# Public Environmental Report:

# Mt Porter Gold Project,

# Mt Porter, Northern Territory

Prepared for:

Arafura Resources NL

November 2006

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# PUBLIC ENVIRONMENTAL REPORT: MT PORTER GOLD PROJECT, MT PORTER, NORTHERN TERRITORY

PREPARED FOR

## ARAFURA RESOURCES NL



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This report has been checked and released for transmittal to **Arafura Resources NL**.

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# TABLE OF CONTENTS

**1. PER STRUCTURE AND OBJECTIVES ..... 1**
1.1 PER OBJECTIVES ..... 1
1.2 PER STRUCTURE ..... 1
1.3 PER PROCESS ..... 2

**2. INTRODUCTION ..... 3**
2.1 PROPONENT DETAILS ..... 3
2.2 LOCATION ..... 3
2.3 TENEMENTS ..... 4
2.4 EXISTING LAND USE ..... 4

**3. LEGISLATIVE CONSENT AND LICENSING REQUIREMENTS ..... 7**
3.1 COMMONWEALTH ..... 7
*3.1.1 Bilateral Agreement ..... 8*
3.2 NORTHERN TERRITORY ..... 9
*3.2.1 Environmental Impact Assessment ..... 9*
*3.2.2 Mining Management ..... 10*

**4. DESCRIPTION OF THE PROPOSED DEVELOPMENT ..... 12**
4.1 ORE RESERVES ..... 12
4.2 OVERALL PROCESS DESCRIPTION ..... 12
4.3 SITE LAYOUT ..... 13
4.4 SITE PREPARATION ..... 15
4.5 MINING ..... 15
*4.5.1 Pit Characteristics ..... 15*
*4.5.2 Mining Methods ..... 16*
*4.5.3 Mining Schedule ..... 16*
*4.5.4 Future Extensions ..... 17*
4.6 ORE PROCESSING AND TAILINGS MANAGEMENT ..... 17
4.7 WASTE ROCK MANAGEMENT ..... 17
4.8 WATER USE ..... 18
*4.8.1 Water Balance ..... 19*
*4.8.2 Water Management ..... 19*
4.9 TRANSPORT ..... 20

**5. WORKFORCE ..... 21**
5.1 REHABILITATION AND DECOMMISSIONING ..... 21
5.2 PROJECT SCHEDULE ..... 22

**6. PROJECT OBJECTIVES, ALTERNATIVES AND JUSTIFICATION ..... 24**
6.1 OBJECTIVES ..... 24
6.2 ALTERNATIVES CONSIDERED ..... 24
6.3 PROJECT BENEFITS ..... 25

**7. EXISTING ENVIRONMENT ..... 26**
7.1 CLIMATE ..... 26

7.2 LANDFORM ..... 27
7.3 SOILS ..... 30
7.4 GEOLOGY ..... 32
*7.4.1 Regional Geology ..... 32*
*7.4.2 Site Geology ..... 33*
*7.4.3 Waste Rock Characterisation ..... 34*
7.5 GROUNDWATER ..... 35
*7.5.1 Regional Hydrogeology ..... 35*
*7.5.2 Groundwater Quality ..... 36*
*7.5.3 Local Hydrogeology ..... 36*
7.6 SURFACE WATER ..... 37
*7.6.1 Catchment Description ..... 37*
*7.6.2 Downstream Water Users ..... 39*
*7.6.3 Average and Flood Flows ..... 40*
*7.6.4 Regional Water Quality ..... 41*
*7.6.5 Project Area Water Quality ..... 43*
7.7 FLORA ..... 47
*7.7.1 Mt Porter Flora ..... 48*
*7.7.2 Species of Conservation Significance ..... 48*
*7.7.3 Introduced Species ..... 48*
7.8 FAUNA ..... 49
*7.8.1 Mt Porter Fauna ..... 49*
*7.8.2 Conservation Significance ..... 50*
7.8.2.1 Birds ..... 52
7.8.2.2 Bats ..... 52
7.8.2.3 Mammals ..... 52
*7.8.3 Introduced Species ..... 52*
7.9 AIR QUALITY AND NOISE ..... 53

**8. EXISTING SOCIAL ENVIRONMENT ..... 54**

8.1 NATIVE TITLE ..... 54
8.2 EUROPEAN HERITAGE ..... 54
8.3 ABORIGINAL HERITAGE ..... 54
8.4 SOCIAL ENVIRONMENT ..... 58
8.5 VISUAL AMENITY ..... 59
8.6 BITING INSECTS ..... 59

**9. POTENTIAL IMPACTS AND MANAGEMENT ..... 61**

9.1 LANDFORM AND SOILS ..... 61
*9.1.1 Potential Issues and Impacts ..... 61*
*9.1.2 Management and Mitigation Measures ..... 61*
9.1.2.1 Sensitive Areas and Ground Disturbance ..... 61
9.1.2.2 Topsoil Management ..... 61
9.1.2.3 Erosion ..... 62
9.1.2.4 Soil Contamination ..... 62
9.1.2.5 Rehabilitation ..... 62
*9.1.3 Impact Assessment ..... 62*
9.2 WASTE ROCK MANAGEMENT ..... 63
*9.2.1 Potential Issues and Impacts ..... 63*
*9.2.2 Management and Mitigation Measures ..... 64*
*9.2.3 Impact Assessment ..... 64*
9.3 GROUNDWATER ..... 65

*9.3.1 Potential Issues and Impacts* ..... *65*
*9.3.2 Management and Mitigation Measures* ..... *65*
*9.3.3 Impact Assessment* ..... *65*
9.4 SURFACE WATER ..... 66
*9.4.1 Potential Issues or Impacts* ..... *66*
*9.4.2 Runoff and Contaminant Management* ..... *66*
*9.4.3 Water Discharge* ..... *69*
*9.4.4 Extreme Rainfall Events* ..... *70*
*9.4.5 Monitoring* ..... *71*
*9.4.6 Impact Assessment* ..... *72*
9.5 FLORA ..... 73
*9.5.1 Potential Issues or Impacts* ..... *73*
*9.5.2 Management and Mitigation Measures* ..... *73*
9.5.2.1 Vegetation Clearing ..... 73
9.5.2.2 Weed Management ..... 74
9.5.2.3 Rehabilitation ..... 74
*9.5.3 Impact Assessment* ..... *74*
9.6 FAUNA ..... 74
*9.6.1 Potential Issues or Impacts* ..... *74*
*9.6.2 Management and Mitigation Measures* ..... *75*
*9.6.3 Impact Assessment* ..... *75*
9.7 AIR QUALITY AND NOISE ..... 76
*9.7.1 Potential Issues or Impacts* ..... *76*
*9.7.2 Greenhouse Gases* ..... *76*
*9.7.3 Management and Mitigation Measures* ..... *77*
*9.7.4 Impact Assessment* ..... *78*
9.8 WASTE AND HAZARDOUS MATERIALS ..... 78
*9.8.1 Potential Impacts* ..... *79*
*9.8.2 Management and Mitigation Measures* ..... *80*
*9.8.3 Impact Assessment* ..... *81*
9.9 CULTURAL ENVIRONMENT ..... 81
*9.9.1 Potential Issues or Impacts* ..... *81*
*9.9.2 Management and Mitigation Measures* ..... *81*
*9.9.3 Impact Assessment* ..... *82*
9.10 SOCIO ECONOMIC ..... 82
*9.10.1 Potential Issues and Impacts* ..... *82*
*9.10.2 Management and Mitigation Strategies* ..... *83*
*9.10.3 Impact Assessment* ..... *83*
9.11 TRANSPORT ..... 84
*9.11.1 Potential Issues and Impacts* ..... *84*
*9.11.2 Management and Mitigation Measures* ..... *84*
*9.11.3 Impact Assessment* ..... *84*
9.12 VISUAL AMENITY ..... 85
*9.12.1 Potential Issues or Impacts* ..... *85*
*9.12.2 Management and Mitigation Measures* ..... *85*
*9.12.3 Impact Assessment* ..... *85*
9.13 BITING INSECTS ..... 85
*9.13.1 Potential Issues or Impacts* ..... *85*
*9.13.2 Management and Mitigation Measures* ..... *86*
*9.13.3 Impact Assessment* ..... *86*

**10. ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT TRIGGERS ... 87**

10.1 WORLD HERITAGE ..... 87
10.2 LISTED THREATENED SPECIES ..... 88
*10.2.1 Orange Horseshoe Bat ..... 89*
*10.2.2 White-striped Sheathtail Bat ..... 89*
*10.2.3 Short-eared Rock Wallaby ..... 89*
*10.2.4 Gouldian Finch ..... 89*
*10.2.5 Partridge Pigeon ..... 90*
*10.2.6 Red Goshawk ..... 90*
*10.2.7 Masked Owl ..... 90*
10.3 LISTED MIGRATORY SPECIES ..... 91
*10.3.1 Saltwater Crocodile ..... 93*
*10.3.2 Migratory Wetland Bird Species ..... 93*
*10.3.3 Migratory Terrestrial Bird Species ..... 93*

**11. REHABILITATION AND CLOSURE ..... 95**

11.1 OVERVIEW ..... 95
11.2 OBJECTIVES ..... 95
11.3 REHABILITATION METHODOLOGIES ..... 96
*11.3.1 Open Pit ..... 96*
*11.3.2 Waste Rock Stockpile ..... 96*
*11.3.3 Infrastructure Areas ..... 96*

**12. HAZARDS AND RISKS ..... 98**

12.1 RISK ASSESSMENT ..... 98
12.2 SAFETY MANAGEMENT ..... 106
12.3 EMERGENCY RESPONSE ..... 107
12.4 INDUCTION AND TRAINING ..... 107

**13. ENVIRONMENTAL MANAGEMENT ..... 108**

13.1 ENVIRONMENTAL MANAGEMENT SYSTEM ..... 108
13.2 ENVIRONMENTAL MANAGEMENT PLAN ..... 110
*13.2.1 Objectives ..... 110*
*13.2.2 Structure and Scope ..... 110*
*13.2.3 EMP Review ..... 112*

**14. PUBLIC INVOLVEMENT AND CONSULTATION ..... 113**

**15. SUMMARY OF COMMITMENTS ..... 114**

**16. GLOSSARY ..... 121**

**17. REFERENCES ..... 123**

# FIGURES

Figure 1: Mt Porter Location ..... 5
Figure 2: Mt Porter Project Tenement and Haul Route Location ..... 6
Figure 3: Site Layout ..... 14
Figure 4: Cross-sectional View of Open Pit ..... 16
Figure 5: Land Unit Distribution in the Mt Porter Area ..... 29
Figure 6: Local Water Catchments Surrounding the Mt Porter Project Area ..... 38
Figure 7: Site Catchments and Sample Locations ..... 39
Figure 8: Archaeological sites in Mt Porter Project Area ..... 57
Figure 9: Water Management Measures and Monitoring Locations ..... 68

# CHARTS

Chart 1: Burrundie Railway Station Monthly Rainfall Data (1889-1974) ..... 26
Chart 2: Soluble Metals in Soils Collected From Four Sites Within the Mt Porter Mineral Lease ..... 31
Chart 3: Total Metals in Soils Collected From Four sites within the Mt Porter Mineral Lease ..... 31
Chart 4: Mean, Decile 9 and Maximum Monthly Runoff per square kilometre of Catchment for Harriet Creek (downstream El Sherana Road) and McKinlay River (Burrundie) Catchments. ..... 41

# TABLES

Table 1: Daily Water Balance ..... 19
Table 2: Likely Employment During Operations ..... 21
Table 3: Planned Construction Schedule ..... 23
Table 4: Rainfall Average Data for Burrundie Railway Station (62 years record) ..... 27
Table 5: Stream Gauging Data Summary ..... 40
Table 6: Water Quality Characteristics of 40 sites in the Mary River Catchment ..... 42
Table 7: Metal Concentrations (µg/L) at 42 sites in the Mary River Catchment ..... 43
Table 8: Surface Water Quality - Mt Porter Filtered Samples 20 June 2006 ..... 45
Table 9: Surface Water Quality - Mt Porter Unfiltered Samples 19 April 2005 ..... 46
Table 10: Surface Water Quality - Mt Porter Unfiltered Samples 2005 Early Wet Season ..... 47
Table 11: Fauna Species of Conservation Significance That May Occur in the Mt Porter Area ..... 51
Table 12: Percent Distribution by Age Groups in Urban Areas ..... 58
Table 13: Potential Pest Mosquitoes of the Frances Creek Area ..... 60
Table 14: Estimated Annual Flow Volumes for Mt Porter Catchments ..... 70

Table 15: Estimated Peak Flow Rates for Mt Porter Catchments ..... 71
Table 16: Land Clearing Requirements ..... 73
Table 17: Emissions from Combustion Engines ..... 77
Table 18: Hazardous Materials Storage Requirements ..... 79
Table 19: Hazardous Waste Materials Likely to be Generated ..... 79
Table 20: Species Listed as Threatened under the EPBC Act 1999 and NPWC Act 2000 That May Occur Within the Mt Porter Project Area ..... 88
Table 21: Migratory Species Listed under the EPBC Act 1999 That May Occur Within the Mt Porter Project Area ..... 92
Table 22: Qualitative Measures of Likelihood ..... 98
Table 23: Qualitative Measures of Consequence ..... 99
Table 24: Risk Matrix and Prioritisation ..... 99
Table 25: Risk Definitions (AS/NZS 4360:1999) ..... 99
Table 26: Environmental Issues and Risk Assessment ..... 100
Table 27: Prioritisation of Environmental Issues ..... 106
Table 28: Summary of Consultation Undertaken to Date ..... 113
Table 29: Summary of Arafura's Commitments for the Mt Porter Project ..... 114

# APPENDICES

Appendix 1: Mt Porter Public Environmental Report Guidelines
Appendix 2: DEH Referral Outcome
Appendix 3: Waste Characterisation.
Appendix 4: Hydrological Report
Appendix 5: Surface Water Report
Appendix 6: Water Monitoring Data
Appendix 7: Flora and Fauna Survey
Appendix 8: AAPA Certificates
Appendix 9: Archaeological Survey
Appendix 10: Draft EMP

# 1. PER STRUCTURE AND OBJECTIVES

## 1.1 PER OBJECTIVES

The objectives of the PER are to:

- Provide all interested stakeholders, including government, with concise and comprehensive information regarding the design, construction and operation of the proposal.
- Provide sufficient information to enable understanding and assessment of the scope and environmental implication of the proposal.
- Assess the environment of the project area and surrounding region.
- Identify all potential environmental impacts of the project.
- Incorporate stakeholder concerns and suggestions into project design and management.
- Outline strategies to avoid or minimise potentially adverse impacts.
- Secure environmental approval for the project from the Northern Territory Government in accordance with the *Environmental Assessment Act 1982*.

## 1.2 PER STRUCTURE

The PER is structured into sections to conform with the PER Guidelines issued by the Department of Infrastructure Planning and Environment (now Department of Natural Resources Environment and the Arts, NRETA) in October 2004. The guidelines with a cross reference showing where each item is addressed in the PER document is provided in Appendix 1.

| | |
|---|---|
| Section 1 | Provides a description of the PER objectives, process and structure. |
| Section 2 | Provides a brief introduction to the proponent and the project. |
| Section 3 | Details the legislative consent and licencing requirements applicable to the project. |
| Section 4 | Provides a detailed description of the project. |
| Section 5 | Details the alternative proposals, objectives and benefits of the project. |
| Section 6 | Describes the existing physical and biological environment. |
| Section 7 | Describes the existing social environment of the Mt Porter area. |
| Section 8 | Describes the potential impacts of the project and details management and mitigation measures. |
| Section 9 | Describes Environmental Protection and Biodiversity Conservation Act Triggers. |
| Section 10 | Describes the rehabilitation objectives, methodology and closure details. |
| Section 11 | Describes the hazards and risks associated with the project and provides management strategies to minimise risk. |

Section 12 Outlines and introduces the concept of the EMP required under the *Mining Management Act*. An EMP details specific management policies, practices and procedures and outlines the public involvement and consultation as well as the role of government organisations in developing the project.

Section 13 Describes the proponent's consultation with stakeholders to date.

Section 14 Contains a glossary of acronyms used within this report.

Section 15 Contains full details of items referenced throughout the report.

Appendices which contain information and data related to the PER, but which are unsuitable for inclusion in the main body of the statement, are attached to the report.

Maps, overlays, tables and figures are included in the PER to clarify text where appropriate.

## 1.3 PER PROCESS

Arafura will implement the following requirements specified in the PER guidelines.

- Prior to the PER being distributed for comment, a preliminary draft of the PER will be lodged with the Environment Protection Agency (EPA) of NRETA, for review and comment.
- Once the PER is ready for comment, 25 copies will be lodged with the EPA for distribution to Northern Territory Government advisory bodies.
- Copies of the PER will be made available for a 28 day public review period at NRETA and DPIFM offices in Darwin and Katherine, council offices and the Northern Territory Library, Parliament House, Darwin.
- A copy of the PER will be placed on a CD ROM for placement on NRETA's internet site. The CD ROM copies will be in ADOBE pdf format.
- A copy of the PER will be placed on Arafura's website for public viewing.

The NRETA action officer for this project is Michael Brown. Contact details are telephone (08) 8924 4136, email michael.browne@nt.gov.au

# 2. INTRODUCTION

## 2.1 PROPONENT DETAILS

Arafura Resources NL (Arafura) proposes to develop and operate the Mt Porter Gold Project.

Arafura is a public listed company based in Perth, Western Australia. Arafura can be contacted at:

| | |
|---|---|
| Head Office address: | Level 4<br>16 St George's Terrace<br>Perth WA 6000 |
| Mailing address: | Post Office Box Y3047<br>East St Georges Terrace<br>Perth WA 6832 |
| Telephone: | (08) 9221 7666 |
| Facsimile: | (08) 9221 7966 |
| Email: | arafura@bigpond.net.au |
| Contact: | Mr Steve Mackowski, Project Manager |

Queries regarding environmental matters contained within the PER should be addressed to MBS Environmental at:

| | |
|---|---|
| Mailing address: | 4 Cook Street<br>West Perth WA 6005 |
| Telephone: | (08) 9226 3166 |
| Facsimile: | (08) 9226 3177 |
| Email: | ksell@mbsenvironmental.com.au |
| Contact: | Kristy Sell, Director Environmental Science |

## 2.2 LOCATION

The Mt Porter Gold Project is located on the eastern side of Mt Porter (292 metres Australian Height Datum), which is the highest of a series of narrow crested peaks along a north-south trending ridge line. The project area is located 20 kilometres north of the town of Pine Creek, and is accessed by the Frances Creek Road leading to the Frances Creek Mine (Figure 1). The Mt Porter Gold Project lies approximately 20 to 25 kilometres south-east of Kakadu National Park and 20 kilometres north of the Kakadu Highway that travels to the east of the project into Kakadu National Park.

The town of Pine Creek is situated on the Stuart Highway approximately 190 kilometres south-east of Darwin and 90 kilometres north-west of Katherine. The Adelaide to Darwin

railway largely parallels the Stuart Highway south of Pine Creek and deviates away from the highway to the north-west of Pine Creek.

## 2.3 TENEMENTS

In 2002 the underlying title, ERL116, was transferred to Arafura Resources NL under a royalty arrangement with Renison Goldfields Consolidated's corporate successor, Iluka Resources Limited. Arafura applied for Mineral Lease 23839, covering the Mt Porter area on 12 March 2003. This was granted on 2 February 2005.

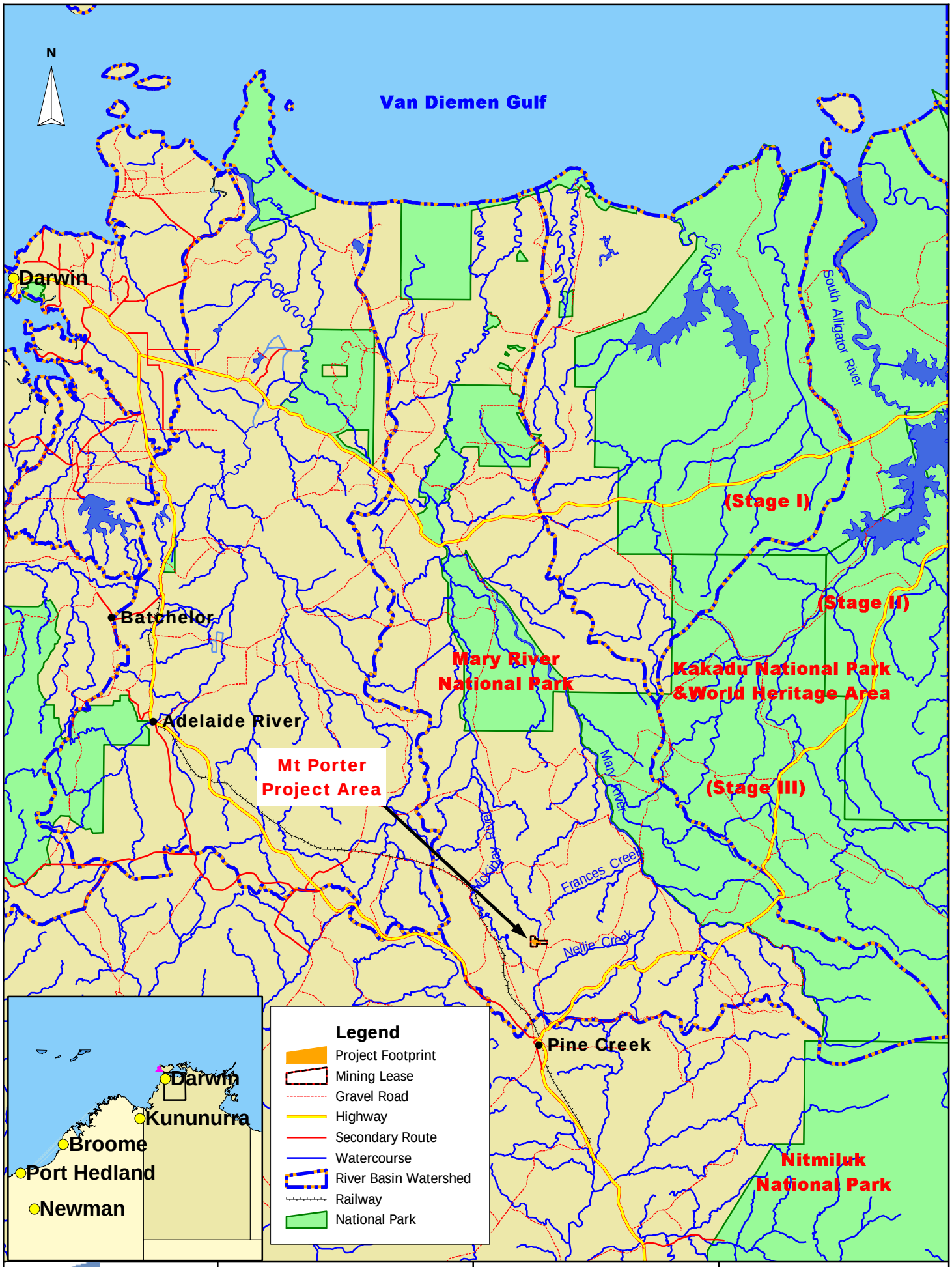
The Mineral Lease encompasses 362.6 hectares. Figure 2 shows the project and mineral lease location.

## 2.4 EXISTING LAND USE

Pine Creek was, until the turn of the century, one of the major centres of the Northern Territory's mining industry. Minerals such as uranium, iron ore, silver, lead and zinc were extracted and Pine Creek became a service centre for over 500 miners.

The Mt Porter Gold Project falls within the Mary River West pastoral lease (PPL815, NT Portion 1630) (Figure 2). Although no pastoral activities currently occur in the immediate vicinity of the proposed mine site, there is potential for pastoral activities to be restored post-mining. Pursuant to Section 184 of the *Mining Act*, Arafura have entered into a compensation agreement with the owners of the Mary River West pastoral lease in respect to exploration and mining activities on the land.

The Mineral lease is also subject to Native Title claims. Arafura has entered into an Indigenous Land Use Agreement with the Northern Lands Council to cover exploration and mining activities on the project area and this agreement has been registered. The agreement includes the possibility of any future Native Title Claims over the project area.

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Scale 1:1000000
Original Size: A4

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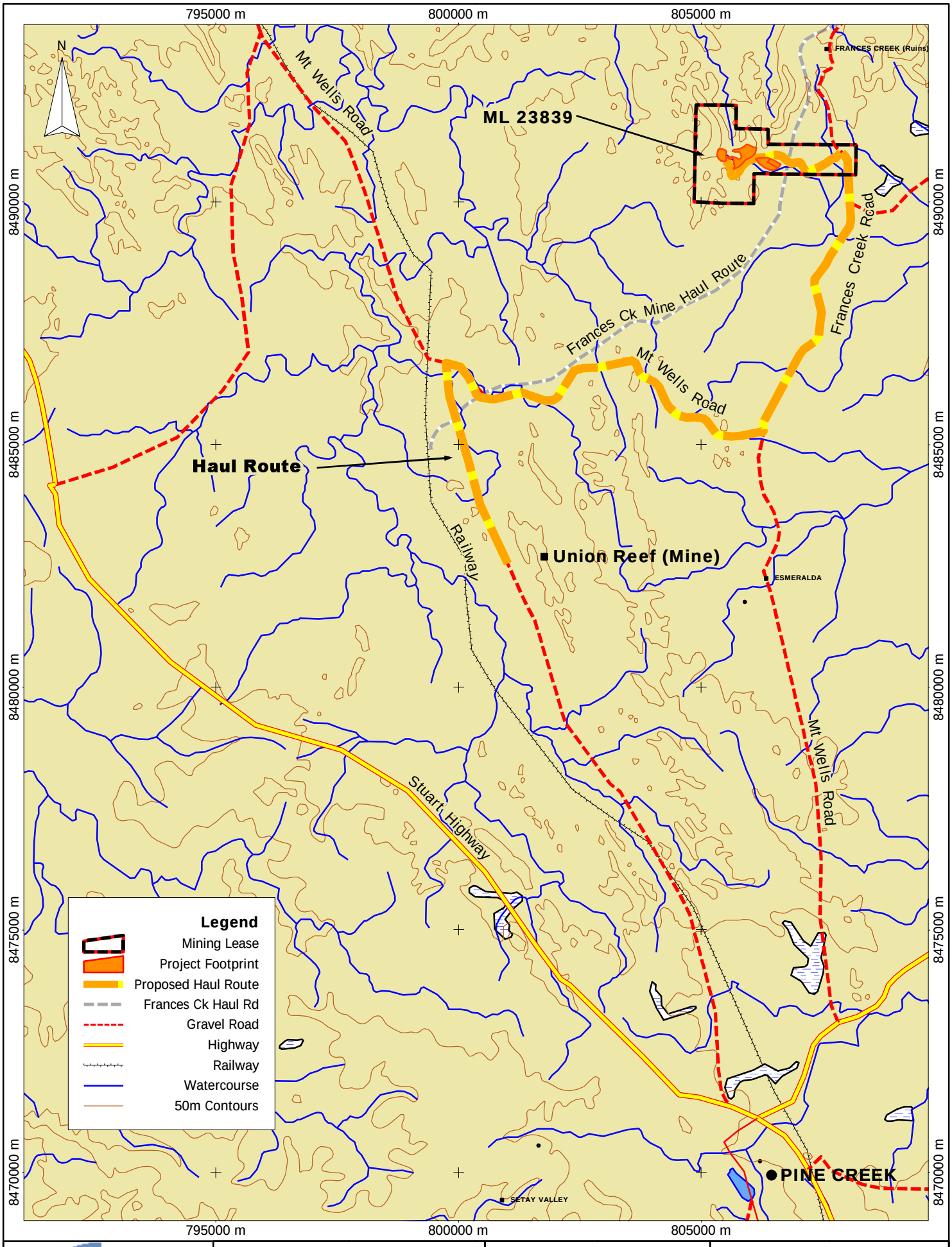
Arafura Resources
Mt Porter

Mt Porter
Location Plan

Figure 1

W:\Arafura Resources\Mt Porter\PER\Drawings\F1 Location-Mt Porter .map 27/11/2006

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Scale: 1:100000
Original Size: A4
Datum:
Australian Geocentric 1994 (GDA94)
0 2 km

Arafura Resources
Mt Porter

Tenement and Haul Route Location

Figure 2

W:\Arafura Resources\Mt Porter\PER\Drawings\F2 TenementHaul.map 24/11/2006 Figure 2 A4

# 3. LEGISLATIVE CONSENT AND LICENSING REQUIREMENTS

## 3.1 COMMONWEALTH

Within Australia's federal system of government, both the regulation of mining operations and the protection of the environment are principally state or territory responsibilities. Commonwealth approval is needed if matters of national significance, as defined in the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, are triggered. The Department of the Environment and Heritage (DEH) is responsible for administering the *Act*. Matters of national significance include the presence of migratory birds, federally listed rare flora or fauna, Commonwealth land, heritage sites, nuclear actions and marine areas.

Commonwealth powers to regulate mining and other activities concerning the environment are primarily contained in Section 51 of the Commonwealth *Constitution*. Of particular importance are the trade and commerce power; taxation power; quarantine power; the corporations power; external affairs power; power over Commonwealth instrumentalities and public service; power over customs, excise and bounties; financial assistance power; and territories power. Importantly Commonwealth law prevails where any law of a state or territory is inconsistent with a Commonwealth law. The Commonwealth therefore has the ability to override territory laws in areas within its legislative competence.

A project is referred to DEH where it is possible that it will trigger matters of national significance under the *Act*. The DEH may delegate the assessment process and day-to-day administration of mines to state and territory governments. This approach minimises unnecessary duplication in administrative processes.

On 11 September 2006, Arafura Resources submitted an EPBC Referral Report to DEH for the Mt Porter project. In response to this referral, DEH notified Arafura Resources on 9 October 2006 that the Mt Porter project was deemed a Controlled Action under Part 9 of the *EPBC Act 1999* and requires approval under the Act. Appendix 2 contains copies of correspondence from DEH regarding the controlled action decision. The decision was triggered under the controlling provisions Part 3, Division 1 namely:

- Sections 12 and 15A (World Heritage).
- Sections 18 and 18A (listed Threatened species and communities).
- Sections 20 and 20A (listed Migratory species).

DEH has advised Arafura Resources that the most significant factor in listing was potential occurrence in the project area of the threatened bird species, the Gouldian Finch (*Erythrura gouldiae*). Potential downstream impacts on the Kakadu World Heritage area were also a factor in the decision.
Other significant species listed under the *EPBC Act* 1999 that DEH considered important as they may potentially be present on the site include:

- Partridge Pigeon (subspecies *Geophaps smithii smithii*), classified as vulnerable.
- Red Goshawk (*Erythrotriorchis radiatus*), classified as vulnerable.
- Masked Owl (*Tyto novaehollandiae*), classified as vulnerable.

The proposed project will be assessed under the Bilateral Agreement signed by the Australian and Northern Territory governments under Section 45 of the *EPBC Act 1999*. This provides for accreditation of certain state environmental assessment processes including an EIS and PER under the Northern Territory *Environmental Assessment Act 1994*. This process is further discussed in Section 4.1.1.

### 3.1.1 Bilateral Agreement

The Northern Territory and Federal governments entered a Bilateral Agreement on environmental impact assessment in 2002. The agreement aims to "minimise duplication of environmental impact assessment processes, strengthen intergovernmental cooperation and promote a partnership approach to environmental protection and biodiversity conservation" (Australian Government, 2002). The Bilateral Agreement also provides accreditation of the Northern Territory environmental impact process, as set out in Schedule 1 to the Agreement. This accreditation ensures that actions requiring approval from both the Federal and Northern Territory governments are co-ordinated and integrated. It also allows the Federal Government to rely on the Northern Territory assessment process.

Procedures to be followed by both Northern Territory and Federal governments are set out in Sections 12 to 20 of the Agreement. These procedures include:

- The Northern Territory encouraging referral of projects/actions to the Federal Government.
- The Federal Government informing the Northern Territory of outcomes of decisions on referrals.
- The Northern Territory ensuring and confirming an accredited process where actions are assessed in line with the Bilateral Agreement.
- The Northern Territory providing a copy of the Assessment Report and/or any other documents relevant to the assessment to the Federal Environment Minister no later than 10 days after the Assessment Report is accepted by the Northern Territory Environment Minister.
- The Federal Government providing the Northern Territory with a copy of any additional information used in its decision on the assessment.
- The Northern Territory and Federal governments informing each other of conditions applying to proposal approval and to avoid inconsistent conditions.
- The Northern Territory and Federal governments co-operating in monitoring compliance with conditions relating to matters of national significance.
- Both parties must be made aware of a breach of conditions relating to matters of national significance and approve any enforcement action to be taken.
- The Northern Territory and Federal governments jointly developing administrative procedures so that the Agreement is administered efficiently and in accordance with each government's legal requirements.

The Northern Territory Government will generally provide a copy of the proponent's assessment documentation to the Federal Government at each stage of the process to ensure

that Federal concerns and comments are taken into account throughout the process.

Direct implications of Bilateral Assessment on this PER are:

- Federal Government input in specifying PER Guidelines.
- Including a separate section of the PER (Section 10) addressing issues subject to the *EPBC Act*.
- Arafura Resources preparing and submitting an addendum to the PER which addresses input received during the public comment period.
- Federal and Northern Territory government assessment of the PER.

## 3.2 NORTHERN TERRITORY

Key Northern Territory environmental legislation applicable to the project includes:

- *Mining Management Act 2001.*
- *Mining Act 1982.*
- *Bushfires Act 1980.*
- *Environmental Assessment Act 1982.*
- *Waste Management and Pollution Control Act 2003.*
- *Environmental Offences and Penalties Act 1996.*
- *Heritage Conservation Act 1991.*
- *Aboriginal Sacred Sites Act 1989 (Sacred Sites Act).*
- *Weeds Management Act 2001.*
- *Ozone Protection Act 1996.*
- *Water Act 1992.*
- *Soil Conservation and Land Utilization Act 1978.*
- *Territory Parks and Wildlife Conservation Act 2001.*

### 3.2.1 Environmental Impact Assessment

*The Environmental Assessment Act 1982* and *Environmental Assessment Administrative Procedures 1984*, which accompanies the *Act*, form the basis for the environmental impact assessment process in the Northern Territory. The Minister for Environment and Heritage is responsible for administering the *Act*, determines which proposals should be subject to assessment under the *Act* and decides on the appropriate level of assessment in each case. DIPE helps implement the assessment procedures on behalf of the Minister.

Where a proposal is considered to have a significant environmental impact, the Minister for Environment and Heritage directs the proponent to prepare and submit a Public

Environmental Report (PER) or an Environmental Impact Statement (EIS) and advises the Minister for Mines and Energy of this requirement.

Arafura submitted a Notice of Intent document, dated May 2004, to the Department of Business, Industry and Resource Development (now the Department of Primary Industries, Fisheries and Mines, DPIFM). The project was considered by a Project Review Committee containing representatives of DPIFM and the Department of Infrastructure, Planning and Environment (now the Department of Natural Resources, Environment and the Arts, NRETA).

In August 2004, the Minister for Environment and Heritage determined that under the *Environmental Assessment Act 1982* the Mt Porter Gold Project was to be assessed by means of the PER process. The level of assessment was set at the PER level because it was considered that the potential environmental impacts of the project were significant, but limited in extent. Draft PER guidelines were published in August 2004 and open for public comment for a 14-day period. Final guidelines were issued in October 2004 and are contained in Appendix 1.

Upon lodgement of the PER, it will be exhibited for public review and comment for four weeks. During this period, the PER will be circulated to advisory bodies for comment in relation to their areas of expertise and responsibility.

For a PER, NRETA, specifically the Environment Protection Agency (EPA) prepares an assessment report and makes recommendations to the Minister for Environment and Heritage regarding approval of the project. The report takes into account issues raised by advisory bodies, the public and the proponent's response to the issues. The Minister for Environment and Heritage considers this report and makes recommendations to the Minister for Mines and Energy regarding approval of the project. The Minister for Mines and Energy may choose to incorporate recommendations from the environmental assessment process in lease or license conditions, and relevant management procedures.

### 3.2.2 Mining Management

Northern Territory mining operations are regulated by the *Mining Management Act 2001,* administered by DPIFM. The *Act* amalgamates all operational provisions for mining into a single statute leaving the *Mining Act 1982* to regulate titles. The *Mining Act* contains limited provisions governing environmental performance, although the Minister can attach specific environmental conditions as part of the grant of tenement.

