Gove Operations

Mining Management Plan 2019

28 June 2019

Version 2

RTA Gove Pty Limited (RTA Gove) (formerly Alcan Gove Pty Limited) operates a bauxite mine, and is closing an alumina refinery with a residue disposal area, on the Gove Peninsula ('Gove Operations'). Under the provisions of the *Mining Management Act*, RTA Gove may only carry out mining activities at a mining site if the Minister has granted an Authorisation to do so.

The application for an Authorisation must be accompanied with a Mining Management Plan (MMP) for the mining site. The primary purpose of the MMP is to formalise the actions to be taken and strategies to be implemented, that will manage impacts to the environment to acceptable and sustainable limits over both the short and long-term.

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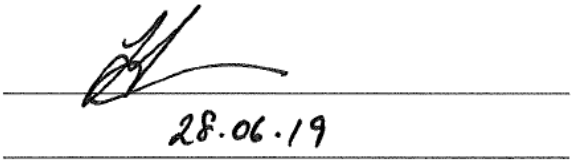
DOCUMENT CONTROL

Declaration

I declare that to the best of my knowledge the information contained in this mining management plan is true and correct and commit to undertake the works detailed in this plan in accordance with all the relevant Local, Northern Territory and Commonwealth Government legislation.

Signed



Signature

Date

Troy Mcnamara

General manager, Gove Operations

ABBREVIATIONS

AAPA	Aboriginal Areas Protection Authority
ALALT	Arnhem Land Aboriginal Land Trust
ALRA	*Aboriginal Land Rights (Northern Territory) Act* 1976 (Commonwealth)
AGD84	Australian Geodetic Datum 1984
AHD	Australian Height Datum
BSPL	Bayer Spent Process Liquor
CHMS	Cultural Heritage Management System
DEAL	Developing East Arnhem Limited (ACN 602 771 979)
DNER	Department of Environment and Natural Resources
DQIP	Discharge Quality Improvement Project
DPIR	Department of Primary, Industry and Resources
EPA	NT Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPMS	Environmental Protection Management Strategy
FS	Feasibility Study
FTE	Full Time Employees
GDA	Geocentric Datum of Australia
GAL	Gove Aluminium Ltd (ACN 000 640 353)
GPM	Gove Procedures Management
GMC	Gulkula Mining Company Pty Ltd (ACN 153 861 806)
HDPE	High Density Polyethylene
HFO	Heavy Fuel Oil
HR	Human Resources
HSE	Health, Safety and Environment
HFT	Harbour Tank Farm
IUCN	International Union for the Conservation of Nature
LFTF	Light Fuel Tank Farm
MBHD	Melville Bay Height Datum
MGA94	Map Grid of Australia 1994
MLN	Minerals Lease
MM Act	*Mining Management Act* (NT)
MMP	Mining Management Plan
NCL	Nhulunbuy Corporation Limited (ACN 009 596 598)
NLC	Northern Land Council
NHD	Nabalco Height Datum
NPI	National Pollutant Inventory
NT	Northern Territory
OoM	Order of Magnitude
PFS	Prefeasibility Study
ROM	Run of Mine
RDA	Residue Disposal Area
RL	Reduced Level (based on AHD)
RTBS	Rio Tinto Business Solution (online incidents/action management and audit system)
RTA	Rio Tinto Alcan
SAAL	Swiss Aluminium Australia Limited (ACN 008 589 099)
SML	Special Mineral Lease
SPL	Special Purposes Lease
SNL	Supernatant Liquor
RTBS	Rio Tinto Business Solution
TPWC Act	*Territory Parks and Wildlife Conservation Act 2006* (NT)
WDL	Waste Discharge Licence
WMP	Water Monitoring Plan (endorsed by EPA)
WWNP	Wastewater Neutralisation Plant

CONTEXT

1. Introduction

Gove Operations is located on the Gove Peninsula in North East Arnhem land in the Northern Territory (NT), 650 kilometres (km) east of Darwin. Gove Operations commenced bauxite mining in the 1970s to supply a local alumina refinery and the export market. The operation includes four functional areas, mine production, refinery, Residue Disposal Area (RDA) and marine, based on the land use, operational status and geographic location.

The bauxite mine is located approximately 20km to the east of Gove Harbour, the ore is transported via a conveyor to stockpiles at the refinery and port at Gove Harbour. These operations are undertaken 24 hours a day, seven days a week, the current rate is approximately 13 Million dry tonnes (Mdt) of bauxite per year. At this mining rate, there are sufficient reserves available within the existing leases to continue mining for approximately ten years (to 2029).

The alumina refinery used the Bayer process, utilising sodium hydroxide (NaOH – caustic soda) to extract alumina from the bauxite ore. The process resulted in a number of waste products, including:

- red mud and red sand wastes, which comprised the insoluble fractions of bauxite ore and consist mainly of silica, oxides of iron, aluminium and titanium, as well as a range of metals that become concentrated through the process; and
- supernatant liquor (SNL), a solution that contained mostly sodium (Na^+), aluminate ($Al(OH)_4^-$) and carbonate (CO_3^{2-}).

Both waste streams are highly caustic, with a pH generally between 10 and 13 and are stored in the RDA, situated approximately 2km to the east of the alumina refinery.

In November 2017, RTA Gove announced that it would not restart the alumina refinery which had been under care and maintenance since curtailment in 2014.

The conceptual closure plans used to inform the closure aspects of the previous 2014 Mining Management Plan (MMP) have been updated by a series of specific closure studies for each functional area. The core objective of the closure studies is to minimise social and environmental risks, and optimise the social, economic and cultural opportunities for the community from the overall closure of Gove Operations. The closure studies robustly evaluate all closure options, identify a feasible final land use, and define the closure actions for each functional area. They ensure the site is in operational readiness for closure execution stage, being the commencement of decontamination, demolition, and remaining rehabilitation activities. The 2019 MMP is based on recently completed closure studies.

The MMP covers activities for Gove Operations, for a period of 12 years until **17 July 2031**, to continue bauxite mining and close the refinery and RDA.

This MMP is an outcome-focused plan that, in addition to detailing the approved mining activities to be undertaken, describes the closure pathway for Gove Operations and sets out the closure actions to construct a final landscape that is aesthetically compatible with the surrounding natural landscape, or supports agreed alternative land uses.

The outcomes for closure are to return land disturbed by bauxite mining and alumina refining to an agreed final land use and landform that is safe, stable and non-polluting. However, the legacy of Gove Operations, operating for almost 50 years, means that practicably some land cannot be fully restored to a natural landscape. These areas are to be remediated and rehabilitated to an alternative land use that meet the closure objectives of safe, stable and non-polluting. The areas identified for alternative land use are typically highly modified and/or contaminated areas. Areas where the land is restored to an industrial land use, and require no

post relinquishment management obligations, may include retained infrastructure assets or native vegetation (excluding food crops). It is expected that full relinquishment of these areas will be achieved. Areas where the final landform includes residual waste, encapsulated by engineered structures, will require post relinquishment management, these Post-relinquishment Management Areas are expected to meet the requirements of an industrial land use, but will require ongoing management by the Operator.

This MMP defines the closure criteria and indicators that will be used to demonstrate that the final landform meets the closure objectives of safe, stable, non-polluting and agreed final land use (including Post-relinquishment Management Areas). The closure criteria and indicators will clearly define the requirements for post closure monitoring data collection. As well as the supporting evidence for the Application for Certificate of Closure and granting of a closure certificate under the *Mining Management Act* (MM Act).

1.1 Intent of Mining Management Plan

The intent of this MMP is to, in accordance with the MM Act:

- Detail the mining interest held for, or associated with, the mining site including ownership;
- Describe the mining activities being undertaken for which RTA Gove requires the Authorisation;
- Detail the organisational structure of the Operator carrying out the mining activities;
- Detail the Operators management system;
- Provide plans of proposed and current mine workings and infrastructure;
- Establish agreed closure objectives, criteria and indicators to construct a final landform that supports the agreed final land use, in accordance with acceptable environmental and social standards;
- Describe the closure pathway, including studies, actions, performance, and timeframes, noting all dates within the MMP are indicative as climatic or economic factors may delay or accelerate the proposed timeframes;
- Confirm closure criteria that satisfy the Minister for the purposes of Operator submitting a Certificate of Closure for relinquishment of the mining authorisation; and
- Identify the Post-relinquishment Management Areas, with ongoing RTA Gove management obligations.

1.2 Functional Areas and MMP structure

This MMP has grouped Gove Operations into four sections to reflect functional status, geographic location, and closure domains:

- **Mine Production** – this section describes the active operations to be authorised under this MMP to support mining the bauxite ore reserves until approximately 2029 and auxiliary services for the local community;
- **Refinery** – this section describes the closure operations for the decontamination and demolition of the alumina refinery to be authorised under this MMP. Noting this is the first component of the closure operations for the refinery location, the second component involves the demolition of infrastructure and assets located at the refinery no longer required once mine production concludes in 2029;

- **Residue Disposal Area (RDA)** – this section describes the closure operations for the decontamination and demolition of the RDA to be authorised under this MMP. Noting this involves the progressive closure of the RDA facility through the treatment and removal of SNL from the liquor ponds and the capping of red mud ponds for effective containment waste over the long term as a legacy site.
- **Marine** – this section describes the closure operations for the off lease area within the inner Gove Harbour. Over the life of the operations, discharge of wastewater, under licence, has resulted in a build-up of sediment affecting the visual amenity of the marine environment.

Each of the functional area sections describes the authorised activities as well as the closure plans.

An overarching context section proceeds these sections and includes the Operator details, overview of management systems, and environmental risk profile for Gove Operations. This section also describes the overall closure strategy and the closure indicators. These indicators, in conjunction with the closure criteria for each functional area, will confirm that the land disturbed by mining and refining activities have attained an acceptable environmental standard and can be returned to the Traditional Owners. The relinquishment process involves the submission of a Certificate of Closure application, as set out in the MM Act.

Figure 1, **1a**, **1b**, and **1c** provides an overview of these functional areas, as well as detailed maps of each functional area, and **Table 1** indicates land use, location and lease detail and their operational status. The highlighted rows indicate those land uses that are described within the mine production section but there closure is addressed within the refinery section based on their geographical location.

