ASSESSMENT REPORT 15

McARTHUR RIVER PROJECT

PROPOSED ZINC-LEAD-SILVER MINE

ENVIRONMENTAL ASSESSMENT REPORT

AND

RECOMMENDATIONS

by the

ENVIRONMENT PROTECTION UNIT
CONSERVATION COMMISSION OF THE NT

AUGUST 1992

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EXECUTIVE SUMMARY

This report assesses the environmental impact of a proposal by Mount Isa Mines Limited (MIM) to establish an underground mine and associated infrastructure at the HYC zinc-lead-silver deposit at McArthur River, approximately 60 km southwest of Borroloola.

The report reviews the Draft EIS, public comments on the Draft, the proponent's response to these comments and the Supplement to the EIS. This report and assessment is based on information and assistance provided by Northern Territory and Commonwealth Government agencies, and from the U.S Environmental Protection Agency.

Included in the report is a discussion of the main issues associated with the proposal and the potential impacts on the biological and physical environment; and recommendations on how adverse effects should be minimised or avoided.

Major Issues

The major issues associated with the construction and operation of the McArthur River Project raised during the review of the DEIS and Supplement are listed below and form the basis of the contents of the assessment report.

- ***Mine design and management***
- ***Mine water management***
- ***Tailings disposal and management***
- ***Erosion management and rehabilitation***
- ***Occupational health and safety***
- ***Waste management (including hazardous and dangerous goods)***
- ***Road transport (dust, spillage, and traffic issues)***
- ***Barge loading facility design and management***
- ***Dredging (impacts and management)***
- ***Concentrate and fuel spillage (impacts, prevention, and countermeasures)***
- ***Social impacts (particularly impacts on local Aborigines)***

The proponent has outlined in the EIS the consultations held with local Aboriginal groups affiliated with land affected by the proposal, and has also acknowledged the potential negative effects on Aboriginal culture. The proponent has undertaken to support a study on the social impacts arising from the project.

In addition, it is understood that ATSIC will be overseeing the preparation of a 5 year community development plan for Borroloola. It has been advanced on their national program to cover all regions in Australia, and has specifically included a strategic

development plan in response to the McArthur River Project. The proponent "is prepared to contribute to such a study".

It is considered that the approach adopted by the proponent and ATSIC will adequately address the social issues associated with the proposal. Recommendations arising from these studies will be reviewed by the NT Government.

The assessment of the potential environmental impacts and the proposed management for the McArthur River Project covers those aspects related specifically to the mine site and those associated with the barging and shipping transport option.

It is important for interpretation purposes that the recommendations in this report are not considered in isolation, as the text contains a number of identified concerns, suggestions, and some considerations to assist decision-making.

Subject to decisions which permit the McArthur River Project to proceed, the primary recommendation resulting from this assessment is as follows:

Recommendation 1

The proponent is to ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the McArthur River Project Draft Environmental Impact Statement, or as modified in the Supplement to the Draft EIS.

It is acknowledged that during detailed implementation of proposals, flexibility is necessary and desirable to allow for changes to the designs and specifications which have been examined as part of this assessment. It is considered that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

The risk of pollution and impacts from concentrate, hazardous chemicals and fuel spills is of considerable concern to most of the respondents to the DEIS. This concern is acknowledged by the proponent who has made substantial commitments to ensure that spills will not occur. This will be achieved by the preparation of an Environmental Management Plan with a "no spill policy".

Specific recommendations to prevent concentrate spills and emissions are given separately for the mine and barging operations.

A. Summary of Mine Recommendations

Recommendation 2

Flood estimates for the mine site should be revised using the additional Power and Water Authority data. Revised flood levels and designs for infrastructure foundations should be verified by the Department of Mines and Energy prior to commencement of construction.

Recommendation 3

(i) The proponent should carry out all water quality, flora and fauna baseline surveys and monitoring programs outlined in the EIS. All baseline surveys should be commenced prior to construction starting on the mine site.

(ii) Monitoring programs are to be detailed within the Environmental Management Plan for approval by the Minister for Mines and Energy.

(iii) The model for mine inflow, aquifer continuity, and dewatering rates and chemistry should be refined to more accurately predict groundwater volumes and quality. Results should be reviewed by the Department of Mines and Energy.

Recommendation 4

(i) The proponent should submit laboratory test results, including the weathering and leaching behaviour tests still to be completed by Environmental Geochemistry International Pty Ltd, to the Department of Mines and Energy for approval of the final design and operation conditions for the tailings disposal method.

(ii) The proponent should maintain adequate tailings slurry chemistry records to assist in predicting alterations to the chemistry, and shall undertake appropriate remedial action to maintain a neutral pH of the decant water.

Recommendation 5

The predictive flood model for the tailings area should be refined and take into account the design of the tailings runoff dam and mine water budget. Department of Mines and Energy approval should be required prior to construction commencing on the tailings runoff dam.

Recommendation 6

The proposed water quality monitoring program outlined in the EIS shall be expanded to include groundwater up stream of the runoff dam in Barney Creek and in the tailings impoundment, and shall identify heavy metals from Catchment 3 water.

Recommendation 7

If the proponent decides to opt for private power generation, final design and operation plans for the power station and fuel storage facility should be submitted to the Department of Mines and Energy for approval prior to construction.

Recommendation 8

The proponent should consult with the Department of Health and Community Services to produce a disease vector baseline survey, monitoring program and remedial action plan for the mine site.

Recommendation 9

The proponent should provide details of the proposed dust monitoring and medical health program, including remedial options, in the Environmental Management Plan for assessment and approval by the Minister for Mines and Energy.

Recommendation 10

The proponent should submit final detailed plans for sewage disposal at the mine site through the Department of Mines and Energy to the Department of Health and Community Services for approval prior to commencement of construction.

Recommendation 11

The proponent should consult with the Department of Mines and Energy at the design stage to ensure that any proposed temporary stabilisation measures for roadworks and earthworks are appropriate.

Recommendation 12

A comprehensive rehabilitation plan for all disturbed areas and waste disposal sites should be prepared by the proponent for approval by the Department of Mines and Energy. This plan should include specific rehabilitation requirements and practices for the waste rock dump and the tailings impoundment.

Recommendation 13

Hazardous waste should be disposed of in an engineered land fill site on the mineral lease. Ongoing monitoring and management of the approved waste disposal site should be outlined in the Environmental Management Plan.

Recommendation 14

The proponent should prepare and submit the Environmental Management Plan incorporating all the undertakings listed in the EIS for the mine site (with specific emphasis on the monitoring criteria) to the Minister for Mines and Energy for approval.

The plans should reflect the varying environmental requirements associated with the construction phase, operation phase and decommissioning phase for the mine, and include:

- water management and monitoring - incorporating the undertakings listed in the EIS. The plan should ensure that all holding ponds, overflow points and receiving water points are monitored for the chemical parameters listed in the Supplement;

- management of surface and underground waste rock dumps;

- fire management in consultation with the Bush Fires Council; and

- the plans must also reflect compliance monitoring requirements and audit requirements stipulated by the Department of Mines and Energy.

B. Summary of Road Transport Recommendations

Recommendation 15

Appropriate measures must be adopted to prevent emissions of concentrate dust during transport to the barge facility.

Recommendation 16

The proposed heavy vehicle driver training program should be submitted to the Department of Mines and Energy for approval, and should be implemented prior to the commencement of haulage operations.

Recommendation 17

The proponent should prepare a spill contingency plan, focussing on concentrate spills at strategic and vulnerable areas such as the Batten Creek crossing.

Recommendation 18

The proponent should prepare a spill contingency plan, covering potential fuel spills at strategic or vulnerable areas on the concentrate haul route such as the Batten Creek crossing.

C. Summary of Barging and Shipping Recommendations

Recommendation 19

If the barge route alternative for fuel and dangerous goods supply is adopted by the proponent, appropriate environmental assessment of this transport mode will be required.

Recommendation 20

(i) The detailed design for Bing Bong facility and barge loading operations should be subject to review by the Department of Mines and Energy, prior to final approval to proceed.

(ii) Best Available Technology and Best Management Practices programs (as approved by the Department of Mines and Energy) should be included in the Environmental Management Plan for Bing Bong, detailing design information on the loading proposal, including equipment and operational conditions.

The Environmental Management Plan should meet the objectives of a no spill policy for all pollutants including concentrate, toxic or hazardous chemicals, and fuel.

Recommendation 21

The proponent should consult with the Bureau of Meteorology to validate the storm surge design levels adopted for the barge facility, and modify design levels as appropriate to meet the objective of containment of hazardous materials, fuel and concentrate during the maximum potential life of the project.

Recommendation 22

The proponent should design the barge loader facility so as to minimise the causeway length across the active sediment transport zone.

Recommendation 23

The proponent should incorporate a study of shore birds, resident and migratory, within the proposed baseline studies at Bing Bong to determine the displacement effects brought about by construction and operation of the barge facility.

Recommendation 24

(i) Site drainage at the barge loading facility stockpile should divert general site rainfall runoff away from the stockpile building. Runoff from the building and the adjacent haul truck access road should be contained and diverted to a pond capable of retaining a 1:100 year 3 day storm event;

(ii) A wheel and underbody wash system should be used at all plant exiting points for the stockpile building to prevent concentrate emissions;

(iii) Appropriate measures must be adopted to prevent emissions of concentrate dust during transfer, transport and storage phases.

Recommendation 25

A wheel and lower body wash facility should be used on the barge prior to disembarking of plant and equipment. The sediment and wash water should be contained onboard for disposal to future concentrate shipments as a dust control measure.

Recommendation 26

The proponent should comply with the guidelines in "Construction Practice Near Tidal Areas In The Northern Territory: Guidelines To Prevent Mosquito Breeding".

Recommendation 27

The offshore anchorage location and mooring design should be included in the final design plan for the Bing Bong operation and submitted to the Department of Mines and Energy for approval. Prior to finalising the carrier mooring site, the Department of Mines and Energy should consult with the Department of Primary Industry and Fisheries and other relevant government agencies over its final location.

Recommendation 28

(i) All anchoring will need to be controlled and pre-determined in the Bing Bong Environmental Management Plan so that anchoring is only undertaken in defined areas. This is particularly important in respect to the barge cyclone mooring site, should this be located in the vicinity of Barranyi (North Island) National Park.

(ii) Any proposed cyclone mooring areas adjacent to North Island should be approved by the Conservation Commission.

Recommendation 29

Approved further studies should be carried out to determine heavy metal thresholds and the total amount of concentrate spillage over time that would require response by the proponent and Government.

Recommendation 30

(i) Based on an appropriate experimental design, the heavy metal monitoring program should be revised to include commercial species of prawn; interpretation and results should be made available to the Department of Primary Industry and Fisheries.

(ii) Analysis of heavy metals in samples of marine biota should take place immediately after any spill and up to several months later (the period to be determined by persistence of elevated heavy metals in sediments and water column) to accurately determine the extent of damage from a spill.

(iii) Both monitoring programs in Appendix P should be linked together to resolve the hypothesis that chemical constituents released by dredging or from spills of ore concentrate will not significantly change marine flora and fauna populations.

Recommendation 31

The Bing Bong Environmental Management Plan should detail provisions for supervision by the proponent of all loading operations.

Recommendation 32

(i) Safe operational parameters (wind and wave) for ship loading conditions should be precisely defined, and submitted to the Department of Mines and Energy for assessment. Any proposed changes to these (which should be conservative in the first instance) will need to be supported with detailed justification.

Compliance with ship loading operational conditions will need to be monitored and rigorously enforced to ensure pre-determined wind and wave conditions are not exceeded, resulting in unacceptable risk increases.

(ii) Night-time operations will require close supervision and assessment to determine if the risks associated with night operations are acceptable.

Recommendation 33

(i) The Environmental Management Plan should contain a Spill Prevention, Control and Contingency Plan for concentrate and other materials (fuel and chemicals) comprising:

- Purpose and objectives
- Materials quantities and properties
- Materials transportation and deportment
- Spill risks and control
- Administrative spill prevention and control procedures including monitoring and threshold limits
- Recovery and countermeasures, equipment and materials
- Response options to prevent future spills occurring
- Reporting (see recommendation below)

(ii) All spills are to be reported immediately to the Department of Mines and Energy. A detailed report of the spill giving full details of estimated size, exact location, monitoring, and response (clean-up and proposed changes to procedures or equipment to ensure event is not repeated) must be supplied within 5 working days.

(iii) The proponent should bear the full cost of any environmental rehabilitation necessary as a result of concentrate or other spills. The proponent should attempt to clean-up all concentrate spills, subject to the agreed provisions of the Environmental Management Plan.

D. Summary of Dredging Recommendations

Recommendation 34

Baseline surveys and subsequent monitoring programs need to be revised to take account of seasonal change (natural fluctuations) in seagrass communities, and should include turbidity sampling.

Recommendation 35

In the absence of water quality standards, decant water release from dredging should result in no unacceptable long-term impacts. This would require both baseline monitoring and long-term additional monitoring to be implemented.

Recommendation 36

The proponent should prepare a dredging management and monitoring program for approval by the Minister for Mines and Energy. The program should include the following matters:

- detailed description of existing environment including seagrass composition, productivity, and juvenile commercial prawn densities;
- detailed description, location and alignment of the channel and barge loading area, optimising the alignment and depth of channel to reduce maintenance requirements;
- baseline monitoring of seagrasses potentially affected by the dredging;
- safeguards to minimise sedimentation and plume dispersion including sediment curtain use (effectiveness and deployment), and dredging trials under varying conditions to minimise plume dispersion;
- turbidity profiling and sedimentation sampling before, during and after capital and maintenance dredging, as well as consideration of monitoring of plume by aerial photography to visually assess plume dispersion (one of the objectives of this monitoring program will be to establish turbidity standards for maintenance dredging over the mine life period).
- on-going monitoring of seagrass recovery; analysis of long-term effects of maintenance dredging;
- response options if monitored impacts and seagrass recovery is unacceptable;
- further information on maintenance dredging turn-around period;
- method of returning spoil to on-shore containment site;
- spoil containment location including a detailed description of the existing environment to be affected;
- containment details and design, including sediment ponds and management and decant monitoring; and
- reporting.

1. INTRODUCTION AND BACKGROUND

This report assesses the environmental impact of a proposal by Mount Isa Mines Limited (MIM) to establish an underground mine and associated infrastructure at the HYC zinc-lead-silver deposit at McArthur River, approximately 60 km southwest of Borroloola.

The report reviews the Draft EIS, public comments on the Draft, the proponent's response to these comments, and the Supplement to the EIS. This report and assessment is based on information and assistance provided by Northern Territory and Commonwealth Government agencies, and from the U.S Environmental Protection Agency.

Included in this report is a discussion of the main issues associated with the proposal and the potential impacts on the biological, physical, and social environment; and recommendations on how adverse effects should be minimised or avoided.

The contents of this report form the basis of advice to the Northern Territory Minister for Conservation on the environmental issues associated with the McArthur River Project.

1.1 Environment Assessment History

Environmental assessment of the project was conducted under a joint arrangement between the Northern Territory Government and the Commonwealth Government.

In accordance with the provisions of Northern Territory Environmental Assessment Act 1982 and the Commonwealth Environmental Protection (Impact of Proposals) Act 1974, Mount Isa Mines (the proponent) was directed to prepare a draft Environmental Impact Statement (DEIS) on the project on 11 March 1992.

Guidelines for the preparation of the EIS were prepared by the Conservation Commission (CCNT) in conjunction with the Commonwealth Department of Arts, Sport, Environment, and Territories (DASET) and were subsequently published in the appendix of the DEIS.

On 22 May 1992 the proponent completed and submitted the McArthur River Project DEIS to the respective Ministers, and placed the document on public exhibition for a 31 day period.

A total of 36 written submissions were received by CCNT and forwarded to the proponent to assist in the preparation of the final EIS, also known as the "Supplement". A list of the respondents and their comments on the DEIS is provided at **Appendix 1** of this report.

The Supplement was received on 20 July 1992. The Supplement was then distributed to Northern Territory and Commonwealth advisory bodies for examination and comment as required under legislation. These comments are incorporated where relevant in the following sections of this report.

2. THE PROPOSAL

2.1 The Mine

The HYC deposit covers an area of approximately 2 km^2 with an average thickness of 55 m, and occurs down to 500 m below the surface. An underground mine is proposed for the McArthur River Project, accessed by a decline and ventilated by shafts. The ore will be selectively mined in near horizontal layers using the "room and pillar" method and will be carried to the surface and processed on site by the concentrator at Barney Hill to produce a bulk fine grained zinc-lead concentrate. Silver will form a minor component of the concentrate.

At full production the concentrator will treat 1.2 million tonnes per annum of ore at a rate of 150 tonnes per hour to produce 350,000 dry tonnes per annum of mixed zinc-lead-silver concentrate.