Before mining starts, the operator of the mine site must apply for an authorisation to carry out mining activities. The application must be accompanied by a Mining Management Plan (MMP) relating to the mining activities. Substantial disturbance relating to exploration work also requires an authorisation, and an application along with an MMP. The MMP is attached to the authorisation and is the principal administrative document for the mine. Section 40 of the *Mining Management Act* stipulates that the MMP is to include:

- Description of the mining activities.
- Safety, health and environmental issues relevant to the mining activities and the management systems to be implemented at the mine site.

- Closure plan detailing costs.

The MMP is reviewed at specified intervals as set out in the authorisation and, if changes occur, the MMP must be amended and submitted to the Minister for acceptance.

An authorisation is granted subject to the condition that the operator complies with a current MMP (submitted with the application for authorisation), and any additional conditions specified in the authorisation that the Minister considers appropriate.

Arafura will lodge a Mining Management Plan (MMP) including an Environmental Management System (EMS), as stipulated in Section 16 of the *Mining Management Act,* after the completion of the environmental assessment process.

It is anticipated that emissions to land, air or water will be licensed according to the Department of Natural Resources, Environment and the Arts (NRETA) and DPIFM requirements. An authorisation under the *Mining Management Act* licences waste rock, tailings, landfill, industrial and domestic refuge, storage of contaminated waste, land application and surface run-off. Arafura will implement procedures to ensure compliance with regulatory requirements at all times.

# 4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

## 4.1 ORE RESERVES

Pine Creek Goldfields Limited (PCG) completed orebody modelling of Mt Porter early in 1994. The estimated global resources were:

- Cut-off 1.5 g/t Au 240-250,000 t at 3.6-3.8 g/t Au
- Cut-off 1.7 g/t Au 215,000 t at 3.9 g/t Au
- Cut-off 2.0 g/t Au 176,000 t at 4.4 g/t Au.

Following additional drilling in November 2003, a new resource estimate was prepared. Identified Resources for the 10400 zone deposit now stand at:

- Cut-off 0.5 grams per tonne gold (g/t Au)

  Indicated Resources 694,000 tonnes at 2.0 g/t Au

  Inferred Resources 184,000 tonnes at 1.55 g/t Au

  Total Resources 878,000 tonnes at 1.9 g/t Au
- Cut-off 1.7 g/t Au

  Indicated Resources 300,000 tonnes at 3.1 g/t Au

  Inferred Resources 55,000 tonnes at 2.6 g/t Au

  Total Resources 355,000 tonnes at 3.0 g/t Au

Preliminary pit optimisation studies have been performed for a range of economic parameters. Models considered involved a range of pit and waste rock requirements (327,000 to 498,000 tonnes of resources; 1.6 to 2.2 million tonnes of waste).

The final pit (which is based on the most favourable economic parameters) includes identified resources of 574,000 tonnes at a grade of 2.1 g/t Au and waste rock totalling 2.4 million tonnes.

## 4.2 OVERALL PROCESS DESCRIPTION

The proposed action is to establish a mining operation within the Mt Porter mineral lease. This will require development of an open cut pit to access the ore body. Ore will be extracted through blasting and excavation. The excavated material will be placed in stockpiles before being loaded onto trucks and transported to the Union Reef CIL plant which is located some 10 kilometres south west of Mt Porter.

A more detailed explanation of the sequential mining process is described below:

1. **Removal of Vegetation:** Any vegetation that needs to be cleared for the purposes of mining at the site, where practicable will be stockpiled for use in later rehabilitation. Clearing will be kept to the minimum required to conduct the mining project.
2. **Remove and Stockpile Topsoil:** The top 200 millimetres will be removed using

scrapers or other efficient earth moving machinery and placed in low stockpiles for later re-use.

3. **Remove and Stockpile Overburden:** Waste includes both the overburden layer and the non mineralised material around the ore body. Waste will be placed in a purpose built waste landform adjacent to the pit as displayed in Figure 3. Approximately 2.4 million tonnes of waste is anticipated to require removal.

4. **Mining:** Extraction will be carried out using an excavator and a fleet of trucks. Blasting will generally be required to fracture the ore and waste rock sufficiently to allow excavation. Ore will be loaded onto haulage trucks and taken to a ROM stockpile at the base of the hill. The resultant pit will be about 4 hectares in area and 115 metres deep to allow production of 574,000 tonnes of ore and 2,400,000 tonnes of waste rock. It is estimated that the total volume of the pit will be one million bank cubic metres. A total of 24 hectares of land is expected to be disturbed by the operation.

5. **Transport:** Road trains will be used to transport ore to the nearby Union Reef CIL processing plant. Transport will occur on dedicated haul roads and existing public roads.

6. **Disposal of Wastes:** Waste rock will be stockpiled adjacent to the pit in a purpose built waste rock stockpile. A total of 2,400,000 tonnes of waste rock is anticipated. The waste rock stockpiles will be shaped to blend with the topography and revegetated.

7. **Rehabilitation:** Rehabilitation will be undertaken with waste rock material deposited in the waste rock stockpile. Topsoil will be replaced over the waste rock stockpile as part of the rehabilitation process.

More details are provided for mining, ore processing, dewatering and tailings disposal in the following subsections.

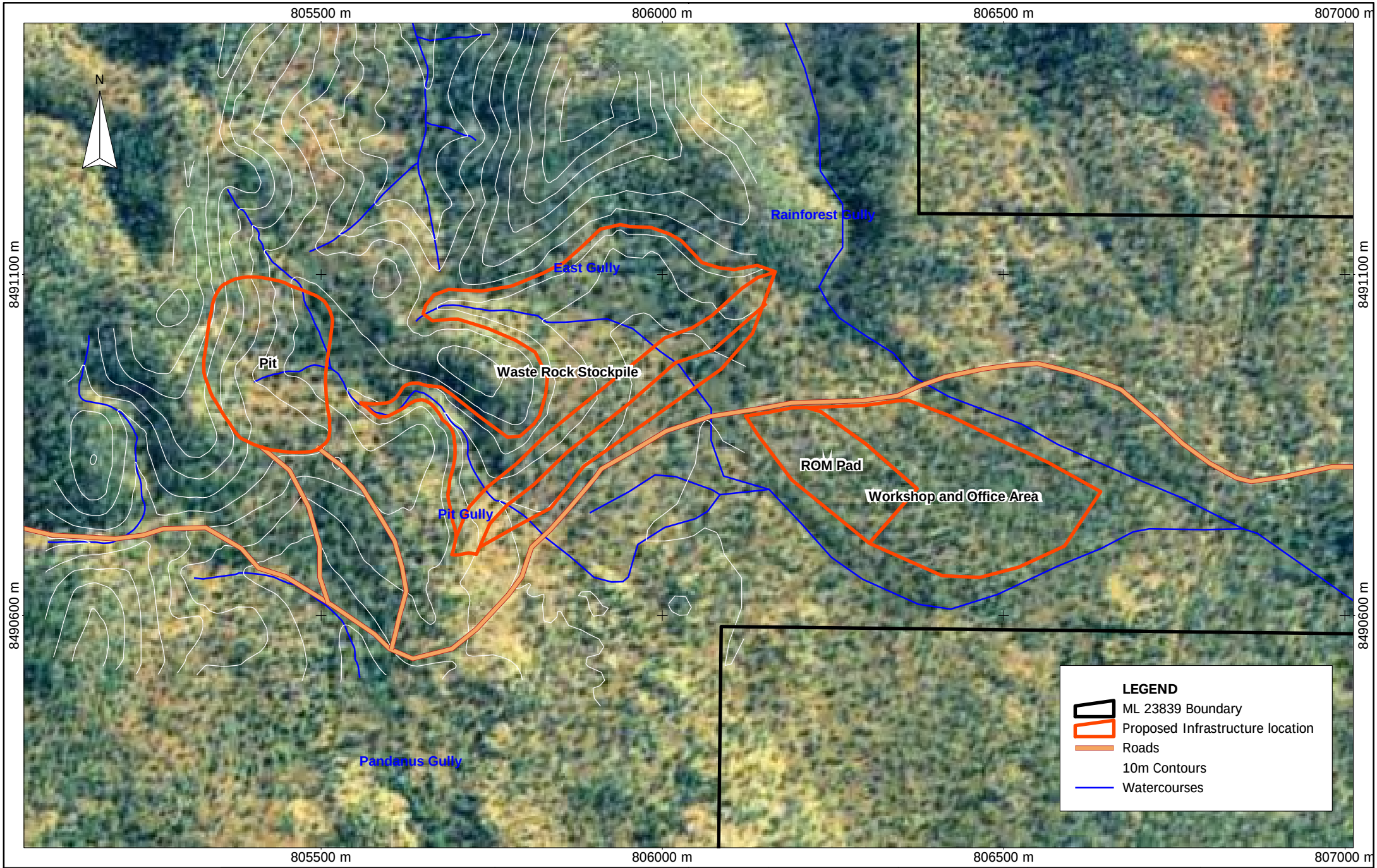
## 4.3 SITE LAYOUT

The conceptual site layout is illustrated in Figure 3.

Approximately 24 hectares of land will be disturbed for the open pit and infrastructure associated with mining operations. The NOI identified a notional area of approximately 12 hectares to locate the mobile infrastructure during the mining program. This area straddled the site access route. The botanical survey has identified a community of remnant rainforest associated with a creek line on the north side of the access road. The nominated infrastructure area and ROM stockpile area have now been amended to exclude this area and avoid disturbance of watercourses. Infrastructure areas will now be confined to the south of the access road to avoid impact on the remnant rainforest vegetation community, and will constitute a surface are of 8.2 hectares.

Much of the mine infrastructure will be mobile. Mobile infrastructure will include:

- Power supply — Portable generator for the site office and workshop
- Site office — Portable site office and ablution facilities
- Workshop — Sea container equipment store
- Fuel storage — Self bunded tanks or on ground tanks in lined bunded area
- Explosives magazine — Explosives will be stored in a magazine of an approved design.

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4 Cook St
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info@mbsenvironmental.com.au

Scale: 1:7000
Original Size: A4
Datum: Australian Geocentric 1994 (GDA94)

0 200 m

Arafura Resources

Mt Porter

Site Layout

Figure 3

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## 4.4 SITE PREPARATION

Earthmoving activities are planned to start in 2007, at the commencement of the dry season (April). These activities will be conducted by experienced earthmoving contractors.

The Mt Porter access road and Frances Creek Road will require considerable earthworks to form them to a standard suitable for use by road trains. There will be no need for construction of separate borrow pits as preliminary studies indicate that material from the upper benches of the open pit will be suitable for this purpose. This waste material will be used to construct the site access road, internal roads, the ROM pad, water storage dams and pads for workshops, stores and offices.

## 4.5 MINING

The deposit is to be mined within an eight month period in the dry season between April and November. The NOI detailed a plan to mine the deposit in three campaigns over the dry seasons. This has now been amended and the mining operation is to be completed within one dry season as described within this PER.

Mining activity will be concentrated between the 215 to 280 metres AHD levels on the eastern slopes of Mt Porter.

Development of the project will principally involve:

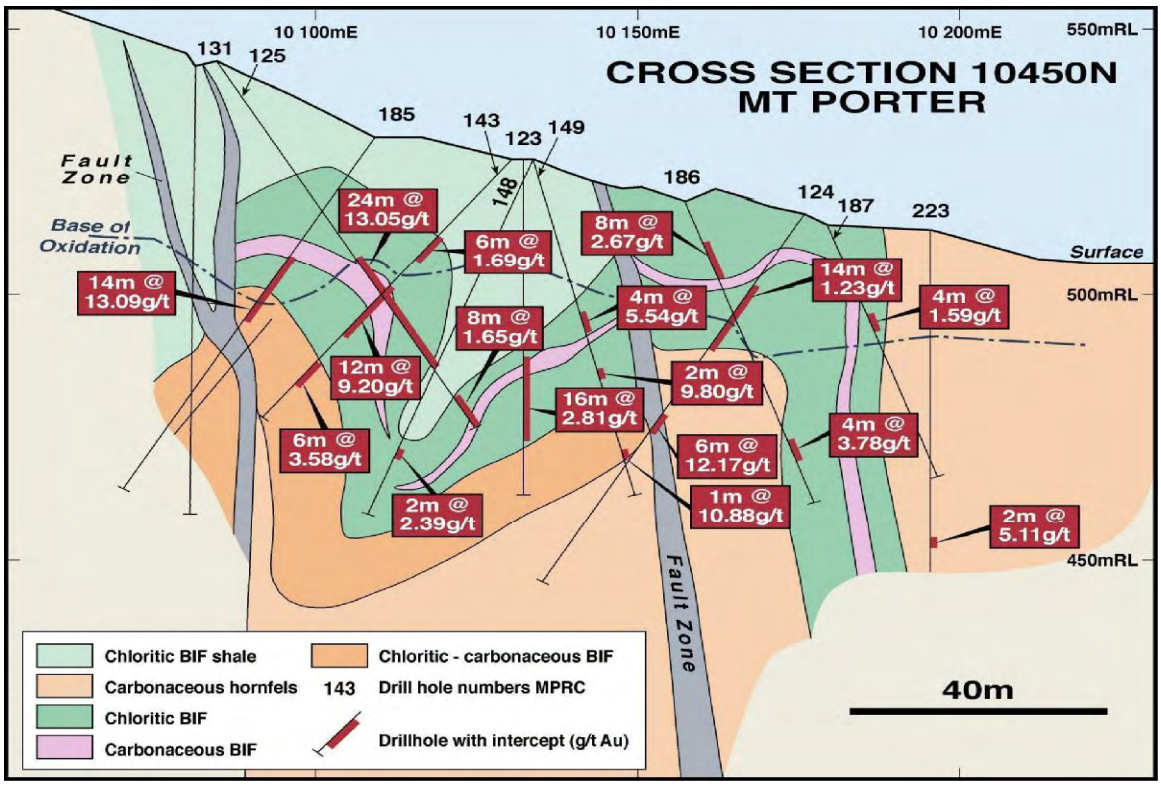
- An eight month mining operation of recoverable mineral resources using standard open-cut methods over an eight month period in the dry season (April to November).
- Temporarily stockpiling ore on site before transporting it off-site using road-trains along existing transport corridors.
- Progressive rehabilitation of areas disturbed by mining operations.
- Decommissioning of the site upon completion of operations.

### 4.5.1 Pit Characteristics

Plan and cross-sectional views of the proposed pit are given in Figure 4. The natural ground level of the surrounds of the proposed pit is 580 metres RL. The open pit will cover a surface area of four hectares. The final pit floor will be at about 460 metres RL, making it about 115 metres deep. It is estimated that a total of one million bench cubic metres (2.5 to 3 million tonnes) of material will be excavated from the pit. This will consist of approximately 200,000 bench cubic metres of ore and 800,000 bench cubic metres of waste for a stripping ratio of between 4:1 and 8:1.

The 10400 Zone pit and associated waste rock stockpile will be constructed within the gully system, which drains south to Nellie Creek. This system comprises East Gully, which is to the immediate east of the 10400 Zone pit, Pit Gully, which drains the area of the proposed pit, and South Gully, which drains the area to the south of the 10400 Zone pit.

**Figure 4: Cross-sectional View of Open Pit**




## 4.5.2 Mining Methods

Mining will be undertaken using conventional open cut method of drilling, blasting and excavation using a hydraulic excavator and dump trucks. Ore and waste material will be removed separately using a 160 tonne excavator and three 50 tonne haul tucks. Mining will be conducted by contractors and will only occur during the dry season.

Drilling and blasting will be required to enable excavation of the waste and ore. Initially there may be an amount of free dig material, consisting of shallow skeletal soils with meta siltstones, greywacke and quartzite pebbles. However, the less weathered waste and ore will require drilling and blasting. Drilling and blasting of waste and ore would proceed on a continuous basis with blasts being fired every two to three days.

## 4.5.3 Mining Schedule

Arafura wish to commence mining as soon as all approvals have been obtained. The current development schedule aims to commence operations at the conclusion of the 2006-07 wet season (in approximately March - April 2007).

Mining equipment is planned to be mobilised in April – May 2007. Mining is scheduled to be completed by November 2007.

At this stage, it is planned that all operations, including rehabilitation, will be completed by the end of 2007. Environmental monitoring will continue for as long as necessary after decommissioning.

### 4.5.4 Future Extensions

The proposed action is a stand alone project, not a stage or a component of a larger action. Exploration is continuing in the area and additional mining by Arafura may occur in the future if appropriate further reserves are discovered. Any additional mining will be subject to a separate application at that time, including an *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*) referral if necessary.

## 4.6 ORE PROCESSING AND TAILINGS MANAGEMENT

No processing will be undertaken on site. Ore from the operation will be transported 15 kilometres to the Union Reefs Mill and toll treated. The mill is owned and operated by GBS Gold International. GBS announced the recommissioning of the Union Reefs Mill on 23 August 2006.

On 21 September 2006 GBS entered into a License Agreement with GeoBiotics, LLC ("GeoBiotics"), a private American firm, for the use of the GEOCOAT® refractory ore treatment process at the Union Reefs Mill. The GEOCOAT® process is a standard bio-oxidation process for the treatment of refractory gold ores and concentrates in a heap leach environment, with subsequent recovery of gold through a normal carbon-in-leach (CIL) circuit.

The first gold pour since recommissioning took place on 25 September, 2006.

## 4.7 WASTE ROCK MANAGEMENT

Approximately 2.4 million tonnes of waste rock is proposed to be excavated from the pit. Waste rock will primarily be disposed of by construction of an out of pit waste rock stockpile located east of the pit. Waste rock will consist of both oxide rock (non-acid forming) and primary rock (potentially acid forming). An estimated 70 to 75% (1.75 million tonnes) of the waste rock in the pit is oxidised.

Initially oxide material stripped from the upper benches of the pit will be used in establishing the ROM pad, site office, access roads and mine access areas. Additional oxide material will be temporarily stored on the hill between the two "fingers" of the waste rock stockpile. This surplus oxide waste rock will be used for capping the primary (potential acid forming) waste rock material in the waste rock stockpile.

Primary waste rock will be deposited in the southern flank of the dry East Gully and the spur between the two valley fingers. The east gully has no observed springs and is incised into competent hornfelsed mudstone and granite. A drainage pipe will be placed along the creekline to act as an underdrain system for any water that enters the waste landform. Additional oxide waste will then be dumped over the underdrain to form a level base for the waste landform. Oxide waste will continue to be placed in the expanding waste landform, but leaving an area along the southern side of East Gully and the western end of the spur between the two gullys, forming a 'donut' waste landform, leaving the central void to be filled with primary waste. Subject to on-going professional advice, lime may be added to the primary waste during placement in the central void to minimise potential for acid generation.

Ultimately the whole waste rock stockpile will be capped with oxide waste relocated from the temporary stockpile on the hill to provide a cover layer as a barrier to ingress of water and oxygen.

The waste rock stockpile will be contour ripped just prior to seeding with a mix of local tree and shrub species. The overall landscape effect will be to extend the current headwaters of East Gully further downstream.

The final waste rock stockpile will cover a surface area of approximately 11.85 hectares.

For the two fingers of the waste rock stockpile, design will include:

- A drainage pipe placed along the creek bed, maintaining a preferred drainage path for water from the upper catchments. Unlike the dry East Gully, the Pit Gully contains a spring in its upper reaches. The spring itself is above the final crest level of the waste landform. A drainage pipe in the creek bed will ensure an underdrain system functions to remove seepage water from under the waste landform.
- Convex top surface, directing runoff to drains on the outer edge of the waste landform.
- Diversion drains will be established around the central zone designated for PAF material. These will be directed to the outer edges of the stockpile and then redirected back to the main drainage lines.

For the leading edge of the waste landform, design will include:

- A final outer face slope of 20 degrees.
- Ten metre wide in-sloping berms with a one metre bund at the leading edge of each berm.
- Rock armoured spillway structures on the side of the stockpile.

## 4.8 WATER USE

As no mineral processing operations will occur on site, water use will be limited to dust suppression within the pit and roads and for domestic purposes in the administration and maintenance facilities. To provide this water, temporary earthen dams will be constructed to store water. An estimate of 500 kilolitres per day of water will be required for site use.

Rain falling in the pit will be directed to sumps at the base of the pit. This water will be used for dust suppression during mining. With the project duration planned for the dry season, quantities of rainwater are expected to be limited.

Temporary earthen dams to store water for site use will be constructed either in the waste landform footprint (prior to the full extent of the landform being reached), on the top level of the waste landform (when sufficient area is constructed) or in the office and workshop area. Water will be pumped to these dams from the open pit sump and the unnamed bore (used as makeup water if there is insufficient quantity from the open pit dewatering).

However, pit inflow water may increase in the final stages of the pit excavation, when the pit is below the standing water level of the unnamed bore. Quantities significantly in excess of the estimated 500 kilolitres per day required for site use will require discharge. The duration of the final stage of the pit excavation below this level is very short and will only be approximately four to six weeks of the eight month project duration. Even with a surplus of 500 kilolitres per day (twice the site usage rate), the total volume of surplus water requiring discharge will be approximately 20,000 kilolitres.

Further hydrological assessment will be conducted to assess the longer term status of the pit lake after mine closure.

### 4.8.1 Water Balance

A daily water balance is shown in Table 1. From this it can be seen that water abstracted to allow safe mining will be sufficient to supply project needs. Excess water is only likely to result from significant rainfall. In such situations, water will be discharged to natural watercourses. Water will be treated prior to discharge as required based on water quality monitoring.

**Table 1: Daily Water Balance**

| | Inputs | Outputs |
|---|---|---|
| Discharge licence volumes | | 500* |
| Dewatering volumes | 500 | |
| Dust suppression volumes | | 500 |
| Office/ablutions/workshop | | 20 |

* Contingency for discharge if dewatering volumes exceed site usage.

### 4.8.2 Water Management

The proposed open pit is located on elevated ground on the slopes to the east of Mt Porter. Due to the high rainfall patterns associated with the wet season, mining will be restricted to the dry season, from April through to November. The location of the pit within 50 metres of the summit of Mt Porter means it has very little natural catchment, and there will be negligible quantities of stormwater runoff to the pit.

Control of sediment in surface water flows is outlined in Section 9.4.2.

A Waste Discharge Licence will be sought from the Controller of Water Resources to cover discharge of water from the site. Monitoring of water quality will continue after project completion in accordance with the requirements of regulatory authorities.

Contaminated water from hydrocarbon storage areas, workshops and the equipment wash bay will be directed to a sediment sump with an oil water separator for treatment prior to discharge into an evaporation pond.

## 4.9 TRANSPORT

Arafura Resources intends to transport ore from the mine for treatment at the Union Reef CIL processing plant, which is located approximately 10 kilometres south-southwest of Mt Porter.

The preferred route for ore to be hauled to Union Reef plant is via the:

- Access road between the Frances Creek Road and the mine site (2.7 kilometres).
- Frances Creek Road to the Mt Wells turn-off (6.5 kilometres).
- Mt Wells Road to the railway corridor (seven kilometres).
- Access road between the Mt Wells Road and the Union Reef CIL Plant (five kilometres).

The proposed transport route is presented in Figure 2.

Other options for transport to the processing plant are being considered. These include the old Frances Creek railway corridor that is being refurbished by Territory Iron for use as a haul road from the nearby Frances Creek mine. However, use of this road would require coordination with Territory Iron haulage vehicles. The traffic congestion and safety aspects involved may render this option impractical. Further discussion with Territory Iron is required before this option could be considered an alternative to the preferred route.

During the project, personnel will commute to and from the site daily from Pine Creek. The Frances Creek Road between Kakadu Highway and the Mt Wells turn-off will also require additional maintenance and procedures which will include:

- Signs on Mt Wells Road, giving warning of road trains entering, leaving and travelling along the haul road.
- Road maintenance to be carried out to DPI standards.
- Standard radio call-ups where deemed necessary.

# 5. WORKFORCE

Once operations commence, the on-site workforce including mining and haulage operators, will rapidly build up to as many as thirty to forty persons at any one time depending on shift arrangements. It is proposed that mining operations will be scheduled for continuous operation that will comprise a day shift and night shift each of 12 hours duration.

All personnel will reside off-site and commute to the mine site on a daily basis.

Table 2 shows a breakdown of personnel likely to be employed during operations.

**Table 2: Likely Employment During Operations**

| **PRIME CONTRACTOR MANNING LEVELS** | |
|---|---|
| **Arafura Staff Positions** | |
| Mining Manager | 1 |
| Deputy Mine Manager | 1 |
| Pit Superintendent | 1 |
| Mine Production Engineer | 1 |
| Senior Mine Surveyor | 1 |
| Survey Technician | 1 |
| Senior Geologist - Mining | 1 |
| Project Geologist | 1 |
| Pit Technician | 1 |
| **Total Arafura Staff** | **10** |
| **Contractors** | |
| **Drill and Blast** | |
| Site Supervisor | 1 |
| Drilling Crew | 5 |
| Blast Crew | 3 |
| Service Crew | 3 |
| **Haulage** | |
| Site Supervisor | 1 |
| Earth Moving operators | 14 |
| Service Crew | 3 |
| **Total Contractor Work Force (On-Site)** | **30** |
| **TOTAL MANPOWER** | **40** |

## 5.1 REHABILITATION AND DECOMMISSIONING

The Mt Porter Gold Project falls within the Mary River West pastoral lease. Prior to commencement of mining, the area was used for pastoral activities. Although no pastoral activities currently occur in the immediate vicinity of the proposed mine site, there is potential for pastoral activities to be restored post-mining.

Areas disturbed by mining and associated activities will be rehabilitated at the conclusion of operations. Waste rock stockpiles will be stabilised and seeded prior to vacating the site. PAF waste material will be encapsulated within the stockpile and water diversion drains will be constructed to ensure the waste landform is not subject to erosion during the wet season.

The office and workshop areas and the access road between Frances Creek Road to the mine site will be rehabilitated after mining operations are completed. The affected portion of the Frances Creek Road will not be rehabilitated. Over time it will revert to the condition it was in prior to mining, i.e. un-maintained public road.

Arafura is committed to carrying out rehabilitation works before the onset of the wet season.

Rehabilitation will be performed in accordance with current accepted industry and public standards and conducted in accordance with Mine Management Plans approved by DPIFM.

More information regarding rehabilitation and closure are presented in Section 10.

## 5.2 PROJECT SCHEDULE

Arafura wish to commence mining as soon as all approvals have been obtained. The current development schedule aims to allow first transport of ore in April 2007. Construction is planned to commence in March 2007 assuming all approvals have been obtained by this time. Mining equipment is planned to be mobilised in March 2007 with initial ore to be placed on a ROM stockpile in April. Mining is scheduled to commence in April 2007.

Table 3 outlines estimated key milestones for the project.

**Table 3: Planned Construction Schedule**

| Key Tasks | Completion Date | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | May 04 | Oct 06 | Nov 06 | Dec 06 | Jan 07 | Feb 07 | Mar 07 | Apr 07 | May 07 | Jun 07 | Jul 07 | Aug 07 | Sep 07 | Oct 07 | Nov 07 |
| NOI | X | | | | | | | | | | | | | | |
| PER | | | X | | | | | | | | | | | | |
| EPBC Referral | | X | | | | | | | | | | | | | |
| Environmental approval | | | | | | | | | | | | | | | |
| Infrastructure construction | | | | | | | X | | | | | | | | |
| Production Commencement | | | | | | | | X | | | | | | | |
| Production complete | | | | | | | | | | | | | | X | |
| Rehabilitation works | | | | | | | | | | | | | X | X | X |
| Closure/Decommissioning | | | | | | | | | | | | | | | X |

# 6. PROJECT OBJECTIVES, ALTERNATIVES AND JUSTIFICATION

The project as described within this document is a result of consideration of the interaction between the design of the operation components and the key financial, environmental, safety and social aspects.

## 6.1 OBJECTIVES

The objectives of the project are to:

- Mine gold ore suitable for toll treatment at the nearby treatment plant owned by GBS Gold International.
- Produce gold ore for toll treatment at a low cost whilst maintaining high levels of performance in terms of quality, safety and environmental production.
- Ensure benefits of the project are shared with members of the Northern Territory and local communities.

## 6.2 ALTERNATIVES CONSIDERED

Alternatives considered during planning of the project included:

- Not Proceeding with the Project: The "no project" option would result in a loss of opportunity to add value to Australia's raw materials and loss of employment opportunities and economic benefit, particularly within local communities. The ongoing global demand for gold would then be met by developing projects elsewhere, including overseas, with a loss of associated benefits to the Northern Territory.
- Project Schedule: The NOI proposed a campaign mining operation where mining would be conducted over the period of three dry seasons. This would require demobilisation of equipment at the onset of the wet season and then remobilisation at the onset of the dry season. This was deemed to pose a number of problems, as infrastructure such as ramps and roads would potentially be damaged in the wet season. From a cost perspective it would entail additional costs in terms of maintenance, repair and mob/demob costs. From an environmental perspective it would also require careful water management during and immediately after the wet season to prevent contamination of surface or groundwater's and to minimise erosion of active operational areas.
- Infrastructure Location: The chosen location and design of the project has taken into consideration the existing environment and potential environmental impacts. The location of administrative infrastructure and site access road took into account the proximity of surface water drainage, topography and good condition native vegetation. No processing will be undertaken on site. Ore will be transported to an existing processing plant for treatment.
- Raw Materials: Extraction of ore is confined to the geographical location in which it occurs. An economic alternative to diesel fuel to provide electricity and to run equipment has not been identified. Use of water supplies generated on site from pit

dewatering or local bores is the most practical option. The closest alternative groundwater supply of sufficient quality and quantity to meet the designed capacity requirements of the project is located about 15 kilometres to the east. This would require substantial infrastructure in piping and power requirements to commission. For such a short duration, campaign operation as proposed, this is not considered feasible.

- Transport Corridors and Options: Transport is a significant cost in the Mt Porter Gold Project. Transport of ore from the project site to the Union Reef Processing plant will use existing roads. Arafura has considered the use of the old Frances Creek railway corridor that is being refurbished by Territory Iron for use as a haul road from the nearby Frances Creek mine. However, use of this road would require coordination with Territory Iron haulage vehicles. The traffic congestion and safety aspects involved may render this option impractical.
- Extraction and Processing Technologies: Open pit gold mining and Carbon in Leach (CIL) processing technology is commonly used throughout the industry. No practical alternatives exist for the ore grade of the project. Construction of an onsite treatment plant was considered, but given the short duration of the project and proximity of other treatment plants willing to undertake toll treatment of gold ore, it was not considered feasible to construct an onsite facility.
- Environmental Management Technologies: The mining and processing technologies proposed for Mt Porter allows use of proven industry environmental management techniques. Arafura's Environmental Policy requires implementation of industry best management practices. These are detailed in Sections 12 and 13. It is the intention of Arafura to implement environmental management actions to leave the project site in a safe and stable manner that requires minimal ongoing care and maintenance
- Workforce Accommodation: The alternative to daily commuting of the workforce from Pine Creek is to construct an on site camp. While this may have the benefit of reducing commuting time of the workforce, it will remove employees from the Pine Creek community. This will have a detrimental effect on services and facilities at the town. The 20 kilometre commute distance is not considered excessive. Also given the short duration of the mining project, construction of an on site camp is considered impractical. The lack of an accommodation camp on site also reduces the disturbance impact on the project area.

## 6.3 PROJECT BENEFITS

Anticipated benefits resulting from the project include:

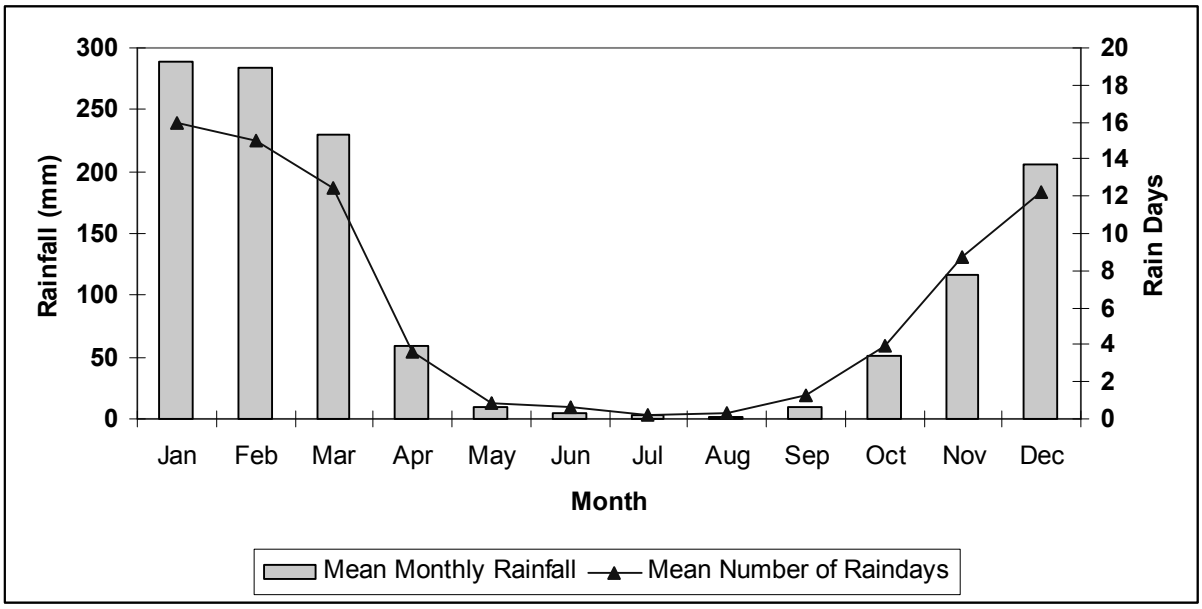
- Arafura will provide direct employment for about 30 people during construction and up to 60 people during the operation. Indirect employment is also likely to be provided as a result of supplying goods and services to the project.
- Arafura has entered an agreement with the Northern Land Council whereby the council will manage the project's register of employment and service opportunities. Preference for employment and training opportunities will be extended to people living in the Mt Porter region.
- Preference will be extended to local businesses for supply of goods and services.
- Arafura, through payment of company tax, payroll tax and royalties, will be contributing directly to the economies of the Federal and Territory governments.

# 7. EXISTING ENVIRONMENT

## 7.1 CLIMATE

The proposed Mt Porter Gold project lies in the tropical monsoon belt of northern Australia. The region experiences hot, humid summers (the 'wet season') and cooler, dry winters (the 'dry season'). Average rainfall in the region is 1,100 to 1,300 millimetres and falls mainly during the period between October and April, especially during the months of January to March, when the area is subject to tropical cyclones and associated tropical low pressure systems and monsoon troughs. The nearest long term rainfall records available are from Burrundie Railway Station (17 kilometres north west of the project area) and averages from this location are shown in Chart 1.

**Chart 1: Burrundie Railway Station Monthly Rainfall Data (1889-1974)**




Mean annual average rainfall for Burrundie Railway Station is 1,263 millimetres, over 98% of which falls between October and April. The highest average monthly rainfall occurs in January (288 millimetres). Pine Creek, 21 kilometres south of the project area, has slightly lower rainfall, with an average annual rainfall of 1,149 millimetres for the period 1874 to 2000.

Mining operations are scheduled to be carried out between April and November, with some preparation and rehabilitation work possibly extending into March and December. Table 4 shows rainfall statistics from the nearest monitoring site, with the period of mining operations highlighted. Average rainfall is low for the April to October period, with median monthly rainfall of less than 33.4 millimetres in each month. Significant rainfall can still occur during this period. The maximum recorded rainfall in July of 114 millimetres indicates that rainfall events of this magnitude are possible throughout the year. The highest recorded monthly rainfall for April is 690 millimetres, enough to prevent mining operations commencing at Mt Porter. A similar situation occurred in 2006 when late season cyclones resulted in monthly rainfall of 413 millimetres in Pine Creek. Monthly rainfalls of over 200 miilimetres have been recorded in October.

November is at the transition to the wet season and with a median rainfall of over 100 millimetres, so significant rain can be expected, although runoff is likely to be low due to the dry state of catchments. December is the start of the wet season proper with a median rainfall of 188 millimetres and maximum recorded rainfall of 592 millimetres.