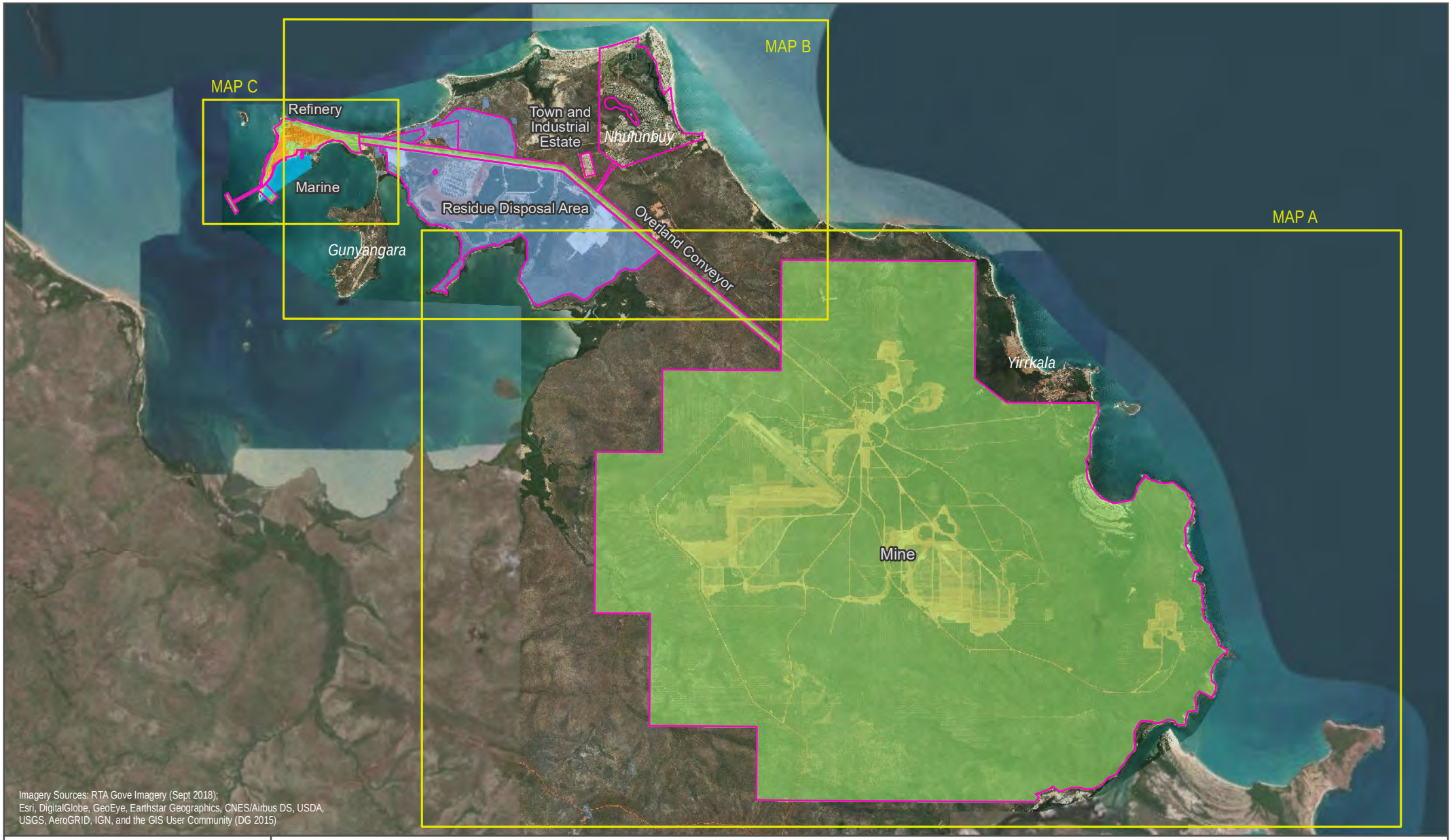
Table 1. Gove Operations Functional Areas

Functional Area	Land use	Location	Status
Mine Production	Mining	Mine (SML11 Part 1)	Active
	Conveyor	Mine (SML11 Part 2)	Active
	Port*	Refinery (SPL213 (bulk cargo wharf) and SPL217 (general cargo wharf)	Active
	Processing (stockpiles/ handling)*	Refinery (SML11 Part 3)	Active
	Services (power generation)*	Refinery (SML11 Part 3)	Active
	Service (airport / potable water supply)	Mine (SML11 Part 1)	Active
Refinery	Alumina refinery	Refinery (SML11 Part 3)	Closure readiness
RDA	Tailings Storage Facility	RDA (RDA lease)	Closure readiness
Marine	Marine Mixing Zone	Inner Gove Harbour (off lease)	Closure readiness
*geographically located at the refinery within the refinery lease			

1.3 MMP Operating Period

This MMP operates until **17 July 2031** for Gove Operations. A key compliance requirement of the MM Act, administered by the Department of Primary Industry and Resources (DPIR).

At least 30 day prior to the expiry of the MMP, the Operator shall submit a new MMP or request by letter an extension of this MMP for a period of 5 years.



Date: 11/03/2020

Map Scale: 1:150,000 (A4)

Projection: GDA 1994 MGA Zone 53

0 1 2 3 4 5

Kilometres

N

LEGEND

Functional Areas

- Mine Production (Status - Operational)
- Refinery - Alumina Refinery (Status - Closure)
- RDA
- Marine

Lease Boundary

GOVE OPERATIONS FUNCTIONAL AREAS 2019

RioTinto

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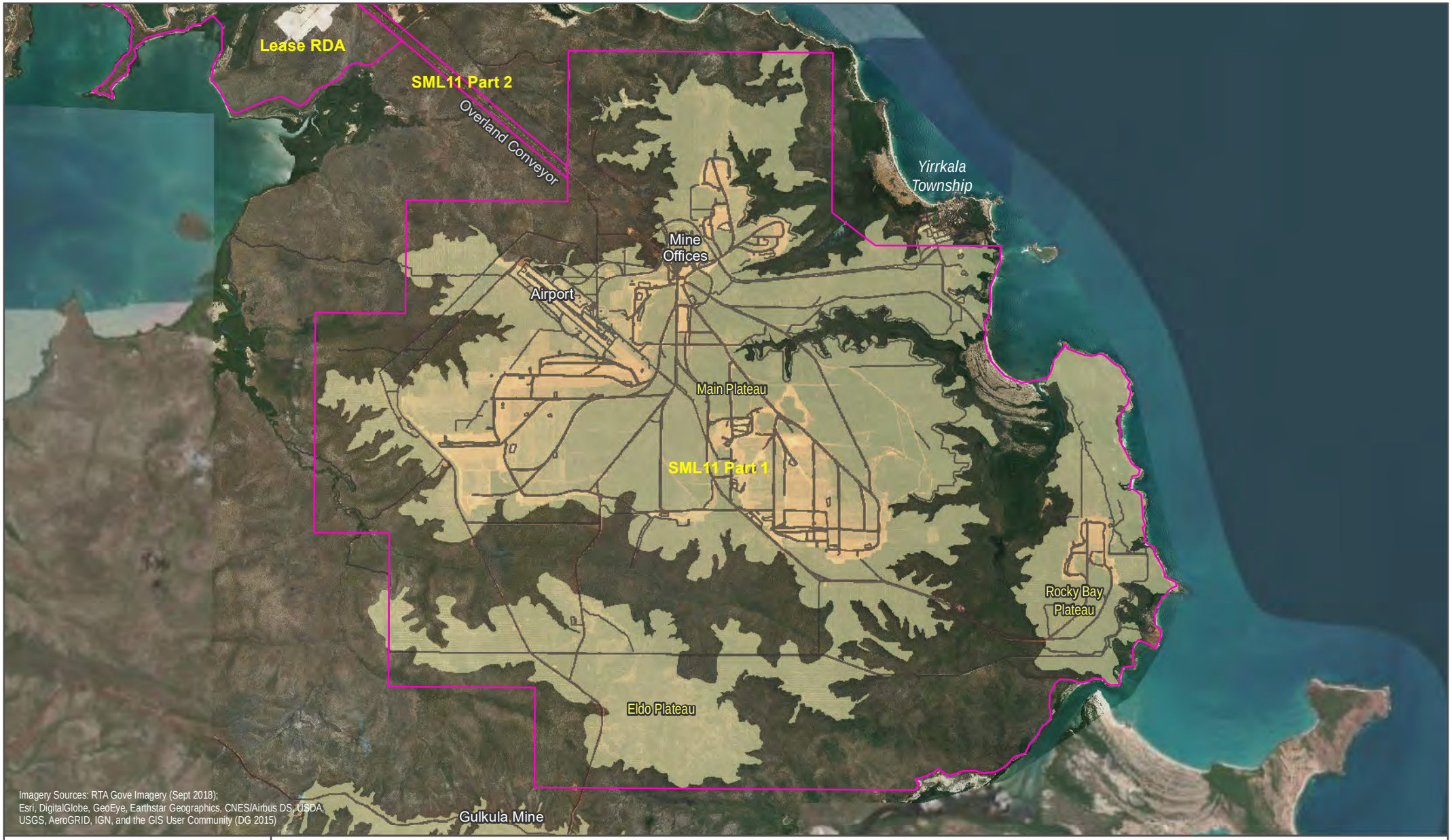

Date: 11/03/2020

Map Scale: 1:110,000 (A4)

Projection: GDA 1994 MGA Zone 53

0 1 2 3 4

Kilometres

N

LEGEND

- Roads
- Plateau
- Lease Boundary

GOVE OPERATIONS - MAP A
MINE PRODUCTION FUNCTIONAL AREA

RioTinto

Date: 11/03/2020

Map Scale: 1:55,000 (A4)

Projection: GDA 1994 MGA Zone 53

0 0.5 1 1.5

Kilometres

N

LEGEND

- Road
- Lease Boundary

Functional Areas

- Mine Production (Status - Operational)
- Refinery - Alumina Refinery (Status - Closure)
- RDA
- Marine

GOVE OPERATIONS - MAP B
RDA AND TOWN FUNCTIONAL AREAS

RioTinto

Date: 11/03/2020

Map Scale: 1:20,000 (A4)

Projection: GDA 1994 MGA Zone 53

0 0.1 0.2 0.3 0.4 0.5

Kilometres

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LEGEND

- Road
- Lease Boundary

Functional Areas

- Mine Production (Status - Operational)
- Refinery - Alumina Refinery (Status - Closure)
- RDA
- Marine

GOVE OPERATIONS - MAP C
REFINERY FUNCTIONAL AREAS

RioTinto

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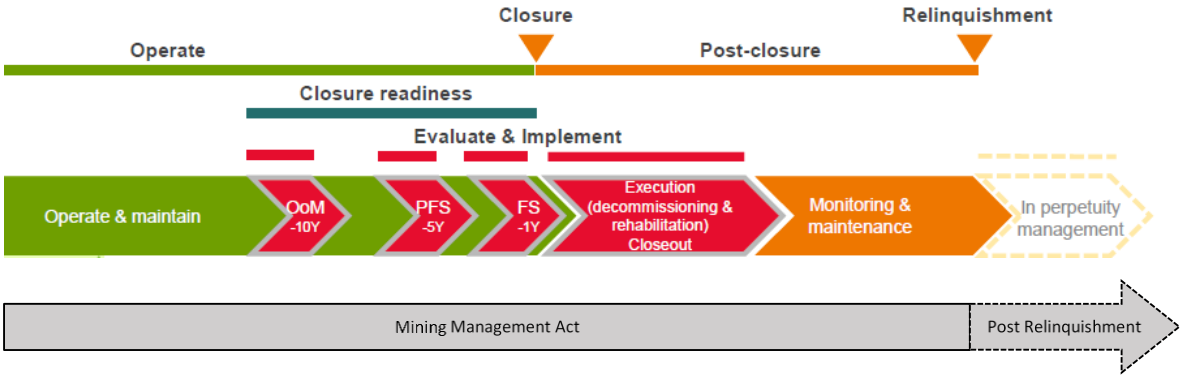
1.4 Definitions