Solid wastes generated from the mine and concentrator will consist of waste rock (to be stored at Barney Hill) and a thickened tailings slurry, to be pumped by pipe to a tailings disposal area and run-off dam approximately 2.5 km northwest of the mine site.

Waste water will be contained on site in runoff ponds and mixed with water in the tailings run-off dam for re-use in the concentrator.

Staffing for the mine will be provided on a fly-in and fly-out basis and housed at an accommodation area approximately 1.5 km west of the mine site during work rosters. During construction the project will employ approximately 300 personnel and approximately 240 personnel in the operational phase. Contractors will provide the majority of services to the project. **Figures 1 and 2** show the location and layout of the mine and associated facilities.

2.2 Concentrate Transport

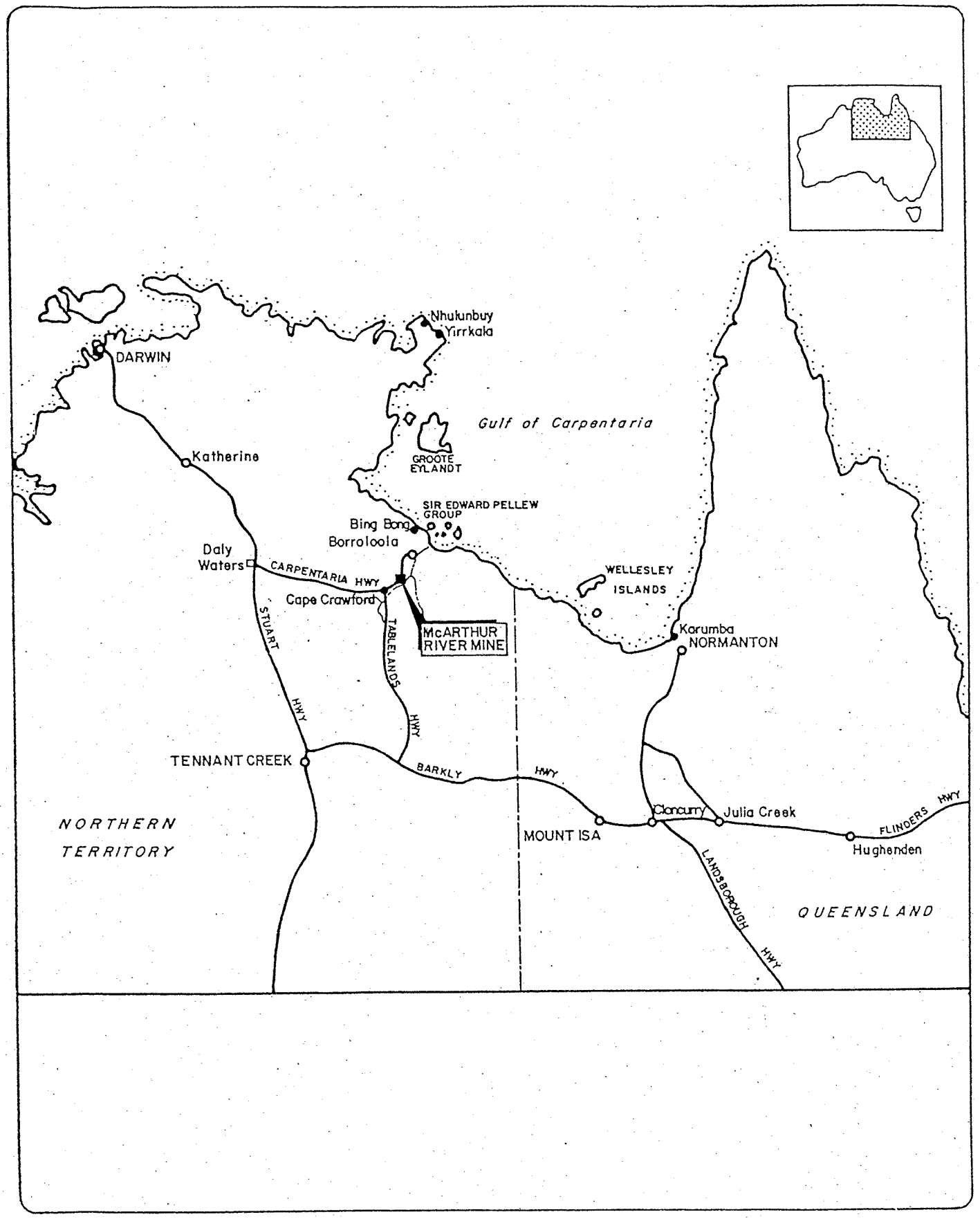
The bulk concentrate will be trucked from the mine to a proposed barge loading facility at Bing Bong Station. The haulage route which includes an excised corridor to bypass west of Borroloola is approximately 130 km long.

The haulage trucks have the capacity to carry 90 tonnes of concentrate, and will make between 14 and 24 shipments per day from the mine to the barge loading facility.

The barge loading facility is proposed to be located approximately 4 km east of the homestead near Mule Creek and will comprise a covered storage facility, where up to 30,000 tonnes of concentrate can be stored prior to loading on the barge (**Figure 3**).

The barge will be loaded with concentrate using a covered conveyor belt, fed by front-end loaders at the storage facility. The conveyor will be mounted on a causeway and trestle structure, approximately 300m in length.

It is proposed to dredge a channel approximately 2.7 km length and 80 m wide to allow barge access to the loading site. A swing basin and berth pocket will be dredged at the conveyor point. The dredged channel will be approximately 3.7 m deep with a pocket 5.5 m deep to allow the barge to be fully loaded.



McARTHUR RIVER PROJECT E.I.S.

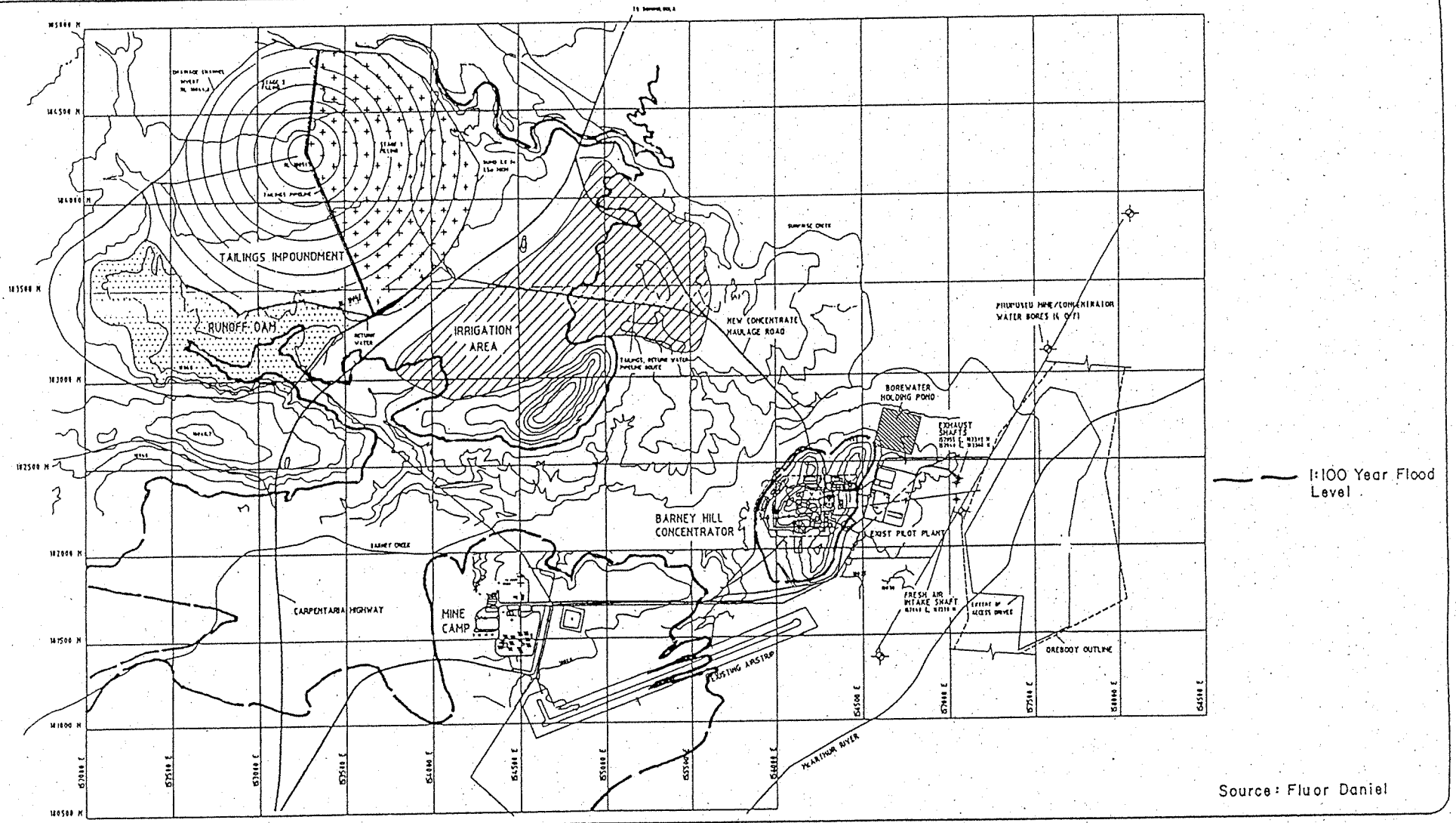
SITE LOCATION

HOLLINGSWORTH DAMES & MOORE

Scale - km

0 100 200 300

File Ref. HOB0338 FIG. 1



Source: Fluor Daniel

McARTHUR RIVER PROJECT E.I.S.

MINE SITE LAYOUT

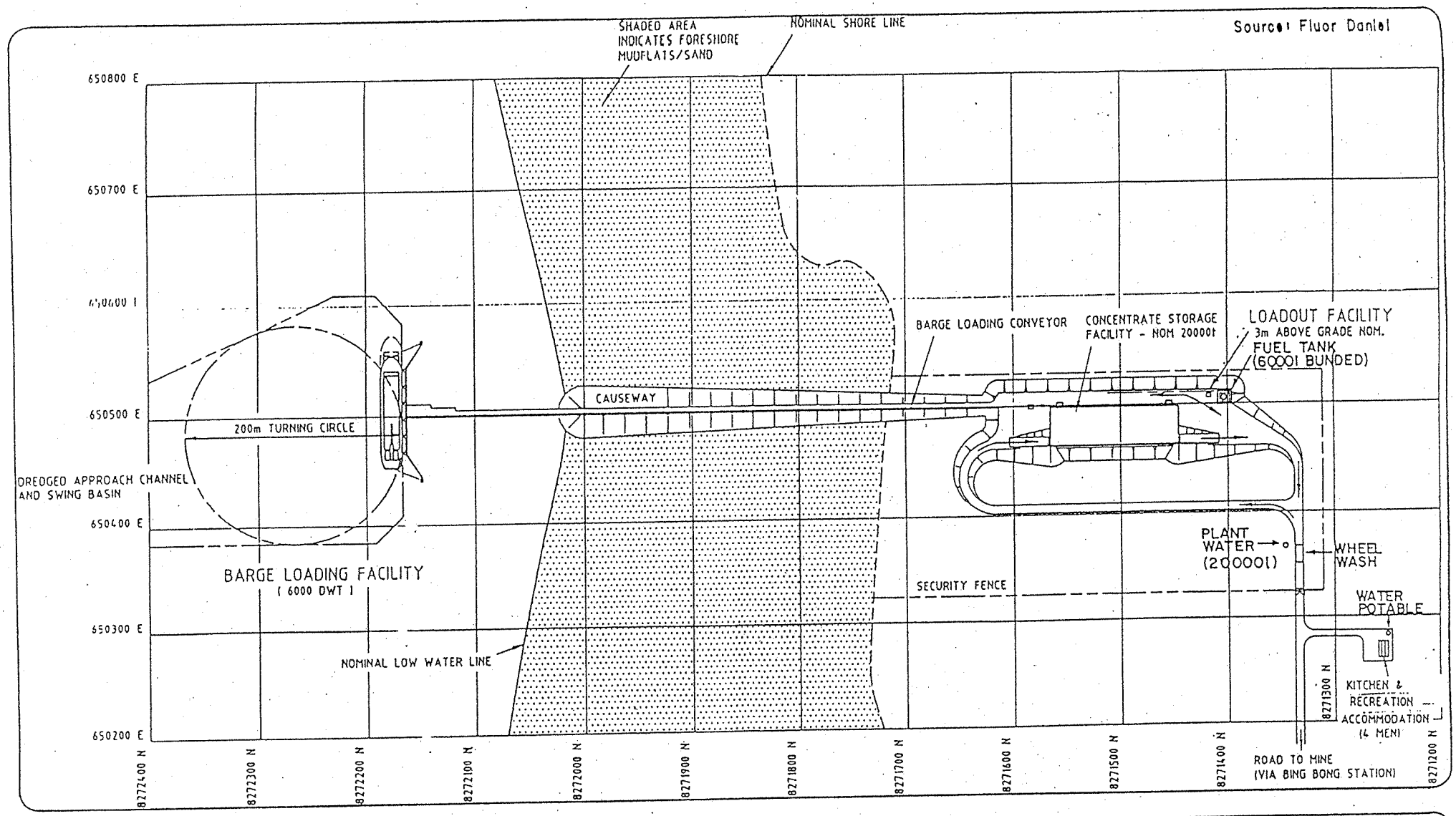
HOLLINGSWORTH DAMES & MOORE

Scale - metres

0 500 1000

File Ref. HO80338

FIG. 2



McARTHUR RIVER PROJECT E.I.S.

BARGE LOADING FACILITY DETAIL

HOLLINGSWORTH DAMES & MOORE

Scale - metres

0 100 200

File Ref. HOB0338

FIG. 3

The barge would have a cargo capacity of 6000 tonnes and covered by lightweight self folding covers. Discharge to the ship from the barge will be by an enclosed conveyor system, fed by front-end loaders.

Ship loading will occur approximately 30 km offshore in deeper waters. Export carrier ships will have a capacity of 20 000 to 30 000 dwt. Approximately 16 ships would be loaded each year.

2.3 Major Issues

The major issues associated with the construction and operation of the McArthur River Project raised during the review of the DEIS and Supplement are listed below. These issues are examined in detail later in this report.

- *Mine design and management*
- *Mine water management*
- *Tailings disposal and management*
- *Erosion management and rehabilitation*
- *Occupational health and safety*
- *Waste management (including hazardous and dangerous goods)*
- *Social impacts (particularly impacts on local Aborigines)*
- *Road transport (dust, spillage, and traffic issues)*
- *Barge loading facility design and management*
- *Dredging (impacts and management)*
- *Concentrate and fuel spillage (impacts, prevention, and countermeasures)*

3. REGIONAL SETTING

3.1 The Region

The McArthur River project is located in the centre of the Gulf region, broadly defined as the area between the Roper River and the Queensland border some 350 km to the south east. The catchments of those river systems that drain into the Gulf of Carpentaria delineate the inland boundary. The headwaters of the main stem of McArthur River lie approximately 230 km inland from the mouth.

3.2 Biogeography

There are two broad terrestrial biogeographic entities within the region which can be described in terms of geomorphologic characteristics and vegetation communities overlaid by a rainfall gradient.

Coastal Unit

Low relief, gently sloping erosional plains run down from the coastward side of prominent inland ridges to extensive areas of coastal and tidal flats. Some laterite outcrops of low relief occur in the unit. The vegetation is dominated by *Eucalyptus tetrodonta* (Stringybark) woodland, with *E. tectifica* (Northern Box) - *E. terminalis* (Bloodwood) woodland and *E. dichromophloia* (Variable-barked Bloodwood) - *E. tetrodonta* low open woodland being other major components.

Beach ridges, low dunes, sandsheets and tidal mudflats with mangroves and samphire characterise the coastline proper.

The barge facility and part of the haul route are within this unit.

Subcoastal Unit

Upland areas consist of high rocky sandstone plateaux and ridges, and high level valleys and depositional plains. Further inland, escarpments, low hills, footslopes and plains eventually grade into either intact areas of mature laterite on old, stable erosion surfaces, or the old, mature clay plains of the Barkly Tableland. Vegetation is dominated by *E. dichromophloia* (Variable-barked Bloodwood) - *E. tetrodonta* low open woodland, with *E. tectifica* (Northern Box) - *E. terminalis* (Bloodwood) woodland also a major component.

The mine site and part of the haul road are located within this unit.

The climate is tropical monsoonal on the coast, tending towards semi-aridity in the interior. Rainfall is highly variable, but generally declines inland from about 1000mm/year on the coast along an isohyet gradient of about 200mm/100km . Cyclones are a significant feature of Gulf region weather.