**Table 4: Rainfall Average Data for Burrundie Railway Station (62 years record)**

| | Lowest Monthly Rainfall | 10th Percentile Monthly Rainfall | Median Monthly Rainfall | Mean Monthly Rainfall | 90th Percentile Monthly Rainfall | Highest Monthly Rainfall | Highest Daily Rainfall | Mean Number of Raindays |
|---|---|---|---|---|---|---|---|---|
| **Jan** | 82.8 | 149.8 | 258.2 | 288.6 | 469.7 | 721.7 | 294.9 | 16 |
| **Feb** | 60.2 | 107.2 | 272.1 | 284.2 | 495.6 | 614.4 | 167.6 | 15 |
| **Mar** | 6.3 | 59.8 | 196 | 229.9 | 472.9 | 654 | 174.5 | 12.5 |
| **Apr** | 0 | 0 | 23.1 | 59.1 | 157.8 | 690.5 | 393.7 | 3.6 |
| **May** | 0 | 0 | 0 | 9.2 | 19.9 | 144.8 | 69.9 | 0.8 |
| **Jun** | 0 | 0 | 0 | 4 | 13.1 | 49 | 41.9 | 0.6 |
| **Jul** | 0 | 0 | 0 | 3 | 2.1 | 114.1 | 104.1 | 0.2 |
| **Aug** | 0 | 0 | 0 | 1.7 | 2.6 | 30.5 | 30.5 | 0.3 |
| **Sep** | 0 | 0 | 3.4 | 10.1 | 34.2 | 70.8 | 64.5 | 1.3 |
| **Oct** | 0 | 4.1 | 33.4 | 51 | 126.6 | 212.1 | 114.3 | 3.9 |
| **Nov** | 0 | 46.9 | 101.4 | 116.7 | 211.5 | 282 | 100.6 | 8.7 |
| **Dec** | 46.6 | 88.2 | 187.8 | 205.2 | 352.2 | 591.9 | 158.8 | 12.2 |
| **Annual** | | 826.8 | 1225.3 | 1262.7 | 1812.6 | | 393.7 | 75 |

Shading of table indicates the period of proposed mining operations.

Air temperatures are relatively high and consistent from year to year. During the coolest time of the year (June to July), the mean monthly temperature for Pine Creek ranges from a minimum of 10 to 13 degrees Celsius to a maximum 20 to 32 degrees Celsius. In the hottest part of the year (October to November), the mean monthly temperature ranges from a minimum of 24 to 27 degrees Celsius to a maximum of 37 to 41 degrees Celsius. The lowest recorded overnight temperatures are below five degrees Celsius.

Humidity measured at Pine Creek averaged 49% in September 2004 and 79% in February 2005 (Bureau of Meteorology, 2006). Evaporation at Pine Creek is estimated at 2,775 millimetres per year (Bureau of Meteorology, 2003). Average evaporation is therefore more than double the average rainfall.

Air temperatures are relatively high and consistent from year to year. During the coolest time of the year (June to July), the mean monthly temperature for Pine Creek ranges from a minimum of 10 to 13 degrees Celsius to a maximum 20 to 32 degrees Celsius. In the hottest part of the year (October to November) the mean monthly temperature ranges from a minimum of 24 to 27 degrees Celsius to a maximum of 37 to 41 degrees Celsius. The lowest recorded overnight temperatures are below five degrees Celsius.

## 7.2 LANDFORM

Topography of the Mt Porter area ranges from about 150 metres AHD along Frances Creek

Road in the eastern part of the tenement to 292 metres AHD at Mt Porter in the centre of the tenement. The geomorphology and land systems of the Katherine - Darwin region were described and mapped by Christian and Stewart (1946). The Mt Porter mineral lease contains two land systems:

- Brocks Creek Ridge Land System.
- Cullen Land System.

Distribution of the land systems across the project are shown in Figure 5.

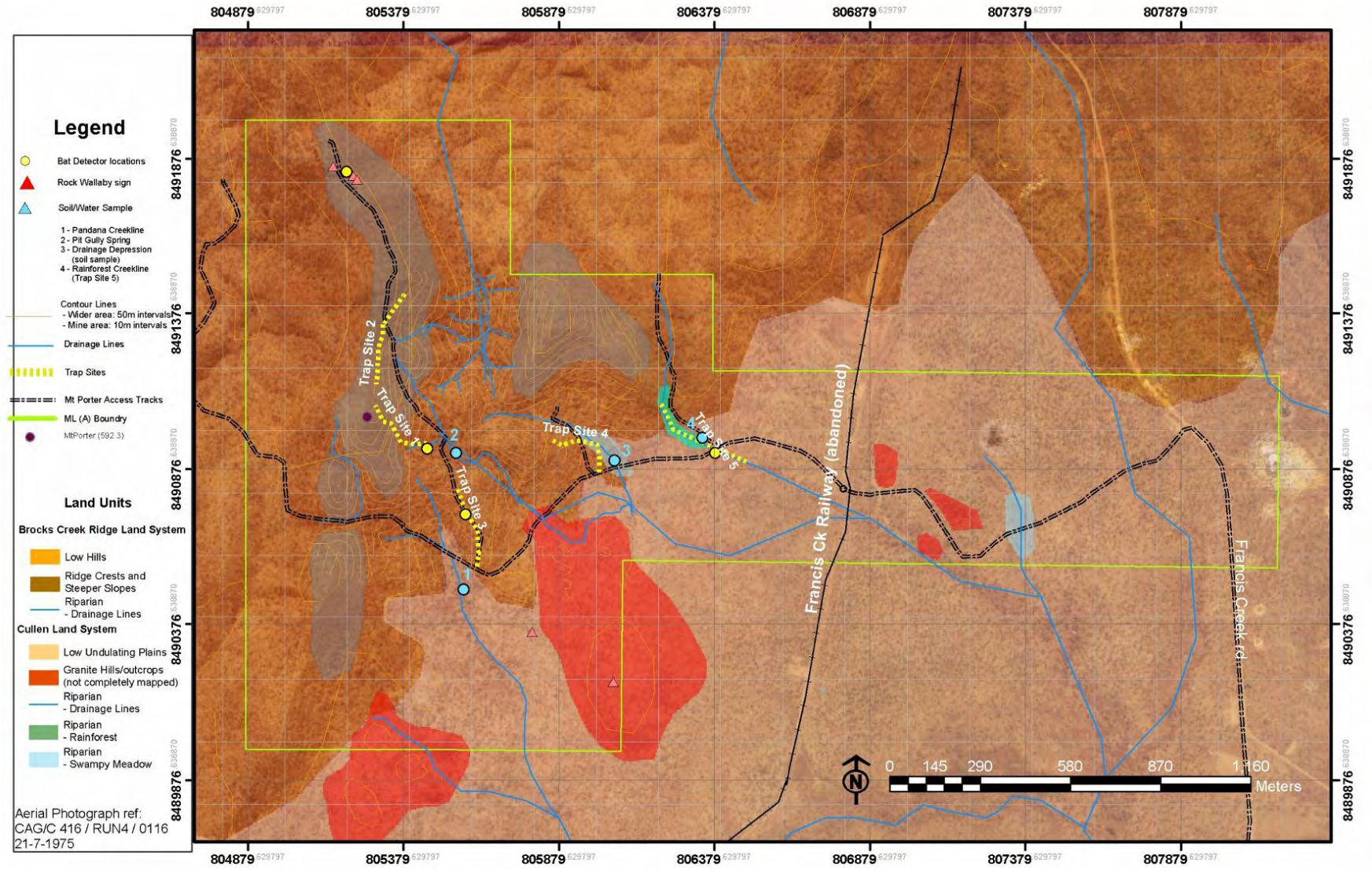
Brocks Creek Ridge is dominant on the west and north side of the lease and Cullen Land System is located on the east and south side of the lease. These two land systems fall into the broader geomorphological unit referred to as Elevated Backbone Country or eroding upland country. The Brocks Creek Ridge Land System is the main land system encountered within the lease area with approximately 80% coverage. The proposed location for the open cut pit lies within the Brocks Creek Ridge Land System. The access road leading into the proposed Mt Porter mine site and the infrastructure location are the only potential disturbance for the Cullen Land System.

The Brocks Creek Ridge Land System is described as consisting of sharp, rocky, north/south ridges, and hills with steep slopes (up to 40 - 60%) to gentle crests that are dissected by watercourses. Erosion is active and there is little or no accumulation of soils on the steep slopes. The system is formed on strongly folded metamorphics of the Brocks Creek Group (i.e. slates, quartzite, sandstone, greywacke and siltstone). The steep rocky ridges are associated with lower convex hills, small alluvial flats and channels incised through sandy or loamy material (Christian and Stewart, 1946).

The Cullen Land System contains topography that varies from rough, rocky granite outcrops to gently undulating country with small areas of flat land. The base rock of this land system is Cullen Granite, which is known to commonly intrude rocks in the Brocks Creek Group from the Brocks Creek Ridge Land System. The granites in the Cullen land system differ in structure and mineral composition and are very resistant to erosion. The relief of the land system is variable. The Cullen Land System, located on the eastern edge of the proposed Mt Porter Gold Project, is part of the largest section of this land system in the region (Christian and Stewart, 1946).

The project area has been subjected to past land disturbance from exploration and pastoral activities, including the development of access tracks and exploration gridlines and drill pads. Disturbance from exploration activities is focused around the area where the open pit will be excavated and where the waste rock stockpile will be constructed.

**Figure 5: Land Unit Distribution in the Mt Porter Area**




(Reproduced from Reilly et al, May 2006)

## 7.3 SOILS

Mainly residual soils have developed over the tenement with some minor alluvial soil occurring within and immediately adjacent to the gullies that drain the project area. Over the hilly country in the western and northern parts of the tenement (metasediment and metadolerite bedrock), the soils are generally skeletal in character. They are only a few centimetres thick on the hilltops, and one to three centimetres thick on the lower parts of the steeper slopes where they are colluvial gravel in character (Arafura Resources NL, 2004).

Soils for the Brocks Creek Ridge Land System generally comprise of very gravelly sandy loam and skeletal soils formed on metamorphics of the Brocks Creek Group (Christian and Stewart, 1946). Alluvial flat areas contain heavier darker soils that obviously contain higher levels of clay and silt, which are described as "Acid" Alluvial soils.

Soils within the steep topography of the Cullen Land System of large rounded granite boulders are described as very gritty, sandy skeletal soils. The undulating country is generally comprised of granitic sandy yellow podsolic soils. Over the flatter granite country in the south-east, residual sandy soils are present. These vary in thickness from a few centimetres around the granite outcrops to several metres in the intervening areas (Arafura Resources NL, 2004).

Soil samples were undertaken by Low Ecological Services. Samples were taken from four sites and analysed for soluble metals (Chart 2) and total metals (Chart 3). The dominant soluble metals were aluminium, calcium, iron, potassium, magnesium, sulfur and silicon. The Swampy Meadow soil sample indicated elevated signs of arsenic, lithium, molybdenum, lead and selenium (all under ANZECC standards, but significantly higher than all other locations).

The principle total metals identified in the soil samples were iron (dominant), manganese, sulfur, arsenic, barium, potassium, lead and zinc. The Swampy Meadow showed elevated readings of manganese, and the Rainforest was significantly higher in sulfur.

Pit Gully spring is immediately downstream from the location of one area of exploration related rehabilitation completed in 1994 and does not show any abnormally high readings of metals. Site layout for the Mt Porter project has been designed to avoid the rainforest area. There are no main drainage lines flowing from the operation area to the Rainforest and it is furthermore expected that Rainforest soils will not be affected by this operation.

Erosion potential of the project area is high during torrential summer rainfall. The areas most at risk of erosion are the skeletal soils on steep terrain and areas with duplex soils when vegetation is disturbed or removed (Low Ecological Services, 2005).

**Chart 2: Soluble Metals in Soils Collected From Four Sites Within the Mt Porter Mineral Lease**

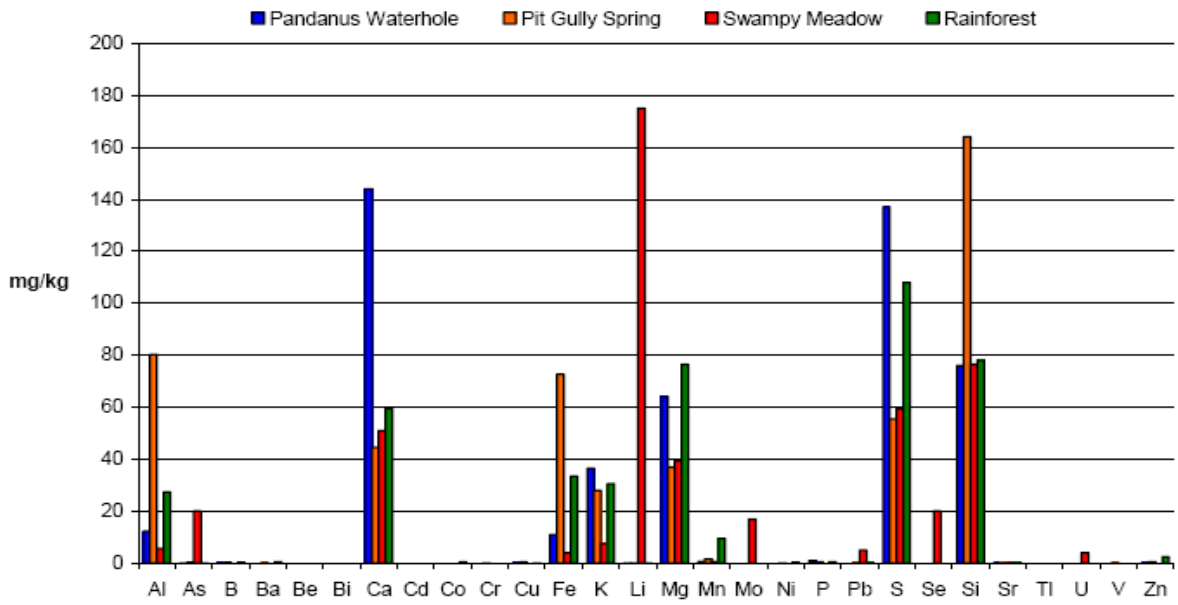
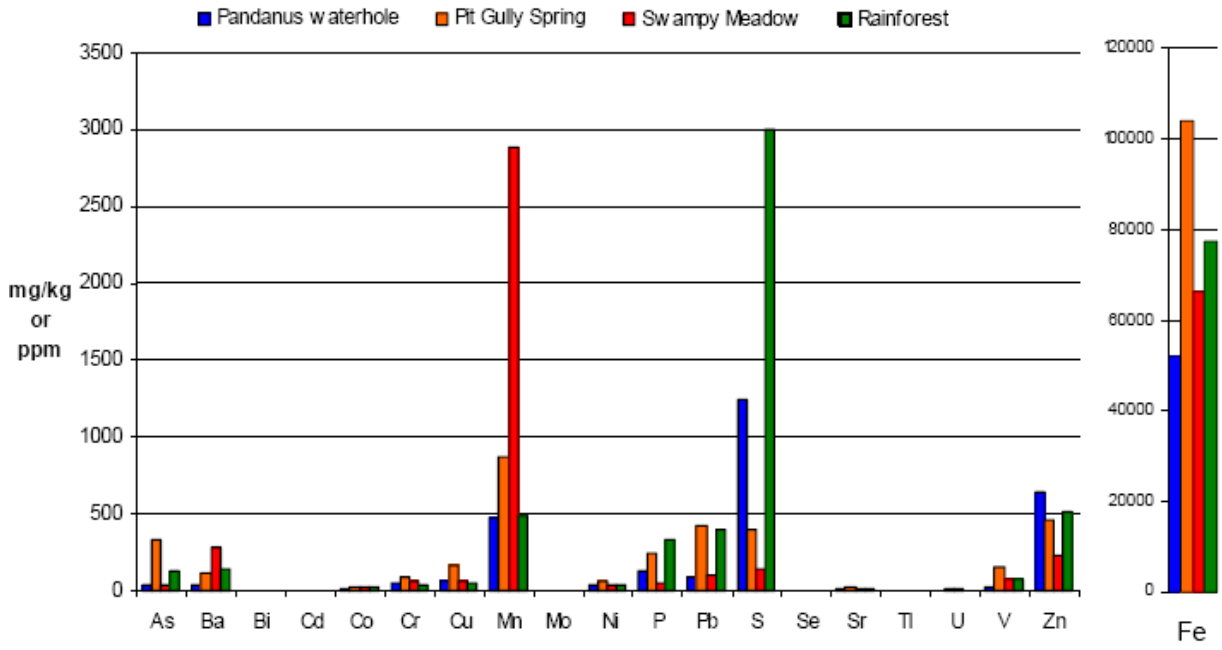



**Chart 3: Total Metals in Soils Collected From Four sites within the Mt Porter Mineral Lease**



# 7.4 GEOLOGY

## 7.4.1 Regional Geology

The Mt Porter gold deposit is located in the Adelaide River-Pine Creek region of the Northern Territory and is hosted by a belt of basement rocks called the Pine Creek Inlier. The Pine Creek Inlier is a province of highly mineralised Archaean and Palaeoproterozoic rocks which extends over a roughly triangular region from near Darwin and Jabiru in the north to Katherine, some 230 kilometres to the south. It contains one of the world's largest and richest uranium provinces and contains about 15% of the world's high grade uranium resources. It is also a significant gold province with well developed infrastructure and services for the mining industry.

The Pine Creek Inlier comprises at least a 10 kilometre thickness of Palaeoproterozoic sedimentary rocks, with minor volcanic intercalations, which rest on a Late Archaean granitic basement. The strata are strongly folded and regionally metamorphosed to low or medium grades, and were intruded by large bodies of granite during and after the period of metamorphism and deformation which is dated at about 1,870 to 1,800 million years ago. The sedimentary rocks were intruded by voluminous basic sills (Zamu Dolerite) prior to the orogenic activity.

In the central part of the Inlier, the Palaeoproterozoic succession comprises, from the base upwards, the Namoona, Mount Partridge, South Alligator and Finniss River groups, but only the South Alligator Group is present at the Mt Porter prospect.

The South Alligator Group has a distinctive threefold division:

- The lower unit is the Koolpin Formation consisting mainly of pyritic and carbonaceous mudstones, with several horizons of ferruginous chert and iron formation in the central part and dolomitic marble units towards the base.
- The Middle unit, the Gerowie Tuff, consists of felsic tuff, tuffaceous cherts and cherty siltstones with thin jaspilite horizons.
- The upper unit, the Mount Bonnie Formation, is of mixed facies, and includes decreasing amounts of sulphidic carbonaceous siltstone-shale with laminated cherts and tuffs, and increasing amounts of greywacke-siltstone-shale of turbiditic origin.

Over the 13 kilometres which separates exposures of Koolpin Formation at the Cosmo Howley and Golden Dyke gold mines, there is good correlation of nine identifiable sub-units of the Middle Koolpin Formation, including five separate iron formations horizons. This subdivision is believed to be useful at least as far east as the Horseshoe Anticline, 10 kilometres west-north-west of Mt Porter, and 20 kilometres from Golden Dyke.

This group is important as the host rocks for a wide variety of mineral occurrences, including stratiform gold mineralisation, epigenetic reef and stockwork gold deposits, and polymetallic massive sulphide deposits. Orebodies at Cosmo Howley, Mount Bonnie (gold/base metals), Golden Dyke (gold ) and Pine Creek are wholly or partly in rocks of this group.

Sills of Zamu Dolerite intrude the South Alligator Group. Three or more sills of considerable thickness (20-150 metres) are of such lateral extent that they effectively constitute regional

markers in the stratigraphic sequence. In a more local context they are sometimes slightly discordant to the enveloping sedimentary sequences.

In the central parts of the Inlier the strata are moderately to tightly folded in a first phase of upright folds about north north-west to north-south axis. In some areas a second phase of gentle easterly upright folds has produced local doming and fold plunge reversals. Major faulting and zones of shearing on north-north-west and northeast trends accompanied and post-dated the main folding, and are important in localising mineralisation.

Gold mineralisation in the Pine Creek Inlier is essentially of three types:

- In the Koolpin Formation stratiform gold mineralisation adjacent to faults and fractures is hosted by iron formation and carbonaceous mudstone (eg. Cosmo Howley, Golden Dyke, Mt Porter).
- In the Mt Bonnie Formation, gold is associated with stratiform massive to banded sulphide-silicate-carbonate mineralisation (eg. Iron Blow, Mount Bonnie).
- In the Mt Bonnie Formation, and to a lesser extent in the underlying Gerowie Tuff and overlying Burrell Creek Formation, gold occurs in sulphidic quartz veins along anticlinal hinge lines (eg. Enterprise/Gandy's Hill/International, Union Reefs, Woolwonga, Goodall, Rustlers Roost, Spring Hill and possibly Moline) especially where there is a strong carbonaceous or sulphide component in the host sequence or where there are marked competency differences between successive layers.

### 7.4.2 Site Geology

The metasedimentary rocks present in the Mt Porter project area belong to the Koolpin Formation of the South Alligator Group. Broadly, the Koolpin Formation is characterised by carbonaceous shales, but in the Middle Koolpin Formation, chloritic sulphidic laminated cherty "shales", with prominently developed chert nodules, ubiquitously present. These cherty units are widely regarded to be silicate facies banded iron formations (BIF).

Due to perceived structural complexity, a lack of exposure and only a limited amount of drill core, the Koolpin Formation stratigraphy at Mt Porter has not yet been fully defined though it does appear that at least two or three BIF horizons separated by carbonaceous mudstone units are present in the middle of the Koolpin Formation. Distinct dolomitic marble units are present towards the base of the unit.

The mineralised Middle Koolpin Formation appears to be 35-40 metres thick on the limbs of the Mt Porter Anticline but possibly (structurally) thicker in the crest of the anticline.

At least three dolerite sills (metadolerite/amphibolite) have been identified within the Koolpin Formation at Mt Porter. The thickest of these (70-80 metres) intrudes the sulphidic carbonaceous mudstone unit (which locally comprises the bulk of the Upper Koolpin Formation) about 20-30 metres above the uppermost BIF layer of the Middle Koolpin Formation. A thinner dolerite sill (10-20 metres) occurs higher in the carbonaceous mudstone of the Upper Koolpin Formation. Another thin dolerite sill (20-30 metres) occurs below the uppermost dolomitic marble layer in the Lower Koolpin Formation.

Thin (0.5-3 metres thick) fine-grained felsic and/or mafic dykes also intrude the mineralised

sequence at Mt Porter. These appear to post-date most of the structural development of the area. Some are definitely cut by auriferous massive sulphide veins but generally these dykes are not otherwise mineralised.

The primary structure through the Mt Porter prospect is the Mt Porter Anticline, which is a prominent and persistent north north west plunging regional structure. The Mt Porter Anticline appears to have many features, which characterise other major fold structures in the Pine Creek Geosyncline:

- Steeply dipping to slightly overturned but generally regular limbs.
- Complex axial zones, commonly with at least two separate antiform folds.
- Thickening of incompetent units, especially carbonaceous shale, in the axial zone, and disruption of competent units.
- Complex fault zones, frequently intruded by late basic or lamprophyric dykes and/or associated quartz veining and stock works.
- Evidence of massive brecciation and mineralisation.

An idealised section through the main mineralised zone is shown in Figure 4.

At the 10400N Zone most of the mineralisation intersected to date occurs in a complex synformal zone marginal to and west of the main axis of the Mt Porter Anticline bounded by major axial plane faults. Additionally, the 10400 Zone is bounded by major faults – a north east trending structure to the southeast, and an east south east trending structure to the north. A major structure may also be present along the western side of the zone though this has not been reliably established.

The Allamber Springs Granite that is a phase of the Cullen Batholith intrudes the Mt Porter Anticline and mineralised metasediment sequence. The north east trending granite contact traverses the southeast portion of the tenement and, on the basis of a drill intersection 500 metres east of the 10400 Zone, dips to the north west at about 40-45º.

### 7.4.3 Waste Rock Characterisation

In 2005, Arafura commissioned MBS Environmental to conduct an investigation into the chemical composition of waste rock likely to be generated by the project. This investigation added to the information obtained from an earlier study completed by Environmental Geochemistry International (EGI) in 1998 where 17 samples of material from the ore zone were tested. A copy of the MBS Environmental investigation is contained in Appendix 3.

Arafura collected a further 35 samples for analysis, all of which were from waste horizons as defined in the current mine design. Results of the investigation showed that:

- The 35 samples could be classified into four ARD groups:
  - Twenty-one samples classified as Non Acid Forming (NAF).
  - Nine samples classified as Potentially Acid Forming (PAF) PAF-Low Capacity (<five kilograms of $H_2SO_4$ per tonne).
  - Two samples classified as PAF (with 35 and 88 kilograms $H_2SO_4$/ per tonne respectively).

  - Three samples classified as PAF-High Capacity, all with greater than 150 kilograms of $H_2SO_4$/ per tonne. This was predominantly from the fresh rock at the base of the pit and will form a very small portion of the waste material.

- The percentage content of significantly PAF material appears small and all contain carbonaceous siltstone-BIF with visible sulphides. Because of the high free carbon content, the Eh value within waste rock stockpile of the PAF material should be extremely low and non-oxidising, thus minimising sulphide oxidation and the potential for acid generation.
- Due to the black coloration of the PAF material, it is likely that it will be relatively easily recognisable.

## 7.5 GROUNDWATER

### 7.5.1 Regional Hydrogeology

The complex stratigraphic and structural geology results in a rather complex hydrogeological environment. Aquifer characteristics show extreme variation according to lithology, tectonic hiatus, and geomorphological history.

Peneplanation, deep chemical weathering (including the production of the ironstones), weathering (to produce laterite profiles in the Cretaceous mesas), sheet wash (in the Tertiary) and cyclic erosional and aggradational episodes (in the Quaternary) are the geomorphological agents of the area's more recent geological history that may have had an influence on the regional hydrogeology.

Dames and Moore (1989) produced a hydrogeological map covering parts of the 1:250,000 topographic sheets Pine Creek SD52-08, Mt Evelyn SD53-05, Katherine SD53-09, and Fergusson River SD52-12. Mining company water supply and dewatering investigations provided much of the information on the groundwater resource exploration and development to produce this map.

Dames &Moore, (1989) state that "Reliable groundwater sources are difficult to locate in the fractured Proterozoic rocks of the Pine Creek Geosyncline". The fractured and karstic rock (limestone) extensive and prolific aquifers of the Daly Basin are too far either to be impacted upon or be considered as an economic source for water supply.

Typically airlift yields are rarely sustainable in this geological environment as with prolonged pumping the enlarging cone of drawdown intersects less permeable zones and as the more permeable zones dewater, the rate of flow at the bore is not sustained. Bore yield reduction is reported toward the end of the dry season.

Seasonal water table (standing water level or 'SWL') fluctuations in bores often exceed five metres so, in the absence of rainfall recharge the saturated aquifer thickness is said to considerably reduced (Dames & Moore, 1989).

In terms of groundwater flow systems, the study area is believed to contain many "local scale" flow systems driven by topography and recharge/discharge processes.

### 7.5.2 Groundwater Quality

Regionally, the groundwater is typically of low salinity with high levels of bicarbonate and a pH that is slightly acid to slightly alkaline. The fractured aquifers of the study area are characterized by groundwater that rarely exceeds a salinity of 700 milligrams per litre, is high in bicarbonate and contains the cations calcium, magnesium and sodium in proportions tending to be highest in magnesium.

### 7.5.3 Local Hydrogeology

In November 2006, Arafura commissioned SKM to conduct a hydrological study of the Mt Porter project area. The following is a summary of the full report presented in Appendix 4.

All of the current groundwater users in the Mt Porter area are believed to be beyond the range of any physical impacts likely to occur because of dewatering.

Minimal groundwater inflow is anticipated in the upper levels of the open pit. The standing water level in a water bore 300 metres south of the pit is at 190 to 195 metres AHD. This is 30 to 35 metres above the designed pit floor. The standing water level identified within the open pit (SKM 2006) is anticipated to be only small capacity aquifers (localised perched water tables). The exploration drilling of these holes did not encounter water production in sufficient quantities to inhibit drilling.

Limited information is known about the occurrence of groundwater at the site with no detailed groundwater investigations having been conducted in the area to date. Review of the Northern Territory Government Groundwater Database identified that a number of boreholes occur within the region, but not in close proximity to the mineral lease. Due to the complex nature of the geology and structure of the region, limited connectivity between aquifer systems is believed to exist, thus information from these bores is thought to be of limited use.

Potential groundwater systems inferred from geological interpretations, drill cores and discussion with personnel from Arafura Resources (Goulevitch pers comm, 2006) include:

- The dominate aquifer system within the proposed mining area is considered to be the meta-sediments of the Koolpin Formation. Permeability in this unit is largely secondary related to fractures, weathering and to a lesser extent, bedding. This unit, as evident from core descriptions, is moderately to highly fractured. Fracture density is believed to varying with depth (decreasing with depth) and proximity to fault zones (increasing closer to faults) across the site, suggesting yields may also decrease relative to these structures.
- The Zamu Dolerite sills form low flow boundaries throughout the site, with groundwater seeps (springs) occurring at the contact between these intrusive units and the Koolpin meta-sediments. Whilst these concordant sills have a low porosity, they are not believed to be impermeable, with spring formation the result of a difference in hydraulic conductivity resulting in a proportion of groundwater flow discharging to the ground surface. Permeability within these intrusive igneous units would once again be secondary related to fractures and joint sets.

Water levels within the proposed pit area have been measured in inclined diamond drill holes (MBDH247 and MBDH 243) drilled during exploration programs. Water levels have been

corrected for drilling angle to obtain vertical depths to the water. The depths were calculated to be:

- MBDH247: 13 metres below ground level (209.5m AHD).
- MBDH243: 10.8 metres below ground level (210.8m AHD).

A water level measurement and water sample were taken from an unnamed bore south of the exploration lease. This bore is believed to be an old production bore used for water supply on previous drilling programs in the area. It is unregistered and limited information is known about its construction and geology.

Comparisons of water level measurements between the unnamed bore and those within the proposed pit area show a 20 metre difference in water level over 265 metre (hydraulic gradient = 0.076metres). This value is extremely high and indicates that the presence of a large fault system may act as the barrier to groundwater flow and connectivity between the sites.

Airlift measurements were made for the unnamed bore with a discharge rate of three litres per second, with a field pH of 6.26 and electronic conductivity of 341 microsiemens per centimetre (approximately 240 milligrams per litre). This would equate to approximately four to six litres per second if the bore was to be pumped, but no indication of sustainable long term yield is available. Although there is limited to no connectivity between the aquifer at the unnamed bore site and that within the pit, the geological setting is comparable, which may suggest yields encountered at this bore may be similar to those expected within the proposed pit.

Pumping at a sustainable yield of six litres per second produces approximately 500 kilolitres per day. It is anticipated that water use on site for dust suppression, office, workshop and ablutions would at least equal this quantity.

## 7.6 SURFACE WATER

MBS Environmental were commissioned to prepared a surface hydrology study report of the project area. This is provided in Appendix 5 and provides additional information to the following.

### 7.6.1 Catchment Description

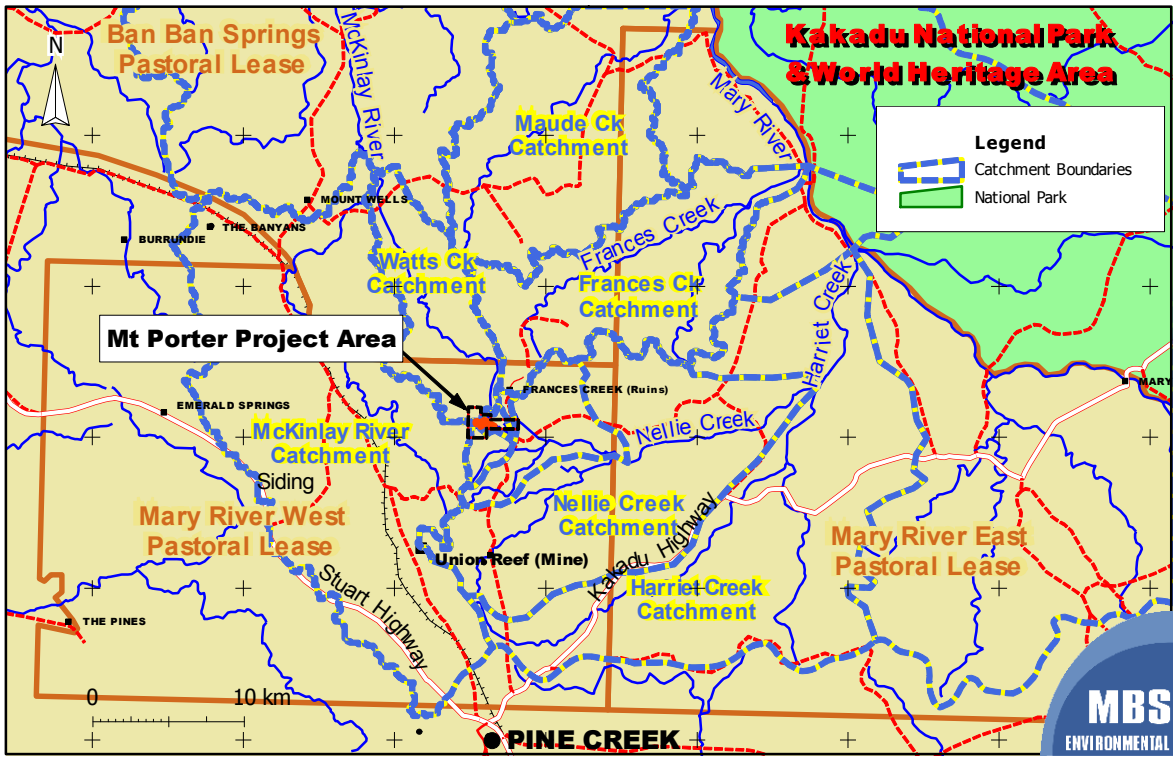
The proposed Mt Porter Gold Project lies in the upper catchments of the Mary River Basin. The Mary River catchment covers an area of 8,000 square kilometres, draining north west into the ocean at Van Diemen Gulf, about 100 kilometres east of Darwin (Figure 1). Approximately 1,300 square kilometres of the catchment is upstream of the confluence of Harriet Creek and Mary River. The upper catchment of Mary River is defined as that upstream of its major tributary, the McKinlay River, which joins Mary River about 100 kilometres from the ocean. The upper Mary River catchment is characterised by channel flow, while the lower catchment is dominated by sheet flow, with large areas of floodplain seasonally inundated, during the wet season, receding to a series of large pools of permanent water “Billabongs” in the dry season.

Figure 6 shows the local catchments surrounding the Project Area. All planned development at Mt Porter is within the Nellie Creek catchment which drains east over 25 kilometres to Harriet Creek, which drains into Mary River 10 kilometres downstream of the confluence. Parts of the mineral lease outside the planned operations extend into the McKinlay River catchment to the west and Watts Creek to the north. Watts Creek drains north over 20 to 30 kilometres to the McKinlay River, which is the largest tributary of the Mary River.

Drainage within the project area consists of several ephemeral gullies which drain to the south and south east toward Nellie Creek.

