the consultation meetings the followings methods were employed to consult.

2.2.2.1 On-site Project Specific Consultation

For the Stage 1 and Stage 2 Murrin Murrin Projects Anaconda has carried out extensive Aboriginal Heritage Surveys with qualified anthropologists and archaeologists in concert with local Aboriginal people. A list of surveys carried out is provided at Appendix A.

For the Stage 1 Project each construction approval package (Notice of Intent and/or Works Approval) that was prepared incorporated an onsite Project specific field review/consultation meeting was carried out with local Aboriginal people. One meeting was carried out for each of the Project Approval stages.

Each survey consisted of:

- An on the ground inspection of the relevant area.
- A classroom/briefing session where the theory, layout and working of the relevant Project area was explained.
- Passing of plans, maps, diagrams and text/reports relevant to the relevant Project area being explained.

At the conclusion of each survey a copy of summary information documenting the event was passed to the Aboriginal community in order that they would have a record of the event.

At all field visits the attendees were provided with transport, messing, personnel protective equipment and remuneration by Anaconda.

2.2.2.2 Environmental Consultation Workshops

At the conclusion of the staged Project approval process a series of on-site environmental workshops were held. Attendance at the workshops is presented as Appendix C.

A total of three workshops have been held to date and these are summarised as Appendix A. These workshops consist of classroom sessions where material is presented and discussed. These classroom sessions are then followed by on-site field visits to relevant portions of the Project Area.

The last two workshops incorporated presentations to the Aboriginal community directly addressing the Stage 2 expansion of the Project and all related Project areas inclusive of

Murrin Murrin East. The last table at Appendix A documents these presentations and the portions directly relevant to the Murrin Murrin East and the Stage 2 Project have been highlighted.

The last consultation meeting was held on 23 September 1998 some 18 days after the issue of the Ministers Section 18 Approval. At this meeting the subject of waste water disposal for the Murrin Murrin plant was covered in depth.

At all consultation workshops attendees are provided with transport, messing, accommodation, personnel protective equipment and remuneration by Anaconda.

Transport was provided on-site while a transport allowance was made available so that the Aboriginal community were able to attend site on the day. In some instances hire care arrangements were made by Anaconda for the Aboriginal community directly.

All three consultation workshops have been videotaped, with the consent of all concerned, and a copy of the videotape recording passed to the ALS, NEIB and GLC.

The video tape recordings provide a permanent living record of the consultation that may be viewed by those not in attendance at the workshop on the day.

2.2.2.3 Murrin Murrin Environmental Liaison/Consultation Committee

Formation of the Committee was discussed and agreed at the first workshop. The inaugural meeting of the Committee was programmed concurrent with the second workshop.

The purpose of the committee is to provide a forum through which Anaconda informs the Aboriginal community of progress onsite and the Aboriginal community can table any environmental concerns related to any aspects of the Murrin Murrin Project.

The Committee is comprised of nominated representatives one of the major responsibilities of whom is to inform the Aboriginal community and the wider Aboriginal community of the information disseminated at the committee meeting.

The committee meetings are programmed at quarterly intervals and will continue into the foreseeable future.

2.2.3 Passing of Documentation

Appendix C provides a log of documents passed by Anaconda to the Aboriginal Community on an ongoing basis throughout the consultation period.

Documents were passed to the Aboriginal community via the ALS, the NEIB and the GLC in addition to being freely available at relevant workshop sessions.

APPENDIX A
SUMMARY OF ABORIGINAL ENVIRONMENTAL CONSULTATION

Murrin Stage 1

ETHNOGRAPHIC/ARCHAEOLOGICAL SURVEYS		
Survey No.	Date	Subject
1.	October-December 1995	Cork Tree Bore Field, Valais Bore Field, Koorong North Bore Field, Koorong South Bore Field, Project Area North and Project Area South
2.	February 1996	Calcrete mining area Mt. Margaret Mission Project Area, North Accommodation and Gum Well Bore Field
3.	May 1996	Windarra calcrete area, water pipeline corridor about Valais. Valais Bore Field extension, Roy Well Bore Field, Charlie Bore Field Nambi Station
4.	August 1996	Natural gas pipeline and Dreamtime research
5.	August 1996	Archaeological consultation for Section 18 clearance Application Murrin Murrin Project Area
6.	November 1996	Water Borefield pipeline corridor between Charlie Bore Field to Murrin Murrin Mine Site

