

McArthur River Mine Open Cut Project

ENVIRONMENTAL ASSESSMENT REPORT

by the

Environment Protection Agency (EPA)

NORTHERN TERRITORY GOVERNMENT

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Northern Territory Government
Department of Natural Resources, Environment and the Arts

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Abbreviations

AAPA	Aboriginal Areas Protection Authority
AC	Acid consuming
AGO	Australian Greenhouse Office
ALRA	<i>Aboriginal Land Rights Act</i>
ANC	Acid neutralising capacity
ARI	Average Recurrence Interval
DEH	Department of the Environment and Heritage [Australian Government]
DNRETA	Department of Natural Resources, Environment and the Arts (formerly part of the Department of Infrastructure, Planning and Environment)
Dmt/y	dry metric tonnes per year
DPIFM	Department of Primary Industry, Fisheries and Mines (formerly part of Department of Business, Industry and Resource)
EMP	Environmental Management Plan
EIS	Environmental Impact Statement
EPA	Environment Protection Agency
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act</i> [Australian Government]
m/s	metres per second
MRM	McArthur River Mine
Mt/y	Million (mega) tonnes per year
NAF	non-acid forming
NLC	Northern Land Council
NOI	Notice of Intent
NT	Northern Territory
OEF	Overburden Emplacement Facility (waste rock dump)
PAF	Potentially acid forming
PPL	Pastoral Property Lease
ppm	parts per million
ROM	Run-of-mine
SIA	Social Impact Assessment
SLA	Statistical Local Area
TOs	Traditional Owners
TSF	Tailings Storage Facility

Executive Summary

This report assesses the environmental impact of a proposal by the McArthur River Mine Joint Venture (MRM) to change the mining method for the existing McArthur River zinc/lead/ silver mining and processing operation from underground to open cut.

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

This Assessment Report reviews the draft Environmental Impact Statement (EIS), public comments, the proponent's Supplement to the draft EIS and further supporting information. Information, comments and advice provided by Northern Territory Government agencies and independent expertise have also been used in the preparation of this report.

Major Issues

The major issues associated with the proposal are:

- The proposed realignment of the McArthur River and Barney and Surprise Creeks.
- The performance and long term management of the tailings storage facility (including post mine closure).
- Location and management of the overburden emplacement facility.
- The potential for reduced water quality in the McArthur River.
- Uncertainty of mine pit closure.
- The performance of the proposed flood protection bund.
- Community consultation methods.
- The potential for impact on freshwater sawfish populations (listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act*).
- Impacts on groundwater (and subsequent impact to the River, including the Djirrinmini Waterhole upstream from the mine).

Conclusions

The outcome of the environmental impact assessment for this proposal is that the Environment Protection Agency (EPA) is unable to conclude that the project can proceed without unacceptable environmental impacts. The EPA is not confident that mining at the site can be managed with minimal long-term risk to the environment adjacent and downstream of the mine site. The proponent has not been able to adequately demonstrate that there will be no significant environmental impacts as a result of the operation or that these can be managed adequately over the proposed life of the operations and beyond.

The issues of most concern include the following:-

1. The potential impacts associated with the realignment of the McArthur River and Barney Creek.
 - The proponent has not provided adequate information to allow an informed decision on the nature of potential impacts associated with these diversions. An independent geomorphologist contracted by the EPA identified key flaws

in the modelling that was undertaken for the EIS. Consequently, the conclusions drawn from the modelling are likely to be compromised.

- The predicted impacts of down and up-stream morphology of the River (identified by the independent geomorphologist) include the progressive degradation of the upstream McArthur River channel and as a consequence causing the destruction of the channel (the geometry and dimensions of the diversion channel can not be maintained); creating a long section of sand aggradation downstream of the diversion channel; and continuing erosion of the diversion channel banks.
- The EIS failed to include hydrological information for Barney and Surprise Creeks. This is a major oversight considering the potential in larger floods for Barney Creek to pose greater risk to the mine infrastructure, including the flood bund and OEF than the diverted McArthur River channel.
- Revegetation of the diverted channel would present a significant challenge to the proponent and require considerable resources to ensure success within the mine life. This has implications for channel stability as well as ecological values of the River.

Given the high risk posed by bankfull flooding events and extreme weather phenomena, and the lack of certainty regarding the proposed design of the River and Creek realignments, the EPA cannot support the approval of the project.

2. The potential environmental risk of mining operations and its components (including the tailings storage facility, the overburden emplacement facility and flood protection bund) posed by its location within the primary channel of a major tropical river. This includes the long term management of materials (sediments and contaminants), and their potential impact on ground and surface waters (and subsequent impact on local ecology) both during and post mining operations.

On the basis of the above information the primary recommendation of this Assessment is

Recommendation 1

- **It is recommended that the proposal as currently outlined in the draft EIS and its Supplement does not proceed.**

1 Introduction and Background

This report assesses the environmental impact of a proposal by the McArthur River Mine Joint Venture (MRM) to change the mining method for the existing McArthur River zinc/lead/silver mining and processing operation from underground to open cut. The operation is located approximately 45 km south-west of the township of Borroloola and 740 km south-east of Darwin, in the Gulf Region of the Northern Territory (NT).

The current operations were established in 1995 and consist of an underground mine and a processing plant which converts the mined ore into bulk concentrate. The concentrate is trucked from the mine to the port of Bing Bong where it is conveyed by barge to ships for export to refineries around the world to be made into zinc and lead metal and alloys.

The open cut project would enable the mine production to increase from 1.6 million tonnes per year (Mt/y) of zinc/lead/silver ore to 1.8 Mt/y. The project also improves the efficiency of the existing processing plant which converts the ore into a bulk zinc/lead/silver concentrate. The existing concentrate storage and transportation systems have sufficient capacity for the open cut project. The rate of concentrate production from the processing plant reduces from 333,000 dry metric tonnes per year (dmt/y) to 320,000 dmt/y due to a lower grade ore from the open cut operation.

This Environmental Assessment Report is based on a review of the draft Environmental Impact Statement (draft EIS); comments from the public and Northern Territory (NT) Government agencies on the draft EIS; and the Supplement to the draft EIS (Supplement) prepared in response to public comments. The draft EIS and Supplement together constitute the Environmental Impact Statement (EIS).

1.1 Environmental Impact Assessment History

MRM currently operate an underground zinc/lead/silver mine and processing facility in the Gulf Region of the NT (Figure 1). In January 2003, MRM submitted a Notice of Intent (NOI) to the NT Government for proposed changes to the existing operation. The proposal submitted was for the replacement of the underground operation with an open cut operation that would increase the mining rate from 1.6Mt/y to 4.8 Mt/y. The proposal included rechannelling of the McArthur River, a weir on the Glyde River, an on-site zinc refinery and a 350MW power station. Since then, MRM have made changes to the proposal, which involved eliminating the Glyde River weir, on-site zinc refinery and power station components, and reducing the proposed mining and production rates. The proposal being assessed is to replace the existing underground operation with an open cut operation that would increase the mining rate from 1.6 Mt/y to 1.8 Mt/y. The proposal includes rechannelling of the McArthur River and all associated infrastructure development associated with changes to the mining operations.

In February 2003, the then NT Minister for Environment and Heritage determined that the proposal would be assessed under the *Environmental Assessment Act* at the level of an EIS. The proponent referred the project to the Australian Government under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. The Australian Government determined that the proposal constituted a Controlled Action under sections 18 and 18A (listed threatened species and communities); and sections 20 and 20A (listed migratory species) of the EPBC Act. The Australian and NT Governments agreed that the project would be assessed through the NT assessment process accredited under the terms of the Bilateral Agreement between the Australian and Northern Territory Governments. The proponent was instructed to prepare one EIS document to fulfil both the Australian and NT Government environmental assessment requirements.

Draft guidelines covering issues to be addressed in the EIS were released for public comment in February 2003 for a period of 28 days. Guidelines for the EIS were finalised taking into account submissions and comments received from various non-government groups and NT

Government agencies. The then NT Minister for Environment and Heritage directed the proponent to prepare an EIS addressing matters set out in the final guidelines.

The draft EIS was submitted to the NT EPA by MRM in August 2005, and underwent a statutory public review for a period of 10 weeks. During the review period the document was also circulated to NT Government advisory bodies for comment. Five public submissions were received during the review period including:-

- The Environment Centre of the Northern Territory;
- The Amateur Fish Association of the Northern Territory;
- The Northern Land Council;
- Mabunji Aboriginal Resource Association; and
- A private citizen

These submissions together with submissions from NT Government agencies were provided to the proponent at the close of the review period. The submissions and issues raised can be found in the proponent's Supplement to the draft EIS (Supplement).

A Supplement was prepared by the proponent to address the issues raised in the public and Government submissions. It was submitted to the EPA in December 2005 and was circulated to NT Government agencies for review and comment. The proponent was advised in December 2005 that due to the significance of the project, the statutory review period for preparing an assessment report would be extended out to a period of 70 days and would be due on 23 February 2006. Following the review of the Supplement, this Assessment Report was prepared to report on the outcomes of the environmental assessment process, and to make recommendations for consideration by the Minister for Natural Resources, Environment and Heritage.

Once the Minister for Natural Resources, Environment and Heritage has considered and agreed to the findings of this Assessment Report it will be forwarded to the Australian Government Minister for the Environment and Heritage for consideration when determining whether to issue an approval under the EPBC Act. The Australian Government has 30 business days in which to issue an approval once it has received this Assessment Report and a notice issued by the Northern Territory's Minister for Natural Resources, Environment and Heritage, as required under Section 130 (1B) (b) of the EPBC Act.

1.2 Regulatory Framework

The proposed MRM open cut project is located wholly within the land borders of the NT. The NT Government has jurisdiction over environmental and other legislation relating to the siting, construction and operation of the proposal. The Australian Government administers the EPBC Act, which applies to the proposed MRM open cut project as it was deemed to have the potential to have a significant impact on threatened species and migratory species listed under that Act. Therefore, environmental assessment is being undertaken in accordance with the requirements of both the *Northern Territory Environmental Assessment Act (1982)* and the *Australian Environment Protection and Biodiversity Conservation Act (1999)*. As the proposal is deemed a controlled action under the EPBC Act, approval will be required from the Australian Government Minister for the Environment and Heritage (or his delegate).

Approval for the MRM open cut project is also required under the Northern Territory *Mining Management Act (2001)*. Under the provisions of the *Northern Territory Environmental Assessment Act (1982)*, the Minister for Natural Resources, Environment and Heritage will inform the Minister for Mines and Energy of the findings of the review and assessment of the environmental aspects of the proposed action. The Minister for Mines and Energy will then make a determination as to whether or not a revised 'Authorisation to Operate' will be issued to MRM under the *Mining Management Act*.

2 The Proposal

The MRM open cut project proposal involves changing the existing underground mine to an open cut mine. The move to open cut would increase the mining rate from 1.6 Mt/y to 1.8 Mt/y. Total reserves would be increased to 43 million tonnes; and the proposed mine life extended by 25 years.

It is proposed that run-of-mine ore would be trucked from the open cut to the existing processing plant to be crushed and ground. Ground ore is slurried with flotation reagents and pumped to flotation cells where the zinc and lead bearing minerals are recovered in the form of a bulk concentrate. The existing processing facilities have sufficient capacity to treat 1.8 Mt/y of ore. Three-hundred and twenty thousand dry metric tonnes per year (dmt/y) of concentrate would be produced.

As is currently the case, the concentrate would be trucked to the port at Bing Bong and barged off-shore for export. The existing port facilities have sufficient capacity and would not require any upgrades as the throughput from the proposed open cut operation would be slightly less than at present. A summary comparison of the current operations and the proposed development is provided in Table 1.

Table 1: Summary Comparison of Existing Operation with Proposed Development (URS 2005).

Component	Current Underground Operations	Proposed Open Cut Operations
Resource	23.2 Mt proved and probable (subsequently upgraded to 40 Mt total)	Pit designed to recover 43 Mt of ore
Mine Life	Subject to annual review	25 years
Mining method	Underground	Open cut
Mining Rate	1.6 Mt/y	1.8 Mt/y
Tailings	Tailings discharged to tailings storage facility	Existing tailings storage facility to continue to be used
Waste rock	No waste rock brought to the surface – used as backfill in underground mine	Stored on surface in overburden emplacement facilities – capacity 185 Mt
Processing	Flotation process producing concentrate (46% Zn con grade)	Flotation process producing concentrates (average 46% Zn con grade)
Power	Gas fired turbines producing 22 MW. Fired with natural gas delivered to site via a pipeline from Daly Waters	Existing power station to be used.
Product	330,000 dmt/y of lead-zinc-silver concentrate	320,000 dmt/y of lead-zinc-silver concentrate
Transport	Concentrate trucked to Bing Bong port, transferred to barge, then offshore loading onto ships	Concentrate trucked to Bing Bong port, transferred to barge, then offshore loading onto ships
Groundwater	Mine dewatering is pumped to the surface and used in the process. Borefields water supply	Borefields water supply to continue Pit water to be collected and used in process
Surface water	Dirty water collected and utilised in the process. Emergency discharge licence in place	Dirty water collected and utilised in the process. Emergency discharge licence in place. Realignment of McArthur River and Barney/Surprise Creeks around open cut.
Air Emission Sources	Power station Fugitive emissions	Power station Fugitive emissions
Workforce	330 operational personnel	Peak of 150 construction personnel 270 operational personnel

The key activities associated with the proposed open cut mine are listed below:

- Realignment of the McArthur River and Barney and Surprise Creeks around the proposed open cut, to access ore under the river bed.
- Construction of a flood protection bund around the open cut and associated infrastructure facilities to prevent floodwaters inundating these operational areas.
- Excavation of the alluvial cover materials that lie above the bedrock. This material is proposed to be used for construction purposes, encapsulation of other waste rock, or rehabilitation.
- Excavation of overburden above and in between the ore-body with this waste rock placed in the overburden emplacement facilities.
- Excavation of ore from the pit. It is proposed to haul the ore to the run-of-mine pad (ROM) where it is to be fed into the existing ore processing plant.
- Rehabilitation of the disturbed areas in accordance with statutory requirements and agreed post-mine land uses.

Facilities associated with the proposed mining operations include:

- Open cut excavation.
- ROM pad and ore stockpiles.
- Overburden emplacement facilities.
- Water management devices (pumps, drains, small receiving dams, dewatering bores and interception trenches).
- Offices, crib facilities, and change house.
- Heavy vehicle hardstands (parking areas) and light vehicle car parks.
- Heavy equipment workshop with associated wash down bays and service areas.
- Stores, warehouses and lay down areas.
- Blasting agent storage and explosives magazines.
- Interconnecting roads and a culvert across the Barney Creek realignment.

The footprint of the proposed open cut project is shown in Figure 2. The major components of the proposal are briefly described in the sections below.

2.1 Realignment of McArthur River, Barney Creek and Surprise Creeks

The McArthur River and Barney Creek would be realigned around the proposed open cut in order to provide access to that part of the ore body under the McArthur River and to direct flows around the proposed flood bund. Surprise Creek would be intercepted by the Barney Creek diversion channel. The proposed realignments are shown in Figures 2 and 3.