Certificate of Closure	Upon meeting the closure criteria, the Minister will issue a certificate of closure and return the security provided by RTA Gove for Gove Operations. On the issue of a certificate of closure, RTA Gove ceases to be liable for any future environmental impact associated with the former use of the land.
Closure Criteria	The standard or level of performance, as specified in this MMP that demonstrates successful closure of the site (MM Act). This MMP defines criteria for each closure objective and uses defined indicators to quantify the level of performance.
Closure Objectives	A clear set of statements relating to environmental and social aspects of closure that describe the intent of the closure strategy.
Closure execution	Commencement of a scope of work that converts the mining site from operating asset into the post-closure land use and includes activities such as decontamination, demolition, landform shaping and rehabilitation.
Indicators	Agreed performance parameters that are measurable and regarded as the minimum to be achieved to meet an acceptable environmental standard; or Agreed documentation of evidence to certify that a process was followed, for example TO consultation, design and construction of engineered structures in the final landform to meet an acceptable social standard.
Operator	RTA Gove Pty Ltd
Post- closure monitoring	Activities that occur when all remediation and rehabilitation activities are complete and attained relevant remediation or rehabilitation completion criteria, as part of a relevant Closure Execution Plan or Rehabilitation Plan.
Post - relinquishment Management Area	Part of the mining site where it is acknowledged that waste from the mining activities are to remain in situ post relinquishment and post issue of Certificate of Closure, subject to such waste areas being contained in a safe, stable, non-polluting land form for which RTA Gove has long term management obligations for monitoring and maintenance beyond closure.
Rehabilitation	Activities to repair the impact on the natural environment from mining by establishment of a final land form and vegetation community. These activities are progressively implemented prior to closure, where possible, and measured by specific rehabilitation completion criteria within the relevant rehabilitation strategies or plans.
Relinquishment	Submission and acceptance of a Certificate of Closure under the MM Act.
Remediation	Activities to remove contamination and/or man-made structures to enable rehabilitation, where required.
Trajectory	A consistent trend of improved condition in key parameters demonstrating a pathway to a self-sustaining state or natural attenuation.

1.5 Life of Operation Stages

The functional areas within Gove Operations are at different stages within the life of the operation. **Figure 2** shows the timeline for the life of the operations used by Rio Tinto as their assets reach closure then through to relinquishment and Post - relinquishment Management Areas. It has been provided to guide the reader of this MMP in the terminology of closure stages and the progressive sequence of the closures studies, Order of Magnitude (OoM), Prefeasibility (PFS) and Feasibility (FS), that are completed to increase the closure knowledge base, planning and cost estimates prior to closure execution.

Figure 2. Functional Status



2. Operator Information

2.1 Ownership of Mining Interests

RTA Gove Pty Ltd (ABN 000 456 663) (RTA Gove) is submitting this MMP in its capacity as Operator of the Gove Operations pursuant to section 10 of the MM Act. RTA Gove is a subsidiary of Swiss Aluminium Australia Limited (ACN 008 589 099) (SAAL), which owns the Gove bauxite mine and alumina refinery. Both SAAL and RTA Gove are wholly owned subsidiaries of the Rio Tinto Group. The Operator details and key contacts are listed in **Table 2**.

Table 2. Gove Operations Operator Details and Contacts

DETAILS	
Operator	RTA Gove Pty Limited (ABN 000 453 663)
Owner	Swiss Aluminium Australia Limited (ACN 008 589 099)
Operator Registered Address	123 Albert Street, Brisbane QLD 4000
Operator Postal Address	PO Box 21, Nhulunbuy NT 0881
Operator Street Address	Melville Bay Road, Nhulunbuy NT 0880
CONTACTS	
Phone	**1800 996 508**
Email	**govecommunities@riotinto.com**

The structure of Gove Operations environmental management team is shown in **Table 3**.

Table 3. Gove Operations Environment Team

Position Title	Area of Accountability
HSE Business Partner	Accountable for the delivery of HSE Plans and provision of HSE support across the business.
Superintendent Environment	Accountable for the delivery of environment plans and provision of environment support across the business.
Specialist Environment (Operations)	Accountable for the delivery of the overall Gove operations Environmental Plan and provision of environmental support across the business.
Specialist - Rehabilitation	Accountable for the delivery of rehabilitation and research programmes.
Specialist Environment (Closure Projects)	Accountable for the delivery of environmental projects.
HSE Field Technician	Accountable for all the field monitoring.

2.2 Mining Interests

The Gove Operations were established pursuant to the Mining (Gove Peninsula Nabalco Agreement) Ordinance 1968. Under this Ordinance, SAAL and Gove Aluminium Ltd (GAL) were authorised to develop and operate the Gove Operation and were issued with a range of tenures for this purpose.

This included Special Mineral Lease (SML 11, Part 1, 2 and 3) which covers the mine, refinery and conveyor (please note that for administrative purposes SML11 was renumbered in 2011 as MLN955). In addition to SML11, SAAL was also issued with a range of Special Purposes Leases (SPLs) which cover associated infrastructure that supports Gove Operations including the Nhulunbuy Township and Industrial Estate.

A register of leases for the mining and processing interests associated with Gove Operations held by SAAL are shown in **Table 4**. Following the enactment of the Commonwealth *Aboriginal Land Rights (NT) Act* 1976 (ALRA), all of the land underlying SML11 and the SPLs was identified as 'Aboriginal land' for the purposes of that legislation.

A deed of grant of freehold title to that land has been executed under the ALRA and will be held in escrow by the Northern Land Council (NLC) until such time as SML11 and the SPLs expire. On expiry, the deed of grant will be delivered, and freehold title in the land will revert, to the Arnhem Land Aboriginal Land Trust (ALALT), who will hold and manage that land on behalf of Traditional Owners.

Table 4. Gove Operations Leases

Lessor	Lease	General description	Grant date	Expiry date
Currently: Northern Territory of Australia	Mineral Lease (Northern) Number 955 (MLN955)	Special Mineral Lease (SML) 11 (Part 1 Mine, Part 2 Conveyor and Part 3 Refinery)	30 May 1969	29 May 2053
Arnhem Land Aboriginal Land Trust c/- Northern Land Council	RDA (Dealing Number 749656)	Residue Disposal Area	30 May 2011	29 May 2053
Currently: Northern Territory of Australia	Special Purposes Lease (SPL) 213	Bulk Cargo Wharf	6 June 1969	29 May 2053
Currently: Northern Territory of Australia	SPL217	General Cargo Wharf	6 June 1969	29 May 2053

LESSOR	LEASE	GENERAL DESCRIPTION	GRANT DATE	EXPIRY DATE
Currently: Northern Territory of Australia	SPL249	Foreshore Protection	22 February 1974	29 May 2053
Currently: Northern Territory of Australia	SPL214	Nhulunbuy Township	30 May 1969	29 May 2053
Currently: Northern Territory of Australia	SPL250	Nhulunbuy Industrial Estate	27 February 1974	29 May 2053
Currently: Northern Territory of Australia	SPL251	Town Services Corridor	22 February 1974	29 May 2053
Currently: Northern Territory of Australia	SPL253	Water discharge	19 April 1974	29 May 2053
Currently: Northern Territory of Australia	SPL 277	Seawater intake	22 August 1973	29 May 2053

2.3 Traditional Owner Agreement

On 26 May 2011, SAAL and GAL entered into the RTA Gove Traditional Owners Agreement (TO Agreement) with the key Traditional Owners of the land underlying the Gove Operations, the ALALT and the NLC. The key Traditional Owners are the Gumatj, Rirratjingu and Galpu clans.

The TO Agreement recognises the rights and interests of Traditional Owners in the land where Gove Operations is situated. The TO Agreement sets out all the terms, conditions and commitments that the company and the Gove Traditional Owners have agreed to ensure a respectful and resilient working relationship. It includes key areas such as:

- employment and training;
- contracting and business development opportunities;
- cross cultural awareness;
- future of town provision;
- access to areas within the mining lease for timber removal;
- cultural heritage;
- environmental management; and
- rehabilitation.

2.4 Other Compliance Requirements

In addition to the requirements of a mining authorisation, other key statutory requirements include:

- Aboriginal Areas Protection Authority (AAPA): Gove Operations operate in accordance with AAPA certificates to comply with the NT *Aboriginal Land Rights Act 1976* and NT *Aboriginal Sacred Sites Act 1989.* AAPA are responsible for granting and issuing permission to conduct works to land on which Aboriginal sacred sites are located, the permission is issued in the form of an AAPA Certificate.
- Waste Discharge Licence (WDL): Gove Operations has a current WDL granted under the NT *Water Act*, that is administered by the Department of Environment and Natural Resources (DENR).

- The NT *Water Act* and the *MM Act* both require a Water Management Plan, to manage the risks and protect water quality and resources. The activities described within Environmental Protection Management Strategies, described in Attachment C, intend to satisfy this requirement. Currently, water management and water quality protection are monitored through a separate Water Monitoring Plan (WMP), which is approved by the DENR, as its primary purpose is to monitor compliance with the WDL and the NT *Water Act.*
- Under the *Water Legislation Amendment Act 2018* (NT), exemptions previously given to mining and petroleum activities under the NT *Water Act* have been removed. As the application for the MMP was submitted prior to 30 June 2019, the activities contained in this MMP are to be treated in accordance with the former *Water Act* prior to the amending legislation.
- Application for a bore work permit (to drill, construct, alter or decommission), pursuant to section 57 of the NT *Water Act*, for bore holes drilled to depth exceeding 3m.
- Licence to Possess or Store Dangerous Goods.
- Certificate to Possess and Use a Schedule 7 Substance No. IR-583: The site has been granted an authorisation to possess and use chlorine for industrial purposes, including cleaning membranes in the water treatment plant.
- Groundwater Extraction Permit 305: to extract groundwater for the purpose of industry (mining) and public water supply, issued by the NT Controller of Waters under the *Water Act*.
- Special Permit to take quantities and types of fish and aquatic life from waters within a specified area and subject to special conditions, for the purposes of environmental monitoring. Permit issued by the DPIR under the *Fisheries Act*.
- Customs Warehouse Licence for storage of petroleum and like products. Licence issued by the Controller General of Customs under *Customs Act*.

Other non-statutory compliance requirements include.

- ISO 14001: Gove Operations maintains its certification to the ISO 14001 Environmental Management System standard.
- Aluminium Stewardship Initiative (ASI): a voluntary international certification for responsible aluminium production. Gove Operations obtained this certification for their bauxite mining and export operations in 2018.

2.5 Compliance Notification Process

The Gove Operations will notify the relevant NT Government agencies (DPIR, DENR, NT EPA and NT Worksafe) of reportable environmental incidents, including the well-being of humans:

- By telephone or email as soon as practicable; and
- In writing on prescribed notification form (FRM-EHS-024) within 24 hours.

Table 5 details the specific environmental reporting requirements prescribed under legislation.

