Northern Territory Environment Protection Authority

ASSESSMENT REPORT 77

GEMCO Eastern Leases Project

GROOTE EYLANDT MINING COMPANY PTY LTD

March 2016

Northern Territory Environment Protection Authority
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Darwin
Northern Territory 0801

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Abbreviations

AAPA	Aboriginal Areas Protection Authority
ALRA	*Aboriginal Land Rights (Northern Territory) Act 1976*
API	Aerial Photograph Interpretation
ALC	Anindilyakwa Land Council
AEP	Annual Exceedance Probability
CTMR	Conceptual Tailings Management Report
draft EIS	Draft Environmental Impact Statement
EARC	East Arnhem Regional Council
EA Act	*Environmental Assessment Act*
EAAP	Environmental Assessment Administrative Procedures
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELR	Exploration Licence in Retention
EMP	Environmental Management Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
GEMCO	Groote Eylandt Mining Company Pty Ltd
HRCDOR	Haul Road Crossing Design Overview Report
IR	Infra-red
ML	Mineral Lease
MNES	Matters of National Environmental Significance
MU	Map Unit
NT	Northern Territory of Australia
NT EPA	Northern Territory Environment Protection Authority
PAF	Potentially Acid Forming

Glossary

Advisory bodies	Agencies having administrative responsibilities in respect of the proposed action
the Australian Government Minister	The Australian Government Minister responsible for the Environment Protection and Biodiversity Conservation Act 1999
Environmental Impact Statement	The Environmental Impact Statement is the draft Environmental Impact Statement and the Supplement to the draft Environmental Impact Statement
Environmental Mining Report	As defined by the *Mining Management Act*, an Environmental Mining Report is a report about an operator's environmental performance in carrying out activities for mining minerals, taking into account: (a) the commitments given by, and the obligations imposed on, the operator in relation to an environmental assessment under the *Environmental Assessment Act*; and (b) the obligations of the operator under the management system for the mining site
the Minister	The Minister of the Northern Territory responsible for the *Environmental Assessment Act*
the Project	GEMCO Eastern Leases Project
the Proponent	The person, organisation or Agency responsible for the development and execution of the proposed action; that is Groote Eylandt Mining Company Pty Ltd
the/this Report	This Assessment Report 77 for the GEMCO Eastern Leases Project
the Responsible Minister	The Minister of the Northern Territory primarily responsible for authorising the proposed action; that is the Minister of the Northern Territory responsible for the *Mining Management Act*
Commenter	Person or person(s) from the public or an organisation that is not an advisory body whom provided written comment on the draft Environmental Impact Statement
the Supplement	The Supplement to the draft Environmental Impact Statement

Summary

Environmental Impact Assessment (EIA) is a process for identifying the potential environmental impacts and risks of a proposed action, evaluating the significance of those impacts and risks and determining appropriate avoidance, minimisation/mitigation and offset measures to reduce those impacts and risks to acceptable levels. This Assessment Report (this Report) examines the EIA for the GEMCO Eastern Leases Project (the Project), proposed by Groote Eylandt Mining Company Pty Ltd (the Proponent).

The Proponent proposes to develop and operate the Project, approximately 2 km east of the existing GEMCO Mine. Approximately 39 million tonnes (Mt) of manganese ore would be mined using open cut, strip mining methods from Exploration Licences in Retention ELR28161 (Northern Eastern Lease) and ELR28162 (Southern Eastern Lease). The Proponent proposes to transport the mined ore from the Project via a new haul road to the existing concentrator, and related facilities at the GEMCO Mine for ore processing and product export.

The Project is intended to enable access to an additional mining area that would be operated as part of the existing mine, rather than an independent mine. Where possible, the Project would utilise infrastructure (e.g. concentrator, stockpiles, roads, etc.) at the existing mine and the Proponent anticipates that upgrades of this infrastructure would not be required. The Project workforce would be drawn from the workforce at the existing mine, and the Project would utilise the mine's existing equipment fleet.

Project operations would be undertaken concurrently with mining operations at the existing mine and ore mined as part of the Project would be blended with ore from the existing mine, and sold as a single product. Construction is anticipated to commence in early 2017, with mining anticipated to commence by the middle of 2018. The Project is expected to have a mine life of 13 years and will increase the life of the existing mine by four years.

New infrastructure and components to be constructed as part of the Project would include:

- new quarries and temporary overburden emplacements
- 8.5 km unsealed haul road from the Project to the existing GEMCO Mine
- flood protection measures
- mine-related infrastructure, such as dewatering dams, water fill points, sedimentation dams, crib huts and truck park-up areas
- temporary laydown storage areas for equipment and consumables necessary for the development of the haul road and dewatering dams.

The Northern Territory Environment Protection Authority (NT EPA) has produced this Report as advice to the Northern Territory Ministers for the Environment (the Minister) and Mines and Energy (the responsible Minister) to be taken into account in decisions made by the Territory Government. The responsible Minister, taking into consideration this Report, will decide whether or not to authorise the Project under the *Mining Management Act* and if so, the conditions that may be applied. This Report does not provide an environmental approval and is not intended to.

The NT EPA decided the Project required assessment at the level of an Environmental Impact Statement (EIS) under the *Environmental Assessment Act* (EA Act). Issues contributing to the decision included:

- risks to biodiversity and threatened species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Territory Parks and Wildlife Conservation Act* (TPWC Act). Significant populations of the northern quoll (*Dasyurus hallucatus*) (endangered, EPBC Act; critically endangered, TPWC Act); brush-tailed rabbit-rat (*Conilurus penicillatus*) (vulnerable, EPBC Act; endangered TPWC Act); masked owl (northern) (*Tyto novaehollandiae kimberli*) (vulnerable, EPBC & TPWC Acts); and northern hopping-mouse (*Notomys aquilo*) (vulnerable, EPBC & TPWC Acts) have been positively identified in the Project area

- risks to surface water and groundwater, and related ecological processes, from the development, operation and closure of the Project and/or Project components

- reduced air quality (e.g. dust) and potential off-site impacts, including exposure to and uptake of contaminants by sensitive biological and human receptors

- potential social, cultural and economic impacts, including the risks of the Project not realising its projected economic and social benefits.

An EIS was considered necessary as Groote Eylandt and its satellite islands have outstanding conservation values, including internationally and nationally significant sites for nesting marine turtles and colonial seabirds. Groote Eylandt is an important site of refuge for Arnhem coast ecological communities and is largely free of invasive weeds and feral animals that are present on the Australian mainland. The Project was considered to be of a size and scale to expose ecologically intact areas and habitats of national significance to threatening processes such as the introduction and spread of weeds and feral animals. The cane toad (*Rhinella marina*) is currently not present on Groote Eylandt. The biological effect of the cane toad has been listed as a key threatening process under the EPBC Act.

A delegate for the Australian Government Minister responsible for the EPBC Act decided that the Project was a controlled action and required assessment and approval under the EPBC Act before it can proceed. The controlling provisions are potential impacts on the following matters of national environmental significance (MNES) that are protected under Part 3 of the EPBC Act:

- Listed threatened species and communities (sections 18 & 18A)

- Listed migratory species (sections 20 & 20A).

The delegate for the Australian Government Minister agreed to accredit the assessment process under the EA Act for the purposes of assessing the Project. The Australian Government Minister will need to consider the Project for an approval decision under the EPBC Act. This Report will inform the consideration.

Information requirements based upon identified risks were described in the Terms of Reference for the Project. The Proponent submitted the draft EIS to address these requirements, including a whole-of-project risk assessment. A total of 50 risks for groundwater, surface water, ecology and social aspects were identified for the Project. Following risk treatment and mitigation, the Proponent concluded that 38 risks were rated as being low, 11 were rated as being moderate and one was rated as high. No extreme risks were predicted by the Proponent following the application of mitigation measures.

The risk which remained high after risk mitigation was the potential for the transport of materials and personnel required for the Project to exacerbate the risk of the cane toad being introduced to Groote Eylandt. The consequence of the risk was considered to be extreme, meaning that even though the likelihood was rated as rare, the resultant risk for flora and fauna remained high. Government advisory bodies and commenters on the

draft EIS emphasised the high risk to the ecological values of Groote Eylandt associated with the potential introduction of the cane toad from Project activities, which is detailed within this Report and recommendations are provided to improve the proposed Cane Toad Management Plan.

The NT EPA considers that the potential environmental impacts and risks of the Project have been adequately identified and that the evaluation of the significance of those impacts and risks has been appropriate. Avoidance, minimisation/mitigation and offset measures to reduce those impacts and risks to acceptable levels were proposed and future requirements to verify modelling and predictions are largely captured in the commitments made by the Proponent.

The NT EPA considers that the identification of MNES by the Proponent has been appropriate and that the Project would directly disturb 1525 ha of potentially critical habitat for four threatened species protected under the EPBC Act. The NT EPA has considered the Proponent's measures to mitigate impacts and provided recommendations to reduce the impacts of the Project, in particular to improve the management of feral cats and cane toads, and rehabilitation and closure. However, the Project cannot avoid the direct impact to MNES, even with measures to mitigate impacts. Therefore, the NT EPA considers that it is likely that the Project will result in residual significant impacts on MNES and that it is appropriate for the Proponent to offset the impacts to the species. The NT EPA acknowledges that multiple programs and initiatives are currently under development and that the outcomes of these would be used to inform the finalisation of proposed management plans and the proposed offsets for the Project. Further consultation is required between the Proponent and the Australian Government Department of the Environment to inform the EPBC Act approval process.

The NT EPA makes 20 recommendations as an outcome of the EIA of the Project. These recommendations are primarily for the Proponent to address when entering into the next stage of the Territory and Commonwealth assessment and approval processes and for the execution of the proposed action. The NT EPA considers it essential that the commitments, safeguards and recommendations detailed in the final EIS, this Report and in the final management plans approved by the Agency responsible for administering the *Mining Management Act*, are implemented and subject to regular reporting and compliance auditing.

Recommendations

Recommendation 1

The Proponent shall ensure that the GEMCO Eastern Leases Project is implemented in accordance with the environmental commitments and safeguards:

- **identified in the final Environmental Impact Statement for the GEMCO Eastern Leases Project (draft Environmental Impact Statement and Supplement to the draft Environmental Impact Statement)**
- **recommended in this Assessment Report 77.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are commitments made by the Proponent.

Recommendation 2

The Proponent shall advise the Northern Territory Environment Protection Authority and the responsible Minister of any alterations to the GEMCO Eastern Leases Project, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

Recommendation 3

A Weed Management Plan for the control and management of weeds shall be prepared. The Weed Management Plan must identify the species of weeds and their location in and around the GEMCO Eastern Leases Project and outline methods for eradicating/controlling existing infestations. It must identify actions to prevent introduction of new weed species from vehicles, machinery or any other method, and align with Statutory Weed Management Plans.

Recommendation 4

The Proponent shall re-evaluate the risk assessment and management strategy for the cane toad. The amended assessment should be used to prepare a Cane Toad Management Plan, in consultation with experts in the management of cane toads.

Recommendation 5

Should the Australian Government decide that offsets are required to compensate for the residual significant impacts to matters of national environmental significance, the Proponent shall submit an offset plan. The offset plan should clearly define the mitigation, management and compensatory measures that will be implemented on site. Any offset measures should be consistent with the Australian Government's Offset Policy and calculator.

Recommendation 6

In consideration of recommendation 5, the offsets plan should take into account the different ecological requirements and threats to each of the listed species considered to be at significant risk from the Project as identified in Assessment Report 77.

Recommendation 7

The Proponent shall prepare and implement a Rehabilitation Plan for the GEMCO Eastern Leases Project. The Rehabilitation Plan should include objectives for the creation of threatened species habitat and recolonisation by threatened species populations, and identify explicit criteria for evaluation. The plan should include a

sampling design and sampling methods for monitoring that will enable measurable evaluation of outcomes against identified criteria, in order to demonstrate the effectiveness of the Rehabilitation Plan for threatened species.

The Rehabilitation Plan should be revised accordingly in response to the results of trials in prescribed burning of rehabilitated areas.

Recommendation 8

The Proponent shall prepare a Closure Plan for the GEMCO Eastern Leases Project that includes closure criteria that have been developed in consultation with relevant stakeholders and approved by the Department of Mines and Energy, including provisions for unplanned closure.

Recommendation 9

The Proponent shall develop and implement a Groundwater Monitoring Program to monitor groundwater level. The Program should be of an appropriate sampling density and frequency to detect water level variations resulting from dewatering for Project mining activities, accounting for seasonality. The numerical groundwater model used to predict drawdown levels should be validated at regular intervals against the results of the Groundwater Monitoring Program, and appropriate management measures developed if adverse impacts are detected.

Recommendation 10

The Proponent shall prepare a Groundwater Dependent Ecosystem Monitoring Plan that is consistent with the details provided in the Environmental Impact Statement. The Groundwater Dependent Ecosystem Monitoring Plan should include reporting requirements and appropriate protocols in the event that adverse impacts are identified.

Recommendation 11

The Proponent shall not mine within any watercourse or any watercourse buffer.

Recommendation 12

The Proponent shall prepare a Water Management Plan that is consistent with the details provided in the Environmental Impact Statement. The Plan should include a suitable groundwater and surface water monitoring program, reporting requirements and appropriate protocols in the event that adverse impacts are identified, and emergency discharge protocols and limits. The Water Management Plan should contain a project water balance that includes water transfers, consumption and quarry water volumes; surface water quality monitoring and reporting; storage water quality monitoring and reporting; and discharge monitoring and reporting.

Recommendation 13

The Proponent shall prepare an Erosion and Sediment Control Plan that is consistent with the details provided in the Environmental Impact Statement and includes the additional recommendations provided in this Report. The Erosion and Sediment Control Plan should be cross-referenced with the Rehabilitation Plan and other relevant sub-plans of the Mining Management Plan, and approved prior to the commencement of works.

Recommendation 14

The Proponent shall take all reasonable measures to avoid disturbing or excavating materials that are identified as potentially acid forming.

If potentially acid forming material cannot be avoided, the Proponent shall prepare a management plan for the handling and storage of materials identified as potentially acid forming and/or capable of generating seepage that does not accord with water quality parameters. The plan should include details of the monitoring program to verify that the handling and storage of materials is effective.

Recommendation 15

The Proponent shall develop a communication strategy to ensure the public and surrounding community, including the persons likely to access Pelican's Nest or to use the unsealed track that comes off the Emerald River Road and provides access to Dalumba Bay, are informed about changes to site access and relocation/restricted access of roads/tracks.

Recommendation 16

The Proponent shall consult with the Anindilyakwa Land Council, the Heritage Branch of the Department of Lands, Planning and the Environment, and any other relevant stakeholder, in relation to a suitable management approach for the single archaeological site (i.e. the manuport), which is located within the Project disturbance footprint. Approvals in accordance with the *Heritage Act* shall be obtained by the Proponent prior to disturbing the site.

Recommendation 17

The Proponent shall prepare a Cultural Heritage Management Plan for the protection of sites of archaeological significance. The Cultural Heritage Management Plan must include employee and contractor induction and awareness of the significance of site protection; methods to register and record monitoring; and obligations under the *Heritage* Act. The Cultural Heritage Management Plan should include provisions to monitor sites for impacts from dust, blasting and unauthorised access, and provisions for corrective actions in the event that adverse impacts are detected.

The results of the additional surveys completed for two clustered sites (i.e. sites ELS06 to ELS13 and ELS15 in the Southern Eastern Lease, and ELN04 to ELN06 and ELN08 to ELN13 in the Northern Eastern Lease) should be used to inform the Cultural Heritage Management Plan before the commencement of the Project.

Recommendation 18

The Proponent shall prepare a Blast Management Plan that specifies ground vibration limits for the rock art sites, as well as periodic monitoring of rock shelters with art to confirm their integrity. The Blast Management Plan should align with the objectives and principles of the Cultural Heritage Management Plan and be prepared and revised in conjunction with the Cultural Heritage Management Plan.

Recommendation 19

The Proponent taking the proposed action is wholly responsible for implementation of all conditions of approval and mitigation measures contained in the Environmental Management Plan and must ensure all staff and contractors comply with all requirements of conditions of approval and mitigation measures contained in the Environmental Management Plan.

The Environmental Management Plan, and sub-plans, should form part of the Mining Management Plan. In preparing each plan, the Proponent shall include any

additional measures for environmental protection and monitoring contained in this Assessment Report 77.

Recommendation 20

The Authorisation for the GEMCO Eastern Leases Project should include a condition requiring the Proponent to make and publish an Environmental Mining Report to satisfy the requirements of the *Mining Management Act* relevant to the Environmental Mining Report. The NT EPA recommends the Environmental Mining Report be made available to the public at 12 month intervals, for the duration of the life of the proposed action.

1 Introduction

The Proponent, Groote Eylandt Mining Company Pty Ltd, proposes to develop and operate the GEMCO Eastern Leases Project (the Project), approximately 2 km east of the existing GEMCO Mine at Groote Eylandt, Northern Territory. The Project has been assessed by the Northern Territory Environment Protection Authority (NT EPA) at the level of Environmental Impact Statement (EIS) under the *Environmental Assessment Act* (EA Act).

The NT EPA has prepared this Assessment Report (this Report) in accordance with section 7(2)(g) of the EA Act and clause 14(3) of the Environmental Assessment Administrative Procedures (EAAP). The purpose of this Report is to ensure that matters affecting the environment to a significant extent are fully examined and reported. This Report is provided to the Northern Territory Ministers for the Environment (the Minister) and Mines and Energy (the responsible Minister) to be taken into account in decisions made by the Territory Government; it does not provide an environmental approval and is not intended to.

1.1 Environmental impact assessment process

Environmental Impact Assessment (EIA) is the process for identifying the potential environmental impacts and risks of a proposed action, evaluating the significance of those impacts and risks and determining appropriate avoidance, minimisation/mitigation and offset measures to reduce those impacts and risks to acceptable levels. The main purpose of the EIA is to inform decision-makers of the risks and potential impacts of a proposed action before any decisions are made and to engage and inform the public in the EIA process.

Through the EIA process, the Proponent must demonstrate:

- that the potentially significant impacts can be satisfactorily managed within acceptable levels, e.g. impacts would not result in long-term or irreversible environmental detriment.
- the effectiveness/feasibility of management measures is in a precautionary/risk management framework.

The EIA process gives weighted consideration to:

- values and risks
- estimation of the likelihood of success of preventative and remedial measures
- the validity and comprehensiveness of programs established to provide ongoing measures of the environmental effects of the Project.

The assessment of risk can be more reliably evaluated where there is a substantial baseline of relevant information. Where this information is limited or not available, risk assessment is inevitably constrained and less precise. In the absence of sufficient baseline information, and in keeping with the objectives of the *Northern Territory Environment Protection Authority Act* to promote ecologically sustainable development (Section 1.4), the NT EPA adopts the guiding principle that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. If potential impacts are understood with a reasonable level of certainty, monitoring programs can be better informed to detect impacts, and management measures can be more effectively targeted to address those impacts.

The legislation establishing the framework to undertake the EIA process in the Northern Territory are the EA Act and the Commonwealth *Environment Protection and*

Biodiversity Conservation Act 1999 (EPBC Act; Section 1.3), when a proposed action is considered likely to have a significant impact on matters of national environmental significance (MNES). These Acts are administered by the NT EPA and the Australian Government Minister for the Environment (the Australian Government Minister), respectively.

1.2 Environmental impact assessment chronology

On 6 May 2014, the Proponent provided the Notice of Intent for the Project to the NT EPA for consideration under the EA Act. On 19 June 2014, the NT EPA decided that the Project requires assessment at the level of an EIS under the EA Act.

On 28 May 2014, the GEMCO Eastern Leases Project (EPBC 2014/7228) was referred to the Australian Government Minister for consideration under the EPBC Act. On 23 June 2014, a delegate for the Australian Government Minister decided that the Project was a controlled action and required assessment and approval under the EPBC Act before it can proceed. The controlling provisions are potential impacts on the following MNES that are protected under Part 3 of the EPBC Act:

- Listed threatened species and communities (sections 18 & 18A)
- Listed migratory species (sections 20 & 20A).

On 23 June 2014, the delegate for the Australian Government Minister agreed to accredit the assessment process under the EA Act for the purposes of assessing the Project. Throughout the EIA process, the NT EPA consulted with and invited comment from the Australian Government Department of the Environment.

Draft Terms of Reference covering matters to be addressed in the EIS were subject to a public review period of 14 days between 30 August and 12 September 2014. On 22 September 2014, a delegate for the NT EPA directed the Proponent to prepare the EIS addressing the matters set out in the Terms of Reference.

The Proponent made the draft EIS for the Project available for public exhibition between 30 May and 10 July 2015. Written comments on the draft EIS were made by eight Government advisory bodies (including a combined submission from staff of the NT EPA and the Australian Government Department of the Environment); three non-government organisations and a member of the public. Copies of the written comments are provided at Appendix F of the Supplement to the draft EIS (the Supplement).

On 27 July 2015, the NT EPA directed the Proponent to conduct a revision of the EIS for the Project and to produce the Supplement to take account of the written comments. The Supplement becomes part of the draft EIS it supplements and is collectively referred to as the final EIS.

On 20 January 2016, the NT EPA received the Supplement. The NT EPA circulated the Supplement to Government advisory bodies for comment and commenters on the draft EIS (referred to hereafter as commenters) for information.

The making of this Report and providing it to the Minister marks the completion of the examination of the final EIS by the NT EPA. The EIA chronology, draft EIS and the Supplement can be viewed on the GEMCO Eastern Leases Project project page on the NT EPA website at:

http://www.ntepa.nt.gov.au/environmental-assessments/assessment/register/gemco-eastern-leases

1.3 Approval and regulatory framework

The Project will require approval and regulation by both the Territory and Australian Governments. The approval and regulatory framework is multifaceted because of the nature and location of the proposed action; and how it would incorporate with the existing GEMCO Mine, which is subject to existing approvals, agreements and conditions. The framework for approval and regulation of the Project is provided at Section 2 of the draft EIS. It is summarised here with an emphasis on the obligations and requirements of the Territory for clarity and completeness.

Following the making of this Report, the NT EPA provides it to the Minister. The Minister is required to give a copy of this Report to the responsible Minister, together with any written comments made by the Minister in relation to this Report. This action is in accordance with clause 14(3AA) of the EAAP. The Minister has reporting obligations to the NT EPA under section 8B of the EA Act, if the Minister makes a written comment in relation to this Report.

The responsible Minister, taking into consideration this Report, will then make a decision as to whether or not the Project should be authorised under the *Mining Management Act* and if so, the conditions that may be applied. The *Mining Management Act* is the primary legislation for the authorisation of mining activities and the regulation of mining sites in the Territory. Section 8A(2) of the EA Act requires the responsible Minister to give the NT EPA notice of the decision as soon as practicable, but within seven days, after making the decision. Alternatively, if the decision by the responsible Minister is contrary to this Report, the responsible Minister must comply with reporting obligations to the NT EPA and the Legislative Assembly in accordance with section 8A(3) of the EA Act.

The Australian Government Minister will need to consider the Project for an approval decision under the EPBC Act. This Report will inform the consideration.

