Murrin Murrin nickel cobalt project — project changes and site alternatives

Anaconda Nickel NL

Report and recommendations
of the Environmental Protection Authority

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Summary

The Minister for the Environment issued approval to Anaconda Nickel NL in June 1996 to implement the Murrin Murrin Nickel-Cobalt Project (Ministerial Statement 418, 5 June 1996).

This report is to provide Environmental Protection Authority (EPA) advice to the Minister for the Environment on proposed changes to the project as set out in the Consultative Environmental Review and Section 46 Review (CER/S46, Dames and Moore, 1996b).

The company is seeking to modify the existing approval for the Murrin Murrin Nickel-Cobalt Project to include:

(a) changes to the processing plant;

(b) the options to produce a number of different products at different rates to those originally proposed;

(c) the option to purchase anhydrous ammonia;

(d) the addition of Roy Borefield;

(e) the option to include gypsum dams within the waste disposal facilities.

The Company is also seeking approval to locate certain project facilities at alternative sites within the general project area.

In the EPA's opinion the following are the environmental factors relevant to the proposals:

(a) Declared Rare and Priority flora;

(b) vegetation communities;

(c) Threatened and Priority fauna;

(d) surface water;

(e) groundwater quantity;

(f) gaseous emissions; and

(g) solid and liquid waste.

The conditions and procedures, in the EPA's opinion, to which the modified project should be subject if implemented are in summary:

(a) the existing Ministerial Conditions applied to the project (Ministerial Statement 418, 5 June 1996), subject to modification of Conditions 1 and 5 (proponent's commitments, and greenhouse gases) as set out in (b) and (c) below;

(b) the proponent's additional commitments made in the CER/S46 document (Dames and Moore, 1996b), and summarised in Table 4 of this report, should be made enforceable; and

(c) the proponent should be required to:

  (i) calculate greenhouse gas emissions for the project;

  (ii) indicate measures adopted to limit greenhouse gases;

  (iii) estimate comparative greenhouse gas efficiency of the project; and

  (iv) consider entry into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement programme.

These conditions and procedures should apply to the project if implemented at the existing approved sites, or at the proposed alternative sites.

The EPA submits the following recommendations:

Recommendation 1

That the Minister for the Environment note the relevant environmental factors and EPA objective set for each factor as set out in Section 3 of this report.

Recommendation 2

That subject to the satisfactory implementation of the EPA's recommended conditions and procedures of Section 4 of this report, including the proponent's environmental management commitments, the modified project can be managed to meet the EPA's objectives, at either the existing approved sites, or the proposed alternative sites.

Recommendation 3

That the Minister for the Environment imposes the conditions and procedures set out in Section 4 of this report.

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1. Introduction

This report is to provide Environmental Protection Authority (EPA) advice and recommendations to the Minister for the Environment on the environmental factors relevant to proposals by Anaconda Nickel NL to modify components of the existing approved Murrin Murrin nickel cobalt project, and to locate certain project facilities at alternative sites.

The Murrin Murrin nickel cobalt project was originally assessed at the level of a Consultative Environmental Review, with the EPA providing its report and recommendations to the Minister for the Environment in May 1996 (EPA 1996a). Approval to implement the project, subject to a number of Environmental Conditions, was issued on 5 June 1996.

In August 1996 Anaconda Nickel referred proposals to the EPA to modify components to the project, and to locate certain project facilities at alternate sites. The Minister for the Environment requested the EPA to assess the proposed modifications under Section 46 of the *Environmental Protection Act 1986*, which provides the mechanism for changing Environmental Conditions applicable to a project. In addition the EPA decided to assess the proposed site alternatives at the level of a Consultative Environmental Review. A combined CER/S46 report was released in September 1996 (Dames and Moore, 1996b).

Further report details of the proposals are given in Section 2 of this report. Section 3 discusses environmental factors relevant to the proposals.

Conditions and procedures to which the proposals should be subject if the Minister determines that they may be implemented are set out in Section 4. Section 5 presents the EPA's recommendations to the Minister.

Appendix 1 provides maps relating to the proposals. A list of people and organisations that made submissions is included in Appendix 2, and published information is listed in Appendix 3.

2. The proposals

Approved project

A detailed description of the existing approved project is provided in Anaconda's Consultative Environmental Review (Dames and Moore, 1996a).

The major components of the Murrin Murrin Nickel-Cobalt Project comprise:

- open-cut nickel-cobalt ore mining operations;
- open-cut calcrete mining operations;
- a processing plant comprising:
  - ore preparation facilities;
  - a high pressure acid leaching process circuit;
  - a counter current decantation washing circuit;
  - a slurry neutralisation circuit;
  - a solution neutralisation circuit;
  - a mixed sulphide precipitation circuit; and
  - a nickel and cobalt refinery;
- water supply borefields; and
- solid and liquid waste disposal facilities (including an evaporation pond, a tailings dam and overburden stockpiles).

These mining and processing operations would be supported by:

- a double contact sulphuric acid plant, with heat recovery for steam generation;
- a power generation and distribution system;
- industrial gas plant;
- on-site fuel and chemical storage facilities;
- product and raw materials handling systems;
- administration, plant support and plant control facilities;
- workforce accommodation;
- airstrip; and
- dedicated mine haul roads.

A location map is provided at Figure 1 (Appendix 1) and the approved project layout is shown in Figure 2 (Appendix 1).

Proposed modifications to the approved project (Section 46)

The proponent is seeking to modify the existing environmental approval for the Murrin Murrin Nickel Cobalt Project to allow:

- changes to the processing plant to enable the production of cobalt metal through hydrogen reduction; and
- the options to produce either mixed nickel cobalt sulphides or process these to produce:
  - nickel metal powder or briquettes;
  - cobalt metal cathode, powder or briquettes; or
  - cobalt metal salts,

  which will result in changes to the quantity of the various products produced at any one time;
- the option to purchase anhydrous ammonia;
- the addition of Roy Borefield; and
- the option to include gypsum dams within the waste disposal facilities.

Key project characteristics provided in the CER/S46 document, including raw materials inputs and process outputs, are indicated in Table 1.
A detailed description of the proposed modifications to the existing approved project is provided in Section 2 of Anaconda's CER/S46 document (Dames & Moore 1996b).

Alternative sites (CER)

The proponent is also seeking separate environmental approval to be able to locate certain project facilities at alternative sites, if it cannot obtain tenure to existing approved sites. The alternative sites are described in the CER/S46 document (Dames & Moore 1996b) and include:

- Northern Processing Plant site;
- Northern Disposal Facility site;
- alternative construction camp site;
- alternative accommodation village site;
- alternative airstrip site; and
- alternative haul road routes.