Murrin Murrin Stage 2

Survey Date	Group	Area Surveyed
12 August 1997	NEIB – Wongutha Yoongarra NEIB – Tjinintjarra	Murrin Murrin East, additional orebodies at Murrin Murrin North, and additional orebodies at Murrin Murrin South.
15 June 1998	NEIB – Goolburthanoo	Murrin Murrin East, Rail Corridors/ Conveyor Route
16 June 1998	NEIB – Goolburthanoo NEIB – Tjinintjarra	
17 June 1998	NEIB – Goolburthanoo NEIB – Tjinintjarra NEIB – Wongutha Yoongarra	
23 June 1998	NEIB – Waljen NEIB – Goolburthanoo NEIB – Tjinintjarra NEIB – Yulbarri	
24 June 1998	NEIB – Waljen NEIB – Goolburthanoo NEIB – Tjinintjarra NEIB – Yulbarri	Section 18 Consultation
31 July 1998	Yulbarri Tjupan, Munjiljara	Borefields, Pipeline Options
1 August 1998	Thithee Binni Burra Milangka Purunga Mugung Mugung/Tjupan Ngurludharra/Wongutha Yoongarra Tjinintjarra	
2 August 1998	Harris Family Wutha	
24 September 1998	NEIB – Yulbarri	Pipeline Options and Murrin Murrin East.

Murrin Murrin Stage 2 Environmental Consultation

Date	Subject
5 July 1997	Onsite field consultation on Stage 4 Water Supply Notice of Intent.
30 August 1997	Onsite field consultation on Mt. Windarra Calcrete Mining Notice of Intent.

25 October 1997	Onsite field consultation on Stage 6 Ore Mining Notice of Intent.
26 October 1997	Onsite field consultation on Stage 5 Waste Storage/Disposal (TSF and Evaporation Ponds) Notice of Intent.
1 November 1997	Onsite field consultation on Stage 3A and 3B Plant and Utilities Notice of Intent.
1 November 1997	Onsite field consultation on Stage 6 Ore Mining Notice of Intent (second round).
28 February 1998 to 4 March 1998 Five day residential workshop at Murrin Murrin.	• Project Overview. • Stage 1 and 2 site preparation, airstrip and campsite. • Stage 3A and 3B Plant and Utilities. • Stage 4 Water Supply. • Stage 5 Waste Storage/Disposal. • Stage 6 Ore Mining. • Mt. Windarra Calcrete Mining. • Pastoral Activities. • Gas Lateral. • Environmental Management System.
28 July 1998 to 29 July 1998 Two day residential workshop at Murrin Murrin.	• Project update, overview and status of Murrin Murrin Stage 1. • Introduction to and explanation of Murrin Murrin Stage 2 Expansion Project. • Site visit to Murrin Murrin East orebodies and transport infrastructure corridors. • Update on Environmental Management System. • Proposed Expansion Project Process Description. • Site visit of Murrin Murrin Stage 1 Plant Site and mining areas.
23 September 1998 1 day workshop	• Environmental Management System • Project Update, Stages 1 and 2 • Site visit of MM Stage 1 Plant Site

APPENDIX B
LOG OF DOCUMENTS PASSED TO ABORIGINAL COMMUNITY

	DATE OF DOCUMENT	DESCRIPTION
Design and Operation Tailings Storage Facilities Murrin Murrin Nickel Cobalt Project WA	01/02/98	Layman guide to tailings design and operation
Murrin Murrin Project Tailings Storage Groundwater Investigation Presentation	04/03/98	Layman guide to ground water investigation techniques for tailings design and operation
Stage 4 Water Supply Approvals Pack	02/10/98	Approvals correspondence and applications for water supply infrastructure
Stage 5 Waste Disposal Facilities Approvals Pack (Tailings and Evaporation Ponds)	11/03/98	Approvals correspondence and applications for tailings and evaporation ponds.
Stage 6 Ore Mining Approvals Pack.	12/02/98	Approvals correspondence and applications for ore mining.
Mt. Windarra Calcrete Quarry Approvals Pack	12/01/98	Approvals correspondence and applications for calcrete quarrying.
Stage 3B Plant and Utilities Approvals Pack	22/12/97	Approvals correspondence and applications for backend of Plant and Utilities.
Stage 3A Plant and Utilities Approvals Pack.	25/08/97	Approvals correspondence and applications for front end of Plant and Utilities.
Murrin Murrin Nickel Project Management Plan Stage 2 Development	11/12/96	Risk Management Plan for safety for Stage 2 NOI activities
Murrin Murrin Nickel Project Notice of Intent Stage 2 Development	20/12/96	Notice of Intent application for Stage 2 construction activities.
Murrin Murrin Nickel Cobalt Project Management Plan Establishment of Access Roads, Initial Water Supply and Temporary Construction Camp.	30/10/96	Risk Management Plan for safety for Stage 1 NOI activities.
Report Environmental Referral Murrin Murrin Lateral Gas Pipeline for Anaconda Nickel Ltd	19/02/97	Environmental description for gas lateral construction activities.
Murrin Murrin Nickel Cobalt Project Environmental Management Plan Construction Phase, Stages 1-4.	17/08/97	Environmental Management Plan for Construction Stages 1 through to 4.
Application by Murrin Murrin Operations Pty Ltd for Ministerial Permission to Take 140 Plants From Two Populations of Hemigenia Exilis on the Murrin Murrin Project Area	01/01/98	Application to take Declare Rare Flora from orebody at MM5.
Variation to Stage 4 Water Supply – Roy Valais and Korong North Borefields and Supply Trunklines Approvals Pack	08/01/98	Approvals correspondence and applications for variation to Stage 4 Water Supply NOI.
Variation to Mt. Windarra Calcrete Quarry Temporary Turkey Nests for Haul Road Construction Approvals Pack	06/03/98	Approvals correspondence and applications for variation to Mt. Windarra Calcrete Quarry NOI.
Stage 3A Variation: Increase to Plant Fuel Storage Facilities and 10KL Unleaded Fuel Facility - Approvals Pack.	06/03/98	Approvals correspondence and applications for variation to Stage 3A NOI/WAA.
Variation to Stage 2 Notice of Intent Approvals Pack.	08/01/98	Approvals correspondence and applications for variation to Stage 2 NOI for additional diesel storage area.
Letter of Intent – Stage 4 Water Supply – Roy Valais and Korong North Borefields and Supply Trunklines Approvals Pack.	13/01/98	Approvals correspondence and applications for Letter of Intent to vary Stage 4 Water Supply NOI.
Murrin Murrin Nickel Cobalt Project Notice of Intent Establishment of Access Roads, Initial Water Supply and Temporary Construction Camp.	29/10/96	Application Report for Notice of Intent Establishment of Access Roads, Initial Water Supply and Temporary Construction Camp