1.3.1 Concurrent approvals

The Project is covered by Exploration Licences in Retention (ELR) ELR28161 and ELR28162, which enables the Proponent to undertake exploration activities. The Proponent will need to apply to convert the ELRs to Mineral Leases (MLs) to allow for mining activities under the *Mineral Titles Act*. The MLs cannot be granted until a Mining Agreement under the Commonwealth *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA) is in place because the Project is located on Aboriginal land scheduled under the ALRA. The Proponent is concurrently seeking these approvals

1.4 Ecologically sustainable development

The Australian Government affirmed its commitment to sustainable development at the United Nations conferences on environment and development, notably via the Rio Declaration and Agenda 21 in 1992 and the Johannesburg Declaration at the United Nations 2002 World Summit. Australia reaffirmed its commitment at the Summit to promote the integration of the three components of sustainable development – economic development, social development and environmental protection – as interdependent and mutually reinforcing pillars.

Australia developed the National Strategy for Ecologically Sustainable Development (ESD) identifying five national principles (Table 1). The Strategy identified ways to apply the principles to a range of industry sectors and issues such as climate change, biodiversity conservation, urban development, employment, economic activity, and economic diversity and resilience.

In December 1992, the Territory Government endorsed the National Strategy and agreed, along with all other States and Territories, to the Intergovernmental Agreement on the Environment.

The strategy defines ESD as:

> *'Using, conserving and enhancing the communities' resources so that ecological processes, on which life depends, are maintained and the total quality of life now and in the future can be increased.*
>
> *ESD is development that aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations.'*

Table 1 – The principles of Ecologically Sustainable Development

ESD Principle	Definition
Integration principle	Consideration needs to be given to the long and short-term economic impacts as well as other environmental, social and equitable impacts.
Precautionary principle	Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: (a) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment (b) an assessment of the risk-weighted consequences of various options.
Inter- and intra-generational equity	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of present and future generations.
Conservation of biological diversity and ecological integrity	The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making
Improved valuation, pricing and incentive mechanisms	Should be promoted to ensure that the costs of environmental externalities are internalised and that the polluter bears the costs associated with environmental pollution.

To achieve the objectives of ESD, the Project needs to continually be informed and guided by the ESD principles. Accordingly, the assessment of this proposal, its potential impacts (positive and negative) and the management measures used to enhance positive and reduce negative impacts was undertaken in the context of ESD principles.

Subsequent decision-making processes by approval bodies must be guided by ESD principles, and the continued project design and development, as well as the development and implementation of management and monitoring programs by the Proponent, should all aim to meet the objective of ESD.

2 Project

A detailed description of the Project is provided in Section 3 of the draft EIS. The following section provides an overview of the Project and its components, which is based on the information provided in the Notice of Intent and the final EIS for the Project.

2.1 Proponent

The Proponent of the Project is Groote Eylandt Mining Company Pty Ltd (GEMCO), which has two shareholders: South32 Pty Ltd (60%) and Anglo Operations (Australia) Pty Ltd (40%). BHP Billiton Manganese Australia Pty Ltd previously held the majority shares prior to the demerger of BHP Billiton Plc in 2015. Its interest is now represented by South 32 Pty Ltd.

South32 Pty Ltd is an independent global metals and mining company that was formed in May 2015 and is a publicly listed company on the Australian Securities Exchange. Its assets include the existing manganese mine on Groote Eylandt (Section 2.3), which accounts for more than 15% of the world's high grade manganese ore production, with approximately 70% of its production exported to global markets. It mines and produces bauxite, alumina, aluminium, energy and metallurgical coal, manganese, nickel, silver, lead and zinc in Australia, Southern Africa and South America.

Anglo Operations (Australia) Pty Ltd is a wholly owned subsidiary of Anglo American Plc, a UK-based mining group that is listed on the London Stock Exchange. Anglo American Plc is one of the world's largest mining companies and has a diverse portfolio of interests in coal, iron ore, manganese, base metals, precious metals and minerals.

2.2 Project description

The Proponent proposes to develop and operate the Project, approximately 2 km east of the existing GEMCO Mine (Figure 1). Approximately 39 Mt of manganese ore would be mined using open cut, strip mining methods from ELR28161 (Northern Eastern Lease) and ELR28162 (Southern Eastern Lease). The Proponent proposes to transport the mined ore from the Project via a new haul road to the existing concentrator, and related facilities at the GEMCO Mine for ore processing and product export (Section 2.3).

The Project is intended to enable access to an additional mining area that would be operated as part of the existing mine, rather than an independent mine. Where possible, the Project would utilise infrastructure (e.g. concentrator, stockpiles, roads, etc.) at the existing mine and the Proponent anticipates that upgrades of this infrastructure would not be required. The Project workforce would be drawn from the workforce at the existing mine, and the Project would utilise the mine's existing equipment fleet.

Project operations would be undertaken concurrently with mining operations at the existing mine and ore mined as part of the Project would be blended with ore from the existing mine, and sold as a single product. Construction is anticipated to commence in early 2017, with mining anticipated to commence by the middle of 2018. The Project is expected to have a mine life of 13 years and will increase the life of the existing mine by four years.

New infrastructure and components to be constructed as part of the Project (Figure 2) would include:

- new quarries and temporary overburden emplacements
- 8.5 km unsealed haul road from the Project to the existing GEMCO Mine
- flood protection measures
- mine-related infrastructure, such as dewatering dams, water fill points, sedimentation dams, crib huts and truck park-up areas
- temporary laydown storage areas for equipment and consumables necessary for the development of the haul road and dewatering dams.

2.3 GEMCO Mine

GEMCO Mine commenced operation in 1964. The mining operation comprises a number of MLs covering a total area of approximately 8500 ha (Figure 1). Operations at the mine involve mining manganese ore by open cut, strip methods (Section 2.3.1), and then washing and sorting the ore in a concentrator (Section 2.3.2). The washed ore is transported from the concentrator by road to the port facility at Milner Bay. The Project would utilise the same mining and processing methods and transportation network as the GEMCO Mine, which are summarised in this section and depicted in Figure 3.

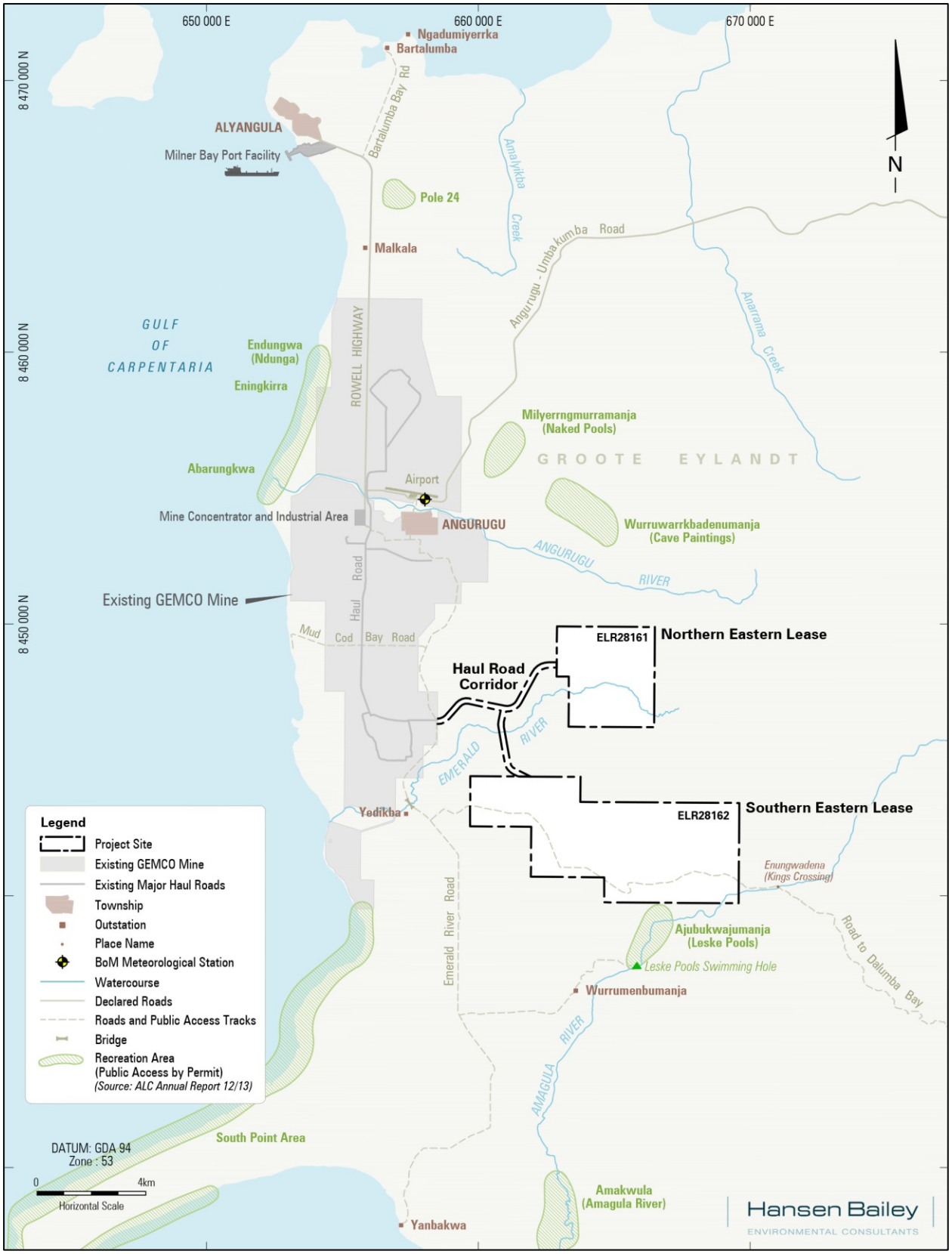

Figure 1 – Local setting (source: GEMCO, 2015)

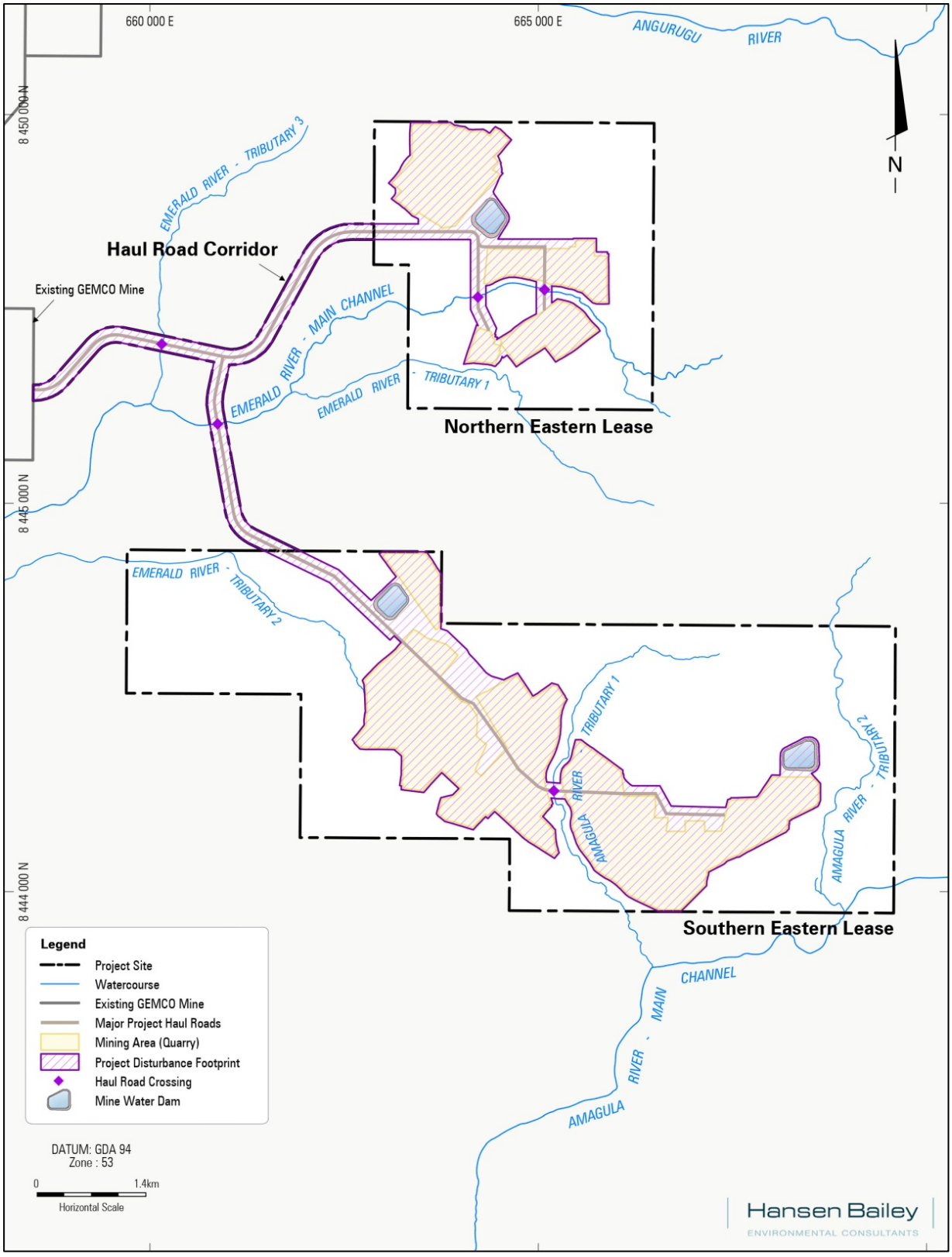

Figure 2 – GEMCO Eastern Leases Project disturbance footprint, including proposed quarry extent, mine water dams and haul road (source: GEMCO, 2015)

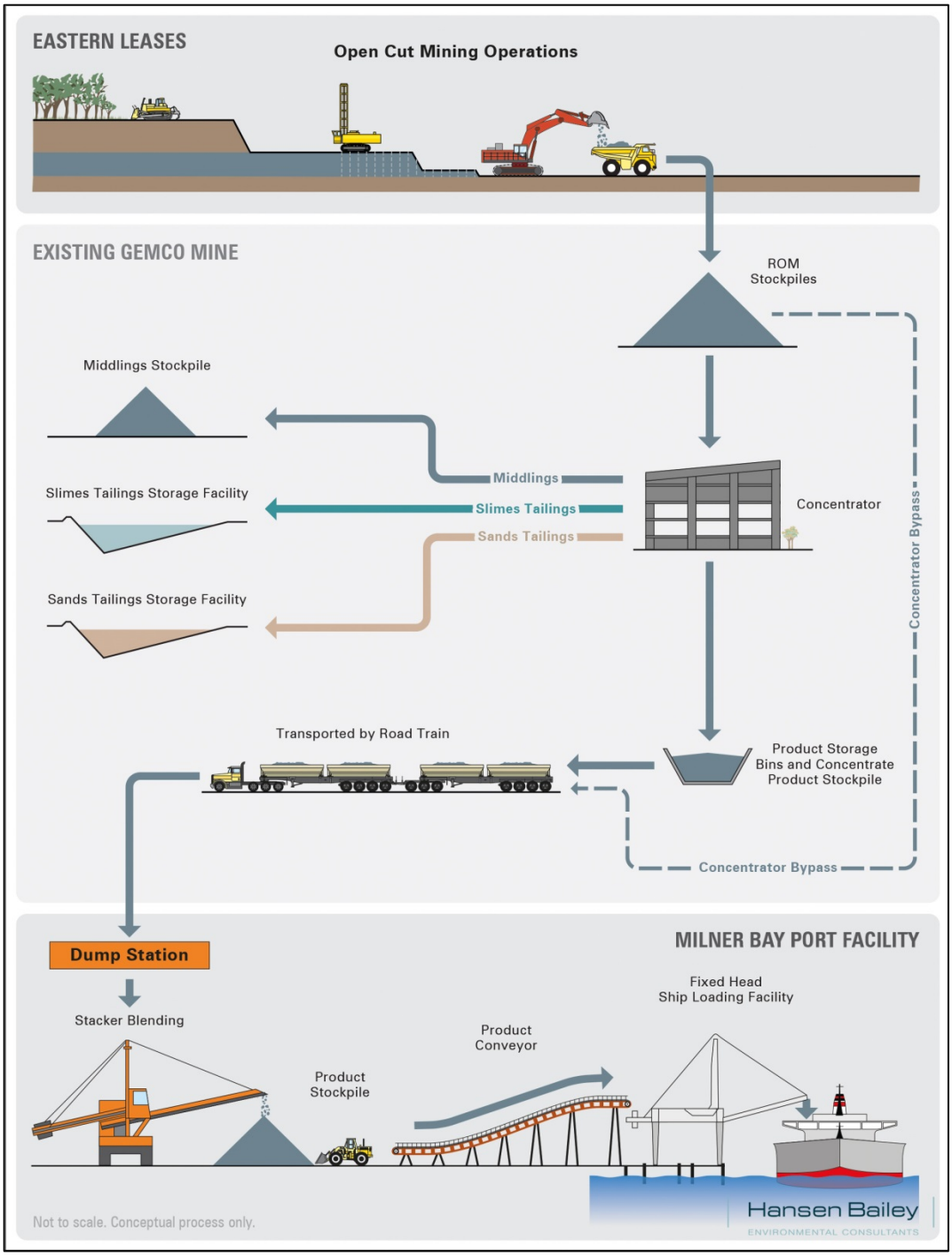

Figure 3 – Production and transportation process (source: GEMCO, 2015)

2.3.1 Mining

Open cut mining is undertaken in strips approximately 40 m wide, and 400 m to 1500 m long. Typical quarry depth varies between 10 and 25 m. The overburden depth within the Project site is up to 25 m, with an ore thickness of up to 5 m. The mining operations involve the following sequence of activities (Figure 4):

- Clearing vegetation using bulldozers.
- Stripping and recovering topsoil. Topsoil is stripped and pushed into windrows, before being picked up by loaders or excavators and placed into trucks. The stripped topsoil will either be placed directly on areas that are ready for rehabilitation, or stockpiled in designated areas for later use.

- Pre-stripping overburden. Overburden is excavated in order to gain access to the ore. This material is either temporarily stockpiled or placed directly within previously mined quarries.
- Drilling and blasting the manganese ore to break-up the materials so that it can be easily handled.
- The ore is mined using a truck and excavator fleet, and the ore is hauled to the existing mine using haul trucks.
- Backfilling quarries following ore removal.
- Topsoil replacement. Topsoil is spread over backfilled areas at an average depth of 0.3 m. Topsoil is then ripped before being seeded.
- Revegetation using seeds from native trees, shrubs and endemic grass species.

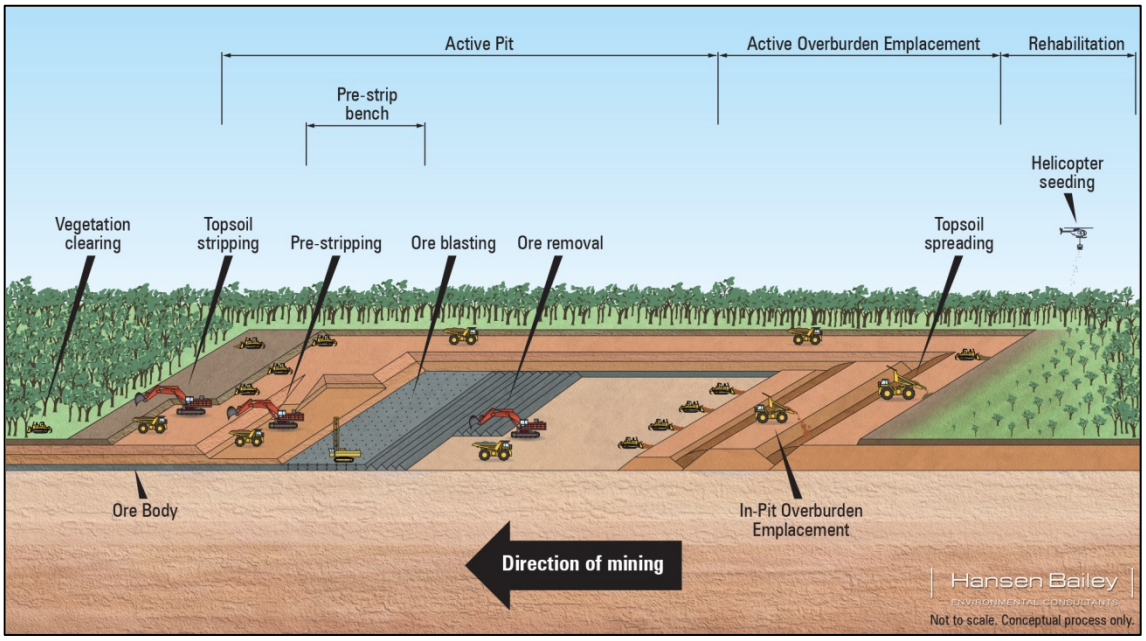

Figure 4 – Schematic of open cut mining operations (source: GEMCO, 2015)

2.3.2 Ore processing

The ore is fed into the concentrator where it is crushed, sized and washed. No smelting of ore occurs on Groote Eylandt.

The main reagent used in processing is milled ferrosilicon, which is a composite of iron and silicon. Ferrosilicon is used as a slurry to assist with separating the manganese ore. It is consumed at a rate of 0.4 kg per tonne of product. Ferrosilicon is defined as non-hazardous under the hazardous chemical rating system.

The concentrator was originally commissioned in 1972, and since that time has undergone various upgrades and improvements. The most recent upgrade was in 2012. The Proponent conducts routine shutdown periods every two months in order to service the concentrator to ensure production targets will continue to be met, and any identified maintenance issues are resolved. The concentrator has a capacity of 5 million tonnes per annum (Mtpa) (wet tonnes) of washed ore/concentrate.

The Project would not increase GEMCO's existing production rate of 5 Mtpa of manganese ore.

2.3.3 Tailings and middlings

The processing of ore at the concentrator gives rise to two types of tailings (sand and slime tailings) and a coarse waste fraction known as middlings. Tailings with a particle size less than 0.1 mm are thickened to produce slimes tailings; tailings with a particle size greater than 0.1 mm are classed as sand tailings. Tailings from the existing operations are disposed of in dedicated tailings storage facilities located within the existing mine. These facilities will be used for the disposal of tailings generated as the result of processing ore from the Project.

Middlings from the concentrator are hauled by truck to a designated storage area and are used as road base construction material or as stemming in blasting.

2.3.4 Rehabilitation

The overarching environmental protection objective for rehabilitation and closure is to return land disturbed by the Project to a post mining landform that is safe to humans and wildlife, non-polluting, stable and able to sustain an agreed post-mining land use. Rehabilitation is intended to be designed to restore mined land to a self-sustaining open woodland, similar to the pre-mining environment and the surrounding undisturbed land.

The Project would be rehabilitated progressively throughout the mine life. Rehabilitation of areas disturbed by the Project would be conducted in accordance with the methods and procedures being used at the existing mine and guided by the environmental protection objective for rehabilitation and closure for the Project.

Project rehabilitation activities would include backfilling quarries with overburden to create a free-draining landform similar to the pre-mining landform. Topsoil would be spread at a depth of 300 mm, and ripped prior to seeding. Revegetation would be undertaken using seed collection from the local area. Species selection will be designed to reflect the diversity, abundance and distribution of vegetation on Groote Eylandt. Similar to the existing mine, aerial seeding would be the primary seeding technique, although seed may also be sown by hand.