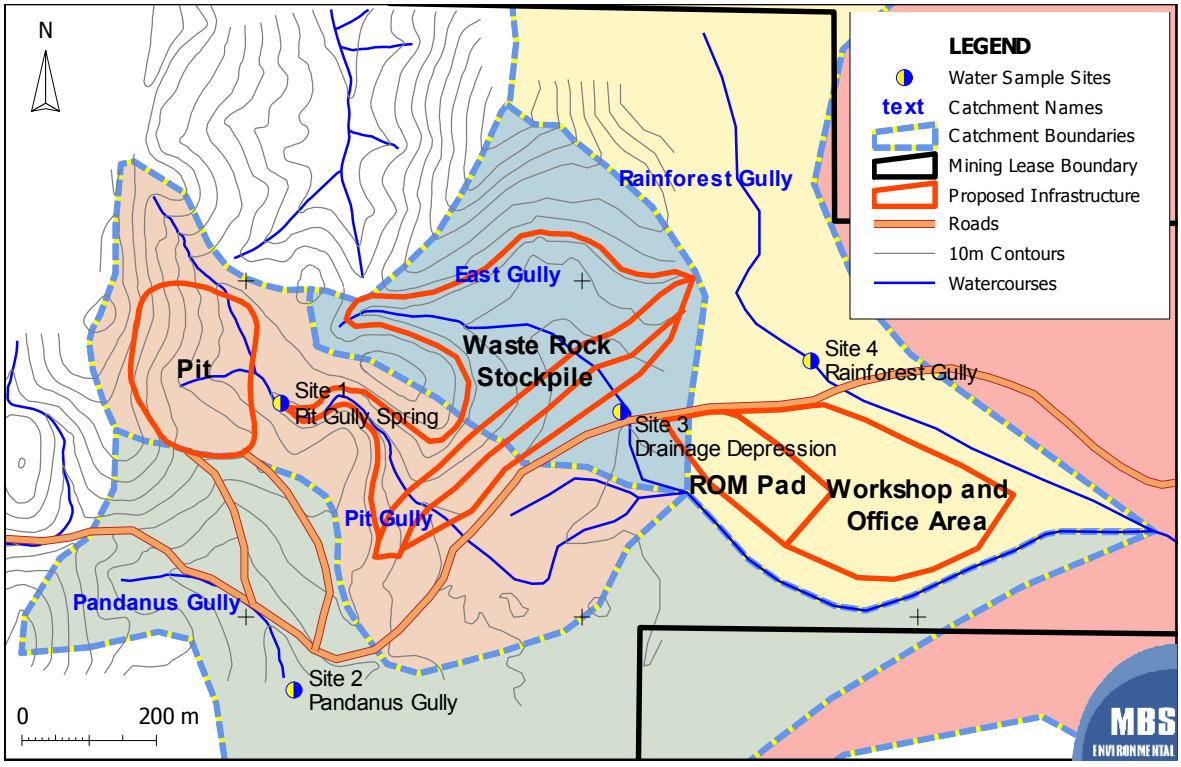
During the wet season relatively large volumes of water flow through the creeks and drainage gullies. Flow ceases in the mid dry season with water remaining in a few pools that act as refuge for freshwater fish, reptiles, amphibians and macro invertebrates. Water in some of these pools appears is maintained well into the dry season by groundwater seepages or small springs.

**Figure 6: Local Water Catchments Surrounding the Mt Porter Project Area**




The open pit and associated waste rock stockpile will be located on the side of a ridge and within a gully system comprising of East Gully and Pit Gully as shown in Figure 7. Surface runoff from the pit area and waste rock stockpile will drain naturally to this gully system. The gully system drains to Nellie Creek.

**Figure 7: Site Catchments and Sample Locations**




## 7.6.2 Downstream Water Users

Three main Beneficial Uses of surface water in the Mary River catchment, have been declared under Beneficial Uses legislation under the *NT Water Act (1992)*. These are:

- Cultural (including aesthetic and recreational).
- Environmental (the maintenance of healthy aquatic ecosystems).
- Riparian use (public rights to extract water for domestic/stock purposes).

These uses are the basis for waste discharge licences and water quality planning - potential waste discharge or water extraction which detrimentally impacts on these Beneficial Uses will not be permitted under the *Water Act*.

There are no townships within the Mary River Catchment, and the resident population was estimated at less than 200 in 2002 (Armstrong *et al*, 2002). The main uses within the project area are environmental. The area is not currently used for grazing, but as it is part of Mary River West Pastoral lease there is potential for riparian use for stock purposes.

Immediately downstream of the project area, Nellie Creek passes through Mary River West and Mary River East Pastoral Leases. The major uses in these leases are also environmental and riparian for stock use. Nellie Creek joins the Mary River via Harriet Creek six kilometres upstream of Mary River Station and Mary River Roadhouse. This is the nearest residence downstream of the project area.

The Mary River forms a portion of the boundary of Kakadu National Park where Harriet Creek joins it, about 35 kilometres downstream of the project area. The Kakadu National Park

diverges from the Mary River about 46 kilometres further downstream, and Mary River does not flow into the park, so there is minimal use of Mary River water in Kakadu. Mary River National Park covers the majority of the Mary River downstream of Kakadu. The final 40 kilometres before the ocean includes some pastoral and leasehold land. Fishing and boating are promoted as major recreational attractions of the National Park so recreation use as well as environmental use is significant in Mary River National Park.

### 7.6.3 Average and Flood Flows

Watercourses in the project area are ephemeral and cease to flow during the dry season, but have consistent flow during the wet season. Several shallow semi-permanent pools are present due to shallow groundwater seepages or springs, but these pools are very localised, with no streamflow between them in the dry season.

Three streamflow gauging stations are located within 20 kilometres of the project area. These are McKinlay River near Burrundie (G8180069), Frances Creek (G8180167) and Harriet Creek at downstream El Sherana Road (G8180252). Details of these stations are in Table 5 (data supplied by NT Water Resources). The Frances Creek station is closest, but only operated from 1961 to 1967 and a reliable rating curve is not available to translate the level measurements to flow measurements.

**Table 5: Stream Gauging Data Summary**

| Site | Distance (km) | Start Year | End Year | Period (Years) | Catchment Area ($km^2$) | Bad Records | Easting | Northing |
|---|---|---|---|---|---|---|---|---|
| **G8180069** McKinlay River near Burrundie | 16 | 1957 | 2005 | 48 | 352 | 12.4% | 794186 | 8502406 |
| **G8180167** Frances Creek, Upstream Frances Creek Mine | 6 | 1961 | 1967 | 6 | 7* | 76.6% | 278309 | 8497580 |
| **G8180252** Harriet Creek, Downstream El Sherana Road | 18 | 1965 | 2005 | 40 | 122 | 40.3% | 823159 | 8486119 |

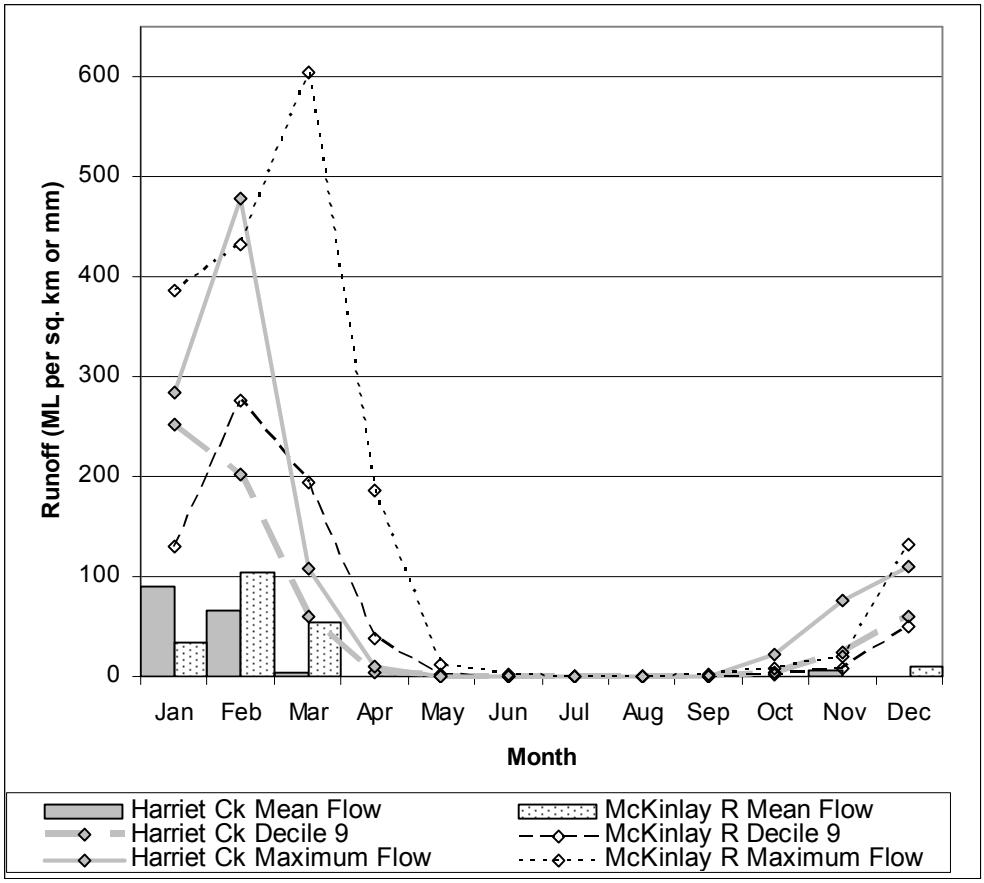
* Estimated catchment area, no record of precise site location could be found.

Chart 4 shows flow statistics per square kilometre for the McKinlay River (Burrundie, G8180069) and Harriet Creek (El Sherana, G8180252) gauging stations. The units are megalitres per square kilometre, which are equivalent to millimetres of rainfall runoff. The statistics shown include mean, maximum, and decile 9 monthly flows. Decile 9 flows are equivalent to 90th percentile, and can be interpreted as the flow which is exceeded on average only once in ten years.

It can be seen from Chart 4 that very little runoff occurs between May and September. Runoff is consistently high in January and February in Harriet Creek and from January to March in the larger McKinlay Catchment. Substantial runoff events have also occurred in the months of October, November, March and April. The highest recorded flow on McKinlay River occurred in the month of March. Since this data was extracted a late cyclone in April 2006 created very high April flows in the district.

The records available for Frances Creek, the nearest monitoring station to Mt Porter, indicate a closer match with the McKinlay River catchment, as Frances Creek flows regularly extend into April and May. This is most likely due to the higher rainfall in the Frances Creek/Mt Porter area compared to Harriet Creek.

**Chart 4: Mean, Decile 9 and Maximum Monthly Runoff per square kilometre of Catchment for Harriet Creek (downstream El Sherana Road) and McKinlay River (Burrundie) Catchments.**




## 7.6.4 Regional Water Quality

Table 6 presents a summary of water quality information for the Mary River catchment extracted from the report "Water Quality of the Rivers and Streams of the Mary River Catchment (N.T.) (Schultz et al, 2002). It should be noted that this report includes data from several monitoring sites downstream of active mines, towns and agriculture, so does not represent only natural background water quality.

Water quality is compared to the ANZECC (2000) trigger values for protection of aquatic ecosystems (referred to as ANZECC trigger values in this section). These values are not intended by ANZECC to be used as a threshold value at which an environmental impact is inferred if exceeded. They are designed to be used with professional judgement as an initial assessment of potential risk. Exceeding trigger values should initiate further site specific investigation.

**Table 6: Water Quality Characteristics of 40 sites in the Mary River Catchment**

| Element | Units | Number of Sites | Median | Range | 10th Percentile | 90th Percentile | ANZECC Trigger |
|---|---|---|---|---|---|---|---|
| pH | | 40 | 6.3 | 6.1 - 7.8 | 6.2 | 6.8 | 6.0-7.5 |
| EC(2000) | µS/cm | 40 | 53 | 12 - 342 | 32 | 119 | 20-250 |
| Nitrate & Nitrite | mg/L | 35 | <0.001 | <0.001-0.006 | <0.001 | 0.004 | 0.030 |
| $NH_3$ Nitrogen | mg/L | 40 | <0.01 | <0.01-0.02 | <0.01 | 0.01 | na |
| Total Kjeldahl Nitrogen | mg/L | 40 | 0.06 | 0.03 - 0.32 | 0.03 | 0.12 | na |
| Total Nitrogen | mg/L | 35 | 0.06 | <0.03 - 0.32 | 0.03 | 0.13 | 0.15 |
| Total Phosphorus | mg/L | 40 | 0.007 | 0.004-0.013 | 0.005 | 0.011 | 0.01 |
| Filterable Reactive Phosphorus | mg/L | 35 | 0.001 | <0.001-0.009 | <0.001 | 0.003 | 0.005 |
| Turbidity | NTU | 40 | 5.7 | 0.7 - 15.0 | 3.8 | 13 | 2 - 15 |
| Total Suspended Particulates | mg/L | 40 | 1.95 | 0.40 - 8.76 | 0.85 | 4.46 | na |

Table 6 shows that the catchment in general has slightly low pH compared with relevant ANZECC (2000) default trigger values. The electrical conductivity is towards the upper end of the ANZECC trigger value range. Other studies confirm the upper Mary River catchment has elevated conductivity compared with the upper Katherine and East Alligator Rivers, (which have electrical conductivities of 38 and 22 micro siemens per centimetre respectively), but is low in comparison to other rivers in the top end of the NT such as the Daly and Roper Rivers (conductivities of approximately 600 and 1,000 microsiemens per centimetre respectively). The higher conductivity is likely to be due to different geology (Schultz et al, 2002). Nutrients (nitrogen and phosphorous) are low, generally below ANZECC (2000) trigger values. Turbidity is within the range of ANZECC (2000) trigger values.

Table 7 presents a summary of metal concentrations for the Mary River catchment extracted from the report *"Water Quality of the Rivers and Streams of the Mary River Catchment (N.T.)* (Schultz et al, 2002). Water samples were taken from 42 sites and a second sampling taken at five sites for a total of 47 samples. ANZECC (2000) specifies several levels of trigger values for toxicants. The values used for comparison in this report are the recommended level for slightly to moderately disturbed ecosystems, which in most cases are those estimated to protect 95% of species.

**Table 7: Metal Concentrations (μg/L) at 42 sites in the Mary River Catchment**

| Element | % of Sites with Measurable Concentrations | Median | Range | 10th Percentile | 90th Percentile | ANZECC Trigger |
|---|---|---|---|---|---|---|
| Aluminium | 96 | **60** | <5-**260** | 12.6 | 150 | 55 |
| Arsenic | 55 | 1 | <1-18 | <1 | 3.32 | 24 (AsIII) |
| Cadmium | 6 | <1 | <1-**3** | <1 | <1 | 0.2 |
| Cobalt | 4 | <1 | <1-5.9 | <1 | <1 | - |
| Chromium | 0 | <1 | <1-<1 | <1 | <1 | 1 |
| Copper | 11 | <1 | <1-**12** | <1 | 0.44 | 1.4 |
| Iron | 100 | 620 | 44-1200 | 186 | 954 | - |
| Magnesium | 100 | 2700 | 460-17,000 | 1048 | 8100 | - |
| Manganese | 100 | 27 | 3.8-390 | 9.6 | 119.4 | 1900 |
| Molybdenum | 2 | <1 | <1-15 | <1 | <1 | - |
| Nickel | 30 | <1 | <1-**16** | <1 | 4.62 | 11 |
| Lead | 0 | <1 | <1-<1 | <1 | <1 | 3.4 |
| Selenium | 0 | <1 | <1-<1 | <1 | <1 | - |
| Uranium | 2 | <1 | <1-1.3 | <1 | <1 | - |
| Vanadium | 2 | <1 | <1-1.2 | <1 | <1 | - |
| Zinc | 60 | 1.6 | <1-**200** | <1 | **84.8** | 8 |

Note: Bold text indicates values exceeding ANZECC 2000 trigger values.

It can be seen from Table 7 that median aluminium concentration is above the ANZECC trigger value. The median concentrations of all other metals analysed are below trigger values, but at least one sample exceeded the ANZECC trigger values for each of cadmium, copper, nickel and zinc.

Further analysis focusing on upper tributaries within the Pine Creek geosyncline indicates significant concentrations of metals in runoff from these areas, which include the Frances Creek catchment.

Widespread high concentrations of aluminium suggest that biota in the area has had an extended period to adapt to high aluminium concentrations (Schultz et al, 2002). The ANZECC trigger values are therefore likely to be too conservative to be applied to protect ecosystems in the Mary River catchment.

### 7.6.5 Project Area Water Quality

Surface water samples were taken within the project area in June 2006, April 2005 and May 2004. The samples taken in April 2005 were collected in pre-acidified bottles and not filtered. This resulted in excessively high values being recorded for a number of elements, particularly aluminium and iron. The samples taken in June 2006 were collected in plain bottles, filtered at the laboratory, and acidified after filtering where necessary for analysis. The unfiltered results are not applicable to the relevant ANZECC guidelines, but may give an indication of

potential problem areas. The May 2004 sample was taken in a non-acidified bottle and was not filtered before analysis.

Most watercourses had ceased to flow at the time of sampling so samples were only collected from locations with more permanent flows related to groundwater. Four sampling sites were chosen as shown in Figure 7 and described below:

1. Pit Gully spring.
2. Pandanus Gully watercourse.
3. East Gully drainage depression.
4. Rainforest Gully watercourse.

No water was present at Site 3, so no sample was collected. All samples were collected between April and June, which is early dry season. The May 2005 sample was taken from pit gully (Site 1) after recent rainfall so could be a mix of surface runoff and groundwater spring flow. The full water analysis results are included in Appendix 6.

Table 8 summarises the notable results for the filtered samples collected in 2006 and shows relevant water quality guidelines.

In both samples the pH is neutral, the water is fresh with a moderate electrical conductivity for the area. Nitrate and nitrite levels are low. The only elements analysed to exceed guidelines are phosphorus, thallium at site1 and zinc at Site 4, which were slightly in excess of aquatic ecosystem trigger values. Zinc was well within both livestock and drinking water guidelines. Arsenic was close to the aquatic ecosystems trigger value at Site 1.

**Table 8: Surface Water Quality - Mt Porter Filtered Samples 20 June 2006**

| Element | Units | Method | ANZECC Drinking Water Guidelines | ANZECC Aquatic Ecosystems 95% Trigger | ANZECC Livestock Trigger | Site 1 Spring Below Pit | Site 4 Rainforest Creekline |
|---|---|---|---|---|---|---|---|
| EC | µS/cm | ALK1 | | 20-250 | - | 220 | 242 |
| pH | - | ALK1 | 6.5 - 8.5 | 6.0-7.5 | - | 7.2 | 6.7 |
| Turbidity | NTU | | - | 2-15 | - | 3 | <1 |
| Nitrate & Nitrite | mg/L | FIA_4 | 50 | 0.030 | 400 | 0.010 | 0.015 |
| $NH_3$ Nitrogen | mg/L | FIA | (50) | None | (430) | 0.01 | <0.005 |
| $PO_4$ Phosphorus | mg/L | FIA_4 | | 0.01* | | **0.02** | **0.02** |
| Aluminium | µg/L | W100M | (200) | 55 | 5000 | 14.90 | 2.00 |
| Arsenic | µg/L | W100M | 7 | 24 | 500 | 5.40 | 1.65 |
| Cadmium | µg/L | W100M | 2 | 0.2 | 10 | 0.02 | 0.10 |
| Cobalt | µg/L | W100M | None | 1.4 L | 1000 | 0.430 | 0.380 |
| Chromium | µg/L | W100M | 50 | 3.3 L | 1000 | <0.1 | <0.1 |
| Copper | µg/L | W100M | 2000 | 1.4 | 500 | 0.82 | 0.55 |
| Iron | µg/L | W100M | (300) | - | None | 20.0 | 40.0 |
| Manganese | µg/L | W100M | 500 | 1900 | None | 59.0 | 51.2 |
| Nickel | µg/L | W100M | 20 | 11 | 1000 | 1.35 | 1.76 |
| Lead | µg/L | W100M | 10 | 3.4 | 100 | 0.05 | 0.67 |
| Sulphate | mg/L | W108I | 500 | - | 1000 | 18.3 | 12.6 |
| Thallium | µg/L | W100M | None | 0.03 L | None | **0.05** | 0.02 |
| Uranium | µg/L | W100M | 20 | 0.5 L | 200 | 0.36 | 0.22 |
| Zinc | µg/L | W100M | (3000) | 8 | 20000 | 3.200 | **20.6** |

*guideline for total phosphorus

Guidelines in brackets are aesthetic, not health values.

L indicates low reliability values for metals and radicals

Numbers in **bold** indicate values exceeding ANZECC trigger values for aquatic ecosystems.

Table 9 summarises the results of the water quality analysis of samples taken in April 2005. As these samples were unfiltered the totals include significant amounts of elements which are not bio-available and the trigger values shown in Table 7 cannot be applied directly to most of these results. The electrical conductivity is somewhat higher than in the 2006 samples at Sites 1 and 4. This may be attributable to very heavy late wet season rainfall in May 2006. The pH is also slightly higher, at Site 1 it is very slightly outside the range of the aquatic ecosystem trigger values, but still near neutral and within the range of observed values at other sites in the Mary River catchment (Table 6).

**Table 9: Surface Water Quality - Mt Porter Unfiltered Samples 19 April 2005**

| Element | Units | Method | Site 1 Spring Below Pit | Site 2 Pandanus Watercourse | Site 4 Rainforest Watercourse |
|---|---|---|---|---|---|
| EC | µS/cm | ALK1 | 330 | 387 | 262 |
| pH | - | ALK1 | 7.6 | 7.3 | 6.6 |
| Nitrate & Nitrite | mg/L | FIA_3 | 0.285 | <0.005 | 0.060 |
| $NH_3$ Nitrogen | mg/L | FIA | <0.005 | 0.87 | 0.09 |
| Aluminium | µg/L | W200I | 20800 | 21000 | 160 |
| Arsenic | µg/L | W200M | 88.5 | 152.0 | 98.5 |
| Cadmium | µg/L | W200M | 1.10 | 1.54 | 0.12 |
| Cobalt | µg/L | W200I | 25 | 25 | 10 |
| Chromium | µg/L | W200I | 60 | 40 | <20 |
| Copper | µg/L | W200I | 90 | 50 | <5 |
| Iron | µg/L | W200I | 51500 | 56500 | 21500 |
| Manganese | µg/L | W200I | - | 3440 | - |
| Nickel | µg/L | W200I | 50 | 40 | <10 |
| Lead | µg/L | W200M | 375.00 | 133.00 | 4.33 |
| Sulphate | mg/L | W100I | 7 | 14.8 | 66.5 |
| Thallium | µg/L | W200M | 0.67 | 0.7 | 0.06 |
| Uranium | µg/L | W200M | 2.81 | 4.05 | 0.14 |
| Zinc | µg/L | W200I | 580.000 | 555.000 | 105.000 |

Table 10 summarises the results of the water quality analysis of the single sample taken from pit gully following rainfall in May 2004. As this sample was unfiltered, the total may include significant amounts of elements which are not bio-available and the trigger values shown in Table 7 cannot be applied directly to most of these results. The electrical conductivity and pH are very similar to the June 2006 samples. It appears that the effect of not filtering is much reduced in this sample compared to the dry season samples. Aluminium is much lower than the May 2005 samples, and closer to the filtered values from June 2006. Zinc and thallium concentrations are also very similar to the June 2006 samples and just in excess of aquatic ecosystem trigger values.

**Table 10: Surface Water Quality - Mt Porter Unfiltered Samples 2005 Early Wet Season**

| Element | Units | Method | Site 1 Pit Gully, flowing. |
|---|---|---|---|
| EC | µS/cm | ALK1 | 248 |
| pH | - | ALK1 | 7.1 |
| Aluminium | µg/L | W200M | 24.8 |
| Arsenic | µg/L | W200M | 3.35 |
| Cadmium | µg/L | W200M | 0.02 |
| Cobalt | µg/L | W200M | 0.1700 |
| Chromium | µg/L | W200M | 0.6 |
| Copper | µg/L | W200M | 57.5 |
| Iron | µg/L | W200M | 60 |
| Manganese | µg/L | W200M | 29.3 |
| Nickel | µg/L | W200M | 1.07 |
| Lead | µg/L | W200M | 0.3 |
| Thallium | µg/L | W200M | 0.05 |
| Uranium | µg/L | W200M | 1.97 |
| Zinc | µg/L | W200M | 8.6 |

Overall data from the natural waters indicate that prior to any mining taking place, the 'background' water available to flora and fauna populations:

- Is close to neutral, mainly in the pH range from 6.5 to 7.5.
- Is low in nitrate but may contain relatively high phosphate for the region.
- Contains moderate levels of arsenic, aluminium, copper, lead, thallium, vanadium and zinc plus significant traces of other metals and sulphate.
- May contain aluminium and iron in colloidal suspension, based on unfiltered sample results.

Arsenic, aluminium, zinc, copper and iron are present in the soil in significant quantities and may be mobilised if acid drainage was to occur.

## 7.7 FLORA

Arafura commissioned Low Ecological Services to undertake a survey of the landscape, flora and fauna of the project area in August 2005 (See Appendix 7). Additional surveys occurred at both Mt Porter and Frances Creek during 2006. The original report was revised to include this additional information.

Territory Iron Limited recently proposed to recommence mining activity at the nearby Frances Creek iron ore mine (located approximately five kilometers north east of Mt Porter). Arafura and Territory Iron have an agreement whereby baseline environmental information

obtained by each party is shared with the other to assist with project planning, operational environmental management and project closure planning. Low Ecological Services conducted baseline flora and fauna surveys for both the Mt Porter and Frances Creek projects. Results of baseline survey work conducted at Frances Creek have been considered during planning of the Mt Porter Gold Project.

### 7.7.1 Mt Porter Flora

Dominant vegetation communities for the Northern Territory have been described and mapped by Wilson *et al.* (1990). The vegetation community mapped as being dominant within Mt Porter Gold Project area is described as *Eucalyptus tectifica* and *Corymbia latifolia* Low Woodland with *Sorghum* understorey (Wilson *et al.* 1990). Site specific studies show however that this description by Wilson *et al.* (1990) is not accurate as the dominant Eucalyptus in these parts is actually *Eucalyptus tintinans* associated with *Corymbia dichromophloia* and *E. miniata*, over a tall *Sorghum* grassland understorey (Low Ecological Services, 2005).

The vegetation is relatively homogeneous over the proposed project area with only slight changes in species richness and abundances between habitat units. Five land unit groups were identified within the project area boundaries. All land units are widespread throughout the project area, namely:

1. Ridge Crests and Slopes.
2. Low Hills.
3. Riparian.
4. Low Undulating Plains.
5. Granite Hills.

Figure 7 shows the proposed Mt Porter project area with reference to the land units.

### 7.7.2 Species of Conservation Significance

Plant species are generally widely spread across most of the landscape within the proposed project area, and the surrounding region. No plant species identified during the survey were listed as being endangered, threatened or endemic within the Mt Porter project area according to the *TPWC Act (2000)* and *EPBC Act 1999* lists. The species recorded during the survey and their associated vegetation communities are common in the region with the exception of a few species within the restricted rainforest riparian habitat. The species and vegetation communities are described in Section 6.2.

### 7.7.3 Introduced Species

Low Ecological Services (2005) identified the following introduced plant species:

- *Hyptis suaveolens (*Hyptis*).*
- *Pennisetum polystachyion (*Mission Grass*).*
- *Hyptis suaveolens.*

- *Pennisetum polystachyion.*
- *Passiflora foetida (*Stinking Passion Flower*).*
- *Euphorbia heterophylla (*Painted Spurge*)*.
- *Crotalaria goreensis (*Gamba Pea*).*

## 7.8 FAUNA

Arafura commissioned Low Ecological Services to undertake a survey of the landscape, flora and fauna of the project area in August 2005 (Appendix 7). A specific survey was also conducted in June 2006 to determine if Gouldian Finches (*Erythrura gouldiae*) were present during the late breeding season.

### 7.8.1 Mt Porter Fauna

There were 87 animal species identified during the Mt Porter baseline survey, including 41 birds, 26 mammals, 17 reptiles, three amphibians and one fish. No Gouldian Finches were observed in the Mt Porter project area during Survey 2 nor within the Frances Creek survey.

The survey mainly resulted in identification of species common to the region during the late wet season with occasional opportunistic identification of uncommon species.

The findings of the fauna survey are summarised below:

- Reptiles identified during the Mt Porter environmental survey are common and widespread.
- Birds identified during the Mt Porter survey were common and widespread in the surrounding region and are well represented in nearby locations such as Kakadu National Park. No bird species of conservation significance were identified during the survey. However, four bird species of conservation significance were identified within the nearby Frances Creek area and the area has the potential to contain Gouldian Finches.
- The only water bird observed was a White-faced Heron (Ardea novaehollandiae) flying over the Cullen Land System in the south of the lease. The survey was conducted at a time when freestanding water was not abundant, leaving little attraction for water birds into the area. The ephemeral nature of watercourses at Mt Porter suggests that the area is not an integral part of water bird life cycles and the close access to adjacent water bodies (i.e. Spring Hill, Kakadu National Park) act as refuge areas for birds that rely on streams within the Mt Porter project area.
- Mammals of conservation concern that were identified during the 2005 Mt Porter survey include Rhinonicterus aurantius (Orange Horseshoe-bat), Taphozous kapalgensis (White-striped Sheathtail bat) and Petrogale brachyotis (Short-eared Rock Wallaby).Possible signs of the Northern Brown Bandicoot (Isoodon macrouru) were observed on the Ridge Crest.
- All frog species listed as occurring or potentially occurring within the Mt Porter mineral lease are considered to be common in the local region.

- The Cane Toad is present within the mineral lease.
- None of the fish and macro-invertebrates identified are considered to have conservation status under the EPBC Act 1999 or TPWC *Act* 2000.

An additional targeted survey for the Gouldian Finch was undertaken at Mt Porter on 21 June 2006. The survey included areas proposed to situate the open pit mine, office complex and wasterock stockpile. No Gouldian Finches were found. Other species of finches were sighted at these locations (Long Tail Finches at the office complex site and the pit site and Crimson Finches at the creek at the east side of the office complex area). These species and the Short-tailed Finch were also seen along the old railway reservation.

Results from baseline fauna surveys at the nearby Frances Creek project were also reviewed to ensure a more comprehensive understanding of local fauna.

At Frances Creek the baseline fauna surveys conducted in May 2006 included a targeted search for the Gouldian Finch (*Erythrura gouldiae*). Habitat known to be preferred by Gouldian Finches was surveyed at several locations in the early morning and late afternoon. Searches were also made of locations where other finch species were sighted. No Gouldian Finches were observed during either the November 2005 or May 2006 site specific surveys.

### 7.8.2 Conservation Significance

The Mt Porter Gold Project lies approximately 20 to 25 kilometres south-east of Kakadu National Park. Mt Porter Gold Project is located within the catchment areas of Frances Creek and Nellie Creek. Both of these creek systems drain to the north-west into Mary Creek which forms the south-west boundary of Kakadu National Park. Kakadu is a listed World Heritage Area and is also listed as a Wetland of International Importance under the Ramsar Convention on Wetlands.

The Mt Porter Gold Project area is typical of the widespread landscape and biota occurring within the Wet-Dry Tropics of the Pine Creek Region. On a national scale the conservation value of the habitat of the Pine Creek region is moderate to high as the flora and fauna of this region is relatively intact, poorly represented within National parks/reserves and is subject to substantial mining development and exploration.

The *EPBC Act* 1999 Protected Matters Database and *TPWC Act 2000* list several species of conservation significance that may occur in the Mt Porter area (Table 11).

More details regarding species listed under the EPBC Act that may occur in the Mt Porter area are provided in Section 10.

**Table 11: Fauna Species of Conservation Significance That May Occur in the Mt Porter Area**

| Common Name | Scientific Name | Status | Species sited at Mt Porter | Species sited at Frances Creek |
|---|---|---|---|---|
| **EPBC Act Protected Matters Database** | | | | |
| Red Goshawk | *Erythrotriorchis radiatus* | Vulnerable | No | No |
| Gouldian Finch | *Erythrura gouldiae* | Endangered | No | No |
| Partridge Pigeon (eastern) | *Geophaps smithii smithii* | Vulnerable | No | Yes |
| Masked Owl (northern) | *Tyto novaehollandiae kimberli* | Vulnerable | No | No |
| Bare-rumped Sheathtail Bat | *Saccolaimus saccolaimus nudicluniatus* | Critically Endangered | No | No |
| Northern Quoll | *Dasyurus hallucatus* | Endangered | No | No |
| Melville Cicadabird | *Coracina tenuirostris melvillensis* | Migratory | No | No |
| White-bellied Sea-Eagle | *Haliaeetus leucogaster* | Migratory | No | No |
| Derby White-browed Robin | *Poecilodryas superciliosa cerviniventris* | Migratory | No | No |
| Rufous fantail | *Rhipidura rufifrons* | Migratory | No | No |
| Oriental Plover | *Charadrius veredus* | Migratory | No | No |
| Oriental Pratincole | *Glareola maldivarum* | Migratory | No | No |
| Little Curlew | *Numenius minutus* | Migratory | No | No |
| Magpie Goose | *Anseranas semipalmata* | Overfly marine area | No | Yes |
| Fork-tailed Swift | *Apus pacificus* | Overfly marine area | No | No |
| Great Egret (White Egret) | *Ardea ibis* | Overfly marine area | No | Yes |
| Cattle Egret | *Ardea ibis* | Overfly marine area | No | No |
| Rainbow Bee-eater | *Merops ornatus* | Overfly marine area | No | Yes |
| Freshwater Crocodile | *Crocodylus johnstoni* | Listed | No | Yes |
| Salt-water Crocodile | *Crocodylus porosus* | Listed | No | No |
| **TPWC Act 2000** | | | | |
| Orange HorseshoeBat | *Rhinonicterus aurantius* | Near Threatened | Yes | Yes |
| Arnhem Sheath-tailed Bat | *Taphozous kapalgensis* | Near Threatened | Yes | Yes |

#### 7.8.2.1 Birds

No bird species of conservation significance were identified during the survey. However, some bird species may potentially occur within the lease. These include:

- The Gouldian Finch (*Erythrura gouldiae*) which is an endangered species under the *EPBC Act* 1999 and the *TPWC Act 2000*.
- The Partridge Pigeon (subspecies *Geophaps smithii smithii*) which is classified as vulnerable under the *EPBC Act 1999*.
- The Red Goshawk (*Erythrotriorchis radiatus*) which is classified as vulnerable under the *EPBC Act 1999* and the Action Plan for Australian Birds (2000).
- The Masked Owl (*Tyto novaehollandiae*) which is classed as a vulnerable species under the *EPBC Act 1999*.

#### 7.8.2.2 Bats

Two bat species of conservation significance were identified during the survey. These were:

- The Orange Horseshoe Bat (*Rhinonicterus aurantius*) was classified as a Near Threatened species (ICUN 2000) in 2005, however the NT population is no longer considered to be threatened.
- The White-stripped Sheathtail Bat *(Taphozous kapalgensis)* is a near threatened species under the *TPWC Act*.

Ghost Bats (*Macroderma gigas)* were sighted at the nearby Frances Creek Project area in a dis-used conveyor tunnel. Ghost Bats (*Macroderma gigas*) were listed as Near Threatened in the Northern Territory prior to 2006, however they are no longer listed in the NT legislation. They are classed as vulnerable under the Red Species List determined by the IUCN. It is not believed that Ghost Bats are present in the Mt Porter project area as there are no known caves in the area to make it an attractive habitat to this species.

#### 7.8.2.3 Mammals

Short-eared Rock Wallaby *(Petrogale brachyotis)* were observed. On a national scale *P. brachyotis* is not considered to be of conservation significance. However, *P. brachyotis* is of some concern as its distribution appears to be contracting northward. Numerous rocky ridges in the local area and also granite hills on the southern extent of the mineral lease are likely to act as refuge areas for rock wallabies in the area.

### 7.8.3 Introduced Species

Three species of introduced animals were found by Low Ecological Services during the 2005 investigation namely *Bufo marinus* (Cane Toad), *Equus caballus* (horse) and *Sus scrofa* (feral pigs). Buffalo (*Bubalus bubalis*) and donkeys (*Equus asinus*) have also been noticed throughout the region (Arafura Resources NL, 2004).

Surveys conducted at nearby Frances Creek recorded several introduced (pest) species. These included feral cats (*Felis catus*), donkeys (*Equus asinus*), feral horses (*Equus caballus*), cane

toads (*Bufo marinus*) and feral pigs (*Sus scrofa*). Both the water buffalo (*Bubalus bubalus*) and feral cattle (*Bos taurus*) are known to be present in the region and have been recoded from nearby Kakadu National Park.

## 7.9 AIR QUALITY AND NOISE

While there is no ambient air quality data available for the project area, existing air quality is expected to be generally good, given the lack of urban populations or industry. Suspended particulate levels are, however, expected to be elevated due to windblown dust and pastoral activities.

A search of the National Pollutant Inventory database indicates that the only industrial facilities and diffuse sources of pollutants within an approximately 50 kilometre radius of the Mt Porter Gold Project area are the Union Reefs Gold Mine and the Pine Creek Power Station. NPI reportable emissions to air from both of these facilities are categorised as low.

No quantitative baseline noise or vibration data is available for the project area. The current extensive pastoral and mineral exploration land uses result in the project area having a relatively low background level of noise. Noise levels would increase slightly on the haul route along Frances Creek Road and Mt Wells Road.

# 8. EXISTING SOCIAL ENVIRONMENT

## 8.1 NATIVE TITLE

In December 2004 an agreement was reached between Arafura Resources NL, the Northern Land Council on behalf of the Wagiman, Warai and Jawoyn native title groups, and the Northern Territory Government for the Mt Porter Gold Project. The agreement addressed the concerns of the Native Title groups with respect to Aboriginal site and heritage protection, employment opportunities, mine site rehabilitation, and financial compensation when mining commences.