	DATE OF DOCUMENT	DESCRIPTION
Murrin Murrin Nickel Cobalt Project Performance and Compliance Report Pre-Construction Phase Activities	16/12/96	Project Performance and Compliance Report Pre-Construction Phase Activities
Murrin Murrin Nickel Cobalt Project Environmental Management Plan Construction Phase Stage 1 and 2	09/12/96	Project Environmental Management Plan Construction Phase Stage 1 and 2
Murrin Murrin Nickel Cobalt Project Consultative Environmental Review	01/02/96	Initial Consultative Environmental Review for Murrin Murrin Project
Murrin Murrin Project Changes & Site Alternatives Consultative Environmental Review and Section 46 Review	01/09/96	CER/Section 46 for Murrin Murrin Project
Presentation Hand Out Notes for Ore Mining and Calcrete Quarrying by Richard Hale, Mining Manager	01/03/98	Notes handed out at Workshop by Richard Hale summarising ore mining and calcrete quarrying activities
Documentation for first Aboriginal Environmental Consultation Workshop. • Agenda. • Copy of all documents listed above. • Hard Copy of all over head projector presentation, colour A4 and A3 paper copies of plans and diagrams used at workshop. • Video tape of proceedings.	28 February 1998 to 04 March 1998 Five day residential workshop at Murrin Murrin.	Notes, plans and diagrams used at first Aboriginal Environmental Workshop held on 28 February 1998 to 04 March 1998.
Documentation for Second Aboriginal Environmental Consultation Workshop and inaugural meeting of the Murrin Murrin Aboriginal Environmental Liaison Committee. Agenda Environmental Management System Briefing, Hard copy of over head projector presentation, Colour A4 and A3 paper copies of plans and diagrams used at workshop. Video tapes of proceedings.	28-29 July 1998.	Notes, plans and diagrams used at Second Aboriginal Environmental Workshop and inaugural meeting of the Murrin Murrin Aboriginal Environmental Liaison Committee held on 28 -29 July 1998.
Documentation for Third Aboriginal Environmental Liaison Workshop and second meeting of the Murrin Murrin Aboriginal Environmental Liaison Committee. Agenda Environmental Management System Briefing. Video Tapes of proceedings.	23 September 1998	Notes plans and diagrams used at third Aboriginal Environmental Liaison Workshop and second meeting of the Murrin Murrin Aboriginal Environmental Liaison Committee.