The Project has been designed and scheduled to ensure that there would be no final voids or elevated overburden emplacement areas at the end of the mine life.

2.3.5 Workforce

The existing mine has a workforce of approximately 860 people, including both employees and contractors. The existing mine is forecast to have a workforce of approximately 860 people in 2018 when the Project is scheduled to commence operations. The Project operations workforce would be drawn from the workforce at the existing mine and there would be no net increase in the size of the Proponent's workforce. There would be no changes to the existing shift, roster or accommodation arrangements.

3 Regional setting

Detailed descriptions of the physical, ecological and social aspects of the Project region are presented in sections and appendices of the draft EIS. The following section provides a broad overview of the regional setting of the Project.

3.1 Location

The Project is located on Groote Eylandt in the Gulf of Carpentaria, approximately 650 km south-east of Darwin and 50 km east of the Arnhem Land coast. Groote Eylandt is Australia's third largest island and the largest island in the Gulf of Carpentaria. It forms part of an archipelago of islands with a land area of approximately 2285 km^2.

Groote Eylandt and the numerous associated smaller islands are Aboriginal freehold land, scheduled under the ALRA. Groote Eylandt is largely undeveloped and much of

the island is used for traditional Aboriginal practices. The existing mine (Section 2.3) is the main development on Groote Eylandt; small tourism and recreational and commercial fishing ventures also operate on the island.

Figure 5 – GEMCO Eastern Leases Project site and Groote Eylandt (source: GEMCO, 2015)

3.2 Ecological values

Groote Eylandt and its satellite islands have outstanding conservation values, including internationally and nationally significant sites for nesting marine turtles and colonial seabirds (NRETAS, 2009). The islands support the densest areas of marine turtle nesting in the Northern Territory, and are especially significant for green and hawksbill turtles. Approximately 900 plant species and 330 vertebrate species are recorded from

Groote Eylandt, including 12 threatened species (NRETAS, 2009). Many of the threatening processes operating on the Australian mainland are absent from, or at low levels in, the Groote archipelago.

3.3 Physical

Groote Eylandt is characterised by extensive lateritic plains, rugged sandstone plateaus and hills in the central and southern parts of the island, and large dunefields and sand plains in coastal areas (NRETAS, 2009). Savanna woodland dominated by Darwin stringybark and woollybutt cover much of Groote Eylandt, but there is a diversity of habitats including sandstone heathlands, dune shrublands, monsoon vine forests, riparian woodlands and paperbark swamps. The smaller islands and islets are mostly low sand and coral islands, rugged sandstone or granite outcrops (NRETAS, 2009).

The Project site is located in the south-western part of Groote Eylandt (Figure 5). The site is characterised by areas of flat to undulating sand plains surrounded by low hills of outcropping quartzic rock. The land within and surrounding the Project site comprises natural bushland. The vegetation and habitats are almost pristine and are strongly influenced by topography and drainage. Eucalypt open forests and woodlands dominate the well-drained areas of the Project site, with swampy and riparian areas dominated by Melaleucas.

The Project site is located in the upper catchments of the Emerald, Amagula and Angurugu Rivers (Figure 2). The Emerald River and its tributaries drain the majority of the Northern Eastern Leases and the western area of the Southern Eastern Leases. The Amagula River drains the eastern area of the Southern Eastern Leases via two main tributaries.

3.4 Transport network

The Rowell Highway is a sealed, two lane road extending from Alyangula to the existing mine. It is used for hauling washed ore from the existing mine to the port facility and for light vehicles travelling between Alyangula and the mine. The Rowell Highway is owned and maintained by the Proponent. No changes to the road transport of ore or port facilities are required as a result of the Project.

The Emerald River Road is an unsealed road that provides access to the southern part of Groote Eylandt, including a number of outstations and recreation areas (Section 3.5). The East Arnhem Regional Council (EARC) owns this road, but the Proponent is responsible for maintaining the section of this road that lies within the Proponent's existing mineral tenements.

The Project haul road would cross the Emerald River Road near the existing mine. At the intersection of the haul road and the Emerald River Road, the haul road would be constructed as an overpass.

An unsealed track, suitable only for 4WD vehicles, comes off the Emerald River Road and provides access to Dalumba Bay. Part of this track is located on the Southern Eastern Lease and the Proponent intends to relocate this section of the track prior to mining. This road is owned by the EARC and the Proponent expects to consult with the EARC and Anindilyakwa Land Council (ALC) in relation to the proposed relocation.

3.5 Socio-economic aspects

The EIS listed the key economic benefits of the Project as:

- capital expenditure in the NT of approximately $160 million during the Project construction phase

- four additional years of operation of the existing mine, which would result in an additional four years of operational expenditure on Groote Eylandt of approximately $1.9 million per year
- supporting a workforce of approximately 860 people for four years longer than the expected current mine life
- continued benefits of royalties and a number of other relayed payments from the existing mine to the Traditional Owners of Groote Eylandt through investment in housing, infrastructure, services and capacity development.

The major townships on Groote Eylandt (Figure 1) are:

- Alyangula, which is located on the north-west of Groote Eylandt and has a population of approximately 1000 people. Alyangula was built by the Proponent and predominately houses the existing mine workforce and their families.
- Angurugu, which is located on the western side of Groote Eylandt, on the Angurugu River. It has a population of approximately 850 people, the majority are Anindilyakwa People. Angurugu is surrounded by mining tenements associated with the existing mine. It is located approximately 6.5 km to the north-west of the Northern Eastern Lease, and is the closest residential community to the Project site.
- Umbakumba, which is located on the north-east of the island and has a population of approximately 450 people, the majority of whom are Anindilyakwa People.

3.5.1 Sensitive receptors

In order to identify the potential hazards and risks associated with the Project, sensitive receptors in proximity to the Project were identified in Section 18 of the draft EIS and summarised here.

The township of Angurugu is the nearest permanently occupied community to the Project area (Section 3.5). Yedikba and Wurrumenbumanja are Aboriginal outstations located 2.2 km east and 3.5 km south of the Southern Eastern Lease, respectively (Figure 1). The outstations comprise a small number of residential buildings that are not permanently occupied and their level of use is understood to vary from occasional visitation to sporadic residency.

The Leske Pools Swimming Hole is a public recreation area used by Groote Eylandt residents and visitors to the island for swimming, camping and fishing activities (Figure 1). It is located 2.4 km south of the Southern Eastern Lease. There are no public facilities at this recreation area and it is not permanently occupied.

4 Environmental impact assessment

The purpose of this section is to evaluate the Project and to present the view of the NT EPA on the environmental acceptability of the Project. The environmental acceptability of this Project is based on analysis of the adequacy of information:

- outlining the proposed action (particularly which components or activities are likely to impact the environment)
- on the existing environment (particularly environmental sensitivities)
- identifying the potential environmental impacts and risks of the Project and evaluating the significance of those impacts and risks

- regarding proposed avoidance or minimisation/mitigation measures to reduce potential impacts and risks to acceptable levels.

It is not intended to record all the matters that were identified and subsequently resolved during the examination of the final EIS. Instead, this Report concentrates on the substantive potential impacts and risks identified during the EIA process. Conclusions drawn and recommendations made in this Report are derived from comments from the review of the draft EIS by advisory bodies and commenters, and responses from the Proponent to those comments in the Supplement. Recommendations are made in this Report to add to or emphasise any commitments made by the Proponent, where the proposed avoidance or minimisation/mitigation measures are considered insufficient or where a safeguard is deemed particularly important.

In this Report, the recommendations (in **bold**) are preceded by text that identifies concerns, suggestions and undertakings associated with the Project. For this reason, the recommendations should not be considered in isolation.

Minor and insubstantial changes are expected in the design and specifications of the Project following the conclusion of the EIA process. It will be necessary for approval mechanisms to accommodate subsequent changes to the environmental safeguards described in the final EIS and recommendations in this Report. If the Proponent can demonstrate that changes are unlikely to significantly increase the risks of an impact on the environment, an adequate level of environmental protection may still be achieved by modifying the conditions attached to relevant statutory approvals governing the Project. Otherwise, further environmental assessment may be required.

Recommendation 1

The Proponent shall ensure that the GEMCO Eastern Leases Project is implemented in accordance with the environmental commitments and safeguards:

- **identified in the final Environmental Impact Statement for the GEMCO Eastern Leases Project (draft Environmental Impact Statement and Supplement to the draft Environmental Impact Statement)**
- **recommended in this Assessment Report 77.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are commitments made by the Proponent.

Recommendation 2

The Proponent shall advise the Northern Territory Environment Protection Authority and the responsible Minister of any alterations to the GEMCO Eastern Leases Project, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

4.1 Summary of environmental risks

The NT EPA initially identified the following risks and potential impacts that contributed to the decision to assess the Project at the level of an EIS:

- risks to biodiversity and threatened species listed under the EPBC Act and the *Territory Parks and Wildlife Conservation Act* (TPWC Act). Significant populations of the northern quoll (*Dasyurus hallucatus*) (endangered, EPBC Act; critically endangered, TPWC Act); brush-tailed rabbit-rat (*Conilurus penicillatus*) (vulnerable, EPBC Act; endangered TPWC Act); masked owl (northern) (*Tyto novaehollandiae kimberli*) (vulnerable, EPBC & TPWC Acts); and northern

hopping-mouse (*Notomys aquilo*) (vulnerable, EPBC & TPWC Acts) have been positively identified in the Project area

- risks to surface water and groundwater, and related ecological processes from the development, operation and closure of the Project and/or Project components
- reduced air quality (e.g. dust) and potential off-site impacts, including exposure to and uptake of contaminants by sensitive biological and human receptors
- potential social, cultural and economic impacts, including the risks of the Project not realising its projected economic and social benefits.

In addition to the above-mentioned risks and issues, an EIS was necessary as Groote Eylandt is an important site of refuge for Arnhem coast ecological communities and is largely free of invasive weeds and feral animals that are present on the Australian mainland. The Project was considered to be of a size and scale to expose ecologically intact areas and habitats of national significance to threatening processes, such as the introduction and spread of weeds and feral animals. The cane toad (*Rhinella marina*) is currently not present on Groote Eylandt. The biological effect of the cane toad has been listed as a key threatening process under the EPBC Act (DSEWPC, 2011).

Information requirements based upon identified risks were described in the Terms of Reference for the Project (NT EPA, 2014). The Proponent submitted the draft EIS to address these requirements.

Section 4 of the draft EIS on risk assessment identified a total of 50 risks for groundwater, surface water, ecology and social aspects associated with the Project. Following risk treatment and mitigation, the Proponent concluded that 38 residual risks remaining were rated as being low, 11 were rated as being moderate and one was rated as high. No extreme risks were predicted by the Proponent following the application of mitigation measures.

The residual risk rated as high was associated with the exacerbation of the potential for cane toad introduction through the transport of materials and personnel required for the Project. The consequence of the risk was considered to be extreme, meaning that even though the likelihood was rated as rare, the resultant risk for flora and fauna remained high. Government advisory bodies and commenters also emphasised the high risk to the ecological values of Groote Eylandt associated with the potential introduction of the cane toad from direct and indirect Project activities. This is discussed in more detail in Section 4.2.10.6 of this Report.

Government advisory bodies and commenters provided additional comment on biodiversity values and threatened species; groundwater recovery; water management; tailings storage and handling; rehabilitation and closure; and environmental management. A number of potential impacts and risks identified through the EIA process were addressed by the Proponent to the satisfaction of Government advisory bodies and commenters and are not discussed further. For example, studies in the draft EIS identified that dust is highly unlikely to impact the nearest sensitive receptors and appropriate mitigation and monitoring were proposed to reduce the risk and to detect any adverse impacts resulting from dust. The remainder of this section of the Report discusses the risks and potential impacts, based on potentially significant risks, raised throughout the EIA process and the Proponent's commitments to address and manage the potential impacts. Where the Proponent provided additional information or revised management options, this is highlighted in the following sections and recommendations to complement or strengthen environmental management strategies and safeguards that are provided.

It is notable that the issues raised in the submissions on the draft EIS did not necessitate the Proponent to consider any changes to the mine layout or Project components.

Moreover, no additional changes to the mine layout or components were proposed between the time from exhibiting the draft EIS and lodging the Supplement.

4.2 Ecology and biodiversity

4.2.1 Vegetation assessment

Vegetation assessment was undertaken by the Proponent using high resolution aerial photography supported by field survey and validation. Vegetation communities within the Project site were classified in accordance with vegetation communities, or Map Units (MU), previously described by Webb (1992). The classification into MU was based on the floristic and structural characteristics of the dominant vegetation type within each community.

The vegetation communities within the Project site were identified as almost pristine and were found to strongly reflect the geology, soils, topography, and the impacts of frequent fires. The results of the vegetation assessment identified 13 MUs (Figure 6). The most extensive vegetation community within the Project site is MU4, which comprises open forests dominated by Darwin stringybark (*Eucalyptus tetrodonta*) and Darwin woollybutt (*E. miniata*) that occur on gently undulating sandy soils. The next most extensive vegetation community is MU18, which occurs on the rock sandstone hills and comprises woodland dominated by Northern cypress pine (*Callitris intratropica*), scarp gum (*E. tetrodonta* and *E. kombogiensis*). The remainder of the Project site comprises a mix of low woodlands, swamp and sedgeland vegetation which are characterised by species such as long-fruited bloodwood (*Corymbia polycarpa*), Darwin box (*E. tectifica*), broad-leaved paperbark (*Melaleuca viridiflora*), swamp tea tree (*Melaleuca cajuputi*), common screwpine (*Pandanus spiralis*) and Darwin silky oak (*Grevillea pteridifolia*).

4.2.2 Flora

A total of 259 flora species were recorded within the Project site. The dominant family groups represent the composition and condition of vegetation within the Project site; these included Poaceae (grasses), Fabaceae – Faboideae (peas), Myrtaceae (Eucalyptus, Corymbia, Angophora and Melaleuca) and Cyperaceae (sedges).

The Australian Government's Environmental Reporting Tool generated for the Project site indicated that no flora species listed under the EPBC Act or threatened flora species habitat are known or considered likely to occur within a 20 km radius of the Project site, and the Proponent recorded none during the field survey.

The Infonet database identified one threatened flora species, the lantern tree (*Hernandia nymphaeifolia*), which is listed as vulnerable under the TPWC Act. The Proponent identified that this species was not considered likely to occur within the Project site as it is only known to occur in littoral rainforest and coastal swamps, which are vegetation types not recorded within the Project site. Field surveys did not identify this species or any other TPWC Act listed flora species.

The Department of Land Resource Management confirmed the findings from the draft EIS and commented that the Proponent correctly identified that no threatened plant species are likely to occur in the Project area, and available data suggested that the area is not likely to contain important habitat for other significant (restricted, data deficient or near-threatened) plant species.

4.2.3 Fauna and habitat assessment

The Australian Government's Environmental Reporting Tool identified the potential presence of 18 threatened species and 20 migratory species listed under the EPBC Act within 20 km of the Project site. The Proponent's search on the Infonet database identified the potential presence of 19 species that are listed as threatened under the TPWC Act within 20 km of the Project site. The searches indicated that numerous

migratory and/or marine species listed under the EPBC Act and TWPC Act have the potential to occur in the locality. The locality was defined as a 20 km radius around the Project site, which included some ocean areas. Consequently, the searches yielded numerous marine species including fish, turtles and marine mammals. Given that the Project is terrestrial, with the exception of haul road crossings, these species were appropriately discounted in the draft EIS and are not considered further in this Report.

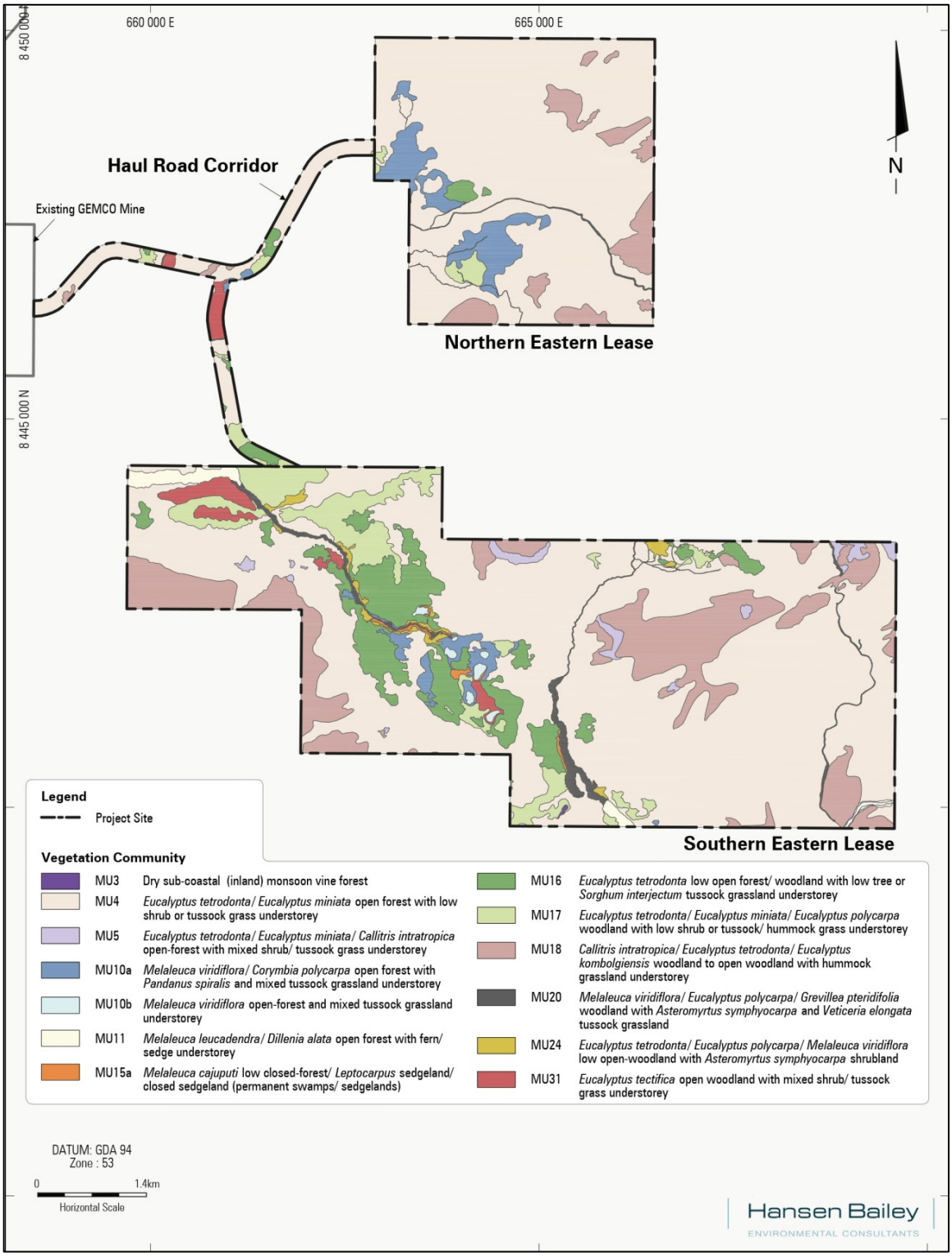

Figure 6 – Vegetation communities within the GEMCO Eastern Leases Project (source: GEMCO, 2015)

Fauna surveys were conducted by Cumberland Ecology across the Project site between 20 May and 3 June 2014 and 1 October and 14 October 2014. Fauna surveys included

terrestrial trapping, pitfall and funnel trapping, bird census, activities searches, ultrasonic bat call detection, harp trapping, spotlighting, call playback, infra-red (IR) camera detection and incidental observations. Targeted searches for threatened species were incorporated into the survey efforts, including methods for small threatened mammals, such as the northern hopping-mouse, brush-tailed rabbit-rat, pale field-rat (*Rattus tunneyi*), northern quoll and water mouse (*Xeromys myoides*).

A total of 115 fauna species were recorded within the Project site, including 54 birds, six amphibians, 31 reptiles and 25 mammals. The following threatened and/or migratory species were recorded during the surveys:

- brush-tailed rabbit-rat (Section 4.2.5)
- northern quoll (Section 4.2.8)
- northern hopping-mouse (Section 4.2.6)
- masked owl (northern) (Section 4.2.6)
- rainbow bee-eater (*Merops ornatus*)
- salt-water crocodile (*Crocodylus porosus*)
- yellow-spotted monitor (*Varanus panoptes*)
- Mertens' water monitor (*Varanus mertensi*).

A likelihood of occurrence assessment was undertaken by the Proponent and the following migratory species were assessed as having a moderate likelihood of occurring on the Project site:

- fork-tailed swift (*Apus pacificus*)
- white-bellied sea-eagle (*Heliaeetus leucogaster*)
- rufous fantail (*Rhipidurra rufufrons*).

The vegetation communities within the Project site were not considered to provide important habitat for the above mentioned migratory species and the draft EIS concluded that there was no evidence to suggest the Project supports an ecologically significant proportion of the population of any of these three migratory species.

Field surveys identified several habitat types occurring within the Project site that provide a range of habitat for fauna species. Key habitats identified and the vegetation MUs within the Project site included:

- Open forest (MU4, MU5)
- Woodland / shrubland (MU16, MU17, MU31)
- Sandstone woodland and rock outcrops (MU18)
- Riparian / seasonal wetland / aquatic (MU11, MU20/10a, MU10b, MU15a, MU24)
- Closed forest (rainforest) (MU3).

Open forest habitat was identified to provide numerous important habitat features that would be suitable for a suite of fauna species, including a number of threatened fauna known or predicted to occur within the Project site. Features within the open forest habitat include a diversity of grasses for seed-eating species, a shrubby understorey for birds and taller eucalypt trees. Hollow-bearing trees of varying sizes and standing dead

trees were recorded in the Project area, providing shelter, roosting and nesting habitat for a number of arboreal fauna species, including microbats and gliders, diurnal birds, owls and some reptiles. Terrestrial features such as fallen logs, debris and leaf litter provide shelter for many small to medium sized terrestrial fauna species on the Project area.

A summary of the habitat preferences for the threatened fauna species found on the Project site during the field surveys undertaken by the Proponent is provided in Table 2.

Table 2 – Habitat preferences for threatened fauna species (modified after: GEMCO, 2015 and GEMCO, 2016a)

Species	Presence on the Project site	Habitat preference
Masked owl (northern)	The masked owl (northern) was recorded from 4 locations within the Project site in open forest habitat (MU4), using call playback and spotlighting.	Habitat types in which the species is considered likely to occur within the Project site are open forest (MU4), sandstone woodland and rock outcrops (MU18), and riparian habitats (MU11, MU20)
Brush-tailed rabbit-rat	The brush-tailed rabbit-rat was recorded from one location within the Project site in open forest habitat (MU4), using an IR camera.	All fauna habitat types within the Project site have the potential to provide habitat for this species.
Northern quoll	The northern quoll was recorded a total of 65 times from 22 locations within the Project site. It was recorded using Elliott trapping, cage trapping, IR camera and incidental spotlighting. This species was recorded in a suite of vegetation communities, including open forest habitat (MU4, MU5), seasonal wetlands (MU10a), riparian habitats (MU11, MU20), woodland / shrubland habitat (MU16, MU17) and sandstone woodland and rock outcrops (MU18).	All fauna habitat types within the Project site have the potential to provide habitat for this species.
Northern hopping-mouse	The northern hopping-mouse was recorded from one location within the Project site in open forest habitat (MU4) during incidental spotlighting searches.	Habitat types in which this species is considered likely to occur within the Project site are restricted to open forest (MU4, MU5) and sandstone woodland and rock outcrops (MU18). A sandy substrate is also essential for this species for the creation of burrows, and therefore only areas within these MUs with suitable substrate would provide ideal habitat for this species.
Yellow-spotted monitor	The yellow-spotted monitor was recorded from 3 locations within the Project site in open forest habitat (MU4) and riparian habitat (MU20) using cage traps and IR camera.	All fauna habitat types within the Project site have the potential to provide habitat for this species.
Mertens' water monitor	Mertens' water monitor was recorded from nine locations within the Project site adjacent to watercourses in open forest habitat (MU4) and riparian habitat (MU11, MU20).	Habitat types which this species would occur within the Project site include riparian (specifically MU11, MU20) and aquatic habitats.