3.3 Areas of Conservation Significance

The Sir Edward Pellew Group of islands is of national and regional significance, and the NT Government has recognised this importance by securing formal reservation of North Island (Barranyi National Park). The terrestrial flora is notable for its species richness, and many animals of significant, rare or endangered species status are associated with the islands and surrounding waters.

The islands and surrounds are on the Interim List of the Register of the National Estate.

The coastline is of importance to migratory birds subject to two bilateral agreements which Australia has entered into with Japan and the People's Republic of China. These are the *Agreement between the Government of Australia and the Government of Japan for the protection of migratory birds and birds in danger of extinction and their environment*, abbreviated formally to "JAMBA", and the *Agreement between the Government of Australia and the Government of the People's Republic of China for the protection of migratory birds and their environment*, or "CAMBA".

The Little Tern breeding site on the coastline between Rosie Creek and Pine Creek, northwest of the Pellew islands, has been nominated to the Register of the National Estate.

The biological and potential recreation values of the Glyde River Gorge and the Caranbirini Waterhole have been identified by the NT Government as worthy of formal

protection under park status, and areas of sandstone karst in the Nathan River - Lorella Springs locality have high geomorphological values.

The seagrass beds of the McArthur River area constitute the most important known dugong habitat in the Northern Territory and one of the top four dugong areas in Australia. Other marine mammals and turtles of conservation significance are also associated with the seagrass beds of the Gulf region. There are international obligations under the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention) relevant to some species, particularly the need to conserve habitats such as seagrass meadows.

3.4 Demography

The region is sparsely populated, with Borroloola being the focus of social and economic activity in the Gulf region. The 1991 census counted 1272 people in the Gulf Region Collection Districts, and about half (591) live in Borroloola. This varies seasonally, due to periodic migrations to Aboriginal outstations or pastoral properties for recreation, hunting or work. Two thirds of Borroloola residents are Aboriginal.

3.5 Economy

The Gulf of Carpentaria fishing industry is of national importance because of the high value prawn export markets. The southwest region around Borroloola is especially significant, with a 5 year average wholesale value for prawns, crabs and fish of about $30 million. The pastoral industry is also important, contributing $28 million in 1988. The status from year to year varies considerably, but the long term growth prospects are limited by the lack of good grazing land.

Tourism is highly seasonal, and is focussed mainly on recreational fishing for barramundi and remote camping/4 wheel drive activities. A 1988 estimate values tourist activity at about $1 million. Mining is currently a negligible contributor to the Gulf region economy.

4. ENVIRONMENTAL ASSESSMENT

The assessment of the potential impacts and the proposed environmental management for the McArthur River Project covers those aspects related specifically with the mine site, and those associated with the barging and shipping transport option.

In general, the assessment focuses on the major issues listed in the previous section, as well as other aspects of the proposal that remain outstanding or that were not covered in enough detail in the EIS.

Under each section heading, the associated sub-issues are listed, together with a summary of the proponent's response and commitments. This is followed by an assessment of the potential impacts and proposed management, and attendant recommendations as appropriate.

It is important for interpretation purposes that the recommendations (typed in bold) in this report are not considered in isolation, as the text contains a number of identified concerns, suggestions, and some considerations to assist decision-making.

Subject to decisions which permit the McArthur River Project to proceed, the primary recommendation resulting from this assessment is as follows:

Recommendation 1

The proponent is to ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the McArthur River Project Draft Environmental Impact Statement, or as modified in the Supplement to the Draft EIS.

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

4.1 THE MINE

The definition of "mine" includes all operations associated with the extraction and processing of the ore, concentrate management, appropriate disposal of wastes, and rehabilitation.

4.1.1 Flood Design Levels

Flood modelling of McArthur River flows derived a 1:100 year flood level of RL38 AHD, and all process plant facilities will be above this design level.

Respondents raised concern over the model used to predict the flood level, and queried the adequacy of the design level to prevent flooding of the ore, concentrate and waste rock stockpiles. Flooding of these may lead to contaminated water entering the surrounding environment.

The initial flood prediction estimate was subsequently re-examined and confirmed in the Supplement. As a precaution, however, flood protection of the ore and waste rock stockpiles has been enhanced by redesigning their platform to RL 40 m AHD; similarly the concentrate stockpile platform has been raised to RL 46 m AHD.

The design flood level of RL 38 m AHD is considered by the Power and Water Authority (PAWA) to be too low. Peak flood discharges estimated by PAWA in 1987 for the McArthur River at Borroloola predict a higher flood level of RL 39.5m AHD at the mine site. The raising of foundation works to RL 40 m AHD and above will provide some measure of protection for the facility, but the modelled levels are too generalised to accurately predict specific flood levels at strategic points or to estimate the potential risks. There are a further 16 years of flow data available from PAWA to refine levels throughout the site and provide information on flow paths and flood velocities.

Recommendation 2

Flood estimates for the mine site should be revised using the additional Power and Water Authority data. Revised flood levels and designs for infrastructure foundations should be verified by the Department of Mines and Energy prior to commencement of construction.

4.1.2 Waste Rock Management

Respondents raised concerns over the plug dumping method proposed for disposing of the waste rock, and the availability of dolomite to neutralise any acid generating potential of the waste rock.

Approximately 50% of the waste rock is dolomite, not 30% as stated in the DEIS (typographic error). The blending ratio of 5 dolomite to 1 pyrite shale was estimated using a sample more like ore than waste rock, and hence the proponent expects the design ratio to provide satisfactory neutralising capacity for the acid generating part of the waste rock.

Plug dumping is used to reduce overall permeability by compacting the waste layers and effectively isolating the acid forming component within dolomite-rich rock. The method is designed to produce a waste rock dump with negative net acid producing potential. Selective dumping of waste rock will be monitored using the Net Acid Generation (NAG) field test to optimise isolation of acid producing rock.

The waste rock site will cover less than 1 ha for the first six years of mining, after which the waste rock will be disposed of down the mine.

The plug dumping disposal method and NAG monitoring method are considered adequate in theory, but the risks associated with the practice cannot be assessed accurately due to the lack of quantitative data. It is important that the waste rock plug dumping method, the underground disposal proposal and associated monitoring programs are detailed within the Environmental Management Plan.

4.1.3 Mine Water Management

Concerns regarding the mine water management system outlined in the DEIS focus on surface and contaminated water flows, and effects on groundwater.

<u>Surface and Contaminated Water Management</u>

There are five issues relevant here:

- contaminated water runoff to McArthur River from the mine site, in particular the heavy metal content;
- die-back in riverine flora due to this runoff;
- adverse impacts on aquatic fauna by heavy metals;
- adverse impacts on terrestrial fauna utilising contaminated water holding ponds; and
- adequacy of monitoring programs to compare predicted and actual impacts on surface waters and terrestrial and aquatic biota in the vicinity of the mine site.

The original proposal has been substantially revised, and the proponent has now adopted the principle of separation of waters of different qualities. Four separate water catchments have been defined for the whole of the mine site. These are:

- Catchment 1. Undisturbed catchment in the saddle of Barney Hill which does not drain any operational areas and hence has no contamination risk. This will discharge to the natural drainage system.

- Catchment 2. The workshop, administration and infrastructure area contains light industrial activities and has a low risk of generating contaminated runoff. It will drain to a pollution trap and sedimentation pond designed to collect the first 50 mm of runoff from any storm event. Rainfall in excess of this will flow into the natural drainage system. The pond will be kept empty during normal operational conditions and de-silted on a regular basis. The water retained after storm events will be disposed of by irrigation.

  Note: Figure 23.2 in the Supplement is incorrect in that the site runoff pond has been mislabelled. Catchment 2 flows into the site runoff pond (labelled sedimentation pond and oil/water separator) for irrigation, while Catchment 3 flows into the containment and settling pond and not the site runoff pond as labelled. Catchment 3 will not be used for irrigation as indicated, but will be sent to the tailings runoff dam for use as process water.

- Catchment 3. Runoff from the ore, waste rock and concentrate stockpiles and process plant surrounds will drain to a containment and settling pond with sufficient capacity to retain the 1:100 year three day storm event. Under normal operating conditions the pond will be kept empty and de-silted. After storm events the retained water will be discharged to the tailings runoff dam for re-use in the process water system.

- Catchment 4. The process facilities such as the concentrator and thickener will be appropriately bunded and will drain to a sump. All spills and rainfall runoff will be directed to the process circuit.

The revised catchment design will significantly reduce the likelihood of any discharge from the mine site, because runoff from the ore and waste rock stockpiles and process area surrounds will be retained in ponds designed to accommodate a 1:100 year three day storm event. Runoff most likely to have elevated contaminant levels will be contained in local area sumps and directed

The proponent is refining the water management system in consultation with the Department of Mines and Energy (DME). In particular, there is uncertainty about the accuracy of the model for the 1:100 three day storm event and the associated design capacity for retention of contaminated water from Catchment 3.

Uncertainties also remain about potential contamination from flooding of the mine site, and the risk to the riverine environment from contaminated runoff cannot be quantified. It is expected that contamination would occur at a local level but be relatively benign in regional terms on current design parameters.
As part of the Environmental Management Plan (EMP), the proponent will need to include a water management and monitoring plan incorporating the undertakings listed at Tables 8.5.1 and 8.5.2 in the DEIS and at Table 1.1 in the Supplement for approval by the Department of Mines and Energy. The plan should ensure that all holding ponds, overflow points and receiving water points are monitored for the chemical parameters listed in the Supplement. Because there are small but significant levels of mercury in the ore, waste rock and tailings, it should also be monitored. Process chemicals such as sodium isobutyl xanthate, baymin, methyl isobutyl carbinol and flocculant may have

significant biological effects, especially if concentrated by evaporation in the tailings impoundment. The level of risk associated with these chemicals needs to be determined, and monitoring implemented if necessary.

In addition, if fauna utilise water from contaminated holding ponds despite design and operational deterrents, the proponent may be required to implement other measures to prevent access such as nets or fences.

The monitoring plan should identify feasible remedial actions that could be implemented if unacceptable impacts occur or appear imminent.

Groundwater

Several issues have been identified concerning:

- estimates of groundwater flow and the hydraulic relationship between the upper and lower aquifers near the mine;
- the chemistry of the groundwater,
- the amount of water to be intercepted and pumped out;
- the method of disposal of the groundwater and its potential effects on the surrounding environment; and
- the potential effects of drawdown of the groundwater on the remnant dry season pools in the McArthur River, and the consequent effects on riverine flora and aquatic fauna.

The original proposal to undertake a regional dewatering program of the groundwater aquifers as a pocket around the mine has the potential for major impacts. There are difficulties in predicting the magnitude and extent of these. For example, despite presenting the current waterbore drillhole results for the mine area, the proponent was unable to accurately predict the required mine water removal rates, nor accurately define the two known aquifers and whether they were connected or not. Consequently the effect of water table drawdown on the riverine environment cannot be predicted accurately.

The regional dewatering program has now been abandoned. Instead, groundwater flow into the decline of the mine will be pumped through an oil/water separator and sedimentation pond (Catchment 2) to a groundwater irrigation system. The existing exploratory adit will be dewatered to make-up the raw water requirements for the concentrator.
Further results from waterbore drillhole studies have improved the understanding of the hydraulic continuity between the upper and lower aquifers. Dewatering waterbore tests have shown significant decreases in standing water at the proposed mine depths, but with a less significant effect on the upper aquifer. The proponent has thus concluded that there may be only limited hydraulic continuity between the shallow and deep strata. Consequently it is expected that less water will need to be irrigated and less drawdown will occur within the upper aquifer. This would reduce the level of drawdown expected on dry season pools in the McArthur River and minimise adverse effects on the riverine environment. The proponent has undertaken to use the groundwater removed from the mine if remedial action is necessary to prevent adverse affects on the McArthur River. PAWA considers that the hydrogeology is still inadequately described and understood, in particular the volume of water to be removed from the mine, the associated effects

of drawdown on the riverine environment, and the quality and suitability of the water for disposal by irrigation.

It is thus not possible to accurately assess the overall impact of dewatering on dry season pools in the Mcarthur River, although it will be less compared to the effects of regional dewatering. It appears that effects will be localised, and mitigation measures may be feasible using irrigation water. Detection and mitigation of adverse effects will require accurate recordkeeping for water quality and levels in waterbores and drawdown monitor holes, and in the McArthur River. Comprehensive baseline studies of riverine and aquatic biota are needed to establish pre-mine conditions, followed by appropriate monitoring to detect any impacts.

It is also difficult to accurately assess the potential impact of the proposed irrigation system (from Catchment 2), although the revised water quality data presented in the Supplement indicate the water is generally of good quality. It has low to medium salinity and low sodium levels, and is suitable for irrigating plants with a medium salt tolerance. Additionally, disposal will be on red and yellow earths which have better drainage characteristics than the clay soils close to the McArthur River. Nevertheless, monitoring of the irrigation and runoff area as outlined by the proponent within the water management plan is important to detect possible long term salinisation trends and effects on native vegetation.

Recommendation 3

(i) The proponent should carry out all water quality, flora and fauna baseline surveys and monitoring programs outlined in the EIS. All baseline surveys shall be commenced prior to construction starting on the mine site.

(ii) Monitoring programmes are to be detailed within the Environmental Management Plan for approval by the Minister for Mines and Energy.

(iii) The model for mine inflow, aquifer continuity, and dewatering rates and chemistry shall be refined to more accurately predict groundwater volumes and quality. Results shall be verified by the Department of Mines and Energy.

4.1.4 Tailings Disposal

Issues associated with tailings disposal relate to further refining the method of disposal, site capacity limitations and long term disposal, flood containment, chemistry of the tailings slurry, suitability of the substrate, seepage potential, acid neutralising potential, salt and dust generation, and rehabilitation.

Dust generation and rehabilitation will be addressed in later sections.

Tailings Disposal Method

The tailings will be discharged as a thickened slurry at a site west of Carpentaria Highway, between Surprise Creek and Barney Creek. The slurry will form a broadly conical pile with a slope of approximately 1% at the centre of a bunded disposal area. Successive discharges will spread and cover previously deposited tailings as thin, free-draining beaches. The tailings will dry quickly and allow for a stable, low angle slope, pancake-type impoundment built over 14 years. The method is dependent on evaporative drying of the stack to produce a dense substrate which is stable under rainfall and which limits subsurface percolation.

The tailings disposal method proposed is not common in Australia, but is suited to low relief and arid areas. The proponent has opted for this method as it appears appropriate for the project and region. The proponent considers that the wet tailings disposal method is not viable for this project due to flat terrain in the vicinity of the mine and the need to re-use as much process water as possible.

Disposal will be staged over three separate parts of the impoundment to facilitate management and subsequent rehabilitation. It is estimated that the tailings impoundment will cover approximately 120 ha.

A runoff dam with a clay core lies directly down slope of the impoundment, and is designed to contain rainfall runoff, decant water and seepage. Surface runoff around and within the impoundment will be controlled by bunds to ensure contaminated water is contained and non-contaminated water excluded.

The proponent will need to submit revised tailings disposal plans for the expanded tailings impoundment from 14 years to decommissioning for assessment by the NT Government.

Tailings Chemistry

Test results indicate that water quality within the tailings runoff dam will have elevated salt levels, but with a neutral pH minimal mobilisation of metals will occur. Sulphate salts are expected to be generated by the tailings, and will migrate upwards and precipitate on the surface during dry periods. These will redissolve during wet periods and the subsequent runoff is expected to initially contain elevated salt levels.

The central thickened discharge method is expected to prevent, or significantly reduce, the potential for seepage of salts. Maintenance of neutral pH and minimisation of percolation of salt through the tailings system will depend on the production of a correct slurry chemistry with the right flow characteristics, and correct application technology at the impoundment.

Tests of tailings samples showed 8.6% S content and thus potentially acid forming according to the Net Acid Producing Potential (NAPP) method. However, the Net Acid Generation (NAG) method indicated the sulphides in the sample, although reactive, did not produce sufficient acid to significantly lower the pH of the material. The Supplement cites experiences with this disposal technique elsewhere, and remedial action to correct changes in pH appear readily achievable. Even so, it is not possible to accurately predict the level of risk such a process will pose to the immediate environment, nor quantify the level of significance of such a risk.

Recommendation 4

(i) The proponent should submit laboratory test results, including the weathering and leaching behaviour tests still to be completed by Environmental Geochemistry International Pty Ltd, to the Department of Mines and Energy for approval of the final design and operation conditions for the tailings disposal method.

(ii) the proponent should maintain adequate tailings slurry chemistry records to assist in predicting alterations to the chemistry, and shall undertake appropriate remedial action to maintain a neutral pH of the decant water.