APPENDIX C
LIST OF ATTENDEES OF ABORIGINAL ENVIRONMENTAL CONSULTATION WORKSHOPS

WORKSHOP 1
28 FEB - 4 MARCH 1998

NAME	ORGANISATION
Adrian Meredith	Goolburthanoo
Alison Tucker	Ngurludjarra-Waljen
Allan Bonney	Mungung
Anthony Meredith	Goolburthanoo
Aubrey Lynch	Yulbarri Nomad
Beverley Lynch	Gooth-thoo-bu-nhu
Cassandra Adams	Wutha
Cheryl Cotterill	Bibila
Elvis Stokes	Goolburthanoo
Faye Bilson	Ngurludjarra-Waljen
Glen Barnes	Ngurra Yungarra Diddo
Jennifer Bevan	Bibila
Karyn Vincent	Bibila
Marisa Vincent	Bibila
Marj Bonney	Mungung
Patrick Bonney	Mungung
Patrick Edwards	Tjinintjarra
Phillip Tucker	Ngurludjarra-Waljen
Rex Weldon	Mungung
Rick Landers	Tjinintjarra
Ron Bonney	Mungung
Roxanne Tucker	Ngurludjarra- Waljen
Sadie Canning	Thithee
Shaneanne Weldon	Mungung
Sharon Tucker	Ngurludjarra-Waljen
Shepherd Smith	Tjinintjarra
Winny Stokes	Gooburthunoo
Yvonne Frewen	Gooburthunoo
Harry Adams Alan Longbon Richard Hale Maggie Thomson David Canning Andrew Clayton	Anaconda
Dave Williams	Golder Associates
Niel Milligan	PPK
Brian Bell	Dames & Moore
Murray Hogarth	Department of Environmental Protection

WORKSHOP 2
28/29 JULY 1998

NAME	ORGANISATION
Adrian Meredith	Goolburthanoo
Maisie Harkin	Thithee
Elvis Stokes	Goolburthanoo
Rhys Winters	Tjinintjarra
Aubrey Lynch	Yulbarri Nomad
Shaneanne Weldon	Mungung
Marj Bonney	Mungung
Harry Adams	Anaconda
Alan Longbon	
Edward Clerk	
David Canning	
Andrew Clayton	
Brian Bell	Dames & Moore

WORKSHOP 3
23 SEPTEMBER 1998

NAME	ORGANISATION
Adrian Meredith	Goolburthanoo
Rhys Winter	Tjinintjarra
Patrick Edwards	Tjinintjarra
Celia Sullivan	Tjinintjarra
Jackie McLean	Tjinintjarra
Karen Dear	Ngurra Yungarra Diddo.
Leo Thomas	Waljen
Thelma O'Loughlin	Ngurludjarra- Waljen
Betty O'Loughlin	Ngurludjarra- Waljen
Ivan Forrest	Lungutjarra
Ron Bonney	Mungung
Aubrey Lynch	Yulbarri Nomad
Masie Harkin	Thithee
Dion Meredith	Gooburthunoo
Phillip Tucker	Ngurludjarra-Waljen
Allison Tucker	Ngurludjarra-Waljen
Rommel McGrath	Bibila
Marjorie Bonney	Mungung
Annaliese Walster	Dept of Mines
Trevor Norton	Dept of Environmental Protection
Harry Adams	
Alan Longbon	
Dave Kluken	Anaconda
Andrew Clayton	
David Canning	
Edward Clerk	
Elvis Stokes	Goolburthanoo
Terry Waters	EMS consultant
Mana Waite	Goldfields Land Council

FILE 402.02.02

ENQUIRIES: Madge Schwede (08) 9235 8099
OUR REF: 98/0600 & 97/0936 I:\idms\open\mls\mls02991.doc
YOUR REF: 402.02.02

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TELEPHONE (08) 9235 8000
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Mr Harry Adams
Major Project Facilitator
Anaconda Nickel Ltd
PO Box 7512
PERTH WA 6850

Dear Mr Adams

SECTION 16 - ARCHAEOLOGICAL SITE MANAGEMENT AND SALVAGE PLAN - MURRIN MURRIN EAST PROJECT

Thank you for your letter of 5 November 1998 and accompanying site management and salvage plan. The latter is fine, however Joe Mattner should be aware that the actual number of ethnographic sites recorded for the Murrin Murrin East Project were ten, rather than one, as stated in the Background section of his Plan.

I am also enclosing the section 16 permit, number 209. This will be ratified by the Aboriginal Cultural Material Committee at its next meeting on 15 December 1998.

Yours sincerely

IRENE STAINTON
ASSISTANT DIRECTOR, ABORIGINAL
HERITAGE, CULTURE AND POLICY ADVICE

13 November 1998

MINISTER FOR HOUSING; ABORIGINAL AFFAIRS;
WATER RESOURCES

Our Ref: 03072
Your Ref: 402.02.02

Mr Harry Adams
Major Project Facilitator
Anaconda Nickel
PO Box 7512
PERTH WA 6850

Dear Mr Adams

ABORIGINAL HERITAGE ACT 1972 - SECTION 18 - ANACONDA NICKEL - MURRIN MURRIN EAST PROJECT AREA - EAST OF LEONORA.

I refer to the section 18 application dated 10 July 1998 received from Anaconda Nickel Ltd seeking permission to use the land containing one ethnographic site (Old Linden Road Soak) and 67 archaeological sites, for the development of mines and infrastructure for the Murrin Murrin East Project Area, within Mining, Exploration and Prospecting Leases M39/314, M39/322, EL39/255 (A M39/558-562), EL39/443 (A M39/637), EL39/564 and PL39/3440, east of Leonora.