The alternative locations and development scenarios are shown in Figures 3 and 4 (Appendix 1).

Table 1. Summary of key project characteristics (from Dames & Moore 1996b)

	Approved Project Capacity	Plant Design Capacity	Project Maximum Capacity
Inputs			
Nickel Cobalt Ore (Mtpa)	4.00	4.032	4.5
Calcrete[1] (Mtpa)	0.90	1.3	1.5
Elemental Sulphur (Mtpa)	0.49	0.54	0.62
Process Water (Mlpd)	30	30	34
Natural Gas (TJpd)	20	8	25
Outputs[2]			
Nickel Metal Briquettes (tpa)	27,000	45,500	50,000
Cobalt Metal Briquettes (tpa)	0	3,000	3,800
Cobalt Cathode Metal (tpa)	1,550	1,550	3,800
Cobalt Sulphate Crystals (tpa)	8,200	8,200	8,200
Mixed Nickel Cobalt Sulphide Powder (tpa)	29,000	29,000	100,000
Nickel Powder (tpa)	0	20,000	20,000
Cobalt Powder (tpa)	0	3,800	3,800
Ammonium Sulphate Crystals (tpa)	60,000	145,000	160,000
Tailings Dam Solids (Mtpa)	3.75	3.3	3.75

Note: (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 1.3Mtpa is based on a calcium carbonate content of 52%.

(2) The product masses listed as the outputs for the Plant Design and Project Maximum columns represent the maximum production rates for each product in isolation from other related products.

3. Environmental factors

3.1 Relevant environmental factors

In the EPA's opinion, based on the submissions and material listed in Appendices 2 and 3, the following are the environmental factors relevant to the proposals:

(a) Declared Rare and Priority flora;

(b) Vegetation communities;

(c) Threatened and Priority fauna;

(d) surface water;

(e) groundwater quantity;

(f) gaseous emissions; and

(g) solid and liquid waste.

3.2 Declared Rare and Priority flora

Aspects of Declared Rare and Priority flora

A description of flora in the project area and the potential impacts of the project is provided in the CER/S46 document (Dames and Moore 1996b).

A total of 339 vascular plant species (including six introduced species) from 146 genera and 52 families were recorded in the project area.

One Declared Rare Flora - Presumed Extinct species, *Hemigenia exilis*, was recorded in the project area. A total of 29 populations comprising 5,600 plants have been identified in the region by the proponent. Six populations occur within the project area.

CALM (1995), quoted in the CER (Dames and Moore, 1996a), indicates that the classification Declared Rare Flora-Presumed Extinct was developed for taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or taxa of which all known wild populations have been destroyed more recently.

The proponent indicates that up to 500 individuals of *Hemigenia exilis* will be directly affected by mining operations in the 30 year life of the project (Dames and Moore, 1996b). The modifications to the project, and the proposed alternative sites, are not expected to increase the impacts on this species. The populations outside the project area will not be affected by the development of Anaconda's project.

Assessment

The area considered for the assessment of this relevant environmental factor is the Laverton Sub-region of the Austin Botanical District, as this is an area over which vegetation communities form a representative environmental system.

The EPA's objective for this environmental factor is "to protect Declared Rare and Priority flora".

The EPA notes that the proponent has taken a number of initiatives in respect of the Declared Rare Flora *Hemigenia exilis.* These include:

- additional local and regional searches for *Hemigenia exilis*;
- collection of seeds for the CALM Threatened Seed Centre; and
- provision of seeds and cuttings to the Kings Park and Botanic Gardens for storage and propagation by cutting, grafting and tissue culture.

The proponent has committed to constructing, operating and decommissioning the project in a manner that minimises disturbance to *Hemigenia exilis,* and to comply with the requirements of the *Wildlife Conservation Act, 1950.*

Existing Ministerial Condition 4 (Ministerial Statement 418, 5 June 1996) requires the proponent to prepare and implement a plan for the conservation and management of this species to the requirements of CALM.

CALM has acknowledged that the proponent has demonstrated a willingness to assist it with management of this species beyond the project area. The Australian Nature Conservation Agency (ANCA) has recommended that the project be allowed to proceed subject to the proponent consulting with CALM.

The EPA also notes that impacts on this species are not expected to be increased by the modifications to the project, or the proposed relocation of certain facilities to alternative sites.

Having particular regard to:

(a) the proponent's commitments in respect of the Declared Rare flora;

(b) the existing Ministerial Condition relating to conservation and management of this species; and

(c) the advice from CALM and ANCA,

it is the EPA's opinion that the proposed modifications to the project, and alternative sites, are unlikely to compromise its objective for protection of Declared Rare and Priority flora.

3.3 Vegetation communities

Aspects of vegetation Communities

A description of vegetation in the project area and the potential impacts of the project is provided in the CER/S46 document (Dames and Moore 1996b).

A total of 40 plant communities were defined and mapped for the project area of which seven are considered to be locally and regionally significant.

Small areas of locally and regionally significant vegetation communities will be disturbed by the proposed relocation of certain project facilities at alternative sites. In some cases the proposed relocations will reduce disturbance. Overall, the proposed modifications and the alternative sites are not expected to significantly alter the project's impacts on vegetation communities.

Assessment

The area considered for the assessment of this relevant environmental factor is the Laverton Sub-region of the Austin Botanical District, as this is an area over which vegetation communities form a representative environmental system.

The EPA notes that the proponent has committed to minimising disturbance to vegetation communities, and progressively rehabilitating disturbed areas. This will be further addressed in an Environmental Management Programme to be prepared and implemented to the satisfaction of the EPA on advice from DEP, CALM and DME.

The proponent has committed to complying with the *Wildlife Conservation Act, 1950* .

The EPA also notes that the proposed modifications to the project, and the alternative sites, are not expected to significantly alter the project's impacts on vegetation communities.

Having particular regard to the proponent's commitments to minimise impacts on vegetation communities, and to comply with the *Wildlife Conservation Act, 1950,* it is the EPA's opinion that the proposed modifications to the project, and the alternative sites, are unlikely to compromise its objective for vegetation communities.