The Department of Land Resource Management confirmed the findings of the draft EIS and considered that the baseline flora and fauna surveys in the Project area were generally adequate for the identification of species and habitat types presented in the final EIS. Moreover, the Department considered the Proponent's assessment of the likelihood of occurrence of other threatened and migratory species to be accurate and that the Project poses no significant risk to any other species apart from those mentioned above. There are no threatened aquatic species known within or near the Project area.

Based on the information provided in the final EIS and advice from the Department of Land Resource Management, the NT EPA is satisfied that the Proponent has adequately

identified the key vegetation types, threatened and migratory species and provided an adequate assessment of habitat values for these species within the Project area.

4.2.4 Impact assessment

The NT EPA requested that the EIS quantify the Project's potential impacts to the abovementioned species, discuss how the impacts would be mitigated and outline whether the impacts following mitigation would be acceptable (NT EPA, 2014).

Section 7 of the draft EIS detailed the Proponent's impact assessment, which considered that the Project activities had the potential to give rise to direct and indirect impacts on flora and fauna:

- direct impacts from clearing 1525 ha of vegetation and habitat for open cut mining and the construction of infrastructure such as roads
- indirect impacts such as habitat fragmentation, edge effects, the effects of noise and vibration, vehicle strikes, lighting, dust, erosion and the introduction of invasive species.

The direct impact of the Project is the removal of native vegetation communities that provide habitat for fauna species. The Proponent estimated that based on whole-of-island habitat mapping, the Project would result in the clearing of approximately 1.3% of the open forest, 0.01% of sandstone woodland and 0.12% of watercourse/riparian zone habitat types within the disturbance footprint, in relation to the available habitat across the remainder of Groote Eylandt (see Section 7.6.2 of the draft EIS).

The direct clearing of habitat within the disturbance footprint would occur gradually over the life of the Project and rehabilitation of mined areas would occur progressively (Section 2.3.4). The habitats within the Project site are connected with similar habitats within the locality, and the staging of clearing and rehabilitation allow for the migration of some fauna species into adjacent areas. The proposed progressive rehabilitation would allow for the creation of habitat for fauna species and the recolonisation of habitat by fauna.

The TPWC Act threatened species found within the Project site were assessed against the direct and indirect impacts of the Project. The Proponent concluded that the Project would not give rise to significant impacts on the yellow-spotted monitor or Mertens' water monitor (see Section 7.6.6 of the draft EIS). The yellow-spotted monitor is wide ranging and has the potential to occur in all habitat types within the Project site (Table 2). Although the Project is expected to clear 1525 ha of potential habitat for the species, the amount of remaining habitat on the island is significant. The Mertens' water monitor was found in vegetated and rocky riparian areas within the Project site, which are largely excluded from the proposed areas of direct mine impact (i.e. clearing, quarries) and suitable habitat for this species would be retained within the Project site. The NT EPA considers that the Proponent has appropriately considered these species and the potential impacts in the draft EIS and are not considered further in this Report.

Information provided in the final EIS and advice from the Department of Land Resource Management and the Australian Government Department of the Environment, concluded that the Project may potentially give rise to significant impacts on the brush-tailed rabbit-rat, northern quoll, northern hopping-mouse and masked owl (northern). Given the significance of these species under the EPBC Act and the TPWC Act, details on the species, threatening processes, general conservation and management directives, and Project specific considerations are summarised here for information and to provide context to the sections regarding the Proponent's proposed measures to avoid (Section 4.2.9) and mitigate impacts (Section 4.2.10).

4.2.5 Brush-tailed rabbit-rat

The brush-tailed rabbit-rat is a moderately large (about 150 g) partly arboreal rat, with a long brush-tipped tail, with the distal third either black or white, and long ears (Woinarski and Hill, 2012a). The fur colour is relatively uniformly brown above, and cream below. It is distinctly smaller than the two other long-tailed tree-rats in the Northern Territory (Woinarski and Hill, 2012a).

The brush-tailed rabbit-rat is listed as vulnerable under the EPBC Act and endangered under the TPWC Act. The species is eligible for listing as vulnerable under the EPBC Act under criterion 1 as it is suspected to have undergone a substantial decline in numbers (Threatened Species Scientific Committee, 2008).

The brush-tailed rabbit-rat is found in monsoonal northern Australia, adjacent islands and southern New Guinea (Kemper and Firth, 2008). The species has been recorded from Queensland, the Northern Territory and Western Australia (Threatened Species Scientific Committee, 2008). There are very few recent records in the Northern Territory and it is currently known to persist in the Northern Territory only on Cobourg Peninsula, Bathurst, Melville and Inglis Islands, and Groote Eylandt (Woinarski and Hill, 2012a).

Inclusive of the record reported in the draft EIS there are only four records of this species on Groote Eylandt post-2002; three of which are within the Project area and one is immediately adjacent. All other records from Groote Eylandt predate 1976. Given the widespread and continuing decline of this species throughout most of the rest of its range, including some other island populations (Department of Land Resource Management unpublished data), it is possible that the Groote Eylandt population is also declining, which emphasises the significance of recent records for the species within or close to the Project area.

4.2.5.1 Threatening processes

No single factor has been demonstrated to have caused the decline of brush-tailed rabbit-rats, but the extent of loss on the mainland and the maintenance of some island populations suggest that it is probably not due to land-use factors but rather to either disease or exotic predators (Woinarski and Hill, 2012a). The most likely causal factor is predation by feral cats (Woinarski and Hill, 2012a). Changed fire regimes and weeds may have changed the availability of preferred or vital food resources (e.g. seeds or stems from particular grass species), and more frequent hot fires may have reduced the availability of hollow logs, tree hollows and the tall fruit-bearing understorey shrubs, and unfavourably changed the composition of grass species (Woinarski *et al*. 2004, 2011; Firth *et al*. 2005, 2006, 2010).

The brush-tailed rabbit-rat was recorded from one location within the Project site and the Proponent identified that all fauna types within the site have the potential to provide habitat for this species (Table 2).

4.2.5.2 Conservation objectives and management

Conservation advice has been prepared for the brush-tailed rabbit-rat by the Threatened Species Scientific Committee and is provided at Appendix A of this Report.

There is a recovery plan currently under development that outlines regional priorities for management for this species. In addition, the *Threat Abatement Plan for predation by feral cats* (DEWHA, 2008) and the *Threat Abatement Plan to reduce the impacts on northern Australia's biodiversity by five listed grasses* (DSEWPC, 2012b) are relevant to the management objectives for the brush-tailed rabbit-rat.

4.2.6 Northern hopping-mouse

The northern hopping-mouse is a medium-sized (25-50 g) terrestrial, granivorous rodent. It has features typical of hopping-mice in general and is the only representative of its genus in northern Australia (Woinarski, 2004a).

The northern hopping-mouse is listed as vulnerable under the EPBC Act. The main factors causing the species to be eligible for listing in the vulnerable category are a range-limited population that is suspected to have declined by >30% over the last 10 years, and is projected to continue to decline by >30% over the next 10 years (Woinarski *et al.*, 2014).

There are few documented records of the northern hopping-mouse (Woinarski *et al*. 1999; Woinarski, 2004a). The largest known northern hopping-mouse populations are on Groote Eylandt and the mainland of north-eastern Arnhem Land (Woinarski, 2004a).

The habitat for the northern hopping-mouse comprises a broad range of grassland, shrubland and open forest habitats, typically in sandy substrates in coastal or near-coastal areas (Woinarski *et al*. 1999). From an extensive search on Groote Eylandt (Woinarski *et al*. 1999), it was recorded most frequently in open shrubland dominated by either Acacia spp., *Hakea arborescens* or *Banksia dentata*, especially where these overtopped hummock grasses *Triodia stenostachya* and where there was high species richness of native peas (including *Tephrosia, Cajanus, Boassiaea* and *Jacksonia* species). Given the apparently relatively broad habitat range used by each species, it is not possible to tightly define any habitat that is "critical" for the survival of any of the species.

4.2.6.1 Threatening processes

There is a lack of specific information on threats to the northern hopping-mouse. However, some assessment of threats likely to be affecting this species may be inferred from evidence of a more general decline in native mammal assemblages across parts of northern Australia (Woinarski *et al*., 2001; McKenzie and Burbidge, 2002). The northern hopping-mouse is likely subject to at least some of the pervasive threatening processes of vegetation change through altered fire regimes and introduced herbivores (e.g. buffalo, cattle, donkeys, horses, pigs), predation by feral cats and strip mining (i.e. Groote Eylandt mining) (Woinarski, 2004a).

The northern hopping-mouse is a highly communal species and several individuals will occupy a single burrow system (Woinarski, 2004a). The burrows are complex, and are used for denning and nesting. The burrow characteristic may render the species particularly susceptible to predation by feral cats, which may wait at burrow entrances and over several nights consume entire colonies (Woinarski, 2004a).

The northern hopping-mouse was recorded from one location within the Project site in open forest habitat (MU4) during incidental spotlighting searches (Table 2). The draft EIS identified that the Project site supports an important population of this species and that the Project is likely to contribute to local population decline. The species is now known to be present in only three areas (see GEMCO, 2016a), inclusive of the record reported in the draft EIS within the Project area. Consequently, the confirmed occurrence of the species in the Project area must be regarded as significant and clearing and fragmentation of suitable habitat within the Project area to pose a high risk to the population. As this species has not been recorded as recolonising rehabilitation areas, this risk is not readily mitigated.

4.2.6.2 Conservation objectives and management priorities

Conservation advice has been prepared for the northern hopping-mouse by the Threatened Species Scientific Committee and is provided at Appendix A of this Report.

Recovery actions for the northern hopping-mouse can be found in the *National Multi-species Recovery Plan for the Carpentarian Antechinus Pseudantechinus mimulus, Butler's Dunnart Sminthopsis butleri and Northern Hopping-mouse Notomys aquilo, 2004–2009* (Woinarski, 2004a). In addition, the *Threat Abatement Plan for predation by feral cats* (DEWHA, 2008) and the *Threat Abatement Plan to reduce the impacts on*

northern Australia's biodiversity by five listed grasses (DSEWPC, 2012b) are relevant to the management objectives for the northern hopping-mouse.

4.2.7 Masked owl (northern)

The masked owl (northern) is a large owl (males 600 g, females 1 kg) with prominent heart-shaped facial disc, with plumage highly patterned by speckling, and generally darker on the back and paler below (Woinarski and Ward, 2012).

The masked owl (northern) is listed as vulnerable under the EPBC Act. The Action Plan for Australian Birds 2010 (Garnett *et al*., 2011) listed the masked owl (northern) as vulnerable because there are a limited number of mature individuals (approximately 3000), a suspected continuing decline in population size and a geographic distribution that may be precarious for the survival of the species (Garnett *et al*., 2011).

The distribution of the masked owl (northern) is very poorly known (Woinarski, 2004b). Three subpopulations have been suggested: Kimberley, Northern Territory and Cape York (Garnett *et al*., 2011). In the Northern Territory, the species occurs from the Cobourg Peninsula down to Katherine and Jasper Gorge (Victoria River area), and to the east at McArthur River. There are also records from Dead Dog Waterhole (Barkly Tableland) and the Tanami Desert (Threatened Species Scientific Committee, 2015 and references therein).

The masked owl (northern) occurs mainly in eucalypt tall open forests (especially those dominated by Darwin woollybutt and Darwin stringybark), but also roosts in monsoon rainforests and forages in more open vegetation types, including grasslands. Although it may roost in dense foliage, it more typically roosts, and nests, in tree hollows. Mammals, up to the size of possums, constitute the bulk of its diet and the masked owl (northern) usually nests in tree hollows within patches of closed forest (Woinarski and Ward, 2012).

Although there is no detailed information for this subspecies, masked owls of other subspecies occupy large exclusive home ranges, estimated at 5-10 km^2 (Woinarski and Ward, 2012).

4.2.7.1 Threatening processes

The reason for the decline and low density of masked owls in northern Australia is unclear (Woinarski, 2004b). The subspecies has been affected by broad-scale changes to the environment of northern Australia caused by altered fire regimes, feral animals and the invasion of native woodlands by exotic plants, particularly introduced pasture grasses (Woinarski, 2004b). However, the most likely cause of declines is a shortage of food, as small and medium-sized native mammals are becoming increasingly uncommon across much of northern Australia (Threatened Species Scientific Committee, 2015 and references therein).

The masked owl (northern) was recorded from 4 locations within the Project site in open forest habitat (MU4), using call playback and spotlighting (Table 2). Advice provided by the Department of Land Resource Management indicates that the masked owl (northern) depends upon 'old-growth' forests with relatively large trees and well developed hollows (>40 cm diameter). Most of the habitat affected by the Project is considered "old growth" forest and therefore the action may reduce the area of occupancy of this species on Groote Eylandt by a substantial amount. The time taken for savanna open forest or woodland to reach ecological maturity and develop hollows is at least 65 years (Woinarski and Westaway, 2008); considerably longer to develop large hollows suitable for the masked owl (northern). Hollow development requires fire, which is largely excluded from mine rehabilitation areas (see Section 4.3), further extending the expected time for hollow development.

Masked owls have substantially larger home ranges and corresponding lower population densities than are likely for either the northern hopping-mouse or brush-tailed rabbit-rat.

The removal of highly suitable masked owl (northern) habitat is likely to diminish the home ranges of individuals that extend well beyond the Project site. Furthermore, these adverse effects on the surrounding population would remain for an indeterminate length of time.

The draft EIS suggested that rehabilitation of the site could be expected to provide foraging areas for the species in the long term and therefore is unlikely to reduce the area of occupancy of the species. However, the assessment of existing mine rehabilitation areas provided no evidence that these areas could support the masked owl (northern), either directly from comparable population densities or home ranges, or indirectly from evidence that suitable hollows for this species have developed. Furthermore, there is no evidence that food resources for masked owls are returning to pre-clearing densities and species composition.

Advice from the Department of Land Resource Management indicated that the removal of suitable masked owl (northern) habitat by the Proponent should therefore be considered a long-term residual detriment to the Groote Eylandt population and it would be appropriate to implement environmental offsets for this impact. In response, the Proponent proposed that offsets would be provided for the masked owl (northern). Offsets would be provided as a precautionary measure, given that long term monitoring data on the habitat value of mine rehabilitation for threatened species were not available at the time of lodgement of the Supplement. The Revised Biodiversity Offsets Strategy is provided in Attachment B of the Supplement and discussed in more detail in Section 4.2.11 of this Report.

4.2.7.2 Conservation objectives and management

Conservation advice has been prepared for the masked owl (northern) by the Threatened Species Scientific Committee and is provided at Appendix A of this Report.

A national recovery plan for the mainland masked owl has been established (Woinarski, 2004b). The main research priority is to derive more precise information on population size, home range, habitat requirements, and response to putative threatening processes.

4.2.8 Northern Quoll

The northern quoll is a distinctive carnivorous marsupial. It is the smallest of the four Australian quoll species; the size of a small cat (weight 300-1100 g) (Woinarski and Hill, 2012b).

The northern quoll occurs across much of northern Australia, from south-eastern Queensland to the south-west Kimberley, with a disjunct population in the Pilbara, but has declined across much of this range (Woinarski and Hill, 2012b). In the Northern Territory, it has been recorded from Groote Eylandt and the nearby North-east and Winchelsea Islands, Marchinbar Island (in the Wessel group), Inglis Island (in the English Company Islands group) and Vanderlin Island (Sir Edward Pellew group). It has been translocated to Astell and Pobassoo islands in the English Company island group (Woinarski and Hill, 2012b).

Northern quolls are opportunistic omnivores, consuming a wide range of prey including arthropods (e.g. insects and spiders), small mammals (e.g. bandicoots, sugar gliders, brush-tail possums and rats), birds (e.g. brown quail), reptiles (skinks and snakes) and frogs. They also eat bird eggs and nectar of eucalypt and grevillea flowers (Oakwood, 2008). Northern quolls will also scavenge from road kills and garbage bins (Oakwood, 2008).

The northern quoll dens in hollow logs, rock crevices and caves, and in tree hollows. Most foraging is on the ground, but it is also an adept climber. It occurs in a wide range of habitats, but the most suitable habitats appear to be rocky areas.

Northern quolls typically have an annual life cycle, with almost all males living for only one year (Oakwood, 2000, 2002). Young are born in the mid Dry season (June), and attain independence in the early Wet season (November). Mating is highly synchronised, occurring in late May/early June. During the non-breeding season, home ranges are about 35 ha, but this increases to about 100 ha for males in the breeding season (Oakwood, 2002).

4.2.8.1 Threatening processes

Quolls appear to have been declining in the Northern Territory for at least several decades (Woinarski *et al*. 2001), possibly because of impacts from feral cats, disease or changed fire regimes. Lethal toxic ingestion caused by cane toads is a key threatening process listed under the EPBC Act.

It is suggested that between 1900 and 1990 the northern quoll has undergone a reduction in its range (Braithwaite and Griffiths 1994). The pre-toad mainland distribution of the northern quoll in the Northern Territory is estimated to be 249 207 km². By 1990 the species was considered to occupy approximately 87% of its former range (216 854 km²). It is estimated that by 2004, the Northern Territory mainland distribution had declined to 20% of its 1990 distribution following invasion of the cane toad (i.e. 47 812 km²) (Threatened Species Scientific Committee, 2005).

The draft EIS confirmed the presence of the northern quoll in the Project site. It was recorded 65 times from 22 locations (Table 2) in a suite of vegetation communities, including open forest habitat (MU4, MU5), seasonal wetlands (MU10a), riparian habitats (MU11, MU20), woodland / shrubland habitat (MU16, MU17) and sandstone woodland and rock outcrops (MU18).

The draft EIS concluded that the Project would not have a significant impact on the northern quoll. The Department of Land Resource Management contended this finding because it was considered that the Proponent may have underestimated the residual risk to this species. This was primarily because the draft EIS stated that the northern quoll has been demonstrated to use rehabilitated vegetation within the existing mine area. However, the survey efforts to obtain this data were limited and not appropriate to be used to make conclusions regarding the residual risk to the species. More detailed data were requested on relative population density in comparable rehabilitated and undisturbed habitats, and the trajectory of “recovery” of quolls into rehabilitated habitats, before it can be concluded that there is no residual detriment to northern quoll populations from mining within the Project area.

In the Supplement, the Proponent acknowledged that the ability of the northern quoll to inhabit mine rehabilitation areas is unknown and identified that the most severe risk to the northern quoll on Groote Eylandt is the introduction and spread of the cane toad, which has the potential to cause island wide extinction of the northern quoll. This is recognised in the final EIS as a high risk, even after mitigation (see Section 4.1). The Proponent revised the Biodiversity Offsets Strategy to include the northern quoll primarily as a precautionary measure, given that long term monitoring data on the habitat value of mine rehabilitation for threatened species was not available at the time of lodgement of the Supplement. The Revised Biodiversity Offsets Strategy is provided in Attachment B of the Supplement. Offsets would focus on feral cat control, as well as quarantine measures for cane toads, which is consistent with the National Recovery Plan for the northern quoll (Hill and Ward, 2010).

4.2.8.2 Conservation objectives and management

Approved conservation advice has been not been prepared for the northern quoll. The National Recovery Plan for the northern quoll (Hill and Ward, 2010) aims to minimise the rate of decline of the northern quoll in Australia, such that viable populations remain in each of the major regions of distribution into the future.

The *Threat Abatement Plan for the biological effects, including lethal toxic ingestion, caused by cane toads* (DSEWPC, 2011) outlines that, given the absence of a potential biological control, and the limited effectiveness of physical barriers, cane toads will not be eradicated in Australia and will continue to spread throughout southern and western Australia. Management documents for the northern quoll include the *National Recovery Plan for the Northern Quoll Dasyurus hallucatus* (Hill and Ward, 2010), *Threat Abatement Plan for predation by feral cats* (DEWHA, 2008) and *Threat Abatement Plan to reduce the impacts on northern Australia's biodiversity by five listed grasses* (DSEWPC, 2012b).

4.2.9 Measures to avoid impacts

Open cut mining projects cannot readily avoid direct impacts to biodiversity where mineral resources are beneath flora and fauna habitat. The Proponent has taken actions to limit impacts by locating the quarries and associated infrastructure away from high quality habitat, which are detailed in Section 3 of the draft EIS. In particular, the Project has been designed to ensure that mining will not encroach on any watercourses (see Section 4.4.3) or rocky hillsides, due to the cultural sensitivity and the nature of the Project site geology. Retention of all the rocky hillsides on site protects rock outcrops that provide refugia for a suite of flora and fauna.

The direct consequence of the Project is the clearing of 1525 ha of potentially critical habitat for four threatened species protected under the EPBC Act; the consequence of not proceeding would result in the socio-economic benefits (see Section 3.5) associated with the development being forgone.

4.2.10 Measures to mitigate impacts

The Proponent has a range of policies, plans and procedures for the existing mine that are relevant to flora and fauna, which are summarised in Section 7 and Appendix C of the draft EIS. The Proponent has committed to reviewing and revising the policies, plans and procedures prior to the commencement of the Project to ensure that they address all activities proposed to be undertaken on the Project site. The mitigation measures are discussed below.

4.2.10.1 Pre-clearing and clearing

Clearing would be undertaken in accordance with the Proponent's Permit to Clear process. This process includes specifications designed to limit the impact of the clearing activity itself as the clearing would be progressively undertaken in a staged manner over the life of the Project. The pre-clearing work would create the potential for mobile species to move to adjacent areas, provide an opportunity for the collection of seeds for use in rehabilitation, and allow for any noxious weeds in the area to be identified.

4.2.10.2 Rehabilitation

Rehabilitation is a key mitigation measure for the Project. Rehabilitated areas would be guided by the existing rehabilitation procedures and manuals, as detailed in Section 6 of the draft EIS. The Proponent has specific procedures relating to rehabilitation activities including topsoil management, topsoil ripping, seed collection, aerial seeding, sowing seed by hand, and weed management. Rehabilitated areas would be monitoring as part of the Proponent's rehabilitation morning program. Rehabilitation is further discussed at Section 4.3 of this Report.

4.2.10.3 Land Management

Land management measures for the Project site would include weed and feral animal control and fire management. The Proponent has an existing Land and Biodiversity Management Plan, which provides an overall framework for land management and managing potential impacts to land and biodiversity. Other specific plans to manage and mitigate indirect impacts include the development of a Traffic Management Plan (requirements for speed limits, safe driving practices, measures to reduce vehicle strike,

and the installation of signage) and air quality measures (dust suppression, watering of haul roads and rehabilitation of disturbed areas). The NT EPA considers that the principles and objectives of the land management measures are appropriate and acknowledges that as the Project enters the design and implementation phases, there would be more specificity around the aspects of the Project to inform the development of the management plans.