Flood Design

The original capacity of the tailings impoundment and runoff dam has been increased by raising the bunding and dam embankment to RL 43 m AHD. This will cater for normal operational water storage requirements for the mine plus additional capacity to contain the estimated 1:100 year three day storm event. Overflow will not occur except in extreme wet season conditions such as a greater than 1:100 year three day storm event. Such overflows would only occur when the surrounding country side is also inundated which would result in maximum dilution of the water.

There is still uncertainty about the adequacy of the predictive model to accurately identify the level of flooding expected at the tailings area (see previous comments on Mine Site). Although the dam height has been increased to RL 43 m AHD, it is essential to ensure that overflow and release of water to McArthur River due to localised storms does not occur under low river flow conditions. Consequently the water balance for the tailings runoff dam needs further refinement to more accurately predict overflow conditions and the design requirements of the runoff dam to prevent such flows.

Recommendation 5

The predictive flood model for the tailings area should be refined and take into account the design of the tailings runoff dam and mine water budget. Department of Mines and Energy approval should be required prior to construction commencing on the tailings runoff dam.

Seepage From Tailings Area

Seepage of salts in the impoundment is not expected by the proponent if the slurry is applied appropriately to aid quick drying of the stacks. The tailings runoff dam is not expected to seep either, due to the engineered clay core. The proponent proposes to monitor the effectiveness of the tailings impoundment and runoff dam by monitoring for ions and metals in the dam, Barney Creek, McArthur River and groundwater monitoring bores downstream of the runoff dam. Scheduling will be on a monthly basis (dry season) and fortnightly basis (wet season) and after any overflow due to flooding. Remedial action comprises an alteration to the application method and/or construction of trenches or retention structures to collect such seepage as may occur.

The proponent has not demonstrated that seepage will not occur, nor accurately predicted its quality or quantity. Due to the undetermined risk from seepage, effectiveness of the proposed monitoring program will depend on further geotechnical assessment of the substrate to assist in predicting seepage chemistry. The monitoring program should also be designed to identify heavy metals from Catchment 3 water as well for salts and acid levels. It should be compatible with the proposed flora and fauna baseline and monitoring programs to be outlined in the Environmental Management Plan for submission to the NT Government for approval. The placement of water monitoring bores in the undeveloped portion of the tailings impoundment will enable early detection of seepage before it passes downstream of the runoff dam, and will allow for a quicker response and alteration to slurry management to limit any seepage. The results may also be useful in defining uncontaminated groundwater quality in the catchment, and in interpreting on-going laboratory tests on the slurry for making predictions on field behaviour.

Recommendation 6

The proposed water quality monitoring program outlined in the EIS should be expanded to include groundwater up stream of the runoff dam in Barney Creek and in the tailings impoundment, and should identify heavy metals from Catchment 3 water.

4.1.5 Power Generation

It is not entirely clear whether diesel fuel or heavy oil will be used in the power station at the mine site. The Supplement has adequately covered the concern over SO_2 emissions by reconfirming the model used for estimating a minimum stack height of 60m (for heavy fuel oil) utilising assessment criteria set by NHMRC/ANZECC standards ie. a one hour goal of 0.25 ppm for SO_2 emissions. This should ensure the accommodation area is not adversely affected by emissions. The natural environment should also be unaffected by emissions as the standards set for emissions follow human health criteria. Evidence points to effects on natural environment at levels roughly twice those that will begin to affect humans.

If the proposed power generation method differs from that assessed in the FEIS, a further report on power generation will be required for determination of environmental assessment requirements.

The EIS has adequately covered the protection of the power station from flood by raising it at or above the RL 40 m AHD level. Further refinement of this level will eventuate following from recommendations listed under Mine Water Management. Potential pollution of the surrounding environment has been mitigated by draining runoff via Catchment 2 for irrigation purposes.

Recommendation 7

If the proponent decides to opt for private power generation, final design and operation plans for the power station and fuel storage facility should be submitted to the Department of Mines and Energy for approval prior to construction.

4.1.6 Health and Safety

Insect Disease Vectors

Concern over insect vectors of disease arose from the lack of appropriate baseline data outlined in the DEIS. No adequate monitoring programs were set in place for the construction and operation phases of the mine site.

The proponent proposes in the Supplement to undertake an additional baseline survey for biting insects in the vicinity of the mine site as well as monthly monitoring program. The baseline survey and monitoring program will be developed in consultation with the Medical Entomology Branch of the Department of Health and Community Services (DHCS).

The proponent has adequately addressed the major concerns associated with preventing insect breeding at the mine site during construction and operation.

Recommendation 8

The proponent should consult with the Department of Health and Community Services to produce a disease vector baseline survey, monitoring program and remedial action plan for the mine site.

Management of Dust

There are 3 areas of concern for dust management at the mine site; concentrate storage, tailings disposal and nuisance dust.

Concentrate and tailings dust are of concern because its extremely fine nature (less than 10 micrometres) means that it is easily respirable and thus a threat to human health.

The concentrate stockpile will be walled with a solid roof, while the concentrate will be maintained at a 13% moisture level to prevent dusting (dusting apparently occurs below 6.5%). The emergency concentrate stockpile will be walled, watered and covered by a temporary canvas cover to prevent dusting. All concentrate handling equipment will also be covered.

The tailings disposal method relies on the drying of the slurry stacks to form a salt encrusted surface. Surface crusting has occurred on McArthur River tailings trials at Mount Isa, and the proponent expects similar crusting to occur at this tailings site. If dusting does occur at the tailings impoundment, it is proposed to spray the water from the runoff dam onto the surface .

The proponent also intends to set up a dust monitoring and medical program for both environmental and occupational health applications.

To this end the proponent has made commitments to the following:

- an air quality monitoring program will be implemented for the mine site and tailings area according to appropriate Australian Standards,
- recording of air data from the automatic weather station at the mine site,
- a background heavy metal soil sample baseline study and annual monitoring program around the mine site, and
- pre-employment medical checks to include X-rays and blood tests for lead and zinc levels, as well on-going medical screening.

The generation of nuisance dust at the mine site will be managed by routine watering of unpaved roads and the watering of bare areas prior to rehabilitation. The requirement for road watering will be routinely monitored and adjusted in frequency as necessary.

The EIS adequately addresses the need for nuisance dust suppression, the suppression of concentrate dust during storage, and makes provision for medical screening and monitoring programs.

Concentrate dust generation is considered further under "Transport Issues"

Recommendation 9

The proponent should provide details of the proposed dust monitoring and medical health program, including remedial options, in the Environmental Management Plan for assessment and approval by the Minister for Mines and Energy.

Noise

The equipment and operations associated with the mine will produce significant localised noise levels. The proponent has acknowledged this and undertaken to complete pre-employment hearing tests as well as on-going hearing checks associated with the planned medical health checks. Operating conditions for equipment will include the use of appropriate protective hearing equipment as well on-going noise surveys. The proponent has also undertaken to recognise noise control as a significant component in the selection of equipment for purchase.

The risks associated with the operation of equipment have been identified and the proponent has undertaken to mitigate these risks through hearing protection, equipment choice and noise monitoring programs.

Sewage Disposal

The sewage disposal proposals are acceptable in principle to DHCS, the regulatory authority for such installations, and will be further scrutinised when detailed designs are available. The system will be designed to accommodate approximately 140 people and will treat sewage to a secondary standard. Treated water will be disposed of by irrigation to a red earth site which has suitable assimilative capacity. However, poor disposal techniques have the potential to create ponded areas for the breeding of biting insects. Contamination of the irrigation area through inappropriate application rates is also possible.

The planned submission of detailed plans for the sewerage system by the proponent should adequately address the concerns raised for the mine site.

Recommendation 10

The proponent should submit final detailed plans for sewage disposal at the mine site through the Department of Mines and Energy to the Department of Health and Community Services for approval prior to commencement of construction.

4.1.7 Erosion Control and Rehabilitation

Soil Erosion

There is a potential risk of severe soil erosion if major site disturbance coincides with periods of heavy rainfall.

The proponent intends to complete all earthworks and associated soil conservation and erosion control measures prior to the onset of the wet season. Where this is not achieved, disturbed and potentially vulnerable areas will be temporarily stabilised by seeding or other erosion control measures until completion of construction is possible.

It is considered that this is an appropriate strategy to adopt, given the uncertainty of predicting the onset of the wet season. However, specialist advice from the Land Conservation Unit of the Commission at the detailed planning stage would ensure that the erosion control measures are appropriate.

Recommendation 11

The proponent should consult with the Department of Mines and Energy at the design stage to ensure that any proposed temporary stabilisation measures for roadworks and earthworks are appropriate.

The rehabilitation proposals for the mine site are not well documented, in particular those for the waste rock dump and the tailings impoundment. Five options are listed in the EIS, but rehabilitation plans will need to take account of the actual physico-chemical site limitations which may affect the establishment of vegetation. With the tailings impoundment and waste rock dump, option 5 would appear to be the only option applicable bearing in mind the nature of the substrate. The tailings impoundment is by far the largest area to be rehabilitated and will require considerable inputs to achieve a stable self sustaining vegetation cover.

Ongoing consultation with specialist advisory bodies within the NT Government will be required to ensure the success of rehabilitation measures.

Recommendation 12

A comprehensive rehabilitation plan for all disturbed areas and waste disposal sites should be prepared by the proponent for approval by the Department of Mines and Energy. This plan should include specific rehabilitation requirements and practices for the waste rock dump and the tailings impoundment.

4.1.8 Disposal of Hazardous Substances and Dangerous Goods

Management of hazardous substances and dangerous goods involves correct storage (particularly of explosives), the handling of such substances, and the disposal of hazardous wastes and containers generated during the operation of the mine.

The proponent has undertaken to comply with relevant codes, Acts and Regulations for the storage and handling of dangerous goods associated with the mine site. This will cover explosives and chemicals used in the process plant.

The proponent has not yet selected a method of hazardous waste disposal but has considered two options. These are burial of waste in either the tailings impoundment or an engineered landfill site.

Management of the tailings impoundment would become increasingly complicated over time by the presence of scattered repositories of hazardous materials. It would appear preferable on economic and environmental grounds to concentrate and contain such wastes in an engineered landfill site on the mineral lease.

Recommendation 13

Hazardous waste should be disposed of in an engineered land fill site on the mineral lease. Ongoing monitoring and management of the approved waste disposal site should be outlined in the Environmental Management Plan.

4.1.9 Aboriginal Significant Sites, Archaeology and Heritage

The proponent has consulted the Aboriginal Areas Protection Authority regarding sites of significance, and has been issued with an Authority Certificate to cover the operation of the mine and tailings dam. The proponent has acknowledged the need for strict compliance with the conditions for the avoidance and protection of sacred sites set out in the Authority Certificate.

A number of respondents to the DEIS stated that the surveys for archaeological and heritage sites associated with the mine site were inadequately documented. This limited an assessment of the effectiveness of the survey methodology, the significance of the sites and the proposed measures for protection. The proponent has provided all the completed archaeological survey reports in the Supplement.

The mine site survey focussed on proposed impact areas such as the process plant site (Barney Hill), tailings pipeline route, tailings impoundment and runoff dam, and the accommodation site. Two archaeological sites were recorded during the course of the survey; Surprise Creek Open Scatter (Borroloola Sheet 6165, GR 128855) and Barney Hill Open Scatter (Borroloola Sheet 6165, GR 163827).

The survey report suggests that the Surprise Creek Open Scatter site is common to many other scatters in the region and that the site is of no special archaeological significance. Further recording is not required.

The site at Barney Hill is of archaeological significance due to its unusual scatter and unique location. The report recommends that the Barney Hill site be further studied via a detailed in situ survey prior to construction and development commencing over the Barney Hill area.
The proponent has stated that neither site are located within areas planned for disturbance, but has undertaken to realign the mine access road to ensure the Barney Hill Open Scatter is bypassed. Should future planning require disturbance of such sites, detailed recording will be undertaken in accordance with the requirements of the Heritage Conservation Act 1991. A follow-up survey will be completed on the site to fully document it, including an assessment of the significance of the European artefacts present. The proponent has undertaken to protect the site from accidental incursions.

The archaeological survey for the mine site appears adequate, even though there are deficiencies regarding the methodology used to identify the archaeological resources within the survey area.

If previously unidentified artefacts or material are identified in the mine site area during construction or operation of the mine, the requirements of the Heritage Conservation Act 1991 will need to be fulfilled.

4.1.10 Environmental Management Plan

The proponent has undertaken in the EIS to prepare an Environmental Management Plan for the mine site which will include;

- a water management plan,
- a rehabilitation plan, and
- an environmental monitoring plan.

The proponent has also agreed to submit an Annual Environmental Report in August each year, as required by the Department of Mines and Energy. This will specifically review the previous wet season water management and propose a water management strategy for the following year.

Monitoring programs are an important component of the EMP, and the proponent has undertaken to include air and noise quality, water quality, soil monitoring, groundwater bore monitoring, monitoring of the irrigation area, flora and fauna, biting insects, waste rock dump, meteorology, and medical health checks. Also included will be fire, weed, and erosion control measures as well a comprehensive rehabilitation program and a hazardous waste management plan.

The issue of thresholds to trigger remedial action or a response has not been resolved. In particular, how and what threshold levels will be set for the monitoring programs such as the terrestrial fauna and flora, aquatic fauna, water quality and soil quality surveys, and the scale of change to be detected. The monitoring programs will need to be statistically valid, accurate, provide a sensitive measure for impact prediction and able to be modified for long term impact monitoring. If monitoring thresholds cannot be stipulated in the monitoring plan, they need to be described in terms of a reactive monitoring program, whereby monitoring results are assessed for impact against baseline data, followed by remedial action if required.

The deficiencies in the baseline studies for the EIS have placed emphasis on the preparation of appropriate EMP's to cover all potential environmental impacts associated with the proposal. The plans should reflect the varying environmental requirements associated with the construction phase, operation phase and decommissioning phase for the mine, and include:

. water management and monitoring, incorporating the undertakings listed at Tables 8.5.1 and 8.5.2 in the draft EIS and at Table 1.1 in the Supplement. The plan should ensure that all holding ponds, overflow points and receiving water points are monitored for the chemical parameters listed in the Supplement. The monitoring plan should identify feasible remedial actions that could be implemented if unacceptable impacts occur or appear imminent;

. management of surface and underground waste rock dumps;

. fire management in consultation with the Bush Fires Council; and

. the plans must also reflect compliance monitoring requirements and audit requirements stipulated by the NT Government.

A spills contingency plan is discussed in detail in Section **4.2.4**.

Recommendation 14

The proponent should prepare and submit the Environmental Management Plan incorporating all the undertakings listed in the EIS for the mine site (with specific emphasis on the monitoring criteria) to the Minister for Mines and Energy for approval.

The plans should reflect the varying environmental requirements associated with the construction phase, operation phase and decommissioning phase for the mine, and include:

. water management and monitoring, incorporating the undertakings listed in the EIS. The plan should ensure that all holding ponds, overflow points and receiving water points are monitored for the chemical parameters listed in the Supplement.

. management of surface and underground waste rock dumps;

. fire management in consultation with the Bush Fires Council; and

. the plans must also reflect compliance monitoring requirements and audit requirements stipulated by the Department of Mines and Energy.

4.2 TRANSPORT ISSUES

4.2.1 ALTERNATIVES

Concentrate Shipment

The single most contentious issue to emerge during assessment was the proposal to truck concentrate through the middle of Borroloola. The proponent has discarded this alternative in favour of using the dedicated bypass corridor northwest of the town, and this is further discussed below.

There were 4 transport route alternatives examined for shipment of the concentrate:

(1) via Ataluma Point on Centre Island. There are 3 options for concentrate handling within this alternative; road transport either in bulk or in containers to a stockpile at Batten Point linked by barge to a shiploader at Ataluma Point, or pipeline transport as a slurry direct to Ataluma Point followed by dewatering and bulk storage at a shiploader.

(2) via Batten Point to Groote Eylandt. This involves road transport in bulk to a barge loading facility at Batten Point for trans-shipment to bulk storage and an existing ship loader at Groote Eylandt.

(3) via road transport in bulk to Darwin. This would utilise an existing shiploader facility.

(4) via road transport in bulk to Bing Bong Station. A shore based loading facility and a self-unloading barge will be used to transfer concentrate to a bulk carrier offshore.

Alternative (4) has been adopted by the proponent on economic grounds, and has the advantage of avoiding the environmentally sensitive areas in McArthur River and around the Sir Edward Pellew Group of islands. Groote Eylandt was ruled out on economics, and this is supported on environmental grounds as it also avoids the Pellews.

Although it is preferable to use existing shiploading infrastructure in Darwin, the cost of operating road transport over this distance has ruled this option out. If it is adopted in the future, the risk to public safety and the increased probability of a spill in environmentally sensitive areas would entail further environmental assessment.

4.2.2 ROAD TRANSPORT

Concentrate Dust Emissions.

Emissions during loading at the mine site are unlikely because the concentrate will be at the designed moisture level. Additionally, the proponent has designed a wheel wash facility to capture any wheel borne emissions.