Material excavated from the new river and creek channels is proposed to be hauled directly to the flood protection bund for placement.

2.2 Flood Protection Bund

A flood protection bund is proposed to protect the working pit and infrastructure from inundation in flood events. A bund has already been constructed around the Stage 1 Test Pit. The proposed bund is intended to protect the site from the 1 in 500 year ARI flood event.

The bund is a zoned fill embankment, with the inner two thirds of the embankment comprised of earth-fill and the outer third of the embankment comprised of rock-fill. Clay material for the earth-fill would be sourced from the pit excavation and watercourse rechanneling where available.

2.3 Open Cut Excavation and Mining Activities

The open cut mining would involve excavating overlying waste earth in horizontal benches to expose the target ore, which would then be removed for processing. As much of the deposit dips at 25° to 35° to the east, the excavation would need to be undertaken in stages, commencing at the shallowest part of the ore body. The pit size currently being considered would enable the removal of 43 Mt of ore. Upon completion, the pit would have a surface area of 83 ha and a depth of 210 m. The maximum length of the top of the pit would be 1,400 m and the width would be 750 m.

The proposed open cut consists of two distinct activities within the one pit: overburden removal and selective ore mining. To maximise the value of the orebody, the mining operation would separate ore and waste (overburden and interburden) so that relatively pure ore is fed to the processing plant.

It is proposed that the mining activities would operate 24 hours per day for 365 days per year, weather permitting, for most of the project life. There may be periods at the beginning and end of the project where the material movement schedules require operation on day shift only.

2.4 Overburden Emplacement Facility

Over the predicted 25 year mine life of the proposed open cut operations, approximately 183 million tonnes (Mt) of overburden waste rock would be mined from the pit. Most of this material would be hauled to the overburden emplacement facility (OEF) located to the north of the pit area. The proposed final footprint of the OEF covers approximately 255 hectares. Additional smaller overburden emplacement facilities are proposed between the flood protection bund and the crest of the final open cut for non-acid forming materials only.

2.5 Processing Facilities

The proposed open cut operations would use the current underground mine processing plant. The only new processing facilities proposed are the run of mine (ROM) pad used to receive the haul trucks from the open cut, and a new primary crusher to replace the existing one, which is located underground. Following crushing, the ore would be processed through the existing plant, which has sufficient capacity for the increased ore production rate of 1.8 Mt/y.

Concentrate would be produced at a rate of 320 000 t/y and stored in the existing concentrate storage shed.

2.6 Tailings Storage Facility

The tailings would be removed from the processing stream as a slurry and pumped to the tailings storage facility (TSF) for disposal within the existing TSF footprint. Tailings placement would shift west of the existing deposition location into the area currently used for the evaporation pond, the dirty water dam, and the clean water dam. This would enable the current cell to be decommissioned and rehabilitated.

2.7 Truck Transport

The concentrate would be transported to the Bing Bong port using the current arrangements. Road-trains with covered, side-tipping trailers are used and consist of prime movers with

quad-axle trailers in a double AB configuration. The road-trains usually have a payload of approximately 120 tonnes.

The haul route would be the same as that used for the existing operations i.e. the Carpentaria Highway from the mine to Borroloola and from Borroloola to the port at Bing Bong. This route is sealed for its full 115 km length and bypasses Borroloola.

The haulage rate would decrease slightly in line with the reduction in annual concentrate production. The frequency of truck trips (return trips) would decrease from 4 200 per year to 4 100 per year. This would equate to approximately 11 truck trips per day, seven days per week.

2.8 Bing Bong Port

Concentrate would continue to be exported via the port at Bing Bong using existing facilities including the load-out and bulk carrier (“Aburri”) operations from Bing Bong to the off-shore export vessel. The average number of return trips taken by the Aburri would decrease slightly from 130 to 126 per year.

2.9 Ancillary Facilities

Some changes to existing infrastructure and service arrangements are proposed in order to service the construction and operation of the proposed open cut mine. The initial open cut operation would use existing facilities for offices and crib rooms. The existing underground operations surface workshop will be used. On completion of the proposed river and creek realignments and flood protection bund, new surface infrastructure would be constructed to service the open cut operations.

The proposed new industrial area would occupy approximately 28 hectares within the flood protection bund. This would include mining offices, change house, crib rooms, hardstand, heavy equipment workshop, and stores. The blasting agent storage compound and detonator magazines would be located approximately 650 m to the east of the hardstand, to separate them from the main work areas.

During the construction phase of the project, a purpose-built construction camp would be erected adjacent to the existing accommodation camp. Two additional single-persons quarters would be provided within the existing accommodation village to accommodate senior managers associated with the proposed open cut operations. No additional facilities will be required for the operational workforce.

The existing power supply, water supply, road and air transport network, and communications systems are considered to be adequate for the construction and operation phases of the proposed open cut operation.

2.10 Decommissioning

At the proposed target ore production rate of 1.8 Mt/y, the life of the proposed open cut operation would be 25 years. Rehabilitation of disturbed areas would be carried out progressively, consistent with operational requirements. The rehabilitation strategy would remain flexible and would be amended as new rehabilitation techniques emerge and as environmental investigations progress, or when MRM’s Mine Management Plan is modified. This will ensure that the most appropriate technology is utilised as it becomes available.

Estimates of costs to remediate contaminated land and to close the operation have been made by the proponent. Financial provision for rehabilitation and closure of the proposed open cut would be reviewed annually through the Mine Management Plan.

2.11 Issues outside the Scope of this Environmental Impact Assessment

The NOI received in January 2003 included a number of components that are not addressed in the EIS, as the proposal has been reduced in scope from that originally proposed in the NOI. Accordingly there are a number of issues outside the scope of this Assessment Report. These include the Glyde River Weir, the on-site zinc refinery, and the 350 megawatt power station. Furthermore the current project has the zinc/lead/silver concentrate leaving the site whereas the product leaving the site in the 2003 proposal was zinc metal which would have resulted in the lead and silver content remaining on site in the waste rock and tailings.

It should also be noted that the current proposal has accounted for a future expansion to mining operations within its design. For example, the location of the bund wall is largely dictated by the location of the resource and a desire not to sterilize reserves for any future expansion of mining operations. This assessment does not include an assessment of a possible future expansion of the mine pit that is implied by current design.

3 Regional Setting

The proposed project area is located approximately 45 km south-west of the regional centre of Borroloola and 740 km south-east of Darwin, NT. The larger region within which the MRM mine site and Borroloola are located is commonly referred to as the Gulf Country or the Gulf Region, a sparsely populated area of northern Australia.

The region experiences a tropical monsoonal climate with two seasons: the wet season which lasts from December to March; and the generally dry conditions which last for the remainder of the year. The vegetation is comprised mainly of *Eucalyptus* and *Corymbia* dominated woodland or open woodland formations, with *Eucalyptus tectifica*/*E. terminalis* woodland occurring extensively on flat to undulating plains covering an area of 30,000 km². The McArthur River is the major surface water feature in the region and is relatively large for the tropical north of Australia, with a total catchment area of approximately 20,000 km². The catchment drains from the headwaters in the Barkly Ranges and flows north-east to the Gulf of Carpentaria at the Sir Edward Pellew Group Islands. The MRM mine site is situated adjacent to the McArthur River, in the middle reaches of its catchment, between the confluences of the Kilgour and Glyde Rivers. The mine site is located approximately 120 km upstream of the river mouth, and approximately 5 km upstream of Bukalara Range.

The two main forms of land tenure that comprise the Gulf Region are pastoral leases and Aboriginal freehold land held under the *Aboriginal Land Rights Act 1976* (ALRA). In all, Aboriginal land held by recognised Aboriginal organisations under Commonwealth or Northern Territory (NT) title comprises approximately 38,451 km², or 38.5% of the total Gulf statistical local area (SLA). The current and proposed mining operation is located on the McArthur River station pastoral lease (PPL 1051), also held by the proponent. The Bing Bong port facility is situated on mineral lease N1126.

3.1 Climatic Conditions

The Gulf Region experiences a monsoonal climate with extreme weather conditions typically a part of the annual climatic cycle. The occurrence of flood and droughts in the region is essentially an annual event. The region receives an annual average rainfall of 750 mm, most of which falls between December and March. During these wet season months, extreme rainfall events can occur. Daily rainfall events in excess of 173 mm and 197 mm have been recorded in January and February respectively. Monthly rainfall in excess of 660 mm has been recorded in February.

The main climatic hazard in the region is tropical cyclones, which may produce flooding, wind damage and high seas. The cyclone season is from November to April with a peak in January and February. Tropical cyclone occurrence maps prepared by the Bureau of Meteorology indicate that on average, 1 cyclone hits the region every 2.5 years.

Stream-flow in the McArthur River is highly variable as a result of thunderstorm activity, cyclones, and monsoonal rainfall. The major wet season flows occur in February and March, however, early wet season floods have occurred in December and January, and occasionally in November. The McArthur River floodplain is regularly inundated up to 5 m deep, and rises in flood levels of 5-7 m over 24 hours are not uncommon. Peak flood flows of 6 200 m³/s have been recorded near the mine site. During the dry season, the McArthur River typically dries to a series of isolated pools between August and September. No flow periods are typically 1-2 months but can last up to 6 months.

The highly variable nature of the environment, especially the occurrence of extreme rainfall events in the wet season, would present a key challenge to the management of the proposed open cut mine.

3.2 Physical Environment

Much of the existing mine site and the proposed open cut area is underlain by alluvium associated with the McArthur River, and fractured rocks of the McArthur Group. The Bukalara Plateau immediately east of the mine site, is a major feature of the region and is composed of flat-lying Bukalara Sandstone standing approximately 30 to 100m above the surrounding countryside. Downstream from the proposed open cut mine site, the McArthur River descends to a coastal plain before reaching the Gulf of Carpentaria. The coastal plain is composed mainly of laterite, sandy soils and alluvium, but scattered residual Mesozoic and Proterozoic rocks (Roper Group) rise approximately 30 m above the plain, particularly in the vicinity of Borroloola.

The soils in the proposed mine area vary according to terrain, ranging from lithosols on hill and ridge tops, to grey and brown cracking clays in gullies and depressions.

Open Cut: The terrain in the proposed open cut area includes areas of near-level alluvial back-plains and dissected marginal slopes adjacent to the McArthur River. The soils comprise mostly deep brown and grey cracking clay soil on the floodplains. Marginal slopes to drainage with deep loamy alluvial soils occur within the fluvial corridor.

Overburden Emplacement Facility (OEF): The terrain at the location of the proposed OEF, primarily comprises a near level to gently inclined alluvial backplain of the McArthur River with deep grey and brown cracking clay soils.

McArthur River Realigned Channel: From the departure point on the McArthur River, the proposed diversion would initially traverse a short section of the fluvial corridor. It would then cross the marginal slopes and river backplain and follow a small tributary stream line, which separates the alluvial backplain from the undulating pediplain to the west. The surficial soils intersected along the proposed alignment are diverse, ranging from fine sandy clay loams within the river corridor, to dispersive cracking grey and brown clays on the backplain and marginal slopes. Shallow gravelly sandy to loamy soils, yellow earths and earthy sands are also present.

3.3 Biological Environment

Nine distinct vegetation communities occur within the proposed project area. Four of these are upland communities on sandstone or rocky hills, three are lowland woodland communities, and two are riparian or riverine communities. Riparian vegetation bordering the braided channel of the McArthur River and its numerous tributaries transect the project area. The key areas and species of conservation significance are summarised below.

3.3.1 Flora

The Bukalara Range that occurs to the east of the project area supports distinctive vegetation communities that are largely restricted to rocky (*Eucalyptus. leucophloia* open woodland) and sandstone areas (*E. phoenicia/Corymbia capricornia* open woodland). Intervening low hills, scree slopes and rocky buttes in the area may also support small, dry vine-forest or vine-thicket communities. Vine forest communities are often floristically diverse and the sandstone habitats contain plant species of botanical importance. The Bukalara Range is regarded as significant at both the national and Territory level, and has in the past been proposed for a conservation reserve (URS 2005a).

No declared threatened flora species have been recorded in the project area. The perennial species of Mitchell grass (*Astrebla lappacea*), which is classified as Data Deficient, occurs in the project area on the black soil plain on the east side of the McArthur River. It is possible that some of the local population of this species could be lost during construction of the proposed realigned river channel.

Of the nine endemic plant species recorded in proximity to the project area, some local populations of the small diffuse annual herb species *Euphorbia mitchelliana* could be affected by the clearing of inland bloodwood vegetation community for the open cut operation. The other eight endemic species were found only in the elevated sandstone plateau environment and therefore will not be directly affected by the project.

A total of 18 weed species were recorded within the project area during surveys. Three of the recorded species, namely Hyptis (*Hyptis suaveolens*), Parkinsonia (*Parkinsonia aculeata*) and Noogoora Burr (*Xanthium strumarium*), are declared noxious weeds Class B (NT *Weeds Management Act, 2001*). The areas of highest weed infestation in the proposed project area, are the riparian areas along the McArthur River and its tributary creeks.

3.4 Fauna

Eight threatened and near-threatened fauna species are known to occur in or near the proposed project area. Two of these species, the Australian Bustard (*Ardeotis australis*) and the Northern quoll (*Dasyurus hallucatus*), are listed as Vulnerable under NT legislation. The Red Goshawk (*Erythrorhynchus radiatus*) is listed as Vulnerable under both NT and Commonwealth legislation. The remaining six species listed below are assigned Near-Threatened status under NT legislation.

- Worrell's Turtle (*Emydura worrelli*)
- Grey Falcon (*Falco hypoleucos*)
- Purple-crowned Fairy-Wren (*Malurus coronatus mcgillivrayi*)
- White-browed Robin (*Poecilodryas superciliosa cerviniventris*)
- Spectacled Hare-wallaby (*Lagorchestes conspicillatus*)

The Carpentarian Grass Wren (*Amytornis dorotheae*), Gouldian finch (*Erythrura gouldiae*) and Carpentarian Rock-rat (*Zyomys palatalis*), are Endangered species that are known to occur in the Gulf region but have not been recorded in proximity to the proposed project area. The Freshwater Sawfish (*Pristis microdon*) has been found in the McArthur River and is listed as Vulnerable under Commonwealth legislation.

The EPBC Act referral identified a total of 31 migratory bird species were recorded in surveys of the project site. These include 6 species in the family Anatidae, 8 in the family Accipitridae, 4 in the family Falconidae, 8 in the family Muscicapidae, 2 in the family Charadriidae, and one each in the families Grus, Recurvirostridae and Meropidae.

Feral animals, particularly the donkey (*Equus asinus*), are numerous in the open cut project area. Signs of the presence of feral pigs (*Sus scrofa*) have been observed across the proposed project area, generally in association with stream lines, major riparian corridors and lower gorge habitats. Feral cats (*Felis catus*) were seen during spotlight surveys in the vicinity of the existing mine camp. Cane toads (*Bufo marinus*) are abundant in the McArthur river area, occurring in large numbers particularly around human habitation (i.e. the camp area), artificial water bodies such as bores, and in riverine habitat along the McArthur and Glyde Rivers.