3.4 Threatened and Priority fauna

Aspects of Threatened and Priority fauna

The CER/S46 report (Dames and Moore 1996b) indicates that:

- a description of likely fauna for the project area has been determined by a desktop survey of relevant scientific literature and other data;
- the habitats of the project area have the potential to support approximately 102 species of birds, 19 native mammals, nine introduced mammals, seven frogs and 74 reptiles species;
- the fauna habitats in the project area are well represented throughout the region and none are considered to be significant;
- the loss of fauna habitat due to clearing may lead to the disturbance of some fauna;
- impacts will be minimised by a range of measures including:
  - minimising the extent of disturbance to the vegetation of the project area;
  - maintaining existing pastoral bores and watering points, where possible;
  - feral animal control;
  - covering drill holes and trenches wherever possible, and capping of exploration drill holes;
  - prohibiting firearms and domestic pets, etc.

- the proposed modifications to the project, and relocation of certain facilities to alternative sites, are not expected to significantly alter the project's impacts on fauna.

The report states that the modifications to the project, and the alternative sites, are not expected to increase the project's impacts on fauna.

Assessment

The area considered for assessment of this relevant environmental factor is the project area, as this is the area over which fauna habitats may be impacted.

The EPA's objective for this environmental factor is to "protect Threatened and Priority fauna species".

The EPA notes that the proponent has outlined a range of measures in the original CER (Dames and Moore 1996a) to manage the potentially adverse impacts of the project on fauna. The proponent has committed to carrying out surveys of the area in consultation with CALM, and to include management of fauna in the Environmental Management Programme for the project.

The EPA also notes that the fauna habitats which would be affected by the project are well represented within the region and none are considered significant.

CALM advised that the potential impacts have been identified, and that satisfactory commitments have been made for their management.

Having particular regard to:

(a) the fact that fauna habitats which would be affected are well represented elsewhere in the region; and

(b) the proponent's commitments to carry out fauna surveys and implement fauna management measures as part of an Environmental Management Programme;

it is the EPA's opinion that the proposed modifications, and alternative sites, are unlikely to compromise its objective to protect Threatened and Priority fauna.

3.5 Surface water

Aspects of surface water

Physical changes to the land surface as a result of the construction of haul roads, mine pits, infrastructure, tailings dam and evaporation pond, have the potential to impact surface water flow and quality On average there are 40 rain days per year in the region, with highest daily rainfalls occurring between January and March.

The CER/S46 report (Dames and Moore, 1996b) indicates that the effects of the project will be limited to :

1. Modification of existing drainage patterns

   Diversion channels will be constructed to reflect the natural channel characteristics and provide alternative flow paths. These changes are considered unavoidable by the proponent.

2. Reduction in downstream flow.

   Direct rainfall into the operating mining areas, treatment plant area, evaporation pond and tailings dam will reduce the available surface water runoff. The largest area involved is the tailings dam which is expected to collect runoff from approximately 10 km^2 when it reaches its full extent. This would constitute less than 2% of the total catchment area of Cement Creek (584 km^2) and is therefore expected to result in a small decrease in the available runoff.

3. Potential water quality impacts

   The diverted surface water runoff will be confined to channels and is not expected to be contaminated by mining works. However, the volume of sediment may be altered, particularly during the construction period. The amount of sediment in the stream water will probably reflect the amount of vegetation clearing and could lead to undesirable erosion problems. The movement of surface soils during construction will be kept as low as practicable by clearing areas only where necessary and revegetating wherever possible.

   The stream flow in Cement Creek downstream of the plant area, airstrip and accommodation village will be monitored for contamination through the measurement of pH, TDS, total suspended solids (TSS) and conductivity. Similar water quality monitoring is proposed for Katata Creek.

In response to an issue raised in the submissions, the proponent advised that 'drainage shadows' may occur in mulga communities where surface runoff is reduced. The proponent indicated that disturbance to sheet flow and mulga communities will be minimised wherever possible. The proponent considers impacts will be localised and not significant.

Assessment

The area considered for the assessment of this relevant environmental factor, surface hydrology, is the Cement Creek and Katata Creek catchments. This is the area within which the proposal could alter surface water flow and quality.

The EPA's objective in regard to this environmental factor is to "ensure no significant adverse changes to drainage and land systems, vegetation and fauna".

The EPA notes that the proponent has committed to minimise 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 monitoring programme for Cement Creek and Katata Creek. These monitoring programmes will be developed and implemented to the requirements of DME, WRC and the EPA.

The EPA considers that effects on vegetation as a result of changes to the drainage patterns are unlikely to be significant, and can be managed through the measures included in the proponent's commitments

The proponent has also indicated that it will install sedimentation ponds if necessary. The PEA considers that this should be addressed in the Environmental Management Programme which is to be prepared in the pre-construction phase, to clearly indicate when basins will be installed.

Having particular regard to the proponent's commitments to:

(a) minimise affects on surface hydrology;

(b) carry out water quality monitoring; and

(c) to include measures to manage water quality problems in an Environmental Management Programme;

it is the EPA's opinion that its objective for surface hydrology is unlikely to be compromised by the proposed modifications to the project, and the alternative sites.

3.6 Groundwater quantity

Aspects of groundwater quantity

An estimated average of 30,000 m^3/d of water at less than 4,000 mg/L total dissolved salts and less than 2,000 mg/L chloride concentration will be required as process water for the 30 year life of the project. The maximum expected water requirement is 34,000 m^3/d, however, the proponent has indicated that it may apply to extract up to 40,000 m^3/d to provide additional security to the project's water supply.

Process water is to be extracted by borefields at the five locations identified for the approved project and an additional borefield, the Roy borefield, which is included as one of the proposed changes to the project.

In the CER/S46 report (Dames & Moore, 1996b), the proponent states that the ability of each borefield to meet a sustainable yield over the life of the project has been estimated through calculations of the current storage available to a system of simulated wells. The consultants (Dames and Moore) consider this approach to be conservative, due to the adoption of conservative storage capacity values and since no allowance is made for aquifer recharge.

The report also indicates that, due to the hard nature of the shallow ferricretes and silcretes in the Roy borefield area, it is unlikely that vegetation in the area is phreatophytic; that is dependant on groundwater. However, the proponent will monitor the condition of vegetation in the vicinity of the borefields and suitable control areas, to determine if the operation of the borefields is adversely impacting vegetation communities in the area.

Assessment

The area considered for assessment of this relevant environmental factor, groundwater quantity, is the extent of draw down from the wellfields. This is the area over which groundwater levels could be impacted by pumping.

The EPA's objective in regard to this environmental factor is "to ensure that groundwater quantity is adequately maintained and that indigenous vegetation is not threatened".