Concentrate may escape from trucks in transit either as dust from dry concentrate due to exposure to the vehicle slipstream, or as a slurry through gaps in the bottom of the truck tray.

Unloading at the barge facility stockpile has the greatest potential to generate dust due to drying in transit and air currents engendered by the side dumping operation.

The proponent has undertaken to use purpose-built trucks to ensure that dust or slurry cannot escape in transit. Covers will be designed to seal the load, but it is not clear whether this will prevent drying of the top layer of concentrate.

Additional measures may be needed to control dust generation, and may include provisions such as dampening the surface layers of concentrate within the trucks immediately prior to unloading.

Recommendation 15

Appropriate measures must be adopted to prevent emissions of concentrate dust during transport to the barge facility.

Concentrate Haulage Route

Alignment.

The proponent originally intended to utilise existing public roads, including Robinson Road through Borroloola. This attracted numerous adverse responses from public and private commentators on the draft EIS, and the option was dropped in favour of constructing approximately 15 km of new road along the 1 km wide dedicated haul corridor which bypasses Borroloola to the northwest. This will connect the Carpentaria Highway at about 8 or 9 km before the turnoff to Borroloola (50 km from the mine site) to the Bing Bong Road about 6 or 7 km north of Borroloola (13 km south of the Batten Point turnoff).

There appear to be no environmental constraints to the construction of the new road along the dedicated corridor, but the existence of significant archaeological or heritage sites has not yet been determined.

Standards and Maintenance.

The impact of 14, and possibly up to 24, 90-tonne road trains per day on the single lane bitumen Carpentaria Highway from the mine site to the bypass will lead to accelerated deterioration of pavement surfaces and gravel shoulders. This will increase the hazard to other traffic as well as haulage vehicles, due to the need to partially move off the bitumen to accommodate oncoming or overtaking traffic. Intersections at the mine site and the bypass are another hazard, due to the length of haul vehicles and the increased times necessary for acceleration and deceleration of loaded vehicles.

The road from Bing Bong Station to the bypass is another section of public road which will be affected by heavy haulage traffic. If the road is to remain unsealed, dust may present a significant visibility hazard to other users. Additionally, corrugations and potholes may result in loss of control of light vehicles, leading to an increase in the number and severity of traffic accidents.

The Batten Creek crossing will need to be upgraded to a standard which minimises the chance of an accident occurring on the crossing or its approaches. It will also be prudent to allow for heavy plant access points to the creek bed downstream of the crossing (see the discussion below on concentrate spills).

The proponent has held discussions with the Northern Territory Government regarding upgrading of the above public roads including the appropriate design standards and maintenance requirements. The bypass and intersections will be built to NT Government standards. The proponent is negotiating with the NT Government regarding funding arrangements for roadworks which are in the public domain.

It is considered that the proponent has adequately addressed the issue of design standards for roads and associated structures.

Construction Materials.

The demand for resources such as gravel may result in significant disturbance at certain sites if resources prove scarce and activities are concentrated within limited areas.
The EIS satisfactorily covers aspects of drainage control and pit rehabilitation, but does not adequately consider site layout criteria such as maximum pit areas or buffer strip requirements. Extraction will need to be carried out in accordance with the guidelines published in CCNT Technical Report N° 13, "Guidelines For Effective Rehabilitation Of Borrow Pits In The Top End" (R.J.Applegate, 1983).

Timing of Construction.

See discussion and recommendation under **4.1.7**, p19.

Traffic Safety.

It is not economically feasible to construct and maintain a dedicated haul road (ie no public access) from the mine site to Bing Bong Station.

The proponent has indicated that road and intersection design standards will meet NT Government criteria, but driver error and reduced visibility on gravel roads has the

potential to elevate the number and severity of road accidents above acceptable levels. This will be exacerbated by the disproportionately high level of heavy industrial vehicle traffic mixed with tourist traffic (often towing boats or caravans) during the dry season.

Wet weather hazards include flooding and scouring of creek crossings, loss of braking efficiency, impaired visibility during heavy rainfall, and loss of traction on unsealed surfaces.

The proponent has recognised the importance of adequate training of haul truck drivers, and has undertaken to set up a driver training course. However, specific details of the scope and standard will not be developed until the detailed design phase of the project.

Recommendation 16

The proposed heavy vehicle driver training program should be submitted to the Department of Mines and Energy for approval, and should be implemented prior to the commencement of haulage operations.

Concentrate Spills.

The potential for concentrate spills due to road accidents within the township of Borroloola was of concern to a number of respondents, especially residents. These concerns have been resolved by the proponent adopting the bypass corridor option.

The risk analysis of spill frequency along the haul route adopts a conservative approach, and is considered adequate despite some uncertainty regarding the basic assumptions.

The proponent has undertaken to use purpose-built trucks for concentrate transport, and the design will take into account the experience gained from the Woodcutters mine project. The proponent also considers that the use of retractable covers will contain the load in the event of a truck overturning, except where the vehicle suffers serious structural damage.

There is still a significant risk that concentrate spills will have severe and unacceptable impacts on biota adjacent to the transport route under the following conditions:

- the concentrate will escape from containment within the vehicle;
- the concentrate will be transported to, or near, the habitat of vulnerable organisms;
- toxic levels of leachate will be generated from the concentrate;
- vulnerable organisms cannot move from their habitats to escape leachate effects; and
- concentrate cannot be cleaned up before any of the above occur.

Given the above, the greatest acute and chronic risks will be to riverine and aquatic biota downstream of creek crossings along the haul route. This will occur during periods of flow when cleanup cannot be readily achieved, and sufficient time will have elapsed to allow generation of toxic levels of leachate.

The Batten Creek crossing has been identified as the most vulnerable site for a spill because of the coincidence of the preconditions for significant environmental impacts and the proximity of the McArthur River.

The proponent has adopted an acceptable approach, given that the low probability of a spill will be further mitigated by the proposed driver training course and the adoption of appropriate design standards for the haul road. Nevertheless, the potential impacts resulting from creek crossing spills, and public perceptions of long term downstream effects on the McArthur River, requires that the proponent make provision for an emergency response in the event of such a spill.

Recommendation 17

The proponent should prepare a spill contingency plan, focussing on concentrate spills at strategic and vulnerable areas such as the Batten Creek crossing.

Dangerous Goods and Fuel

The barge facility will require fuel for power generation and for barging operations. The current intention is to use road transport, and this will pose another hazard to vulnerable biota (aquatic and riverine) in the event of a spill because of the mobility of the material.

Although the responsibility for cleaning up spills on public roads usually rests with the haulage contractor, the proponent needs to address fuel spills along the haul route within a spill contingency plan.

The proponent has stated that inward transport to the mine site of materials, fuel, dangerous goods and explosives will be in accordance with the relevant legislative requirements. This is an acceptable response, given that such transport will largely be undertaken by haulage contractors not directly under the control of the proponent.

Recommendation 18

The proponent should prepare a spill contingency plan, covering potential fuel spills at strategic or vulnerable areas on the concentrate haul route such as the Batten Creek crossing.

4.2.3 BARGING AND SHIPPING

Fuel and Chemicals

The proponent has not considered the option of barging fuel, process chemicals or other dangerous goods to the mine site via the Bing Bong barge facility and the haul road. If this option proves feasible, a rigorous assessment of the potential environmental impacts will be required because of the significant conservation and heritage values of the surrounding coastal waters and littoral zone.

Recommendation 19

If the barge route alternative for fuel and dangerous goods supply is adopted by the proponent, appropriate environmental assessment of this transport mode will be required.

Spills Policy

The risk of pollution and impacts on marine organisms from concentrate and fuel spills is of considerable concern to most of the respondents to the draft EIS.
This concern is acknowledged by the proponent who has made substantial commitments to ensure that spills will not occur, including the preparation of an Environmental Management Plan with a "no spill policy" and use of Best Available Technology (BAT) and Best Management Practices (BMP). Details of BAT and BMP however, were not described in the EIS and a commitment has been made to include details in the Bing Bong Environmental Management Plan (EMP).

Recommendation 20

(i) The detailed design for the Bing Bong facility and barge loading operations should be subject to review by the Department of Mines and Energy, prior to final approval to proceed.

(ii) Best Available Technology and Best Management Practices programs (as approved by the Department of Mines and Energy) should be included in the Environmental Management Plan for Bing Bong, detailing design information on the loading proposal, including equipment and operational conditions.

The Environmental Management Plan should meet the objectives of a no spill policy for all pollutants including concentrate, toxic or hazardous chemicals, and fuel.

Onshore Facilities

Design for Storm Surge.

The project design life of 20 years was adopted as the return period for calculating the still water storm surge level of 4.0m above Chart Datum. The projected wave height was calculated at 3.6m on top of this, giving a total design height of 7.6m. This will avoid wave slam forces on the main barge loading structures, but it is not clear whether the stockpile building will be affected or inundated at this level.

The proponent has stated that the stockpile building will be designed to cyclone proof standards, and will be located in an area above the design storm surge level. The same criteria apply to oil storage facilities, which will also be bunded to contain spills; this will afford slightly more protection from inundation. The objective is to completely contain concentrate and all potentially hazardous materials in the event of a cyclone.

The above design criteria are acceptable for the 20 year project life, but there is the possibility that the project life may be considerably extended. If the mine lease period is set at 25 years with an option for a further 25 years, the 20 year storm surge return period will be inappropriate for calculating surge levels. The alternative of modifying structures to allow for a greater probabilistic exposure to higher surge levels during an extended project life may not be economically feasible.

The design storm surge level of +4.0m CD thus appears to be inadequate given the real possibility of a considerably extended project life, and will not meet the objective of complete containment at the facility. The wave height calculations appear to be adequate.

Appendix E.1 of Volume 2 of the Supplement discusses the marine physical environment pertinent to the facility, and recommends that "at the next phase of investigation the cyclonic surge levels, wave heights etc. be confirmed by the Bureau of Meteorology numerical model that has been developed especially for the Gulf" (p3.12). This is considered essential to confirm the validity of the +4.0 m CD level even if the project life remains at 20 years.

Recommendation 21

The proponent should consult with the Bureau of Meteorology to validate the storm surge design levels adopted for the barge facility, and modify design levels as appropriate to meet the objective of containment of hazardous materials, fuel and concentrate during the maximum potential life of the project.

Effects on coastal processes.

The proposed causeway to the barge loader was identified as having the potential to upset the equilibrium dynamics of longshore sediment transport processes, with associated effects on Little Tern breeding areas some 20 km northwest of the facility. Although there is a considerable volume of potentially mobile sediment near shore, and the available evidence suggests long term progradation of the coastline, the vectors and rates of sediment dynamics are not known. The comparison of aerial photographs for the period 1943 - 1984 may not show the long term trends, because long term low energy processes may be interrupted by storm events. For example, the effect of Cyclone Kathy in March 1984 on offshore dune morphology may not have been accounted for in the interpretation of sediment patterns (presumably the photography was flown post-cyclone).

Given the uncertainties regarding sediment transport, it is not possible to assert that "there will be a gradual change in the coastal alignment", or that "physical changes...would occur gradually allowing the ecology of the area to adapt" (Supplement Vol. 1, p.6.2). However, it is reasonable to expect that changes in a low energy environment will be slow in the absence of storm events or other perturbations such as changes in nearshore currents due to dredged channels. It would appear prudent of the proponent to design a causeway of minimal length to minimise the need to shift sand around the causeway or dredge it from the mooring basin. This would also allay concerns about the long term effects of sand depletion on the Little Tern breeding areas northwest of the facility.

Although the proponent has not determined the final configuration of the causeway and trestle, the design shown in the DEIS (Vol.1, Figure 3.8.3) is preferable to that shown in the Supplement (Figure 41.3).

Recommendation 22

The proponent should design the barge loader facility so as to minimise the causeway length across the active sediment transport zone.

Effects on Coastal Fauna.

The Gulf coastline, including the Bing Bong - Sir Edward Pellew islands area, provides important habitats for migratory birds subject to international agreements.

The displacement of terrestrial and marine fauna attributable to the shore based facilities and operations is accepted as likely to be minimal, but a baseline study and follow up surveys once the facility is operational will provide a valuable scientific basis for predicting the potential effects of similar projects or expansions of the proposed facility.

Recommendation 23

The proponent should incorporate a study of shore birds, resident and migratory, within the proposed baseline studies at Bing Bong to determine the displacement effects brought about by construction and operation of the barge facility.

Foundation Material.

The use of dredge spoil as foundation material for the causeway and stockpile facility may not be advisable if there is any uncertainty regarding its engineering suitability. It is considered more prudent to utilise available resources of known geotechnical characteristics on Bing Bong Station. Borrow pit design on the site designated for extraction in Figure 41.5 of the Supplement will need to meet the additional requirements for settling ponds and associated structures if the disposal of dredge spoil is to be accommodated there - see Section **4.3** on dredging.. Although no estimate of pit dimensions or extraction volumes was given in the Supplement, the hatched area in Figure 41.5 suggests an area of about 25 ha will be used. The 760 000m^3 of dredge spoil will cover this area to a depth of at least 3m. Consequently, the guidelines applicable to roadside borrow pits are not considered appropriate, and the proponent will need to provide design details and engineering criteria for the borrow pits/dredge spoil ponds. Refer to **4.3** for recommendations.

Fuel Storage and Barge Refuelling Structures.

There is a risk of spillage of diesel fuel from storage and transfer facilities, and such spills may have deleterious effects on littoral flora and fauna, and marine animals including seabirds, turtles, dugong and cetaceans. There is also a potential threat to terrestrial biota and groundwater resources adjacent to the facility.

The risk of spillage is greatest during refuelling of the barge. Coupling failure is the most probable event leading to a spill, although rupture of the pipeline or fuel storage tanks remains a possibility.
The proponent has undertaken to incorporate features into the design of the berth head fuel transfer structures to prevent loss of pipeline contents during normal barge refuelling operations in the event of coupling failure.

It is considered that the proposed design measures are adequate to safeguard against most realistic event scenarios, but it is important to ensure the storage facilities are located above the storm surge level.

The use of dispersants in the event of a spill is not appropriate, but containment devices or absorbent materials will be necessary to minimise the effects on vulnerable organisms. It is not clear whether fuel for the barge will be stored onshore, since the only tank storage indicated in the DEIS is 6,000 litres. The capacity of the barge is 30,000 litres. These matters need to be addressed fully in the spill contingency plan.

Concentrate Stockpile Spills.

Concentrate may escape from the stockpile facility by wind, water or gravity. The building will be cyclone proof, and will completely enclose the stockpile. Trucks may be involved in accidents at the site, but this is considered unlikely due to low speeds needed to negotiate the access road. Containment within the truck will also reduce the probability of loss of concentrate.

Consequently, the only likely loss of significant volumes of concentrate will be caused by water. The greatest risk would be due to storm surge, since flooding by overland flow is virtually impossible given the terrain. Adequate provision for storm surge will thus be the major safeguard against spills from the stockpile, and has been discussed previously. Nevertheless, site drainage should incorporate provisions for diverting any runoff away from or around the building. Runoff from the building itself and the truck access road needs to be contained in case of spills occurring during wet weather. See following section for runoff control.

Concentrate Stockpile Emissions.

Concentrate emissions may occur as airborne dust or by mobilisation of deposited dust during rain. The generation of dust has been discussed previously in relation to road transport, but there needs to be provision of water points within the stockpile building to maintain adequate moisture content. The building should also be capable of containing any dust which may be generated during further handling of the concentrate.

There is the potential for chronic emissions occurring via plant and equipment wheels and lower body structures. This includes front end loaders which may move between the stockpile and other parts of the facility. The location of the wheel wash facility as shown in Figure 3.8.3 of the DEIS is inappropriate, as significant deposition of wheel-borne dust is possible outside of the building before the wheel wash.

A ready solution to the above issues would be to install wheel wash facilities at the building entry and exit points, such that vehicles cannot avoid using them. Rainfall runoff from the stockpile building and truck access road will require containment and diversion to a settling pond, as discussed previously. It should be feasible to combine some components of the wash and rainfall containment structures.

Conveyor Spills and Emissions.

There is a direct threat to marine and littoral biota if spills or emissions occur from the conveyor. The proponent has undertaken to use the best available technology, including a completely enclosed conveyor and conveyor monitoring and protection systems to guard against mechanical failure or blockages. Sprays will be fitted for dust control. As part of the proponent's "no spills policy", there will be comprehensive operator training, monitoring and procedural measures established to back up the mechanical systems.
It is considered that the implementation of a no spills policy is an acceptable strategy to prevent spills or emissions, provided that it is supported by an adequate spill contingency plan.

Barge Loading Spills and Emissions.