The following process took place in reaching an agreement between the parties:

- The Grantee Party made application to the Government Party for the grant to it of Mineral Lease 23839 ("the Lease").
- The Government Party gave notice of its intention to grant in accordance with Section 29 of the *Native Title Act 1993* Mineral Lease 23839 on 9 April 2003.
- The Native Title Party lodged a native title determination application, and the Land Council held instructions to represent the Native Title Party in respect of the matters contained in this Deed.
- The parties negotiated in good faith in accordance with Subdivision P of Division 3 of Part 2 of the *Native Title Act 1993* in respect of the grant of the Lease, and reached an agreement of the kind mentioned in Section 31(1)(b) of the *Native Title Act 1993* to enable the valid grant of the Lease.
- The agreement records the terms between the parties, and is intended that it be given to the National Native Title Tribunal in accordance with section 41A(1)(a) of the *Native Title Act 1993*. Further, it is intended that the Commonwealth Minister for Immigration and Multicultural and Indigenous Affairs will be advised in writing of the making of the agreement pursuant to section 41A(1)(b) of the *Native Title Act 1993.*

## 8.2 EUROPEAN HERITAGE

A search of the Australian Heritage Database was conducted in August 2005 to determine if any registered heritage sites occur in or adjacent to the project area. No sites were listed in the database.

## 8.3 ABORIGINAL HERITAGE

An AAPA Certificate C2003/025 is held in respect of ERL 116 for mineral exploration. Certificate C1993/197 was also issued for mining on ERL 116 in 1993. The previous lease titleholder completed an Aboriginal archaeological survey in 1993 in preparation for planned mining at that time and prior to the issue of C1993/197 (Mulvaney, 1993).

In 2002, ERL116, was transferred to Arafura Resources NL. Arafura applied for Mineral Lease 23839, covering the Mt Porter area on 12 March 2003. This was granted on 2 February

2005. AAPA certificate C2004/098 was issued for mining on ML 23839. In commencement of the works the subject of the AAPA certificate, Arafura commissioned an additional archaeological survey in 2005 (Gunn, 2005). Assistance was sought from the Jawoyn Association, Aboriginal Areas Protection Authority, and the Northern Land Council, as well as from local Jawoyn and Wagiman communities at Pine Creek prior to the survey but no Traditional Owners could be identified. Appendix 8 contains a copy of the AAPA Certificate for ML 23839.

The Gunn (2005) survey assessed 15 sites within the project area that were previously recorded by Mulvaney and also identified six new sites. The full report is presented in Appendix 9.

The archaeological sites around Mt Porter can be seen as a single complex of a number of different site types, all of which are related to the exploitation of the dolerite seam on the ridge north of Mt Porter. They provide a record of the overall land use of the area incorporating specialist quarrying (including leilira blade production), specialist working of the raw material into particular artefacts (points and straight-edged scrapers), opportunistic use of other stone outcrops (quartz and fine grained siliceous), stone axe-head production sites (grinding grooves), and general campsites (Gunn, 2005). The complex has the potential to greatly improve knowledge of the Aboriginal use of the area. However, as such site complexes are common across the Mt Todd-Pine Creek-Mt Bundy-Adelaide River region the complex is not unique and similar conclusions could be drawn from study of these other complexes.

The Gunn (2005) report recommended, from an archaeological perspective, the following limitations and restrictions be applied:

- All archaeological sites be disturbed as little as possible.
- A 50 meter diameter exclusion zone be provided for the protection of sites MP03, MP07, MP48 (excluding the current access track), MP49 (excluding the current access track)
- The access track passed MP49 be covered and compacted with a coarse gravel to prevent dust building up over the art panel.
- Any further disturbance to sites MP06, MP42 or MP50 be preceded by further archaeological study, including the systematic collection of all artefacts within the proposed disturbance area.
- If required, sites MP05, MP08, MP19-23 and MP46, may be destroyed without further archaeological study.
- Should disturbance of any sites be necessary and unavoidable, prior to such disturbance, the developer must obtain the consent in writing of the Minister for Environment and Heritage, or a designated representative, to disturb or destroy the site.

Several sites may be impacted by the proposed mine. These include site MP21, MP05 and to a lesser extent MP34 and MP06 (Figure 8).

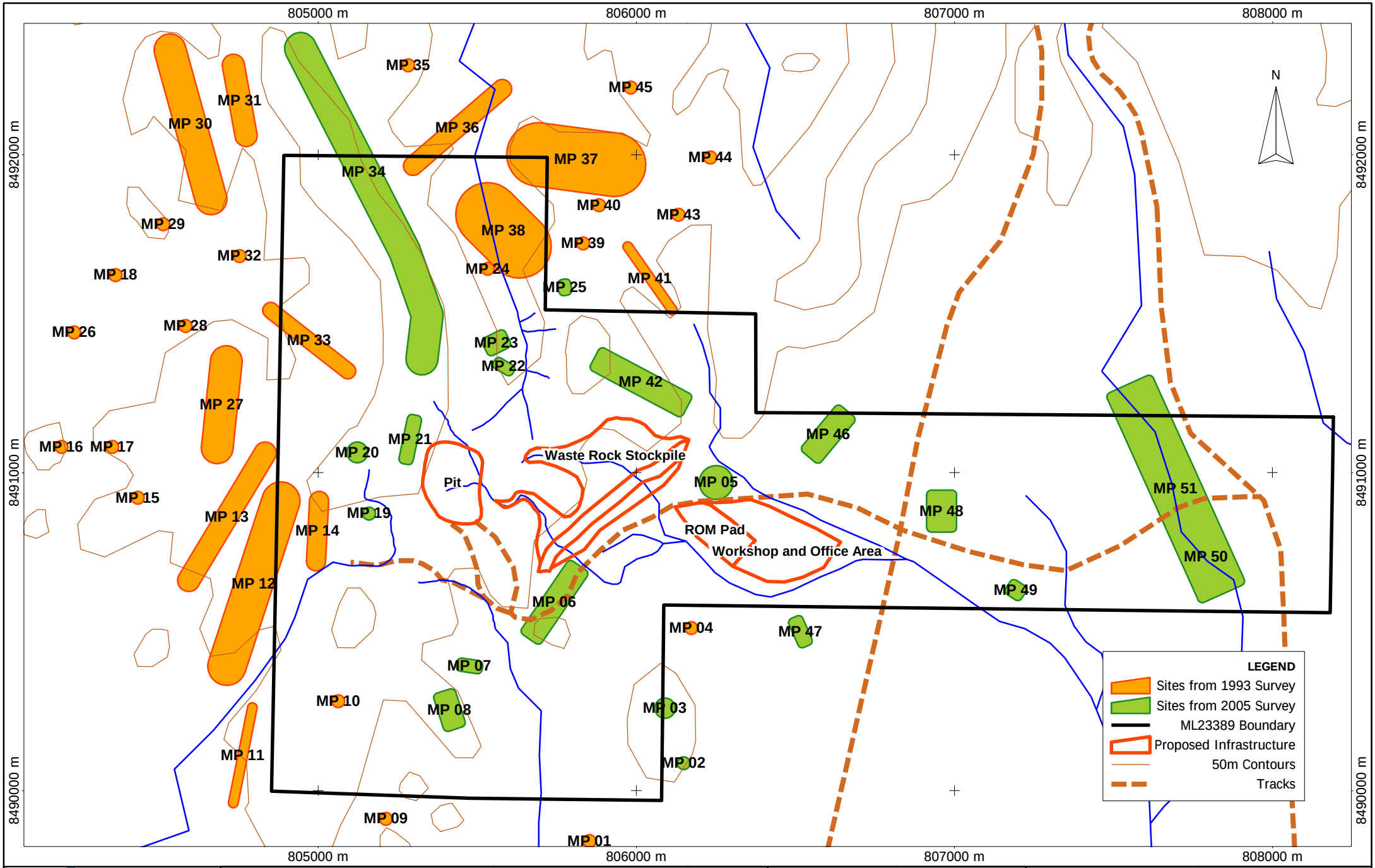
Site MP21 is a low significance artefact scatter that is located on the boundary of the proposed open pit. An application to remove this site will be submitted to the Northern Territory Minister for the Environment and Heritage pursuant to section 29(1) of the *Heritage Conservation Act 2000*, to enable removal if mining activity can not practically be managed to avoid the site.

Site MP34 is a major quarry site that lies outside the direct impact area of the proposed mining project and so is capable of being avoided by the mining activities.

Site MP05 is an open artefact scatter with a low artefact density. The site is cut by the access track. The portion of the site, north of the access road, can be avoided. However, the site infrastructure is to be located immediately south of the road. To account for any portion of the site that may occur within the infrastructure area, an application to remove will be made for the affected portion of this site. Continued use of the access road should create no additional impact to the remainder of the site.

Site MP06 is a quarry and open artefact scatter with a low artefact density and scoring a medium level of site significance. The site is also bisected by the existing access track. This access track will need to be widened for use as the haul road from the open pit to the ROM pad. The site abuts the toe of the proposed waste landform. As with the other sites, the policy of site avoidance will be applied as a first preference, with fencing erected to protect the site. Again, to account for the possibility that a portion of the site may be impacted by road widening, an application to remove will be submitted.

The access track from the Frances Creek Road to the proposed mine site passes within 30 metres of art site MP49. Gunn (2005) has categorised this site as being of high archaeological significance. Realignment of the access road past this site is proposed in order to avoid damage that may result from dust caused by mine and ore haulage traffic.





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Scale: 1:15000
Original Size: A4
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Datum: Australian Geocentric 1994 (GDA94)

Arafura Resources
Mt Porter

Heritage Sites

Figure 8

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**Figure 8: Archaeological sites in Mt Porter Project Area**

## 8.4 SOCIAL ENVIRONMENT

The Mt Porter project area is 20 kilometres north of Pine Creek, which is the nearest population centre. Pine Creek is on the Stuart Highway between Darwin and Katherine. Pine Creek district covers an area of 400 square kilometres and has a population of about 500 people of which 10% are Aboriginal (ABS, 2002).

Major industries in the district include agriculture (beef and cattle), mining and tourism. Tourism sites feature the unique landscape, Aboriginal heritage, flora and fauna in the world heritage listed Kakadu National Park, 50 kilometres north-east of Pine Creek.

Review of the 2001 census figures showed that:

- The population of Pine Creek and surrounds was 472 with about 10% of the population identified as Aboriginal or Torres Strait Islander.
- The Pine Creek population is older on average than Northern Territory and Australia as a whole with a median age of 36 compared with 30 for the Northern Territory.
- About 42% of the Pine Creek workforce is employed in the mining industry. The second largest industry in Pine Creek is accommodation, cafes and restaurants, employing 14% of the workforce.
- Pine Creek had a higher percentage of adult males in full time employment (76%) than the Northern Territory as a whole. Other towns in the Northern Territory with high levels of employment are also mining towns.
- About 44% of the population over the age of 15 has post-school qualifications.
- The median weekly personal income is $600-699, which is greater than the Northern Territory median weekly personal income in the $500-$599 range.

The Pine Creek population demographics are representative of the Northern Territory averages as seen in Table 12.

**Table 12: Percent Distribution by Age Groups in Urban Areas**

| Age Group (years) | Pine Creek (%) | Total Northern Territory (%) |
|---|---|---|
| 0 - 4 | 8.9 | 9.8 |
| 5 - 19 | 14.2 | 24.8 |
| 20 - 64 | 68.7 | 62.1 |
| 65 and over | 8.2 | 3.2 |
| Total | 100 | 100 |

Facilities available in Pine Creek include:

- A community library and museum.
- Numerous sporting facilities, including indoor/outdoor sports centre.
- Multi-resource centre and community hall.
- A supermarket and two licensed premises.

- Three fuel outlets and a take-away food outlet.
- A police station.
- Health clinic with two permanent nurses and visiting doctor from Katherine once a week.
- Primary school including pre-primary.

Many facilities are available in Katherine (a regional centre), 90 kilometres away, or Darwin, 150 kilometres away.

## 8.5 VISUAL AMENITY

The project is in a sparsely populated area used primarily for pastoral activities. The main visible components of the project area are the open pit and haul roads. These are only visible from private roads within the project area and possibly from inaccessible hilltops within nearby pastoral leases.

The mining operations area will not be visible from any public road or railway. Frances Creek Road adjoins the access track to the Mt Porter project area. Mt Wells Road is six kilometres away, Stuart Highway is 18 kilometres away and Kakadu Highway 13 kilometres away.

Transport of ore from Mt Porter to the Union Reef mill will be visible to the public as it will occur on predominantly public roads. Ore will be hauled along the Frances Creek Road to the Mt Wells Road turnoff, then along the Mt Wells Road to the Railway Corridor which is the access road between the Mt Wells Road and the Union Reef CIL Plant mill.

Project operations will not have a visual impact from the Stuart or Kakadu Highways other than from transporting product. The proposed haulage route includes seven kilometres of Mt Wells road which is a public road and a designated tourist route.

The final pit void and waste rock stockpiles will remain at the end of the project.

## 8.6 BITING INSECTS

No site specific biting insect information is available for the Mt Porter Area. Given the absence of standing water in the project area, the distance to permanent water, the short duration of the proposed project and its scheduling during the dry season, no survey has been conducted.

At the conclusion of the Mt Porter project, groundwater inflow into the pit void will result in a permanent pit lake. A biting insect survey was undertaken for the nearby Frances Creek project in June 2006 due to the presence of a number of permanent water storage structures within the project area. The project area contained open pit lakes that had flooded for 30 years. The survey found most existing pits within the mining lease appeared to contain minimal mosquito breeding sites, due to the predominantly steep sides and deep water. Sites that contained significantly higher mosquito breeding habitats included dams that contained

shallow water or grassy areas, small ephemeral creeklines within the mining lease and broad floodways.

The most common species of adult biting insects recorded from the Frances Creek project area were *Culex annulirostris* and *Anopheles annulipes s.l.* Several other species, including *Coquillettidia xanthogaster*, *Culex palpalis* and *Anopheles bancroftii*, also occur, but in very low numbers. *Culex annulirostris*, *Culex palpalis*, *Anopheles annulipes s.l.*, *Anopheles bancroftii* and *Coquillettidia xanthogaster* were considered to have potential to become pest species given the right conditions for breeding. All bite after sundown though *Anopheles bancroftii* and *Coquillettidia xanthogaster* are known to bite during the day in shaded areas. It is also expected that *Ochlerotatus vigilax* and *Ochlerotatus normanensis* will be present though they were not recorded during the June site visit to Frances Creek. Both species have been recorded in numbers likely to cause pest problems during trapping programs at the nearby Union Reef Gold Mine.

The nuisance status, possible vectors carried and peak abundance times for those species considered most likely to become pests at Frances Creek are outlined in Table 13**.**

**Table 13: Potential Pest Mosquitoes of the Frances Creek Area**

| Species | Nuisance Status | Potential Vectors | Peak Abundance |
|---|---|---|---|
| *Anopheles annulipes s.l* | + | Malaria | November - April |
| *Anopheles bancroftii*<br>Black Malaria Mosquito | +++ | Malaria | February - July |
| *Coquillettidia xanthogaster*<br>The Golden Mosquito | +++ | None known | March - August |
| *Culex annulirostris*<br>Common Banded Mosquito | +++++ | Murray Valley Encephalitis Virus<br>Kunjin Virus<br>Japanese Encephalitis Virus<br>Ross River Virus<br>Barmah Forest Virus | January - August |
| *Culex palpalis*<br>Freshwater Banded Mosquito | +++ | Murray Valley Encephalitis Virus<br>Kunjin Virus<br>Japanese Encephalitis Virus<br>Ross River Virus<br>Barmah Forest Virus | January - August |
| *Ochlerotatus normanensis*<br>Floodwater Mosquito | +++++ | Ross River Virus<br>Barmah Forest Virus | September - January |
| *Ochlerotatus vigilax*<br>Salt Marsh Mosquito | +++++ | Ross River Virus<br>Barmah Forest Virus | January - April |

# 9. POTENTIAL IMPACTS AND MANAGEMENT

## 9.1 LANDFORM AND SOILS

### 9.1.1 Potential Issues and Impacts

The majority of proposed mining activities will be located within the eastern foothills of Mt Porter (between 215 and 280 metres AHD) and the eastern slopes and foothills of the ridge which extends to the north and south-south-west of Mt Porter. The Frances Creek Road in the east of the tenement and the access road between Frances Creek Road and the mine site traverse the more gently undulating granite country.

The following potential impacts on soils and landform have been identified:

- Compaction of soil surfaces by vehicles and equipment: Mining equipment will compact the surfaces of roads and infrastructure areas throughout the mine. This will increase surface runoff during periods of rainfall.
- Erosion of disturbed surfaces: The period of disturbance during mining and rehabilitation, until vegetation is established, can produce significant erosion risk, particularly in environments such as the Mt Porter area characterised by high intensity rainfall events.
- Contamination of soils by hydrocarbons.
- Disturbance of unique land systems: Localised disturbance to identified land units, namely, Brocks Creek Ridge Land System and Cullen Land System.
- Maintenance of suitable soil to allow successful revegetation of rehabilitated surfaces.

### 9.1.2 Management and Mitigation Measures

Arafura aims to conserve surface soil to help with site rehabilitation and to minimise environmental degradation. Management and mitigation measures to achieve these aims include:

#### 9.1.2.1 Sensitive Areas and Ground Disturbance

- An internal Land Clearance Procedure will be implemented for all ground disturbance activities, to track the cumulative clearing undertaken for the project **(Commitment 9.1.2.1a)**
- Access to all areas outside the immediate mine area and off formed roads and tracks will be prohibited **(Commitment 9.1.2.1a)**.
- Vehicles and mobile equipment will be parked only in designated parking areas. Vegetated areas will not be used for parking **(Commitment 9.1.2.1b)**.

#### 9.1.2.2 Topsoil Management

- Stripping topsoil to a depth of about 100 millimetres where practicable and placing directly onto rehabilitation areas or stockpiles (**Commitment 9.1.2.2a)**

- Placing stockpiled topsoil in windrows less than two metres high to minimise loss of seed viability and soil biota **(Commitment 9.1.2.2b)**.
- Rehabilitation of the waste landform and site infrastructure areas will be undertaken at the conclusion of mining. All rehabilitation will be performed in accordance with contemporary accepted industry best practice and conducted in accordance with an approved MMP **(Commitment 9.1.2.2c)**.
- Stripping and stockpiling topsoil (where required) in dry and preferably still wind conditions, to minimise dust generation and assist rapid revegetation **(Commitment 9.1.2.2d)**.

#### 9.1.2.3 Erosion

- Controlling slope gradients to minimise erosion and soil loss (**Commitment 9.1.2.3a).**
- Installing diversion bunds and drains as necessary to control local surface water runoff to minimise overland flow and consequential erosion **(Commitment 9.1.2.3b)**.
- Ripping rehabilitation areas on the contour to remove compaction, improve soil structure and improve infiltration capacity **(Commitment 9.1.2.3c)**.
- Routinely inspecting rehabilitated and disturbed surfaces for erosion, particularly after significant rainfall. Implementing appropriate remediation measures if soil erosion is observed during routine inspections **(Commitment 9.1.2.3d)**.

#### 9.1.2.4 Soil Contamination

Contamination management and mitigation measures are discussed in Section 9.8.2

#### 9.1.2.5 Rehabilitation

Rehabilitation management is discussed in Section 11.

### 9.1.3 Impact Assessment

Potential adverse impacts on soil and landforms are expected to be minimal after implementing control measures described above.

Long-term change to the landscape will be minimal as a result of mining. All mining areas will be rehabilitated before closure. Disturbed surfaces will be managed to prevent excessive erosion. Infrastructure areas will be rehabilitated to their pre-mining landforms and stabilised with local provenance flora species. Rehabilitation will be conducted at the conclusion of the mining operation.

Revegetation will occur through careful management of topsoil and its contained seed resource. Supplementary seeding or planting may occur if rehabilitation monitoring demonstrates that revegetation is not proceeding in line with expected results.

Land uses occurring before the project may continue after appropriate protection of rehabilitation areas from grazing.

Identified Land Systems and land units are not endemic to the project area and are widely represented in the region. The vegetation, flora and fauna species of these land units is typical of the Wet-Dry Tropics. Land Systems, land units and their respective vegetation, flora and fauna have been reserved in nearby National Parks such as Kakadu National Park and Litchfield National Park.

## 9.2 WASTE ROCK MANAGEMENT

### 9.2.1 Potential Issues and Impacts

Potential issues and impacts include:

- Acid development of soils.
- Lack of acid neutralising capacity.
- Contamination of surface water or groundwater leading to toxic environmental effects.
- Erosion of external surfaces over time. This may lead to loss of sediments to surface water drainages or in extreme cases instability of structures.

Waste characterisation results detailed in Section 7.4.3 indicate that the percentage content of significantly PAF material appears small and all contain carbonaceous siltstone-BIF with visible sulphides. Because of the high free carbon content, the Eh value within the waste rock stockpile of the PAF material should be extremely low and non-oxidising, thus minimising sulphide oxidation and the potential for acid generation.

Due to the black coloration of the PAF material, it is likely that it will be relatively easily recognisable and thus can be managed separately to other NAF material.

A number of options for waste rock disposal were considered. Arafura considers there is no practical alternative to depositing the waste in an out of pit waste rock stockpile. Backfilling of waste is not practical because as a greenfields site, there are no other open pit voids in close proximity to allow this to occur. Rehandling of waste rock from a temporary out of pit waste rock stockpile to the pit void on completion of mining was considered to have greater adverse impacts than forming a permanent out of pit waste rock stockpile. Reasons for this include:

- Land disturbance would be required for each option. Backfilling would not prevent disturbance.
- PAF material if placed back in the pit would be in a location where it could not be practically encapsulated with NAF material where infiltration of water and oxygen could be reliably prevented.
- PAF material would be subject to oxidation for the period while in a temporary stockpile. Construction measures used to minimise oxidation would not be implemented as these would make material rehandling on completion of mining more difficult.
- Waste placed back in the pit would be subject to seasonal wetting and drying cycles. Insufficient groundwater is expected to remain in the pit over time on completion of mining to completely cover PAF material i.e. water cover concept to prevent oxidation. This would increase the risk of acid generation over time.

- If acid generation could not be reliably prevented form occurring after backfilling of the pit, higher risk of contamination of local aquifers exists.

Given that the out of pit waste rock stockpile is the preferred option for the mine waste, encapsulation of the PAF material in the waste rock stockpile is necessary.

### 9.2.2 Management and Mitigation Measures

The waste rock stockpile will be rehabilitated at the conclusion of mining operations.

The waste rock stockpiles will be shaped so it forms a physically and chemically stable landform. This will be achieved by:

- Ensuring all PAF material is encapsulated in the waste landform **(Commitment 9.2.2a)**. If required, neutralising agents will be applied during placement of PAF material.
- Arafura will conduct further testing of PAF material as it is encountered during mining to ensure its geochemical properties are understood and management measures described in this PER will be effective in preventing acid generation over time **(Commitment 9.2.2b)**.
- Contouring the waste rock stockpile so that it blends with the surrounding topography so that the final design is aesthetically pleasing **(Commitment 9.2.2c)**.
- Contouring the waste rock stockpile top surface at gentle gradients to direct drainage off the stockpile and discourage infiltration over the PAF cell **(Commitment 9.2.2d).**
- Building diversion drains where stockpile construction obstructs water courses. **(Commitment 9.2.2e)**.
- Deep ripping the waste rock stockpile slopes on the contour to assist water absorption and minimise erosion **(Commitment 9.2.2f)**.
- Spreading topsoil on the waste rock stockpile once shaping is complete to facilitate revegetation **(Commitment 9.2.2g)**. Local provenance species will be used if supplementary seeding is required. Arafura shall liaise with the pastoral station owner in relation to the suite of species to be used.
- Routinely inspecting the rehabilitated waste rock stockpile for erosion, particularly after significant rainfall. Implementing appropriate remediation measures if soil erosion is observed during routine inspections **(Commitment 9.2.2h)**.

### 9.2.3 Impact Assessment

Implementing the management and mitigation measures will result in stable vegetated landforms which have minimal impact on the environment. It will allow resumption of pre-mining low level grazing.

# 9.3 GROUNDWATER

## 9.3.1 Potential Issues and Impacts

Potential groundwater issues or impacts include:

- Lowering of localised groundwater levels as a result of mining.
- Deterioration of local groundwater quality as a result of seepage of contaminants from mining activities into local aquifers.
- Groundwater abstraction may reduce the volume of surface water flows due to the potential hydraulic connection between surface and ground waters.
- Concentration of salts on road areas where groundwater is used as a dust suppressant.
- Pipeline infrastructure impacting on pastoral activities.
- Septic sewage treatment systems may pollute the groundwater if located in areas where the water table is high.
- Possible acidification of groundwater due to aerial exposure in the pit void.
- Subsequent death or damage to aquatic flora and fauna.

## 9.3.2 Management and Mitigation Measures

Arafura Resources will maintain groundwater quality and contain impacts of dewatering so they do not affect any other beneficial users. Management and mitigation measures to achieve this include:

- Flow meters will be fitted to groundwater extraction bores to enable monitoring of extraction volumes **(Commitment 9.3.2a)**
- Monthly monitoring of standing water levels (SWL) of production bores for the duration of the operation **(Commitment 9.3.2b)**.
- Septic systems will be located in areas where there is sufficient depth to the natural watertable to allow the system to operate effectively and minimise risk of polluting the groundwater **(Commitment 9.3.2c)**.
- Post-mining monitoring of ground water levels and quality twelve months after mine closure. If deemed necessary, further monitoring of groundwater will be conducted **(Commitment 9.3.2d)**.

## 9.3.3 Impact Assessment

Potential adverse impacts on groundwater are expected to be minimal after implementing the control measures described above.

The short duration and small scale of the project involves minimal quantities of groundwater abstraction. It is anticipated that groundwater levels will recover within a short period following conclusion of mining.

The pit void, which has been dewatered during mining, will refill with groundwater (and stormwater during each wet season). Experience from historical mining operations at the nearby Frances Creek has demonstrated that pits which intersect the water table act as groundwater recharge areas in the wet season and experience evaporative loss during the dry season.

Location of the open pit in a topographic high in the local area combined with the fractured rock nature of local aquifers means that little, if any, through flow of groundwater from the pit will occur. Any contaminants present in the pit water will be contained. If recharge fluxes are greater than evaporative losses, some leakage of soluble materials into local aquifers may occur. Impacts are likely to be localised and minimal as this scenario only occurs in the wet season when a high level of dilution will occur.

## 9.4 SURFACE WATER

### 9.4.1 Potential Issues or Impacts

The proposed mining operations pose the following issues for surface water:

- Diversion of surface water flows during mining and rehabilitation resulting in increased sediment loads to downstream environments.
- Contamination of surface water as a result of release of pollutants (eg sediment and hydrocarbons) associated with earthmoving, excavation and other mining activities.
- Potential for acidification of surface waters due to exposure of sulphide waste rock material to rainfall.
- Development of a lake in the pit void after mining ceased with water quality affected by increased salinity (due to concentration of salts from evaporation) and acidification (due to exposure of sulphide materials in the pit walls).
- Flooding of the project area.
- Temporary reduction in surface water volume to ephemeral creeks as a result of diverting runoff from operational areas and catching surface water in dams to provide water for the operations.

### 9.4.2 Runoff and Contaminant Management

Arafura aims to prevent or minimise any deterioration in surface water quantity and quality. Most runoff from the project area will be uncontaminated other than increased sediment loads due to contact with recently disturbed surfaces. Impacts of this will be managed by installation of detention basins to remove sediments, minimising the areas of disturbance, and progress rehabilitation of disturbed areas. Impacts will also be minimised by the scheduling of mining to take place during the dry season, so that rehabilitation of most areas should be complete or well underway by the onset of wet season rainfall.

The only chemicals used on site will be hydrocarbons used for vehicle maintenance and explosives. All hydrocarbon storages will be bunded and explosives will be stored in purpose built facilities to prevent any contamination of surface water from these sources. Further contamination management and mitigation measures are discussed in Section 9.8.2.

The major landform changes created by mining are the construction of the waste rock stockpile and the open pit. In the NOI (Arafura Resources NL, 2004) Arafura stated an intent to construct a wetland filter immediately downstream of the convergence point of East Gully and Pit Gully to remediate any acid water emanating from the waste rock stockpile. Further investigations, however, have indicated that construction and maintenance of a wetland filter for treatment of surface run-off is not appropriate for this project. Encapsulation of the minor proportion of PAF waste rock with NAF oxide waste will provide effective management of PAF material. The lag time to establish filter vegetation decreases the effectiveness of artificial wetlands for the short duration nature of the project. Maintaining water in the wetland filter during the dry season is also prohibitive in the local climate and drying out of the wetland filter would substantially reduce its effectiveness.

The Mt Porter Wastes Characterisation and ARD Management Report (MBS Environmental, September 2005) indicates that leachate from the stockpiles may contain enhanced levels of copper, iron, manganese and zinc, but provision of shallow detention basins downstream of the stockpile will be sufficient to allow precipitation of these metals via dilution, aeration, and ferrous iron oxidation to ferric. The use of a detention basin to treat surface run-off from the mine and waste stockpile areas is therefore preferred to wetland filters.

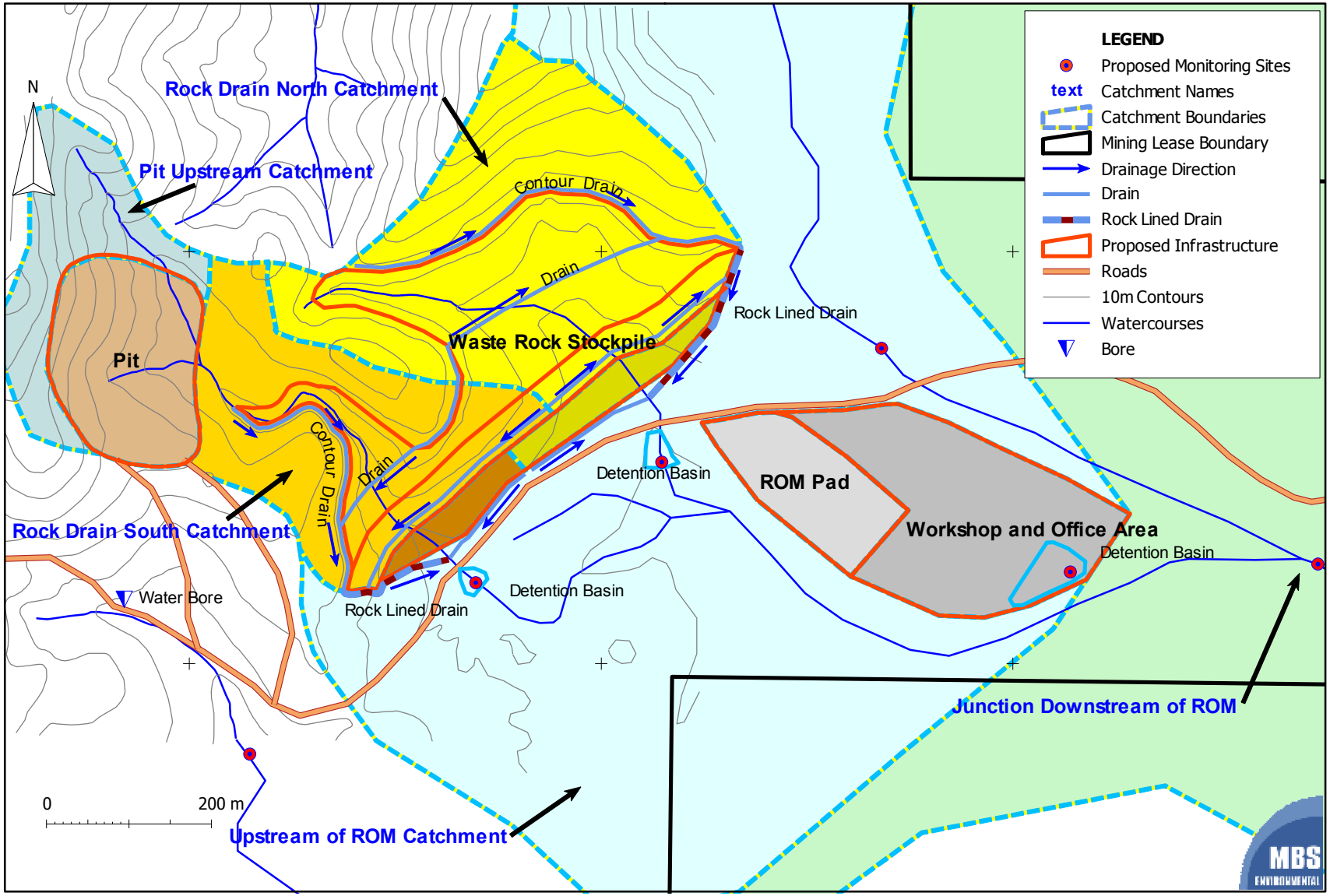
Runoff from the waste rock stockpile will also be managed by construction of a free draining stockpile top surface as described in Section 9.2.2.

Management and mitigation commitments for runoff and contaminant management will include:

- Any surface run-off requiring discharge to the environment will be directed to detention basins to remove sediment prior to discharge (**Commitment 9.4.2a)**.
- Contouring the waste rock stockpile top surface at gentle gradients to direct drainage off the stockpile and discourage infiltration over the PAF cell **(Commitment 9.4.2b).**
- Building diversion drains where stockpile construction obstructs water courses. **(Commitment 9.4.2c)**.
- Shallow detention basins will be established on Pit Gully and East Gully downstream of the waste rock stockpile to remediate runoff from the waste rock stockpile (**Commitment 9.4.2d)**.
- Culverts and/or floodways will be installed as required where roads cross watercourses and drains. Water diversion structures will be armoured, where necessary, to reduce the velocity and erosion potential, of surface flows **(Commitment 9.4.2e)**.
- Hydrocarbon storage will be in accordance with Australian Standard *AS1940 Storage and Handling of Flammable and Combustible Liquids* **(Commitment 9.4.2f)**. Further contamination management and mitigation measures are discussed in Section 9.8.2.

Potential locations of surface water management measures are shown in Figure 9.

**Figure 9: Water Management Measures and Monitoring Locations**



### 9.4.3 Water Discharge

Groundwater and stormwater runoff will be pumped from the pit to allow mining operations. Water sourced in this way will be the primary source of water for dust suppression, but there is potential for sufficient excess water to be created to require some to be discharged.

Dewatering quantities have not yet been determined in detail, but it is considered likely the bulk of dewatering will be utilised for dust suppression on site. It is estimated that dewatering in excess of mine water requirements will only be required in the final four to six weeks of the project duration. If a dewatering requirement of double the water use requirement of 500 kilolitres per day was disposed of for the final six weeks the total discharge would be around 20,000 kilolitres. Any excess would need to be discharged to the watercourses after passing through a detention basin to reduce sediment. Discharges would be required to meet water quality criteria to ensure it will not cause environmental damage.

As all mining will be carried out during the dry season, stormwater inflow to the pit is expected to be low. Any flow that occurs will be pumped out with dewatering discharge and managed in the same way. Average rainfall to the pit for the mining period totals about 10,000 kilolitres over eight months, this is equivalent to 20 days water requirement for dust suppression. About half of the likely rainfall would occur in November. Average rainfall for November is 116.7 millimetres, this would result in about 4,500 kilolitres of stormwater in the pit, which is about nine days water requirement for dust suppression. The worst case for stormwater would be an extremely wet November, combined with high dewatering requirements. The 90th percentile rainfall for November is 352.2 millimetres, which would result in 45 kilolitres runoff, or 17 days water requirement. If such rainfall occurred it is likely some discharge of combined stormwater and dewatering from the pit would need to be made from the site.

Very heavy rainfall (over 400 millimetres) has occasionally occurred in April, although the 90th percentile runoff for April is only 157.8 millimetres. Contingency plans need to be in place for such rainfall events. It is likely such an event would result in temporary suspension of mining operations due to flooding of access roads.

No water quality analysis of pit groundwater has been carried out, but it can be expected to be similar to that from the Pit Gully Spring (monitoring Site 1). Water sampled from this site was of generally good quality, and very similar to early wet season rainfall runoff at the same site. The only characteristics of any concern were very slightly elevated thallium, zinc and phosphorus. Although slightly exceeding the ANZECC default trigger values for protection of aquatic ecosystems they are naturally occurring levels in the area and should not be of any environmental concern. Stormwater is expected to be of equal or better quality than groundwater, but may be higher in suspended sediments.