In accordance with my powers under section 18(3) of the *Aboriginal Heritage Act 1972*, and following consideration of the recommendations from the Aboriginal Cultural Material Committee, I hereby grant consent to Anaconda Nickel Ltd to use the land containing one ethnographic site (Old Linden Road Soak) and the 67 archaeological sites referred to in the consultant's report, for the development of mines and infrastructure for the Murrin Murrin East Project Area, within Mining, Exploration and Prospecting Leases M39/314, M39/322, EL39/255 (A M39/558-562), EL39/443 (A M39/637), EL39/564 and PL39/3440, east of Leonora, on condition that the recommendations of the archaeological report are implemented. In particular that:

- the Company commission a qualified archaeologist, who is issued with a section 16 permit, and prepares and submits to the Aboriginal Affairs Department a management plan which addresses further detailed recording and analysis of a sample of the sites in the Murrin Murrin East Project area, including Hage Bore East 6, Hage Bore East 7 and the historical archaeological aspects of Hage Bore East 36;

- Aboriginal requests for involvement in a salvage program and the storage and display of collected material are honoured; .
- a representative sample of the sites, which are not to be impacted, be protected by marking or fencing the site boundaries as appropriate; and
- the concerns of members of the Aboriginal community regarding the adequate disposal of waste water are addressed.

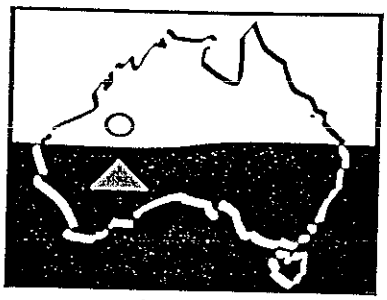
In addition, I am obliged to remind you that as the area is the subject of several Native Title claims, you should not proceed until you have satisfied the relevant provisions of the Native Title Act.

If you have any queries concerning this matter, please contact Mr Peter Randolph on (08) 9235 8100 or Dr Madge Schwede on (08) 9235 8099.

Yours sincerely

Dr Kim Hames MLA
MINISTER FOR ABORIGINAL AFFAIRS

10 SEP 1998



Anaconda Nickel Limited
ACN 060 370 783

Date: 5 November, 1998
Document Reference Number: 402.02.02

Mr Peter Randolph
Department of Aboriginal Affairs
1st Floor Capita Centre
197 St George's Terrace
PO Box 7770
Cloisters Square
PERTH WA 6850

Dear Sir

NOTICE UNDER SECTION 18 OF THE ABORIGINAL HERITAGE ACT 1972 - MURRIN MURRIN EAST PROJECT.

Please find enclosed a management plan, prepared by Mr Joe Mattner (qualified, practicing archaeologist) which addresses the detailed recording and analysis of a representative sample of sites from the Murrin Murrin East area.

This plan is submitted in order to address condition 1 of the Ministers consent to disturb aboriginal sites dated 10th September 1998.

Upon your acceptance of the attached management plan we will move to implement same and proceed to disturb those sites not listed in the plan for salvage.

Should you have any queries on the above matter please contact the undersigned directly on 9212 8550.

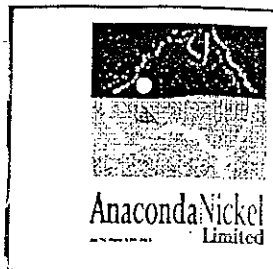
Yours faithfully
ANACONDA NICKEL LTD

Harry Adams
Major Project Facilitator
enc

P.O. Box 7512, Perth WA 6850 - Level 12 Quayside, 2 Mill Street, Perth WA 6000.
Telephone: (08) 9212 8400 Facsimile: (08) 9212 8401

Hage Bore East 6 & 7 Exploration Plan

Anaconda Nickel Limited



"Hage Bore East 4"

"Hage Bore East 5"

6784000 mN

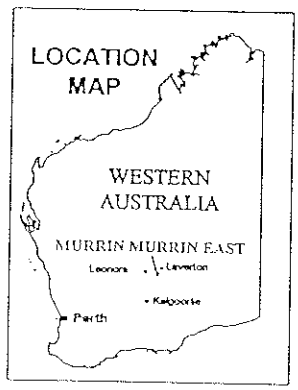
site boundary lost (mining)

"Hage Bore East 6"
(boundary approximate)

Hage Bore East 12

Hage Bore East 11

"Hage Bore East 7"
(boundary very approximate)



6783000 mN

Hage Bore East 13

(uncertain boundary)