The greatest risk of spills or emissions which may affect sensitive or vulnerable biota is at the barge loading point. This is because the conveyor mechanical protection systems do not extend onto the barge, spilt concentrate may not be readily retrieved due

to rapid dispersal or adverse weather, and the habitats of species having significant national and international conservation values may be adversely affected.
The proponent will use best available technology such as automatic position detectors for loading chutes to prevent concentrate transfer in case of misalignment, and will apply the no spill strategy to the barge loading operation. The proponent has undertaken to set up equipment and procedures to deal with spills, and will arrange insurance to cover restoration costs in case of catastrophic structural failure or accidents.

Dust generation at the ship mooring area is another source of potential fugitive spillage over time. Concentrate moisture content will be critical to reduce dust, and how this is achieved at these transfer sites will need specific attention by the proponent. It is suggested that a dust skirt around the telescopic chutes be considered as a possible safeguard in the final design stage.

Recommendation 24

(i) Site drainage at the barge loading facility stockpile should divert general site rainfall runoff away from the stockpile building. Runoff from the building and the adjacent haul truck access road should be contained and diverted to a pond capable of retaining a 1:100 year 3 day storm event;

(ii) A wheel and underbody wash system should be used at all plant exiting points for the stockpile building to prevent concentrate emissions;

(iii) Appropriate measures must be adopted to prevent emission of concentrate dust during transfer, transport and storage phases.

There is a risk of emissions along the causeway or at the berth head due to plant traffic from the barge to the stockpile facility, especially when front end loaders from the barge are disembarked. Consequently, a wheel and lower body wash system needs to be installed on the barge. Wash water and sediment will need to be contained on board for disposal to future shipments.

Recommendation 25

A wheel and lower body wash facility should be used on the barge prior to disembarking of plant and equipment. The sediment and wash water should be contained onboard for disposal to future concentrate shipments as a dust control measure.

Infrastructure.

The barge loading facility will require power, water and sewerage infrastructure to support the facility and accommodation areas. Power generation will be by diesel fuelled generators, with fuel tanks bunded as required to contain any spills. Water will initially be supplied by road tanker, followed by development of as yet undefined groundwater resources. Groundwater quality improves with distance from the coast, and bores may be located several kilometres from the facility. Significant impacts are not considered likely from the extraction, treatment or piping of water provided that disturbed sites are rehabilitated, and the potential for increased risk of mosquito breeding is minimised (see following discussion re guidelines).

The proponent has undertaken to use a packaged treatment plant which will satisfactorily treat domestic sewage. Residual sludge can be disposed of either in disused borrow pits to enhance the rehabilitation process, or in a domestic waste landfill site. It will be important to avoid ponding of any treated water which may lead to increased mosquito breeding activity. Consequently, the proponent will need to adhere to the guidelines published in 1988 in the booklet "Construction Practice Near Tidal Areas In The Northern Territory: Guidelines To Prevent Mosquito Breeding".

Recommendation 26

The proponent should comply with the guidelines in "Construction Practice Near Tidal Areas In The Northern Territory: Guidelines To Prevent Mosquito Breeding".

Offshore Activities

Loading Activities and Carrier Mooring Location.

The issues associated with the carrier mooring location and associated loading and unloading activities include:

- potential disturbance to the seafloor and marine habitat
- potential impact on commercial fisheries, including the risk of collision
- potential impacts of boat traffic on marine mammals
- the possible introduction of exotic marine organisms from the discharge of ballast water from export ships
- the increased risk and potential impact of spills in the area

The impact and risk of concentrate and fuel spillage has been addressed in the previous section. It is reasonable to assume that the risk of small spillage and dust emissions could be higher at the offshore anchorage location due to exposure to heavy weather conditions. Spill modelling and risk assessment will have to be undertaken for this new location.

It should be noted that the final site for the offshore anchorage is subject to further investigation by the proponent, and the oceanographic survey remains to be completed.

It is suggested that an additional area be investigated and established for stand-by purposes (queuing circumstances), and located to reduce its impact on existing fishing grounds.

As part of the oceanographic survey to determine the offshore anchorage site, it is important that benthic marine samples are collected to enable the existing environment to be interpreted and to minimise the impact of anchorage and chains on important marine habitat.

It is considered possible that the loading operation (barge transport) could have the potential to impact on the area available to prawn trawlers. In addition, the offshore carrier mooring site could also impact on fishing grounds and operations. The significance of this impact can not be quantified at this stage, as the exact location for

the mooring site has not been determined. Accordingly, there remains some potential for user group conflict at this location.

Recommendation 27

The offshore anchorage location and mooring design should be included in the final design plan for the Bing Bong operation and submitted to the Department of Mines and Energy for approval. Prior to finalising the carrier mooring site, the Department of Mines and Energy should consult with the Department of Primary Industry and Fisheries and other relevant government agencies over its final location.

The risk of collision between a trawler vessel and the barge has been adequately addressed by the proponent, and it is considered that procedures can be adopted to prevent such an incident. Navigation matters to ensure the safety of crew and the containment of concentrate can also be managed, and procedures can be designed to minimise navigational incidents causing spillage.

It is considered that boat traffic associated with the Project would have a zero to negligible impact on dugongs in the area.

The introduction of exotic organisms through re-ballasting is possible, however this threat is very unlikely if export ships comply with the Australian Quarantine and Inspection Service guidelines. The proponent has advised that it has very little control over this area of the operation, but a commitment was made in the Supplement to make it mandatory that all ships using the Bing Bong mooring facility will comply with these guidelines.

Cyclone Mooring and Beaching

As little work has been undertaken on cyclone mooring and beaching locations, further investigations will be required by the proponent to complete this section of the Bing Bong EMP. It is important that these investigations include an examination of the existing environment so as to minimise the impacts of anchors and mooring chains on important seagrass meadows and other habitats.

Recommendation 28

(i) All anchoring will need to be controlled and pre-determined in the Bing Bong Environmental Management Plan so that anchoring is only undertaken in defined areas. This is particularly important in respect to the barge cyclone mooring site, should this be located in the vicinity of Barranyi (North Island) National Park.

(ii) Any proposed cyclone mooring areas adjacent to North Island should be approved by the Conservation Commission.

4.2.4 Marine Spills

The risk of pollution and impacts on marine organisms from concentrate and fuel spills is of considerable concern to most of the respondents to the DEIS.

This concern is acknowledged by MIM who have, in turn, made substantial commitments to ensure that spills will not occur, including the preparation of an

Environmental Management Plan with a "no spill policy" and use of "Best Available Technology and Practices".

The main issues raised by respondents in response to the DEIS regarding spills and associated pollution included:

- the adequacy of information on the existing environment to determine and assess the potential impacts and specific baseline information for future monitoring.
- the toxicology of the concentrate and the bioavailability and bioaccumulation of heavy metals in biota.
- the potential impact of heavy metal pollution on dugong and green turtles, both considered to be endangered species and listed as vulnerable to extinction in the IUCN Red List of Threatened Species - IUCN, 1990, and protected under the Bonn Convention (international treaty);
- the human risk from eating contaminated seafood
- the potential impact of heavy metal build up in waders and migratory birds
- the impact on commercial fisheries particularly the Gulf Prawn Fishery and possible marketing implications.
- undefined heavy metal concentration thresholds (contamination levels regarded as being unacceptable) that would prompt action from the mining company.
- the level of impacts (evidence of a problem) that would be tolerated by the company or Government.
- the lack of specific management actions that would be undertaken should monitoring indicate unacceptable levels of contamination.
- the potential cumulative effects from repeated spills over the 20 or more year life of the Project.
- the impact and risk of diesel spills from land and from ships on marine life.
- risk analysis and rate of concentrate spillage - including loading operations in poor weather conditions
- the confidence in the accuracy and detail of spill dispersion modelling
- the lack of detail concerning clean-up response and ability to clean up spills in poor weather conditions that would most likely be the case for a major spill scenario.
- specific information on concentrate spill prevention including barge design and operational safeguards.
- poorly defined monitoring program objectives.
- anomalies between Table 1.2 commitments and text commitments.

The proponent has responded to the majority of these issues by adopting a no spill

policy. The proponent believes that if no spills occur, then all of the above concerns would be allayed. The proponent believes that "the objects of the assessment process are satisfied if safeguards and monitoring programmes are over-designed to compensate for any lack of information".

The proponent's no spill policy includes the utilisation of Best Available Technology (BAT) and Best Management Practices (BMP), derived from investigations of other similar concentrate loading operations around the world including the North-west Alaskan Red Dog Mine. These safeguards are detailed in Table 1.2, (pages 1.29 - 1.34) and Section 9.2 of the Supplement to the EIS. Details of BAT and BMP however, were not described in the EIS and a commitment has been made to include details in the Bing Bong Environmental Management Plan (EMP)

Table 1.2 highlights all circumstances under which a concentrate spill could occur including fugitive spills during barge and shipping operations (the highest risk scenario) and disaster circumstances, such as vessel collision or capsizing under cyclonic conditions (the lowest risk scenario).

The proponent concludes that for minor operational spills involving concentrate there would be a "negligible effect likely on marine biota except in the (<200m) vicinity of the spill".

To ensure the adequacy of the safeguards and to respond to unacceptable trends, the proponent proposes to annually monitor heavy metals in biota, sediment and seawater around the barge loading facility, in accordance with a proposal outlined by the Northern Territory University in Appendix P of the Supplement. A preliminary baseline survey involving 20 sampling locations for sediment, seawater, mangrove leaves, seagrass, and oysters has begun for this monitoring program.

Contamination from large spills caused by accident or equipment failure is considered unlikely by the proponent. The proponent predicts that the effects from such an event would be limited to within 2 km of the spill, resulting in sub-lethal effects on benthic biota and no significant effect on mobile marine fauna.

The FEIS concludes that the effect of heavy metal contamination on seabirds around the facility will be negligible; however, no monitoring is proposed to substantiate this prediction.

According to Table 1.2, should a diesel spill occur the primary safeguard is that "it is volatile and will degrade rapidly". The proponent considers that such a spill would be small and unlikely, given that fuel storage and use would be in accordance with N.T. Government regulations.

The proponent concludes that the most likely cause of any spill would be due to human error or equipment failure. Accordingly, the proponent has placed considerable importance on operator training and a code of practice which would be incorporated in the Bing Bong Environment Management Plan (Section 10 -Supplement).

The proponent has made a commitment that many of the safeguards will be described in further detail once more information about the location and environment becomes available, and acknowledges that the "proposal is at the feasibility design stage" and that detailed design has yet to take place. This is also true for the safeguards inherent in the barge design and operations to minimise the likelihood of spillage. A commitment has also been made that this matter will be addressed at the detailed design stage.

Spill impacts

Potential impacts on the existing environment caused by a spill would depend on the toxicity of the material spilt; the size of the area affected; the location and sensitivity of the environment; sea conditions; and the time of year the spillage occurred.

It is likely that small spills would have a locally significant impact, but would probably not be significant on a greater than local basis. Large spills could have greater than local impacts on fish and invertebrate and possibly marine mammal populations.

In the final EIS for the Red Dog Lead and Zinc Mine prepared by the U.S. Environmental Protection Agency and the U.S Department of the Interior, it was concluded that

> "small spills during ship transfers would be dispersed rapidly and would not cause even a short-term impact" (page V-63 - Final EIS Red Dog Mine).

This conclusion, however, is not totally relevant to the McArthur River Project as local dispersion conditions for the two locations are somewhat different.

It is considered that chronic spillage and large spills would have potential to result in significant impacts on both marine birds and mammals, depending upon the time of year and the local weather conditions. Although the proponent believes that "cumulative effects from repeated spills is not considered as a credible scenario" (7.9 Supplement), this argument alone does not answer the concern.

It is considered that chronic spillage is possible, however unlikely, given the number of concentrate transfer points and handling links and the number of movements during the life of the mine (20-50 years). The problem of small but continuous spills will have to be closely monitored (supervision and reporting), and any impact identified in the monitoring programs.

It is considered that important commercial prawn stocks could be adversely affected in the event of a major spill, in the short to medium-term. Furthermore, there is some concern that in the event of a major spill there is a potential for market loss through perceived toxicity of the catch. This latter problem would probably necessitate the introduction of quality assurance measures by the Fishing Industry to allay market fears. It is considered that market concerns would be not be insurmountable.

Impacts of diesel fuel spills could be heavy on local marine life. Overall these impacts would be short-term but with the potential to be very severe, under worst case scenarios. A large fuel spill during a low tide could have greater than local significance and result in hydrocarbon-induced water quality degradation.

As stated in the beginning of the assessment report (Regional Setting) the McArthur River area is probably the most important habitat for dugongs in the Northern Territory and is amongst the top four dugong areas in Australia. As a result the potential impact on dugongs from spillage of concentrate with this Project is of particular concern and specific comment was made in this regard by many of the respondents to the draft EIS.

It is believed that in the event of a spill it is possible that metals will be taken up by the seagrasses which could then accumulate in dugongs and other fauna associated with seagrass beds, including prawns.

According to Professor Helene Marsh, Chairman of the IUCN Sirenia Specialist Group, seagrasses absorb metals from sediments. Also, parts of the plants may show pronounced seasonal variability in metal concentrations related to the age of the plants and background levels of metals, and as a result it is her opinion that baseline studies in the area potentially affected by spills should be replicated at several times of the year. This is supported.

> "Although seagrasses appear to be moderately resistant to the direct effects of metals, the high concentrations of metals in plants mean that herbivores such as dugong...are most at risk". "Any small lowering in the rate of change of dugong populations (through changes in breeding or fatalities) is considered significant to the local population balance" (Ward, 1989 cited in Marsh H. comments on Draft EIS McArthur River Project).

An important issue associated with heavy metals in dugong and turtles, and other marine animals in the area is the dietary importance of these animals to the local Yanyuwa Aboriginal people. Subsistence implications and cultural consequences of the Project, such as the potential to lower the numbers of dugong and turtle for local traditional hunters, or fears that these animals are contaminated, are of concern.

It is believed that large episodic or chronic spillage of fuels and chemicals that could seriously damage habitat might adversely affect marine mammal populations, although the net impact of ordinary port operations on marine mammal resource availability would not be significant. Nevertheless, it is considered that the human risk from eating contaminated food, as well as the cultural implications of perceived contaminated food, has been handled by the proponent in a cursory manner. These matters will be addressed in the proposed Social Impact Study (see Recommendation 42).

In conclusion, because the existing environment has yet to be described in any detail, it is not possible to determine with certainty the likely biological impacts of concentrate spills in the marine environment. However, as stated above, small spills are expected to have a limited impact, whilst large spills could have far reaching implications.

Toxicity

It is noted that lead and zinc concentrates will be essentially sulphides. Sulphides are insoluble and release toxic contaminates very slowly upon prolonged exposure to the elements. If submerged under most marine conditions, they would be expected to remain intact and not oxidise to the soluble metal sulphates over a short period of time. Upon dilution and mixing with water however, some initial release would occur. McArthur River zinc concentrate is known to leach very readily (Section 7.8 DEIS). Further detailed hydrological baseline data is required to determine dispersion matters.

Although the proponent has expanded information on toxicity in Section 7 of the Supplement, there remains some doubt concerning bio-accumulation. It is considered by the assessment authority that vertebrate animals exposed to chronic lead contamination will accumulate lead in tissues and suffer toxic effects. The proponent argues, however, that since lead bonds strongly to hydrated iron oxide and that high iron concentrations are found in the sediment at Bing Bong, the bioavailability of lead will be limited.

In the event of a spill, slowly settling concentrate would create suspended solids water quality impacts, and would be significant in the case of a major spill.

Tests of concentrate on Nitzschia (a diatom), shows that this marine organism is the most sensitive to heavy metal toxicity. The proponent estimates that the chronic toxicity limit for Nitzschia is 3.4mg/L of concentrate (0.1x Lowest Observable Effect Concentration). There was no attempt by the proponent to determine threshold limits for heavy metal monitoring from these studies.

It appears, however that this task might not be possible, nor is it possible to state the threshold levels of concentrate spillage over time. If environmental monitoring did show up signs of toxic effects from the concentrate, the proponent has not identified what could be done to rectify the problem at that stage. From this, it appears that it would be virtually impossible to conceive an appropriate management response if long-term toxic effects on marine organisms become evident, given that the transport option is an integral part of the economic viability of the Project.

At this stage of the Project it does not seem possible to establish standards for various environmental parameters against which the overseeing authority would determine whether environmental impacts are within acceptable levels prior to the project proceeding.

Recommendation 29

Approved further studies should be carried out to determine heavy metal thresholds and the total amount of concentrate spillage over time that would require response by the proponent and Government.

Monitoring

The heavy metal monitoring program proposed by the proponent has the overall objective to confirm the effectiveness of safeguards and to be able to respond with appropriate actions if necessary. This overall objective is reasonable although appropriate response actions remain unknown.