The EPA notes that the project site falls within the Goldfields Groundwater Area and that a decision by the Water and Rivers Commission (WRC) on the acceptability of the proponent's borefields is required before a licence would be issued under Part III of the *Rights in Water and Irrigation Act 1914*. Where uncertainties exist in relation to the adequate protection and management of groundwater resources, the WRC has a responsibility to require developers to provide it with appropriate detailed studies prior to decision making or the granting of any approvals to develop a borefield. Where such studies indicate that water supply issues cannot be adequately protected or managed then it is the responsibility of the WRC to refuse the licence or seek alternative measures to address the issues of concern.

The WRC advised that the proponent has obtained a groundwater abstraction licence for the existing approved wellfields and is liaising with the Commission regarding a licence for the additional Roy borefield. The EPA considers that any groundwater licence issued for the Roy borefield should contain conditions that the volume of groundwater permitted to be pumped will be reviewed if monitoring indicates adverse impacts on the vegetation.

Having particular regard to:

(a) the proponent's commitments to monitor vegetation in the wellfield areas; and

(b) the licensing powers of the Water and Rivers Commission;

it is the EPA's opinion that its objective for groundwater quantity is unlikely to be compromised by the proposed modifications to the project, and the alternative sites.

3.7 Gaseous emissions

Aspects of gaseous emissions

The proponent has repeated air dispersion modelling initially carried out for the approved project, to include the cobalt sinter plant and the revised emission characteristics.

The predicted SO_2 and NO_2 levels are summarised in Table 2.

Table 2. Maximum predicted ground level concentrations (from Dames & Moore 1996b).

Pollutant	Maximum Predicted Concentration for each Averaging Period (µg/m³)				
	1-Hour			24-Hour	Annual
	Over Whole Modelled Area	Beyond the Plant Boundary	At Closest Residence[1]	Over Whole Modelled Area	Over Whole Modelled Area
Sulphur Dioxide					
• Normal Operations	720	610	91	79	6.7
• Upset Conditions	1,440	950	154	129	10.5
Nitrogen Dioxide					
• Normal Operations[2] (one gas turbine)	100	90	15	14	1.2
• Upset Conditions[2] (two gas turbine)	105	100	22	17	1.5

Note (1) Minara Homestead.

(2) Assuming that all oxide of nitrogen are emitted as nitrogen dioxide.

The proponent has also estimated (Dames & Moore 1996b) that the proposed project will emit a total of 0.38 Mtpa of carbon dioxide. The major sources of carbon dioxide emissions are related to the neutralisation of the process streams with calcrete, power generation, and the production of hydrogen gas. Greenhouse gas emission have been minimised by efforts to ensure the efficient use of energy. The major energy efficient features being:

- recovery of heat from the gas turbine for the generation of steam and additional electrical energy; and
- recovery of heat from the sulphuric acid plant where the combustion of sulphur is expected to supply over 90% of the projects' energy requirements.

Assessment

The area considered for assessment of this relevant environmental factor, gaseous emissions, is the project area and its immediate environs. This is the area within which gaseous emissions must be controlled to meet policy limits.

The EPA's objective for this environmental factor is "to ensure that gaseous emissions, including greenhouse gases and odours, both individually and cumulatively, conform to the agreed standards and do not cause an environmental or human health problem in the area surrounding the proposed plant". Further, the EPA considers the proponent should use all reasonable and practical measures to reduce the discharge of wastes, including gases.

The EPA has promulgated two Environmental Protection Policies (EPPs) for atmospheric pollutants for the Kwinana and Kalgoorlie areas. The EPA uses the Kwinana EPP standards and limits as guidelines for the assessment of new industrial projects (where there are no existing sources) and for existing industrial plants which are seeking approval for modifications (EPA 1992).

In the Kwinana EPP, a limit is defined as "a concentration not to be exceeded" and a standard is defined as "a concentration which it is desirable not to exceed". The standard is interpreted as the value which the ground level concentration must be below for 99.9% of the time.

The standards and limits for sulphur dioxide and particulates used in the EPP for the Kwinana policy area are summarised in Table 3 below.

Table 3. Standards and limits used in the EPP for the Kwinana Policy Area

Species	Area	Averaging Period	Standard ($\mu g/m^3$)	Limit ($\mu g/m^3$)
Sulphur Dioxide	Industrial Estate	1 hour	700	1400
		24 hour	200	365
		Annual	60	80
	Residential	1 hour	350	700
		24 hour	125	200
		Annual	50	60
Particulates PM_{10}	Residential	24 hour	-	120
		Annual	-	40

The EPA notes that the modelling carried out by the proponent indicates that predicted ground level concentrations of SO_2 and NO_2 at the nearest residence will be below the EPP standards at all times. NO_2 levels will be less than the standard of 320 $\mu g/m^3$ over the entire area modelled at all times. SO_2 levels will only exceed the EPP limit of 700 $\mu g/m^3$ for short distances beyond the plant boundary during startup of the sulphuric acid plant.

Having particular regard to its policy for atmospheric pollutants adopted in the Kwinana EPP, and the air dispersion modelling results, it is the EPA's opinion that its objective for gaseous emissions relating to SO_2 and NO_2 can be met by the modified project at the existing approved sites, or the proposed alternative sites.

The EPA notes that the estimated load of carbon dioxide emitted by the project represents an increase of around 0.1% in the total emissions of carbon dioxide in Australia in 1994 and that the proponent has taken a number of measures to reduce emissions. However, the EPA considers that the existing Ministerial Condition relating to greenhouse gas emissions (Condition 5) should be strengthened.

The EPA considers that the proponent should be required to:

1. calculate the greenhouse gas emissions for their project;
2. indicate measures adopted to limit greenhouse gas emissions for their project;
3. estimate the comparative greenhouse gas efficiency of their project with the efficiency of comparable projects producing a similar product; and
4. consider entry into the Commonwealth Government's "Greenhouse Challenge" voluntary co-operative agreement programme which includes:
   - an inventory of emissions;
   - opportunities for abating greenhouse gas emissions in the organisation;
   - a greenhouse gas mitigation action plan;
   - regular monitoring and reporting of performance; and
   - independent performance verification

Subject to amendment of existing Condition 5, it is the EPA's opinion that its objective for gaseous emissions in relation to greenhouse gases can be met by the modified project. This should also apply to the project at alternative sites.

The proponent has committed to specifying emission criteria in tender documents for the supply of equipment for the plant and to carry out compliance testing to the Kwinana EPP standards, to the satisfaction of the EPA.

Detailed specifications for discharge of emissions, monitoring and reporting should be established by the Department of Environmental Protection in licence conditions set under Part V of the Environmental Protection Act.