3.5 Cultural Environment

The rich coastal, marine and riverine environments of the Gulf Region have supported comparatively large populations of Aboriginal people. The MRM proposal is on lands that were traditionally used by the Gudanji, Binbinga and Yanyula people. Borroloola and its immediate surrounds have residents from a number of Aboriginal groups and include the Garawa, Mara and Alawa people. Not all of these groups are traditional owners of lands that would be directly affected by the open cut proposal; however, many people still have an

interest in the project. Aboriginal residents of the region continue to value traditional culture, which includes strong attachments to land, sites and customary land management practices.

Numerous sites of significance to Aboriginal people have been recorded in the McArthur River region. The Aboriginal Areas Protection Authority has identified 146 sacred sites across the existing MRM mineral lease area, adjacent areas, and between the mine site and the mouth of the McArthur River.

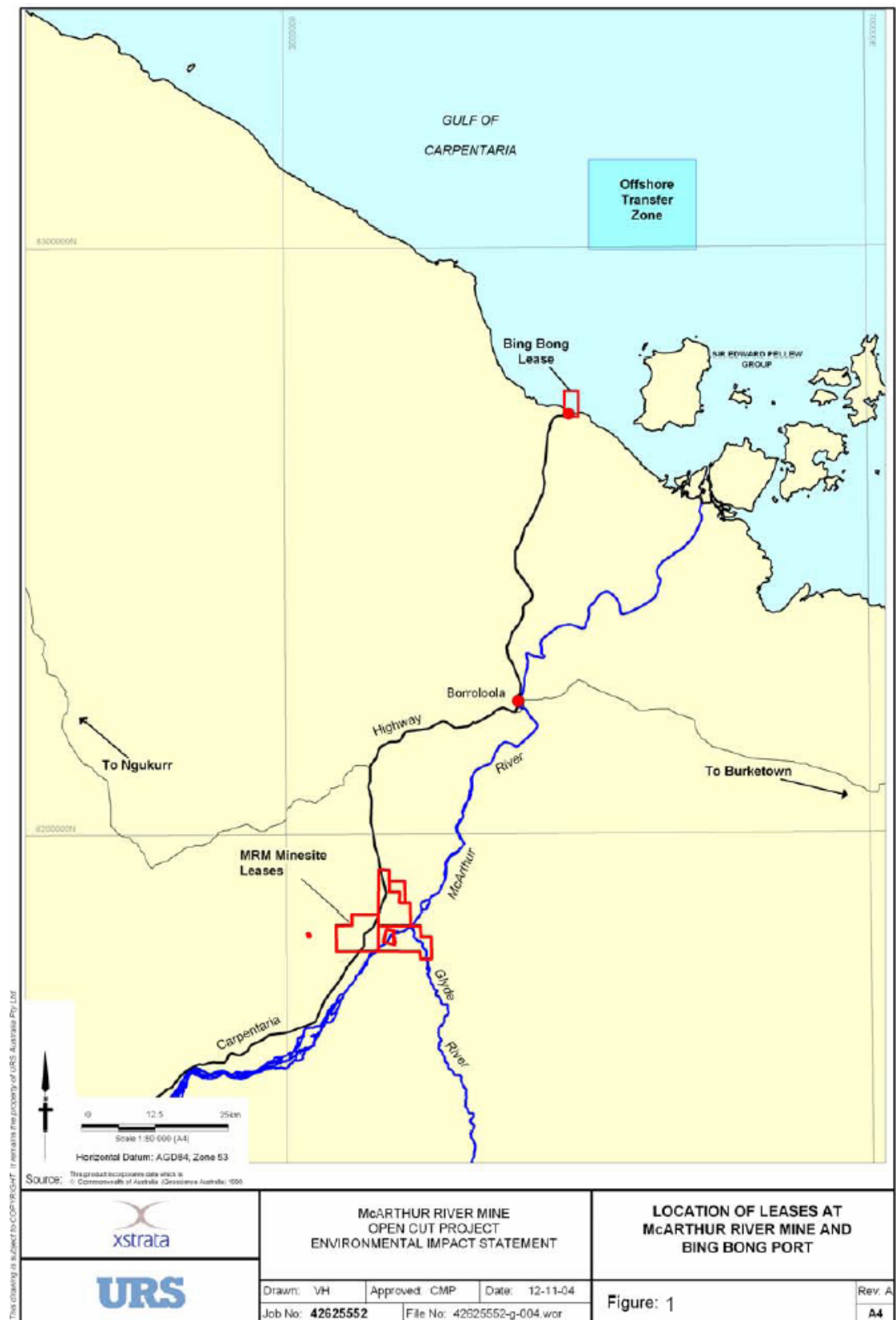
Previous archaeological research undertaken at the existing mine site identified a number of archaeological sites that were deemed to be of low archaeological significance. Three archaeological sites and a number of isolated artefacts were identified within the proposed project area during field surveys undertaken at the site of the test pit. The archaeological sites were considered to be of medium and high archaeological significance.

3.6 Socio-economic Environment

The Gulf Region is sparsely settled and minimally served by urban centres. The town of Borroloola, the main regional service centre, is located 45 km north-east and downstream of the proposed mine site. The 2001 census put the region's population at 3482 people. The population is relatively young with a quarter of the population (26.4%) aged below 15 years, and 54% aged below 30 years. Sixty-five percent of the population identify as indigenous Australians, who live in communities scattered throughout the region. The non-Aboriginal population is mainly concentrated in Borroloola and scattered pastoral homesteads, roadhouses, and other minor enterprises (fishing, tourism etc.). There has been an increase in the non-indigenous population of the Gulf region which can reasonably be attributed in part to the development of the existing MRM and its impact on the development of Borroloola.

The total workforce of the Gulf Region is 1,276 (818 males and 458 females). Indigenous people make up 59.8% of the total labour force (450 males, 313 females). The unequal sex ratio is mainly attributable to the preponderance of males in the workforce in the census division where the existing MRM mine is currently located.



The largest single employment category in the Gulf Region is the Community Development Employment Program (CDEP), employing 675 people or 52.9% of the total workforce. Of the total indigenous labour force, 637 or 83.5% are employed under the CDEP, and only 78 or 10.2% are employed in other categories of the labour force. The corresponding figures for the non-indigenous labour force are 38 or 7.5% employed under CDEP and 90.1% employed in other categories. The unemployment rate for the Gulf as a whole is 4.7% of the total workforce, for indigenous people 6.3%, and for non-indigenous people, 2.4%.

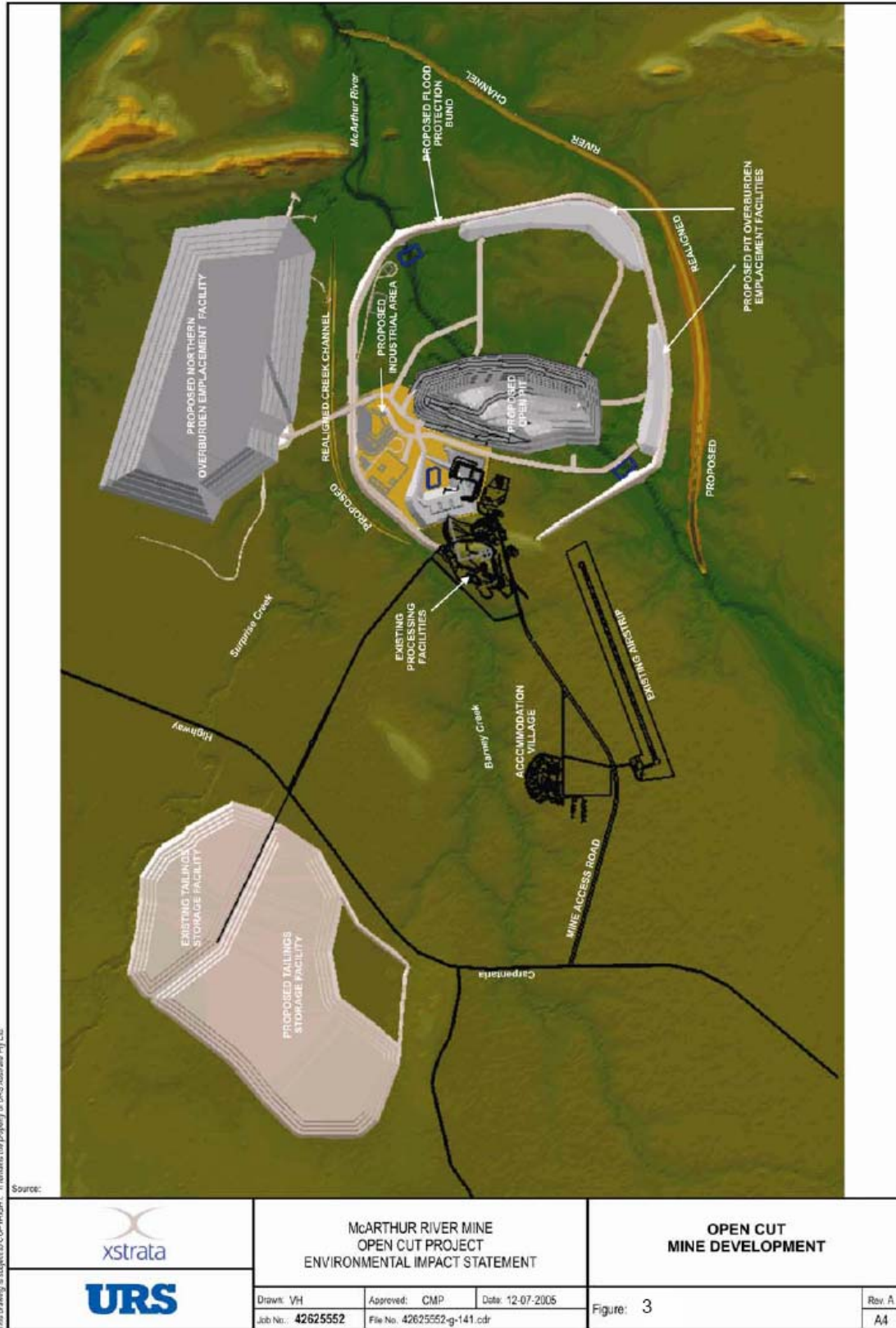


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0 750 1500m
Scale 1:45 000 (A4)
Horizontal Datum: AGD84, Zone 53
Date of Aerial Photography, 2001

	<p>McARTHUR RIVER MINE OPEN CUT PROJECT ENVIRONMENTAL IMPACT STATEMENT</p>		<p>OPEN CUT MINE FOOTPRINT</p>	
	<p>Drawn: VH Job No: 42625552</p>	<p>Approved: CMP File No: 42625552-g-044c.wor</p>	<p>Date: 14-07-05</p>	<p>Figure: 2</p>
				<p>Rev: C A4</p>



4 Environmental Impact Assessment

4.1 Introduction

The purpose of this Environmental Assessment Report is to evaluate the environmental protection measures of the project proposal and to determine whether the proposal meets relevant environmental criteria. This is done by identifying all potential environmental impacts of the proposal and evaluating the corresponding safeguards or prevention measures suggested by the proponent.

The environmental assessment of this project is based on consideration of the following from the EIS:

- completeness of information concerning the proposal (particularly with reference to construction or activities that are likely to impact on the environment);
- completeness and detail regarding the existing environmental condition and sensitivities;
- thoroughness regarding the description of the range and extent of potential impacts; and
- appropriateness of any proposed mitigation measures or safeguards.

Conclusions are based on comments from both a review of the draft EIS by relevant government agencies and the public and also the Supplement in response to these comments and (independent) expert advice and reference to scientific literature.

The outcome of the environmental impact assessment for this proposal is that the EPA is unable to conclude that the project can proceed without unacceptable environmental impacts. The EPA is not confident that mining at the site can be managed with minimal long-term risk to the environment adjacent and downstream of the mine site. The proponent has not been able to adequately demonstrate that there will be no significant environmental impacts as a result of the operation.

The issues of most concern include the following:-

1. The potential impacts associated with the realignment of the McArthur River and Barney Creek.
 - The proponent has not provided adequate information to allow an informed decision on the nature of potential impacts associated with these diversions. An independent geomorphologist contracted by the EPA identified key flaws in the modelling that was undertaken for the EIS. Consequently, the conclusions drawn from the modelling are likely to be compromised.
 - The predicted impacts of down and up-stream morphology of the River (identified by the independent geomorphologist) include the progressive degradation of the upstream McArthur River channel and as a consequence causing the destruction of the channel (the geometry and dimensions of the diversion channel can not be maintained); creating a long section of sand aggradation downstream of the diversion channel; and continuing erosion of the diversion channel banks.
 - The EIS failed to include hydrological information for Barney and Surprise Creeks. This is a major oversight considering the potential in larger floods for Barney Creek to pose greater risk to the mine infrastructure, including the flood bund and OEF than the diverted McArthur River channel.

-
- Revegetation of the diverted channel would present a significant challenge to the proponent and require considerable resources to ensure success within the mine life. This has implications for channel stability as well as ecological values of the River.

Given the high risk posed by bankfull flooding events and extreme weather phenomena, and the lack of certainty regarding the proposed design of the River and Creek realignments, the EPA cannot support the approval of the project.

2. The potential environmental risk of mining operations and its components (including the tailings storage facility, the overburden emplacement facility and flood protection bund) posed by its location within the primary channel of a major tropical river. This includes the long term management of materials (sediments and contaminants), and their potential impact on ground and surface waters (and subsequent impact on local ecology) both during and post mining operations.

On the basis of the above information the primary recommendation of this Assessment is:

Recommendation 1

It is recommended that the proposal as currently outlined in the draft EIS and its Supplement not proceed.

The *Environmental Assessment Act* allows for each matter affecting the environment to be fully examined and taken into account in relation to a development proposal. The *Environmental Assessment Administrative Procedures* provides for the Minister for Natural Resources, Environment and Heritage to make comments, suggestions or recommendations concerning a development proposal, that she thinks fit for the protection of the environment. This information is contained in this Assessment Report and the advice is provided to the “responsible” Minister (the approving Minister – the Minister for Mines and Energy) for their information when making a determination as to whether or not a revised ‘Authorisation to Operate’ will be issued to MRM under the *Mining Management Act*.

In addition to the uncertainty of information relating to the River and Creek realignments, there were a number of other issues where a lack of supporting information prevented the EPA concluding that the potential environmental impact of the proposal was acceptable. In summary, these relate to the following:-

- The management, monitoring and contingency planning for the operations of the overburden emplacement facility;
- The management, monitoring and contingency planning for the operations of the tailings storage facility;
- Investigation of the potential for contaminant mobilisation to occur from non-acid forming material;
- The management, monitoring and contingency planning for the flood protection bund;
- A revegetation strategy for the River and Creek realignments demonstrating that an ecologically functional corridor could be achieved within the shortest timeframe possible;
- The impact of drawdown on the ecology of the McArthur River; and
- The potential impacts of the project on the Freshwater Sawfish.