The NT EPA makes the following comments and recommendations on the targeted risks that are associated with direct loss of habitat for the threatened species, potential increased risk of cane toad colonisation (Section 4.2.10.6), potential increased risk of predation by feral cats (Section 4.2.10.5), and potential spread of weeds (Section 4.2.10.4).

4.2.10.4 Weeds

Weeds are a major threat to ecosystems and will displace native flora and fauna. Invasion of native vegetation by weed species can have an impact on the function of the natural community. This can occur by weeds out-competing naturally occurring species, reducing the variety of native species and reducing the availability of food sources, shelter and nesting sites for wildlife.

Weed species can rapidly colonise areas following disturbance or degradation and then provide a source of infestation throughout an area. Weed spread can occur through contaminated vehicle and machinery movement, soil disturbance and relocation, and aeolian and fluvial processes.

The Proponent has existing procedures in relation to weed management that would be reviewed and applied to the Project activities, and to the overall management of the Project site. The manual would include measures for the control of existing weeds, which are very limited on the Project site, and measures to prevent the introduction of weeds. Current mine procedures include weed mapping and spraying, and vehicle wash-down procedures to prevent the spread of weeds.

It is notable that no declared weeds were recorded within the Project site during the field survey and the Department of Land Resource Management verified the findings of the draft EIS and the additional information provided in the Supplement on weed management. The Proponent acknowledged the serious threat that weeds may pose to biodiversity, water resources and the success of mine rehabilitation. Additional information was provided in the Supplement on the weed management practices that would be adopted for the Project. The additional information included a description of measures to prevent weed infestations, as well as measures to prevent weed colonisation of rehabilitation, roadways and areas within disturbed soils. It describes vehicle hygiene procedures that would be adopted.

Since the lodgement of the Supplement, the Department of Land Resource Management updated the information on all weed species recorded on Groote Eylandt and the correct declaration Class (Table 3).

Table 3 – Weed species and classification on Groote Eylandt

Common name	Botanical name	Declared
Gamba grass	*Andropogon gayanus*	Class A
Bellyache bush	*Jatropha gossypiifolia*	Class A
Mossman River grass	*Cenchrus echinatus*	Class B
Perennial mission grass	*Cenchrus polystachios*	Class B
Ornamental rubber vine	*Cryptostegia madagascariensis*	Class A
Hyptis	*Hyptis suaveolens*	Class B
Candlebush	*Senna alata*	Class B
Sida	*Sida* spp.	Class B
Snakeweed	*Stachytarpheta* spp.	Class B
Grader grass	*Themeda quadrivalvis*	Class B
Caltrop	*Tribulus cistoides*	Class B
Neem	*Azardirachta indica*	Class B

Groote Eylandt is in the Class A (to be eradicated) zone for gamba grass and bellyache bush management, and Class B for neem. Gamba grass, neem and bellyache bush are subject to Statutory Weed Management Plans. Management obligations outlined in these plans must be adhered to by all land holders. Other Class A weeds, if found, would need to be targeted for eradication as per their legislative requirements.

Recommendation 3

A Weed Management Plan for the control and management of weeds shall be prepared. The Weed Management Plan must identify the species of weeds and their location in and around the GEMCO Eastern Leases Project and outline methods for eradicating/controlling existing infestations. It must identify actions to prevent introduction of new weed species from vehicles, machinery or any other method, and align with Statutory Weed Management Plans.

4.2.10.5 Feral animals

The feral cat and the domestic dog/dingo were recorded during surveys undertaken by the Proponent. Feral cattle, horses, donkeys, pigs, goats, water buffalo, rusa deer, the European red fox and the cane toad are absent from the Project site and from Groote Eylandt, more broadly.

Feral cats are strongly implicated in the widespread decline of small and medium- sized mammals across northern Australia. Areas where most threatened mammal species persist are either free of cats, or retain habitat characteristics that ameliorate cat predation. Ecologically benign fire regimes and absence of grazing by introduced herbivores helps retain complex habitat structure and other resources important for small mammals, and reduces the impacts of cat predation. These factors are strongly implicated in the persistence of some threatened species on Groote Eylandt compared to the mainland.

The risk that feral cats pose to small and medium-sized mammals across Northern Australia is acknowledged in the draft EIS. The Department of Land Resource Management noted that the draft EIS correctly identified the risk of increased impacts from feral cats created by the Project, through clearance of vegetation and expanded road network, creating disturbed areas and corridors that is likely to increase feral cat dispersal and facilitate hunting efficiency. However, the Department of Land Resource Management noted that management and control measures identified in the draft EIS to mitigate the threat posed by feral cats are not adequate or practical. Localised cat trapping is ineffective at reducing cat numbers in open populations. Currently, the only effective way to mitigate the impacts of feral cats on native wildlife is with sustained baiting and ultimately eradication programs at appropriate landscape scales, with effective barriers to recolonisation such as cat eradication on entire islands or within large predator-proof exclosure fences.

In response, the Proponent has revised its commitment to cat trapping and any feral cat control work on the Project site is proposed to be undertaken as part of a broader program of feral cat control on Groote Eylandt (undertaken as part of the delivery of biodiversity offsets via contributing funding towards the implementation of the Threatened Species Management Plan). It is understood that the Proponent is consulting with the Department of Land Resource Management and the Australian Government Department of the Environment for the development of feral cat management strategies (see Section 4.2.11). The NT EPA expects that the outcomes of the consultation and the development of the Threatened Species Management Plan would be used to inform feral cat management strategies by the Proponent.

4.2.10.6 Cane toads

Native Australian predators have evolved in the absence of prey species with the chemical defences present in cane toads. Consequently, predators are vulnerable to

being lethally poisoned when cane toads invade and establish in their area. Local population extinctions of the predators, including the northern quoll, have been observed following the arrival of cane toads in some areas (DSEWPC, 2011). Lethal toxic poisoning through ingestion of the cane toad has been identified as the cause of these local extinctions. The biological effects, including toxic ingestion, caused by cane toads, was listed as a key threatening process under the EPBC Act in 2005 in response to concerns about the impact of cane toads on the northern quoll (DSEWPC, 2011).

Cane toads pose a severe threat to the biodiversity of Groote Eylandt, and particularly an extreme risk to the highly significant population of northern quoll. The Project, as an extension of existing mining activity, poses continuing and potentially increased risk of cane toad establishment due to ongoing freight movement and human transport to Groote Eylandt. The risk posed by cane toads is exacerbated by the toads' ability to establish quickly once introduced, which means that the impacts of the cane toad are likely to occur swiftly following introduction. Impacts would also inevitably be island-wide, rather than constrained to the Project and activity areas.

The Proponent acknowledged that the cane toad is a serious threat to the unique biodiversity of Groote Eylandt. The draft EIS identified that the Proponent has an existing management plan in place to prevent the introduction of cane toads to Groote Eylandt, which would be extended to include the Project. The Department of Land Resource Management and the NT EPA requested additional information on the existing cane toad management protocols and whole-of-island mitigation measures.

In response, the Supplement included an outline of actions in the Cane Toad Management Plan. Advice from the Department of Land Resource Management indicated that the Supplement broadly provided the principles and objective to manage cane toads across the Project area and Groote Eylandt. However, the final EIS did not provide details on how the plan has been/would be implemented, and how its efficacy is measured. Based upon the information provided in the final EIS, the following deficiencies were identified:

- The scope of the plan includes only the Proponent's operational areas rather than the whole island. The Project potentially increases risk of toad introductions via both direct mine operation activities and indirectly across the island. For a Cane Toad Management Plan to be effective it needs to mitigate risk across the whole island.
- It is unclear what and how risk assessments have been undertaken to inform the plan in terms of potential pathways of cane toad introductions, risks of non-detection or adequacy of response.
- The monitoring and surveillance outlined in the Supplement appear inadequate to reliably mitigate risk of cane toad introduction:
    - Barge inspections are undertaken by barge operators rather than independent trained quarantine officers.
    - No information is provided on the periodicity of inspections by the Mine's environmental team, nor how these inspections are undertaken.
    - Barge inspections are only undertaken at Milner Bay and not Umbakumba.
    - Dogs trained to detect toads are not used for inspections at any ports, thus greatly increasing the likelihood of hidden toads not being detected.
    - The cane toad detection devices and traps described in the Supplement are part of a research program to trial their efficacy and evaluate the feasibility of using them as components of monitoring and surveillance for

toads on Groote Eylandt at some point in the future, but as yet they are untested in the field. Therefore they cannot be considered part of a management plan to exclude toads at this stage. Furthermore, the developers of these devices have advised that they are not designed to work in isolation; direct frequent monitoring and surveillance of potential toad habitat by trained personnel in the vicinity of mine activities, island entry points and settlements is essential.

  - No such direct monitoring and surveillance for toads that may have got through quarantine is in place on the island.
  - The frequency of cane toad-proof fencing checks is inadequate, especially during the Wet season when fences are more likely to be damaged and toads are more active.

- No information is provided on incident response and disposal procedures.
- The draft EIS indicated that the plan would be reviewed and revised as necessary to ensure that it was appropriate for all activities, flagged the introduction of annual audits of quarantine procedures and made recommendations for their continuous improvement. However, no information was provided on current reporting procedures.

Based upon the information provided in the final EIS and the abovementioned advice from the Department of Land Resource Management it is appropriate for the risk assessment for the cane toad to be revised. It is recommended that a comprehensive risk assessment is undertaken on the potential pathways for introduction and establishment of cane toads to Groote Eylandt. The NT EPA acknowledges that the ALC, who manage the land of Groote Eylandt, has a vital role in the control and management of cane toads. The NT EPA expects that the ALC will be consulted during the revaluation of risk assessment and that collaborative approaches to manage cane toads will be developed between the two parties, where possible. The outcomes of the risk assessment should be used to develop a revised Cane Toad Management Plan, which should be subject to independent peer review. The Cane Toad Management Plan should include:

- revised risk assessments
- identification of all actions necessary to minimise the risk of toad establishment on Groote Eylandt (not limited to the mine site or leases)
- roles and responsibilities
- detailed procedures and protocols for undertaking monitoring, surveillance and quarantine inspections
- detailed procedures and protocols for incident response
- training requirements of staff and contractors
- reporting and evaluation procedures to assess the Plan's effectiveness and revision
- independent audit and review.

Recommendation 4

The Proponent shall re-evaluate the risk assessment and management strategy for the cane toad. The amended assessment should be used to prepare a Cane Toad Management Plan, in consultation with experts in the management of cane toads.

4.2.11 Offsets

Environmental offsets are actions taken to counterbalance the significant residual impacts of a proposed action. Offsets are required for MNES protected under the EPBC Act in the event that significant impacts are predicted to remain after avoidance and mitigation measures have been taken.

The NT EPA considers that the identification of MNES has been appropriate. The Project would directly disturb 1525 ha of potentially critical habitat for four threatened species protected under the EPBC Act:

- northern hopping-mouse
- brush-tailed rabbit-rat
- northern quoll
- masked owl (northern).

The loss of this quantity of critical habitat for these species is likely to reduce the area of occupancy and adversely affect habitat critical to the survival of the species. The NT EPA has considered the Proponent's measures to mitigate impacts and provided recommendations to reduce the impacts of the Project, in particular to improve the management of feral cats and cane toads. However, the Project cannot avoid the direct impact to MNES, even with measures to mitigate impacts. Therefore, the NT EPA considers that it is likely that the Project will result in residual significant impacts on MNES and that it is appropriate for the Proponent to offset the impacts to the species in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPC, 2012a).

The draft EIS included proposed offsets for the northern hopping-mouse and the brush-tailed rabbit-rat. The draft EIS did not predict significant, residual impacts on any other EPBC Act listed species. Although the northern quoll and masked owl (northern) were found within the Project site, the draft EIS concluded that the Project would not have a significant, residual impact on these species because habitat for these species would be created in areas of mine rehabilitation.

A number of advisory bodies and commenters did not support the Proponent's conclusions and encouraged the Proponent to revise the data used to verify its claims. The Department of Land Resource Management highlighted that although survey efforts were broadly appropriate to identify species and potential habitat, the efforts and subsequent analyses were not appropriate to enable conclusions to be made on the residual risk to the listed species occurring in the Project area. For example, there was only sparse information about the extent and rate of recolonisation of rehabilitated areas by the key threatened species, and the ultimate recolonisation at densities similar to pre-mining levels by any of these species could not be assumed; therefore, the assumptions were unlikely to be representative or accurate to inform proposed offsets.

The Proponent revised the proposed offsets strategy in its entirety and produced the Revised Biodiversity Offset Strategy in the Supplement. The Revised Biodiversity Offset Strategy was expanded to include the northern quoll and masked owl (northern), and the primary focus of offsets shifted towards direct conservation actions rather than research. The Revised Biodiversity Offset Strategy outlines that the Proponent is proposing to secure offsets by providing funding towards the implementation of the Threatened Species Management Plan. The Threatened Species Management Plan is being developed by the Department of Land Resource Management, in consultation with the ALC and other key stakeholders on Groote Eylandt, and is due for completion by 2017.

The Revised Biodiversity Offset Strategy commits to the following key principles with respect to offsets funding:

- Offset funding will be provided to conservation program/s that deliver an overall conservation outcome that improves or maintains the viability of the target species.

- Offset funding will be used for conservation programs that are scientifically robust and reasonable.

- The conservation programs will include a pre-defined monitoring and reporting program to confirm that they are achieving their objectives.

The Proponent is confident, following consultation with the Department of Land Resource Management, that these principles can be achieved by providing funding towards the implementation of the Threatened Species Management Plan. However, as noted in Section 7 of the Revised Biodiversity Offset Strategy, in the event that programs developed as part of the Threatened Species Management Plan do not meet these principles, the Proponent has committed to considering alternative programs.

The NT EPA consulted the Australian Government Department of the Environment on whether the Revised Biodiversity Offsets Strategy met the requirements of the Australian Government's Offsets Policy (DSEWPC, 2012a). The Australian Government Department of the Environment considered that the Revised Biodiversity Offsets Strategy did not provide sufficient detail to meet the principles outlined in the Policy. In particular, the Revised Biodiversity Offsets Strategy only provided general, high level concepts and insufficient detail of proposals to contribute to feral cat management programs that could form part of the Threatened Species Management Plan. The following information was requested from the Proponent to demonstrate that the offset proposal would meet the principles of the Australian Government's Offsets Policy (DSEWPC, 2012a).

- identification of a scientifically robust, measurable, auditable, enforceable and achievable environmental outcome that achieves a conservation gain for listed threatened species undergoing a residual significant impact as a result of the proposed action

- the actions that will be implemented to achieve the identified environmental outcome

- a system of monitoring, reporting and adaptive management that ensures the proposed environmental outcome is achieved

- a means by which to quantify monetary offset contributions so that they are 'of a size and scale' proportionate to the residual impacts on the protected matter.

Supplementary information provided by the Proponent acknowledged that it would be necessary to develop the information requested by the Australian Government Department of the Environment prior to implementing the Revised Biodiversity Offsets Strategy. However, much of the information requested would be developed over the coming 12-18 months as an outcome of the Groote Eylandt Biodiversity Initiative and as part of the development of the Threatened Species Management Plan.

The Proponent acknowledged that, in the event of delays to the development of the Threatened Species Management Plan, it would be necessary to independently develop further information on conservation programs. However, the Proponent indicated that this would not be a preferred outcome.

The NT EPA acknowledges that multiple programs and initiatives related to threatened species management on Groote Eylandt are currently under development and that the outcomes of these would be used to inform the proposed offsets for the Project. In its current form the Revised Biodiversity Offsets Strategy does not provide sufficient detail

to meet the principles outlined in the Australian Government's Offsets Policy (DSEWPC, 2012a). Further consultation is required between the Proponent and the Australian Government Department of the Environment to inform the EPBC Act approval process.

Recommendation 5

Should the Australian Government decide that offsets are required to compensate for the residual significant impacts to matters of national environmental significance, the Proponent shall submit an offset plan. The offset plan should clearly define the mitigation, management and compensatory measures that will be implemented on site. Any offset measures should be consistent with the Australian Government's Offset Policy and calculator.

The Department of Land Resource Management queried the information provided on page 18 of the Supplement in respect of the inclusion of the northern quoll and masked owl (northern) and the statement that it should not result in additional land for offset. The Proponent argued that these species make use of the same habitat as the northern hopping-mouse and brush-tailed rabbit-rat, and therefore any offsets for the latter can be designed in a manner that also benefits the northern quoll and masked owl (northern). This reasoning fails to consider important differences in ecological requirements amongst these species, and the different effects of environmental threats posed by the proposed development.

Recommendation 6

In consideration of recommendation 5, the offsets plan should take into account the different ecological requirements and threats to each of the listed species considered to be at significant risk from the Project as identified in Assessment Report 77.

4.3 Rehabilitation and closure

The total area to be cleared over the life of the Project has been estimated by the Proponent to be 1525 ha. Rehabilitation principles are designed to restore mined land to self-sustaining open woodland, similar to the pre-mining environment and the surrounding undisturbed land (Section 2.3.4).

The Proponent has developed detailed completion criteria for rehabilitated areas for the existing mine and undertakes annual monitoring of rehabilitation against the completion criteria. The rehabilitation monitoring program includes a network of analogue sites (i.e. undisturbed areas representative of the landform and vegetation prior to mining) and rehabilitation sites. Data recorded during the monitoring program includes: soil profile chemistry and geochemistry; ground cover (i.e. proportion of litter, grass and bare ground); species composition and abundance, with a focus on woody species that have been nominated as key and primary species; diameter of trees and shrubs; canopy cover; fauna activity and presence of weeds. The data from each monitoring plot are used to determine whether the rehabilitated area is on the expected trajectory for its age and to classify the rehabilitated area into the completion criteria. To date, the Proponent has rehabilitated approximately 1000 ha within the existing mine, with rehabilitation varying in age from a few months to over 30 years. Section 6.2.4 of the draft EIS detailed the completion criteria for rehabilitation at the existing mine and Section 6.2.5 of the draft EIS summarised the status and success of rehabilitation at the existing mine.

The Proponent has the following existing plans and procedures that guide rehabilitation, and these would be updated to reflect Project activities:

- Rehabilitation Standard
- Rehabilitation Planning Manual

- Land and Biodiversity Management Plan
- Closure Plan.

The Proponent has individual procedures relating to specific rehabilitation activities including vegetation clearing; topsoil management, topsoil ripping, seed collection; aerial seeding; sowing seed by hand and weed management. Topsoil that has been stripped ahead of mining would be placed directly onto available rehabilitation areas, where possible. This would minimise the need for stockpiling of topsoil, reduce the potential for weed infestation from stockpiled soil and increases the chance of establishing a dense native vegetation cover to outcompete weeds. In the event that monitoring indicates that rehabilitation is not on trajectory to meet the closure criteria, the rehabilitation would be subject to remedial works such as supplementary planting or extra weed control procedures.

Section 6.3.4 of the draft EIS noted that the completion criteria would be reviewed to confirm their adequacy for the Project site, and amended as necessary. Detailed rehabilitation and closure objectives for the Project would be guided by the Proponent's closure plan for the existing mine, and will be developed through a consultative process with stakeholders, including the ALC.

The Proponent has recently undertaken some fauna surveys in some mine rehabilitation areas with the intent of initiating a monitoring program to evaluate faunal recolonisation of rehabilitation areas. However, no explicit criteria have been established for evaluating rehabilitation with respect to fauna species generally or threatened species specifically, such as targets for rehabilitation habitat condition and/or area, and species distributions and/or densities. Furthermore, the survey/monitoring methods described in the draft EIS were not considered by the Department of Land Resource Management to be sufficient to effectively evaluate recolonisation of fauna species, with weaknesses including no control sites, inadequate replication and sampling intensity at sampling sites.

The proposed rehabilitation method identified in the draft EIS provided for a uniform landscape and would not replicate all landform types originally found within the Project site (e.g. areas of sandy soils, undulations, rocky habitat for northern quolls' dens etc). More information was requested on how the proposed rehabilitation methods and final landform would provide suitable habitat for listed threatened species.

In the Supplement, the Proponent acknowledged that the rehabilitation will not necessarily replicate all of the microhabitat features and landform types originally found within the Project site. In particular, the draft EIS indicated that the Project has the potential to give rise to significant impacts on the northern hopping-mouse and brush-tailed rabbit- rat. This assessment was made because it was uncertain whether the rehabilitation will be able to provide habitat for these species, given their specific habitat needs (sandy soils in the case of the northern hopping-mouse) and lack of evidence of these species in rehabilitation to date. The final EIS therefore included a commitment to provide offsets for the loss of this habitat and the Proponent has committed to developing completion criteria for fauna. Prior to the commencement of the Project, it is expected that the Proponent would review the completion criteria and ensure that completion criteria for fauna is developed.

The draft EIS noted that fire would be restricted from the rehabilitated areas, wherever possible, to allow for floral species to establish. A number of submissions on the draft EIS highlighted that after several years it could be difficult to introduce a controlled or traditional fire regime due to the changes in the species composition and habitat structure of the area (e.g. large build-up of fuel). More information was requested on how the fire regimes would be controlled within the rehabilitated areas, including post-closure, with particular reference to baseline data to determine the effectiveness of rehabilitated areas in providing habitat for listed threatened species.

In the Supplement, the Proponent acknowledged the role that fire plays in the ecosystems of Groote Eylandt and noted that rehabilitation will ultimately be subject to fire. In response to this, and other submissions in relation to the introduction of fire into rehabilitation, the Proponent has committed to undertaking a trial on prescribed burning of rehabilitation. Section 4.3.6 of the Supplement describes the proposed trial. The trial program will gather data on the response of rehabilitation to prescribed burning. Following the completion of the trial program, procedures in relation to prescribed burning of rehabilitation would be developed by the Proponent for the Project.

Recommendation 7

The Proponent shall prepare and implement a Rehabilitation Plan for the GEMCO Eastern Leases Project. The Rehabilitation Plan should include objectives for the creation of threatened species habitat and recolonisation by threatened species populations, and identify explicit criteria for evaluation. The plan should include a sampling design and sampling methods for monitoring that will enable measurable evaluation of outcomes against identified criteria, in order to demonstrate the effectiveness of the Rehabilitation Plan for threatened species.

The Rehabilitation Plan should be revised accordingly in response to the results of trials in prescribed burning of rehabilitated areas.

The Proponent has a mine closure plan for the existing mine, which forms a part of the Mining Management Plan. The overarching objective of the closure plan is to describe how the mine will be successfully closed and rehabilitated to achieve the agreed post-closure land-use, and the performance criteria that will be used to measure successful closure. It is important that the Proponent prepare a stand-alone Closure Plan for the Project that is aligned with the principles and objective of the closure plan for the existing mine. The Closure Plan should include clear closure criteria, which have been determined for the Project site through consultation with relevant stakeholders, including for unplanned closure, which would take account of all the areas requiring rehabilitation.

Recommendation 8

The Proponent shall prepare a Closure Plan for the GEMCO Eastern Leases Project that includes closure criteria that have been developed in consultation with relevant stakeholders and approved by the Department of Mines and Energy, including provisions for unplanned closure.