3.8 Solid and liquid waste

Aspects of solid and liquid waste

The CER/S46 report (Dames and Moore, 1996b), indicates that tailings discharge from the process will consist of three major streams, the neutralised leach residue slurry, bleed solution from the mixed sulphide precipitation, and gypsum slurry from the solution neutralisation circuit. The leach residue slurry, at about 40% solids, is pumped to a tailings dam for long term storage at a rate of approximately 460 tph or 3.75 Mtpa of dry solids. This dam is expected to be approximately 512 ha after 25 years of operations after which additional dams will be developed adjacent to the existing dams. The tailings dam is designed to provide sufficient surface area for evaporation of supernatant water and any rainfall within the dam catchment. However, the supernatant will be decanted and pumped to the evaporation pond, to increase the final solids density within the tailings dam. In addition, the dam cells will undergo cycles of slurry discharge and drying to increase the final settled densities.

The bleed waste solution produced following filtration of the mixed sulphide precipitate will be neutralised with calcrete slurry before discharge into the evaporation pond. The pond will cover an area of approximately 350 ha

Gypsum slurry produced from the solution neutralisation circuit will be discharged to the gypsum dam. The gypsum deposition rate will be approximately 1 Mtpa and the dam will be approximately 100 ha. Supernatant water will be decanted and pumped to the evaporation pond, to maximise the final solids density within the dams. In addition, the dam cells will undergo cycles of slurry discharge and drying to increase the final settled densities.

The CER/S46 (Dames and Moore, 1996b) indicates that the major issue associated with the tailings dam and the evaporation pond is the potential impact of these facilities on the groundwater levels and quality. The report states that detailed engineering design work for the tailings dam and evaporation pond is still being conducted by the proponent and that the base and sides of the tailings dam and evaporation ponds will be treated (eg: rolling and compaction) to reduce the permeability if required. A groundwater monitoring programme would also be established up and down gradient of these areas to monitor changes in the depth of the water table and changes to the water quality, particularly total dissolved salts (TDS). Prior to the construction of the tailings dams, gypsum dams, and evaporation pond the proponent will undertake a number of studies to ensure that the integrity of the solid and liquid waste facilities can be maintained.

The proponent has also made a commitment to report on the development and performance of the disposal facilities (tailings dams, gypsum dams, and evaporation pond) to the EPA after five years of operation.

Assessment

The area considered for the assessment of this relevant environmental factor is the project area, as it is this area which could be affected by failure of waste disposal facilities, and the area over which final rehabilitation of the facilities is required.

The EPA's objective in regard to this environmental factor is "to ensure that the area of the tailings dam is kept to a practical minimum, that recycling is adopted where practical to reduce water demand, and that solid and liquid wastes are contained within the tailings dam and isolated from the groundwater and surface surrounds".

The EPA notes that the project's tailings dams will be subject to control and regulations of the Department of Minerals and Energy (DME), the Department of Environmental Protection and the Water and Rivers Commission. The proponent has committed to design and operation of the dams in accordance with those requirements, and to the satisfaction of the EPA. This should include measures to recycle water where practical.

The proponent has also committed to a more detailed evaluation of potential alternative tailings disposal options, including provision for the re-examination of the in-pit disposal option, five years after the commencement of operation. The EPA considers this important to minimise the tailings dam area if practical.

The proposed modifications to the project, and the alternative sites are unlikely to significantly alter the impacts or risks associated with solid and liquid waste disposal.

Having particular regard to:

(a) the control and regulation which exists on tailings dams; and

(b) the proponent's commitments in respect of managing solid and liquid wastes,

it is the EPA's opinion that its objective for solid and liquid waste disposal can be met by the modified project, and the alternative sites.

4. Conditions and procedures

4.1 Conditions

In the EPA's opinion, the modified project should be subject to the following conditions if implemented:

(a) the existing Ministerial Conditions applied to the project (Ministerial Statement 418, 5 June 1996), subject to modification of Conditions 1 and 5 (proponent's commitments, and greenhouse gases) as set out in (b) and (c) below;

(b) the proponent's additional commitments made in the CER/S46 document (Dames and Moore, 1996b) and summarised in Table 4 of this report, should be made enforceable; and

(c) the proponent should be required to:

  (i) calculate greenhouse gas emissions for the project;

  (ii) indicate measures adopted to limit greenhouse gases;

  (iii) estimate comparative greenhouse gas efficiency of the project; and

  (iv) consider entry into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement programme.

These conditions should apply to the project if it is implemented at the existing approved sites, or the proposed alternative sites.

4.2 Procedures

Aboriginal Heritage

The EPA has noted the submissions from the Aboriginal Affairs Department, and from the Aboriginal Legal Service of Western Australia on behalf of the Bibila-Lungutjarna and Goolburthunoo people. The proponent has made a commitment to comply with the *Aboriginal Heritage Act 1972*. Existing Ministerial Condition 1 (Ministerial Statement 418, 5 June 1996) requires the proponent to comply with all its commitments. The proponent has also advised that matters relating to land tenure are being addressed through the Mining Act and the Native Title Act. In the EPA's opinion, this is the appropriate course for dealing with these matters.

relevant factors	objective	proponent's commitment	epa recommendation
1. Declared Rare and Priority flora, and vegetation communities.	To protect Declared Rare and Priority flora and ensure no significant loss of locally and regionally significant vegetation communities.	EMP to address flora and vegetation management (Commitment 1) and EMS provides for best practice environmental management (Commitment 2). Minimise disturbance to *Hemigenia exilis* and comply with Wildlife Conservation Act (Commitment 4).	The modifications to the projects and the alternative sites, are unlikely to compromise the EPA's objective to protect Declared Rare and Priority flora, and vegetation communities.
2. Threatened and Priority fauna	To protect Threatened and Priority fauna species and their habitat.	EMP to address fauna management (Commitment 1) and EMS provides for best practice environmental management (Commitment 2). Fauna studies will be undertaken in consultation with CALM and the DEP to ensure there is adequate information to manage impacts on fauna through the EMP and EMS (Commitment 18).	The modifications to the project, and the alternative sites, are unlikely to compromise the EPA's objective to protect Threatened and Priority fauna species, and habitats
3. Surface water	Ensure no significant adverse changes to existing drainage systems, vegetation/land systems, and dependent fauna.	Monitoring and management addressed by proponent in commitments 1 (EMP), 2 (EMS) and 6 (minimise transport of sediments and monitor Cement Creek and Katata Creek).	The EPA's objective for surface hydrology can be met by the modified project, at the existing approved site and the alternative sites.
4. Groundwater quantity	To ensure that groundwater quantity is adequately maintained, and that indigenous vegetation is not threatened.	Monitoring and management will be addressed in the EMP and EMS (Commitments 1 & 2). Pastoral water supplies in the project area will be maintained (Commitment 15).	The EPA's objective for groundwater quantity can be met by the modified project at the existing approved site and the alternative sites.