While it is the primary conclusion of this Assessment Report that the proposal currently presents an unacceptable risk to the environment and therefore should not proceed, there is the recognition that the decision to approve the mine may be based on other factors, besides

the risks to the biophysical environment of the Region. The Assessment Report therefore contains an assessment of all potential impacts.

4.2 Realignment of McArthur River and Barney Creek

In the current open cut project proposal, the location of the ore body under the main channel of the McArthur River requires the diversion of the river. To protect the open cut pit from inundation, Barney Creek is also proposed to be realigned and Surprise Creek intercepted around a flood bund which would be constructed around the footprint of the ore body (Figures 2 and 3). Descriptions of the proposed hydrology and morphology of the engineered McArthur River realignment can be found in the draft EIS Section 12.10.

The proponent has attempted to design the realignment to mimic the general geometry of the existing McArthur River channel and provides information in the EIS on the expected hydraulic performance of the realigned channel including its effect on flow velocities in various flood scenarios and consequent flood levels, erosion and sedimentation, and water quality based on modelling runs. There are, however, significant uncertainties associated with the geomorphological and ecological aspects of the proposal. The primary concerns associated with the proposal are discussed for the main part in other sections of this report and include:

- The destruction of six kilometres of riparian/ riverine corridor (Section 4.6.1);
- The fragmentation of habitat that has the potential to impact many species (Section 4.6.1);
- Uncertainties regarding the effects on upstream and particularly downstream aquatic environments (Section 4.6.2);
- The effects on erosion and sedimentation in the channel and the flow-on effects to other river reaches (see below);
- Considering the mineralogy of the area, the possibility of releasing contaminants to the McArthur River through ground disturbance and the mobilisation of metals (Section 4.4.1);
- The creation of a barrier to the passage of fish and other aquatic species, in particular the smaller fish species and the freshwater sawfish (*Pristis microdon*) (Section 4.6);
- The establishment of a functioning ecological community on the realigned channel similar to that of the pre-disturbed McArthur River channel (Section 4.6.1);
- The impacts on people living downstream, either through perceived or physical effects associated with altering the river, including impacts to tourism opportunities and traditional lifestyles (Section 4.13); and
- The implications for other Northern Territory and Australian rivers.

The EPA commissioned an independent geomorphologist to undertake an assessment of the realignment information provided in the EIS. The detailed findings of the consultant's report are included in Appendix 3 of this assessment report. In summary, the report identifies some key flaws in the modelling that was undertaken for the EIS. Consequently, the conclusions drawn from the modelling are likely to be compromised. The report also outlines some predicted impacts of the diversion channel on up- and downstream channel morphology, including:

- Progressive degradation of the upstream McArthur River channel due to drawdown immediately upstream of the river diversion and the consequent, very high shear stresses that would occur. Under these conditions, it is likely that for the 2 and 5 year ARI flood, planted vegetation would not survive, and the geometry and dimensions of

the diversion channel could not be maintained, in short, the diversion channel would be destroyed with unknown consequences to the mine infrastructure from an uncontrolled river flow;

- Conversion of the channel into a sand slug (that is creating a long section of sand aggradation downstream of the diversion channel) due to deposition downstream from high upstream sediment supply. This would bury aquatic habitats, riparian plants and form in-channel benches at locally wider cross-sections and be extremely difficult and expensive to rehabilitate; and
- Continuing erosion of the diversion channel banks until a time when dense riparian vegetation is established, which according to the proponent's estimation would take longer than 10 years. It is argued that revegetation might never occur given the predicted erosion of the channel.

A key issue identified in the consultant's report is the failure of the EIS to include hydrological information for Barney and Surprise Creeks. This is a significant oversight considering the potential in larger floods for Barney Creek to pose greater risk to the mine infrastructure, including the flood bund and OEF, than the diverted McArthur River channel.

Revegetation of the diverted channels would present a significant challenge to the proponent and require considerable resources to ensure success within the mine life. The Supplement uses the Isaac River diversion in Queensland as an example to illustrate the resilience of river systems "in terms of natural restoration with voluntary colonisation of riparian vegetation even where there is minimal direct implementation of revegetation initiatives". Accounts from the independent geomorphological consultant indicate that the Isaac River diversion is not an example of good practice and the diversion is experiencing significant erosion problems.

On the basis that essential information is not provided in the EIS to allow a more informed decision on the nature of potential impacts associated with the diversions, and given the high risk of unacceptable aquatic habitats and ecosystem degradation, in addition to the risk posed by bankfull flooding events and extreme weather phenomena **it is recommended that the proposal as currently outlined in the draft EIS and its Supplement does not proceed.**

4.3 Waste Management

4.3.1 Overburden Emplacement Facility

Multi-element tests conducted on the overburden that is expected to be removed from the mine pit show that some of the material contains enriched concentrations of metals such as arsenic (As), cadmium (Cd), copper (Cu), manganese (Mn), lead (Pb) and zinc (Zn) relative to what might be expected in normal background concentrations (Section 7.2.3 draft EIS). This has major implications for handling of the waste material, particularly when considering acid rock drainage and the behaviour of some of these metals in the environment in acid conditions. Design and construction of the proposed overburden emplacement facility (OEF) is therefore critical in preventing mobilization of contaminants into the environment.

The proponent has designed the OEF so that the potentially acid forming (PAF) overburden and interburden material from the pit is placed in clay-lined cells within the western side of the OEF beneath layers of non-acid forming (NAF) and acid consuming (AC) material. The PAF material is estimated to comprise 11% of the total waste material based on analysis of 656 selected core samples taken from 35 drill holes in the immediate vicinity of the proposed pit. The proponent has suggested that the likelihood of acid generation from the PAF cells would be minimal given the buffering capacity of the NAF and AC material in the overburden that would surround the cells, that is, the ability of the materials to neutralize acid due to their chemical composition.

There are concerns, however, that the volumes of neutralising material available and the neutralising capacity of the material have been overestimated by the proponent. The proponent has not adequately considered contingencies in the event that the volume of problematic material is greater than initially estimated and needs to identify and commit to potential additional control measures to mitigate this problem. Additionally, there is some question as to whether the material can be adequately detected and selectively handled in a way that will ensure it is appropriately disposed.

In response to these concerns, the proponent provides assurances that a program is under development that will provide for testing of a 'suitable' number of samples to distinguish NAF and PAF materials during mining and that selective handling of some suitable cover material such as the dolomitic breccia material will not be an issue. Further studies by the proponent will more thoroughly characterise and quantify the various OEF cover resources. The proponent argues that even in the event of acid leachate forming within the OEF, the water management system will deal with the contaminated water; however, the EIS indicates that only one section of the OEF reports (pumped) to the water management system.

The proposed design of the OEF is detailed in the draft EIS (Section 7.2.4). Surface run-off water and seepage from the OEF will be handled in two ways according to the catchment from which the water originates. Water that is shed from the western side in which the PAF cells are proposed to reside, will report to an appropriately-engineered PAF pond to ensure that no contaminated water is discharged to Barney Creek. This water can then be pumped to the water management dam associated with the tailings facility for reuse in ore processing.

The proponent expects that runoff from the upper surfaces of the OEF will be largely of neutral pH since the potentially acid-forming materials should be protected from exposure to air and water infiltration deep within the NAF overburden. Run-off from the eastern or NAF side of the OEF is not expected to contact PAF material.

The EIS states that metals in runoff/seepage from overburden materials are likely to remain within ANZECC (2000)/NEPM (1999) concentration guidelines criteria for livestock drinking water under neutral or alkaline conditions. Respondents to the EIS have queried the consequences should leachate from the eastern catchment of the OEF become acidic. This was not considered likely by the proponent as it is expected that any small amounts of PAF material that are incidentally placed in the eastern catchment of the OEF will be overwhelmingly buffered by the presence of non-acid forming and acid consuming material in situ. Ongoing sampling would validate this; however, there are still some lingering uncertainties and concerns.

On the basis of the information provided, it is not possible to conclude that contaminants mobilised from the OEF will not enter the McArthur River.

In the event that the mine was to proceed the EPA would recommend that leach column testing and revised block modelling be undertaken during mining activities to continually assess the overburden material for potential acid generation characteristics. Correlation of test work with waste rock placement in the OEF would also need to be undertaken throughout the operational life of the mine.

Although the proponent has indicated that the run-off from the OEF will likely be pH neutral, there is concern that the NAF and perhaps the AC material may also require active management due to non-acidic drainage issues. Leach column tests undertaken on NAF material have shown that elutriate (leachate) concentrations of sulfates and metals such as zinc and manganese, increase over time and are elevated above guideline criteria in some samples. As a minimum requirement, the proponent would be expected to commit to investigating the potential and developing a risk management strategy for this type of drainage.

The measure proposed for dealing with NAF runoff from the OEF involves temporary containment in sedimentation ponds on the eastern side of the OEF for a period of time to

enable suspended sediment to settle. If pond capacity is exceeded then the water would overflow into Barney Creek via engineered spillways. The EPA is concerned at the potential to pollute Barney Creek with elevated metals levels from the NAF, particularly in combination with any other contaminated water from the current mine.

The potential for metal mobilisation to occur from non-acid forming material has not been adequately investigated nor a risk management strategy prepared with detailed contingencies in the event that non-acidic drainage is found to be a significant source of contaminants.

It is proposed to periodically remove captured sediment 'sludge' from the sediment ponds to prevent contaminated water reaching Barney Creek. In the event that leachate from the eastern OEF becomes acidic, this would create a more significant problem as some metals would be released in soluble form. The proponent makes the statement, "should there be an emergency discharge in an extreme storm event, the massive dilution would not result in measurable impact on contaminant concentrations downstream". This should be regarded as a last-resort incidental pollution reduction measure and all efforts should be employed to prevent this occurring to avoid the deposition of metals in aquatic sediments due to pH fluctuation down the discharge channel and in aquatic ecological communities.

In the event that the proposal was to receive an Authorisation to Operate, the EPA is likely to recommend that a contingent Waste Discharge Licence be continued to both monitor the water in the sedimentation ponds appropriately to determine contaminant levels, and to set appropriate levels for discharge to the receiving environment in the event of an extreme storm event.

4.3.2 Tailings Storage Facility

Existing TSF

Tailings leakage from the existing tailings storage facility was discovered in 1997 and testing indicated that water in Surprise Creek contained some sulfate, a signature of tailings leakage, but only background levels of lead and zinc (URS 2005a). Although the TSF was originally designed to prevent leakage, the nature of the underlying soils and parent materials provides flow paths for transport of water from the tailings. The proponent has attempted to address this through various strategies including pumping contaminated water from Surprise Creek back into the TSF, installing a cut-off trench between the TSF and the creek, reducing tailings accumulation in the section of the TSF nearest the creek, and implementing a groundwater monitoring program. Recently, a sub-soil barrier to block seepage flows was installed by injection of a geopolymer into the soil to create a dense low-permeability matrix. The trial of this method was an apparent success and the further geopolymer barriers have been installed fronting Surprise Creek. The proponent indicates that the water quality monitoring program will determine the effectiveness of this strategy. If further seepage of the existing TSF occurs then the proponent will give consideration to establishing a groundwater recovery bore network here.

This is supported irrespective regardless of whether mining operations are expanded.

Proposed TSF

Design of the TSF proposed for the open cut project is described in the draft EIS (Section 7.4.3). Awareness of the shortcomings of the underlying soil and rock matrix has prompted the proponent to incorporate many of the strategies used to mitigate seepage from the existing facility into the design. This includes a rock wall with earth fill core incorporating a cut-off key in the base of the TSF wall, and a network of bores to recover groundwater downgradient of the TSF. It is proposed to pump water from these bores to the TSF water management dam

for recycling in the ore concentrator. A clay liner was considered but determined to be less effective than establishing the bore network. Prevention of seepage from the TSF is likely to be both difficult and cost-prohibitive and the EPA accepts that the proposed management measures are the most practicable with current technology given the size of the facility and underlying soils. However, it is concerning to note that the proponent is unable to prevent seepage in the first instance and that the imperative is to recover groundwater that is potentially contaminated thus adding to the inventory of water in the water management system and potentially impacting on a wider area with respect to the drawdown cones of the bore network. This begs the question of the suitability of the site for location of a tailings facility.

The EIS would have benefited from the provision of a tailings storage facility management, monitoring and contingency plan and program which addressed:-

- **Monitoring of the proposed strategies to control contaminated seepage entering Surprise Creek from the proposed tailings storage facility addressing both mine and post mine operations;**
- **Outlined planned contingencies in the event that seepage of contaminated water is entering Surprise Creek; and**
- **Consideration of a continuous improvement program and how it could be implemented to ensure that all contingency actions employ best environmental practice technologies.**

The rock fill component of the TSF embankments will be sourced from the open pit. As with the waste rock dump, there is a risk that this material could give rise to mobilisation of contaminants during rainfall events. Refer to Section 4.4.1 of this report.

A concern was raised about the proposed practice of disposing of 7,700 tonnes of contaminated waste per year, and an unquantified amount of sludge, in a 'designated section' of the TSF. While it is acknowledged that this is common practice at mine sites and that the TSF, as the mechanism to receive mine waste, is the most appropriate disposal area, the disposal of contaminated waste and sludge adds to the concern about possible impacts to Surprise Creek from TSF leakage and the ultimate rehabilitation of the TSF upon completion of mine operations discussed in Section 4.7.2.

Overall the EPA has concern about the operation of the tailings storage facility and its potential to impact on the receiving environment due to seepage, ongoing maintenance and monitoring requirements (including beyond mine life) (Section 4.7.2)

4.4 Surface Water

4.4.1 Non-acidic Drainage

The proposal includes a number of components which have the capacity to result in the non-acidic mobilisation of contaminants into surface waters. These include the OEF cover material, the TSF embankments, the excavations of the McArthur River and Barney Creek diversions, and the flood bund constructed around the pit. The proponent intends to construct these components from non-acid forming (NAF) rock; however, concerns have been raised regarding the possibility of metal contaminants from the NAF material being washed into Barney and Surprise Creeks and the McArthur River either through rainfall runoff or flood erosion. There is a risk that inputs of metal salts into these systems, as has happened in Surprise Creek, could increase salinities in dry season pools and become incorporated into sediments where they will be subject to wetting and drying action, and biological activity,

increasing the likelihood of formation of soluble metal species within the river system due to pH fluctuations and potentially adversely impacting on aquatic habitat. The results of leach column testing in the EIS indicate that NAF material is likely to contain relatively lower concentrations of soluble metals [than PAF], although soluble Mn (and occasionally some other metal concentrations) and SO₄ may exceed livestock drinking water criteria. It is considered that the NAF material will require active management to ensure this issue is minimised.

The proponent has maintained that metals will remain insoluble and unavailable to ecological processes, despite the concerns from Government, and indicates that if water quality within the proposed OEF sediment ponds does not meet agreed discharge standards, then it would be pumped to the water management dam. This management measure applies to only one area of the mine whilst the concerns raised apply to all disturbed surfaces that could contain mineralisation from the ore body.

The results of the leach column testing of NAF material from the proposed pit area justify the requirement for further investigation to inform the monitoring of NAF material used in all mine site components and the need for contingency plans to be in place to support any mine operation.