4.4 Water

4.4.1 Groundwater recovery

Section 9 of the draft EIS detailed that dewatering activities would be required to enable mining in the Project area. It is predicted that drawdown of groundwater levels around active quarries would occur and that groundwater levels would recover rapidly following mining. The draft EIS included a numerical groundwater model, which used data obtained from groundwater monitoring bores, as well as geological information gathered during the Proponent's exploration drilling program. Once mining has been completed in a quarry, active quarry dewatering would cease and groundwater table recovery would commence. The groundwater model predicted that around each quarry 80% of the drawdown would recover within five years of mining. Almost total recovery of groundwater levels (i.e. to pre-mining levels) was expected to be achieved within 20 years of the completion of mining.

The submissions by the NT EPA, the ALC and a member of the public requested further information in relation to groundwater recovery and/or expressed concerns as to whether groundwater would recover post-mining. In response to these submissions, the Proponent engaged Australasian Groundwater and Environmental Consultants Pty Ltd

to provide additional analyses of data to validate the Proponent's claim regarding groundwater recovery. Data from the existing mine were used because the hydrogeological characteristics at the existing mine and the Project site are comparable; and the data would be representative of typical groundwater levels within and surrounding previously mined areas. In particular, the post-mining effects on groundwater levels in the vicinity of the mined area (i.e. mined and rehabilitated quarries) and re-establishment of the groundwater table in backfilled quarries were assessed in respect of the Project. *The Groundwater Recovery at the Existing GEMCO Mine Report* is provided at Attachment C of the Supplement.

Post-mining effects on groundwater levels in the vicinity of mined areas were assessed using groundwater monitoring data collected at the existing mine. Monitoring data were obtained from bores located less than 1 km from mined areas, and showed no significant residual effects on groundwater levels. Monitoring of bores confirmed that, within 10 years of mining, groundwater levels in backfilled overburden have recovered to pre-mining levels.

The NT EPA is satisfied that the monitoring data from the existing mine and the additional analyses of groundwater recovery potential provided in *The Groundwater Recovery at the Existing GEMCO Mine Report* are suitable to support the Proponent's claims regarding groundwater recovery. However, it would be appropriate for the modelled predictions to be validated by the collection of data throughout the life of the Project, and post-closure, if relevant. This would enable the Proponent to confirm that drawdown from the Project and/or the impacts from groundwater recovery are no greater than those predicted in the assessment and/or amend the Project accordingly in the event that the predictions are erroneous.

Section 9.5 of the draft EIS describes the groundwater monitoring network for the Project. The network was established as part of the groundwater investigations for the draft EIS and the Proponent has committed to continuing the program throughout the life of the Project. Automatic loggers, which record standing water levels every few minutes, are currently installed on all monitoring bores across the Project site. Monitoring is planned to continue and would enable natural groundwater level fluctuations (such as responses to the Wet season) to be distinguished from potential water level impacts due to dewatering resulting from mining activities.

Recommendation 9

The Proponent shall develop and implement a Groundwater Monitoring Program to monitor groundwater level. The Program should be of an appropriate sampling density and frequency to detect water level variations resulting from dewatering for Project mining activities, accounting for seasonality. The numerical groundwater model used to predict drawdown levels should be validated at regular intervals against the results of the Groundwater Monitoring Program, and appropriate management measures developed if adverse impacts are detected.

4.4.2 Groundwater dependent ecosystems

Groundwater dependent ecosystems are prevalent in the south western portion of the Northern Eastern Lease, and the central and western portion of the Southern Eastern Lease. Vegetation map units MU3, MU10a, MU11, MU16 and MU31 are associated with shallow occurrences of groundwater, which correspond with the low-lying areas of the Project site (largely vegetated by low woodland and scrubland) and along streams (closed forest predominates, groundwater is located close to the ground surface). Figure 7 shows the location of these map units beyond the Project's disturbance footprint.

The draft EIS predicted that groundwater would recover rapidly following mining and that significant long term impacts on groundwater dependent ecosystems would not occur.

Further investigation by the Proponent supported claims that it is unlikely that significant residual effects on groundwater levels would occur as a result of the Project (i.e. 13 years) (see Section 4.4.1).

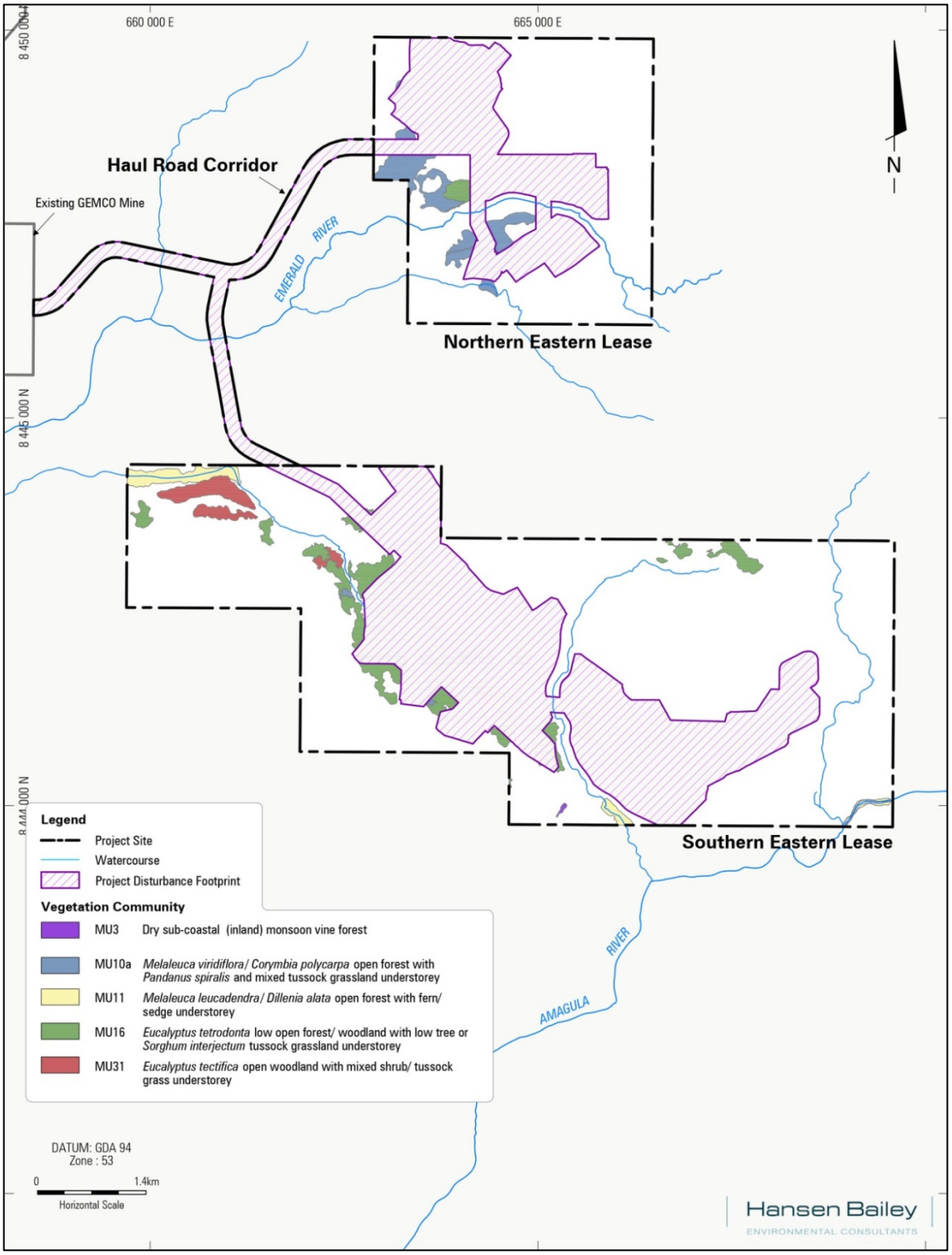

Figure 7 – Groundwater Dependent Ecosystems beyond the GEMCO Eastern Leases Project disturbance footprint (Source: GEMCO, 2016a)

The NT EPA considered that the effects of water drawdown on groundwater dependent ecosystems were poorly examined in the draft EIS and requested that further information to address concerns regarding post-mining groundwater levels and measures to ensure that groundwater dependant ecosystems would not be impacted by the Project. Section 9.4.3 of the draft EIS provided detail on the groundwater predictions, and Attachment C

of the Supplement provided supporting data on groundwater recovery potential (also see Section 4.4.1 of this Report).

The Proponent intends to monitor standing water levels across the Project site (see Section 4.4.1) and to develop and implement a program to monitor the condition of groundwater dependent ecosystems beyond the Project's disturbance footprint. The purpose of the monitoring program would be to gather data to identify any changes to the vegetation characteristics resulting from changes to groundwater levels from the Project. The monitoring would be undertaken through:

- aerial photograph interpretation (API) and vegetation community ground-truthing. The API and vegetation ground-truthing will assist in determining the extent of assessed groundwater dependent ecosystems, and will identify appropriate sites for long term monitoring. API would be undertaken every five years during the operational mine life, with the option of some supplementary ground-truthing to confirm the extent of groundwater dependent ecosystem vegetation. Over time, the extent of groundwater dependent ecosystems would be reviewed to determine any expansion/contraction of areas of groundwater dependent vegetation or key groundwater dependent plant species

- the establishment of permanent vegetation monitoring plots in groundwater dependent ecosystems. Representative monitoring plots would be established in areas predicted to experience groundwater drawdown due to mining, as well as in areas beyond the predicted limit of drawdown due to mining. Monitoring would record data for a range of variables. These variables are still to be confirmed but may include:

    - species diversity of vascular plants (native and exotic)
    - cover and abundance of indicator vascular plants (the indicator species for each vegetation community would be determined following the first round of monitoring)
    - cover of exotic vascular plants
    - stem counts and basal area calculations of woody vegetation
    - projective foliage cover of each stratum
    - general health (e.g. presence of dieback) of dominant trees and shrubs.

Recommendation 10

The Proponent shall prepare a Groundwater Dependent Ecosystem Monitoring Plan that is consistent with the details provided in the Environmental Impact Statement. The Groundwater Dependent Ecosystem Monitoring Plan should include reporting requirements and appropriate protocols in the event that adverse impacts are identified.

4.4.3 Watercourses

The Project site is located in the upper catchments of the Emerald River, Amagula River and Angurugu River (Figure 2). The Project components are located at the headwaters of these catchments and site drainage is highly ephemeral through the majority of the site.

The Proponent has designed the Project to ensure that mining would not encroach on the Emerald and Amagula Rivers and their tributaries. Buffers have been delineated around these watercourses (4.4.1) and the Proponent has committed to not mine within the buffers. This would avoid disturbance to the main channels of the watercourses and limit interference with the surface water flows.

The buffers were delineated by the predicted extent of the 1% Annual Exceedance Probability (AEP; 1 in 100 year) flood extents. The buffers were defined through 2D hydraulic modelling, based on high resolution topographic data, gathered through LIDAR survey. The hydraulic model calculated flow directions, depths and the extent of flooding, and these extents were used to define the watercourse buffers. Buffers were included as part of mine planning in order to ensure that mining activities would not impact the watercourses and to avoid the need for levees or river diversions, which are not proposed as part of the Project. The hydrology modelling results were validated against flow estimated using the Rational Method in accordance with the procedures in the *Australian Rainfall and Runoff – A Guide to Flood Estimation* (Pilgrim, 1987).

The 1% AEP was used to delineate the buffers in order to ensure that there would be a low probability of there being an interaction between the mining areas and the watercourses (Figure 8). The width of the buffers varies substantially across the Project site, given that buffer widths are based on modelled flood extents, rather than on specified distances from the bankfull maximum. The buffer width is influenced by factors such as flood flows, and the profile of the watercourse. In areas where the watercourses are deep with high banks, the buffers are quite narrow given that large flows are restricted to the main channel of the watercourses. Wider buffers are proposed in areas where the watercourses are shallower, and flood flows extend beyond the main channels. The NT EPA considers that the Proponent has taken reasonable measures to develop site appropriate watercourse buffers and supports the Proponent's commitment to not mine within watercourse buffers.

Recommendation 11

The Proponent shall not mine within any watercourse or any watercourse buffer.

4.4.4 Water management and monitoring

Groote Eylandt has a tropical climate and generally experiences distinct Wet and Dry seasons. Weather is largely dictated by the annual monsoon cycle and it is common for Groote Eylandt to experience monsoon rains and cyclones between November and March. Flooding associated with cyclones, storms and low monsoonal troughs frequently affect the region during this time.

In the event that a flood event greater than the predicted 1% AEP occurs, such an event could result in flood encroachment on the proposed quarry footprints. The potential for quarry inundation under flood conditions is reduced by the proposed mining sequence (see Section 2.3.1), which involves only a small proportion of the proposed mining footprint being active at any point in time during the mine life. Active quarries would also be maintained in a dewatered state to allow mining to progress.

It is anticipated that floodwaters would rapidly inundate the active quarry. Upon recession of floodwaters, any accumulation of floodwater in the quarries would be pumped to the designated water storages as a water supply for dust suppression. The excess water would be managed as part of the mine water management system in order to avoid adverse water quality impacts.

The proposed water management system for the Project was detailed in Section 10 of the draft EIS. The proposed management strategy is intended to contain and reuse quarry water for mine water supply (i.e. dust suppression) to prevent any adverse impacts on downstream surface water values. An operation simulation model was used to assess the Project water balance across a range of climatic conditions over the life of the Project. The water balance model was also used to assess appropriate sizing and location of dams, availability of quarry water, and frequency and volumes of any necessary controlled releases of excess quarry water. Modelling results showed that median water demands over the life of the mine would generally be greater than the amount of quarry water that will be generated by the Project in a given year. This

indicates an overall water deficit for the Project and the need for external water supply in certain years of operation. The Proponent is proposing to use available mine water from the existing mine to address any water deficit for the Project.

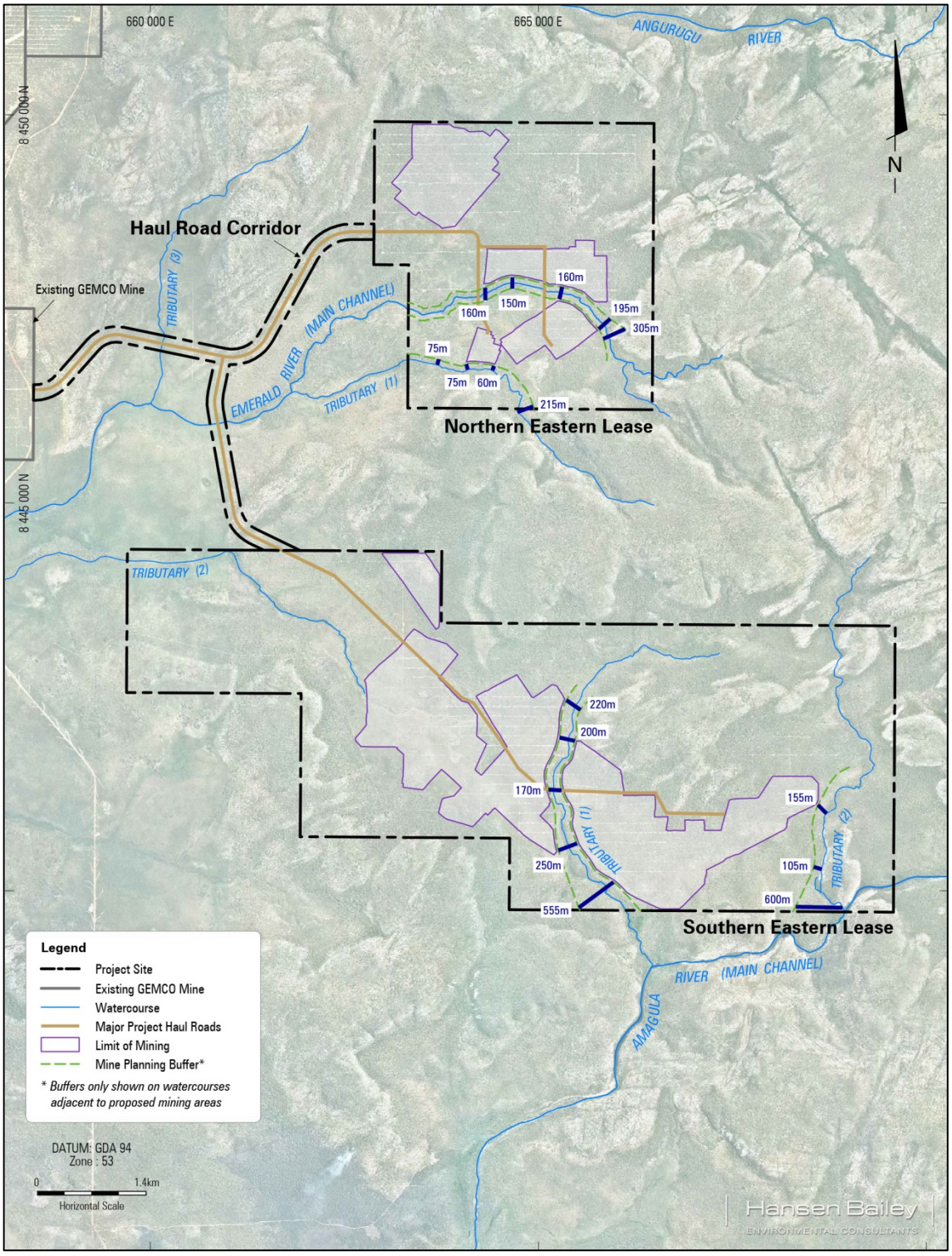

Figure 8 – Mine planning buffers within the GEMCO Eastern Leases Project (source: GEMCO, 2016b)

Modelling of the proposed water management system also indicates that there would be no requirement to discharge quarry water based on 124 years of modelled climate data, including extreme wet periods. Project water storages are designed to avoid the need for any routine discharges of quarry water and modelling further predicted that there would be sufficient total storage capacity to contain quarry water during the range of historic climate conditions over the life of the mine without the need for discharge.

Contingency emergency discharge protocols and limits have been developed by the Proponent to ensure that any release of quarry water would be within the natural range of water quality for the receiving environment and avoid any adverse changes to the surface water quality at the point of release. The nominated discharge criteria have been calculated using the methods contained in the *National Water Quality Management Strategy: the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (*ANZECC & ARMCANZ, 2000a) for pristine, high conservation value settings and are based on monitored baseline water quality.

The surface water resources in the vicinity of the Project site currently support a range of environmental values, including aquatic ecosystems and human uses. Beneficial uses have been declared for the Emerald River, Angurugu River and their receiving coastal waters west of Groote Eylandt. The declared beneficial uses for these waters are aquatic ecosystem protection, recreational water quality and aesthetics. The existing environmental values relevant to the surface water setting were identified from a review of local and downstream land uses (see Section 3.5.1), stakeholder consultation and published information.

A 12 month water quality baseline dataset (January to December 2014) was provided in the draft EIS and it is understood that the Proponent is continuing to collect data on an ongoing basis. The monitoring program included field testing and laboratory analysis for a broad range of physicochemical parameters. It was designed to establish the baseline surface water quality prior to commencement of the Project, and allow the ongoing collection of water quality over the life of the Project. Monitoring sites were positioned to provide long-term data for appropriate reference sites (i.e. upstream of proposed project activities or within equivalent undisturbed and high conservation value watercourses), within and downstream of areas potentially affected by Project activities, and confluences where water quality is affected by mixing of water courses.

The baseline water quality of the Emerald and Amagula Rivers was typically acidic and non-saline with low turbidity and low total suspended sediment concentrations. Nutrients and mineral concentrations were low; with the exceptions of elevated concentrations of some metals, including aluminium, copper, manganese and zinc.

The *National Water Quality Management Strategy: Australian Guidelines for water quality monitoring and reporting (*ANZECC & ARMCANZ, 2000b) suggest that at least a continuous period of 24 months of baseline water quality monitoring be used to develop site-specific trigger values. The Proponent has committed to continuing the surface water monitoring program to establish contingency discharge protocols and limits and to inform the Water Management Plan for the Project. The Proponent has also committed that all proposed discharge limits will be updated once 24 continuous months of data are available and that the results would be presented as part of the Mining Management Plan for the Project. The NT EPA supports these commitments and is satisfied that the Proponent has established a robust monitoring program to inform the development of a Water Management Plan. The NT EPA considers that the potential impacts to water from the Project can be managed to an acceptable level.

Recommendation 12

The Proponent shall prepare a Water Management Plan that is consistent with the details provided in the Environmental Impact Statement. The Plan should include a suitable groundwater and surface water monitoring program, reporting requirements and appropriate protocols in the event that adverse impacts are identified, and emergency discharge protocols and limits. The Water Management Plan should contain a project water balance that includes water transfers, consumption and quarry water volumes; surface water quality monitoring and reporting; storage water quality monitoring and reporting; and discharge monitoring and reporting.

4.5 Erosion and sediment control

The Project has the potential to increase the amount of erosion occurring in the Project site through vegetation clearing and construction of the quarries, haul roads, light vehicle access tracks, and infrastructure. The Wet season heavy rain can erode and wash away disturbed soils, which has the potential to result in sedimentation and increased turbidity in nearby watercourses.

The Department of Land Resource Management noted that the Proponent has committed to developing and implementing an Erosion and Sediment Control Plan (ESCP) that is consistent with the International and Australian best practice guidance materials for erosion and sediment control (IECA, 2008; DECC, 2008). However, the Department considers that the ESCP could be enhanced to deliver better environmental outcomes, including the long-term rehabilitation goals. The following recommendations should be included in a unified, whole-of-site ESCP, to be cross-referenced as required to related Environmental Management Plans, such as the Rehabilitation and Closure Plans:

- The ESCP should include details of permanent and temporary erosion and sediment control methods and treatments to be implemented during both the construction (development) and operational phases (including post-extraction), and be cross-referenced with the Rehabilitation Plan addressing final landform and drainage and related stabilisation measures, soil management and establishment of vegetation cover, including ground cover standards/targets, monitoring and contingency.

- The ESCP should address management of vegetation clearance and road formation and drainage, including stabilised crossings and discharge points. Note: soil windrows formed when blading access tracks should be removed to prevent concentration of surface flows, and the Department does not recommend the use of 'V' drains - parabolic or trapezoidal profiles are preferred.

- In addition to land disturbing activities within the mine lease, an ESCP should also be prepared, in conjunction with other parties as required, to cover associated developments outside the lease such as construction of any roading, load-out facilities, airstrips, accommodation camps, etc. that may be required for the Project.

The implementation of the ESCP should be to the satisfaction of the Department of Mines and Energy, to ensure the applicant takes sufficient measures to avoid or minimise sediment runoff during both the construction and operational phases, including closure, to prevent environmental harm or nuisance.

Recommendation 13

The Proponent shall prepare an Erosion and Sediment Control Plan that is consistent with the details provided in the Environmental Impact Statement and includes the additional recommendations provided in this Report. The Erosion and Sediment Control Plan should be cross-referenced with the Rehabilitation Plan and other relevant sub-plans of the Mining Management Plan, and approved prior to the commencement of works.