Table 5. Legal Reporting Requirement for Environmental Incidents

LEGISLATION	REPORTING
Mining Management Act	Under Division 4 Section 29, the Operator must report environmental incident or serious environmental incident. As soon as practicable after the Operator for a mining site becomes aware of the occurrence of an environmental incident or serious environmental incident on the site, the Operator must notify the Chief Executive Officer of the occurrence.
Waste Management and Pollution Control Act	An incident causing or threatening to cause pollution resulting in material or serious environmental harm must be reported to the DENR within 24 hours of becoming aware of the incident.

Waste Discharge Licence (Issued under NT *Water Act*)	An incident causing wastewater discharges that exceed conditions of the Waste Discharge License (WDL) must verbally notify and follow up by a written report to the DENR. The written report must be issued using prescribed notification form (FRM-EHS-024).
Weed Management Act	To report the presence of a declared weed on occupied land within 14 days of becoming aware of it being present on the land.
Biosecurity Act	As soon as practicable after the Operator becomes aware of a reportable biosecurity incident in relation to goods, the person must, report the incident to a biosecurity officer or the Director of Biosecurity

2.6 Cultural Heritage

Gove Operations adheres to its site Gove Cultural Heritage Management System (CHMS) procedure and cultural heritage guidance note. The site CHMS procedure complements and is guided by the Rio Tinto Communities and Social Performance Standard and the Cultural Heritage Management Group procedure. In practice, prior to land disturbance in Gove Operations lease areas a Rio Tinto Archaeologist would undertake an assessment to ensure compliance to our site operating procedure and to ensure compliance to the NT *Aboriginal Sacred Sites Act 1989* and the NT *Heritage Act 2011*. The assessment includes a review of the site CHMS site database for any sites located in the disturbance area and whether an archaeological assessment has been undertaken and the issue and relevance of an AAPA Certificate for the disturbance area.

The Gove Operations Cultural Heritage Management Database also captures boundaries of AAPA Certificates issued and some sacred sites. The information related to sacred sites cannot be shared and information relating to sites is available from AAPA.

In addition, the TO Agreement has provisions in relation to sacred sites and consulting with Traditional Owners. Consultation with Traditional Owners primarily occurs at the Leaders Forum established under the TO Agreement. Traditional Owners also participate in cultural heritage surveys to determine new disturbance.

Attachment A provides details of cultural heritage matters for Gove Operations.

2.7 Public and Private Infrastructure

Gove Operations owns and operates all of the infrastructure associated with its operational areas. The majority of this infrastructure is located within SML11 and includes the mine operations, the conveyor corridor and the alumina refinery.

Within SPL214 and SPL250 (the Nhulunbuy Township and Industrial Estate), Gove Operations owns and maintains approximately 470 residential and commercial properties, with the remaining properties (approximately 1000) being subleased by third parties including the NT Government.

Essential service infrastructure such as the Gove District Hospital, Nhulunbuy Primary School, Nhulunbuy High School and the Police Station are operated and maintained by the NT Government.

The Nhulunbuy Corporation Limited (NCL) was established by SAAL and GAL, undertakes all municipal functions within the Nhulunbuy Township, similar to other like towns located in the NT. The NCL operate and maintain assets such as the swimming pool, town hall, and recreational areas on behalf of Gove Operations.

2.7.1 Potable Water

Gove Operations extracts the town's potable water supply from a groundwater bore field located within SML11 Part 1 Mine, the field includes 19 shallow bores within a 2km radius of the airport precinct. The NCL manages the treatment and distribution for the local residents.

2.7.2 Power and Sewerage

The power generators are located within SML11 Part 3 Refinery, and provide power for Gove Operations as well as the local communities including Nhulunbuy, Yirrkala, Gunyangara and other local users.

A small sewerage system located within SML11 Part 3 Refinery, treats waste collected at the refinery and RDA. Whilst the NCL operates a reticulated sewerage network for the Nhulunbuy Township located within SPL 214.

2.7.3 Gove Airport

The Gove Airport is located on SML11Part 1 Mine, and is operated and maintained by the NCL. Gove Airport commenced operation in the 1970's and is serviced daily by Air North's Darwin-Gove-Cairns return E170 jet service and a smaller Brasilia 120 aircraft between Darwin, Groote Eylandt and Gove five days a week.

There are seven aircraft charter operators based at Gove Airport who conduct a combined total of around 20,000 movements a year.

The Airport facility consists of a main terminal (check in counters, security area, toilets, arrivals area, food and car rental kiosks), operations centre, old terminal, and hangars.

2.7.4 Port Facility

The port facilities located at Gove Harbour within Melville Bay facilitate the export of bauxite, and the import of general cargo and bulk liquids required for the Gove Operation and region. The port facilities operate 24 hours, the export (bulk cargo) wharf is located on SPL 217 and the general cargo wharf is located on SPL 213. The NT Government has appointed RTA Gove to be the pilotage authority for the Gove pilotage area under section 66(2) *Ports Management Act.*

Gove Operations manages the security of the port facility under the *Maritime Transport and Offshore Facilities Security Act 2003*.

2.7.5 Roads

Gove Operations maintain all roads within the boundaries of its leases. Gove Operations works with the NLC, East Arnhem Regional Council and the NT Government in relation to roads that adjoin those within Gove lease areas.

2.8 Workforce Description and Demography

Gove Operations employees and primary contractors remain largely employed on a residential basis with critical, unique or flexible roles undertaken on a 'fly in fly out' (FIFO) basis as required. Gove Operations' workforce of approximately 400 Full Time Employees (FTE) and primary contractors account for 11.5 percent of the Nhulunbuy population of 3,200 recorded during the 2016 census.

The workforce composition and demographic will alter as transition towards mine closure occurs. Subject to business requirements, this will mean a more diverse workforce including both residential & FIFO employees as well as further utilisation of contracting partners. Initiatives to encourage an improved female to male employee ratio are in place with emphasis on local employment. Residential to FIFO ratio changes from current levels are expected to occur from approximately 2026.

3. Community

The township of Nhulunbuy continues to be the service hub for Northeast Arnhem Land. According to the 2016 census, the township has a population of around 3,200, which is similar to population statistics prior to the curtailment of the refinery.

Yolngu communities and homelands continue to rely heavily on the township for both social and commercial services including supermarkets, banking, healthcare, education, policing and housing. Yolngu leaders continue to emphasise the importance of a strong and well serviced township for the entire region as the population is approximately 16,000.

In June 2018, a social and economic impact assessment was commissioned. Outcomes and results of this assessment will provide a detailed and up to date knowledge base of key social and community issues to be considered for operational closure. Gove Operations will liaise with NT Government representatives regarding the outcomes of this assessment.

3.1 Identified Stakeholders and Consultation

Gove Operations consults and engages with a wide range of parties and individuals, including those in communities, political representation, different levels of government and government institutions, employees, unions, contractors and suppliers, the media, academic or research institutions, and non-government organisations etc. Throughout the life of the business, these groups or individuals may change and accordingly stakeholder mapping and analysis is updated as required to incorporate these changes.

Consultation and engagement allows for mutual understanding of the needs of both the business and stakeholders. Gove Operations ensures that the business and its communities remain mutually informed throughout the life of the operation.

Table 6 below demonstrates a list of all interested parties and stakeholders affected by the Gove Operations and details of engagement.

Table 6. Current Stakeholders

Stakeholder Group	Interests	Commitments	Engagement Tools	Example Consultation Topics
Traditional Owners	Community, Environment, Land Management, Regional and Economic Development	Traditional Owner Agreement 2011	Leaders Forum Regular meetings	• Environmental matters • Employment and training • Business performance • Contract opportunities
Community members including Nhulunbuy, Yirrkala, Birritjimi & Gunyangara	General services provided by RT, power/water Mine life timeframe Community investment Maintain of social fabric Environment and rehabilitation Business opportunities	Keeping them informed through regular mechanisms and tools Investing in the region	Community notices (Facebook page) 1800 hotlines Engagement forums Publications (SD Report) Local events Communities email box	• Employment opportunities • Utilities matters • Community investment • Works undertaken that affect community members • Business performance • Contract opportunities

Stakeholder Group	Interests	Commitments	Engagement Tools	Example Consultation Topics
NT Government	Job creation for local Aboriginal groups Revenue for the region Taxes Royalties Indigenous capacity development Environment Security Bond	MMP Security Bond obligations WDL	MMP Annual Performance Reporting SML11 Report Regular meetings	• MMP • WDL
NGO	Fish / sustainability Air emissions Avoid risk / changes Reputation	MMP	Publications	
NLC	Job creation for local Aboriginal groups Impact of change to Traditional Owners Traditional Owner land ownership Business opportunities	Traditional Owner Agreement 2011	Leaders Forum Regular meetings	• Environmental matters • Employment and training • Business performance
Employees	Job security	EBA Agreement	Employee briefings Employee update publications such as newsletters, scorecards, site banners and employee intranet.	• Business performance • Employment opportunities

3.2 Community Relations

Gove Operations strives to build strong relationships with communities and stakeholders for the duration of its operations, and to make a positive impact in the regions where we operate through stimulating economic development and employment.

Gove Operations undertakes Communities and Social Performance (CSP) activities that support and enhance existing long-term relationships with stakeholders.

These activities are derived from a CSP plan which is developed in four year periods, which are reviewed and updated on an annual basis by the Gove Operations Communities team.

The CSP plan contains targets, priorities and actions for the Communities team.

Gove Operations monitors and tracks performance through internal reporting procedures and provides external updates annually via Rio Tinto's Sustainable Development Report.

3.2.1 Community Investment

Gove Operations invests directly in community through contributions and support that benefit the Gove Peninsula community. These investments are made up of both financial and in kind contributions.

Contributions to non profit groups are delivered through several initiatives including a sponsorships and donations programme, a community development fund (due to expire in 2019) and through multi-year funding agreements with stakeholders.

Into the future, where practicable, the focus will be for community investments to align with existing programmes supported by governments, donors and other partners, to leverage positive outcomes, avoid redundancy and/or dependency on Gove Operations. Investments will aim not to replace programmes and services provided by governments unless there is a clear business case to do so.

Gove Operations will report annually on community contributions made across the Gove Peninsula as part of its community investment programmes.

3.2.2 Indigenous Training and Employment

Under the TO Agreement, Gove Operations is committed to support and increase local Indigenous employment and capacity building in Gove Operations and local organisations within the community.

Gove Operations is currently in the process of deploying its regional employment strategy known as the Horizon Strategy. The purpose of the strategy is threefold:

- to develop sustainable employment outcomes for members of North East Arnhem Land Clans;
- provide clear pathways to employment that are built on identifying minimum standards of education and skills based training with provision of structured internal support mechanisms; and
- acknowledge that all the Traditional Land Owners and North East Arnhem Land Clan groups are key partners in the delivery of employment pathways.

The key deliveries of the strategy include:

- school to work pathways which includes school engagement, site visits, school based apprenticeships, traineeships etc.
- indigenous employment and development which includes work ready programmes with Gumatj Regional Training Centre, YBE Djama Mirri Mala and mandatory safety training provided by Gove Operations; and
- further employment, which includes Yolngu employment with operating partners, facilitating employment pathway programmes for Yolngu people with operating partners and transition of Yolngu trainees to Rio Tinto operational employees.