As all operations will be carried out during the dry season it is likely any discharges would evaporate or infiltrate into the watercourse bed within a short distance downstream. Local watercourses typically do not start to flow until December, after cessation of mining and dewatering activities. A waste discharge licence will be required to permit discharge of water from the mining lease.

Further investigation of groundwater will be carried out to better define likely dewatering

quantities prior to mining.

Commitments to manage and mitigate water discharge include:

- No water discharge to the environment will occur without an approved Waste Discharge Licence. Discharges will meet approved water quality criteria **(Commitment 9.4.3a)**.
- Any dewatering discharge will be monitored and treated if necessary to meet agreed release criteria as specified in the MMP and waste discharge licence before release to the environment **(Commitment 9.4.3b).**

### 9.4.4 Extreme Rainfall Events

The majority of mining will take place during the relatively dry months of May to October. The available climate data shows that while it is probable that little or no runoff will occur during these months, rainfall events of up to 100 millimetres are possible at any time (Section 7.1). Infrastructure required only during the dry period can be served adequately with diversion structures and sediment basins sized to a 100 millimetre rainfall event. Any infrastructure remaining in October will need to have suitable control measures installed for the upcoming wet season. Infrastructure in place in March to April at the commencement of the project will also require drainage management structures able to cope with major rainfall events, including those associated with tropical cyclones, which can still occur at that time of year.

Based on the available stream flow data (Section 7.6.3) and regional flood estimation methods, estimates have been made of average peak flows and annual volumes, and flood peak flows for relevant catchments within the project area. The locations of these catchments are shown in Figure 9.

Results of these calculations are shown in Table 14 and Table 15. The figures in Table 14 for annual volumes are derived by scaling monitoring data from McKinlay river at Burrundie by catchment area.

**Table 14: Estimated Annual Flow Volumes for Mt Porter Catchments**

| | Catchment Area ($km^2$) | 10th Percentile Annual Flow (ML) | Median Annual Flow (ML) | Mean Annual Flow (ML) | 90th Percentile Annual Flow (ML) | Maximum Annual Flow (ML) |
|---|---|---|---|---|---|---|
| Pit Upstream | 0.038 | 0.4 | 2.0 | 10.2 | 11.9 | 22.0 |
| Upstream of ROM | 0.734 | 6.9 | 39.1 | 198.7 | 231.2 | 428.4 |
| Rock Drain North | 0.138 | 1.3 | 7.3 | 37.3 | 43.5 | 80.5 |
| Rock Drain South | 0.085 | 0.8 | 4.5 | 23.0 | 26.7 | 49.5 |
| Total at Watercourse Junction Downstream of ROM | 2.740 | 25.8 | 145.7 | 741.4 | 862.8 | 1598.6 |

The peak flows in Table 15 were calculated by the method developed for the Alice Springs to Darwin Railway design by Weeks *et. al*. (2002). Details of calculations are given in Appendix A.

**Table 15: Estimated Peak Flow Rates for Mt Porter Catchments**

| | Catchment Area ($km^2$) | 5 Year ARI Peak Flow ($m^3s^{-1}$) | 10 Year ARI Peak Flow ($m^3s^{-1}$) | 20 Year ARI Peak Flow ($m^3s^{-1}$) | 50 Year ARI Peak Flow ($m^3s^{-1}$) |
|---|---|---|---|---|---|
| Pit Upstream | 0.038 | 0.5 | 0.7 | 0.9 | 2.1 |
| Upstream of ROM | 0.734 | 4.4 | 6.2 | 8.1 | 15.1 |
| Rock Drain North | 0.138 | 1.3 | 1.8 | 2.4 | 4.9 |
| Rock Drain South | 0.085 | 0.9 | 1.3 | 1.7 | 3.6 |
| Total at downstream Junction | 2.740 | 11.7 | 16.4 | 21.4 | 36.2 |

Table 14 shows that the mean annual stream flows for all drains on site are less than 75 megalitres. Average annual streamflow of the Nellie Creek tributary immediately downstream of the site is over 740 megalitres, so any stormwater runoff from disturbed areas will be diluted by about 90% before leaving the mining lease. Table 15 shows the maximum flows that diversion structures will be required to cope with will be of the order of five cubic metres per second.

Management commitments to cope with extreme rainfall events include:

- Water management measures for infrastructure completed before the end of April will be designed to cope with major rainfall events of up to 500 millimetres **(Commitment 9.4.4a)**.
- Water management measures for landforms and infrastructure remaining at the end of October will be designed to manage wet season rainfall events **(Commitment 9.4.4b)**.
- Water management measures for temporary disturbances and infrastructure to be removed by October will be designed to manage dry season rainfall events of up to 100 millimetres **(Commitment 9.4.4c)**.

## 9.4.5 Monitoring

A water monitoring program will be implemented under the Environmental Management Plan (Appendix 10) **(Commitment 9.4.5a)**. The monitoring program will record water quality upstream and downstream of operations, and will include monitoring sites downstream of all operational activities. Suggested monitoring locations are shown in Figure 9. Data from DPIFM monitoring sites located in the wider Mary River catchment will also be reviewed.

The water monitoring program will include regular sampling of water unaffected by and water downstream of mining activities within the lease. Monitoring results will be reviewed against past monitoring and ANZECC guidelines to detect any deterioration in water quality and allow action to be taken **(Commitment 9.4.5b)**.

The water monitoring program will include analysis of water potentially to be discharged to

the environment prior to any such discharge **(Commitment 9.4.5c)**.

Quantity of water discharge will be monitored and recorded **(Commitment 9.4.5d)**. Flow meters will be installed on dewatering and stormwater discharge pipelines and daily records kept of discharge volumes. Water volumes taken from the dewatering or groundwater for site use will also be monitored.

Frequency of monitoring will be determined by the type and purpose of monitoring. Dewatering and dust suppression water quality will be monitored regularly during operations. As operations will be occurring in the dry season it is likely there will be little opportunity to monitor stormwater and natural streamflow during operations, but procedures will be developed to allow opportunistic monitoring of any runoff events that occur. Post-mining monitoring of surface water quality down stream from the project area will be undertaken for at least 12 months after mine closure. If deemed necessary, further monitoring of surface water will be conducted **(Commitment 9.4.5e).**

Water quality analysis should include elements known to occur at high levels naturally in the area and those likely to be impacted by mining. These would include pH, electrical conductivity, arsenic, nitrate, phosphate, iron, copper, lead, thallium, uranium, vanadium, nickel and zinc. All samples must be filtered prior to any addition of preservatives.

### 9.4.6 Impact Assessment

As all mining will be undertaken during the dry season, there is expected to be little or no runoff during operations, hence no impact on surface water due to stormwater runoff during operations. Implementation of the management and mitigation measures above will adequately manage any unseasonal rainfall events.

Groundwater appears to be of similar quality to existing surface water flows, and discharge of dewatering, if necessary will have no adverse effects on watercourses. As discharge will be during the dry season, it is unlikely water will travel far downstream and visible impact will likely be limited to increased vegetation growth in the local area.

Post mining impacts will be limited to potential runoff issues from the waste rock stockpile area. Management and mitigation measures described should ensure there is no adverse impact on water quality. Continuing monitoring will allow remedial action to be taken if necessary.

Current drainage paths will be maintained with the exception of the open pit, which will remove about 6.5 hectares of catchment area from pit gully. The presence of the pit may result in cessation of flow from pit gully spring, however this will primarily only affect the area already buried by the waste rock stockpile.

# 9.5 FLORA

## 9.5.1 Potential Issues or Impacts

Impacts on species on flora may include:

- Localised flora loss particularly for species present within the Ridge Crests and Slopes land unit.
- Loss of riparian vegetation throughout the project area, namely in the areas proposed for haulage roads and waste rock stockpile that transect the Swampy Meadow Zone.
- Death of vegetation as a result of groundwater drawdown in water extraction areas.
- Successful establishment of vegetation on restored landforms.
- Spread of existing weed species and the introduction of new weed species into the area.

Clearing of land is required for extraction of the gold ore and construction of mining infrastructure. Table 16 outlines the extent of clearing proposed for the Mt Porter Operation.

**Table 16: Land Clearing Requirements**

| Infrastructure | Area (hectares) | Affected Land Units |
|---|---|---|
| Open Pit | 3.98 | 70% Low Hills<br>30% Ridge Crests |
| Waste rock stockpile | 11.82 | 90% Low Hills<br>10% Swampy Meadow |
| ROM pad | 2.36 | 100% Low Undulating Plains |
| Offices, workshop and stores | 5.78 | 100% Low Undulating Plains |
| **Total** | **23.94** | |

## 9.5.2 Management and Mitigation Measures

Arafura aims to minimise loss of habitat and re-establish appropriate vegetation communities through rehabilitation. The company will also endeavour to manage and control the spread of weed species resulting from its operations. Management and mitigation measures that will be implemented to achieve these aims include:

### 9.5.2.1 Vegetation Clearing

- Developing a Land Clearing Management Procedure as part of the EMP (**Commitment 9.5.2.1a)**.
- Minimising the impact of clearing by restricting vegetation clearing to the minimum necessary for operations (**Commitment 9.5.2.1b)**.
- Clearly delineating the perimeter boundary of all areas approved for clearing before clearing works begin (**Commitment 9.5.2.1c)**.

#### 9.5.2.2 Weed Management

- Preparing a Weed Management Plan as part of the EMP. The plan will include, but will not be limited to, issues of vehicle and personal hygiene in regards to weeds, identification of weed species (including noxious weeds) and control and eradication measures **(Commitment 9.5.2.2a)**.
- Requiring all earthmoving equipment introduced to the project area to have been cleaned to remove soil and plant seeds prior to entry **(Commitment 9.5.2.2b)**.
- Confining company vehicles to travelling on purpose-built roads to minimise potential vehicle-borne spread of weed species **(Commitment 9.5.2.2c)**.

#### 9.5.2.3 Rehabilitation

Rehabilitation management and mitigation measures are discussed in Section 11.

### 9.5.3 Impact Assessment

Potential adverse impacts on flora are expected to be minimal as a result of implementing management measures described above.

Procedures to regulate the amount of clearing will ensure only the minimal area required to implement the project is disturbed. The small scale of the project means that only 24 hectares of land will be disturbed, with 20 hectares being rehabilitated at the conclusion of mining (eight months after clearance occurred).

The short duration of the project means that topsoil will only be stockpiled for a short period, thus minimising loss of seed viability.

Site infrastructure has been located to avoid significant vegetation features, such as the riparian rainforest. Vegetation communities to be disturbed are common and widespread in the region. No species or communities of conservation significance will be affected.

## 9.6 FAUNA

### 9.6.1 Potential Issues or Impacts

Developing and operating the Mt Porter Gold Project poses the following issues:

- Removing about 24 hectares of habitat during the life of the mine.
- Adversely impacting species of conservation significance such as the Orange Horseshoe Bat, Arnhem Sheathtail Bat, Partridge Pigeon and Short-eared Rock Wallaby.
- Accidentally killing animals on mine roads and the haul road to the Union Reef Plant.
- Controlling feral animals such as donkeys, horses, cats and pigs.

## 9.6.2 Management and Mitigation Measures

Arafura aims to minimise loss of fauna habitat and re-establish appropriate habitat through rehabilitation.

Management and mitigation measures to achieve these aims include:

- Requiring employees and contractors to attend an induction program that will include a component on environmental management. In particular, the induction will clearly explain employee and contractors' roles and responsibilities to restrict impacts on fauna and habitat **(Commitment 9.6.2a)**.
- Educating all employees and contractors to recognise species of conservation significance, particularly the Gouldian Finch, and requiring them to report any sightings to the Environmental Manager **(Commitment 9.6.2b)**.
- Reporting sightings of species of conservation significance to the Northern Territory Parks and Wildlife Commission **(Commitment 9.6.2c)**.
- A monitoring program and Management Plan will be developed specifically for the Gouldian Finch. As part of the site induction all staff will be educated in identifying Gouldian Finches and procedures to be followed if Gouldian Finches are observed **(Commitment 9.6.2d)**.
- Restricting speeds on haulage routes and mine roads to minimise fauna death on roads **(Commitment 9.6.2e)**.
- Cleared vegetation will be stockpiled and respread in the rehabilitation program to provide fauna habitats **(Commitment 9.6.2f).**
- Developing a Wildlife Rescue Procedure to operate in conjunction with land-clearing operations and where vehicle movements occur **(Commitment 9.6.2g)**.
- Participating in feral animal control programs on Mary River West stations, if requested by owners **(Commitment 9.6.2h)**.
- Arafura will undertake Cane Toad trapping programs during the life of the Mt Porter Project **(Commitment 9.6.2i)**.
- Banning domestic animals and firearms on site **(Commitment 9.6.2j)**.
- Waste management procedures will be implemented to minimise attraction of feral animals to the project area **(Commitment 9.6.2k)**.
- Drill holes will be capped and appropriately rehabilitated to remove potential hazard to the local wildlife **(Commitment 9.6.2l)**.

## 9.6.3 Impact Assessment

Approximately 24 hectares of land will be cleared of which most will occur in the Low Hills and Ridge Crests land unit. Although these disturbances may result in localised population reduction in the Mt Porter project area, most species are common and widespread throughout their range and their status is unlikely to be affected.

The project will not impact on the preferred habitat of species of conservation significance, such as the Gouldian Finch, which prefers woodlands of *Eucalyptus tintinans* and *Sorghum*

grasses.

Similarly the Orange Horseshoe-bat has highly specialised roost requirements. The lack of local roosting habitat implies there will be no significant impact on populations other than temporary loss of small areas of foraging habitat.

With regular movement of vehicles along roads both within the mine and between the mine and Union Reef Mill, it is probable that some animal injuries and death will occur. Restricting the speed at which vehicles travel will reduce the likelihood of vehicle-animal collisions. It will also reduce the severity of potential injuries, particularly to larger animals.

## 9.7 AIR QUALITY AND NOISE

### 9.7.1 Potential Issues or Impacts

Potential air quality issues include:

- Mobile equipment emissions from engine exhausts, including carbon monoxide, carbon dioxide and nitrous oxides.
- Generation of dust from mining operations and vehicle movement on unsealed roads.
- Generating dust during material transfer operations.
- A negative impact on climate change associated with increased greenhouse gas emissions.

Potential noise issues include:

- Mobile equipment noise from engines.
- Generator noise.
- Open pit blasting noise and vibration.

Potential impacts from air and noise emissions associated with the project are expected to be minimal. The remote location of the project and the absence of nearby residential facilities will limit any adverse impacts.

### 9.7.2 Greenhouse Gases

Greenhouse gas emissions from the Mt Porter Gold Project will be produced by diesel consumption and production of landfill waste. An estimated 880,000 litres of diesel fuel is expected to be consumed over the eight month period.

Table 17 shows the total emissions using the NPI emissions manuals for engine combustion during the project.

**Table 17: Emissions from Combustion Engines**

| Source | Combustion Emissions (Kg) | | | | | |
|---|---|---|---|---|---|---|
| | CO | Formaldehyde | NOx | $PM_{10}$ | SO2 | VOC's |
| Off Road Vehicles | 34,913 | 2,018 | 98,982 | 6,769 | 9,981 | 7,958 |
| Diesel stationary plant | 3,248 | | 15,040 | 1,072 | 1,000 | 1,096 |
| **TOTAL** | **38,161** | **2,018** | **114,022** | **7,841** | **10,981** | **9,054** |

Section 9.8 provides estimates of the quantity of putrescible waste produced, with an estimate of up to seven tonnes. Using the emissions calculator provided by the Australian Greenhouse Office (2006), emissions from landfill were calculated to be 10.5 tonnes of carbon dioxide.

The Australian Greenhouse Office (2005) states that "broadscale clearing of remnant vegetation is generally assumed to produce emissions of one megatonne carbon dioxide-equivalent from clearing of 4,000 hectares", which equates to 250 tonnes per hectare. The total area of disturbance at Mt Porter is about 24 hectares, resulting in 6,000 tonnes of carbon dioxide. This will be offset by rehabilitating 20 hectares at the conclusion of the project, sequestering 5,000 tonnes of carbon dioxide. Only four hectares will be permanently disturbed (the area of the open pit), so the net production of carbon dioxide from this source (clearing for the project) will be 1,000 tonnes.

### 9.7.3 Management and Mitigation Measures

To minimise point source emissions Arafura will ensure:

- Emission control equipment is installed on all combustion engines **(Commitment 9.7.3a)**.
- Diesel combustion engines in stationary and mobile equipment and diesel-powered electric generators will be operated and maintained to minimise emissions of combustion gases **(Commitment 9.7.3b)**.

To minimise the impact of fugitive emissions, Arafura will implement the following:

- Water trucks will be used to control fugitive dust within the pit and on internal roads to minimise dust emissions **(Commitment 9.7.3c)**
- Movement of mobile equipment and vehicles will be limited to formalised tracks and roads where dust control methods can be used **(Commitment 9.7.3d)**.
- Equipment operators will remain in enclosed, air-conditioned cabins to minimise exposure to dust emissions **(Commitment 9.7.3e)**.
- Areas will be rehabilitated at the conclusion of operations to prevent dust generation **(Commitment 9.7.3f)**.

Management and mitigation measures to minimise greenhouse gas emissions:

- Joining the Federal Government's Greenhouse Challenge Plus program and monitoring greenhouse emissions and efficiency **(Commitment 9.7.3g)**.

- Energy efficiency will be a major consideration in the selection and design of equipment and plant **(Commitment 9.7.3h)**.
- Encouraging all employees to be energy efficient in their day to day activities and educating them on this **(Commitment 9.7.3i)**.

To minimise impacts associated with noise, Arafura will implement the following measure:

- Reducing the noise from equipment by installing soundproofing and/or noise abatement devices, where practicable, around/on primary sources of noise such as power generators and water pumps (**Commitment 9.7.3j).**
- Maintaining, to the extent practicable, the natural acoustic barriers (for example trees and ridges) between noise sources and neighbouring communities **(Commitment 9.7.3k).**
- Hearing protection equipment will be made available and utilised in onsite areas where engineering controls are deemed inappropriate or ineffective **(Commitment 9.7.3l).**

### 9.7.4 Impact Assessment

The nearest settlement is 20 kilometres away at Pine Creek. The remote location of the project and absence of nearby residential facilities limits potential adverse impacts air emissions are expected to have on the local or regional environment and/or human health.

Fugitive dust will be generated from mining and blasting activities, vehicular movement and wind erosion. Dust generated will be localised. Experience with other mining operations has demonstrated that these relatively course particles (i.e. greater than 10 microns) are likely to settle within a short distance of the point of generation.

Greenhouse gas emissions will result primarily from on-site generation of power and from exhausts of vehicles and mobile equipment. Given the project's remoteness, it is not anticipated that the additional greenhouse gas resulting from this project will have an adverse impact on local or regional air quality. The short duration of the project will also mean that greenhouse gas emissions will be small on a regional and Territory basis.

## 9.8 WASTE AND HAZARDOUS MATERIALS

The only hazardous materials that will be used in any significant quantity will be diesel, oils and explosives. Arafura will aim to effectively manage hazardous materials and wastes during the life of the project, to minimise potential adverse impacts to the environment.

Appropriate ablution facilities including a septic system will be constructed on site, along Department of Health and Community Services guidelines, to service the workforce.
A site landfill will be developed to dispose of putrescible rubbish and inert waste. This will be developed in a suitable area of the waste rock stockpile.

The total amount of rubbish expected to be produced is very small. The one off nature of the mining operation is confined to an active period of approximately eight months of the year. The absence of a residential camp means that the volume of putrescible waste likely to be

generated will be low. It is anticipated the 30-40 employees on site will generate food scraps, office waste and general rubbish to fill one 240 litre rubbish bin per week. This equates to approximately one cubic metre of (uncompacted) domestic rubbish per month, for a total of six to seven cubic metres for the mining period. Combined with other inert wastes (such as pallets, packaging and parts), an estimated 2 cubic metres a month will be produced on site.

Hazardous materials storage requirements are detailed in Table 18. Hazardous materials likely to be generated during the project are detailed in Table 19.

**Table 18: Hazardous Materials Storage Requirements**

| Substance | Area of Use | Storage Type | Storage Amount |
|---|---|---|---|
| Diesel | Mobile equipment and power generation | 2 x 55,000 litre tanks | 110,000 litres |
| Diesel | Power generation/borefield | 2 x 10,000 litre tanks | 20,000 litres |
| Lubricants | Equipment maintenance | 200 litre drums | 2000 litres |

**Table 19: Hazardous Waste Materials Likely to be Generated**

| Waste Substance | Area Generated | Proposed Disposal Method |
|---|---|---|
| Waste oil | Equipment maintenance | Off-site disposal to licensed facility |
| Waste grease | Equipment Maintenance | Off-site disposal to licensed facility |
| Oil filters, oily rags and hydraulic hoses | Equipment Maintenance | Off-site disposal to licensed facility |
| Putrescible wastes | Crib room scraps | On-site landfill facility |
| Inert wastes (eg cardboard, wood, concrete) | Construction, general waste | On-site landfill facility |
| Sewage wastewater | Mine site ablutions | Septic tank systems |
| Scrap metal | Construction, equipment maintenance | On-site landfill facility |

Non-hazardous wastes likely to be produced include:

- Sewage.
- Domestic rubbish (food and office waste).
- Industrial rubbish (tyres, steel, timber).

### 9.8.1 Potential Impacts

Potential impacts include:

- Spillage to the environment of hydrocarbons and hazardous materials used in the mining or associated activities.
- Incorrect storage of hazardous materials leading to contamination of soil, surface water and ground water.

- Disposal of hazardous wastes generated during construction and operations including tyres, waste oil, grease and industrial waste.
- Spillage of ore product during transport to the Union Reef Mill.
- Disposal of putrescible wastes in an onsite landfill.
- Storage of explosives.

## 9.8.2 Management and Mitigation Measures

Arafura will aim to effectively manage hazardous materials so as to minimise and control any potential discharges to the environment.

Management and mitigation measures to achieve this aim will include:

- Material Safety Data Sheets will be available and accessible at all work places where hazardous materials are used **(Commitment 9.8.2a)**.
- Design of on ground hydrocarbon storage tanks and secondary containment will be in accordance with AS1940 -2004 Storage and Handling of Flammable and Combustible Liquids **(Commitment 9.8.2b)**.
- All mobile equipment and light vehicle servicing activities including wash down will be done on impermeable surfaces **(Commitment 9.8.2c)**.
- The heavy vehicle workshop will contain a purpose-built wash down facility incorporating an appropriate sediment and oil/grease removal system **(Commitment 9.8.2d)**.
- An Emergency Response Procedure will be developed to ensure appropriate response can be made to minimise the environmental impact caused by incidents involving hazardous materials or wastes **(Commitment 9.8.2e)**.
- The mobile refuelling truck will carry spill containment and cleanup material at all times and the driver will be trained in the use of these materials **(Commitment 9.8.2f).**
- A register of all hazardous materials imported to the site or generated as a result of site activities will be maintained. This will document the hazardous material name, location, approximate volume, storage method and where applicable, disposal method for the substance and containers **(Commitment 9.8.2g)**.
- Bringing hazardous materials to the site in bulk packaging wherever possible. This practice will minimise the number of containers and reduce risk of spillage **(Commitment 9.8.2h).**
- Hazardous waste generated by the operation will be transported offsite to licensed waste disposal facilities. This is likely to include waste oil, grease and heavy equipment oil and fuel filters **(Commitment 9.8.2i)**.
- All hazardous wastes will be temporarily stored in designated containers and contents properly labelled at all times **(Commitment 9.8.2j)**.
- Domestic waste from the offices and workshops will be properly handled, transported to, and disposed of in the onsite landfill **(Commitment 9.8.2k)**.
- Reusable pressurised containers and vessels will be returned to suppliers. Pressurised

containers and vessels that are not reusable will be punctured using suitable equipment and disposed of in the onsite landfill **(Commitment 9.8.2l)**.

- Arafura staff and contractors will be trained in proper handling and disposal of waste material **(Commitment 9.8.2m)**.
- Explosives magazine will be constructed and operated in accordance with regulatory requirements **(Commitment 9.8.2n)**.
- A licence to Store Dangerous Goods will be obtained for the storage of diesel fuel on site **(Commitment 9.8.2o)**.
- Septic systems will be located in suitable areas where there is sufficient depth to groundwater to allow the system to operate effectively **(Commitment 9.8.2p)**.
- Prior to their installation, plans for the septic systems will be approved by the relevant government agency **(Commitment 9.8.2q)**.

### 9.8.3 Impact Assessment

By implementing appropriate storage and handling measures in accordance with industry standards and practices, dangerous goods and hazardous substances used in the operations will not present a hazard or cause environmental harm.

Hydrocarbons are the primary type of hazardous material anticipated to be required on site. No bulk chemicals are required as processing of ore will occur at another facility. Correct management through implementation of the above measures will ensure that adverse impacts are prevented or minimised.

## 9.9 CULTURAL ENVIRONMENT

### 9.9.1 Potential Issues or Impacts

Potential Aboriginal cultural impacts include:

- Unauthorised destruction or damage to identified sites.
- Identification of additional Aboriginal sites during the quarrying process.
- Increased levels of employment among the local indigenous population.

### 9.9.2 Management and Mitigation Measures

Management and mitigation measures to address potential issues or impacts will include:

- The location coordinates of sites of archaeological significance will be stored in a suitable database by Arafura and shall be made accessible to project design, construction and operations personnel **(Commitment 9.9.2a).**
- All employees and contractors will be required to participate in a general site induction before starting work. The induction will include:
    - Information on the importance of the cultural environment and protecting artefacts and archaeological sites.

  - Information on the correct procedure if items of potential Aboriginal or heritage significance (including bones) are discovered during quarrying or other mining activities **(Commitment 9.9.2b).**
- The Northern Land Council and NRETA will be contacted immediately if items of potential Aboriginal significance are discovered **(Commitment 9.9.2c)**.
- A 50 metre exclusion zone shall be provided around sites of high archaeological significance (sites MP03, MP07, MP34, MP48 and MP49 (excluding the area currently disturbed by the access track) **(Commitment 9.9.2d)**.
- The access track from Frances Creek Road to the mine site will be relocated to avoid generation of dust from the road impacting MP49 **(Commitment 9.9.2e)**.
- Arafura will operate with a preference to employ people from the local community where suitable **(Commitment 9.9.2f)**.

### 9.9.3 Impact Assessment

No significant Aboriginal sites occur in areas requiring clearing for infrastructure and landforms. Through education of employees and implementing the management measures outlined above, adverse impacts upon Aboriginal cultural heritage will be minimised.

Positive impacts on local Aboriginal communities will arise from increased opportunities for employment, training and education. Continuing involvement and discussions with the Northern Land Council and local Aboriginal groups shall ensure that opportunities for positive impacts are maximised.

## 9.10 SOCIO ECONOMIC

### 9.10.1 Potential Issues and Impacts

Potential social and economic impacts include:

- Increased local employment in the Pine Creek area.
- Utilisation of local processing plant (Unions Reef).
- Increased use and maintenance of local roads, namely Frances Creek Road.
- Increased traffic movements as material is imported and exported from the project area.
- Increased contribution to the Northern Territory and Federal economies as a result of royalties and payroll taxes.
- Increased pressure on Pine Creek accommodation and medical services.
- Increased business opportunities for local business.
- Temporary change of land use from pastoral to mining.
- Potentially negative impact on tourism within the area.

## 9.10.2 Management and Mitigation Strategies

Management and mitigation measures that will be implemented will include:

- On final decommissioning plant and infrastructure will be dismantled, made safe and unless requested otherwise by project stakeholders, removed from the site **(Commitment 9.10.2a)**.
- Compensation agreements will be reached with landowners for loss of use of land used by Arafura for mining or associated infrastructure **(Commitment 9.10.2b)**.
- Employment opportunities will be advertised locally and preference will be given to local candidates **(Commitment 9.10.2c)**.
- Provision of goods and services will be advertised locally and preference will be given to local businesses **(Commitment 9.10.2d)**.
- First aid facilities will be established onsite for the duration of the project. These facilities will be manned by appropriately qualified employees **(Commitment 9.10.2e)**.
- A liaison will be established between onsite Emergency Response and First Aid personnel and providers of equivalent services in Pine Creek, Katherine and Darwin **(Commitment 9.10.2f)**.
- Arafura will establish a complaints procedure by which the public can lodge complaints about the operation or impact of the mine **(Commitment 9.10.2g)**.

## 9.10.3 Impact Assessment

Implementing the management and mitigation measures will result in a low risk of the project negatively impacting the socio-economic environment.

Employment from the Mt Porter project will provide a beneficial impact on the local communities, especially that of Pine Creek.

Increased traffic on the Stuart and Kakadu Highway will come from light vehicles as well as supply trucks. This is not anticipated to be significant, particularly as traffic on the highway has been reduced as a result of commissioning of the railway.

Most of the workforce will already live in the region. Commitments to preferentially employ local candidates provide education and training to members of the local indigenous community and preferentially engage local goods and service providers will help to ensure the local community experiences project benefits.

Local land use will change during the life of the project from pastoral (stock grazing) to active mining. It will revert to pastoral when extraction is complete.

The project will provide an economic boost to the local area and Northern Territory economy through increased business opportunities for local businesses. Increased contribution to the Northern Territory and federal economies as a result of royalties and payroll taxes will result in a net benefit.

# 9.11 TRANSPORT

## 9.11.1 Potential Issues and Impacts

Potential issues and impacts from transport in and out of the Mt Porter project area include:

- Dust and road traffic noise.
- Potential road safety issues between mine traffic and other local traffic.
- Increased maintenance requirements of public roads.

## 9.11.2 Management and Mitigation Measures

To ensure impacts of mine transport are minimised the following management actions will be put in place:

- Erecting warning signs at the junction of Frances Creek Road and Mt Wells Road to advise the public they are entering private property and must comply with all directions issued by Arafura. Discouraging casual access **(Commitment 9.11.2a)**.
- Erecting signs on Mt Wells Road, giving warning of road trains entering, leaving and travelling along the haul road **(Commitment 9.11.2b).**
- Road maintenance will be carried out to DPI standards. This will include regular grading of the Frances Creek and Mt Wells roads and additional maintenance on stream crossings on the Mt Wells Road between Pine Creek and the mine as necessary to improve all-weather access **(Commitment9.11.2c).**
- If deemed necessary, a commuter bus will be provided to minimise traffic between Pine Creek and Mt Porter **(Commitment 9.11.2d).**
- Road train drivers will use radio communications to coordinate safe passing. Only one to two road trains will operate at any time **(Commitment 9.11.2e)**.
- Licensed road vehicles will be used for haulage and standard axle loadings will be complied with **(Commitment 9.11.2f)**.
- Sufficient freeboard will be left at the top of all trailers when loading to ensure ore product can not spill **(Commitment 9.11.2g)**.

## 9.11.3 Impact Assessment

Traffic impacts to Pine Creek as a result of mine traffic will be minimal due to the low number of vehicle movements. No local communities are located within impact distance of the route. One residence can be accessed via the affected portion of Mt Wells Road, but it is not visible from the road.

Safety precautions and management strategies implemented by Arafura will reduce the risks associated with increased traffic on the Mt Wells road and Frances Creek road as a result of personnel movements and ore haulage. The upgrading of sections of Mt Wells Road used by ore haulage road trains will improve sight lines and watercourse crossings. The increased heavy traffic will have an adverse affect on tourist traffic using the road, however, warning signs and road improvements will keep the impact manageable.

Prior to the commencement of the project, Arafura will reassess transporting options.

## 9.12 VISUAL AMENITY

### 9.12.1 Potential Issues or Impacts

The only potential issues are:

- Visibility of operations from Stuart and Kakadu Highways, Mt Wells Road, and Alice Springs to Darwin Railway.
- Increased use of Mt Wells public road.
- Visibility of permanent features after closure of operations.
- Distraction of highway users by lights.

### 9.12.2 Management and Mitigation Measures

Despite the low potential for impact on public visual amenity, Arafura aims to minimise the impact on the visual amenity of the project site. Management and mitigation measures to achieve this include:

- The impact of clearing will be minimised by restricting clearing of vegetation to the minimum necessary for operations **(Commitment 9.12.2a)**.
- Access to the project site will be limited to employees and authorised visitors. All project access will be well signposted to control traffic movement in and out of the project area **(Commitment 9.12.2b)**.
- The waste rock stockpile will be contoured so it ties in with the surrounding topography **(Commitment 9.12.2c)**.

### 9.12.3 Impact Assessment

Project operations will not have a visual impact from the Stuart or Kakadu Highways other than from transporting product.

The final void and waste rock stockpile will remain at the end of the project. These will have a low visual impact following rehabilitation owing to the site's isolated location and the control measures to be implemented.

## 9.13 BITING INSECTS

### 9.13.1 Potential Issues or Impacts

Potential issues and impacts relating to biting insects are:

- Local transmission of mosquito carried diseases such as Malaria.
- Increase in adult mosquito populations to pest proportions.

### 9.13.2 Management and Mitigation Measures

Arafura is committed to ensuring the health and safety of its workforce. To ensure impacts from biting insects are minimised the following management actions will be put in place:

- During the site specific induction advising all employees of the potential for seasonal problems relating to biting insects including their potential pest, nuisance and disease carrying potential. All employees will be made aware of the diseases mosquitoes may carry **(Commitment 9.12.2a)**.
- During site specific inductions, all staff will be advised on personal protection measures to protect themselves from mosquitoes and other biting insects **(Commitment 9.13.2b)**.
- If mosquito breeding reaches significant levels, Arafura will liaise with the MEB to determine appropriate larvicides to use to control the problem **(Commitment9.13.2c)**.

### 9.13.3 Impact Assessment

It is not expected that biting insects will be a concern for the Mt Porter Gold Project given the absence of standing water in the project area, the distance to permanent water, the short duration of the proposed project and its scheduling during the dry season.

Education of employees, ongoing monitoring of mosquito populations and effective management of mosquito breeding grounds will ensure that any impacts associated with biting insects are minimised or avoided.

At the conclusion of the project, groundwater inflow into the pit void will result in a permanent pit lake.

A survey for biting insects was undertaken at the nearby Frances Creek mine. The site includes open pit lakes that have flooded for 30 years and a number of large water storages which permanently hold water. The survey found most existing pits within the mining lease appeared to contain minimal mosquito breeding sites, due to the predominantly steep sides and deep water.

Other water storage features surveyed at Frances Creek appeared to contain significantly higher mosquito breeding sites that the open pit lakes. Such features can be either permanent or ephemeral and include:

- Dams that contained shallow water or grassy areas.
- Small ephemeral creeklines within the mineral lease.
- Broad floodways.

At the conclusion of the proposed operation at Mt Porter, all water storage dams will be decommissioned and rehabilitated. Other than the open pit lake, no water storage structures will remain. The remainder of the site will revert back to the conditions existing before mining, being ephemeral creek systems with isolated soaks and springs containing permanent water.

# 10. ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT TRIGGERS

The Arafura Mt Porter Project has been deemed a Controlled Action under the *Environment Protection and Biodiversity Conservation Act 1999*. The controlling actions triggered by the proposal are:

- World Heritage (Sections 12 and 15A).
- Listed threatened species and communities (Sections 18 and 18A).
- Listed migratory species (Sections 20 and 20A).

## 10.1 WORLD HERITAGE

The Mt Porter project area lies approximately 20 kilometres from the boundary of the Kakadu National Park World Heritage Area. This is sufficiently far enough away that the project will have no visual, dust or noise impacts upon the World Heritage values of the park.

The proposed Mt Porter Gold Project lies in the upper catchments of Nellie Creek to the south and Watts Creek to the north. Nellie Creek drains east over 35 kilometres to the Mary River. The Mary River flows along the western edge of Kakadu National Park for about 46 kilometres before flowing away from the park to the north-west. There is limited potential for surface water runoff to impact on Mary River water quality and subsequently Kakadu National Park.

The RAMSAR wetlands are over 25 kilometres from the project area. The nearest RAMSAR wetlands, Kakadu Stage I and Stage II are in the South Alligator and East Alligator river catchments, based on the textual descriptions in the RAMSAR site information sheets (RIS), so no downstream impacts on RAMSAR wetlands will occur. Maps indicate that the entire of Stage III of Kakadu National Park has been listed as part of the Kakadu Stage I RAMSAR site. Impacts will still be negligible due to the lack of contaminated discharge from site, the distance downstream to Kakadu, and the fact that the Mary River does not flow into wetland areas of Kakadu National Park, it only skirts the edge of the park for 46 kilometres.