4.5.1 Haul road crossings of watercourses

It is necessary in a number of locations for the Project haul road to cross watercourses on the Project site, including the Emerald River and tributaries of the Emerald River and Amagula River (Figure 2). A number of submissions on the draft EIS requested additional information on the crossings, including further assessment of impacts and more detail on the design and operation of the crossings.

In response, the Proponent prepared the Haul Road Crossing Design Overview Report (HRCDOR) to provide additional information on the crossings, including a detailed description of the operation of the culverts, proposed monitoring of the crossings and adaptive management in the event of impacts being detected. The HRCDOR is presented in Attachment E of the Supplement.

The haul road crossings of watercourses would be constructed, operated and maintained in accordance with the conceptual design and management principles contained in the HRCDOR. Contingency remediation works that would be undertaken in the event that the culverts are not operating effectively have been provided.

The NT EPA is satisfied that the watercourse crossings from the Project can be managed in a manner that avoids unacceptable environmental impacts provided that the commitments and contingencies detailed in the HRCDOR are implemented and are aligned with the ESCP.

4.6 Geochemistry

Geochemical characterisation is necessary to determine whether leachate from overburden, tailings and/or ore is likely to contain unacceptable concentrations of major ion solutes and metals (NT EPA, 2013). An understanding of the characteristics of materials that are to be excavated and disturbed during mining and ore processing is required to inform mine planning and handling limitations for the design and operation of any overburden or tailings storage facilities and subsequent rehabilitation of these facilities.

The Proponent collected 116 samples for geochemical characterisation; 86 overburden, 26 ore and four middlings samples. A series of static and kinetic geochemical tests were completed on the samples. The geochemical test program was designed to assess the degree of risk from the presence and potential oxidation of sulphides, acid generation and the presence/leaching of soluble metals/metalloids and salts. The assessment also included characterisation of standard soil parameters including salinity, dispersion, cation exchange, exchangeable sodium percentage, and major metal concentrations. The testworks and assessment were consistent with Australian and International guidance for the identification and predication of leachates (AMIRA, 2002; INAP, 2009; NT EPA, 2013).

The Proponent also commissioned RGS Environmental Pty Ltd to review the geochemical data for the slime and sand tailings generated and stored at the existing mine. The ore lithology is relatively uniform between the existing mine and the Project and it was considered that the tailings from the existing mine would be representative of the range of tailings materials likely to be generated from the processing of ore from the Project. These data were reviewed and the main findings were:

- The slime and sand tailings are classified as non-acid forming on the basis of having negligible sulphur content and excess buffering capacity.
- The slime and sand tailings typically have relatively low total metal/metalloid concentrations in solids, which are within the health-based investigation level (land use category C, generic land use including recreational open spaces; NEPC, 2013). The exception was elevated concentrations of manganese, which is not unexpected given that the samples are derived from processing manganese ore.
- The concentration of most trace metals/metalloids in leachate from slime and sand tailings is low, typically below the laboratory limit of reporting, and less than the Australian water quality triggers for 95% level of freshwater species protection (ANZECC & ARMCANZ, 2000a).

The results from the 30 ore and middling samples indicate that the materials have similar geochemical properties, which are consistent with the tailings review. The materials are largely benign and ongoing surface runoff and seepage from materials is unlikely to significantly impact upon the quality of surface water and groundwater. In addition, these materials are only stockpiled for a relatively short period of time and have limited interaction with contact water. The geochemistry of these materials does not indicate the need for any special management measures for the handling or stockpiling and are not considered further in this Report.

The majority of overburden samples (83 of 86 samples) were found to be non-acid forming. However, three samples collected from within a small, isolated area in the north-west section of the Southern Eastern Leases were classified as Potentially Acid Forming (PAF). The samples were sourced from below 18 m depth at two separate drill holes and within a highly weathered section of laterite. The Proponent indicated that these samples are considered to be an anomaly rather than representative of the broader geochemistry of the Project site. The Proponent has committed to undertaking further geochemical sampling ahead of mining in the areas located within 500 m of the samples to characterise the materials and inform management measures. These include additional geochemical testing and selective handling and placement of the material.

The Proponent has identified that specific management measures for the handling and placement of overburden would be required for any materials positively identified as PAF. Management measures would include:

- Selectively handling and burying any PAF material within the centre of overburden emplacement areas away from final outer surfaces. PAF would be placed directly within in-pit overburden emplacement, and would not be stored within temporary overburden emplacements.

- Registering any PAF material in the Proponent's geological database.

In addition, samples will be collected at random from overburden emplacements and analysed on-site using net acid generation tests as a rapid screening tool, and surface water and seepage from overburden emplacement areas would be monitored to ensure that key water quality parameters remain within appropriate criteria. The Proponent has committed to monitoring surface runoff and seepage from the proposed overburden emplacement areas for pH, electrical conductivity, total suspended solids and dissolved metals/metalloids and major ions, including manganese.

The NT EPA encourages prevention and avoidance as a proactive strategy that removes the need for mitigation (NT EPA, 2013). Mitigation should only be considered after all reasonable avoidance measures have been taken and appropriate monitoring to detect adverse impacts has been developed and implemented.

Recommendation 14

The Proponent shall take all reasonable measures to avoid disturbing or excavating materials that are identified as potentially acid forming.

If potentially acid forming material cannot be avoided, the Proponent shall prepare a management plan for the handling and storage of materials identified as potentially acid forming and/or capable of generating seepage that does not accord with water quality parameters. The plan should include details of the monitoring program to verify that the handling and storage of materials is effective.

Dispersive clays can impact water quality as an irritant and aesthetically due to the prolonged suspension of clays in the water column. Section 6.3.3 of the draft EIS identified that dispersive clay minerals (e.g. smectite or kaolinite clay minerals) were not

identified within the Project site and are not expected to present significant materials handling issues. In the event that dispersive materials are encountered during earthworks, these materials will be managed by selectively handling and placing materials as backfill within the final quarry void, thereby minimising the potential for erosion and water quality impacts. The NT EPA is satisfied that the Proponent has taken reasonable measures to identify dispersive materials and that appropriate management measures are proposed for the handling and placing of materials, including the implementation of an ESCP (see Section 4.5).

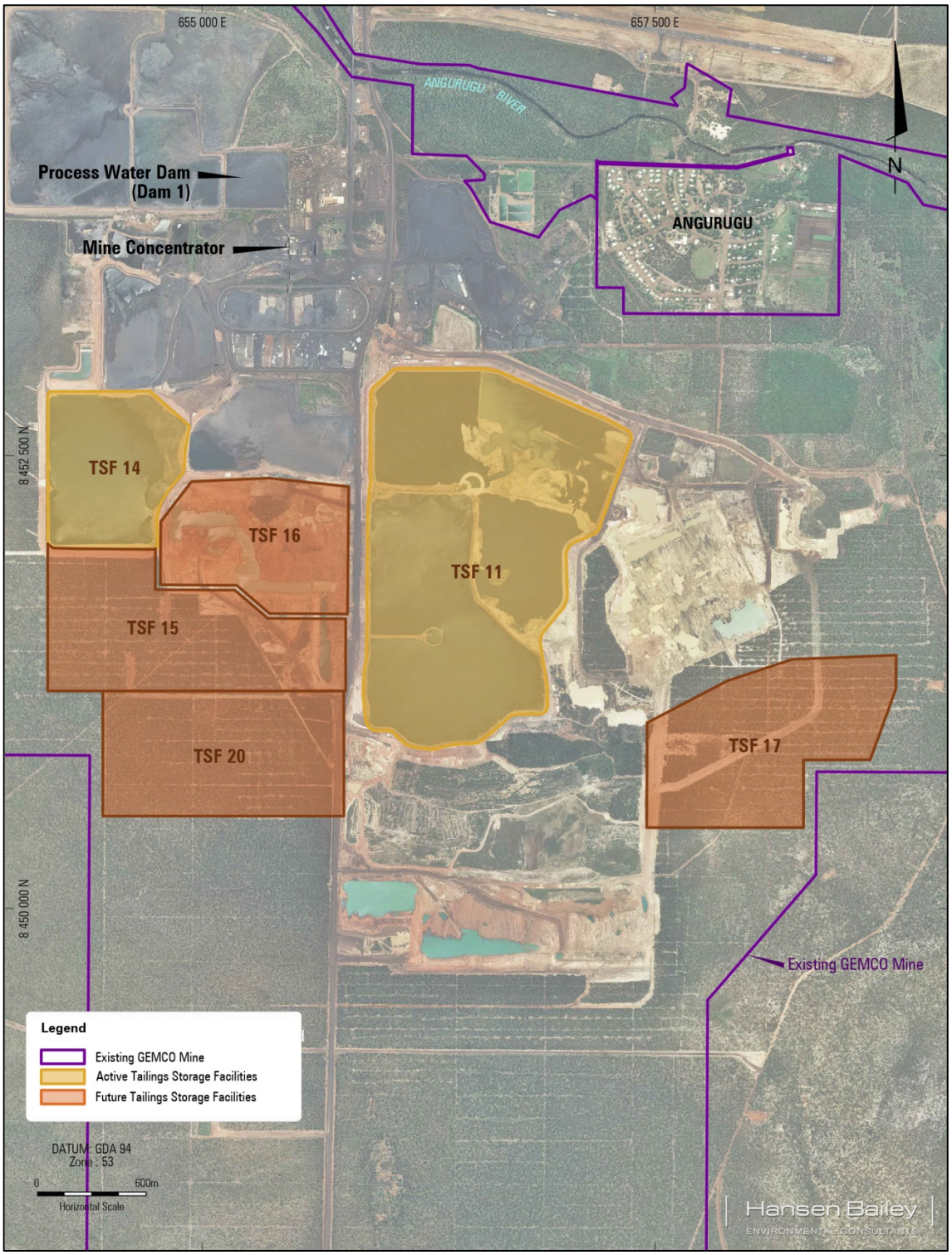

Figure 9 – Conceptual remaining life of mine Tailings Storage Facilities layout (source: GEMCO, 2016a)

4.7 Tailings

Manganese ore from the Project will be transported to the existing GEMCO mine for processing. The processing of manganese ore gives rise to waste streams, including tailings and middlings (Section 2.3.3). The total volume of tailings and middlings generated by the Project is estimated to be 17 Mt (dry) and 1.2 Mt, respectively. Tailings from the processing of Project ore would be stored in tailings storage facilities at the existing mine, in accordance with existing management procedures.

The NT EPA requested additional information on the management of tailings, including justification and confirmation that the facilities at the existing mine have sufficient capacity to accommodate tailings generated from processing Project ore. In response, the Proponent prepared a Conceptual Tailings Management Report (CTMR) to provide additional information on the management of tailings, including information on the capacity and operation of tailings dams. The CTMR is presented in Attachment D of the Supplement.

The CTMR detailed a life of mine tailings balance that demonstrates that excess tailings storage capacity would be available at each year of the life of the Project. The CTMR detailed the design, management and monitoring measures for the storage of tailings, including details of the location of the active and proposed tailings storage facilities (Figure 9). The measures would be implemented over the remaining mine life to ensure that tailings storage will not give rise to significant adverse environmental impacts.

The NT EPA is satisfied that the tailings generated from the Project can be accommodated within the footprint of the existing mine and managed in a manner that avoids unacceptable environmental impacts, provided that the commitments, safeguards and recommendations detailed in the CTMR are implemented and are subject to regular reporting and compliance auditing.

4.8 Socio-economic aspects

Section 15 of the draft EIS provided a summary of the social and economic risks associated with the Project. The Proponent detailed the established framework for the management of socio-economic impacts and benefits from the existing mine and how the framework would be amended to accommodate the Project. In particular, the draft EIS addressed the distribution of royalties, economic impacts, taxes, social consultation, short-term increases in employment, continuation of employment and service provisions and progression of mine closure planning. The Proponent conducts regular monitoring programs, including employee contractor health and wellbeing, community complaints, human rights monitoring, social baseline studies and impact assessment for key quality of life indicators and community perception surveys. The Proponent has developed, and annually reviews, a Community Development Management Plan, and has an External Affairs team responsible for external company communications with key stakeholders and communities on Groote Eylandt. The NT EPA has reviewed the frameworks and management plans provided in the draft EIS and considers that the existing procedures operating within the framework for socio-economic aspects are appropriate and that the potential social and economic impacts from the Project have been adequately addressed.

In addition to the existing framework and procedures, the social impact assessment identified additional socio-economic aspects to avoid, mitigate and/or manage that were specific to the Project. These included loss of access to land, impacts on social amenity, anxiety and uncertainty surrounding new mining areas, impacts on spirituality and sacred sites, and loss of connection to place. The Proponent proposed that the Mining Agreement under the ALRA to be negotiated between the Proponent and the ALC for the Project is the primary vehicle for addressing a number of these impacts. The NT EPA notes that mining cannot commence until a Mining Agreement under the ALRA is in

place and considers that the aforementioned social considerations should form part of the negotiations to inform the proposed Mining Agreement.

Based on the information provided in the final EIS and commitments made by the Proponent to address social impacts specific to the Project in the Mining Agreement, the NT EPA is satisfied that the Proponent has adequately identified the potential social impacts from the Project. The NT EPA notes that it is important for socio-economic aspects to be subject to regular review and that grievance, disputes and complaints, and how they were resolved, are recorded and reported to the ALC and the Department of Mines and Energy, consistent with reporting requirements under the *Mining Management Act* (see Section 4.10).

4.8.1 Site access

An unsealed track, suitable only for 4WD vehicles, comes off the Emerald River Road and provides access to Dalumba Bay. Part of this track is located on the Southern Eastern Lease and the Proponent intends to relocate this section of the track prior to the commencement of the Project. This road is owned by the EARC and the Proponent intends to consult with the EARC and the ALC in relation to the proposed relocation.

In addition, the ALC expressed concern that access to the North Eastern Lease for traditional owners would be restricted. The ALC noted that an important cultural site is located in the north eastern corner of the North Eastern Lease and access would need to be maintained for traditional owner use.

The Proponent highlighted that the ALC's submission related to Pelican's Nest, which is a rock formation located directly to the east of the Northern Eastern Lease. It should be noted that Pelican's Nest is not located within the Project site, and no mining would take place in the vicinity of this site. In 2001, the ALC gave permission for the Proponent to carry out exploration development in the Project area and, as a result, the Proponent constructed a 4WD access track from the Emerald River Road to the Northern Eastern Lease. It is understood that the traditional owners currently access Pelican's Nest via the Proponent's 4WD access track and exploration tracks. These tracks are the only known tracks in the vicinity of Pelican's Nest.

Continued public use of the exploration tracks would not be possible once the Project is operating due to safety considerations. It may therefore be necessary, during the life of the mine, for the traditional owners to access the area through less formal tracks, as would have been the case prior to the development of the exploration tracks. The Proponent has indicated that developing a formal access track to Pelican's Nest would necessitate clearing of further vegetation and may require additional watercourse crossings, which has not been considered as part of the EIA process for the Project.

The NT EPA considers that it is appropriate for the Proponent to engage and come to agreement with the EARC and the ALC in respect of site access and relocation of the tracks/roads prior to the commencement of the Project.

Recommendation 15

The Proponent shall develop a communication strategy to ensure the public and surrounding community, including the persons likely to access Pelican's Nest or to use the unsealed track that comes off the Emerald River Road and provides access to Dalumba Bay, are informed about changes to site access and relocation/restricted access of roads/tracks.

4.9 Cultural heritage

An archaeological assessment was undertaken to identify sites of Indigenous and non-indigenous historical significance within the Project site. The assessment methodology

included a desktop review, field survey and impact assessment to determine the cultural significance of the sites identified from the field survey.

A total of 28 sites of varying levels of archaeological significance were identified during the field survey. The majority of sites were rock shelters containing art, and other archaeological features such as artefacts, deposits and grindings. There were two locations (one within the Northern Eastern Lease and one within the Southern Eastern Lease) where a large number of sites were clustered within a small area.

The Proponent's assessment of cultural significance was based on the results of the field survey with consideration of the character of the sites both individually and collectively. Significance was determined for each site by assessing its cultural value (including aesthetic, historic, scientific, social and spiritual value) against defined attribute criteria, consistent with the Burra Charter (ANCICMS, 2000). The majority of sites were identified as being of high cultural value.

4.9.1 Manuport

Of the 28 sites located during the field survey, only one site of archaeological significance is located within the Project disturbance footprint. The site contains a manuport, which is a natural object that has been moved from its original context by humans. Advice from the Heritage Branch of the Department of Lands, Planning and the Environment indicated that it is possible for the manuport to be relocated to an area outside the Project footprint. However, permission to do so would be required from the Minister responsible for administering the *Heritage Act* and the management options and final location would be a matter between the Custodians and the Proponent.

The Proponent proposed relocating the manuport beyond the Project disturbance footprint as a management option and has committed to consulting with the ALC in relation to a suitable management approach for the single archaeological site (i.e. the manuport). The Proponent acknowledged that relocation of this site would be considered to be disturbing or destroying a site under the *Heritage Act*, and approval would be required under section 72 of this Act prior to disturbing the site.

Recommendation 16

The Proponent shall consult with the Anindilyakwa Land Council, the Heritage Branch of the Department of Lands, Planning and the Environment, and any other relevant stakeholder, in relation to a suitable management approach for the single archaeological site (i.e. the manuport), which is located within the Project disturbance footprint. Approvals in accordance with the *Heritage Act* shall be obtained by the Proponent prior to disturbing the site.

4.9.2 Indirect impacts

The remaining sites of archaeological significance identified during the field survey are located outside the immediate Project disturbance footprint. However, the proximity of these sites to the Project may give rise to indirect impacts from the Project activities, which could include increased visitor access and impacts from dust and blasting.

The ALC expressed concerns regarding blasting and indirect impacts on sites of archaeological significance in their submission on the draft EIS. In particular, the ALC noted that the Proponent needed to ensure that monitoring was routinely conducted to ensure blasting activities were not resulting in damage to cultural sites adjacent to mining areas; and acknowledged that a geotechnical survey would be undertaken to set vibration limits to protect these sites.

The Proponent has committed to undertaking further archaeological surveys of the two clustered sites to ensure that all individual sites within these areas have been identified. The area in which the clustered sites are located is an extensive cavernous landscape,

containing a high density of archaeological material. It is therefore possible that not all of the archaeological features in the vicinity of these clusters were recorded during the survey undertaken for the draft EIS. To ensure that mitigation measures conserve all the archaeological resources in the vicinity of the clusters, The Proponent intends to conduct further archaeological surveys of these two clusters prior to the commencement of the Project.

It is important to highlight that the cluster of sites and other sites are outside the Project disturbance footprint and are unlikely to be impacted directly by the Project. The nearest rock shelter is located approximately 400 m away from the proposed mining area and the majority of shelters are over 1 km away.

In addition to undertaking further surveys, the Proponent has committed to preparing a Cultural Heritage Management Plan to document the restrictions that would be placed on access to the archaeological sites, detailing a program of awareness training for employees, and outlining a program of annual monitoring to detect changes to archaeological sites. The Plan would include an 'unexpected find' procedure to help mitigate impacts in the event that previously unrecorded sites of cultural heritage significance are found during Project activities.

Recommendation 17

The Proponent shall prepare a Cultural Heritage Management Plan for the protection of sites of archaeological significance. The Cultural Heritage Management Plan must include employee and contractor induction and awareness of the significance of site protection; methods to register and record monitoring; and obligations under the *Heritage Act*. The Cultural Heritage Management Plan should include provisions to monitor sites for impacts from dust, blasting and unauthorised access, and provisions for corrective actions in the event that adverse impacts are detected.

The results of the additional surveys completed for two clustered sites (i.e. sites ELS06 to ELS13 and ELS15 in the Southern Eastern Lease, and ELN04 to ELN06 and ELN08 to ELN13 in the Northern Eastern Lease) should be used to inform the Cultural Heritage Management Plan before the commencement of the Project.

A Blast Management Plan would also be developed for the Project to ensure that blasting activities are appropriately managed so as not to cause harm to rock shelters and art during the life of the operations. The Plan would include the determination of ground vibration limits for the rock art sites, as well as periodic monitoring of rock shelters with art to confirm their integrity.

Recommendation 18

The Proponent shall prepare a Blast Management Plan that specifies ground vibration limits for the rock art sites, as well as periodic monitoring of rock shelters with art to confirm their integrity. The Blast Management Plan should align with the objectives and principles of the Cultural Heritage Management Plan and be prepared and revised in conjunction with the Cultural Heritage Management Plan.

4.9.3 Sacred sites

Sacred sites are places in the landscape that have a special significance under Aboriginal tradition. They are often features in the landscape such as rivers, trees or rocky outcrops. The Aboriginal Areas Protection Authority (AAPA) is responsible for issuing Authority Certificates under the *Northern Territory Sacred Sites Act*; an Authority Certificate provides conditions for any works undertaken on or near sacred sites.

The ALC is the Land Council for the Groote Eylandt Archipelago and it is understood that the ALC is currently undertaking a separate sacred sites assessment of the Project site. The Proponent acknowledged that discussions with the ALC and the AAPA are ongoing and that the assessment of sacred sites had not been finalised before the making of this Report.

There is a risk that the outcomes of the identification of sacred sites could result in reassessment of project feasibility and/or in changes to mine layout and operational components of the Project. The Proponent acknowledged that in some instances, management of sacred sites may involve amending the proposed mining footprint in order to provide appropriate buffers around sacred sites. It would be appropriate for the Proponent to consider whether Recommendation 2 of this Report would apply if changes are required. However, the NT EPA acknowledges that the changes to the mine plan that may be required as a result of sacred sites negotiations would likely involve a reduction in the mining footprint.

The Proponent is currently in discussions with the ALC in relation to the management of sacred sites, and the Proponent has committed to obtaining an Authority Certificate under the *Northern Territory Sacred Sites Act* prior to the commencement of the Project, to ensure that there is no unauthorised disturbance to sacred sites.

4.10 Environmental Management

Section 19 of the draft EIS described the proposed environmental management measures that would need to be developed and implemented to address the potential environmental impacts associated with the Project. This section also detailed the Proponent's internal environmental management standards and environmental management system, including the minimum mandatory environmental standards and performance requirements for the existing mine. Various internal targets and key performance indicators are routinely set by management for site operations and departments. Monitoring and internal reporting of results relative to these key performance indicators occurs monthly in order to review the effectiveness of management and mitigation strategies. In the event that a non-compliance (or notifiable incident occurs), the Proponent reports these incidents to the ALC and the DME consistent with Section 29 of the *Mining Management Act*.

The environmental management measures and procedures for the Project would be based on the environmental management framework currently in place for the existing mine, and would be updated to incorporate project-specific management measures as appropriate. The Proponent proposed several site-specific management plans that would also be required to be developed, which would include:

- Rehabilitation Standard
- Rehabilitation Planning Manual
- Mine Closure Plan
- Land and Biodiversity Management Plan
- Cane Toad Management Plan
- Biodiversity Offsets Strategy
- Water Management Plan
- Erosion and Sediment Control Plan
- Air Emissions Management Plan

- Blast Management Plan
- Cultural Heritage Management Plan
- Risk Management Plan

The plans are broadly conceptual in acknowledgement that as the Project enters the design and implementation phases there would be more specificity around the aspects of the Project. All management plans and procedures developed for the Project must be finalised and approved by, or developed to, the satisfaction of relevant Government agencies and stakeholders within specified timeframes. It is recommended that, as a minimum, the ALC should be a key stakeholder to which management plans are submitted for comment prior to finalisation. These approved plans and procedures will be one of the primary tools by which the Proponent will implement management and monitoring commitments made in the final EIS and the recommendations detailed in this Report.