Table 4. Summary of relevant factors, objectives, proponent's commitments and EPA's opinions.

relevant factors	objective	proponent's commitment	epa recommendation
5. Gaseous emissions	To ensure that gaseous emissions, including greenhouse gases and odours, both individually and cumulatively conform to the agreed standards and do not cause an environmental or human health problem in the area surrounding the proposed processing plant. The proponent must use all reasonable and practicable measures to reduce the discharge of wastes, including gases.	Monitoring and management addressed by proponent in commitment 2 (EMS) and commitment 9 (CO_2 emissions calculated on an annual basis). Specification of emissions criteria in tender documents and compliance testing during commissioning (Commitment 19).	The EPA's objective for gaseous emissions can be met by the modified project at the existing approved site, and the alternative sites.
6. Solid and Liquid waste	To ensure that the area of the tailings dam is kept to a practical minimum, that recycling is adopted to reduce waater demand, and that solid and liquid wastes are contained within the tailings dam and isolated from groundwater and surface surrounds.	Monitoring and management addressed by proponent in commitments 1 (EMP), 2 (EMS), commitment 12 (Design and operation), 13 (Further assessment and investigation), 14 (Monitoring), X (5 year review), and 3 (Rehabilitation).	The modifications to the project, and the alternative sites, are unlikely to compromise the EPA's objective for solid and liquid waste disposal.

Table 4. Summary of relevant factors, objectives, proponent's commitments and EPA's opinions (cont'd).

Traffic

The EPA has noted matters raised in submissions regarding traffic generated by the project. Main Roads Western Australia (MRWA) has advised that the company will need to construct overtaking lanes at the entrance to any MRWA vested road to minimise safety risks. The proponent has indicated that it will comply with MRWA's requirements. The proponent also indicated that if MRWA considers the additional traffic created by using the alternative haul routes is unacceptable, it will revert back to the original haul route options. It is the EPA's opinion that traffic matters associated with this project can be managed by MRWA.

5. Recommendations

The EPA submits the following recommendations:

Recommendation 1

That the Minister for the Environment note the relevant environmental factors and EPA objective for each factor as set out in Section 3 of the report.

Recommendation 2

That subject to the satisfactory implementation of the EPA's recommended conditions and procedures of Section 4 of this report, including the proponent's environmental management commitments, the modified project can be managed to meet the EPA's objectives at either the existing approved sites, or the proposed alternative sites.

Recommendation 3

That the Minister for the Environment imposes the conditions and procedures set out in Section 4 of this report.