The only discharges of water associated with the Mt Porter mining operation will be potential discharge of dewatering from the pit. It is anticipated that most dewatering will be used by the mining operation for dust suppression. If any discharge is required it will be a limited quantity towards the end of the dry season, and will be extremely unlikely to reach the Mary River before evaporation or infiltrating into the watercourse bed. The groundwater is of good quality and any discharge will be regulated by a waste discharge licence requiring high water quality standards to be met. There will therefore be no adverse impact on the Mary River or Kakadu.
Long term runoff from the waste rock stockpile area will be managed by rehabilitation of the stockpile surface, encapsulation of any potentially acid forming material, and installation of detention basins to remove sediment. Water quality of runoff from the waste rock stockpile will be monitored. No adverse impact is expected on Nellie Creek water quality. The project area has a total catchment area of approximately one square kilometre. This means any runoff will be diluted by a factor of 50 before joining Nellie Creek, and by a factor of 600 before

reaching Mary River. This dilution further ensures that there will be no adverse impact on Mary River or Kakadu.

## 10.2 LISTED THREATENED SPECIES

The *EPBC Act* 1999 Protected Matters Database and *Territory Parks and Wildlife Conservation Act* (2000) list several species of environmental significance that may occur in the Mt Porter area (Table 20). In addition, Territory Iron Limited is currently mining the Frances Creek resource, located approximately five kilometers north east of Mt Porter, which was also subject to a separate PER. Arafura and Territory Iron have agreed to share baseline environmental information to provide a regional context to the occurrence of threatened species.

**Table 20: Species Listed as Threatened under the EPBC Act 1999 and NPWC Act 2000 That May Occur Within the Mt Porter Project Area**

| Species Name | EPBC Status | Habitat[1 2] | Recorded in Site Specific Surveys |
|---|---|---|---|
| **Mammals** | | | |
| Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicuniatus*) | Critically Endangered | Caves, woodland communities, particularly those with *Eucalyptus alba*. | x |
| Northern Quoll (*Dasyurus hallucatus*) | Endangered | Generalist that dens in tree hollows, rock crevices and caves | x |
| Orange Horseshoe Bat (*Rhinonicterus aurantius)* | Near Threatened | Caves/mines. During the wet season they will disperse from the caves/mines to forage and live in monsoon forests and open woodlands | ✓ |
| White-stripped Sheathtail Bat *Taphozous kapalgensis* | Near Threatened | Tree dweller. Species range is usually considered to be the flood plains to the north of the lease. | ✓ |
| **Fish** | | | |
| Freshwater Sawfish (*Pristis microdon*) | Vulnerable | Usually found in turbid channels of large rivers over soft mud bottoms more than 1 m deep (DEH 2006). | x |
| **Birds** | | | |
| Gouldian Finch (*Erythrura gouldiae*) | Endangered Migratory (JAMBA) | Open woodlands and dense grasslands. | x |
| Red Goshawk (*Erythrotriorchis radiatus*) | Vulnerable | Open forest and woodland, especially near rivers and wetlands. | x |
| Partridge Pigeon (Eastern) (*Geophaps smithii smithii*) | Vulnerable | Woodlands with short grass; open rocky or sandy ground by streams. | x |
| Masked Owl (northern) (*Tyto novaehollandiae kimberli*) | Vulnerable | Forests and open woodlands with large trees | x |

Additional information for these species is provided in the following subsections.

### 10.2.1 Orange Horseshoe Bat

Although *R. aurantius* was classified as a Near Threatened species (ICUN 2000) in 2005, the NT population is no longer considered to be threatened. The species is endemic to Australia and its distribution extends from the Pilbara to western Queensland, with most of the populations occurring in the Northern Territory (Churchill 1991). Consequently, only the Pilbara form of *R aurantius* is considered threatened (EPBC web site, 2006). Churchill (1991) suggests the scarcity of *R. aurantius* is due to highly specialised roost requirements and low numbers of caves and mines with suitable microclimates. In any event, the lack of local roosting habitat implies there will be no significant impact on the population as the animals are likely flying in from nearby areas as indicated by the few recordings during baseline surveys.

### 10.2.2 White-striped Sheathtail Bat

*T. kapalgensis* is a data deficient species and has only been recorded from the Kapalga and Kakadu areas of the Northern Territory where it occupies the floodplains. It is a fast and direct flying species that forages in open areas well above treetop height in open woodlands and adjacent grassy plains, but also descends to lower levels where flight paths are not obstructed (McKean and Friend 1979 – from bat book). Potential threats of this species are not known.

### 10.2.3 Short-eared Rock Wallaby

*Petrogale brachyotis* were observed within the Granite Hills land unit (i.e. part of the Cullen Land System) on the southern extent of the Mt Porter project area. On a national scale, *P. brachyotis* is not considered to be threatened within conservation legislation statements such as the *EPBC Act 1999* or the *TPWC Act 2000*. However, *P. brachyotis* is of some concern as its distribution appears to be contracting northward. Therefore, the Mt Porter project will contribute to habitat loss in the short-term for P. *brachyotis* if rocky ridges are disturbed or removed in mining operations. Numerous rocky ridges in the local area and also granite hills on the southern extent of the mineral lease will act as refuge areas for rock wallabies in the area.

### 10.2.4 Gouldian Finch

The Gouldian Finch (*Erythrura gouldiae*) is an endangered species under the *EPBC Act 1999* and the *TPWC Act 2000* that could possibly occur within the Mt Porter mineral lease. Open Woodlands of *Eucalyptus tintinans* and Sorghum grasses provide a preferred habitat for Gouldian Finches. They have experienced considerable decline in numbers over the past 50 years (Woinarski et al. 1989). Proposed threats and reasons of decline of populations are trapping, changes in fire regime, grazing cattle and respiratory mites. There are few known breeding areas and few populations occurring in National Parks.

At Frances Creek the May 2006 fauna survey also included a targeted search for Gouldian Finch (*Erythrura gouldiae*). Habitat known to be preferred by Gouldian Finches was surveyed at several locations in the early morning and late afternoon. These locations

included Frances Creek and other creeks, the old tailings storage facility swamp, alluvial areas dominated by Eucalypts and *Sorghum* grasses and low rocky hills dominated by Eucalypts and *Sorghum* grasses. Searches were also made of locations where other finch species were sighted. No Gouldian Finches were observed during either the November 2005 or May 2006 site specific surveys.

An additional targeted survey was undertaken at Mt Porter on 21 June 2006. The survey area included the mine pit site, office complex site and waste rock stockpile area. No Gouldian Finches were found. Other species sighted were Long Tail Finches at the office complex site and the pit site. Crimson Finches were seen at the creek at the east side of the office complex area. These species and the Short-tailed Finch were also seen along the old railway reservation.

With the less than one year duration of the proposed project, it is considered there is limited potential for the proposal to disturb possible Gouldian Finch habitat areas. Management strategies for protecting the Gouldian Finch are described in Section 9.6.2.

### 10.2.5 Partridge Pigeon

The Partridge Pigeon (subspecies *Geophaps smithii smithii*) is classified as vulnerable (*EPBC Act 1999*) and has experienced considerable reduction in numbers and range in Northern Australia over the last 70 years (RAOU 1993). They can be locally common, but are generally scarce (RAOU 1993). The decline of Partridge Pigeons has been attributed to the degradation of small waterholes by exotic animals and altered fire regimes (RAOU 1993). They are represented in a number of regional National Parks and are more commonly observed in Open Woodlands of the Low Undulating Hills land unit. This species was observed at Frances Creek. Localised habitat loss within the Mt Porter lease is unlikely to disturb habitat where the Partridge Pigeon may occur.

### 10.2.6 Red Goshawk

Red Goshawk (*Erythrotriorchis radiatus*) is classified as a vulnerable species under the *EPBC Act 1999* and the Action Plan for Australian Birds (2000). This bird occupies a range of habitats in northern and eastern Australia, including coastal and subcoastal tall open forests and woodlands. However, within these habitats Red Goshawks are sparsely distributed. Red Goshawks breeding requirements are very specific, for example they will only nest in trees taller than 20 metres and these must be within one kilometre of water (Birds Australia 2005). Most of the range contraction in this species has occurred in New South Wales and southern Queensland where suitable habitat has been cleared. It is estimated that fewer than 1,000 Red Goshawks remain (Birds Australia 2005). No observations of the species have been made in the area and there is likely to be little impact on the species by the mining operation.

### 10.2.7 Masked Owl

Masked Owls (*Tyto novaehollandiae*) are classed as a vulnerable species under the *EPBC Act 1999*. They inhabit forests, woodlands, timbered waterways and open country on the fringe of these areas (Pizzey and Knight 1997). They require tall trees with suitable hollows for nesting and roosting and adjacent areas for foraging. The population range is a broad coastal band around most of mainland Australia and throughout Tasmania (i.e. no more than 300

kilometres from the coast). Population numbers of Masked Owls are low on the mainland. While the loss of several large trees in the pit area will occur, there is no evidence that the species has occurred in the area.

## 10.3 LISTED MIGRATORY SPECIES

A search of the *EPBC* Protected Matters Database identified one migratory reptile species and 14 migratory bird species that might occur in the Mt Porter project area. The species together with their *EPBC Act 1999* status, habitat requirements and indication of whether they have been recorded from the project area are detailed in Table 21. Migratory species may also be protected under three international treaties to which Australia is a signatory. These treaties are:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn).
- China – Australia Migratory Bird Agreement (CAMBA).
- Japan – Australia Migratory Bird Agreement (JAMBA).

Additional information for these species is provided in the following subsections.

**Table 21: Migratory Species Listed under the EPBC Act 1999 That May Occur Within the Mt Porter Project Area**

| Fauna Species | EPBC Status | Habitat[1,2] | Recorded in Site Specific Surveys |
|---|---|---|---|
| Salt Water Crocodile (*Crocodylus porosus)* | Migratory (Bonn) Listed Marine Species | Coastal rivers and swamps, inland along major rivers. | x |
| Gouldian Finch (*Erythrura gouldiae*) | Endangered Migratory (JAMBA) | Open woodlands and dense grasslands. | x |
| White Egret (*Ardea alba*) | Migratory (CAMBA, JAMBA) | Shallows of rivers, estuaries, tidal mudflats, freshwater wetlands | x |
| Cattle Egret (*Ardea ibis*) | Migratory (CAMBA, JAMBA) | Wetlands, tidal mudflats, pastures, croplands. | x |
| Fork-tailed Swift (*Apus pacificus*) | Migratory (CAMBA, JAMBA) | Largely aerial | x |
| Oriental Plover (*Charadrius veredus*) | Migratory (Bonn, JAMBA) | Open plains, bare rolling country, ploughed land, muddy/sandy wastes near inland swamps, tidal mudflats, bare claypans, margins of coastal marshes. | x |
| Melville Cicadabird (*Coracina tenuirostris melvillensis*) | Migratory (JAMBA) | Canopy of rainforest, Eucalypt forest, woodlands and mangroves. | x |
| Oriental Pratincole (*Glareola maldivarum*) | Migratory (CAMBA, JAMBA) | Plains, shallow, wet and dry edges of open bare wetlands, tidal mudflats and beaches. | x |
| White-bellied Sea-Eagle (*Haliaetus leucogaster*) | Migratory (CAMBA) | Coasts, islands, estuaries, inlets, large rivers, inland lakes and reservoirs. | x |
| Rainbow Bee-eater (*Merops ornatus*) | Migratory (JAMBA) | Open woodlands with sandy/loamy soil. | x |
| Little Curlew (*Numenius minutus*) | Migratory (Bonn, CAMBA, JAMBA) | Dry grasslands and floodplains, margins of drying swamps and tidal mudflats. | x |
| Rufous Fantail (*Rhipidura rufifrons*) | Migratory (Bonn) | Undergrowth of rainforest/wetter Eucalypt forest, monsoon forest, sub-inland and coastal scrubs, mangroves and watercourses. | x |
| Magpie Goose (*Anseranas semipalmate)* | Migratory EPBC | Large seasonal wetlands and well vegetated dams; wet grasslands; floodplains. | x |
| Painted Snipe *(Rostratula benghalensis s. lat.)* | Migratory (CAMBA) | Shallow freshwater wetlands, vegetated ephemeral and permanent lakes and swamps, and inundated grasslands | x |
| Derby White-browed Robin *Poecilodryas superciliosa cerviniventris* | Migratory (JAMBA) | Rainforest, swamp woodlands, bamboo/pandanus thickets by watercourses, mangroves | x |

[1] (Swan 2005); [2] (Pizzey and Knight 2003)

### 10.3.1 Saltwater Crocodile

The Saltwater or Estuarine Crocodile (*Crocodylus porosus*) inhabits coastal rivers and swamps from the Kimberley to Gladstone in Queensland. They also extend inland along major river systems and freshwater swamps (Swan, 2005).

No signs of Saltwater Crocodiles were recorded from the Mt Porter project area. This species has not been recorded in surveys of nearby areas. It is unlikely that this species will be encountered during mining operations at Mt Porter.

### 10.3.2 Migratory Wetland Bird Species

Seven migratory wetland bird species have potential to occur in the Mt Porter project area. These are the White or Great Egret (*Ardea alba*), Cattle Egret (*Ardea ibis*), Magpie Goose (*Anseranas semipalmate),* Painted Snipe *(Rostratula benghalensis s. lat.),* Oriental Plover (*Charadrius veredus*), Oriental Pratincole (*Glareola maldivarum*) and Little Curlew (*Numenius minutus*).

All of these species inhabit tidal mudflats and margins or shallows of watercourses, inland swamps or dams. The White Egret, Magpie Goose and the Cattle Egret are resident in the Northern Territory all year round while the Oriental Plover, Oriental Pratincole and Little Curlew are only resident during the non-breeding season (September – March, November – February and September – April respectively). The Painted Snipe is scarce and erratic over much of Northern Territory and is dispersive in response to rainfall (Pizzey and Knight, 2003).

None of the species listed above were recorded in the surveys conducted by Low Ecological. The White Egret was recorded in the Frances Creek Project area. The Magpie Goose is common in the greater region at particular times of the year. The Cattle Egret, Oriental Plover and Little Curlew have all been recorded during nearby surveys. The Oriental Pratincole was not recorded at Mt Porter or other nearby surveys. The Oriental Pratincole is a nomadic species which only spends a short time at any one location before moving on.

There are a number of water bodies in the region that offer a range of habitat for these species, however, these do not occur within the Mt Porter Project area. These species may use ephemeral water courses opportunistically, however it is not anticipated that the operation will impact negatively on the conservation significance of these species.

### 10.3.3 Migratory Terrestrial Bird Species

Seven migratory terrestrial bird species might occur in the Mt Porter project area. These are the Fork-tailed Swift (*Apus pacificus*), Melville Cicadabird (*Coracina tenuirostris melvillensis*), Gouldian Finch (*Erythrura gouldiae*), White-bellied Sea-Eagle (*Haliaetus leucogaster*), Rainbow Bee-eater (*Merops ornatus*), Rufous Fantail (*Rhipidura rufifrons*) and White-browed Robin (*Poecilodryas superciliosa cerviniventris*). The Gouldian Finch has been discussed in the previous section.

These species inhabit a range of habitats. The Fork-tailed Swift is a largely aerial species which spends most of its time in the air. The Melville Cicadabird inhabits the canopy of

rainforest and Eucalypt forests and woodlands while the Rufous Fantail occupies the understorey of similar forests and woodlands. The Rainbow Bee-eater prefers open woodlands with sandy or loamy soils while the White-browed Robin prefers wetter forests such as rainforests, swamp woodlands and mangroves. The White-bellied Sea-Eagle is normally found inland only along major rivers and requires trees greater then 30 metres in height or coastal/riverine cliffs in which to nest.

None of the species listed above were recorded during the site surveys, however, the Rainbow Bee-eater was recorded during a baseline survey at Frances Creek. Surveys of nearby areas have also recorded the remaining species. All migratory terrestrial bird species likely to inhabit the Mt Porter project area have also been recorded in Kakadu National Park (Woinarski et al, 1989).

Development of the Mt Porter project will result in localised removal of habitat. Of this undisturbed area, approximately 56% is in the Low Hills land unit, 34% in the Small Alluvial Flats land unit, 5% in the Ridge Crests land unit and 5% in the Swampy Meadow land unit.

The Ridge Crests and Slopes land unit is not considered preferred habitat for the migratory terrestrial bird species listed above (Reilly et al, 2006). Therefore the project will only impact a small proportion of the preferred habitat. The Rainbow Bee-eater, Melville Cicadabird, and White-browed Robin are all highly mobile nomadic species able to move to nearby undisturbed areas of habitat. The Rainbow Bee-eater is often seen around disturbed areas such as quarries, road cuttings and mines where exposed bare soil provides suitable breeding sites (Higgins, 1999).

Very few large trees (greater than 30 metres) and no cliffs are in the project area making it unlikely that the White Bellied Sea-Eagle is resident. The Fork-tailed Swift is unlikely to be impacted upon by habitat removal as it is a largely aerial species.

Additional impacts may result from vehicle movements along haul roads. Collisions between birds and vehicles can result in injury to or death of bird species.

Management and mitigation measures outlined in Section 9.6.2 will minimise any impacts on migratory terrestrial bird species. These measures include restricting vehicle speeds along all haul roads, developing and implementing a Wildlife Rescue Procedure and restricting land clearing to the minimum necessary for operations.

# 11. REHABILITATION AND CLOSURE

## 11.1 OVERVIEW

The purpose of decommissioning and closure planning is to describe the rehabilitation and closure strategies necessary to adequately address environmental issues to the satisfaction of regulatory authorities and Arafura at the completion of operations. The strategies are designed to ensure maintenance free or "walk away" closure over the long term.

The five basic steps involved in closure planning are:

- Removal and disposal of all infrastructure not required for other uses.
- Remediation of any soil or water contamination.
- Rehabilitation of disturbances.
- Post-closure maintenance and monitoring.
- Tenement relinquishment and financial security retirement.

As part of obtaining all permits necessary to start mining, Arafura will submit a security bond to DPIFM in case of any unplanned failure of the project. The size of this security bond will be reviewed in conjunction with DPIFM to ensure it remains consistent with level of disturbance caused by the project at any specific time **(Commitment 11.1a )**.

Rehabilitation will occur nearing the end of operations and will be completed to allow a return to pre-mining land use (pastoral) once full decommissioning is complete.

Indigenous species will be used to rehabilitate disturbed areas. Ideally revegetation will occur through careful management of topsoil and its contained seed resource. Supplementary seeding or planting may occur if rehabilitation monitoring demonstrates that revegetation is not proceeding in line with expected results.

Monitoring will be conducted after completion of rehabilitation to establish the effectiveness of rehabilitation over time. Monitoring will consider physical stability, erosion, minimisation, vegetation establishment (species diversity, density, cover) and weed presence **(Commitment 11.1b)**.

## 11.2 OBJECTIVES

The overall objective of decommissioning and closure planning is to establish a safe, stable landform with a self-sustaining and resilient vegetative cover similar in species richness and density to that in the surrounding landscape so that pastoral activity can resume.

Further to the overall objective for the project, specific completion criteria will be developed to address the following components of rehabilitation and closure of the site:

- Safety: Protect the public, domestic animals and wildlife from injuries.
- Geochemical and Physical stability: Ensure the physical and geochemical stabilisation of all project components in the short and long-term.

- Revegetation: Rehabilitate disturbed areas and habitat using local, native species.
- End land use: Allow a return to pre-mining land use (pastoral) once full decommissioning of operations is complete.

To ensure the objectives are met, Arafura will prepare and implement a Rehabilitation Plan as part of the Mining Management Plan.

## 11.3 REHABILITATION METHODOLOGIES

Rehabilitation will occur nearing the completion of mining. All rehabilitation will be in accordance with contemporary-accepted industry best practice and in accordance with an approved MMP.

As described in Section 9.1.2.2 topsoil will be stripped, where practicable, to a depth of approximately 100 millimetres from disturbed areas and placed in stockpiles less than two metres in height. As topsoil is stripped, it will be managed to allow for reuse for rehabilitation. Direct replacement will occur wherever practicable.

Specific rehabilitation tasks are needed to address differing types of land disturbance. Rehabilitation methodologies implemented for each disturbance type are described in more detail in the following sub sections.

### 11.3.1 Open Pit

Rehabilitation of the depleted mine pit will involve construction of a safety bund to prevent vehicle entry to mined areas.

### 11.3.2 Waste Rock Stockpile

Rehabilitation objectives for the waste rock stockpile will broadly include:

- Restoring the disturbed areas to a safe and stable landform that blends in with the surrounding landscape.
- Ensuring any PAF rock is encapsulated within an envelope of oxide waste. The waste rock stockpile will be designed to be water shedding to minimise the risk of water ingress into potentially PAF waste.
- Revegetating the waste rock stockpile, using best practice technology, with locally occurring native species.

Details of waste rock stockpile rehabilitation is discussed in Section 4.7and 9.2.2.

### 11.3.3 Infrastructure Areas

Infrastructure will be removed from the site at the completion of mining This will include administrative offices, workshops, fuel storage tanks, generators, water storage structures and

water pipes.

Disturbed surfaces will be rehabilitated after removal of infrastructure. This will involve:

- Treating any localised contamination (i.e. hydrocarbon spillages). Depending on the contaminant type and concentration, contaminated material may be removed or buried within the waste landform.
- Where topsoil is available, it will be respread over the reshaped surfaces and deep ripped.
- Contour ripping to help water infiltration and surface water control if required.
- Seed will be applied to ripped surfaces during rehabilitation.

# 12. HAZARDS AND RISKS

Arafura will address major hazards for the mining operation, both human-caused emergencies and natural disasters that threaten life, the environment and/or property.

The National Geoscience Dataset Geohazard Risk Contour Map (Australian Geological Survey Association, 1990) puts Pine Creek in a risk zone of having a 10 percent chance of exceeding an acceleration coefficient of 0.07 to 0.08 in the next 50 years. This is the median value for Australia, meaning the earthquake risk is low as is generally the case across Australia. As such, no special measures need to be incorporated into project design to address earthquake risk.

## 12.1 RISK ASSESSMENT

An environmental risk assessment was undertaken in accordance with Australian/New Zealand Standard 4360:1999 Risk Management. To maximise the pro-active management of environmental issues it is important that manpower and other resources are allocated on priority issues. It is normally accepted that the highest risk issues receive the highest priority. The generally accepted measure of risk is the product of the likelihood of an event occurring and the consequence of the event. For example an event that has a high likelihood and moderate consequence may be considered to have similar risk as an event that has a moderate or low likelihood and high consequence. Although the process has a high degree of subjectivity, it can provide very good analysis of risk when input is provided by experienced client representatives who have knowledge of the site.

The methodology used in the risk assessment rated both likelihood and consequence on a scale of 1 to 5. These numbers were assessed in the matrix shown in Table 22 and Table 23 to provide an indicator to the degree of risk associated with the issue and relative priority of the issue. Industry data was used to assess the **likelihood** of an environmental risk occurring. The **consequence** of an environmental issue was assessed by determining the severity of the effect, the area/population to be affected, the permanence of effects and the capacity of the area to recover.

**Table 22: Qualitative Measures of Likelihood**

| Level | Descriptor | Description |
|---|---|---|
| 1 | Rare | Environmental issue has not occurred in the past and there is a low probability that it may occur in exceptional circumstances. |
| 2 | Could Occur | Environmental issue may have occurred in the past and there is a moderate probability that it could occur at some time. |
| 3 | Should Occur | Environmental issue may have arisen in the past and there is a high probability that it should occur at some time. |
| 4 | Likely to occur | Environmental issue has been a common problem in the past and there is a high probability it will occur in most circumstances. |
| 5 | Will Occur | Environmental issue will occur, is currently a problem or is expected to occur in most circumstances. |

**Table 23: Qualitative Measures of Consequence**

| Level | Descriptor | Description and Example |
|---|---|---|
| 1 | No impact | Technical breach of environmental requirements with no environmental effect.<br>(eg) Licence requiring a toe drain around tailings to receive any seepage. The drain is yet to be installed but there is no seepage. |
| 2 | Minor | Minor non-recurrent issues.<br>(eg) Isolated incidences of pollution standards which are exceeded. |
| 3 | Limited | Issues of a continuous nature but with limited environmental effect.<br>(eg) Groundwater pollution with limited biological damage and no contamination of a potentially useable groundwater source. |
| 4 | Significant | Issue of a significant nature (medium term impact). It also includes incidents which could politically, legally or economically affect the operation regardless of extent of environmental impact.<br>(eg) Groundwater pollution with potential serious biological damage and/or contamination of a potentially useable groundwater resource. |
| 5 | Major | Major Issues with potentially serious public health and/or environmental consequences.<br>(eg) Major hydrocarbon spill to a land area, major tailings failure with extensive surface and water pollution. |

Table 24 and Table 25 show the risk and priority matrix used and the definitions of the risk levels respectively.

**Table 24: Risk Matrix and Prioritisation**

| Likelihood | Consequence | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 5 | 16 | 11 | 8 | 3 | 1 |
| 4 | 21 | 15 | 10 | 5 | 2 |
| 3 | 22 | 18 | 13 | 9 | 4 |
| 2 | 24 | 20 | 17 | 12 | 6 |
| 1 | 25 | 23 | 19 | 14 | 7 |

**Table 25: Risk Definitions (AS/NZS 4360:1999)**

| | |
|---|---|
| High | Immediate action required |
| Significant | Senior management attention needed |
| Moderate | Management responsibility must be specified |
| Low | Manage by routine procedures |

**Table 26: Environmental Issues and Risk Assessment**

| Potential Incident | Environmental Impact | Likelihood | Consequence | Priority | Risk | Cause | Current Control |
|---|---|---|---|---|---|---|---|
| **Pit Development** | | | | | | | |
| Loss of topsoil during pit development. | Insufficient topsoil available for rehabilitation. | 3 | 4 | 9 | S | Lack of awareness of requirements to stockpile topsoil<br>Topsoil used for other applications<br>Topsoil covered by other material. | Topsoils stockpiles signposted. |
| Generation of acid rock drainage from pit walls both during development and after pit closure. | Increases acidity of groundwater, surface water and soil. | 3 | 3 | 13 | S | Pit wall rocks containing high sulphide levels exposed to increased weathering processes. | |
| Dewatering impacts on regional aquifer during pit development. | Decrease in Groundwater level which may impact on vegetation in the area.<br>Change in regional water quality | 2 | 3 | 17 | M | Dewatering | Ground water levels anticipated to recover after mining. |
| Impact on environment over time after pit closure. | Change in groundwater levels and quality (primarily salinity)<br>Stock Exposure to saline water<br>Attraction of feral animals to water source<br>Collapsing of pit walls/<br>Fauna trap<br>Third party use. | 5 | 3 | 8 | S | Change in catchment features and groundwater recharge/discharge.<br>Evaporative concentration.<br>Pit filling up with water. | Monitoring of pit water quality over time. |

| Potential Incident | Environmental Impact | Likelihood | Consequence | Priority | Risk | Cause | Current Control |
|---|---|---|---|---|---|---|---|
| **Surface Mining** | | | | | | | |
| Dust emissions | Dust | 3 | 3 | 13 | S | Blasting<br>Haulage<br>Vehicular movements<br>Loading/unloading of trucks<br>Grade control digging | Water sprays on roads |
| Hydrocarbon Spillage | Contamination of soil, groundwater and surface water. | 3 | 1 | 22 | L | Damaged/ruptured bulk storage tanks<br>Spillage whilst transferring hydrocarbons | Fuel stored in Self-bunded tanks or bunded compounds.<br>Spills immediately collected and contaminated soil disposed in landfill site |
| Other air emissions | Air pollution | 2 | 2. | 20 | M | Vehicle and stationary engines combustion.<br>Blasting byproducts. | |
| Failure of the dewatering pipelines. | Erosion of soil<br>Release of water into the environment which impacts on groundwater quality and vegetation.<br>Loss of process water. | 4 | 2 | 15 | M | Pipeline Fracture.<br>Leaking Valves/Poly couplings.<br>Spills. | Inspection of pipelines. |
| **Waste landform** | | | | | | | |
| Generation of acid rock drainage from waste rock stockpile. | Increases acidity of soil, ground water and surface water. | 3 | 3 | 13 | S | Ores containing high sulphide levels exposed to weathering processes. High surface area of exposed rock increasing weathering. | High Sulphide waste rock is encapsulated in the waste landform to minimize exposure to weathering elements.. |

| Potential Incident | Environmental Impact | Likelihood | Consequence | Priority | Risk | Cause | Current Control |
|---|---|---|---|---|---|---|---|
| Erosion of battered faces on the waste rock landform. | Build up of sediment in stormwater drains and surface water systems.<br>Windblown Dust<br>Lack of rehabilitation.<br>Visual impact | 3 | 3 | 13 | S | Insufficient revegetation of slopes to help stabilise batter<br>Surface water runoff<br>Wind erosion<br>General surface instability. | Rehabilitation<br>Stormwater diversion from top of waste landform.<br>Construction of drains around waste landform.<br>Sheeting with rocky material and topsoil to help stability. |
| **Hydrocarbons** | | | | | | | |
| Spillage of hydrocarbons during bulk transport to site by road. | Contamination of soil, groundwater and surface water | 3 | 4 | 9 | S | Vehicle accident<br>Leaking valve/hoses on truck<br>Ruptured tank | Emergency Response Procedures. |
| Spillage of hydrocarbons during filling tanks onsite. | Contamination of soil, groundwater and surface water | 3 | 4 | 9 | S | Leaking valve<br>Leaking hoses<br>leaking pipelines<br>Spillage<br>Human Error | Bunded apron and sump at loading area to contain spills. |
| Leakage of Hydrocarbons from storage areas/pipelines | Contamination of soil, groundwater and surface water. | 3 | 4 | 9 | S | Ruptured tank<br>Damaged pipelines<br>Damaged flanges/valves | Bunding around fuel tanks.<br>Regular inspection and maintenance of facility. |
| Waste oil spillage. | Hydrocarbon contamination of surrounding soil, groundwater and surface water. | 3 | 4 | 9 | S | Ruptured tank<br>Faulty valves | Regular inspection and maintenance of facility. |

| Potential Incident | Environmental Impact | Likelihood | Consequence | Priority | Risk | Cause | Current Control |
|---|---|---|---|---|---|---|---|
| Spillage/Leakage of 44 gallon drums containing special oils and degreaser. | Contamination of soil, groundwater and surface water | 3 | 2 | 18 | M | Spills whilst decanting from the drum<br>Ruptured/damaged drums | Locate drums on containment pallets. |
| **Workshop Facilities** | | | | | | | |
| Hydrocarbon contamination while onsite. | Contamination of soil, groundwater and surface water | 3 | 4 | 9 | S | Ruptured or damaged containers | Bunded areas are located around all bulk hydrocarbon storage tanks. |
| | Loss of resources. | 3 | 4 | 9 | S | Spillage while transferring, using or transporting hydrocarbons onsite. | Spills immediately collected and contaminated soil disposed in landfill site.<br>44 gallon drums containing hydrocarbons and old batteries at the workshop are within an earth bunded area. |
| Hazardous material spills | Contamination of soil, groundwater and surface water. | 3 | 2 | 18 | M | Transfer from one container to another<br>Damaged containers<br>Damaged hoses (if applicable) | A spill containment kit will be located in the workshop area. |
| **Explosive Facilities** | | | | | | | |
| Spillage of Ammonium nitrate (on and offsite) | Contamination of soil, groundwater and surface water. | 3 | 4 | 9 | S | Spillage whilst filling and emptying the bulk tank.<br>Ruptured tanks. | Bunded area around the compound to contain spills.<br>Waste containers to collect the spills.<br>Has appropriate MSDS information to clean up spills. |

| Potential Incident | Environmental Impact | Likelihood | Consequence | Priority | Risk | Cause | Current Control |
|---|---|---|---|---|---|---|---|
| **Waste Management** | | | | | | | |
| General waste management, including landfill site. | Windblown litter<br>Leachate<br>Dust<br>Odour<br>Landfill Gas emissions<br>Attracts Vermin<br>Loss of resources (including decreased life of landfill site) | 1 | 2 | 23 | L | Inappropriate siting, design and operation of landfill site | Bury in active face in waste stockpile daily. |
| Putrescible wastes. | Leachate<br>Odour<br>Landfill Gas Emissions<br>Attracts vermin | 1 | 2 | 23 | L | Disposal of wastes into inappropriately designed landfill site<br>Not covering wastes as soon as it is disposed to the site | Bury in active face in waste stockpile daily. |
| Other wastes eg tyres, batteries, pallets and packaging. | Litter<br>Contaminants from some wastes entering soil, groundwater or surface water.<br>Decrease life of landfill site. | 3 | 1 | 22 | L | Inappropriate storage and disposal of wastes. | Batteries are stored in an earth bunded area and sent offsite for recycling<br>. |
| Disposal of contaminated soil. | Leaching of pollutants into soil, groundwater and surface water.<br>Vegetation loss. | 4 | 2 | 15 | M | Disposal in inappropriate area. | Bury in active face in waste stopckpile daily. |

| Potential Incident | Environmental Impact | Likelihood | Consequence | Priority | Risk | Cause | Current Control |
|---|---|---|---|---|---|---|---|
| **Rehabilitation** | | | | | | | |
| Ineffectual seeding | Loss of vegetation<br>Slow growth rates | 2 | 4 | 12 | S | Lack of rain<br>Cyclone<br>Planting of inappropriate species. | Research into appropriate species and times of the year where planting is optimum. |
| Impacts on soils and degree of erosion. | Sediment build up in surface water and other drainage systems so water will find alternative route causing erosion and flooding of areas.<br>Inability to rehabilitate | 5 | 3 | 8 | S | Lack of vegetation on slopes<br>Lack of stormwater diversion systems. | The waste landform will be designed to shed water. Drainage systems will be constructed in consideration of surface water flows. |

**Table 27: Prioritisation of Environmental Issues**

| Potential Incident | Risk | Priority |
|---|---|---|
| Impact on environment over time after pit closure. | Significant | 8 |
| Soil erosion. | Significant | 8 |
| Loss of topsoil during pit development. | Significant | 9 |
| Spillage of hydrocarbons during bulk transport by road. | Significant | 9 |
| Spillage of hydrocarbons while filling tanks onsite. | Significant | 9 |
| Leakage of Hydrocarbons from storage areas/pipelines. | Significant | 9 |
| Waste oil tank spillage. | Significant | 9 |
| Hydrocarbon contamination at workshops. | Significant | 9 |
| Spillage of Ammonium nitrate (on and offsite) | Significant | 9 |
| Dust emissions during surface mining | Significant | 13 |
| Generation of acid rock drainage from pit walls both during development and after pit closure. | Significant | 13 |
| Generation of acid rock drainage from waste rock stockpile. | Significant | 13 |
| Erosion of battered faces on waste rock stockpile. | Significant | 13 |
| Failure of the dewatering pipelines. | Moderate | 15 |
| Disposal of contaminated soil. | Moderate | 15 |
| Dewatering impacts on regional aquifer during pit development. | Moderate | 17 |
| Spillage/Leakage of 44 gallon drums containing oils and degreaser. | Moderate | 18 |
| Hazardous material spills at workshops. | Moderate | 18 |
| Other air emissions during surface mining | Moderate | 20 |
| Hydrocarbon Spillage during surface mining | Low | 22 |
| Other wastes eg tyres, batteries, pallets and packaging. | Low | 22 |
| General waste management, including landfill site. | Low | 23 |
| Putrescible wastes. | Low | 23 |

## 12.2 SAFETY MANAGEMENT

In common with all mining and processing operations, the mine will present hazards and risks. A Safety Management System will be developed for the project. Details of the system will be included in the Mining Management Plan provided to DPIFM.

All contractors will be required to have their own documented safe work practices and procedures. Arafura will require these to be compliant with the project Safety Management System.

## 12.3 EMERGENCY RESPONSE

Arafura will develop an Emergency Preparedness and Response Plan (EPRP). This will be included into the site Mining Management Plan (MMP) prior to operations commencing. In general, the EPRP will endeavour to ensure:

- A safe environment for all employees, contractors, visitors and neighbours.
- That all activities are conducted in an environmentally responsible manner consistent with environmental regulations, guidelines and best practice.
- The identification and management of all significant environmental risks.
- That the response to emergencies is predicted primarily on the preservation of human life and the safety of emergency response personnel.
- The containment of emergencies and their effects within facility boundaries.
- Cooperation with external emergency response organisations.
- A safe return to normal operations.