Hage Bore East 16

Hage Bore East 14

Hage Bore East 15

Hage Bore East 20

Hage Bore East 19

Hage Bore East 18

Hage Bore East 17

Hage Bore East 24

LEGEND

- Road / Track
- Cut line
- Proposed drill lines
- Proposed drill holes
- 5 m buffer
- Dam
- Creek
- Site not to be disturbed
- Site subject to Section 18 application
- Scattered artifacts
- Anthropological sites

Archaeological Survey by J. Mattner, 7/1998

Pyke Hollow 9

6782000 mN

Pyke Hollow 10

Pyke Hollow 8

Dam

421000 mE

422000 mE

Scale: 1:10,000

0 250 500

metres

Projection AMG Zone 51 (AGD 84)

MME00_Am003 11/1998 X. Bacu

APPENDIX B

Appendix B

Summary of Hemigenia exilis studies

SUMMARY OF STUDIES UNDERTAKEN FOR *HEMIGENIA EXILIS*

BACKGROUND

Hemigenia exilis was first discovered by Spencer Le Marchant Moore in 1895, and described in 1899. After the plants initial discovery, it was not seen again until 1995 when the species was rediscovered on Anaconda Nickel's Murrin Murrin South Project east of Leonora in the Western Australian goldfields (lat.28° 56′ 48″ long. 121° 47′ 30″). It was previously listed as Declared Rare Flora - presumed extinct by the Western Australian Department of Conservation and Land Management (CALM). *Hemigenia exilis* (S.Moore) (Lamiaceae) is an upright multi-stemmed shrub with divaricate branches to 1.5m high, sessile leaves and purple flowers. Most populations of the species occur on eroded slopes and gullies adjacent to the laterite hills. The results of physical and chemical analyses of soils from these sites indicate that the species occurs over a range of habitats. *Hemigenia exilis* appears to be root-suckering with few seedlings evident around mature plants. The fruits of *Hemigenia exilis* contain 4 nutlets which are reticulate or rugose and those of the species *Hemigenia exilis* ripen in early summer. Despite the large quantities of seed produced by individual plants, their root suckering ability indicates that the species may not be an obligate seeder.

OBJECTIVES

In August 1995 Anaconda Nickel commissioned botanical field surveys of the Murrin Murrin Project Area, which identified one population of *Hemigenia exilis* on the Murrin Murrin 3 orebody. A further sixteen days of field searches for *Hemigenia exilis* were carried out in the period from September to November 1995 together with 14 days in January 1996.

The objectives of these surveys were:

- to demarcate the boundaries of known *Hemigenia exilis* populations in the Project Area to facilitate their protection;
- to identify the locations of other populations in the region;
- to define the species' habitat in botanical, geological, physiological or other terms, as well as providing written and photographic records;
- to collect soil samples for analysis;
- to monitor permanently marked plants over an extended period;
- to collect seed for CALM's Threatened Flora Seed Centre;
- to undertake propagation trials from seeds and cutting material; and
- to inform and educate the public about this species through a limited publicity campaign.

Subsequently a total of six populations containing in excess of 800 individuals of *Hemigenia exilis* were found to occur within the Murrin Murrin Project Area. Nine populations of some 2000 pants were also found outside the project area.

INTRODUCTION

Anaconda planned the management of *Hemigenia exilis* populations within the area proposed for exploration drilling in consultation with CALM officers. The company's main concerns were that exploration activities could cause direct or indirect disturbance of this species. Therefore Anaconda submitted an application "to take" no more than 50 *Hemigenia exilis* plants to the Minister for Environment to allow exploration to continue in the Murrin Murrin South project development area. This application was duly approved and enabled Anaconda's personnel to operate equipment within the *Hemigenia exilis* areas under the guidance of a field supervisor. It also allowed for some unavoidable damage to the plants. The conditions attached to this permit included field procedures developed by Anaconda in the preceding weeks. In addition, Anaconda had to record the location of any *Hemigenia exilis* plants destroyed as a result of exploration activities.

On completion of the exploration drilling program in the Murrin Murrin south project development area, the drill lines and access tracks have been closed to all personnel. A follow up survey revealed that even though Anaconda had ministerial approval to destroy up to 50 *Hemigenia exilis* plants, only eight plants had sustained minor stem or branch damage with foliage loss.

Subsequent to Anaconda's initial drilling program in the Murrin Murrin South Project Area, Anaconda set about a regional search of its tenements to identify further populations of *Hemigenia exilis* and develop a regional database. The result of this research has culminated in the following database:

Regional Locations of *Hemigenia exilis*.