Appendix 1

Figures

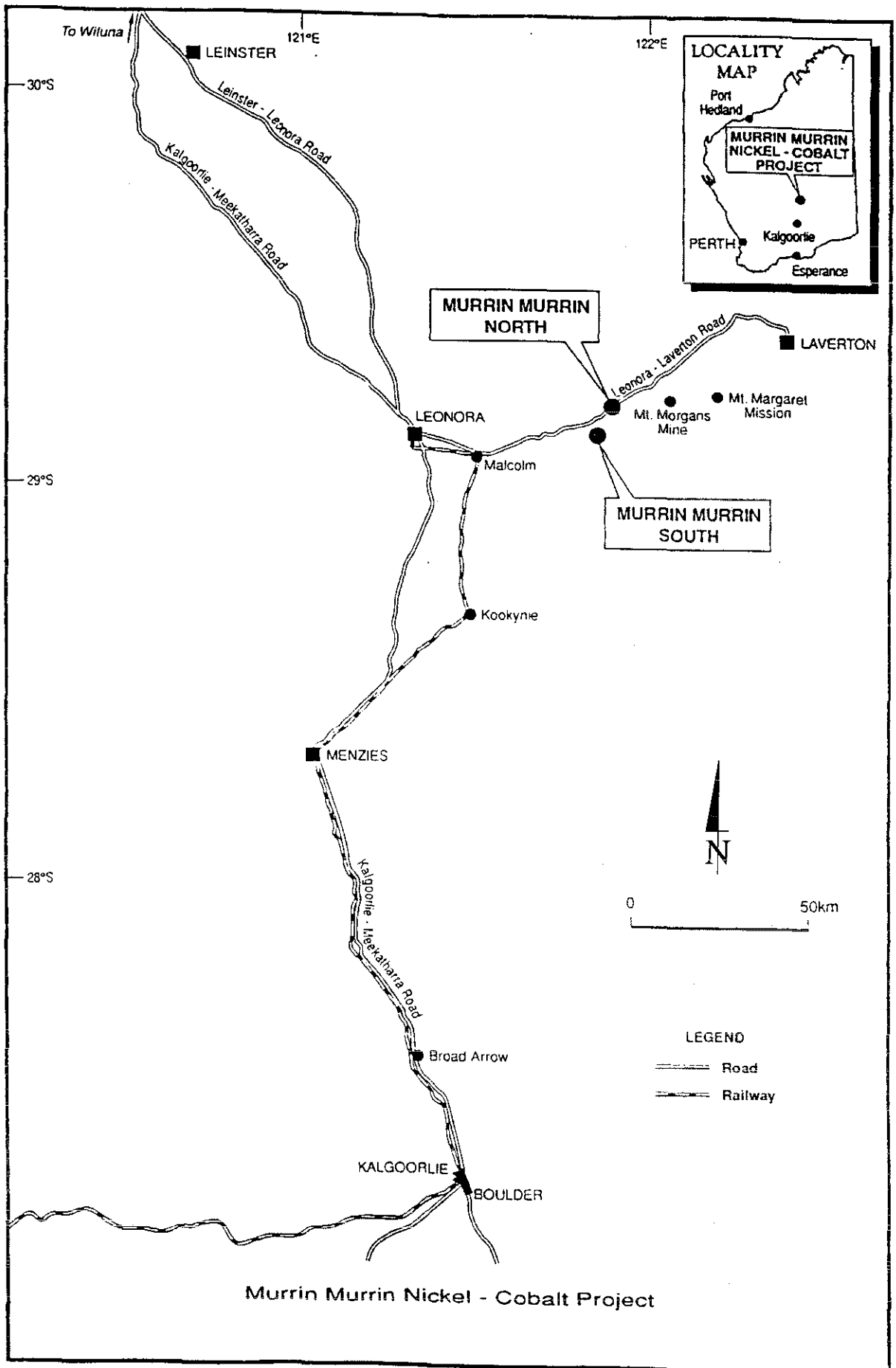
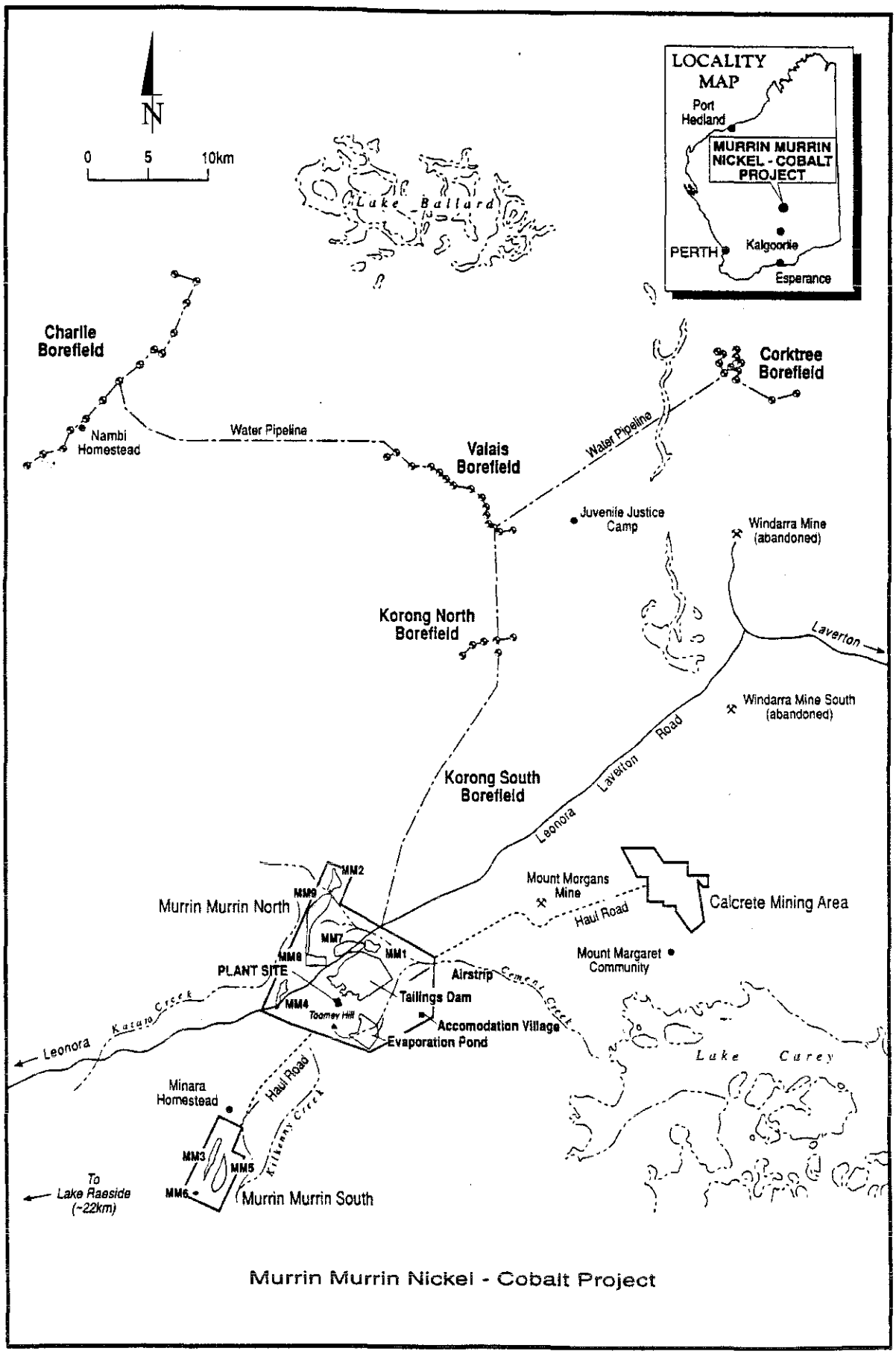


Figure 1. Location of project area (Source: Figure 1.1, Dames & Moore, 1996).



Murrin Murrin Nickel - Cobalt Project

Figure 2. Approved project layout.