The NT EPA considers that environmental management measures can provide the mechanism to adequately avoid, mitigate and manage the potential environmental risks of the Project. The NT EPA has recommended conditions to ensure that the Proponent implements a suitable Environmental Management Plan (EMP) over the life of the Project, which are presented in previous sections of this Report. In addition to implementing the EMP, the Proponent should establish a monitoring, auditing and reporting regime to ensure that the measures outlined in the EMP are implemented and reviewed regularly.

The NT EPA considers it essential to the performance of the Project that the requirements in management systems, plans and procedures are incorporated into the Proponent's tendering and contracting procedures and that all contractors are fully aware of, and act in compliance with, relevant management plans. The information should be provided to all personnel as part of an induction process.

4.10.1 Proponent's commitments

Section 19.5 of the draft EIS included the initial commitments provided by the Proponent. A number of the submissions on the draft EIS requested additional information in relation to management measures proposed for the Project, or requested that the Proponent consider additional management measures for particular aspects of the Project. In some instances, the responses involved the Proponent committing to additional or revised management measures.

The Commitments Register contained in the draft EIS was revised to reflect the additional or revised management measures and is contained in Attachment A of the Supplement. The commitments are derived from the mitigation measures referred to in the draft EIS, the EMP and additional commitments made based on comments from advisory bodies and commenters.

Recommendation 19

The Proponent taking the proposed action is wholly responsible for implementation of all conditions of approval and mitigation measures contained in the Environmental Management Plan and must ensure all staff and contractors comply with all requirements of conditions of approval and mitigation measures contained in the Environmental Management Plan.

The Environmental Management Plan, and sub-plans, should form part of the Mining Management Plan. In preparing each plan, the Proponent shall include any additional measures for environmental protection and monitoring contained in this Assessment Report 77.

4.10.2 Environmental Mining Report

The NT EPA strongly supports the making of an Environmental Mining Report for the Project in accordance with the *Mining Management Act*. The NT EPA recommends that the Environmental Mining Report be available to the public at intervals of 12 months for the duration of the life of the Project, commencing from the beginning of the Authorisation. It is the NT EPA's expectation that the Environmental Mining Report should demonstrate that environmental impacts from the Project are no greater than those predicted in the EIA through reporting performance of environmental aspects, including the effectiveness of the environmental safeguards and mitigation measures applied in respect of the Project, and an assessment of the accuracy of the forecasts of the environmental effects of the Project.

Recommendation 20

The Authorisation for the GEMCO Eastern Leases Project should include a condition requiring the Proponent to make and publish an Environmental Mining Report to satisfy the requirements of the *Mining Management Act* relevant to the Environmental Mining Report. The NT EPA recommends the Environmental Mining Report be made available to the public at 12 month intervals, for the duration of the life of the proposed action.

5 Conclusion

The NT EPA considers that the potential environmental impacts and risks of the Project have been adequately identified and that the evaluation of the significance of those impacts and risks has been appropriate. Avoidance, minimisation/mitigation and offset measures to reduce those impacts and risks to acceptable levels were proposed and future requirements to verify modelling and predictions are largely captured in the commitments made by the Proponent.

In particular, the NT EPA considers that the identification of MNES by the Proponent has been appropriate and that the Project would directly disturb 1525 ha of potentially critical habitat for four threatened species protected under the EPBC Act. The loss of this quantity of critical habitat for these species is likely to reduce the area of occupancy and adversely affect habitat critical to the species. The NT EPA has considered the Proponent's measures to mitigate impacts and provided recommendations to reduce the impacts of the Project, in particular to improve the management of feral cats and cane toads, and rehabilitation and closure. However, the Project cannot avoid the direct impact to MNES, even with measures to mitigate impacts. Therefore, the NT EPA considers that it is likely that the Project will result in residual significant impacts on MNES and that it is appropriate for the Proponent to offset the impacts to the species.

The NT EPA acknowledges that multiple programs, initiatives and consultation related to threatened species management on Groote Eylandt are currently under development and that the outcomes of these would be used to inform the finalisation of proposed offsets and issue-based management plans under provisions of the *Mining Management Act*, Commonwealth approvals and/or concurrent negotiations and agreements. Information gaps remaining from the EIA process require the Proponent, Government, the ALC and the regional community to rely on post-assessment analyses and consultation to address these gaps. The NT EPA expects that the outcomes of further consultation and the development of the programs and initiatives would be used to inform management strategies and plans by the Proponent prior to the commencement of the Project.

The NT EPA makes 20 recommendations as an outcome of the EIA of the Project. These recommendations are primarily for the Proponent to address when entering into the next stage of the Territory and Commonwealth assessment and approval processes (e.g. EPBC Act, Mining Agreement under the ALRA, authorisation under the *Mining*

Management Act, etc.) and for the execution of the proposed action. The NT EPA considers it essential that the commitments, safeguards and recommendations detailed in the final EIS, this Report and in the final management plans approved by the Agency responsible for administering the *Mining Management Act*, are implemented and subject to regular reporting and compliance auditing.

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Appendix A – Approved conservation advice

The Minister's delegate approved this conservation advice on 01/10/2015

Conservation Advice

Notomys aquilo

northern hopping-mouse

Conservation Status

Notomys aquilo (northern hopping-mouse) is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act). The species is eligible for listing as Vulnerable as, prior to the commencement of the EPBC Act, it was listed as Vulnerable under Schedule 1 of the *Endangered Species Protection Act 1992* (Cwlth).

The main factors causing the species to remain eligible for listing in the Vulnerable category are a range-limited population that is suspected to have declined by >30% over the last 10 years, and is projected to continue to decline by >30% over the next 10 years (Woinarski et al., 2014).

Description

The northern hopping-mouse is a medium-sized rodent, with a head and body length of 91 - 112 mm and a tail length of 158 - 173 mm (Woinarski and Flannery, 2008). It has features typical of hopping-mice in general, with very long narrow hindfeet, large ears and eyes, and a very long partly tufted tail (Woinarski, 2004). It is the only representative of its genus in northern Australia, and its morphology is highly distinctive, being sandy-brown above and paler below (Woinarski, 2004). Hopping-mice move with a distinctive gait, such that the bipedal tracks may provide the most conspicuous signs of its presence (Woinarski, 2004). Its diet mainly comprises seeds of grasses, herbs and shrubs (Woinarski, 2004).

Distribution

The distribution of the northern hopping-mouse has never been well delineated. The original specimen collected before 1867 was nominally from Cape York Peninsula, but it has not been recorded from Queensland since and the provenance of the original specimen is doubtful (Dickman, 2012). In the 1930s and 1940s, Donald Thomson recorded *N. aquilo* from Groote Eylandt and reported sightings from the Northern Territory mainland near the mouth of the Roper River (Dixon and Huxley, 1985), and in 1948 Johnson (1964) collected specimens on Groote Eylandt. Subsequently, there have been some additional confirmed and unconfirmed records from the Arnhem Land mainland (including as far west as near the Cadell River, in 1973), and many further records from Groote Eylandt, particularly on coastal dunes and sandsheets (Woinarski et al., 1999). However, there have been no confirmed records from the Australian mainland for at least 10 years (Woinarski et al., 2014).

Threats

There is a lack of specific information on threats to the northern hopping-mouse. However, some assessment of threats likely to be affecting this species may be inferred from evidence of a more general decline in native mammal assemblages across parts of northern Australia (Woinarski et al., 2001; Watson and Woinarski, 2003; Pardon et al., 2003; McKenzie and Burbidge, 2002). The northern hopping-mouse is likely subject to at least some of the pervasive threatening processes of vegetation change through altered fire regimes and (on the mainland) introduced herbivores (buffalo, cattle, donkeys, horses,

pigs), and predation by feral cats. It is also subject to some impacts from strip-mining on north-eastern Arnhem Land and Groote Eylandt (Woinarski, 2004).

Woinarski et al., (2014) identifies current and potential threats to the species as follows:

Threat factor	Consequence rating	Extent over which threat may operate	Evidence base
Inappropriate fire regimes	Severe	Entire	Limited correlative evidence (Woinarski et al., 1999)
Grazing and trampling by introduced herbivores	Minor	Minor (mainland only)	Not demonstrated, but plausible
Predation by feral cats	Severe	Entire	Not demonstrated, but highly plausible
Habitat loss and fragmentation	Severe	Minor	Parts of its range are subject to extensive strip mining for manganese and bauxite

Conservation Actions

The conservation actions below are based on information provided in Woinarski (2004) and Woinarski et al., (2014).

Conservation and Management Actions

Theme	Specific actions	Priority
Active mitigation of threats	Implement fire management that reduces the frequency, intensity and extent of fires	High
	Implement cost-effective control measures for feral cats that minimise impacts of predation	High
	Develop and implement post-mining rehabilitation procedures that provide for re-colonisation by this species	Medium-High
	On the mainland, reduce the populations of introduced herbivores	Medium
Captive breeding	Develop an insurance captive population on Groote Eylandt	Medium
Quarantining isolated populations	Maintain or enhance constraints on cat imports on Groote Eylandt; prevent imports of introduced herbivores	Medium
Translocation	Examine options for reintroductions to mainland areas that no longer support extant populations	Medium
	Use captive-bred animals to experimentally assess reintroduction options at former mine sites	Medium
Community engagement	Involve Indigenous ranger groups in survey, monitoring and management	High

Survey and Monitoring priorities

Theme	Specific actions	Priority
Survey to better define distribution	Undertake targeted surveys in Arnhem Land	High
	Undertake targeted surveys on Cape York Peninsula	Medium
	Undertake more detailed mapping of the species distribution on Groote Eylandt	Medium
Establish or enhance monitoring program	Establish an integrated monitoring program to describe long-term trends in abundance, and responses to management actions	Medium-High
	Assess the effectiveness of management actions, and adapt/refine them accordingly	Medium-High

Information and research priorities

Theme	Specific actions	Priority
Improve sampling techniques	Evaluate options for increasing the efficiency of sampling protocols at sites of known occurrence, in order to improve the reliability of detection	Medium-High
Assess relative impacts of threats	Undertake a detailed autecological study to more specifically identify impacts of threatening processes	Medium-High
	Determine the response of the species to a range of fire regimes	Medium-High
	Determine the major causes of mortality (in particular impacts of cats)	Medium-High
Assess effectiveness of threat mitigation options	Assess the effectiveness of mine rehabilitation measures for providing suitable habitat	Medium-High
	Assess the effectiveness of a range of possible cat control mechanisms	Medium
Resolve taxonomic uncertainties	n/a	
Assess habitat requirements	Identify critical features that define suitable habitat	Medium
Assess diet, life history	Assess critical components of diet, and associated management requirements	Medium
	Identify factors influencing reproductive success	Medium
Undertake research to develop new or enhance existing management mechanisms	Develop methods for broad-scale, targeted feral cat control	Medium

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A statement for the purposes of approved conservation advice
(s266B of the *Environment Protection and Biodiversity Conservation Act 1999*)

Approved Conservation Advice for *Conilurus penicillatus* (Brush-tailed Rabbit-rat)

This Conservation Advice has been developed based on the best available information at the time this Conservation Advice was approved.

Description

Conilurus penicillatus, Family Muridae, also known as the Brush-tailed Rabbit-rat and the Brush-tailed Tree-rat, is a robust rodent (average weight approximately 150 g), most notable for its long (180 mm) and tufted (brush-like) tail. The end half to one third of the tail can be either black or white, with the ratio of these colour morphs varying among populations. Its general body colour is chocolate brown above and cream white below, and it has relatively large eyes and ears.

Conservation Status

The Brush-tailed Rabbit-rat is listed as **vulnerable**. This species is eligible for listing as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) under Criterion 1 as it is suspected to have undergone a substantial decline in numbers. The species is also listed as vulnerable under the Northern Territory *Territory Parks and Wildlife Conservation Act 2000*. It is not listed as threatened in either Queensland or Western Australia.

Distribution and Habitat

The Brush-tailed Rabbit-rat is found in monsoonal northern Australia, adjacent islands and southern New Guinea (Kemper and Firth, 2008). In Australia, the species has been recorded from Queensland, the Northern Territory and Western Australia, where its distribution is restricted mostly to islands, coastal areas and areas of relatively high rainfall.

In Queensland, the only record of the species was made in 1963 from Bentinck Island in the Gulf of Carpentaria. In the Northern Territory the Brush-tailed Rabbit-rat has been recorded in near-coastal areas and islands from between Centre Island (in the Sir Edward Pellew group) in the east to near the mouth of the Victoria River in the west (DNREA, 2007). The species has been recorded on Groote Eylandt, in south east and eastern Arnhem Land, on Inglis Island (off Arnhem Land), on the Coburg Peninsula, on the Tiwi Islands and in Kakadu National Park. However, there are no recent records from much of this historically recorded range (DNREA, 2007).

In Western Australia the Brush-tailed Rabbit-rat is restricted to the northern Kimberley where its distribution is both patchy and large, with several known populations (How, 2007, pers. comm.). The species is known to be present from near King Sound to the Mitchell Plateau (Kemper and Schmitt, 1992), a distributional range of about 400 km. Most records are from the Mitchell Plateau and nearby Prince Regent Nature Reserve (Bradley et al., 1987; Abbott and Burbidge 1995; Start et al., 2007).

The Brush-tailed Rabbit-rat appears to have quite specific habitat requirements and is largely restricted to mixed eucalypt open forest and woodland, or on dunes with *Casuarina*, seeming to prefer habitats that are not burnt annually, that have an understorey of predominantly perennial grasses and a sparse-to-moderate middle story (Kemper and Firth, 2008).

This species occurs within the Northern Territory, Rangelands (WA) and Southern Gulf (Qld) Natural Resource Management Regions.

The distribution of this species is not known to overlap with any EPBC Act-listed threatened ecological communities, but it may co-occur in parts of its range with other EPBC Act-listed threatened fauna species including the Partridge Pigeon (Eastern and Western subspecies), Masked Owl (Tiwi Islands and Northern subspecies), Golden-backed Tree-rat, Butler's Dunnart, Yellow-snouted Gecko, Northern Quoll, Golden Bandicoot (mainland subspecies) and Gouldian Finch. It may also co-occur with the EPBC Act-listed threatened herb species *Typhonium mirabile* and *T. jonesii*.

Threats

No single factor has been demonstrated to have caused the apparent decline in range of the Brush-tailed Rabbit-rat (DNREA, 2007). Threats to the species are likely to be habitat alteration resulting from inappropriate fire regimes and the introduction of herbivores, habitat destruction resulting from forestry and mining operations, and predation by feral cats. These threats vary across the species' range, although there are no specific data to demonstrate their impact (Johnson, 2008, pers. comm.) and researchers note the need to quantify their relative impact (Fordham and Brook, 2007, pers. comm.).

Research Priorities

Research priorities that would inform future regional and local priority actions include:

- Collate, evaluate and make available, unpublished historical data
- Develop and maintain a monitoring program across the species' national range. This program may incorporate:
    - Surveys using baselines that have been established for faunal surveys on Cobourg Peninsula, the Tiwi Islands and in Kakadu National Park (DNREA, 2007)
    - Surveys at appropriate spatial and temporal scales across the species' known and potential distribution in the Kimberley region
    - In addition to the current WA DEC Kimberley Islands survey, surveys to determine the species' current distribution on islands throughout its range, in particular islands where the species has previously been recorded but where no recent records have been made (i.e. Bentinck Island)
    - Surveys of suitable habitat and potential habitat to locate any additional populations, for example on the mainland adjacent to the Sir Edward Pellew Group and Bentinck Island.
- More precisely assess population size, distribution, ecological requirements and the relative impacts of threatening processes such as, inappropriate fire regimes, habitat modification by introduced herbivores and predation by feral cats on the species.

Regional Priority Actions

The following regional priority recovery and threat abatement actions can be done to support the recovery of the Brush-tailed Rabbit-rat.

Habitat Loss, Disturbance and Modification

- Monitor known populations to identify key threats and the effectiveness of management actions, where appropriate.
- Investigate formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure.

Invasive Weeds

- Develop and implement a management plan for the control of Gamba Grass (*Andropogon gayanus*) and Mission Grass (*Pennisetum polystachyon*) in regions where the species occurs.

Predation by Cats

- Ensure the implementation of the Threat Abatement Plan for predation by feral cats (1999).
- Work with Aboriginal landowners to maintain effective quarantine actions for island populations, most particularly relating to preventing the introduction and establishment of cats on the islands where the species occurs.

Fire

- Develop and implement a suitable fire management strategy across the range of the Brush-tailed Rabbit-rat. It is likely that a regime of low incidence of fire is suitable for the species, which is probably obtainable by undertaking early season, small-scale, patchy burns.
- Provide maps of known occurrences to local and state rural fire services and seek inclusion of mitigative measures in bush fire risk management plan(s), risk register and/or operation maps.

Conservation Information

- Continue to raise awareness of the Brush-tailed Rabbit-rat within the relevant land management authorities and within the local community. Target audiences include:
    - The Anindilyawaka Land Council, managers of the Indigenous Protected Area that includes Groote Eylandt
    - Relevant land managers on the Tiwi Islands
    - Relevant land managers in the Kimberley region.

Enable Establishment of Additional Populations

- Evaluate the possibility of establishing translocated populations, either on currently uninhabited islands and/or in appropriately managed conservation reserves.

Local Priority Actions

The following local priority recovery and threat abatement actions can be done to support the recovery of the Brush-tailed Rabbit-rat.

Habitat Loss, Disturbance and Modification

- Ensure that the species is considered in any proposed expansion to manganese mining operations on Groote Eylandt.
- Ensure that the species is considered in any proposals for the mining of bauxite on the Mitchell Plateau.
- Ensure that habitat clearance for plantation forestry on the Tiwi Islands does not compromise population viability.

This list does not necessarily encompass all actions that may be of benefit to the Brush-tailed Rabbit-rat, but highlights those that are considered to be of highest priority at the time of preparing the conservation advice.

Existing Plans/Management Prescriptions that are Relevant to the Species

Actions relevant to feral cat management are included in the Threat Abatement Plan for predation by feral cats (1999). Many of the actions in this advice are listed as priority actions for the species in the Northern Territory (DNREA, 2007).

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The Minister's delegate approved this conservation advice on 01/10/2015

Conservation Advice

Tyto novaehollandiae kimberli

masked owl (northern)

Conservation Status

*Tyto novaehollandiae kimberli (*masked owl (northern)) is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act). The species is eligible for listing as Vulnerable as, prior to the commencement of the EPBC Act, it was listed as Vulnerable under Schedule 1 of the *Endangered Species Protection Act 1992* (Cwlth).

The Action Plan for Australian Birds 2010 (Garnett et al., 2011) list the masked owl (northern) as Vulnerable. The main factors that the Action Plan for Australian Birds 2010 identifies as making the subspecies as eligible for listing in the Vulnerable category are a limited number of mature individuals (approximately 3000), a suspected continuing decline in population size and a geographic distribution that may be precarious for the survival of the species (Garnett et al., 2011).

Description

The masked owl (northern) is a large owl with a prominent heart-shaped facial disc and plumage that is highly patterned by speckling and is generally darker on the back and paler below (Woinarski, 2004). The northern subspecies and the Tiwi Islands subspecies (*T. n. melvillensis)* of masked owl are smaller than other Australian subspecies (Woinarski, 2004), including the nominate subspecies (*T. n. novaehollandiae*) which can reach lengths of up to 41 cm and 50 cm with wings spans of up to 110 cm and 128 cm (male and female sizes respectively) (Higgins & Peter, 2002). Compared to other species of *Tyto* owls in northern Australia, such as the barn owl (*T. alba)*, masked owls have conspicuously well feathered legs and large, strong claws and feet (Higgins & Peter, 2002).

Distribution

The distribution of the masked owl (northern) is very poorly known (Woinarski 2004). Three subpopulations have been suggested: Kimberley, Northern Territory and Cape York (Garnett et al., 2011).

The few records that are available from the Kimberley region of Western Australia show the masked owl (northern) to occur from Yampi Sound north-east to Cambridge Gulf, including Windjana Gorge and Augustus Island (Barrett et al., 2003; Johnstone & Storr, 1998; Mees, 1964). There are also historical records from near Broome (Crossman, 1910).

In the Top End of the Northern Territory, the species occurs from the Cobourg Peninsula down to Katherine and Jasper Gorge (Victoria River area), and to the east at McArthur River. There are also records from Dead Dog Waterhole (Barkly Tableland) and the Tanami Desert (Barrett et al., 2003; Blakers et al., 1984; Goodfellow, 2001; Higgins, 1999; Mees, 1964).

In Queensland, there are historical records from the Normanton region, and from Pascoe, Archer, Chester and Watson Rivers on Cape York Peninsula (Higgins, 1999; Mees, 1964; Storr, 1984). The owl occurs along the southern rim of the Gulf of Carpentaria, Cape York Peninsula

and south to Atherton Tablelands and the Einasleigh-Burdekin divide (Garnett et al., 2011). There is some confusion about where the Queensland southern limit of the subspecies is, with authorities suggesting Mackay (Mees, 1964) or Coomooboolaroo Station (west of Rockhampton) (Woinarski, 2004).

Threats

The reason for the decline and low density of masked owls in northern Australia is unclear. The subspecies has undoubtedly been affected by broad-scale changes to the environment of northern Australia caused by altered fire regimes, grazing by livestock and feral animals, and the invasion of native woodlands by exotic plants, particularly introduced pasture grasses (Woinarski, 2004). However, the most likely cause of declines is a shortage of food, as small and medium-sized native mammals are becoming increasingly uncommon across much of northern Australia (Pardon et al., 2003; Sattler & Creighton, 2002; Winter & Allison, 1980; Woinarski et al., 2001; Woinarski et al., 2010).

The current regime of more intense, frequent and extensive fires may also reduce the availability of the large trees and hollows (Williams et al., 1999) required for nesting. One study in tall eucalypt forests and woodlands near Darwin (Pittman, 2003) found that the populations of common brushtail possums (*Trichosurus vulpecula)* and black-footed tree-rats (*Mesembriomys gouldii)* were nearing a carrying capacity imposed by hollow availability, and possums were found to monopolise hollows in woodland fragments at the expense of other species.

Other potential threats include competition with other large owls (Schodde & Mason, 1980) and the increasing spread and pace of development in the Darwin and Daly River areas of the Northern Territory, which could be reducing the extent of suitable habitat for the subspecies (Woinarski, 2004).

Conservation Actions

Conservation and management actions

- Implement an appropriate fire management regime for preventing the loss of large, hollow-bearing trees, and which promotes the density of prey (native mammals).
- Reduce the impacts from feral animals and weeds at a landscape scale.

Survey and monitoring priorities

- Assess the subspecies' population size and distribution.
- Design and implement a monitoring program to assess population trends at key sites.

Information and research priorities

- Identify the habitat requirements of the subspecies.
- Assess population trends in response to fire management and weed and feral species control programs.
- Identify the causes for the decline in the masked owl's main prey species.
- Examine impacts of fragmentation on the subspecies and use the resulting knowledge to develop guidelines for habitat protection and corridor configuration in landscapes subject to increasingly intensive development.

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