Population No.	Plant Nos.	AMG Coordinates North (m)	East (m)	Coordinate Source.	General Location	Map Sheet 1:250,000
HE1	>200	-	-	-	Murrin Murrin South, MM3	Laverton
HE2	~15	-	-	-	Murrin Murrin South, MM3	Laverton
HE3	~20	-	-	-	Murrin Murrin South, MM3	Laverton
HE4	>200	-	-	-	Murrin Murrin South, MM3	Laverton
HE5	>200	-	-	-	Murrin Murrin South, MM5	Laverton
HE6	~200	-	-	-	Murrin Murrin South, MM3	Laverton
HE7	~50	6,800,591	380,153	GPS	Near Rio Tinto	Laverton
HE8	>200	6,875,155-6,875,931	275,051 - 275,470	GPS	Poison Creek	Laverton
HE9	~50	6,776,149-6,776,252	253,242 - 253,424	GPS	Copperfield Breakway, Perrinvale South West of Mt Ida	Menzies
HE10	~100	6,776,184	253,198	GPS	Copperfield Breakway, Perrinvale South West of Mt Ida	Menzies
HE11	>200	6,882,703	271,844	GPS	Head water to Poison Creek South west of Agnew	Leonora
HE12	>400	6,958,968	258,027	GPS	Jones Creek, north of road	Sir Samuel
HE13	3	6,731,513	386,051	GPS	South of Yerilla Homestead	Edjudina
HE14	~200	6,784,327	420,930	GPS	North north east of Yundamindra H.S.	Edjudina
HE15	~50	6,783,662	422,455	GPS	North north east of Yundamindra H.S.	Edjudina
HE16	~300	6,784,663	421,194	GPS	North north east of Yundamindra H.S.	Edjudina
HE17	>150	6,862,500	318,800	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE18	~400	6,862,500	318,200	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE19	~50	6,859,800	315,900	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE20	>350	6,859,800	315,500	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE21	~300	6,859,400	315,800	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE22	~200	6,859,600	316,200	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE23	~2	~6,856,500	~312,800	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora

Regional Locations of *Hemigenia exilis (Continued)*

Population No.	Plant Nos.	AMG Coordinates North (m)	East (m)	Coordinate Source.	General Location	Map Sheet 1:250,000
HE24	~150	6,860,000	316,337	GPS	Wilson Creek, West of Teutonic bore Mining Centre	Leonora
HE25	~200	6,857,378	313,154	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE26	~100	6,857,491	313,465	GPS	Wilson Creek, West of Teutonic Bore Mining Centre	Leonora
HE27	~40	6,856,881	301,856	GPS	Wilson Creek, North of Minnicritchie Well	Leonora
HE28	~800	6,858,248	306,928	GPS	Wilson Creek, North of Jungle Well	Leonora
HE29	~400	6,868,717	302,842	GPS	Marshall Creek, east of Heather Well.	Leonora.
HE30	~2500	6,860,130 6,860,635	306,950 307,080	DGPS	Marshall Pool, south of Clifford Bore.	Leonora
HE31	~4000	6,863,830 6,864,600	303,495 303,740	DGPS	Marshall Pool, west of Clifford Bore.	Leonora
HE32	~200	6,864,240 6,864,275	305,300 303,330	DGPS	Marshall Pool, north of Clifford Bore.	Leonora
HE33	~500	6,785,250	420,450	DGPS	Eucalyptus, east of Hage Bore	Edjudina
HE34	~50	6,785,750	420,470	DGPS	Eucalyptus, east of Hage Bore	Edjudina
HE35	~50	6,785,230	420,780	DGPS	Eucalyptus, east of Hage Bore	Edjudina
HE36	~30	6,784,100	420,560	DGPS	Eucalyptus, east of Hage Bore	Leonora
HE37	~15	6,806,450	382,450	GPS	Hepl, Minara Station	Laverton
HE38	~45	6,805,900	382,175	GPS	Hepl, Minara Station	Laverton
HE39	~150	6,873,400	302,540	DGPS	Marshall Pool, northeast of Clifford Bore.	Leonora
HE40	~20	6,861,954	303,350	DGPS	Marshall Pool, west of Clifford Bore.	Leonora.
HE41	~300	6,869,130	303,190	DGPS	Marshall Pool, southeast of Heather Well.	Leonora.
HE42					South of Malcolm rail siding	Leonora.

MONITORING PROGRAM

A long term monitoring program which has focused on the *Hemigenia exilis* populations known as HE1-6 commenced in 1995 to study the biology of the species and to monitor any impacts of Anaconda Operations activities on the condition of these populations. These populations were chosen due to their proximity to areas being explored and developed by Anaconda Nickel. The

presence of personnel in the vicinity facilitated the protection and additional opportunistic monitoring of these populations.

The condition of 41 juvenile and mature plants, and their habitats, has been monitored and recorded each month for a period of a 25 months. In June 1998 monitoring was subsequently reduced to quarterly observations, in consultation with CALM, due to the de-listing of *Hemigenia exilis* from the Declared Rare Flora status.