Gove Operations has a number of internal positions who assist with facilitating delivery of the above Horizon Strategy.

The Specialist Indigenous Participation position will facilitate the implementation and delivery of the programme. There are two dedicated Supervisors positions for the Dhuka Mala mine and Djama Mirri Mala production crews. These are both dedicated to support the transition of Yolngu from training to jobs within Gove operations.

Currently, Gove Operations supports sixteen traineeships, seven of which are contractor roles.

It is a priority for Gove Operations to increase local participation in its workforce, and to focus attention on providing flexible work arrangements and traineeships.

Accordingly, Gove Operations will continue to work with relevant stakeholders to refine its Horizon strategy. To create different pathways to job participation, and work together to identify and resolve current community challenges and barriers.

4. Environmental Factors

The following is a short description of the environmental factors that influence the manner in which Gove Operations undertakes its activities. **Attachment B** provides a detailed description and the significant environmental values. Operations are limited by the distinct tropical climate that constrains mobilisation of resources and the rehabilitation of vegetation communities.

4.1 Climate

Gove Peninsula has a monsoonal climate, influenced by coastal factors and is characterised by hot, wet, humid summers and mild, drier winters.

The Gove region experiences most of the annual rainfall over a distinct wet season from December to April, characterised by an active northwest monsoon. Thunderstorms are common, and heavy rainfall events can occur, often associated with tropical cyclones. On average, every two years a tropical cyclone and gale force winds are expected to pass near Gove. As well as generating very high wind forces, cyclones can also cause storm surges in addition to considerable wave action.

Tropical cyclones in Australia's northern region form predominately during the wet season between November and April. There are on average 7.7 days per season when a cyclone exists. The north-western Gulf of Carpentaria near Gove has the highest concentration of cyclone days. The Gulf of Carpentaria averages two cyclones a year.

The winter months from April to November are cooler and drier with south-easterly trade winds. The driest months are typically August to October, when evaporation usually exceeds the monthly rainfall. The mean annual evaporation exceeds the mean annual rainfall by 50%, however rainfall in this area is known to be highly variable and may exceed the evaporation rates in wetter years. Median monthly rainfall in the dry season is less than 60mm, and months with no rainfall are common. Sea breezes have a local influence on the strong trade winds during these months.

Annual rainfall totals since 1971 have varied from 654mm to 2,572mm. Rainfall recorded at Gove airport from 2014 to 2018 are shown in **Table 7** (source: weather station 014508, Bureau of Meteorology (BoM)).

Table 7. Gove Annual Rainfall from 2014 to 2018

Month	Monthly Rainfall (mm)					
	2014	2015	2016	2017	2018	
Dec	145.8	359.6	184.2	25.2	132.4	Wet season
Jan	518.8	354.2	27.6	296.3	366.6	
Feb	219.2	549.6	161.8	216.2	218.2	
Mar	230.4	512	131	76.8	444.0	
Apr	294.4	164.4	47	ND	36.8	
May	27.4	22.4	171.8	21.8	25.8	Dry season
Jun	ND	112.6	32.3	22.4	8.2	
Jul	ND	40.4	15.2	9.8	25.2	
Aug	0.6	6.4	6.8	ND	0.2	
Sep	0	0	65.2	0.2	0.0	
Oct	0	1.4	9.2	7.8	0.0	
Nov	0	0	0.8	94.6	0.0	
Year (Total)	1436.6	2123	852.9	771.1	1257.4	

The mean monthly temperatures recorded at the Gove airport (source: weather station 014508, BoM) from 2014 to 2018 are presented in **Table 8.**

Table 8. Gove Monthly Mean Temperature from 2014 to 2018

Month	Monthly mean maximum temperature (°C)					
	2014	2015	2016	2017	2018	
Dec	31.4	33.3	33	34.9	34.5	Wet season
Jan	31.1	32.3	34.5	31	31.5	
Feb	31.5	31.7	34	31.5	32.9	
Mar	31.5	32.2	33.4	31.2	31.7	
Apr	30.7	31.8	32.8	32.2	32.9	
May	28.6	30.7	31.4	30.8	30.5	Dry season
Jun	28.3	28.8	30.1	30.7	28.9	
Jul	28.2	27.8	28.8	29.2	28.9	
Aug	30.8	28.9	29.3	30.3	29.7	
Sep	31.6	30.8	31.5	31.5	31.2	
Oct	33	31.3	32.7	33.5	32.7	
Nov	34.3	34.3	34.2	33.4	34.0	
Average	30.9	31.2	32.1	31.6	31.6	

4.2 Site Datums

The local height datum at Gove is referred to as either the Nabalco Height Datum (NHD) or Melville Bay Height Datum (MBHD). The NHD or MBHD is 1.893 metres (m) below the Australian Height Datum (AHD). Therefore, 1.893m should be added to AHD to convert to site datum (NHD or MBHD) or alternatively, 1.893m should be subtracted from NHD or MBHD to convert to AHD. The horizontal datum used at the Gove site is AGD84, AMG Zone 53.

4.3 Topography

The regional topography is represented by an extensive plateau, 60-80m above sea level, that occupies the central and eastern part of Gove Peninsula. It is bound in most places by escarpments, up to 20m in height, which are less pronounced on the western and Melville Bay side. Relief of the plateau areas highlights remnants of an old erosion surface or peneplain, which extended throughout the region in Mesozoic and Tertiary times. The plateau is capped with laterite, some of which forms the bauxite deposits mined by Gove Operations.

The refinery is situated on mostly undulating to flat land, with elevations in the range of 5 to 10m AHD. A small portion of the plant to the north-west near Wargarpunda Point reaches elevations of up to 22m AHD. Most of the refinery catchment slopes gently to the south and drains into Gove Harbour. The RDA is located on naturally undulating land, with elevations ranging from 3m AHD to 25m AHD. The RDA catchment comprises four modified drainage systems: Duck Pond Creek catchment, Wallaby Beach Creek catchment, Macassar Creek catchment and Crawfords (No-Name) Creek catchment.

4.4 Geology and Soils

The basement geology of the Gove Peninsula and the Gove Operations lease areas is the Palaeoproterozoic aged Bradshaw Complex. The Bradshaw Complex consists of granite-gneiss and is included in the Arnhem Inlier geological province, which forms part of the North Australian Craton (Geoscience Australia). In broad terms, the Bradshaw Complex is overlain by Cretaceous aged quartz sandstone (Mullaman Beds), Tertiary-Quaternary aged laterite and bauxite (Gove Operations Ore material), and Quaternary aged unconsolidated sediments. Outcrops of the granite-gneiss occur at Drimmie Head, East Woody Island, Mt Gorton, Dimbuka Rocks and numerous rocky islands within Melville Bay.

4.5 Biodiversity

Gove Operations is located within the north-east Arnhem Coast Bioregion and Groote Meso-Scale Bioregion, which is located on the western side of the Gulf of Carpentaria, in far northeast Arnhem Land. The bioregion is recognised as a site of high conservation significance in the NT and rated as internationally significant in relation to a number of threatened species, which may potentially occur within it. A number of plant and vertebrate species occurring in the bioregion are restricted within the NT to the broader north-east Arnhem region, which has interesting bio-geographic affinities with Cape York Peninsula.

The Gove Operation is surrounded by the Dhimurru Indigenous Protection Area (IPA), which was declared in 2000 under the International Union for the Conservation of Nature (IUCN) Category V – Protected Landscape/Seascape: Protected Area. This area is managed mainly for landscape/seascape conservation and recreation. The terrestrial component of the Dhimurru IPA covers an area of approximately 101,000ha surrounding Nhulunbuy including 9,000ha of sea country.

A full description of the significant biodiversity features, that inform the Environmental Protection Management Strategies, is provided in **Attachment B**.

5. Operators Management System

5.1 Rio Tinto Management System

Gove Operations adheres to the Rio Tinto Management System. It is an integrated system for the management of health, safety, environment, communities and social performance, and quality. It sets the standard and core requirements for all Rio Tinto Group businesses and comprises 17 elements intended to be generally in conformance with ISO 14001. These elements define the requirements, to plan and do, monitor performance, respond to incidents or unplanned events, develop corrective actions and review their implementation and

effectiveness - effectively establishing a continuous improvement cycle. The system is supported through the Rio Tinto Business Solution (RTBS) an online information management system to track compliance and corrective actions.

The Rio Tinto Management System is supported by Standards, that ensure that all Rio Tinto Business Units understand the social and environmental impact of their operations and are managing these to an acceptable level.

The relevant environmental, technical, closure and community Standards include:

- Water quality protection and water management (E11)
- Air quality protection (E12)
- Chemically reactive mineral waste management (E13)
- Land management and rehabilitation (E14)
- Hazardous materials and non-mineral waste management (E15)
- Biodiversity protection and natural resource management (E16)
- Slope geotechnical hazards (D3)
- Tailings and water storage (D5)
- Communities and Social Performance
- Closure

Compliance with the Standards is assessed by qualified Rio Tinto auditors from other Business Units on a periodic basis (typically every two years) through the Health, Safety, Environment and Community Audit (HSEC Audit) programme.

The MMP has been structured to align with the environmental Standards, for consistency with the Gove Operations internal document control systems, Gove Procedures Management (GPM), and audit processes, to assist implementation of the MMP by Rio Tinto employees and contractors.

5.2 Environmental Management

Environmental management involves the completion of a risk assessment based on the site history, current and planned activities for Gove operations. Risks ranked as critical, high and moderate are assigned an Environmental Protection Management Strategy (EPMS) to manage this risk to an acceptable level.

For the mine production, the risks are associated with the transportation, storage, handling and/or usage of diesel for equipment at Gove Operations. Other activities that are likely to pose environmental impacts are, native vegetation clearing activities, water discharges from around the workshop, spread and/or introduction of weeds/pests, fauna injury/mortalities, and bushfires.

Mine production operations located within the refinery identified environmental risks associated with the transportation, storage, handling and/or use of diesel, material handling and processing, ship loading, sewage treatment, and surface water discharge.

The alumina refinery and RDA risks are associated with the transportation, storage, and treatment of hazardous waste materials including supernatant liquor (SNL), wastewater neutralisation, caustics (red mud storage), trace metals, diesel and oily water generated at the refinery. Other activities that are likely to pose environmental impacts are related to exotic species management, vegetation clearance, wastewater discharge, or accidental release of hydrocarbons.

The EPMS to be implemented by Gove Operations are aligned to the Rio Tinto environmental standards. **Attachment C** provides the risk assessment completed for 2018 and the related

EPMS, noting these documents are updated on a regular basis to adapt to changing situations and risk profile.

6. Closure

This section of the MMP outlines the closure strategy for each of the four functional areas. The Nhulunbuy Township does not form part of Gove Operations for the purposes of the MM Act and accordingly it will be addressed separately with the NT Department of the Chief Minister.

The activities within the mine production functional area are expected to end in 2029, based on the current mine plan. The alumina refinery and RDA functional areas are in 'closure readiness' following the announcement of early closure in late 2017, after approximately 3 years in care and maintenance post curtailment. The alumina refinery within the refinery functional area will be closed prior to the surrounding mine production areas, it also includes infrastructure required to support the town and wastewater neutralisation plant to treat the SNL stored within the RDA.