The hypothesis proposed for the monitoring program is "that the chemical constituents released by dredging of seafloor sediments or from a spill of ore concentrate, will be detrimental to marine flora and fauna in coastal waters of the Bing Bong area" (Appendix P - Supplement, page 1).

It is considered that this hypothesis would be impossible to resolve from the analytical program described since only metals in tissue would be analysed.

A suitable null hypothesis for the proposed heavy metal monitoring program is:

H_o: heavy metals concentration in seagrasses and other marine biota (including prawns) are not significantly different from the baseline data collected in 1992 and 1993.

The proponent has indicated in Section 10.2.6 that

> "heavy metal monitoring in seawater, seagrass, sediment and prawns will continue during the operation of the facility...Details given in appendix P".

It should be pointed out that there is no mention of commercial prawns in the monitoring program proposed by the NTU and, accordingly, the monitoring program cannot be described as ongoing.

No baseline information is currently available for heavy metal concentrations in commercial prawns in the Project area (Appendix N - Supplement).

Recommendation 30

(i) Based on an appropriate experimental design, the heavy metal monitoring program should be revised to include commercial species of prawn; interpretation and results should be made available to the Department of Primary Industry and Fisheries.

(ii) Analysis of heavy metals in samples of marine biota should take place immediately after any spill and up to several months later (the period to be determined by persistence of elevated heavy metals in sediments and water column) to accurately determine the extent of damage from a spill.

(iii) Both monitoring programs in Appendix P should be linked together to resolve the hypothesis that chemical constituents released by dredging or from spills of ore concentrate will not significantly change marine flora and fauna populations.

Risk of Spillage

Transfer of concentrates and fuel from the causeway to the barge and to the carrier vessel create an unknown risk of spillage, although it is considered that this risk would be small if all safeguards are adhered to.

It is accepted that human error and equipment failures would be the likely cause of spillage. This is supported from events at Red Dog Mine where in September 1990, a front end loader dumped three buckets of concentrate mixture into the ocean due to human error, as well as from information received from the Great Barrier Reef Marine Park Authority regarding their assessment of the Dallhold Nickel Mine Project.

Given this conclusion it is paramount that the proponent's commitment to "positive and active supervision of all loading operations such that they can be switched off at the instant a problem occurs" be detailed in the Bing Bong EMP.

Recommendation 31

The Bing Bong Environmental Management Plan should detail procedures to provide for supervision by the proponent of all loading operations

The risk of spillage will increase if loading is carried out in poor weather conditions and during night-time operations. One respondent was concerned that as costs of the carrier vessel were high and that time schedules for concentrate shipment to Japan might be pre-determined, these factors could lead to operations in unsafe or high risk conditions.

The proponent responded in the Supplement that "loading operations will only occur if pre-determined wind and wave conditions do not occur.

Specifications of these conditions however, were not provided for assessment and the proponent has made a commitment that these conditions will be determined once the design details have been established. The proponent advises these conditions would be "varied in light of operational experience". This is understood and is reasonable.

The proponent states that in the event of a "cyclone warning" loading operations would cease. This does not seem to be a prudent response and it is suggested that this be changed to "cyclone watch" when the EMP is being prepared.

Directly related to the above is the continuing concern of the proponent's "down-time" estimation during which unloading could not proceed.

Wave climate has been modelled by the proponent (Appendix E of the Supplement), however, "no direct measurements of waves at the site and insufficient bathymetric information is available for accurate hindcasting of waves"(Section 6.8.6, DEIS.). It is important that more accurate climate and wave data be collected, and that all other circumstances that could cause down-time (eg. spill clean-up; barge maintenance and break downs; cyclone events, as these were not included in the estimates; maintenance dredging; union disputes; quarantine hold-ups; etc) be collectively assessed.

It is considered that this study is very much in the interest of the proponent to investigate as down-time costs due to standing by waiting for suitable weather conditions could be high. Furthermore, this problem could impose serious constraints should the proponent wish to expand operations in the future.

The above study may well in fact change the estimates of potential down-time envisaged by the proponent, and restrictions of this kind could increase the chances of having to operate in unacceptable risk conditions.

Accordingly, there remains concern that at some time over the life of the mine, loading will occur in conditions that increase the risk of small and large spills to an unacceptable level.

Recommendation 32

(i) Safe operational parameters (wind and wave) for ship loading conditions should be precisely defined, and submitted to the Department of Mines and Energy for assessment. Any proposed changes to these (which should be conservative in the first instance) will need to be supported with detailed justification.

Compliance with ship loading operational conditions will need to be monitored and rigorously enforced to ensure pre-determined wind and wave conditions are not exceeded, resulting in unacceptable risk increases.

(ii) Night-time operations will require close supervision and assessment to determine if the risks associated with night operations are acceptable.

Regardless of every commitment by the proponent to ensure that no spills occur, there remains a likelihood of spillage occurring over the life of the mine. On the material provided in the EIS for assessment it is not possible to estimate the likely rate or size of such spillage.

The Australian National Parks and Wildlife Service has concluded that the risks associated with the proposal are high, particularly in relation to the significant natural resources in the vicinity of the Sir Edward Pellew Group of islands. This conclusion cannot be supported nor denied.

Detailed risk assessment will only be possible once further information on the existing environment, including flora and fauna in the vicinity of the Barge Facility and Carrier

Mooring location, and specific measures to reduce risk are identified. This is recommended below.

Spill dispersion and contingency plans

There is still no clear indication as to the potential for dispersion of concentrate spilled into the water. The information provided in the EIS is not sufficient to adequately assess the risk to marine ecosystems in the "near field" and "far field" areas. This problem is further exacerbated, as the location for the ship anchorage location has yet to be determined.

With the limited information available, it is considered that any concentrate spillage is likely over time to disperse over a considerable area.

Contingency plans for spilt concentrate and oil were not detailed in the final EIS. Accordingly these plans cannot be assessed at this stage. Such plans will need to incorporate a risk analysis that specifically indicates what areas are likely to be affected, including benthic ecosystems and intertidal and coastal communities, and the appropriate methods for defence and cleanup.

In addition to the above, the existing dispersion models do not overlay the theoretical trajectories on the coast in such a way as to determine sites most at risk to be hit with a concentrate plume or fuel spill.

Included in the proponent's no spill policy is a commitment that "spilt concentrate will be recovered" (Section 7.9, DEIS). However, it is unlikely that clean up of any but the largest spills would be feasible due to dispersion, the time it would take to respond, and many other factors, including the ability to do so. The latter would most likely apply to small fugitive spills.

Recommendation 33

(i) The Environmental Management Plan should contain a Spill Prevention, Control and Contingency Plan for concentrate and other materials (fuel and chemicals) comprising:

- **Purpose and objectives**
- **Materials quantities and properties**
- **Materials transportation and deportment**
- **Spill risks and control**
- **Administrative spill prevention and control procedures including monitoring and threshold limits.**
- **Recovery and countermeasures, equipment and materials**
- **Response options to prevent future spills occurring**
- **Reporting (see recommendation below)**

(ii) All spills are to be immediately reported to the Department of Mines and Energy. A detailed report of the spill giving full details of estimated size, exact location, monitoring , and response (clean-up and proposed changes to procedures or equipment to ensure event is not repeated) must be supplied within 5 working days.

(iii) The proponent should bear the full cost of any environmental rehabilitation necessary as a result of concentrate, and other spills. The proponent should

attempt to clean-up all concentrate spills, subject to the agreed provisions of the Environmental Management Plan.

4.3 Dredging

The capital (initial) and maintenance dredging program has been identified as a major area of concern with the Bing Bong transport route option. Specific issues are:

a. The direct and indirect impacts (both short-term and long-term) on seagrasses . For example, seagrass composition and density may change in the area, and smothering of seagrass by large amounts of sediment could trigger a self augmenting process of increased sedimentation and seagrass decline.

b. Secondary effects of dredging through seagrass removal, such as:

   - potential adverse impacts on the Gulf of Carpentaria's prawn fishery through the loss of juvenile and adult prawn habitat;
   - potential impacts on marine mammals and reptiles (dugong and turtles) through the loss of habitat and the creation of a physical obstacle possibly affecting the migration of dugong; and
   - potential to affect local coastal processes.

c. The management and monitoring of dredge spoil.

d. Maintenance dredging requirements.

e. Safe navigation operations to minimise the risk of grounding and other hazards to people, equipment, and the marine environment.

To mitigate the potential adverse effects of dredging, the proponent has placed emphasis on the safe operation of the cutter-suction dredge, including "the use of a turbidity curtain" (p 40.3 of the Supplement, but not included in Table 1.2), and scheduling dredging operations between May and September to minimise impacts on juvenile prawns. It is not clear whether these safeguards would be the same for maintenance dredging.

In regard to maintenance dredging operation, suction dredging is proposed which generates less turbidity than the cutter-suction dredge. From the preliminary modelling, the proponent believes that maintenance dredging would be required probably every 3 to 4 years, with up to 90 000m^3 of spoil being removed.

The proponent proposes that all capital (760 000m^3) and maintenance dredged spoil will be disposed of on-shore in a bunded area (the borrow site for foundation material for the barge loading facility), and that spoil would not be dumped at sea without a permit.

Decant water from the dredge spoil would be discharged to primary and secondary sedimentation ponds prior to release back to the marine environment via Mule Creek. Sulphur levels and acid generation will be surveyed and a commitment has been made to neutralise the dredge spoil should any acid be generated.

The proponent emphasises that discharges would be licensed under the Water Act 1992 by the Power and Water Authority (PAWA). PAWA has advised the assessment authority that the Water Act 1992 does not apply within a mining area and that all controls would be exercised by the Department of Mines and Energy.

The predicted effects identified by the proponent from the dredging program are listed in Table 1.2 (pp 1.27, 1.28) of the Supplement to the DEIS. In summary, the proponent believes that the impacts on seagrasses would be negligible on a regional level, however, there would be localised increased turbidity levels, with some smothering of adjacent seagrass. No long-term effects outside the dredged channel and adjacent areas, and only short-term elevated sediment load in run-off water during operations is predicted.

Further studies and environmental monitoring identified by the proponent to manage the dredging operation include:

- a baseline survey of non-commercial fish species and benthic organisms (including juvenile prawns) in the vicinity of the proposed dredging area;
- an oceanographic survey (including hydrography and bathymetry);
- studies to determine the likely frequency of the maintenance dredging; and
- an on-going monitoring program of seagrass beds and benthic organisms near the barge landing site.

Impacts

On the information provided it is not possible to determine with any certainty the significance of direct impacts of the dredging operations at the local level, as the existing marine environment has not been described. Accordingly, impacts on seagrasses and other marine organisms cannot be ascertained.

Although the magnitude on a regional level of the potential impacts of the dredging have been described (0.016km^2 of direct seagrass removal compared with a regional coverage of 183 km^2 prior to the 1985 cyclone), the significance of the loss of the seagrasses in this area has been over simplified, and the significance of the dredging impacts at the local level has not been determined.

The proponent has provided no information on seagrass species richness, productivity, density, and species composition in the areas to be affected. Indeed, the actual location, alignment and length of the dredging channel has yet to be determined.

> "The oceanographic survey needs to be completed before the location of the facility and before the alignment can be determined".

On the basis of the material provided it is not possible to determine the secondary impacts on marine fauna from the dredging. This is acknowledged by the proponent who states:

> "The potential indirect impact from dredging cannot be quantified but will be limited".

Although sediment plume dispersion information is not well documented, the proponent believes that smothering impacts would only be experienced up to 500m from the

dredging. This can not be confirmed, however, it is highly likely that direct impacts of smothering would be limited to the site.

The predicted long-term impact of maintenance dredging on adjacent seagrass beds and benthic organisms areas is uncertain and will require further investigation. It is possible that continuous sedimentation caused by maintenance dredging over the life of the mine could set up a regime where seagrasses could not recover from each dredging operation.

The potential impact of dredging on physical coastal processes has been satisfactorily addressed by the proponent (Section 7.11 DEIS and Section 7 Supplement). It is supported that the dredging operation is unlikely to have any noticeable impact on coastal process.

Maintenance dredging

Sedimentation of the channel due to day to day wave action is uncertain. Given that little information is available on the underlying nature of the sediments, the long-term stability of the area following dredging is unknown at present.

According to Appendix E of the Supplement, in the "absence of current measurements longshore sediment transport is not known", and " underwater dune movement into the dredge channel may result in significant infill".

Furthermore it is stated that this build up might not be evenly distributed along the channel.

Sediment size is also unknown at this stage. "It is possible that finer sediments occur offshore" (Appendix E- Supplement). Should this be the case sedimentation could be as high as 50,000 m3 per year.
Channel siltation associated with a moderate cyclone could be up to 30,000 m3 and "up to four times higher if the bottom sediments are found to be fine sand". With this scenario maintenance dredging would be event driven.

For cyclones, an allowance of 50 000 m^3 every 3 years is proposed. When added to the day to day sedimentation rates of 90 000m^3 over 3 years, the overall calculated maintenance allowance of 20 000 - 30 000 m^3 per year appears to be underestimated.

Although further studies to confirm maintenance dredging turn-around have been proposed by the proponent, the limited information available indicates that the 3-4 year maintenance requirement is not conservative and represents probably the outside range.

Safeguards and monitoring

Although there is a commitment by the proponent to monitor juvenile prawns there is no baseline information available to determine if the area is valuable to the Gulf Prawn Fishery.

The environmental monitoring program proposed in Appendix P has not been designed with an objective to monitor the impacts of dredging on seagrasses. This failure to specify clearly the objectives of the monitoring program is significant.

The monitoring program proposed in Appendix P of the supplement does not include seagrasses and has not been designed to pick up dredging effects (for example, the

sampling locations in areas likely to be affected by sedimentation are limited and are not considered to be sufficient).

The McArthur River Project does not have any baseline information in relation to seagrass communities to be affected by the proposal. Other marine baseline data presented in the McArthur River EIS is no more than 3 months old.

Recommendation 34

Baseline surveys and subsequent monitoring programs need to be revised to take account of seasonal change (natural fluctuations) in seagrass communities, and should include turbidity sampling.

Siltation and sedimentation safeguards are reasonable, however, apart from a turbidity curtain, no other safeguard is considered to minimise the plume size and dispersion.

It is considered that plume monitoring and turbidity/sedimentation monitoring will also be necessary.

Dredge spoil disposal and management

There is no geotechnical information on the suitability of the spoil for disposal in the proposed borrow pit, and there is no existing environmental information for the on-shore spoil location site.

No detailed information is provided on the potential impacts of the spoil tailings run-off into Mule creek.

There is no detailed information on the design of the spoil dam (bunded area) and sedimentation ponds nor information on the management of decant water release. Water quality standards have not been determined.

Recommendation 35

In the absence of water quality standards, decant water release from dredging should result in no unacceptable long-term impacts. This would require both baseline monitoring and long-term additional monitoring to be implemented.

Finally, although there are major deficiencies in the information on the dredging component in the EIS, it is considered unlikely that the capital and maintenance dredging program will not be environmentally feasible. Based on the information provided in the EIS and known dredging operations in Australia and overseas, it is feasible that the potential impacts (although not totally defined) could be controlled with appropriate measures together with a reactive monitoring and management program.

It is considered reasonable to recommend that further studies as outlined in this section will need to be completed before a better understanding of the implications can be determined and assessed by the N.T. Government.

Recommendation 36

The proponent should prepare a dredging management and monitoring program for approval by the Minister for Mines and Energy. The program should include the following matters:

- **detailed description of existing environment including seagrass composition, productivity, and juvenile commercial prawn densities;**
- **detailed description, location and alignment of the channel and barge loading area, optimising the alignment and depth of channel to reduce maintenance requirements;**
- **baseline monitoring of seagrasses potentially affected by the dredging;**
- **safeguards to minimise sedimentation and plume dispersion including sediment curtain use (effectiveness and deployment), and dredging trials under varying conditions to minimise plume dispersion;**
- **turbidity profiling and sedimentation sampling before, during and after capital and maintenance dredging, as well as consideration of monitoring of plume by aerial photography to visually assess plume dispersion (one of the objectives of this monitoring program will be to establish turbidity standards for maintenance dredging over the mine life period);**
- **on-going monitoring of seagrass recovery; analysis of long-term effects of maintenance dredging;**
- **response options if monitored impacts and seagrass recovery is unacceptable;**
- **further information on maintenance dredging turn-around period;**
- **method of returning spoil to on-shore containment site;**
- **spoil containment location including a detailed description of the existing environment to be affected;**
- **containment details and design, including sediment ponds and management and decant monitoring; and**
- **reporting.**

4.4 Social Issues

Social issues associated with the mine site include:

- the adequacy of the social assessment;
- interference with traditional use of the environment associated with the mine, including concerns regarding heavy metal contamination and reduced subsistence resources;
- water quality of the Barney Creek and McArthur River in relation to Aboriginal use of the rivers;

. Aboriginal liaison;

. disruption of the community structure and lifestyle at Borroloola; and

. employment and training available for the local community.