4.4.2 McArthur River (freshwater reach) water quality

The existing underground mine has a waste discharge licence for contingent discharges during flooding periods where there is a risk that water management ponds could overflow. In flood periods, there is the potential for contaminants from the existing TSF and other sources on the mine site to flow into local drainages such as Surprise Creek, Barney Creek and the McArthur River, albeit highly diluted by flood flows. The TSF is the most significant potential source of contamination on the existing mine site. It has a history of leakage into Surprise Creek and this is discussed in more detail in Section 4.3.2. Despite the implementation of various measures to contain this seepage, the implications for downstream contamination, both real and perceived, are considered significant with respect to the proposed mining changes.

The expansion of the mine from underground to open cut would see a significant expansion of the TSF, and the emergence of another potential source of metals and sulfates in the form of the OEF, discussed in Section 4.3.1. Additionally, there is a perception that the material used to construct the flood protection bund around the proposed pit area also contains levels of contaminants above specific guideline levels. This was discussed in the previous Section.

According to the EIS, investigations of river water quality prior to the existing mine development generally had limited data which were not sufficient to characterise the natural variability of water quality in the McArthur River. Since the development of the existing mine, two monitoring sites have been established to assess water quality in the McArthur River near the mine. Site SW6 is located downstream of the mine and the Barney Creek junction, and Site SW7 is located upstream of the mine. Since 1995, water quality at these sites has been sampled at monthly intervals (when flowing) for pH, electrical conductivity, salinity, sulfate and total metal concentrations (copper, lead, zinc) and analysed to determine water quality changes with respect to flow regimes and to compare the downstream water quality with that above the mine.

Surface water quality in the McArthur River near the mine site is strongly influenced by the seasonal streamflow and generally high ambient levels of metals as total suspended solids (TSS) in the water, and stream sediments. Ambient levels of metals in McArthur River (i.e. flow upstream of the mine not affected by mining activities) are naturally elevated due to the close proximity of mineralised zones to the surface. The metals are contained within or adsorbed onto sediments, so are readily entrained and transported in streamflow. The EIS indicates that natural sulfate sources derived from the geology of Barney and Surprise Creek catchments and historical seepage from the existing tailings storage facility into Barney Creek

are possible causes of increased sulfate concentrations (and electrical conductivity) in the McArthur River downstream of the mine.

Site SW6 shows median sulfate concentrations approximately 60% higher than the median concentrations upstream of the mine, but it is the EPA's conclusion that water quality sampling from only 2 data points is insufficient to fully assess the mines contribution to a decline in water quality in the catchment, and any risks of toxicity in the aquatic ecosystem.

Concern regarding water quality issues and the bioavailability of aquatic toxicants resulted in a request from the EPA for further information in relation to these issues to help determine the effects of the existing TSF and the Barney and Surprise Creek catchments. In response MRM presented data in relation to hardness modified trigger levels for copper, lead and zinc as requested and compared to all of the water quality data available for filterable metal (instead of total metal). This data indicated that the risks to the aquatic ecosystem were acceptable for copper and lead but showed a clear trend to elevated zinc levels in the Barney Ck catchment around the mine site. Barney Ck water quality levels for the 95% of species protection for zinc were exceeded by 3 times, indicating moderate to high impacts on aquatic biota could be expected due to the soft water in this catchment.

MRM presented data to develop a "signature" for filtered copper, lead, zinc and determined the natural catchment in the mine area contributes to the normal concentration of these toxicants found in the McArthur River. However stream flow was not analysed in the assessment making it difficult to determine if the elevated levels of salt (as electrical conductivity) and sulphate were related to flow events or mining activities in the catchment.

The EPA concludes that:

- **There is already probable impact to water quality resulting from mining activity;**
- **Further work is required to determine the effects of the existing TSF on water quality;**
- **The data on availability of toxicants to the aquatic ecosystem of the McArthur River most probably indicates a low risk, although some doubt still exists given the range of water hardness levels and lack of flow event analysis;**
- **There is a need for water quality objectives or targets for the catchment using all appropriate background water quality data; and**
- **Given the softness of the water in Barney Creek, attention should be paid to preventing any mining wastes from coming into contact with these higher risk waters.**

River sediment quality needs to be the subject of study as metallic toxicants emitted from the mine and the natural catchment will be stored in the river bed, and if levels increase beyond guideline levels then some rehabilitation may be required. Potentially toxic sediments (mobilised by any additional acid sulphate conditions in the sediments) could alter water quality conditions negatively in first flush conditions of storm flow.

No sediment data is available for the freshwater reaches of the McArthur River. As the sediment is the ultimate repository for toxicants such as lead and zinc, this is a significant oversight in any monitoring program dealing with metal toxicants, given these can be suspended in sediments during high flow periods and then drop out of suspension during low flows in the dry season. The ANZECC 2000 guidelines state that "suspended particles gradually settle and accumulate as part of the bottom sediments. Rates of sedimentation vary from as low as 1 mm/y in coastal marine waters, to 10–20 mm/y in some riverine and estuarine systems. Highest values are found in settling basins removed from high currents and close to point sources, and rates in the range 3–7 mm/y are typical". There is potential for metals to accumulate in sediments over time, particularly in the timeframe that the proponent

intends to operate the mine. The lack of any data on sediment metal content in the MacArthur River and the tributaries represents a substantial knowledge gap required to predict the environmental performance of both the current mine and any future proposals. This is a high risk knowledge gap particularly during first flush events and low flow events after storm events.

EPA concludes the lack of sediment data prevents a complete assessment of the environmental risks posed by the proposal.

4.4.3 McArthur River Estuary and Sir Edward Pellew Islands

Consideration has been given to the potential for contamination in the Gulf of Carpentaria from MRM's bulk concentrate loading activities at Bing Bong Port since before the original mine was approved. In October 1992, the then Northern Territory University undertook baseline studies of the port area to determine the status of relevant pollutants in water, sediments and biota that could indicate whether or not future mining/loading activities could impact the area. Since that time and the subsequent establishment of the mine on the McArthur River, the university, now Charles Darwin University, has undertaken annual monitoring studies of water, sediments and selected biota to maintain an understanding of MRM's impacts to coastal waters.

Additionally, two studies commissioned by MRM were undertaken to assess whether there has been any increase in zinc and lead levels in sediments since mining operations commenced, one focusing on the estuarine reaches of the McArthur River downstream of Borroloola and another to study marine sediments at the mouth of the McArthur River and at the Bing Bong Offshore Trans-shipment area (Munksgaard & Parry 2002; Munksgaard & Parry 2003). The EPA is not aware of any pre-mine baseline studies undertaken for the McArthur River tidal environment.

Munksgaard & Parry (2003) tested sediment taken from depositional sites along the river from Borroloola to the deltaic channels at the McArthur River mouth for the presence of various metals including lead and zinc. Tests included measures of the availability of metals to the marine environment, the possible origins of lead in sediments through lead isotope ratios ($^{208}\text{Pb}/^{206}\text{Pb}$), and comparison of historical to recent metal concentrations through sediment cores. This one-off study found no evidence of metal contamination derived from the current mining activities within the sediments of the McArthur River downstream from Borroloola.

The study undertaken in 2002, taking in Bing Bong Port, the Bing Bong Trans-shipment area as well as the McArthur River mouth, measured metal concentrations in sediments and biota including oysters and sea grass. Samples were tested to ascertain whether metals in sediments and marine biota were derived from the McArthur River ore body, including from bulk concentrate at the Port and anchorage sites. Comparison was also made with reference sites in the Southern Gulf region. Again, there was no evidence of impact from the mine. However, the annual reporting for the Bing Bong area in the vicinity of MRM port loading facilities, indicated that the swing basin and dredged channel, including some biota, have been contaminated with lead-zinc concentrate since port activities began. The impacts of this on marine biota, either sessile or mobile, are not well described, in particular the potential impacts to migratory wader birds that might use the adjacent mud flats and mangroves to feed and nest. This is discussed in more detail in Section 4.6.5.

There are some anomalous data apparent in these reports. For example, cadmium levels in oysters at a site on West Island have been consistently at or above maximum guideline levels for molluscs but levels at all other sites have remained within the background range for the area (Munksgaard & Parry 2004) since 1992. Other studies in northern Australia have found cadmium to be naturally elevated in various biota, including oysters and dugong kidney (McConchie et al. 1988; Dight & Gladstone 1993; McConchie & Lawrence 1991). During the

2000/2001 wet season, two tropical lows and three tropical cyclones impacted the Southern Gulf of Carpentaria, with consequent reworking of the sediments and significant loss of seagrass along the Bing Bong coast (Parry & Munksgaard 2002). This has contributed to some explainable anomalies and has also brought changes to the monitoring program with respect to species availability. Some anomalies have been difficult to explain either because sediment and water data have not supported substantive conclusions or a sample has perhaps been accidentally contaminated during sampling or analysis.

The EPA is satisfied with the findings of these scientific studies, and acknowledges that there is no scientific evidence to date of impact from the mine in the estuarine reaches of the river or in the Gulf, excluding the immediate vicinity of Bing Bong Port.

These results provide little comfort, though, to the people living downstream of the mine, particularly the Yanyuwa or saltwater people in the McArthur River delta and Gulf Country. Many of the objections to the open cut project have originated from the communities (language groups) downstream of the existing mine and in particular the community in the Sir Edward Pellew Islands. A values and issues paper prepared by a member of the Mabunji Aboriginal Resource Association, highlights the importance of the McArthur River and the Sir Edward Pellew Island group of islands to the Yanyuwa and others both in terms of cultural and spiritual relationship to country, and the potential for future opportunities the area presents because of its beauty and ecological values.

Concerns have arisen from a number of events and ongoing perceptions, some of them unrelated to mine activities. These events have not engendered trust within the community. Despite the best intentions of any risk management system, there is always the potential for accidents and this has become very apparent to the local people of the area.

In the absence of a trusting relationship with the mine to date and an incomplete understanding and perhaps suspicion of rigorous scientific principles, these people have come to regard the mine as a major threat to their way of life and their future. The proponent, as part of the EIS process for the open cut project, has recently engaged with the downstream community with respect to the ongoing monitoring of the mine's activities in the Gulf and their potential to impact on the downstream environment. The proponent has indicated that an agreement was reached that the monitoring program would be expanded to account for people's concerns, and the program development and subsequent outputs would be scrutinised by an independent party as agreed between the proponent and the concerned communities to improve the perception of impartiality. **This is a commendable step in progress towards resolution of some of the issues presented and the EPA would support this approach in the event that mining proceeds.** It is recommended that any studies target specific food types used by traditional owners using a risk based approach and that concern can be alleviated over time perhaps species by species. Further discussion of social impact issues is discussed in Section 4.13 of this report.

4.4.4 Flood Protection Bund

A flood protection bund is proposed to be constructed around the ore resource footprint in the McArthur River floodplain to protect the open pit from inundation during a 1 in 500 year ARI flood event. As previously noted in this report, the location of the bund has been primarily dictated by the location and extent of the resource beyond that proposed to be mined within the 25-year period. It is acknowledged that this is a strategic approach to ensure that the resource is not sterilised for future expansion proposals; however, it is of concern to the EPA and others that the potential impacts to surface water of the current proposal are essentially dictated by a future resource that may or may not be exploited.

It is proposed that materials for the bund be sourced from the open pit and the river realignment channel depending on availability of suitable clay and rock fill. Rock fill is to consist of non-acid forming (NAF) rock. As with the TSF embankments and the waste rock

dump, the issue of non-acidic mobilisation of contaminants remains (neutral drainage). Should the material be found to present a significant risk, then subject to the project proceeding, contingencies would have to be implemented to manage the problem. Refer to Section 4.4.1.

The proponent acknowledges that the flood protection bund is a significant feature in the floodplain and during larger flood events (50-year ARI floods and greater), it will significantly influence peak flood levels. There are concerns that contaminated material could be eroded from the waste rock dump by flood waters, particularly from Barney Creek. As no hydrological information has been provided for Barney Creek it is uncertain whether erosion will occur. The proponent maintains that these peak flood level increases will not adversely affect the proposed mine operations or key infrastructure, and that the mine pit will be protected in the event of a 500-year ARI flood event.

Section 4.2 of this report includes consideration of independent geomorphological advice provided to the EPA regarding the river realignment. The implication of this advice to the integrity of the flood bund are of particular concern to the EPA because it calls into question the modelling results of the McArthur River flooding regimes. In the extreme event that the bund is breached, the EPA acknowledges that the mine pit will most likely fill with water and will become inoperable. If this occurred there is concern, that contaminated material from within the pit and bunded area could be released to the McArthur River and deposited in the downstream environment. During such an event, the proponent argues that any contamination would be diluted by the large volumes of water in the river and floodplain. It should be noted though that the EPA does not regard any such dilution as a satisfactory pollution control measure in view of best practice waste management principles.

The EPA has concerns regarding the integrity of the bund wall during extreme events and the possibility of contaminants from bund wall rupture impacting on the McArthur River aquatic ecosystems either through sedimentation or contaminant transport.

4.5 Groundwater

4.5.1 Open pit dewatering

Past records indicate that the river has ceased to flow for up to 5 months during dry years but the EIS indicates that in an average year, flows continue for most of the year with some cessation at the end of the dry, subject to seasonal variation. Groundwater modelling presented in the EIS shows that dewatering of the open pit will increase groundwater drawdown and that, during particularly dry years, the non-flow period of the river could be extended by up to 15 days towards the end of the mine's life.

Djirrinmini waterhole, a perennial pool directly upstream of the river diversion entrance, is likely to be affected by groundwater drawdown as the cone of depression moves out from the pit during the life of the mine. While Djirrinmini Waterhole is filled by stream flow on a seasonal basis each wet season, during the dry season when the stream flow diminishes, groundwater inflow from the surrounding aquifers plays an important role in maintaining water levels. Initial modelling determined that mine pit dewatering was likely to reduce the groundwater level in the weathered bedrock and alluvium by up to 0.5m, which would reduce the lateral flows into the waterhole and affect the depth and extent of the pool. Further field studies undertaken by the proponent to refine the groundwater model saw the predicted drawdown value reduced to 0.35m. There is no quantified estimate of how this drawdown would affect the pool but the maximum effect is not likely to occur until after 25 years of mining.

The primary concern relating to reduction in groundwater inputs to the river and particularly the perennial pools is the effect that this may have on pool ecology. This is discussed further in Section 4.6.2 of this report.

4.6 Biology

It was a widely held view amongst respondents to the EIS that the information presented on the biological environment was inadequate for the purpose of making an appropriately-informed assessment of the potential project impacts and management responses. The environment of the region has a high conservation value, yet it is poorly understood. The effect of this gap in biological knowledge on the ability to comprehensively assess the potential impacts of the project on the environment is exacerbated by the absence of comparable projects in tropical environments that can demonstrate long-term sustainability. In such circumstances, it is important that there is adequate baseline information, transparent and appropriately-informed risk assessment, and well-settled management responses for the proposed open cut project.