Although the marine functional area is located outside Gove Operations lease boundary, it has been included to inform DPIR of the closure studies and closure plan. The discharges into the marine functional area, under the Waste Discharge Licence issued by the NT EPA, is anticipated to end once the SNL inventory in the RDA is exhausted and the red mud ponds are capped to prevent the creation of more contaminated water.

6.1 Closure Pathway

Closure of all functional areas will follow a pathway shown in **Figure 3**. It starts with undertaking **studies** to evaluate closure options, guided by achieving the closure objectives. These studies inform the operational **actions**, the progressive remediation, demolition and rehabilitation of the land to construct the agreed final landform. This phase includes the collection of monitoring data, with specific rehabilitation completion criteria and trigger values for water quality, to ensure these activities are completed to an acceptable environmental standard. The next step focuses on demonstrating the **performance** of the constructed final landform. It involves completing post closure monitoring programmes to collect closure indicator data to demonstrate attainment of the closure criteria. The final step is **closure**, the relinquishment of the leases and returning the land to the Traditional Owners, noting the Post - relinquishment Management Areas require ongoing access for management and monitoring activities.

Closure criteria provide an agreed framework to measure attainment of the closure objectives for each functional area and support the Application for Certificate of Closure. Each functional area has its own closure criteria; please refer to the following functional area sections.

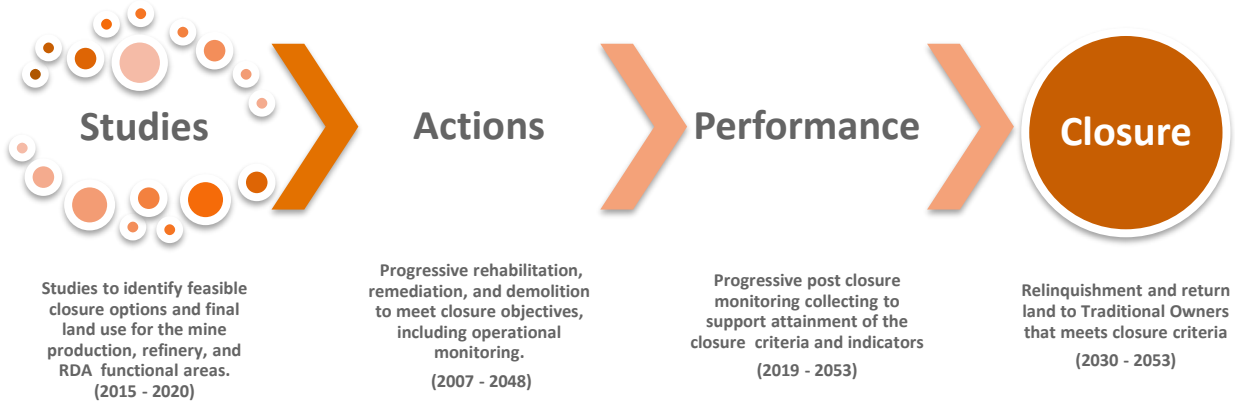
Closure indicators are the performance measures embedded within the closure criteria. The indicators are detailed in **Section 6.4**. These include science-based indicators to quantify an acceptable environmental standard. As well as indicators that specify the documentation or evidence required to certify that a process was followed to meet an acceptable standard, for example Traditional Owner acceptance of final land use, or engineering certification for construction of final landform and infrastructure.

For Gove Operations there are several key legal milestones for closure:

- relinquishment of the mining authorisation, in accordance with the Certificate of Closure process outlined in Section 46 of the MM Act; and
- expiration (or earlier surrender) of the lease on the deed of grant, when the land will revert to the ALALT, who will hold and manage that land on behalf of Traditional Owners; and/or

- negotiation of legal arrangements for Post - relinquishment Management Areas, for long-term monitoring and maintenance activities post 2053.

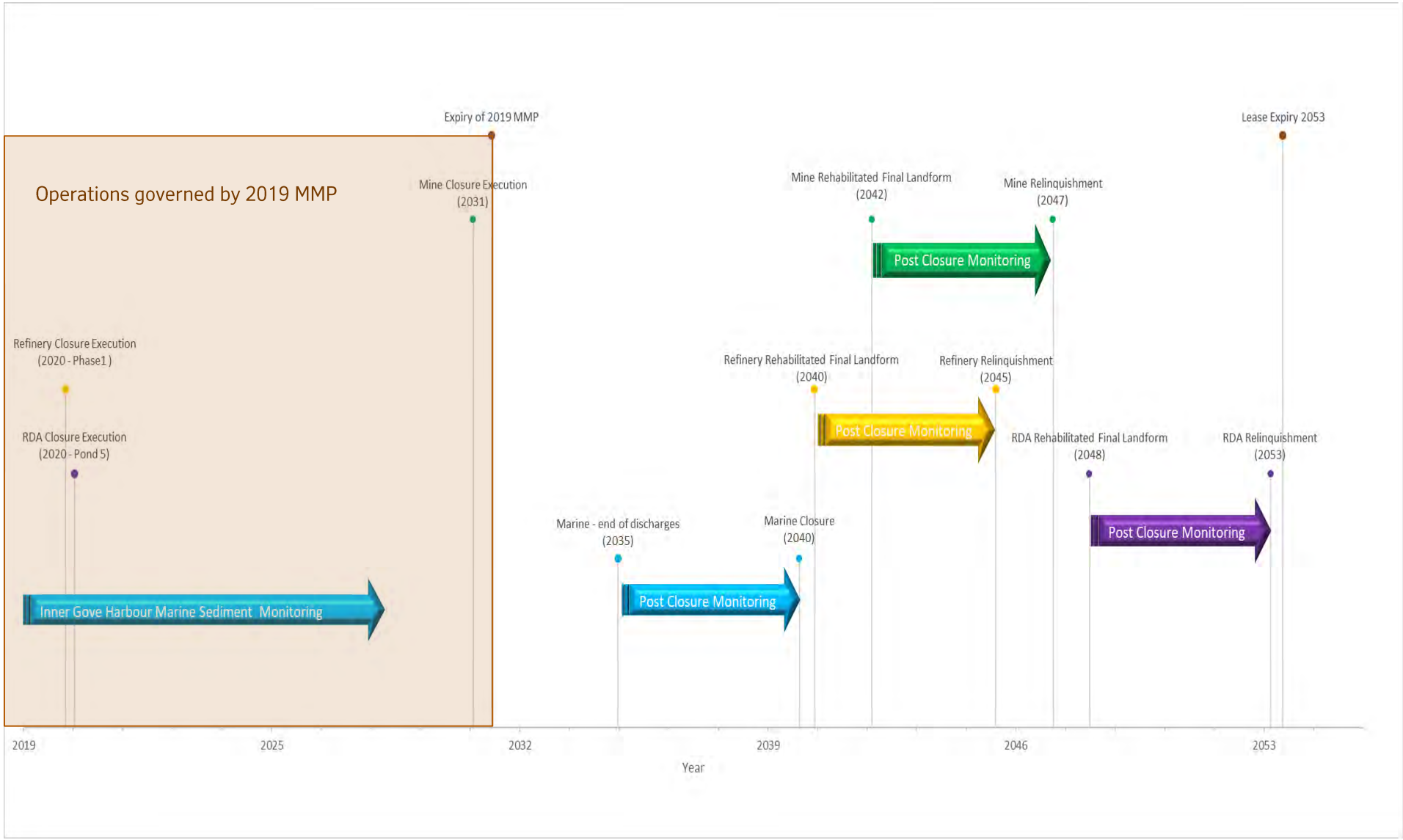
Figure 3. Gove Operations Closure Pathway



The proposed timeline for closure is shown in **Figure 4**, it is a conceptual representation of closure for each functional area and overall timeframe for relinquishment of the land. It indicates key milestones for closure, including the completion of all actions to create a '**Rehabilitated Final Landform'**, implementation of '**Post Closure Monitoring'** to demonstrate attainment of the closure objectives, and the expected timing of '**Relinquishment**'. Importantly, it shows that the full length of lease period will be required to achieve relinquishment, and the post closure monitoring programme is beyond the timeframe of this MMP. An overview of the closure actions for each functional area is provided within the following sections, these actions form the basis for the timeline presented.

The long timeframes are primarily due to earthworks being constrained by the dry season, and the remote location of Gove Operations. It assumes that completion of rehabilitation will take up to 10 years. The following post closure monitoring period, for at least 5 years, is based on the closure criteria. It is focused on collecting the closure indicator data to demonstrate the final landform has attained the closure objectives of: safe, stable, non-polluting and agreed final land use. The progressive rehabilitation of areas will result in the majority of rehabilitation exceeding 15 years in age before relinquishment, and the minimum age of rehabilitation being 15 years. The data collected from rehabilitation monitoring, and other environmental monitoring programmes (eg. surface water, ground water and marine) will be used to support post closure monitoring programmes, and implement adaptive management plan, detailed in **Section 6.5**.

Figure 4. Conceptual Gove Operations Closure Timeline



6.2 Closure Objectives

The closure objectives are to return a landscape that is safe, stable, non-polluting, and able to sustain an agreed final land use, to the Traditional Owners.

The guiding principles and design for closure for each of the objectives is described in **Table 9**. This is the context for the design of the final landform and the closure criteria to measure whether current environmental and social expectations have been attained.

Table 9. Principles and Design for Closure

OBJECTIVE	PRINCIPLE	DESIGN
Safe	Protect the safety and the wellbeing of our employees, contractors and communities.	- Post-mining landscape that is safe and secure for humans and animals and suitable for relinquishment. - Demolition actions defined by Australian standards and safety regulations. - Waste materials and contaminants will be disposed of in accordance with current (2018) regulations or effectively contained within acceptable limits as guided by National Environmental Protection (assessment of site contamination) Measure – Schedule B1 Guideline on Investigation Levels for soil and groundwater 2013 (F20013C00288) (NEPM) and Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018).
Stable	Protect the surrounding marine environment and native vegetation areas (receiving environments) from surface water runoff.	- Design and construct surface water catchments and drainage guided by the pre-disturbance hydrology and topography. - Landform to be geo technically stable and designed to maintain an acceptable long-term static drained Factor of Safety (FoS), Maximum Design Earthquake (MDE), and Probability of Failure. - Surface water management designed for erosional stability, based on appropriate event probability. - Sediment release from erosion does not adversely impact on water quality parameters for the marine receiving environment. - Erosion does not affect functionality of the final landform. - Erosion and stability (waste consolidation) does not compromise the integrity of capping system. - Site-specific trigger levels for water quality parameters for the marine receiving environment (guided by ANZG 2018).
Non-polluting	No long-term impacts on environmental values or unacceptable human health risks from known contamination sources and groundwater pathways.	- Waste materials are effectively contained, neutralised, or removed. - Groundwater pathways are controlled with no evidence of impacts on surrounding environmental values (noting surface water pathway controlled by stable design principles). - Site-specific trigger levels for marine receiving environment, groundwater and soil quality (guided by NEPM)

OBJECTIVE	PRINCIPLE	DESIGN
Able to sustain an agreed final land use	Leave a positive legacy with key assets and infrastructure retained to support the social and economic future of the region. Protection of sacred sites in close consultation with Traditional Owners.	- Final landform has similar environmental values as surrounding areas, with exception of the legacy sites. - Support suitable vegetation for post-mining land use. - Rehabilitated areas will provide appropriate habitat for fauna utilisation – abundance and diversity will be appropriate. - Manage soil to meet a post-mining land use zone classification. - No infrastructure left on-site unless agreed with stakeholders. - Maintain Traditional Owners access to areas of cultural significance. - Foster economic opportunities for Traditional Owners and local communities

6.3 Closure Study Programme

Closure is a complex task involving the management of multiple technical safety and environmental risks. A closure study programme is being implemented to ensure that these risks are appropriately managed. The study programme follows a prescribed set of project development phases, broadly split into option development and evaluation, and implementation phases of work. The development and evaluation phase includes three distinct project studies, the Order of Magnitude (OoM), the Prefeasibility (PFS), and the Feasibility (FS). The Implementation phase covers Execution, Monitoring and Close out. The safety-critical elements of closure have necessitated that the overall closure study be managed as sub-projects. All of these sub-projects will follow the same study programme to ensure conformance with a project governance structure to ensure decisions are not made in isolation or at the expense of the overall outcome.