Aboriginal Issues

The proponent has outlined in the EIS the level of discussions undertaken with local Aboriginal groups affiliated with land affected by the proposal. The proponent has also acknowledged the negative effects that the proposal may have on cultural aspects of the Aboriginal community. The fly-in fly-out nature of the proposal does reduce the potential for conflict as mine employees will have no free time for off-site recreation.

The aspect of offering training and employment to Aborigines (a potential positive aspect of the proposal) and the subsequent increase in "acculturation of Aboriginal society" as a result of this, has also been acknowledged by the proponent, but no formal procedures to monitor or rectify such impacts were presented in the EIS.

The proponent has not adequately addressed all aspects of potential impacts of the mine on the local Aboriginal groups. However, it is noted that considerable effort has been made to liaise and consult with such groups, and the proposals for training scholarships and the undertaking to continue consultation highlights this. The proponent also "agrees and supports a study along the lines proposed by the Northern Land Council".

Further to the above, it is understood that a consortium of Aboriginal associations in the Borroloola region has proposed a community development planning study (see below). The proponent "is prepared to contribute to such a study".

General Community Issues

Community issues revolve around the social and economic impact of the mine on the township, opportunities for training and employment, and levels of contractual work.

The proponent has provided some detailed responses to comments in the EIS regarding employment positions, training opportunities and contractual work. The proponent has adopted a philosophy towards encouraging "maximum participation of suitably qualified local people to work on the project", and to "encourage the training of local residents who are not currently qualified".

The social impact on the community was not outlined well, with similar limited statements as per the description of potential effects on the Aboriginal community.

It is understood that ATSIC will be funding a consultancy to develop a 5 year community development plan for Borroloola. It has been advanced on their national program to cover all regions in Australia, and has specifically included a strategic development plan in response to the McArthur River Project.

It is considered that the approach adopted by the proponent and ATSIC will adequately address the social issues associated with the proposal. Recommendations arising from these studies will be reviewed by the NT Government.

APPENDIX 1

LIST OF RESPONDENTS TO THE MCARTHUR RIVER PROJECT - DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)

NT OFFICE OF LOCAL GOVERNMENT	1
NT DEPARTMENT OF LANDS AND HOUSING	2
NT DEPARTMENT OF MINES AND ENERGY	3
NT WORK HEALTH AUTHORITY	4
NT DEPARTMENT OF THE CHIEF MINISTER	5
NT DEPARTMENT OF TRANSPORT AND WORKS/ POWER AND WATER AUTHORITY	6
NT MUSEUM OF ARTS AND SCIENCES	7
NT DEPARTMENT OF PRIMARY INDUSTRY AND FISHERIES	8
NT DEPARTMENT OF HEALTH AND COMMUNITY SERVICES	9
NT CONSERVATION COMMISSION	10
NT EMERGENCY SERVICE	11
ABORIGINAL AREAS PROTECTION AUTHORITY	12
NT DEPARTMENT OF LAW	13
COMMONWEALTH ENVIRONMENT PROTECTION AGENCY	14
ABORIGINAL AND TORRES STRAIT ISLANDER COMMISSION	15
BUREAU OF RURAL RESOURCES	16
AUSTRALIAN CONSTRUCTION SERVICES	17
AUSTRALIAN HERITAGE COMMISSION	18
AUSTRALIAN NATIONAL UNIVERSITY (NARU, MARJORIE SULLIVAN)	19
AUSTRALIAN NATIONAL PARKS AND WILDLIFE SERVICE	20
AUSTRALIAN CONSERVATION FOUNDATION	21
R BRONS	22

SUMMARY OF COMMENTS ON THE MCARTHUR RIVER PROJECT - DRAFT EIS

APPENDIX 1

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
EXISTING AIRSTRIP - concern over need to upgrade airstrip, facilities, no information on types of aircraft and responsibility for maintenance.	X					X					X												X														4
TRANSPORT OF CONCENTRATE THROUGH BORROLOOLA - concern over loss of amenity to township of Borroloola, noise impacts and accident risk if Robinson Road is used.	X	X		X	X	X		X	X	X	X			X	X						X		X		X			X				X		X	X		18
ABORIGINAL LAND CLAIM DATA - inaccuracies regarding status of land claims and community living areas. Further discussion required on recovery of other traditional lands.		X													X				X												X		X	X		6

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
INADEQUATE ASSESSMENT OF ROAD TRANSPORT OPTIONS - including the need to re assess the use of excised corridor west of Borroloola, transport of concentrate to Darwin and containerisation of concentrate for road or barge.	X	X				X				X				X	X			X		X	X		X		X			X				X		X	X		15
FLOOD WARNING AT MINE SITE - ventilation shafts require covers, warning system required for underground workers and construction of alternative escapeway to decline.			X																																X		2
MARINE FACILITY - require clarification of responsible regulatory agencies during construction and operation.			X	X																																	2
MINING OPERATION - open stoping with room and pillar design, a sensible choice in terms of safety and optional productivity.			X																																		1

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
TAILINGS RUNOFF DAM - site appears safe from 1:100 year flood event. Concerns over design to prevent overflow, holding capacity, tailings content and satisfactory installations to prevent sub-surface seepage ie. of salt and heavy metals.			X			X		X	X	X				X		X					X		X	X	X						X			X	X	14
MANAGEMENT OF, AND MONITORING DUST - concern over use of appropriate standards, equipment and monitoring methods. Further discussion required on management of dust at all loading points and tailings disposal area. Include remedial actions.			X							X				X						X				X	X						X			X			8
ORE STOCKPILE - use of water suppression is supported. Presence of gangue minerals and silica might pose a hazard.			X																																		1

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
CONCENTRATE STOCKPILE - use of water suppression is supported. Require further information on suppression method. Concerns over protection from flooding and protection of emergency stockpile in the wet.			X																		X														X	X	4
MEDICALS - premedicals needed and blood tests taken quarterly. Refer NHMRC guidelines.			X	X					X															X							X			X			6
BASELINE SURVEYS - some existing environments poorly outlined ie. marine and a number of appropriate surveys still need to be outlined and completed, and current survey data upgraded to identify species and establish tolerance levels.			X				X	X	X	X				X		X		X	X	X	X			X		X		X		X	X			X		17

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
ENVIRONMENTAL MONITORING PROGRAM - ie. water, fauna, flora, sediments/ soil not adequate. Requires upgrading to include results from baseline surveys, identify monitoring parameters, standards and safe-guards to be implemented. Include short and long term studies and remedial action.			X				X	X		X						X		X	X	X	X		X					X			X	X			X		14
WATER MANAGEMENT - requires further detail on surface water flooding, ground water dewatering, contaminated water and irrigation water management. Remedial actions need detailing due to adverse impacts. Receiving water standards need defining, and a discussion required on the 'no release' design.			X			X		X	X	X				X			X			X	X		X	X	X			X	X			X	X			X	X	18
MANAGEMENT PLANS - require mine management, environmental monitoring and rehabilitation plans.			X																																		1

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
POWER STATION - Level of sulphur dioxide emitted is of concern, especially in the wet season.				X	X																																2
TRUCKS - proposed truck type leaks concentrate dust during transport, concern over long term effects on flora & fauna along corridor.				X						X														X	X			X							X	X	7
EMPLOYMENT AND ECONOMIC FLOW-ON - concern over whether multipliers are optimistic or underestimated.					X	X																															2
BARGE AND BARGE OPERATIONS - clarification and further information required on barge design, barge moorings and barge operations from facility, through dredged channel, and to ship through all weather conditions. Discussion required on containerisation methods and overall management of personnel.						X				X				X		X		X		X				X		X		X	X		X			X	X	14

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
ROAD ACCIDENT FREQUENCIES - underestimated and need further risk assessment, both for the public and concentrate transport.						X		X		X													X														4
NT ROADS - clarification on contribution to maintenance of Carpentaria Highway and Batten Point Road from Borroloola to Bing Bong Station gate. Discussions required on upgrading crossings also.						X				X				X			X						X		X			X									7
MODELLING - further modelling required for justification of 1:100 year flood level for mine site ie. RL 38AHD. Further modelling required for groundwater hydrogeology and surface water interface.						X		X		X										X												X			X	X	7

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
DISTURBANCE TO MARINE RESOURCES - concern of effects on fishery through loss of seagrass from dredging, continued disturbance and spills of concentrate.							X	X	X							X		X		X	X		X			X				X	X	X			X		13
RISK ASSESSMENT FOR CONCENTRATE SPILLS - further risk assessment required for spills, leaching potential and effects on marine environment including cumulative effects. Toxicity test levels need re-assessing to appropriate standards. Contingency plans required for recovery. Provide details on Red Dog facility.							X	X	X	X				X		X		X		X	X		X		X	X	X	X		X		X	X	X			X		18
ARCHAEOLOGY - inadequate information on archaeology survey presented in report. Concern over adequacy of surveys to allow assessment of sites and protection of sites.							X			X									X			X									X				X		6

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
PROCESS AREA POND - concerns over quality of water, holding capacity, monitoring, flood protection and disposal method.								X		X																											2
BARGE LOADING FACILITY - inadequate locational, geotechnical, design of all facilities, construction and operational information ie. including conveyor. Require further information on effects of facility on coastal processes. Discussion should cover best available technology.								X		X				X				X		X	X		X	X		X		X		X		X			X	X	14
SOCIAL IMPACTS ON BORROLOOLA - residents able to undertake contract work, a possible net benefit to community. Require discussion on BCGC input to research survey on training, contractual and on-site work, as well as identifying demand for goods and services.								X															X		X		X	X	X								6

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
HEALTH CARE CAPACITY - need to address off-site health care capacity required and address impact on local health clinic.									X																												1
SEWAGE PROPOSALS - further details on design and disposal methods required for the camp,mine and barge loading facility.									X	X																											2
ENVIRONMENTAL AUDITS - required during construction and operation of whole project. Plus identification of agencies responsible for approving conformance.									X	X																											2
TRAFFIC VOLUMES - increased risk for accidents and requirement for emergency services. Require upgrading of fire protection and fighting equipment, ie. at bulk fuel holdings, if road capacity increased.											X												X					X							X		4

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
CYCLONES - shelter facilities required at mine and barge loading facility, including upgrading of communications and welfare capability. Facility at Bing Bong should be well clear of storm surge. Discussion required on barge operations safety procedures, ie. during adverse weather.										X	X			X							X		X	X				X			X				X			9
TAILINGS DISPOSAL - require further information on method of transport of tailings ie. pipeline and corridor, tailings disposal method, capacity of disposal area, geotechnical data, and monitoring of surface and seepage characteristics. Further details required on alternative designs and sites, including the post 14 year plans.										X						X	X				X		X		X						X				X	X		9

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
DREDGE SPOIL DISPOSAL - require detailed plans for disposal, including geotechnical data on site dredge spoil characteristic, suitability for barge loading facility foundations, suitability for disposal in borrow pits, and location of borrow pits. Discuss option to dispose offshore. Also require further information of dredge spoil wash water and silt disposal.										X				X		X	X	X																	X		6
EROSION CONTROL MEASURES - on the whole adequate. Concern over construction of earth works through wet season without specific controls. Concern over stability of engineering works on slopes ie. tailings disposal area, barge loading facility.										X							X									X				X					X		5

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
BORROW PITS - require further information on construction materials for mine project area, roads, barge loading facility. Including borrow pit locations, geotechnical data and Aboriginal/ heritage clearances required.										X							X																		X		3
DREDGING OPERATIONS - require detailed information on capital and maintenance dredging operations and plans for dredge corridor. Include discussion on seagrass beds and responses to dredging.							X	X		X						X		X		X	X		X			X			X		X			X		12
BUSHFIRES - require further information on bushfire prevention and protection for the mine project area and barge loading facility.										X																									X		2
STANDARDS - assure all relevant/ appropriate standards for quality levels are referenced in text.			X	X	X	X		X	X	X						X				X											X			X		11

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
WEEDS AND FERAL ANIMALS - ie. cane toad, require further information on control of spread of weeds and feral animals in and out of project sites.								X		X								X																			3
BITING INSECTS - all project water/slurry/ sewage bodies should be tested for potential to increase breeding of biting insects.									X	X															X												3
OFFSHORE SHIP LOADING FACILITY - further data required on ship operations area ie. environment, mooring, ballast water control, emergency operation due to weather and effects on subsea environment. Require further information on responsible authorities and controls.										X				X		X		X		X	X							X		X	X			X		10
WASTE ROCK MANAGEMENT - further details on practices for identify and separating waste rock types required ie. acid leaching potential.			X							X							X																	X		4

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
HAZARDOUS WASTE DISPOSAL - require specific waste disposal for all wastes and containers, not use of tailings disposal area.										X																									X		2
REHABILITATION PLANS - require further details on trial/experimental plots, nursery plans, tailings disposal area, waste rock site and process area pond.										X							X							X		X								X		5
DECOMMISSIONING - further details required on decommissioning of barge loading facility, causeway, trestle and ship mooring area.										X																											1
DIESEL FUEL SUPPLY AND SPILLS - require explanation of best technology and procedures for cleaning up diesel spills, both along the road corridor and the marine environment. Contingency plans required. Discussion require on option to transport diesel through barge loading facility and ramifications.										X				X				X													X	X					5

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
ABORIGINAL CULTURE AND RECREATIONAL USE OF REGION - further discussion required on use of the region by Aborigines ie. coastal zone (specifically women). Discussion also required on Aboriginal affinity to region, including use of community outstations in the vicinity of the mine and affects of project on such affinity and outstations.										X		X			X			X	X						X								X	X		8
HEAVY METALS - require further detailed baseline surveys of heavy metals in marine substrate and flora/fauna due to naturally elevated levels, and difficulty in identifying adverse effects in organisms.										X								X		X	X		X	X		X		X		X	X	X			X		12
GREENHOUSE EFFECTS - possible rise in water needs to be accommodated in design of barge loading facility. Require discussion on potential impacts on mine site.														X																		X					2

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
ABORIGINAL LIAISON - require further discussion on liaison with Aborigines during construction and operation of project and employment of an Aboriginal liaison officer. Further details required on proposal for training and employment of Aborigines.															X								X	X	X			X						X	X			7
EXPORT FISHERY PRODUCTS - concern over adverse reaction to barge loading facility in a prawn fishery, in regards to possible heavy metal contamination.							X		X							X													X	X	X	X					7
REGISTER OF NATIONAL ESTATE - number of Aboriginal places and sites in vicinity of mine, but they are unlikely to be adversely affected by mining. The land transport route will not directly impinge on places listed. The Discovery Gossan at the HYC Prospect is of geological significance and needs protecting.																		X																			1

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
SOCIAL IMPACT STUDY - further detailed study required to accurately reflect Aboriginal use of region and affects of project on them. Report should be made public.												X			X			X	X	X				X	X						X			X	X		10
AGREEMENTS - report should reflect bilateral agreements, treaties and conventions, which Australia has co-signed ie. China and Japan migrators bird agreements, Bonne Convention on conservation of migratory species. Report should also reflect current threatened species lists.																		X		X						X											3
DISASTER PLANS - required for airport and road accidents, as well as environmental disaster events.											X												X															2
MINING NOT SUPPORTED - mining and processing causes environmental damage. No benefit to society and mines are an eyesore on the landscape.																									X				X									2

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
CENTURY MINE - report needs to discuss ramifications of this project against MIM's.																															X						1
MARKET DEMAND ANALYSIS - requires further detailed assessment.																																X					1
MINE DEVELOPMENT - Supported.		X																				X					X	X									4
RECREATIONAL IMPACT - concern over use and abuse of current facilities and localities, and any plans for future facilities and localities.										X													X		X										X	X	5
HISTORY OF MIM AND THE REGION - outline MIM history at HYC and at other related mine communities.																																			X		1
AUTHORITY CERTIFICATES - Research and liaison completed, certificates issued.												X																									1

CATEGORY OF COMMENT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	TOTALS
PROCEDURES -																																					
. Short assessment and comment time frame.	X								X												X			X	X			X				X			X		8
. Need re-write Draft EIS for release.																										X				X		X		X			4
. Supplement - should be made available for public comment.							X																														1
. Guidelines - report does not satisfy guidelines.							X			X				X		X																		X			5
DOCUMENTATION -																																					
. Document inadequate to provide detailed comment.			X				X		X										X																		4
. Textural and figure ambiguities and inaccuracies - measurements, weights, lengths, locational information and statistics quoted differently in text and also inaccurate in places.	X	X			X	X	X	X		X				X			X							X								X	X		X		13
. SUMMARY TABLES 11.1, 11.2 and 11.3 are not specific enough in regards to potential impacts, mitigation measures and safeguards.										X									X																		2