The aim of monthly observations was to identify any physical changes to the plants (such as changes in leaf colour, growth increments, the position of the new seasons growth, time of flowering and climatic factors associated with flowering) during summer, winter and the onset of rains. In addition, field observations monitored the regrowth of plants and checked for signs of grazing.

Over the 25 month period Anaconda has been able to develop a substantial database of both field observations and a photographic record. Anaconda's monitoring program of *Hemigenia exilis* has exceeded all its objectives by increasing the parameters monitored by including detailed observations of surrounding flora as well as increasing the initial 12 month monitoring period to 25 consecutive months. Anaconda's substantial monitoring program is ongoing and has been commended by CALM as an industry best practice in environmental monitoring of Declared Rare Flora.

SEED COLLECTION TRIALS

In addition to the survey work Anaconda has carried out a seed collection program as the *Hemigenia exilis* fruit ripened in November and December. This program required approval from the minister for the Environment "to take" Declared Rare Flora for the express purpose of collecting seed. The seed was collected for use in seed germination trials and for CALM's Threatened Flora Seed Centre. CALM's Threatened Flora Seed Centre requested that 1, 000 seeds be collected from upto ten individual plants within each *Hemigenia exilis* population, or from several plants within close proximity from each other.

CALM commenced germination trials in April 1996 to test the viability of the seeds and the early results demonstrated germination occurring in as little as ten days. The germinants were offered to the Kings Park and Botanic Garden were they have been grown at their nurseries.

With funding from Anaconda Nickel, CALM's Threatened Flora Seed Centre collected seed from a number of populations over three years for germination trials. The development of a suitable protocol for the germination of *Hemigenia exilis* seed was the objective of these trials. In July 1998 a final report on this research was completed. This final report concluded that all the initial objectives

set out in 1995 and all other objectives that had been developed over the 3 year period had been achieved. In summary the final report on the seed biology of *Hemigenia exilis* concluded the following points:

- Research of the seed biology of *Hemigenia exilis* using a reduced surface tension test results indicated that less than one third of the seed produced at any one time was potentially viable;
- a range of treatments were used to initiate germination; these included the use of smoked water, varying concentrations of the growth hormone Gibberellic Acid, scarification of he seed coat, heat and/or cold stratification, the application of aqueous smoke solution and the removal of the seed plug (located on the ventral surface of the seed) under three different temperature regimes (constant 15, alternating 25/10 and 30/5 C);
- these treatments were used singly or in combination;
- seed commenced germination within 6 days and continued up to 120 days, with germination ranging from 0% to 87%;
- a distinct variation in germination between populations was also evident;
- the results from these germination trials suggests that this species posses some form of dormancy which requires combined or sequential environmental stimuli to maximise germination;
- dormancy can be partially broken by the application of the growth hormone Gibberellic Acid (38% germination) and in full by removal of the seed plug in combination with Gibberellic Acid application (87% germination). The term *epistomium* has been adopted in the apparent absence of a suitable term to describe that portion of the seed that acts as a plug. This research has significant implications for the conservation and rehabilitation of wild populations of this species.

DNA RESEARCH

In 1996 Anaconda Nickel began funding for a Ph.D. study into genetic research of *Hemigenia exilis*. This research has been undertaken Ms Julia Mattner through the Kings Park Laboratories and has involved many field trips to the Leonora/Laverton area over the last two years. The basis of this research was to gain an understanding of the genetic makeup and variability between populations of *Hemigenia exilis* in an attempt to understand the bio-diversity of the species. To date, over 50 plants have been tested for genetic variability. Research has thus far indicated that from the populations tested, HE1 and HE4, they are well dispersed in terms of genetic material indicating less significance in genetic makeup between populations than previously thought. The culmination of work undertaken by Anaconda Nickel in the DNA research and management of *Hemigenia exilis* has led to *Hemigenia exilis* being taken off the Declared Rare Flora listing and reduced to a priority 4 status
A final report of the DNA research of *Hemigenia exilis* is to be submitted in 1999.

MANAGEMENT PLAN FOR *HEMIGENIA EXILIS*

The management of *Hemigenia exilis* during exploration and construction phase of the Murrin Murrin Stage 1 Project was conducted in accordance with Conservation and Management Plan for *Hemigenia exilis* (1996e). This management plan was prepared by Dames & Moore for Anaconda Nickel Ltd and was considered a comprehensive plan of management for the species by CALM.

During the operational phase of the Murrin Murrin Stage 1 Project, *Hemigenia exilis* will be managed in accordance with the Environmental Operational Procedure *EOP 01: Vegetation Management - Rare Flora.* The procedure is incorporated within the Company's Environmental Management System which was prepared in consultation with CALM, DME and DEP and approved by the EPA. The procedure is required to minimise disturbance and ensure protection of Rare Flora in the Project area in accordance with the Proponent Environmental Management Commitment No. 4 and the *Wildlife Conservation Act 1950.*