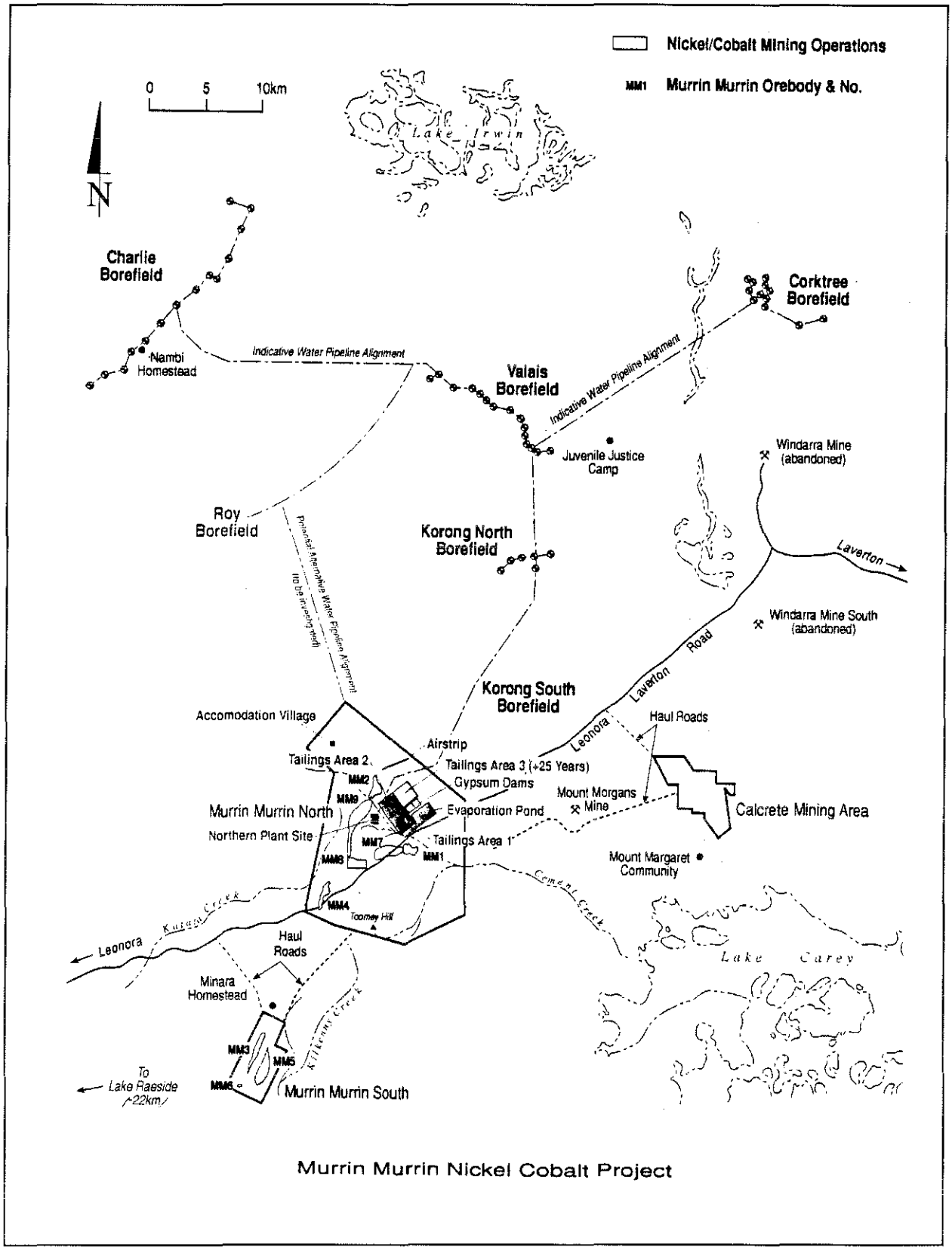


Figure 3. Proposed alternative project sites. (Source: Figure 1.4 , Dames & Moore, 1996).

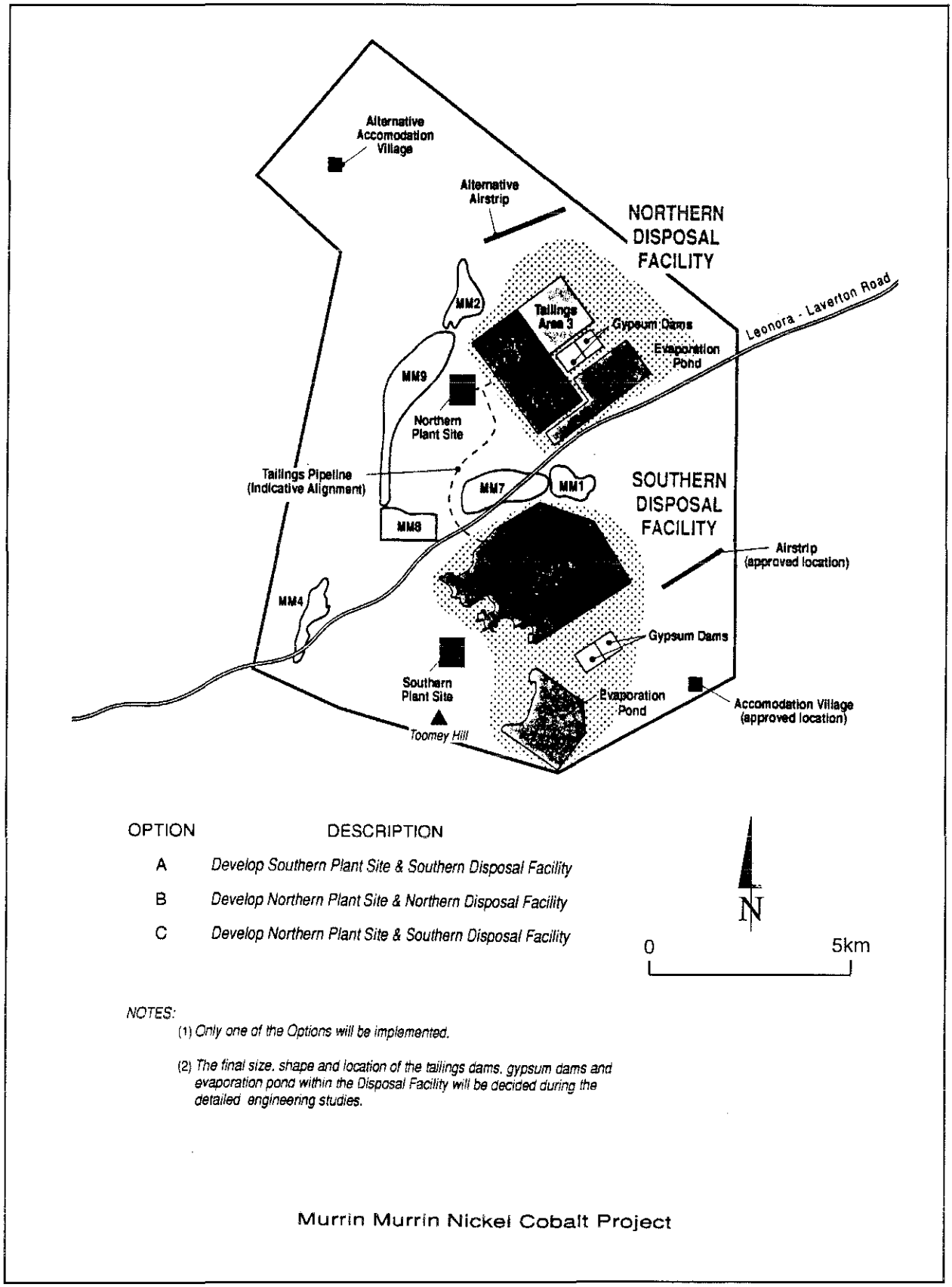


Figure 4. Potential development scenarios. (Source: Figure 1.5 Dames & Moore, 1996).

Appendix 2

List of people and organisations that made submissions

State and local government agencies

Department of Conservation and land Management

Environmental Protection Agency (Commonwealth)

Aboriginal Affairs Department

Department of Minerals and Energy

Main Roads Western Australia

City of Kalgoorlie-Boulder

Members of the public

Aboriginal Legal Service of Western Australia (Inc.) on behalf of the Bibila-Lungutjarra and Goolburthunoo People

Resolute Samantha Limited

Appendix 3

References

Dames & Moore 1996a, *Murrin Murrin Nickel-Cobalt Project: Consultative Environmental Review , February 1996*, Anaconda Nickel NL.

Dames & Moore 1996b, *Murrin Murrin Nickel Cobalt Project: Project Changes & Site Alternatives: Consultative Environmental Review and Section 46 Review, September 1996*, Anaconda Nickel NL.

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Greenhouse Coordination Council 1994, *A Revised Greenhouse Strategy for Western Australia 1994*, Environmental Protection Authority, Perth, Western Australia.