4.6.1 *Habitat Loss and Fragmentation*

The proposed project will result in the clearing of 833 ha of native vegetation. The vegetation community that will be most directly affected is the Coolibah woodland community, of which 385 ha will be cleared. Riverine woodland represents the next largest area to be cleared (188 ha), followed by Hill Woodland (171 ha), Inland Bloodwood (59 ha), and Riparian Corridor (39 ha). Clearing of these native vegetation communities will result in the direct loss of habitat for flora and fauna that currently occur in the area.

Of greatest concern is the loss of approximately 4 km and 2.1km of riparian corridor vegetation that will occur as a result of the McArthur River and Barney Creek realignments respectively. In surveys conducted in the project area, the riparian vegetation of the river was found to be particularly rich, and contained several habitat specialists. Habitats upstream and downstream of the realignment will remain fragmented for the time it takes to establish a functioning riparian corridor on the realigned channel. Habitat fragmentation is likely to be exacerbated by the removal of 188 ha of adjacent riverine woodland, and degradation of habitats remaining in the vicinity of the mine through increased levels of disturbance and susceptibility to weed invasion. The impact that loss and fragmentation of riparian corridor habitats will have on the specialised fauna that use those habitats is difficult to predict based on current knowledge.

The proponents have committed to establishing a 60 m – 100 m wide riverine corridor along the realigned channel. The likelihood that this would provide equivalent ecological function to the existing corridor has been questioned by respondents to the EIS, and further concerns were raised about the length of time that it will take to achieve an ecologically functioning riverine corridor. The proponent states in the draft EIS that “altered habitat conditions for riverine and aquatic fauna are expected along the realignment.” However, the conclusion was reached that the break in the riverine corridor is not expected to be a major barrier to the dispersal of riverine forest specialist birds, which are relatively mobile.

There is a lack of substantive data presented in the EIS to demonstrate that the loss of the existing riparian corridors will not cause fragmentation of fauna populations in the short- and longer-terms.

It is critical that a revegetation strategy aims to quickly establish a new riparian and riverine corridor that, as much as possible, simulates the existing habitat. The riparian revegetation needs to be driven at least as much by the need to re-build an adequate and functioning riparian community as by stream stabilisation. **Information presented in the EIS does not adequately convey how the proponent proposes to achieve this outcome. No trials have been conducted to date and it is noted that even after 10 years of mine operation, including 3 years of planning an expansion, there is no mention in the EIS of any existing efforts to collect seed or to establish seedlings for revegetation or rehabilitation purposes.**

Methods of rapid rehabilitation are integral to the establishment of riparian corridor dispersal routes and the minimisation of downstream sedimentation impacts. As stated in Section 4.2 it is expected that there will be continuing erosion of the diversion channel banks until a time when dense riparian vegetation is established. The success of revegetation is considered unlikely given the predicted erosion of the channel. The proponent has committed to monitoring revegetation and implementing remedial actions as required until revegetation reaches full canopy height, but further commitment is required toward the objectives of promoting aquatic and riparian function, including an assurance that the riparian/riverine revegetation will be undertaken to an equivalent width of that currently existing.

4.6.2 Aquatic Environments

The river flows through a deeply incised channel that is lined with tall riparian forest. Aquatic habitats along the river include deep permanent refuge pools with dense fringing vegetation, relatively shallow sandy bottomed runs and rock bars. The ephemeral Surprise Creek and Barney Creek flow into the McArthur River at the site of the proposed open cut, and provide habitat preferred by some aquatic species. The Glyde River, a semi-permanent tributary of the McArthur River, flows into the main channel 5 km downstream of the mine. The Port McArthur tidal wetlands lie 60 – 100 km downstream of the mine at the mouth of the McArthur River. These wetlands are recognised as being of national significance (Environment Australia 2001) and have a high conservation value.

The key areas of concern regarding potential impacts on the aquatic environment that were raised through the assessment process are:

- Isolation of upstream and downstream aquatic environments;
- Downstream impacts of sedimentation and contamination; and
- Alteration of river flows.

These issues are discussed further below.

Isolation of upstream and downstream aquatic environments: The proponent acknowledges in the EIS that the new diversion channels of the McArthur River and Barney Creek, will initially contain habitat not typical of the existing system. This may limit the ability of aquatic fauna to colonise areas upstream of the realignment. To minimise the effects, the proponent has committed to designing the new channels to emulate the existing physical characteristics of the river and creeks. Biological design of the new channels are proposed to be undertaken interactively with designers, fish biologists and rehabilitation specialists using the existing channel substrate characteristics described in the draft EIS and supported with additional surveys during the 2006 wet season.

Concerns were raised in response to the draft EIS about the length of time that it would take to establish a functioning aquatic environment in the realigned channels, and whether or not the approach proposed by the proponent is likely to achieve this outcome. Specific concerns relate to how changed flow conditions and habitat would affect fish passage, and upstream colonisation of those species that have a short life-span of 1-2 years. In response to these concerns, the proponent proposed that off-stream pools would be provided along the realigned channel to act as fish resting areas. Additional ecological mitigation strategies proposed include: constructed resting pools such as enhancing substrate/habitat diversity (e.g. placement of snags, creation of deep zones, and silt bars); and ensuring adequate riparian vegetation coverage around the perimeter of the pool. The proponent has committed to implementing a monitoring program to identify impediments to the movement of aquatic fauna so that mitigation measures can be implemented.

Respondents to the draft EIS continue to have concerns about whether or not the off-stream pools are going to adequately provide for fish passage. Of particular concern, is the length of the realigned McArthur River that develops flow velocities between 1 – 1.5 m/s. Figure K.7

of the EIS indicates that rather than having natural runs of less than 100m in length of higher velocity followed by lower velocity pools and reaches, the realigned river regime will have one run of high velocity water of 1.2 m/s for approximately 5 kilometres. Within this a higher velocity run of flows in excess of 1.5m/s for approximately 2 kilometres is predicted. The EPA is concerned that these velocities over these distances constitute a strong barrier to fish, in particular smaller native species. It is important to the natural habitat of any river system that smaller fish species are able to rest at regular intervals in stream velocities less than 0.3-0.6m/s (Kowarsky and Ross 1981; Mallen-Cooper 1992; Mallen-Cooper 1994; Leis and Carson-Ewart 1997; Seymour et al. 2004; Pusey et al. 2004;). Fish already tired by navigating the lower reaches, seeking to spawn in the upper reaches of the McArthur River will have no areas to rest for approximately 5km. This hydraulic barrier may allow only larger fish species to reproduce, affecting the composition of fish species in the McArthur river.

The biological design specifications proposed by the proponent in the draft EIS are quite generic, and are based on habitat characterisation of the river at just 2 locations along the stretch of river that will be diverted. In light of this, **the information presented so far is inadequate for the purpose of making an informed assessment of the potential long-term impacts of the channel realignments on the aquatic environments upstream and downstream of the mine. Information should have been provided by the proponent in the form of detailed characterisation of the in-stream habitats of the existing river channel and detailed biological design specifications proposed for the realigned channel.**

Downstream impacts of sedimentation and contamination: The proponent acknowledges in the draft EIS that some project components have the potential to degrade downstream aquatic habitats through increased sedimentation and the release of contaminated water. The sources and nature of potential contamination are discussed in Sections 4.3 and 4.4.

There were concerns amongst respondents to the draft EIS that the proponent has failed to adequately acknowledge the potential impacts on the downstream environments as far as the coast and Sir Edward Pellew Islands. Furthermore, the proponent was criticised for not establishing downstream aquatic survey sites and macroinvertebrate survey sites, which could inform the environmental assessment and provide a baseline for monitoring downstream impacts. In response to these concerns, the proponent has committed to designing and implementing an aquatic monitoring program in consultation with the NT Government, which will include downstream monitoring sites, and investigating options for a macroinvertebrate monitoring program. The fact that collection of these baseline data has not already commenced raises some concerns for the robustness of any future monitoring program.

The draft EIS acknowledges that erosion of the new channel may cause an increased amount of sedimentation in downstream environments. The geomorphologist's findings are discussed in Section 4.2. The EPA considers that there are other potential sediment sources from the mine site, including the flood protection bund wall, the OEF and other disturbed areas. Specific concerns have been raised about sedimentation in the Port McArthur wetlands at the mouth of the river, and associated impacts on migratory species (see section 4.6.5). More generally, increased sedimentation has the potential to smother aquatic vegetation, and to cause changes to habitat availability and a general reduction in aquatic health. The proponent proposes to reduce erosion and sedimentation through rehabilitation of the realigned channel, and has developed a revegetation strategy to achieve this (see Section 4.6.1). **Given the challenges associated with rehabilitation of the realigned channels that are discussed elsewhere in this report, the possibility of ongoing downstream sedimentation issues should not be overlooked by the proponent.**

Morphological studies of the McArthur River undertaken for the EIS covered the reach 10 km downstream of the mine, however, details of areas where increased sedimentation may occur were not provided. The proponent has not presented long-term options for monitoring and mitigation of downstream sedimentation. **The downstream monitoring program proposed by the proponent is recognised as a step in the right direction with regards to the**

acknowledgement of potential downstream impacts. However, it does not include monitoring of sediment deposition and therefore does not address many of the key concerns raised in response to the potential impacts of sedimentation on downstream aquatic environments (refer to Section 4.4.2).

Environmental Flows and Drawdown Effects: Groundwater drawdown is expected to occur as a result of dewatering of the open cut (Section 4.5.1). The EIS does not provide an assessment of the potential implications of changes to these environmental flows on the aquatic environment.

The closest permanent pool to the mine site is Djirrinmini Waterhole, which is located 1 km upstream of the proposed flood protection bund. The proponent acknowledges that permanent waterholes are the most important aquatic habitats in the region as they act as dry season refuge habitat for aquatic species. Towards the end of the 25 year mine life and towards the end of the dry seasons, groundwater drawdown has the potential to reduce the extent and depth of the waterhole.

Of great concern is how this might affect the suitability of the pool as a refuge habitat for aquatic biota and in particular the Freshwater Sawfish (see Section 4.6.3). Loss of flow, and shrinkage of waterholes, during the dry season, constitute the most environmentally challenging conditions for aquatic biota in the monsoon tropics. It is considered that the mine may severely exacerbate this challenge for the biota that inhabit Djirrinmini waterhole.

Additionally, the increased drawdown immediately upstream of the proposed river diversion caused by the significant stream power and sheer forces associated with the realignment has the potential to initiate upstream-progressing degradation, which would propagate upstream erosion over time and could drain the water hole (Appendix 1).

There was widespread concern amongst respondents to the draft EIS that the proponent has not provided substantive data to demonstrate an understanding of the potential impacts on aquatic biota or how these impacts might be managed.

In response to these concerns the proponent has indicated that it is difficult to predict the impacts that will be likely in 25 years time, and therefore a comprehensive monitoring program of the waterhole's aquatic biology will be implemented during the initial years of the open cut project before any drawdown effects are expected to occur. A program for monitoring groundwater levels in both the weathered bedrock and the alluvial aquifers at the waterhole has been implemented to provide baseline groundwater levels near the pool and will continue throughout the life of the mine. The proponent states that as the drawdown effects would occur gradually and only towards the end of the mine life there would be adequate time to identify the extent of any impacts on the aquatic biology and to develop mitigation measures. While it is recognized that an assessment of the potential long-term ecological impacts is difficult, this reaffirms the need for a better understanding of the ecology of Djirrinmini waterhole.

The EIS did not consider the range of potential impacts on the ecology of Djirrinmini waterhole or mitigative measures.

4.6.3 Threatened Species - Freshwater Sawfish

The Freshwater Sawfish (*Pristis microdon*) is classified as Endangered by the IUCN, and Vulnerable by the EPBC Act, and *Territory Parks and Wildlife Conservation Act*. The species was recorded in the McArthur River during recent surveys of the species range across northern Australia.

A number of respondents to the draft EIS and Supplement were critical of the proponent for providing insufficient information about the Freshwater Sawfish. The proponent has not assessed or predicted the potential impacts of the project on the Freshwater Sawfish.

Furthermore, details of how MRM proposes to manage, monitor and mitigate potential impacts on this species, were not provided in the EIS.

The threatened status of the Freshwater Sawfish supports the need for some level of certainty in relation to the potential impacts of the project on this species, and how these impacts will be managed, monitored and mitigated. Concerns about potential impacts on the Freshwater Sawfish raised by respondents to the EIS, relate to:

- management of dry season refuge pools along the McArthur River, particularly the Djirrinmini Waterhole, which may be important sawfish habitat;
- migration along the realigned channel; and
- ecosystem changes to habitats and prey species due to downstream impacts.

In Section 15 of the Supplement, MRM commits to conducting a survey for the Freshwater Sawfish in the McArthur River during the early dry season of 2006, and again near the end of the dry season 2006. Based on the results of the survey, a detailed management and monitoring plan for this species is to be developed. An overview of the proposed survey and monitoring approach developed by Dr. Dean Thorburn, of Murdoch University, Perth (a leading authority on sawfish), is provided in the Supplement. The approach includes, annual monitoring for the presence of the Freshwater Sawfish at locations upstream and downstream of the mine, in the original channel and in the realigned channel following the first wet season of use.

In the absence of baseline surveys, and proposed management, monitoring and mitigation strategies, an adequate assessment of the potential impacts of the Open Cut project on the Freshwater Sawfish cannot be made at this point in time. It is accepted that the proponent cannot undertake surveys until the end of the wet season in 2006, however, it should have been possible for the proponent to present a preliminary assessment of the potential impacts of the project on the species and subsequently to propose management and mitigation measures.

4.6.4 Other Threatened and Near-Threatened Species

The EIS documented a number of threatened and near-threatened species that have been recorded from the mine site and surrounding areas. Concerns were raised in response to the draft EIS that there has been a limited assessment of the potential impacts of the project on significant flora and fauna species that occur upstream and downstream of the mine. The proponent did provide a discussion of the threatened and near-threatened status of some significant species that are likely to occur outside the project area, however, discussion of the potential impacts of the project on these species was limited in the EIS. The main potential upstream and downstream impacts will likely be associated with species that are reliant on the aquatic, riverine and estuarine environments associated with the McArthur River and tributaries. A discussion of how these aspects have been addressed by the proponent is provided in Section 4.6.2 and Section 4.6.5.

The draft EIS identified 3 threatened fauna species that are known to occur in or near the project area. These are the Red Goshawk, Australian Bustard and Northern Quoll.

Red Goshawk: The Red Goshawk was tentatively recorded from the mine area in 1992, but this sighting has never been confirmed and subsequent searches for the species have not been successful. The loss of habitat for development of the mine would cause a reduction in habitat for this species. The proponent considers that this reduction will be temporary. However, given that the Red Goshawk typically nests in large trees near watercourses, it is more likely that the loss of habitat around the mine site will occur over the medium to long-term until suitable large trees become established.

Australian Bustard: The Australian Bustard occurs in low numbers on the floodplain of the McArthur River and currently uses habitats that will be removed for the construction of the OEF. The proponent considers that due to the amount of habitat available in the region, the removal of habitats for construction of the mine will have only a localised impact on the Australian Bustard. It should be noted that many of the factors thought to be contributing to the decline of this species are operating in the McArthur River region (i.e. weeds, cattle grazing, fire). The proponent should be aware of how the open cut project may affect the Australian Bustard, not just in the way of direct habitat destruction, but also through the mines contribution to, and management of, the threatening process that are operating on a larger scale.