Rio Tinto's robust internal governance process includes external and internal experts to challenge project outcomes, assumptions and options evaluated. The project studies engage third party assurance providers for the engineering aspects of the projects.

In a traditional closure context, the evaluation phase is the collection of the closure knowledge base, plan preparation, stakeholder engagement, determination of final land-use, development of closure criteria and cost estimate. The implementation phase covers the decontamination, demolition, remediation, and rehabilitation of the site to achieve the final end-use, these are detailed in the Closure Execution Plan for each specific closure project.

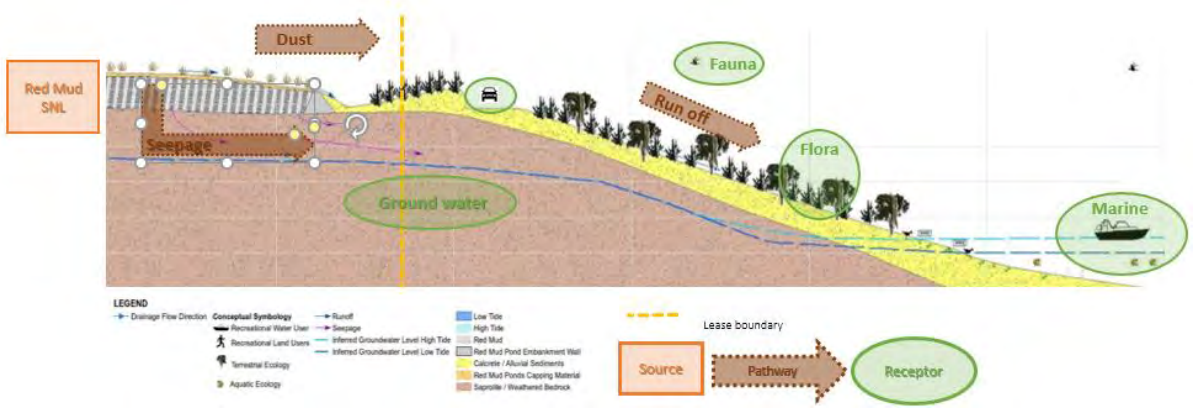
6.4 Closure Indicators

Closure indicators are the agreed measures embedded within the closure criteria, to measure the performance of the final landform after the completion of all closure actions and rehabilitation activities. The indicator values included in this MMP are derived from existing site monitoring data and the relevant Australian guidelines. It is acknowledged that these values are based on the best available data and the collection of data from suitable analogue and/or reference sites during the completion of operational monitoring programmes over the next 10 years may be used to support revision of these values. The adaptive management plan in **Section 6.5**, describes the process to support revision of these values.

The selection of closure indicators is based on demonstrating that the closure actions effectively intercept or close exposure pathways from the source to the receptor. **Figure 5** illustrates a conceptual 'source – pathway- receptor' continuum based on the Northern Ponds in the RDA. It shows the source of contamination and potential receptors or receiving

environment and the possible exposure pathways under the current operational status at Northern Ponds.

Figure 5. Source – Pathway – Receptor continuum – Northern Ponds current



The majority of source contamination is within the refinery and RDA functional areas, although the 'source – pathway- receptor' continuum can apply to other areas. The chemicals used, in the greatest quantities, during the refinery process were sodium aluminate and caustic soda. The signature of caustic materials, released into the surrounding environment (soil or groundwater), is most typically indicated by increased pH, Alkalinity, and metal(loid) concentrations. Metal(loid)s which are likely to be associated with caustic materials originating from bauxite processing operations include aluminium, arsenic, chromium, copper, gallium, molybdenum, lead, vanadium, and zinc.

This signature of caustic materials has informed the selection of parameters for the indicators. As well as the assessment of the 'source – pathway- receptor' continuum, to identify the most likely exposure pathways following implementation of closure actions, such as capping and restoration of vegetation.

The following functional area sections detail the closure criteria and specify the relevant indicators. **Table 10** indicates the closure indicators applicable for each functional area, as expected areas with the higher levels of contamination have attracted a greater number of indicators.

Table 10. Closure indicators

Closure Indicator	Closure Objective	Mine	Refinery	RDA	Marine
Marine Water Quality	Non-polluting / Stable		☑	☑	☑
Oysters	Non-polluting		☑		
Erosion	Non-polluting / Stable			☑	
Groundwater	Non-polluting	☑	☑	☑	
Soil	Non-polluting		☑		
Vegetation	Stable	☑	☑	☑	
Third party certification:					
Engineering	Safe			☑	
Execution	Safe	☑	☑	☑	
Contamination	Safe		☑	☑	
Geo tech	Safe			☑	
HHERA	Safe		☑	☑	☑
Final land use agreement	Agreed final land use	☑	☑	☑	

6.4.1 Marine Water Quality

The purpose of the marine water quality indicator is to demonstrate that the final landforms within the refinery, RDA and marine functional areas are non-polluting and stable. The marine waters surrounding these areas, form the ultimate receiving environment for any exposure for example surface water runoff or groundwater seepage.

To achieve closure the aim is to demonstrate that there are no significant impacts arising from the final landform on the current Declared Beneficial Uses and Objectives for the Gove Area marine waters. These include aquatic ecosystem protection, recreational water quality, and aesthetics.

The indicators nominated in **Table 11** are set to protect High Ecological Value ecosystems (99% protection levels). This level of protection should also protect the full range of environmental values: recreational (primary and secondary), water quality, human consumption, aesthetics, cultural and spiritual values.

The indicator values have been adopted from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) or derived in accordance with internationally recommended derivation procedures and benchmarked against site specific data. The ANZG 2018 methodology for collection of the monitoring data will be used to demonstrate attainment of the indicator values, unless otherwise agreed with the NT EPA.

Table 11. Marine Water Quality Indicators

Parameter (Metal(loid)s dissolved, <0.45µm filtered)	2018 WDL (171-08) Gove Harbour TVs	2018 WDL (171-08) Drimmie Arm/No Name Bay TVs	Background WQ Melville Bay	Water Quality Closure Indicators (metal(loid)s based on 99% protection levels)
pH	8.5	8.5	8.2	7.5-8.5
Turbidity (NTU)	NV	NV	5	5
Aluminium (µg/L)	9 (16*)	9 (16*)	1.7	16
Arsenic (µg/L)	4.5**	4.5**	1.9	7.5***
Copper (µg/L)	0.3	0.3	0.3	NR
Gallium (µg/L)	309 (360*)	309 (360*)	0.02	360
Molybdenum (µg/L)	1558 (1920*)	1558 (1920*)	11	1920
Vanadium (µg/L)	100	50	2.5	50
Zinc (µg/L)	15	15	0.4	NR

TVs= Trigger Values from WDL171-08

*New guideline values from *Van Dam, J.W., Trenfield, M.A., Streten, C. Harford, A.J., Parry, D., van Dam, R.A. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments. Environmental Science Pollution Research, 25: 26592-26602. https://doi.org/10.1007/s11356-018-2702-y*

** New guideline values being developed by CSIRO and AIMS

*** Van Dam 2017. Assessing the biological effects of arsenate on tropical marine biota. Report prepared for Rio Tinto. Australian Institute of Marine Science, Darwin. (49 pp).

NR=Not required as not a contaminant of concern – 80th%ile in refinery seawater channel discharge dissolved copper=0.27µg/L, dissolved zinc= 1µg/L, at background concentrations.

NV=no value

6.4.2 Oysters

The oyster indicator will be used to demonstrate that exposure pathways from the refinery and marine functional areas, such as surface water runoff and groundwater seepage, are not significantly impacting these receptors. Oysters are monitored to observe any build-up in potential contaminants of concern that may result from oysters filtering seawater contaminated by runoff or discharges from the refinery or the sediment within the marine functional area.

Gove Operations has collected data on oysters since 2004, in accordance with the Water Monitoring Plan and conditions of their WDL, resulting in a robust data base against which to assess oyster quality during closure. This plan includes collecting data from:

- Bonner Rocks, a reference site, located in the NW of Gove Peninsula;
- Harbour Islet, located within the mixing zone at inner Gove Harbour;
- West Woody Island, located to west of Gove Peninsula; and
- Granite Island, located to the SW of Gove Harbour.

Figure 6 indicates the location of the oyster sampling sites, and **Table 12** provides the data collected from the reference site.