## 12.4 INDUCTION AND TRAINING

All personnel will be required to participate in a site specific induction when they start employment. Occupational hazards, environmental requirements and social/community issues associated with the project will be addressed in the induction.

Ongoing training and meetings to review work practices and safety issues will be held regularly under auspices of the Mine Manager. Regular operational meetings will cover immediate requirements.

# 13. ENVIRONMENTAL MANAGEMENT

## 13.1 ENVIRONMENTAL MANAGEMENT SYSTEM

Arafura will develop and implement a Corporate Environmental Management System (EMS). The EMS will support a project / site Environmental Management Plan (EMP) and provide a formal description of the methodical framework for managing environmental issues.

The EMS aims to describe processes, procedures, practices to implement environmental considerations into all aspects of operations. An important component of the EMS is a platform for ongoing review and reporting of environmental performance of operations in a quantifiable and consistent manner.

The EMS will consist of the following 11 elements:

**1. Environmental Policy and Objectives**

The Corporate Environmental Policy:

- Provides objectives for conduct of all operations, employees and contractors.
- Details Arafura's commitment to continuous improvement in environmental performance, pollution prevention and compliance with environmental legislation, regulations and standards.

**2. Legal Obligations and Other Requirements**

Statutory requirements set the standard for minimum compliance. Arafura, its employees, contractors, suppliers and other third parties are bound by:

- Federal and Territory legislation and regulations.
- Company standards.
- Company-authorised procedures, directives and instructions applicable to the workplace.

A Compliance Register detailing applicable legal requirements and voluntary commitments by Arafura will be developed.

**3. Management Commitment**

Company directors recognise the importance of leading by example and demonstrating management commitment to EMS objectives. Senior management is committed to active involvement in implementing this system.

Arafura senior management will review the EMS at least annually to ensure it remains adequate, effective and appropriate. The review will take into account:

- Relevant results of environmental audits.
- Extent to which objectives and targets have been met.
- Continuing suitability of the EMS.
- Concerns of all interested parties.

**4. Key Responsibilities and Reporting Structure**

Environmental management has direct-line accountability, with individual employees and contractors responsible for conducting activities in an environmentally-acceptable manner.

Successful implementation of the EMS will depend on a commitment from all employees and contractors, detailed job and responsibility descriptions, developing key performance indicators, induction and training. Individual responsibilities and authorities will be defined, documented and communicated to facilitate effective environmental management.

**5. Education and Training**

It is recognised that employees and contractors who do work that may have significant environmental impacts will require appropriate training, education and/or experience. Training and competency needs will be identified and competencies assessed.

Arafura will ensure appropriate training is provided for all employees and contractors to meet its EMS requirements. All employees, including site-based contractors, will be required to attend an induction when they start work; this will include environmental awareness and responsibilities and the function and implementation of the EMP.

**6. Communication and Consultation**

Arafura will communicate and consult with internal and external stakeholders. Effective communication with staff, contractors, regulatory authorities and the community will be inherent in all activities.

Procedures are being developed for establishing and maintaining a document control system and for receiving, documenting and responding to relevant information and requests from external parties.

**7. Environmental Issues and Risks**

Environmental issues and risks associated with Arafura's activities, discharges, consumables and products will be identified, evaluated and managed. EMPs and associated procedures will document requirements to manage and minimise environmental risks during construction, normal operations, closure and emergency situations as far as practicable. Risk assessments will be conducted for all new projects before issue of contracts or modification to existing processes. A Hazard Register will centralise risk assessment information.

**8. Operational Control**

Arafura recognises that the adoption, use and continuous improvement of consistent standards, procedures and guidelines will result in sound environmental management.

Arafura will ensure that procedures, work permits and risk assessment outcomes are effectively implemented to achieve environmental objectives associated with all aspects of its operations, including managing change and emergency situations.

Environmental monitoring will provide ongoing information about impacts of individual tasks or projects and effectiveness of control strategies that are implemented to minimise these impacts.

**9. Contractor Management**

Arafura will establish standards to ensure that risks to the environment resulting from the contracting of equipment, materials or services are reduced to as low as reasonably practicable.

Arafura will establish a systematic approach to selecting and managing contractors to ensure company environmental standards are maintained. An inspection program will ensure performance of contractors is consistent with EMS requirements.

**10. Environmental Performance**

Monitoring systems and procedures and collecting data will form the basis of measuring key performance indicators and Arafura's performance against yearly environmental objectives and targets, compliance with regulatory requirements, voluntary commitments and the EMS.

Systems will be established for internal and external reporting of environmental hazards, incidents, non-compliances and communication of environmental monitoring results.

**11. Environmental Audits and Inspections**

Audits, inspections and reviews will allow individual operations and projects to identify areas for improvement and will help continually improve environmental performance. Inspections will focus on practical implementation of procedures, identification and management of hazards and achievements of key performance indicators.

Audits will ensure both the EMS and specific components of the system are complied with. Reviews will ensure EMS requirements are desirable, practicable and help the operation meet its regulatory and voluntary environmental commitments and key performance indicators.

## 13.2 ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) will be developed in consultation with NRETA and DPIFM, prior to start of construction. The following sections detail the proposed content and structure of the EMP.

### 13.2.1 Objectives

The objective of an EMP is to clearly describe key environmental strategies to be adopted by Arafura to manage the project in accordance with the company's Environmental Policy and statutory environmental requirements.

Development of an EMP is an integral component of the EMS, required under Section 40 of the *Mining Management Act* to be included in the Mining Management Plan.

### 13.2.2 Structure and Scope

Procedures outlined within the EMP document will apply to all components of the project during construction, operation and closure phases. The EMP will be binding on all Arafura's employees and contractors. The EMP will be developed in accordance with:

- The *Draft Environmental Management Plan (EMP) Guidelines* prepared by DIPE (undated); the EMP requirements outlined in the draft PER Guidelines;
- DBIRD's Mining Management Plan Advisory Note (DBIRD February 2002); and
- DBIRD's *Small Mining Operations Mining Management Plan Advisory Note (DBIRD November 2002).*

The EMP structure will be split into two sections. The first section will describe administrative details necessary to effectively guide and implement the EMP. These are:

- The Arafura Environmental Policy.
- Environmental performance objectives for core areas.
- Appropriate resources necessary to fulfil EMP requirements.
- Environmental responsibilities necessary to implement the EMP.

The second section will detail individual management strategies that the project will adopt to meet the objective of the EMP document. Management strategies will be developed for the following core areas:

- Emergency Preparedness and Response.
- Fire management
- Environmental Training.
- Soil and Land Management.
- Vegetation Management.
- Fauna Management.
- Air Quality Management.
- Noise and Vibration Management.
- Groundwater Management.
- Surface Water Management.
- Waste and Hazardous Materials Management.
- Ethnographic and Archaeological Management.
- Socio-Economic Management.
- Rehabilitation.
- Closure Management.

Each environmental aspect will be presented in a format that concisely details:

- The potential environmental issues or impacts as a result of the project.
- Arafura objectives and targets for managing potential environmental issues or impacts.
- Management strategies necessary for Arafura to meet environmental objectives and targets. These strategies are subdivided into the construction and operations phase of the project.
- Monitoring and reporting requirements associated with management strategies.

- Contingency planning if required. A large component of contingency planning is detailed within the section on, Emergency Response and Preparedness.
- Persons responsible for managing the environmental aspects.

A draft EMP is attached as Appendix 10. This contains information that will form the core part of the second section of the EMP.

### 13.2.3 EMP Review

Because of the short duration of the operation (eight months), it will not be necessary to review the document.

# 14. PUBLIC INVOLVEMENT AND CONSULTATION

Arafura initiated stakeholder consultation for the project before it submitted the Notice of Intent in July 2003. Consultation allowed issues raised during the process to be taken into consideration in the project's design, development, operation and closure.

Significant stakeholders were identified through discussions with DPIFM, NRETA, DPI, and the Northern Lands Council.

A list of consultation activities undertaken is detailed in Table 28.

**Table 28: Summary of Consultation Undertaken to Date**

| Consultation | Date |
|---|---|
| Equest, the registered proprietor of the land on which the Tenement is located, was formally advised of the Mineral lease application at the time of lodgement. He was also advised of the NOI and public exposure of the draft PER guidelines in mid 2004 and had a right to make a submission prior to the Minister issuing the final PER guidelines in late 2004. No submission was made and no objection was made by Equest regarding the mineral lease application. Equest and Arafura have agreed as to the compensation to be paid to Equest in respect of the resultant disturbance to the land. | Mid-2004 |
| The owner of the Mary River West cattle station, Garry Hamilton, was formally advised of the Mineral lease application at the time of lodgement. He was also advised of the NOI and public exposure of the draft PER guidelines in mid 2004 and had a right to make a submission prior to the Minister issuing the final PER guidelines in late 2004. No submission was made and no objection was made by Mr Hamilton regarding the mineral lease application. | Mid-2004 |
| AGES Conference 2006: Arafura presented at the AGES Conference. The presentation included a section on the proposed Mt Porter operation. | March 2006 |
| Arafura conducted a Community Forum in Darwin. It was open to members of the community with an interest in the Mt Porter Project, including local businesses, Rotary and local shires. Arafura presented and discussed the opportunities for local business and shires in developing the Mt Porter deposit. | June 2006 |
| Arafura conducted a presentation at the Industry Resource Conference, detailing proposed the Mt Porter Operations. | September 2006 |
| Manufacturing Council Meeting | October 2006 |
| Northern Territory Mining Council | October 2006 |
| Ongoing correspondence with the Northern Lands Council to negotiate the terms of the agreement between Arafura and the Native Title claimants Wagiman, Warai and Jawoyn. | |

# 15. SUMMARY OF COMMITMENTS

Commitments with respect to the design and management are made throughout the PER. For convenience, commitments and key performance indicators where applicable are summarised in Table 29.

**Table 29: Summary of Arafura's Commitments for the Mt Porter Project**

| Commitment Number | Commitment and Key Performance Indicators Where Applicable |
|---|---|
| **Landform and Soils (PER Section 9.1)** | |
| **9.1.2.1a** | An internal Land Clearance Procedure will be implemented for all ground disturbance activities, to track the cumulative clearing undertaken for the project. |
| **9.1.2.1b** | Access to all areas outside the immediate mine area and off formed roads and tracks will be prohibited. |
| **9.1.2.1c** | Vehicles and mobile equipment will be parked only in designated parking areas. Vegetated areas will not be used for parking areas. |
| **9.1.2.2a** | Stripping topsoil to a depth of about 100 millimetres where practicable and placing directly onto rehabilitation areas or stockpiles. |
| **9.1.2.2b** | Placing stockpiled topsoil in windrows less than two metres high to minimise loss of seed viability and soil biota. |
| **9.1.2.2c** | Rehabilitation of the waste landform and site infrastructure areas will be undertaken at the conclusion of mining. All rehabilitation will be performed in accordance with contemporary accepted industry best practice and conducted in accordance with an approved MMP. |
| **9.1.2.2d** | Stripping and stockpiling topsoil (where required) in dry and preferably still wind conditions, to minimise dust generation and assist rapid revegetation. |
| **9.1.2.3a** | Controlling slope gradients to minimise erosion and soil loss. |
| **9.1.2.3b** | Installing diversion bunds and drains as necessary to control local surface water runoff to minimise overland flow and consequential erosion. |
| **9.1.2.3c** | Ripping rehabilitation areas on the contour to remove compaction, improve soil structure and improve infiltration capacity. |
| **9.1.2.3d** | Routinely inspecting rehabilitated and disturbed surfaces for erosion, particularly after significant rainfall. Implementing appropriate remediation measures if soil erosion is observed during routine inspections. |
| **Waste Rock Management (PER Section 9.2)** | |
| **9.2.2a** | Ensuring all PAF material is encapsulated in the waste landform. |
| **9.2.2b** | Arafura will conduct further testing of PAF material as it is encountered during mining to ensure its geochemical properties are understood and management measures described in this PER will be effective in preventing acid generation over time. |
| **9.2.2c** | Contouring the waste rock stockpile so that it blends with the surrounding topography so that the final design is aesthetically pleasing. |
| **9.2.2d** | Contouring the waste rock stockpile top surface at gentle gradients to direct drainage off the dump and discourage infiltration over the PAF cell. |
| **9.2.2e** | Building diversion drains wherever stockpile construction obstructs significant |

| Commitment Number | Commitment and Key Performance Indicators Where Applicable |
|---|---|
| | water courses. |
| **9.2.2f** | Deep ripping the waste rock stockpile slopes on the contour to assist water absorption and minimise erosion. |
| **9.2.2g** | Spreading topsoil on the waste rock stockpile once shaping is complete to facilitate revegetation. |
| **9.2.2h** | Routinely inspecting the rehabilitated waste rock stockpile for erosion, particularly after significant rainfall. Implementing appropriate remediation measures if soil erosion is observed during routine inspections. |
| **Groundwater Management (PER Section 9.3)** | |
| **9.3.2a** | Flow meters will be fitted to groundwater extraction bores to enable monitoring of extraction volumes. |
| **9.3.2b** | Monthly monitoring of standing water levels (SWL) of production bores for the duration of the operation. |
| **9.3.2c** | Septic systems will be located in areas where there is sufficient depth to the natural watertable to allow the system to operate effectively and minimise risk of polluting the groundwater. |
| **9.3.2d** | Post-mining monitoring of ground water levels and quality twelve months after mine closure. If deemed necessary, further monitoring of groundwater will be conducted. |
| **Surface Water Management (PER Section 9.4)** | |
| **9.4.2a** | Any surface run-off requiring discharge to the environment will be directed to detention basins to remove sediment prior to discharge. |
| **9.4.2b** | Contouring the waste rock stockpile top surface at gentle gradients to direct drainage off the dump and discourage infiltration over the PAF cell. |
| **9.4.2c** | Building diversion drains where stockpile construction obstructs water courses. |
| **9.4.2d** | Shallow detention basins will be established on Pit Gully and East Gully downstream of the waste rock stockpile to remediate runoff from the waste rock stockpile. |
| **9.4.2e** | Culverts and/or floodways will be installed as required where roads cross watercourses and drains. Water diversion structures will be armoured, where necessary, to reduce the velocity and erosion potential, of surface flows. |
| **9.4.2f** | Hydrocarbon storage will be in accordance with Australian Standard *AS1940 Storage and Handling of Flammable and Combustible Liquids.* |
| **9.4.3a** | No water discharge to the environment will occur without an approved Waste Discharge Licence. Discharges will meet approved water quality criteria. |
| **9.4.3b** | Any dewatering discharge will be monitored and treated if necessary to meet agreed release criteria as specified in the MMP and waste discharge licence before release to the environment. |
| **9.4.4a** | Water management measures for infrastructure completed before the end of April will be designed to cope with major rainfall events of up to 500millimetres. |
| **9.4.4b** | Water management measures for landforms and infrastructure remaining at the end of October will be designed to manage wet season rainfall events. |
| **9.4.4c** | Water management measures for temporary disturbances and infrastructure to be removed by October will be designed to manage dry season rainfall events of up to 100 millimetres. |

| Commitment Number | Commitment and Key Performance Indicators Where Applicable |
|---|---|
| **9.4.5a** | A water monitoring program will be implemented under the Environmental Management Plan. |
| **9.4.5b** | The water monitoring program will include regular sampling of water unaffected by and water downstream of mining activities within the lease. Monitoring results will be reviewed against past monitoring and ANZECC guidelines to detect any deterioration in water quality and allow action to be taken. |
| **9.4.5c** | The water monitoring program will include analysis of water potentially to be discharged to the environment prior to any such discharge. |
| **9.4.5d** | Quantity of water discharge will be monitored and recorded. |
| **9.4.5e** | Dewatering and dust suppression water quality will be monitored regularly during operations. As operations will be occurring in the dry season it is likely there will be little opportunity to monitor stormwater and natural streamflow during operations, but procedures will be developed to allow opportunistic monitoring of any runoff events that occur. Post-mining monitoring of surface water quality down stream from the project area will be undertaken for at least 12 months after mine closure. If deemed necessary, further monitoring of surface water will be conducted. |
| **Vegetation and Flora Management (PER Section 9.5)** | |
| **9.5.2.1a** | Developing a Land Clearing Management Procedure as part of the EMP. |
| **9.5.2.1b** | Minimising the impact of clearing by restricting vegetation clearing to the minimum necessary for operations. |
| **9.5.2.1c** | Clearly delineating the perimeter boundary of all areas approved for clearing before clearing works begin. |
| **9.5.2.2a** | Preparing a Weed Management Plan as part of the EMP. The plan will include, but will not be limited to, issues of vehicle and personal hygiene in regards to weeds, identification of weed species (including noxious weeds) and control and eradication measures. |
| **9.5.2.2b** | Requiring all earthmoving equipment introduced to the project area to have been cleaned to remove soil and plant seeds prior to entry. |
| **9.5.2.2c** | Confining company vehicles to travelling on purpose-built roads to minimise potential vehicle-borne spread of weed species. |
| **Fauna Management (PER Section 9.6)** | |
| **9.6.2a** | Requiring employees and contractors to attend an induction program that will include a component on environmental management. In particular, the induction will clearly explain employee and contractors' roles and responsibilities to restrict impacts on fauna and habitat. |
| **9.6.2b** | Educating all employees and contractors to recognise species of conservation significance, particularly the Gouldian Finch, and requiring them to report any sightings to the Environmental Manager. |
| **9.6.2c** | Reporting sightings of species of conservation significance to the Northern Territory Parks and Wildlife Commission. |
| **9.6.2d** | A monitoring program and Management Plan will be developed specifically for the Gouldian Finch. As part of the site induction all staff will be educated in identifying Gouldian Finches and procedures to be followed if Gouldian |

| Commitment Number | Commitment and Key Performance Indicators Where Applicable |
|---|---|
| | Finches are observed. |
| **9.6.2e** | Restricting speeds on haulage routes and mine roads to minimise fauna death on roads. |
| **9.6.2f** | Cleared vegetation will be stockpiled and respread in the rehabilitation program to provide fauna habitats. |
| **9.6.2g** | Developing a Wildlife Rescue Procedure to operate in conjunction with land-clearing operations and where vehicle movements occur. |
| **9.6.2h** | Participating in feral animal control programs on Mary River West stations, if requested by owners. |
| **9.6.2i** | Arafura will undertake Cane Toad trapping programs during the life of the Mt Porter Project. |
| **9.6.2j** | Banning domestic animals and firearms on site. |
| **9.6.2k** | Waste management procedures will be implemented to minimise attraction of feral animals to the project area. |
| **9.6.2l** | Drill holes will be capped and appropriately rehabilitated to remove potential hazard to the local wildlife. |
| **Atmospheric Pollution and Noise Management (PER Section 9.7)** | |
| **9.7.3a** | Emission control equipment is installed on all combustion engines. |
| **9.7.3b** | Diesel combustion engines in stationary and mobile equipment and diesel-powered electric generators will be operated and maintained to minimise emissions of combustion gases. |
| **9.7.3c** | Water trucks will be used to control fugitive dust within the pit and on internal roads to minimise dust emissions. |
| **9.7.3d** | Movement of mobile equipment and vehicles will be limited to formalised tracks and roads where dust control methods can be used. |
| **9.7.3e** | Equipment operators will remain in enclosed, air-conditioned cabins to minimise exposure to dust emissions. |
| **9.7.3f** | Areas will be rehabilitated at the conclusion of operations to prevent dust generation. |
| **9.7.3g** | Joining the Federal Government's Greenhouse Challenge Plus program and monitoring greenhouse emissions and efficiency. |
| **9.7.3h** | Energy efficiency will be a major consideration in the selection and design of equipment and plant. |
| **9.7.3i** | Encouraging all employees to be energy efficient in their day to day activities and educating them on this. |
| **9.7.3j** | Reducing the noise from equipment by installing soundproofing and/or noise abatement devices, where practicable, around/on primary sources of noise such as power generators and water pumps. |
| **9.7.3k** | Maintaining, to the extent practicable, the natural acoustic barriers (for example trees and ridges) between noise sources and neighbouring communities. |
| **9.7.3l** | Hearing protection equipment will be made available and utilised in onsite areas where engineering controls are deemed inappropriate or ineffective. |
| **Waste and Hazardous Materials Management (PER Section 9.8)** | |

| Commitment Number | Commitment and Key Performance Indicators Where Applicable |
|---|---|
| **9.8.2a** | Material Safety Data Sheets will be available and accessible at all work places where hazardous materials are used. |
| **9.8.2b** | Design of on ground hydrocarbon storage tanks and secondary containment will be in accordance with AS1940 -2004 Storage and Handling of Flammable and Combustible Liquids. |
| **9.8.2c** | All mobile equipment and light vehicle servicing activities including wash down will be done on impermeable surfaces. |
| **9.8.2d** | The heavy vehicle workshop will contain a purpose-built wash down facility incorporating an appropriate sediment and oil/grease removal system. |
| **9.8.2e** | An Emergency Response Procedure will be developed to ensure appropriate response can be made to minimise the environmental impact caused by incidents involving hazardous materials or wastes. |
| **9.8.2f** | The mobile refuelling truck will carry spill containment and cleanup material at all times and the driver will be trained in the use of these materials. |
| **9.8.2g** | A register of all hazardous materials imported to the site or generated as a result of site activities will be maintained. This will document the hazardous material name, location, approximate volume, storage method and where applicable, disposal method for the substance and containers. |
| **9.8.2h** | Bringing hazardous materials to the site in bulk packaging wherever possible. This practice will minimise the number of containers and reduce risk of spillage. |
| **9.8.2i** | Hazardous waste generated by the operation will be transported offsite to licensed waste disposal facilities. This is likely to include waste oil, grease and heavy equipment oil and fuel filters. |
| **9.8.2j** | All hazardous wastes will be temporarily stored in designated containers and contents properly labelled at all times. |
| **9.8.2k** | Domestic waste from the offices and workshops will be properly handled, transported to, and disposed of in the onsite landfill. |
| **9.8.2l** | Reusable pressurised containers and vessels will be returned to suppliers. Pressurised containers and vessels that are not reusable will be punctured using suitable equipment and disposed of in the onsite landfill. |
| **9.8.2m** | Arafura staff and contractors will be trained in proper handling and disposal of waste material. |
| **9.8.2n** | Explosives magazine will be constructed and operated in accordance with regulatory requirements. |
| **9.8.2o** | A licence to Store Dangerous Goods will be obtained for the storage of diesel fuel on site. |
| **9.8.2p** | Septic systems will be located in suitable areas where there is sufficient depth to groundwater to allow the system to operate effectively. |
| **9.8.2q** | Prior to their installation, plans for the septic systems will be approved by the relevant government agency. |
| **Cultural Environment Management (PER Section 9.9)** | |
| **9.9.2a** | The location coordinates of sites of archaeological significance will be stored in a suitable database by Arafura and shall be made accessible to project design, construction and operations personnel. |
| **9.9.2b** | All employees and contractors will be required to participate in a general site |

| Commitment Number | Commitment and Key Performance Indicators Where Applicable |
|---|---|
| | induction before starting work. The induction will include:<br>• Information on the importance of the cultural environment and protecting artefacts and archaeological sites.<br>• Information on the correct procedure if items of potential Aboriginal or heritage significance (including bones) are discovered during quarrying or other mining activities. |
| **9.9.2c** | The Northern Land Council and NRETA will be contacted immediately if items of potential Aboriginal significance are discovered. |
| **9.9.2d** | A 50 metre exclusion zone shall be provided around sites of high archaeological significance (sites MP03, MP07, MP34, MP48 and MP49 (excluding the area currently disturbed by the access track). |
| **9.9.2e** | The access track from Frances Creek Road to the mine site will be relocated to avoid generation of dust from the road impacting MP49. |
| **9.9.2f** | Arafura will operate with a preference to employ people from the local community where suitable. |
| **Socio-Economic Environment Management (PER Section 9.10)** | |
| **9.10.2a** | On final decommissioning plant and infrastructure will be dismantled, made safe and unless requested otherwise by project stakeholders, removed from the site. |
| **9.10.2b** | Compensation agreements will be reached with landowners for loss of use of land used by Arafura for mining or associated infrastructure. |
| **9.10.2c** | Employment opportunities will be advertised locally and preference will be given to local candidates. |
| **9.10.2d** | Provision of goods and services will be advertised locally and preference will be given to local businesses. |
| **9.10.2e** | First aid facilities will be established onsite for the duration of the project. These facilities will be manned by appropriately qualified employees. |
| **9.10.2f** | A liaison will be established between onsite Emergency Response and First Aid personnel and providers of equivalent services in Pine Creek, Katherine and Darwin. |
| **9.10.2g** | Arafura will establish a complaints procedure by which the public can lodge complaints about the operation or impact of the mine. |
| **Transport Management (PER Section 9.11)** | |
| **9.11.2a** | Erecting warning signs at the junction of Frances Creek Road and Mt Wells Road to advise the public they are entering private property and must comply with all directions issued by Arafura. Discouraging casual access. |
| **9.11.2b** | Signs on Mt Wells Road, giving warning of road trains entering, leaving and travelling along the haul road. |
| **9.11.2c** | Road maintenance to be carried out to DPI standards. This will include regular grading of the Frances Creek and Mt Wells roads and additional maintenance on stream crossings on the Mt Wells Road between Pine Creek and the mine as necessary to improve all-weather access. |
| **9.11.2d** | If deemed necessary, a commuter bus will be provided to minimize traffic between Pine Creek and Mt Porter. |
| **9.11.2e** | Road train drivers will use radio communications to coordinate safe passing. Only one to two road trains will operate at any time. |

| Commitment Number | Commitment and Key Performance Indicators Where Applicable |
|---|---|
| **9.11.2f** | Licensed road going vehicles will be used for haulage and standard axle loadings will be complied with. |
| **9.11.2g** | Sufficient freeboard will be left at the top of all trailers when loading to ensure ore product can not spill. |
| **Visual Amenity Management (PER Section 9.12)** | |
| **9.12.2a** | The impact of clearing will be minimised by restricting clearing of vegetation to the minimum necessary for operations. |
| **9.12.2b** | Access to the project site will be limited to employees and authorised visitors. All project access will be well signposted to control traffic movement in and out of the project area. |
| **9.12.2c** | The waste rock stockpile will be contoured so it ties in with the surrounding topography. |
| **Biting Insects Management (PER Section 9.13)** | |
| **9.12.2a** | During the site specific induction advising all employees of the potential for seasonal problems relating to biting insects including their potential pest, nuisance and disease carrying potential. All employees will be made aware of the diseases mosquitoes may carry. |
| **9.12.2b** | During site specific inductions, all staff will be advised on personal protection measures to protect themselves from mosquitoes and other biting insects. |
| **9.12.2c** | If mosquito breeding reaches significant levels, Arafura will liaise with the MEB to determine appropriate larvicides to use to control the problem. |
| **Rehabilitation and Closure Management (PER Section 11)** | |
| **11.1a** | As part of obtaining all permits necessary to start mining, Arafura will submit a security bond to DPIFM in case of any unplanned failure of the project. The size of this security bond will be reviewed in conjunction with DPIFM to ensure it remains consistent with level of disturbance caused by the project at any specific time. |
| **11.1b** | Monitoring will be conducted after completion of rehabilitation to establish the effectiveness of rehabilitation over time. Monitoring will consider physical stability, erosion, minimisation, vegetation establishment (species diversity, density, cover) and weed presence. |

# 16. GLOSSARY

| | |
|---|---|
| AAPA | Aboriginal Areas Protection Authority |
| AHD | Australian Height Datum |
| ARD | Acid rock drainage |
| Authorisation | Authority to mine granted pursuant to the *Mining Management Act 2001* |
| BIF | Banded Iron Formation |
| BONN | Convention on the Conservation of Migratory Species of Wild Animals (BONN: City where Convention was concluded). |
| CAMBA | China – Australia Migratory Bird Agreement |
| CIL | Carbon-in-Leach |
| DBIRD | Northern Territory Department of Business, Industry and Resource Development |
| DEH | Department of Environment and Heritage |
| DPI | Northern Territory Department of Planning and Infrastructure. |
| DPIFM | Northern Territory Department of Primary Industry, Fisheries and Mines. |
| EGI | Environmental Geochemistry International |
| EIS | Environmental Impact Statement |
| EMP | Environmental Management Plan |
| EMS | Environmental Management System |
| EPA | Environmental Protection Authority |
| EPBC | Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* |
| EPRP | Emergency Preparedness and Response Plan |
| ERL | Exploration Retention Licence issued pursuant to the *Mining Act 1980* |
| JAMBA | Japan – Australia Migratory Bird Agreement |
| Mines Division | Mines and Petroleum Management Division of the Northern Territory Department of Business, Industry and Resource Development |
| MMP | Mining Management Plan prepared pursuant to the *Mining Management Act 2001* |
| NAF | Non Acid Forming |
| NLC | Northern Land Council |
| NRETA | of Natural Resources Environment and the Arts |
| PAF | Potential Acid Forming |
| PCG | Pine Creek Goldfields Limited |

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|---|---|
| PER | Public Environmental Report |
| RGC | Renison Goldfields Consolidated Limited |
| RL | Reduced Level (AHD +299.845 metres) |
| ROM | Run of Mine |
| SWL | Standing Water Level |
| WDL | Waste Discharge Licence as issued pursuant to the *Water Act 1992* by the Controller of Water Resources, Department of Infrastructure, Planning and Environment. |
| WRS | Waste Rock Stockpile |

# 17. REFERENCES

ANZECC (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand.

Arafura Resources NL. (2004). Notice of Intent (NOI) ML 23839 (Application) Mt Porter. Unpublished report.

Armstrong, M., Woinarski, J., Hempel, C., Connors, G. and Beggs, K. (2002). A Plan for the Conservation of Biodiversity in the Mary River Catchment, Northern Territory. Darwin: Department of Infrastructure, Planning and Environment.

Australian Bureau of Statistics (2002), 2001 Census of Population and Housing. Population Summary Northern Territory.

Australian Geological Survey Association (1990). National Geoscience Dataset Geohazard Risk Contour Map. Retrieved 20/05/2006 from http://www.ga.gov.au/bin/htsqr?file=/oracle/geomet/geomet2.htsqr&datasetno=2393. Last updated 10 August 2006.

Australian Government (2002) An Agreement between the Commonwealth of Australia and the State of Western Australia Under Section 45 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* Relating to Environmental Impact Assessment. Department of the Environment and Heritage.

Australian Greenhouse Office (2005). Land Use Change Sector Greenhouse Gas Emissions Projections 2005. Commonwealth of Australia.

Australian Greenhouse Office (2006).Emissions Calculator, Retrieved 9/11/06 from (http://www.greenhouse.gov.au/challenge/members/technicaltools.html).

Bureau of Meteorology (2003), Annual Average Evaporation Map of Australia. Retrieved 25/10/2006, from http://www.bom.gov.au/climate/map/evaporation/evap_ann.shtml. Last Updated 03/11/2003.

Bureau of Meteorology (2006), On-line climate data. Retrieved 26/10/2006 from http://www.bom.com.au.

Christian CS and Stewart GA (1953). *General Report on Survey of Katherine-Darwin region 1946.* Land Research Series No. 1, CSIRO Melbourne.

Churchill SK (1991). *Distribution, Abundance and Roost Selection of the Orange Horseshoe-bat Rhinonycteris aurantius, a Tropical Cave Dweller*. Australian Wildlife Research 18: 343 – 353.

Dames and Moore and, Power and Water Authority, (1989). Hydrogeology of the Pine Creek Mining Region. 1:250,000 Scale Map (updated Aug. 2002). Department of Infrastructure, Planning and Environment, Northern Territory of Australia.

DBIRD (Department of Business, Industry and Resource Development) (February 2002). Mining Management Plan Advisory Note.

DBIRD (Department of Business, Industry and Resource Development) (November 2002). Small Mining Operations Mining Management Plan Advisory Note.

Department of Infrastructure Planning and Environment, August 2004, *Draft Guidelines for the Preparation of a Public Environmental Report*, Mt Porter Gold Project.

Environmental Geochemistry International Pty Ltd (1004). *Mount Porter Project Environmental Geochemistry of Waste Rock and Implications for Waste Management*. Unpublished report for Pine Creek Goldfields Ltd.

Environmental Protection Agency (Northern Territory). (200s). Guidelines for Preparation of a Public Environmental Report. Mt Porter Gold Project.

ERA Environmental Services. (1993). *Terrestrial vegetation of the Mount Porter Project* Area. Unpublished report for Pine Creek Goldfields Limited.

Garnett ST and Crowley GM. (2000). The Action Plan for Australian Birds 2000. Environment Australia 2000. http://www.deh.gov.au/biodiversity/threatened/action/birds2000/

Goulevitch, J., 2004. Results of core drilling program November 2003, Mount Porter Gold Prospect, NT. Annual report ERL 116.

Gunn, B, (2005). *Mt Porter Gold Mine Site, Pine Creek, NT: Archaeological Survey*. Unpublished report for Arafura Resources NL.

Higgins, P. J., Ed. (1999) Handbook of Australian, New Zealand and Antarctic Birds, Vol 4. Parrots to Dollarbird. Oxford University Press, Melbourne.

Low, B. (2005). *Environmental Survey of Landscape, Flora and Fauna of the Proposed Mt Porter Gold Project Area (ML(A) 23839).* Unpublished report for Arafura Resources NL.

MBS Environmental (2006). *Mt Project, Northern Territory: Surface Hydrology Study*. Unpublished report prepared for Arafura Resources.

McKean JL and Friend GR (1979). *Taphozous kapalgensis, a new species of Sheath-tailed bat from the Northern Territory, Australia. Vic. Nat.* Vol. 96: 239-241.

Mulvaney, K. (1993). *Aboriginal Archaeological Investigation Mount Porter Proposed Gold Mine.* Unpublished report for Pine Creek Goldfields Limited.

Northern Territory Government. (2005). Pine Creek http://www.pinecreek.nt.gov.au/

Pizzey, G. and Knight, F. (2003) The Field Guide to the Birds of Australia. Harper Collins Publishers, Sydney.

Reilly, T., Low, B. and Matthews, D. (2006) *Survey 2: Landscape, Flora and Fauna Survey of the Proposed Frances Creek Iron-ore Prospects, May 2006*. Low Ecological Services, Alice Springs. Unpublished draft report prepared for Territory Iron Limited.

RAOU (1993). *Threatened and Extinct Birds of Australia.* RAOU Report No. 82.

Schultz, T. J., Townsend, S. A. and Edwards, C. A. (2002). Water quality monitoring in the Mary River catchment. Tech. Report 41/2002.

Department of Infrastructure, Planning and Environment, Darwin, NTStrahan, R., Ed. (2004) The Mammals of Australia. Reed New Holland, Sydney.

SKM (2006). *Mt Porter Hydrological Recommendations.* Unpublished report prepared for Arafura Resources.

Standards Australia & Standards New Zealand (1999). Risk Management AS/NZS 4360:1999. Jointly published by Standards Australia International Ltd, Sydney, and Standards New Zealand, Wellington.

Swan, G. (2005) A Photographic Guide to Snakes & Other Reptiles of Australia. New Holland Publishers (Australia), Sydney.

Wilson BA, Brocklehurst PS, Clark MJ, and Dickinson KJM. (1990). *Vegetation Survey of the Northern Territory, Australia.* Technical Report No. 49. Conservation Commission of the Northern Territory, Darwin.

Woinarski, J.C.Z., Gambold, N., Menkhorst, K. and Braithwaite, R.W. (1989). *Wildlife of Kakadu National Park Stage III*. Unpublished report prepared by CSIRO Division of Wildlife and Ecology for Australian National Parks & Wildlife Service.

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# APPENDICES

# APPENDIX 1

## Mt Porter Public Environmental Report Guidelines.

# APPENDIX 2

## Department of Environment and Heritage Referral Outcome.

# APPENDIX 3
## Waste Characterisation

# APPENDIX 4

## Hydrological Report

# APPENDIX 5

## Surface Water Report.

# APPENDIX 6

## Water Monitoring Data.

# APPENDIX 7

## Flora and Fauna Report

# APPENDIX 8

## AAPA Certificates

# APPENDIX 9

## Archaeological Survey

# APPENDIX 10
## Draft EMP