Northern Quoll: The Northern Quoll is thought to now be locally extinct in the project area, which has been attributed largely to the presence of cane toads. Quolls typically prefer rocky habitats, and the proponent notes that populations may still exist in the sandstone ranges where cane toads are less abundant. Although the potential impacts of the project on the Northern Quoll were not discussed in the EIS, it is considered unlikely that the project will significantly impact on the Northern Quoll given that preferred rocky habitats do not occur on the mine site.

Near-Threatened Fauna: The Purple-crowned Fairy wren (Eastern sub-species), White-browed Robin and Worrell's Turtle, are near-threatened species that may be directly affected by the project. Although the conservation status of these species is not such that there is immediate concern, these species are likely to qualify for listing as a threatened species in the near future. Therefore, the potential for new developments to affect their conservation status needs to be considered.

Specific concerns have been raised that the loss of riparian and riverine habitats as a result of the realignments of the McArthur River and creeks, will lead to increased population fragmentation of the Purple-crowned Fairy Wren and White-browed robin, both of which are riparian specialists. The proponent noted in their response to these concerns, that these species are classified as "near threatened", which is the lowest threat category and therefore does not regard them as being of high conservation importance. The proponent proposes to monitor the status of bird populations along affected sections of the McArthur River by undertaking regular bird counts upstream and downstream of the mine and at points along the realigned channel.

Threatened Flora: No threatened plant species were identified during surveys undertaken for the EIS. The proponent notes that 24 threatened plant species have been recorded from the Gulf Coastal Bioregion, and some may remain undetected by flora surveys in the project area. A shortfall of the survey approach adopted by the proponent is that it did not comprehensively sample areas that will be directly affected by the development of the open cut, flood protection bund and realignments. Furthermore, the proponent did not undertake targeted sampling in areas where significant species may be predicted to occur. Therefore, the surveys do not provide a high level of assurance that significant plant species will not be affected.

The near-threatened species *Ophioglossum gramineum*, was recorded on the sandstone plateau habitats adjacent to the project area, along with 7 endemic species, 2 data deficient species and 2 potentially new species. The endemic species *Rothia indica subsp. australis* was found at a site along the Glyde River that will not be directly affected by the project. The proponent has indicated that some of the local population of Mitchell grass (*Astrebla lappacea*) (data deficient) and *Euphorbia mitchelliana* (endemic), could be lost during construction. Some respondents to the EIS considered that the proponents should demonstrate that the populations of these species will not be severely impacted.

Sandstone Habitats: The proponent states in the EIS that the protection of sandstone habitats to the east of the project area from fire and human disturbance is recognised as a priority due to the high conservation value of the area. The Endangered *Carpentarian grasswren* has been recorded from these habitats, and sandstone habitats typically support flora species of

conservation significance. The proponent proposes to implement a management plan aimed at reducing fire risk in the area.

4.6.5 Migratory Species

The EIS states that nine species of migratory birds listed under the EPBC Act have been recorded at the mine site. The proponent considers that none of the species will be significantly affected by the project, due to the absence of important habitats in the project area, and the wide ranging nature of the species recorded. **This assessment is accepted for all of the recorded migratory species, except the White-browed Robin which is a riparian specialist recorded from the McArthur River riparian corridor. Diversion of the McArthur River and creeks does have the potential to impact this species through habitat fragmentation as previously discussed in Section 4.6.1.**

A key concern raised during review of the EIS, is the potential impact of the proposal on populations of migratory birds in wetlands at the mouth of the River. Impacts on the wetlands may result from increased sediment load carried in wet season flow, and contamination of sediments in the long-term. In response to these concerns, the proponent indicated in the Supplement that the areas of significance to migratory species are very remote from the mine operations and no threatening mechanisms have been identified that might impact on their status. The proponent has committed to further analysis of sediments in the McArthur River from Borroloola to the river mouth on an annual basis, including a transect across the delta of the mouth of the McArthur River which would extend in three parallel lines out to Port McArthur. If the sampling within the river and the additional transects shows no impact over two years after the open cut operations begin, the transect sampling will cease and will focus on the river. It is the EPA's view that monitoring of sediment deposition and contamination in the wetlands would assist in determining if any significant impacts are occurring, and would act as a mechanism for detection of long-term sedimentation and contamination issues.

The EIS does not provide adequate information to assess potential impacts on migratory species as a result of the Bing Bong Port operation. Concerns have been raised that the potential contamination of the coastal areas around Bing Bong was poorly addressed in the EIS. Sampling in the Bing Bong Port area has indicated an uptake of ore-derived lead in sediments immediately to the west of the facility, and in molluscs and seagrass. The proponent implements a monthly seawater and marine sediment sampling program at Bing Bong Port. In addition, an annual monitoring program is undertaken to measure metal concentrations in seawater, marine sediments, oysters, *Telescopium* and *Terebralia* molluscs, and seagrass. The proponent has committed to expanding its monitoring program as discussed in Section 4.4.3. This program would need to consider migratory birds.

4.6.6 Terrestrial Invertebrates

Terrestrial invertebrate diversity in the project area is little known, and no studies have been undertaken by the proponent. There are no species of conservation significance (listed under the *Territory Parks and Wildlife Conservation Act*) that are known to occur in the project area. This is not unexpected based on the very limited knowledge base that exists for terrestrial invertebrates. It is noted by one respondent that a number of poorly known butterfly species occur in the region.

4.6.7 Cultural Significance and Traditional Use

Respondents to the draft EIS were critical of the proponent's lack of consultation with Aboriginal people whose traditional country is downstream of the mine. The EIS provides very limited discussion of the cultural significance of the country to Aboriginal people, and does little to acknowledge the concerns that these people have raised regarding the potential impacts of the mine. In response, the proponent states that these people have now been

incorporated into its consultation program, and monitoring of the McArthur River estuary downstream of the mine will be undertaken for a period of at least 2 years. Issues associated with consultation of local Aboriginal people are addressed in Section 4.13. Monitoring of the downstream estuarine environment of the McArthur River is discussed in Section 4.4.

4.6.8 Weeds

Eighteen weed species were identified during surveys of the project area, including three species declared under the *Weed Management Act 2001*. The areas of highest weed infestation are along McArthur River and its tributaries, where Noogoora Burr *Xanthium strumarium* occurs in dense stands to over 2 m in height. Other areas where weeds are concentrated included disturbed areas such as road sides, tracks and cleared land. Sandstone habitats that occur in Bukalara Range were found to be relatively free of introduced weed species.

Earthworks associated with all aspects of the project construction have the potential to spread existing weeds and to introduce new weeds to the site. The main concern raised during the assessment process was associated with how the proponent will manage weeds along the newly formed creek and river alignments. These areas will provide particular challenges to weed management as they will provide perfect conditions for weed invasion, and the ability to manage weeds will be directly linked to rehabilitation success. The establishment and spread of weeds at the site will be confounded by the highly dynamic nature of the riverine environment, upstream weed sources, and the presence of cattle and feral animals.

The proponent proposes to incorporate weed management of the open cut project into MRM's existing weed management plan for the mine site and surrounding areas. This plan is prepared and implemented with the assistance of the district weeds officer from NRETA. The plan sets long term and annual strategies, and incorporates programs at both the mine site and Bing Bong. The primary weeds of management concern have been identified as Devils Claw, Hyptis, Bellyache Bush, Parkinsonia, Noogoora Burr and Chinee Apple. Management strategies have been developed for each of these species. The plan is reviewed annually.

In response to specific concerns raised regarding the establishment of weeds along the realigned channels, the proponent proposed to develop and implement a weed management plan and weed monitoring program for the revegetated area. Regular monitoring of the realigned channel is to be undertaken to allow early detection and eradication of weeds before establishment. The area is to be fenced from cattle and other large feral animals to further reduce the likelihood of seed transportation in particular *Xanthium strumarium* (a spiny seed that sticks to the fur of animals) and other weedy species into the revegetation area. The weed management program along the realigned river and creek channels is to be incorporated into the site's existing weed management plan.

The draft vegetation management plan presented in the draft EIS, focuses on monitoring, early detection and control of weed infestations. The proponent has provided inadequate details in the EIS on preventative measures that would be implemented during construction and operation to minimise the introduction and spread of weeds around the site. These measures are important as they would act as the first line of defence in tackling weed management issues.

4.6.9 Feral Animals

Feral animals, particularly the donkey (*Equus asinus*), are numerous in the project area. Other feral species recorded include feral pigs, station cattle, cats and cane toads. The proponent has identified the threat that feral animals and cattle present to the successful revegetation of the realigned river and creek channels, and therefore proposes to fence these areas. The presence of feral animals may also contribute to the spread of weeds, especially in the riparian corridor.

If a mine was to proceed a Weed and Feral Animal Management Plan would need to be prepared detailing preventative measures that will be implemented during construction and operation to minimise the introduction and spread of weeds. Details of how the potential negative impacts of feral animals would be managed, would also need to be provided.

4.7 Rehabilitation and Closure

4.7.1 *Mine pit closure*

The proponent's preferred closure strategy for the proposed open pit is to maintain the McArthur River in the realigned river channel but to breach enough of the flood protection bund to allow flood flows that overtop the river channel to enter the pit. The EIS indicates that this is likely to occur in floods with a peak discharge greater than approximately 400 m³/s, which have an Average Recurrence Interval (ARI) of about two years. In this scenario, the pit is expected to fill with river water relatively quickly.

Concerns have been raised regarding the possible contamination of downstream environments during flood flows through the pit. Mass balance modelling combined with geomorphological studies, hydrological modelling and geochemical equilibrium modelling were undertaken to predict the likely impacts of various scenarios for mine pit closure (Draft EIS Sections 12 and 20).

The water quality of the mine pit is likely to be influenced by rainfall, pit wall seepage, groundwater, TSF seepage, and with the flood bund breach scenario, river water. Mass balance modelling demonstrated that sulfate concentrations (selected as the primary water quality indicator) in the open pit would likely be buffered by occasional inflows of river water generally maintaining the concentrations close to that of the river water. The buffering effect of the river water is likely to become apparent after several years. Assuming that in reality this is the case, overflows of the pit void should not result in the transport of contaminants above background levels into the McArthur River.

Inflows from the McArthur River are considered to be considerably larger than evaporation or seepage outflows from the pit and hence the pit is expected to maintain levels close to full. The advantage of this preferred closure strategy is that most low flows, including bed load, can continue to move through the realigned river channel to support downstream ecosystems. The EIS states that the preferred closure strategy will not result in the loss of the riverine ecosystem that will have developed along the realigned section of the river during the life of the open cut mining operations.

The concerns with the mine pit void relate to large floods exacerbated by intense climatic events such as cyclones, or catastrophic events. The proponent considers these to be of insignificant risk due to the low probability of occurrence; however, the McArthur River experienced a 1 in 50 year ARI flood in 2003, which led to the requirement of controlled discharge from the TSF and inundated a wide area of the current site. **Considering that no hydrological information was provided for the Barney Creek diversion and modelling for the McArthur River realignment has been questioned, there remains a high level of uncertainty with regard to the possibility of a major environmental incident occurring as a result of the proposal.**

4.7.2 *Tailings Storage Facility*

The issue of contaminated seepage from the tailings has been discussed in Section 4.3.2. Groundwater recovery bores are proposed to be used to prevent seepage from discharging into Surprise Creek and this would continue for an indefinite period following mine closure (>30 years). The long term requirements of this method include power for bore pump operation, personnel for monitoring and maintenance as well as replacement parts, and security to protect the bore array from vandalism.

It is likely that the costs of further monitoring and maintenance until such time as seepage ceases or seepage water satisfies agreed criteria, will need to be secured through agreement with the appropriate NT Government authority, currently Minerals and Energy Division of DPIFM. This agreement will have to be substantial enough to cover all costs relating to ongoing rehabilitation, monitoring and maintenance of all aspects of the mine site at the time of closure.

EIS respondents recommended that the impact of various future scenarios, for a time period greater than 30 years (best to worst case) should be modelled and asked that the risk of these scenarios occurring and the resultant environmental impact associated with these scenarios be predicted. Further, management options for minimisation of the risk of these adverse environmental impacts occurring were requested by NRETA. The proponent has undertaken modelling for best- and worst-case scenarios for the TSF to 25 years, that is, during the expected mine life. No further modelling into the longer term has been presented except to estimate how long the recovery bore network may need to operate to ensure no further surface expression of seepage water would occur. **The EIS should have provided modelling of the proposed tailings storage facility to account for best- and worst-case scenarios into the long term (>30 years) to determine the risk of these scenarios occurring and the predicted probable environmental impact. Management options for minimization of the risks of these adverse environmental impacts occurring should have been presented.**

The proponent has committed to ensuring that sufficient resources are available so that closure strategies into the longer term can be properly implemented; however, the lack of available information for long term potential impacts introduces significant uncertainty. It is acknowledged that detailed closure strategies could be developed during the life of the mine as best-practice methodologies advance, but the proponent has not been able to sufficiently demonstrate that it can satisfy its commitments in this regard. This information is necessary to demonstrate that long-term sustainability of the TSF is possible within the climatic parameters of the McArthur River region.

4.7.3 Overburden Emplacement Facility

This report has previously raised concerns about the stability of components of the mine proposal given the high seasonal probability of adverse climatic conditions in the Gulf region and the quality of information presented for the river and creek diversion proposals. Similarly, there are concerns with the stability of the final OEF landform. As with the TSF, the OEF is of concern due to the nature of the material stored there. NAF and PAF issues have been addressed in Section 4.4.

On the basis of the information provided the EPA is unable to sufficiently assess the potential impacts associated with both short-term and longer-term scenarios for the OEF. Further consideration must be given to the hydrology of Barney and Surprise Creeks, and the diversion proposal, with respect to potential impacts on the OEF stability in accordance with the recommendations provided by the independent geomorphological consultant (Appendix 1).

4.8 Objectives and Benefits of the Mine Expansion

The draft EIS presents the objectives of the mine as securing the long-term viability of the McArthur River operation by changing from underground mining, which is becoming uneconomical due to reduced output rates and safety issues necessitating increased expenditure, to open cut mining methods. This will provide MRM with the opportunity to increase its participation in the zinc business and to capture an increased portion of the market for zinc concentrates, which is increasing significantly in demand.

The benefits of this proposal to the Northern Territory have been stated in the draft EIS as significant and include the contribution of \$175 million to the Gross State Product of the

Territory, the creation of an average 290 jobs during construction and 610 during operation (including flow-on effects). Additionally, the proponent estimates that it will contribute \$329 million annually to the economic output of all industries in the NT (including flow-on effects).

A 2004 study undertaken by ACIL Tasman (prepared for the then Office of Territory Development) found that MRM directly impacts on the economy via its production, employment and investment and through its demand for a range of goods and services it indirectly generates additional output, value added (the building block of Gross State Product) and employment in the Territory. General equilibrium modelling of these direct and indirect impacts indicated that if MRM were to close at the end of 2005 the Northern Territory economy would experience a decline in GSP and employment. Estimates for the twelve month period after mine closure indicated that:-

- GSP would be 0.96% lower;
- Employment would be 0.57% lower; and
- Wages and salaries paid to Territorian's would be 1.18% lower.

These direct and indirect impacts highlight that MRM was (in 2004) contributing some \$84.1m to the Territory's GSP (direct and indirect contributions). The majority of MRM's direct contribution is via wages and salaries as MRM was not profitable and was not paying royalties or state taxes.

A respondent to the EIS raised a concern regarding the uncertainty of the current mine life indicating that the underground mine was originally proposed to have a mine life of 25 years and is being decommissioned after only 10. Further, the respondent is concerned that the proponent has not demonstrated that the operation will remain viable given that "the EIS states that during mining if strip rates are too high, ore quality is low or the zinc price falls, there is the possibility that the mine would close within the 25-year life" The EIS states "As the ore-body deepens, ever increasing amounts of waste must be uncovered for each tonne of ore. The ratio of waste tonnes mined to ore tonnes mined is termed the 'strip ratio'. Above a certain strip ratio, depending on ore grades, metal prices, and mining and processing costs, it is no longer economic to mine the ore by open cut methods" This has implications for the stated benefits of the proposal and calls into question the value of diverting the McArthur River and associated impacts in the face of this uncertainty. The proponent expresses confidence that the proposal will be viable and indicates that if the mine life is reduced, contingencies are in place to ensure there will be no long-term detrimental impacts post-closure.

The Northern Territory Government took part in a nation-wide survey of recreational and indigenous fishing (2000-01 National Recreational and Indigenous Fishing Survey). The latest estimates from the survey (URS 2005b) place spending on recreational fishing in the Northern Territory at \$26.7 million in 2000-01, down from the 1995 estimate of \$30 million. Total recreational fishing effort in the Territory was estimated at 1.9 million hours, with barramundi the most popular target species, accounting for 42% of all hours fished. The Amateur Fishermen's Association estimates that the McArthur River area accounts for considerably more of the Territory's recreational fishing effort than the 11% assessed in 2002.

It is recognised that recreational fishing is responsible for significant tourism in the Territory, including in the lower McArthur River. Access is through use of personal equipment or through charter companies. Inputs into amateur fishing trips are usually greater than the financial (market) value of the fish and seafood caught, but in compensation the fishermen receive additional recreational, social and cultural benefits that are difficult to quantify.

As discussed in the EIS, the environmental safeguards to be implemented as part of the Open Cut Project have been designed to ensure there will be no significant detrimental downstream effects. No impacts on the recreational fishing industry in the lower McArthur River are

expected. Consequently the potential costs to the tourism and fishing industries in the region as a result of the project are considered to be negligible.

4.9 Chemical toxicity

The toxicity of chemicals used in the processing of the ore to produce the bulk lead-zinc concentrate was queried with respect to aquatic ecosystems and humans. Material Safety Data Sheets were provided by the proponent for hazardous chemicals such as isopropyl xanthate and copper sulfate pentahydrate. These MSDSs do not provide adequate data on aquatic ecosystem effects, probably due to a lack of relevant investigations for these substances.

Appropriate mechanisms for management of these chemicals would need to be implemented by the proponent through a Mining Management Plan.

4.10 Air Quality

Dust deposition impacts from disturbance of contaminant sources on the mine site have been raised. Of primary concern was the possibility of airborne contaminants from dust blowing into the McArthur River water. Meteorological data from the region and at the mine site indicates that dust is likely to blow away from the river channel and settle over the mine site. The proponent currently monitors dust deposition, including lead and zinc concentrations, and commits to reviewing the existing program to determine the effectiveness of implementing standard dust control measures during mining activities. Additionally, the EPA considers that any contamination of the McArthur River catchment from mine site dust will be detected through the water quality monitoring program outlined in Section 4.4 and provided these monitoring programs are implemented as advised or recommended, no further actions on air quality for the expansion are required.

4.11 Greenhouse Gas Emissions

The proponent has made a number of commitments in relation greenhouse gas emissions, however, they have stated that the 'implementation of greenhouse gas offset strategies is not warranted and has not been planned at this time'. Although the proposal under assessment is not projected to lead to a significant increase in greenhouse gas emission, the mine activity still contributes approximately 120,000tCO₂-e of emissions, which is considered to be a significant amount. This represents approximately 0.7% of total NT emissions (based on 2002 data from the Australian Greenhouse Office (AGO)). Within the NT's energy sector, which covers energy consumption from mining activities, the estimated emissions constitute approximately 2% of total emissions for that sector (2002 AGO data). In comparison to emissions emitted from other mining activities within the NT, the level of greenhouse gas emissions from the proposed activity is considered to be significant. In addition the proposal includes 833 ha of clearing of native vegetation which further adds to greenhouse gas emissions.

The Northern Territory Government is committed to introducing mandatory public reporting of greenhouse gas emissions by major industry. Implementation of this commitment is currently being explored, informed by related national processes investigating the establishment of a nationally consistent system for reporting on energy and greenhouse gas emissions. It is noted that the proponents have already made a commitment to join the Greenhouse Challenge. Reporting obligations under the Greenhouse Challenge include: providing timely annual reports with agreed content on greenhouse gas emissions and emission reduction activities; making accurate annual public statements about participation in the program; and participating in independent verification of annual progress reports. Until a national or Northern Territory reporting system is established, annual reporting should be undertaken through the Environmental Management Plan/Mining Management Plan process. At a minimum, reporting should detail total annual greenhouse gas emissions, provide a

breakdown of emissions by gas and source (actual emissions and in carbon dioxide equivalents), and the emissions intensity of production.

If mining was to proceed the EPA would expect the proponent to identify opportunities for offsetting greenhouse gas emissions from the operations as well as undertaking annual reporting of greenhouse gas emissions from the McArthur River Mine to the Northern Territory Government.

4.12 Cultural heritage

Archaeological surveys were undertaken of the open cut project area as part of the EIS process. Three archaeological sites of moderate to high significance and 42 background scatters were found that are likely to be disturbed by the project in its current form. Of the sites, one site MRM4 is considered to be of major significance and discussions were held with the proponent and Heritage Conservation Services to assess the possibility of preserving the site.

Archaeological site MRM4 is a large stone artefact quarry. The survey report undertaken by Begnaze (and commissioned by the Company) states “the size and concentration of artefacts identified at MRM4 suggest that the site was an important location for the procurement of the raw material used in the manufacture of stone artefacts.....it does have the potential to answer questions regarding stone reduction sequences and procurement methods for the region”.

In assessing the significance of an archaeological site, the Burra Charter states that the scientific value or research potential of a place depends on the importance of the data involved, on its rarity, quality or representativeness and on the degree to which the place or object may contribute to further substantial information. The Heritage Conservation Services of NRETA believes that the archaeological site MRM4 constitutes a rare site type for the area and has indicated a preference for the site to remain intact in the first instance with all efforts made to preserve this site.

As requested, MRM included the results of the archaeological surveys undertaken by Begnaze in September 2005 in the EIS Supplement. This archaeological survey report makes a number of recommendations in relation to mitigative measures for the sites of high archaeological significance and proposes that the proponent consider the relocation of part of the OEF in order to preserve site MRM4. It is noted that this was not considered in the EIS Supplement, instead it quotes the recommendations contained in the Begnaze report, specifically “If the area for the proposed Overburden Emplacement Facility cannot be moved to avoid this site, it is recommended that before the Open Cut Project commences, permission should be sought from the Minister for Natural Resources, Environment and Heritage to destroy the site with the proviso that there is a detailed surface recording including a sample collection of artefacts and test pit excavation at the site”.

When considering the area of MRM4, a conservative estimate of stone artefacts is numbered at greater than 130,000. MRM4 is of high scientific and archaeological value and it would be difficult to mitigate the loss of this site. The values of this site cannot be captured or represented without a substantial study of the site. A collection of artefacts from the site will have more value than detailed recording alone.

Accordingly, the proponent was requested to provide information to demonstrate the reasons for the proposed location of the OEF with specific regard to the preservation of site MRM4. The proponent stated that criteria used to determine the location of the OEF included:-

- Minimisation of haul distance;
- Minimisation of earthworks for site preparation;
- Minimisation of disturbance to surrounding drainage systems;
- Absence of environmentally sensitive areas; and

-
- Maximising the distance from the Carpentaria Highway.

The proponent also states that moving the OEF further west away from archaeological site MRM4 would move it closer to site MRM5 and to the Carpentaria Highway. Moving the OEF further north would impact on a currently undisturbed drainage system and come closer to archaeological site MRM3. It is the proponent's opinion that the proposed location of the OEF is considered to represent the best compromise of the above criteria.

MRM also state that consultation with Traditional Owners determined that the site was not of significance. Heritage Conservation Services would expect MRM to provide documentary evidence of consultation with the Traditional Owners who inspected the site MRM4 in October 2005, specifically in respect to the identity of Traditional Owners consulted and whether the inspection was carried out with the assistance of the Aboriginal Areas Protection Authority.

Re-shaping the OEF and the preservation of MRM4 is still the preferred option for Heritage Conservation Services. The report states that moving the OEF either further west or further north would move it closer to the sites MRM5 and MRM3. These two archaeological sites are much smaller in area and possess a considerably lower level of archaeological significance than MRM4. The consent process for MRM3 and MRM5 is likely to entail considerably less mitigative works than would be recommended for MRM4 should the proponent wish to apply to destroy the site.

If the mine was to proceed, then the EPA would seek further information from the proponent on consultations undertaken with the Traditional Owners as well as options for the preservation of archaeological site MRM4.

4.13 Social Impact

The McArthur River and Borroloola region has a rich history of cattle production, mining exploration and the traditional use of the land and adjacent marine environments by Aboriginal people. Commercial mining of the "Here's Your Chance" lead-zinc deposit first commenced in 1994 by Mount Isa Mines (MIM) Holdings, prior to Xstrata purchasing the company.

This mix of land uses and cultures has led to a great contemporary diversity in the communities of the region and varying views on the open cut mine proposal. The project is on lands traditionally used by the Gudanji, Binbinga, and Yanyuwa people. Although areas of land are identified as belonging to particular language and family groups, other groups may have important traditional interests in that land. Borroloola and its immediate surrounds have residents from a number of Aboriginal groups and include the Garrwa, Mara, and Alawa people. Not all of these groups are traditional owners of lands likely to be directly affected through mine development; however, most have an interest in the future of the area and the benefits or otherwise that are perceived from the mine.

As well as the Traditional Owners and Aboriginal people that have an interest in the proposal, a settlement has gradually developed at King Ash Bay on the McArthur River drawn by the fishing in the area, and Borroloola Township has attracted residents from outside the region who now regard the area as home.

Sentiment regarding the proposal is divided between those people who perceive the proposal as being a positive for the region, those who don't want the proposal to happen and those people who are concerned about possible impacts of the mine expansion or are uncertain about what the implications of the proposal might be.

Concerns about changing from underground to open cut mining relate largely to the perceived threat the mine has to the ecology of the McArthur River and its receiving environment in the Gulf. These concerns have been expressed by residents and users of the river, particularly

members of the Yanyuwa people whose traditional lands incorporate much of the tidally-influenced reaches of the river and the Sir Edward Pellew Islands. This is discussed in more detail in Section 4.4.3 of this report. These perceptions have been fuelled by the past attitudes of the mining company and historical events through the history of mining in the area.

There has been a perception that undertakings by the proponents of the underground mine were not fulfilled. There were also a number of mine-related incidents that occurred during the ten years of the current underground mine operation and extreme natural events that confounded issues, including the cyclones and monsoonal depressions that impacted the Southern Gulf in 2001/2002, and the 1 in 50 year ARI flood in 2003. Furthermore, there has been recognition that the consultation process associated with current mining activities and the proposed expansion has been largely unsatisfactory. All of these events and issues have created distrust and suspicion within some members of the downstream community.

The 1992 draft Environmental Impact Statement for the underground mine stated that the mine would lead to the following benefits to the local community:

- Employment of local residents through the construction and operation phases (up to 40 workers) adding income to Borroloola and boosting the local economy;
- Establishment of a servicing business for haul trucks in the Borroloola township leading to further job creation and more efficient bulk transport of fuel leading to more affordable fuel for Borroloola residents;
- Use of the Borroloola airstrip for commuting of fly-in fly out (FIFO) workforce with possible benefits to local services including the establishment of a commuter bus system between the mine site and the town;
- Potential mine tour opportunities;
- Provision of mobile equipment for use in specific circumstances; and
- Use of library established at the mine.

Some of these proposed perceived benefits did not eventuate (such as the use of the airstrip as well as establishing a servicing business for haul trucks) for various reasons following the mine's approval.

Some of the original concerns and issues expressed by the local people in Borroloola were published in a report for the Mabunji Aboriginal Resource Association (NLC 1993) and included:

- The uncertainty associated with timing of the original proposal following delays over a number of years in the commencement of the project;
- Uncertainty with respect to what the project was about;
- Influx of contractors and employees from elsewhere;
- The increased heavy vehicle traffic through the township;
- Lack of royalty payments;
- Consultation methods; and
- Impacts on the environment generally and natural species in particular.

Some of these issues were addressed through project changes while others remain, despite the mine having operated for ten years. The Mabunji Report indicates that MIM sought to consult directly with the Aboriginal people through a consultant and this engendered a certain level of distrust between the Aboriginal people and their local organisations. There is still a perception that inappropriate consultation is still occurring as the proponent prefers to undertake its consultation through the MAWA business enterprise, an organisation that directly benefits from the mine and does not necessarily speak for all the people of the Region.

In view of the critical issues associated with this proposal, the widely held perceptions of potential downstream impacts from the mine and the uncertainties inherent in the proposal, the EPA expects that any future consultation will be undertaken through the most appropriate

mechanisms to maximise transparency and accountability to stakeholders. Any further discussion with the various groups in the region should be conducted in accordance with a community engagement strategy outlining the appropriate mechanisms that will not isolate the various groups and which has been reviewed and agreed with the Northern Territory Government.

4.14 Biodiversity Offsets

During the initial stages of consultation with the NT Government on the draft EIS, the proponent promoted the concept of a biodiversity offset to compensate for the residual, unavoidable harm to the biodiversity of the area caused by the project. A proposal was provided to the NT government for consideration. The proponent has emphasised that the proposed biodiversity offsets are not meant to compensate for poor environmental management, but are additional to other measures in place to avoid or minimise environmental harm.

The views of respondents to the proposal were varied; some supported the concept, providing comment on the best methodology while others were critical of the concept of selecting an area for biodiversity conservation when it was considered that all areas of value should be protected and not one area at the expense of another. It was also considered that the protection of biodiversity should be promoted regardless of the mine proceeding.

The NT Government is currently developing policy with respect to environmental offsets in general. Consequently, the proposed offset is not considered in this Assessment Report.

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URS (2005b). McArthur River Open Cut Project Supplement to the draft Environmental Impact Statement, December 2005.

Appendix 1 – Report by Geomorphological Consultant