Figure 6. Location of oyster sampling sites

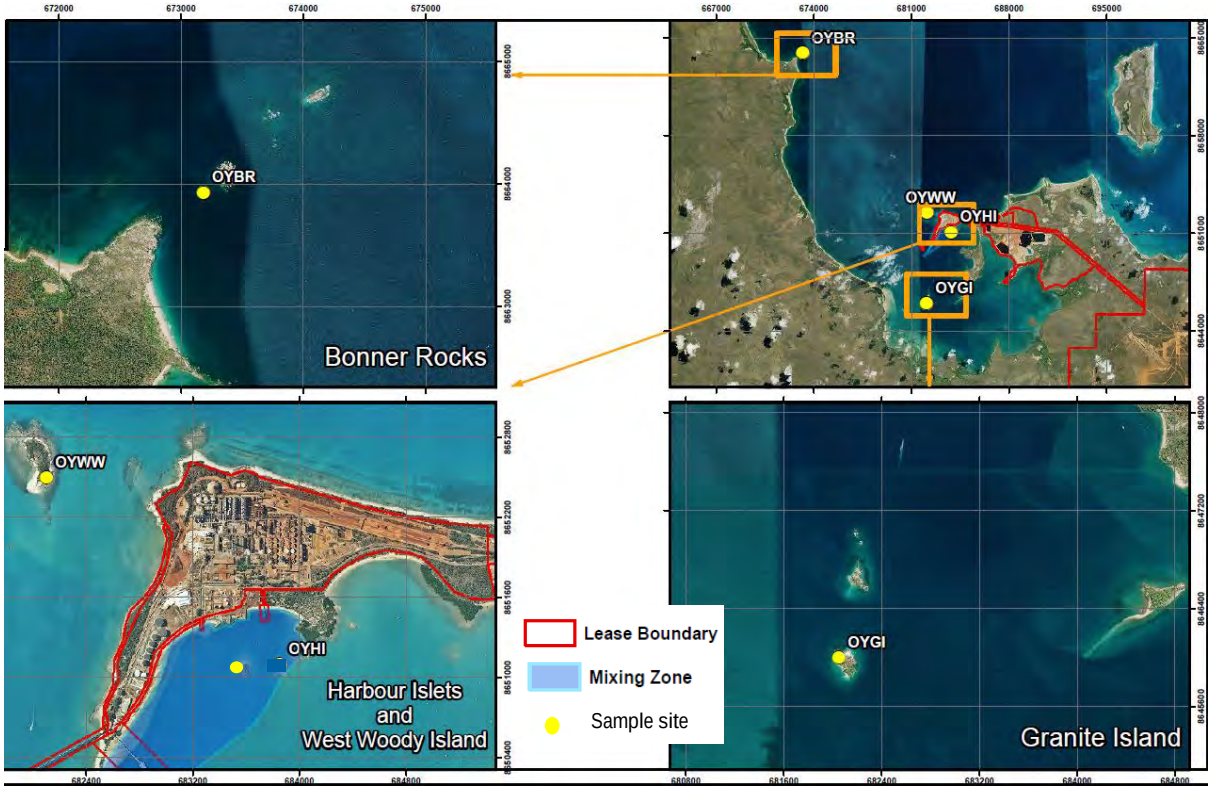


Table 12. Bi-annual data from 2004 – 2018 collected at reference site

Parameter	Oyster results (concentrations: mg/kg wet weight)		
	Bonner Rocks (Reference)		
	20th	50th	80th
	Percentile		
Aluminium	1.90	2.20	4.12
Arsenic	6.16	7.45	11.24
Cadmium	1.94	2.32	2.81
Copper	27.69	36.60	41.31
Gallium	0.002	0.002	0.003
Molybdenum	0.07	0.11	0.15
Vanadium	0.12	0.19	0.27
Zinc	35.58	44.31	52.72

The data collected under this long-term monitoring program will form the basis of the oyster indicators listed in **Table 13**.

Table 13. Oyster Indicators

Parameters	Oyster Indicators
Aluminium	Trajectory of decline in concentrations towards the reference site observed for at least 5 years
Arsenic	Below reference site
Cadmium	Below reference site
Copper	Below reference site
Gallium	Trajectory of decline in concentrations towards the reference site observed for at least 5 years
Molybdenum	Trajectory of decline in concentrations towards the reference site observed for at least 5 years
Vanadium	Trajectory of decline in concentrations towards the reference site observed for at least 5 years
Zinc	Trajectory of decline in concentrations towards the reference site observed for at least 5 years

6.4.3 Erosion Rates

Erosion rates will assess the stability of the RDA final landforms. It aims to demonstrate that the vegetation establishment and infrastructure is adequately managing the sediment runoff from catchments within the RDA, and is protecting receptors from this exposure pathway. The erosion rate indicators are to be measured from three separate catchments within the RDA, collecting surface water quality data prior to discharge into the marine environment, to identify any rehabilitation or waste containment failures.

Based on landform evolution modelling for the RDA PFS study, low level erosion is below 10 tonne/ha/year, and the integrity of the capped landform is maintained, and this has been adopted as the erosion rate indicator.

6.4.4 Groundwater Quality

The groundwater indicators nominated in **Table 14** are set to demonstrate an 80% species protection level of groundwater resources and receiving environments from potential discharges from the refinery and RDA final landforms. The sampling of the groundwater for these indicators is to demonstrate the groundwater, as a receptor, is not exposed to contamination pathways, also that seepage of contaminated groundwater is not impacting other receptors including marine habitats.

The quality values and methodology used to derive acceptable contamination levels and protection of groundwater resources in the long term are guided by NEPM.

Noting that post closure monitoring for the all the functional areas is expected after this MMP expires, the indicators values will be verified through the implementation of the Water

Monitoring Plan, or equivalent, under this MMP, in accordance with the adaptive management plan in **Section 6.5**.

Table 14. Groundwater Quality Indicators

Parameter (Metal(loid)s dissolved, <0.45µm filtered)	Groundwater Quality Indicators	References
pH	<8.5	ANZG 2018
Aluminium (µg/L)	202*	Van Dam et al 2018
Arsenic (µg/L)	80*	Van Dam 2017
Gallium (µg/L)	1,700*	Van Dam et al 2018
Molybdenum (µg/L)	10,700*	Van Dam et al 2018
Vanadium (µg/L)	280*	ANZG 2018
Benzene (µg/L)	500	NEPM 2013
Xylene (µg/L)	200	NEPM 2013

* 80% species protection

Van Dam et al 2018. New guideline values from Van Dam, J.W., Trenfield, M.A., Streten, C. Harford, A.J., Parry, D., Water quality guideline values for aluminium, gallium and molybdenum in marine environments. Environmental Science Pollution Research, 25: 26592-26602. https://doi.org/10.1007/s11356-018-2702-y

Van Dam 2017. Assessing the biological effects of arsenate on tropical marine biota. Report prepared for Rio Tinto. Australian Institute of Marine Science, Darwin. (49 pp).

NEPM 2013. National Environmental Protection (assessment of site contamination) Measure – Schedule B1 Guideline on Investigation Levels for soil and groundwater 2013 (F20013C00288)

6.4.5 Soil Quality

The aim of the soil indicator is to demonstrate that soil within the refinery functional area has been remediated and is no longer acting as a 'source' of contamination for exposure pathway such as seepage and run off to receptors including groundwater, native vegetation, and marine environment. Also to demonstrate attainment of the agreed final land use quality.

The quality values and methodology used to derive acceptable soil contamination levels in the long term are guided by NEPM and benchmarked against site specific data. The soil quality indicators nominated in **Table 15** are set for acceptable levels for human health protection.

Over the next 10 years data will be collected to develop indicators for aluminium, gallium, molybdenum, and vanadium as NEPM values do not current exist for these metals.

The post closure monitoring for the refinery functional area is expected to commence after this MMP expires. Also more information on the level of soil contamination within the refinery will be available once demolition of the refinery structure is completed. The adaptive management plan described in **Section 6.5** will enable incorporation of new data and information.

Table 15. Soil Quality Indicators

Parameter	Soil data collected from Pond 4 (Tetrakis 2018)	Soil data collected from Borrow Area – Pond 5 (Tetrakis 2018)	Refinery (Soil and Water 2016)	Soil Quality Indicator (Health-based investigation levels for Recreational C)	Soil Quality Indicator (Health-based investigation levels for Industrial D)
pH	5.6 – 6.0	5.4 – 6.0	4.1 – 12.2		
Aluminium (mg/kg)	13,700 – 88,900	27,000 – 80,600	n/a	*	*
Arsenic (mg/kg)	1 0 – 9.5	2.8 – 36.2	<5 - 40	300	3,000
Chromium (mg/kg)			<2 - 247	300	3,600
Copper (mg/kg)	0.5 – 3.2	0.8 – 1.2	<5 – 55	17,000	240,000
Gallium (mg/kg)	4.2 – 24.1	11.65 - 31	0.1 – 57	*	*
Lead (mg/kg)			<5 - 21	600	1,500
Molybdenum (mg/kg)	0.32 – 1.28	0.47 – 4.64	<2 - 52	*	*
Vanadium (mg/kg)	22 - 106	47 - 364	<5 - 588	*	*
Zinc (mg/kg)	4 - 17	4 - 8	<5 - 338	30,000	400,000
* No Health-based investigation levels, RTA Gove to develop site-specific values in accordance with NEPM standards.					

6.4.6 Vegetation

Vegetation closure indicators are designed to provide the final assurance that rehabilitated areas have attained their specific completion criteria, as measured by the rehabilitation monitoring for each functional area or sub closure domain. Rehabilitation monitoring data will demonstrate the vegetation established is on a trajectory towards or has attained the agreed parameters based on relevant reference sites, or the target vegetation community benchmarks (for example vegetation on capped areas). A trajectory is a consistent trend of improved condition in key vegetation and habitat parameters within a vegetation community demonstrating a pathway to a self-sustaining state.

Post closure monitoring for the vegetation indicators involves collection of vegetation and habitat data from rehabilitation and reference sites. Rehabilitation monitoring data may be used as evidence for attainment of the vegetation indicators, where possible.

The reference sites included in the monitoring program should best represent a realistic target for assessing the successful restoration of the native or target vegetation community. The reference sites provide a site-specific representation of vegetation community composition and structure, taking into account local environmental conditions and possible local constraints to revegetation success (such as historical site disturbance or management).

Reference sites will be monitored concurrently with rehabilitation sites to take into account temporal variation due to external factors such as rainfall and bushfire. Each round of monitoring will include direct comparisons between reference and rehabilitation sites.

The data collected from monitoring events will be analysed to determine if the rehabilitation sites have become statistically similar to the reference sites by at least 15 years after planting or re-establishment activities. This will be based on a combination univariate and multivariate statistical analyses including, where relevant, Analysis of Variance, time segment analyses and graphs for univariate data and multivariate permutational Analysis of Variance and non-metric Multidimensional Scaling for multivariate data.

Attainment of the vegetation indicators will be determined when the following targets are met:

- attributes in rehabilitation sites listed in **Table 16** are statistically similar to or greater than reference sites at 15 years post successful re-establishment; or
- target vegetation community benchmarks, for capped areas is an average foliage projection cover >70%, or other benchmarks maybe developed for specific revegetation requirements.

Table 16. Vegetation indicators for native revegetation areas

ATTRIBUTES	TARGETS FOR REHABILITATION SITES RELATIVE TO REFERENCE SITES AT YEAR 15
Species Richness (No. of species)	
Native over-storey	Similar to or greater than
Native mid-storey	Similar to or greater than
Native ground stratum (grasses)	Similar to or greater than
Exotic ground stratum	Similar to or less than
Total Native	Similar to or greater than
Total Exotic	Similar to or less than
Community Structure (% cover)	
Native over-storey	Similar
Native mid-storey	Similar
Native ground stratum (grasses)	Similar
Exotic	Similar to or less than

6.4.7 Third Party Certification Documentation

These indicators ensure that the relevant evidential documentation is retained to support the application for a Certificate of Closure. Gove Operations are to provide third party certification for the following:

- Engineering – purpose to certify the design and construction of engineering structures that will remain post relinquishment, for example capping systems, embankments, surface water management structures, and groundwater seepage interception systems, completed as part of the feasibility studies by third party engineer.
- Execution – purpose to verify compliance with relevant Australian standards on decontamination, demolition, and waste management in the implementation of the Closure Execution Plans, or confirmation of attainment of rehabilitation completion criteria.
- Contamination - purpose to verify compliance with agreed final land use and land-use zoning, to be completed by contamination auditor.
- Geo tech – purpose to verify geotechnical stability of the RDA through completion of stability audit.
- Human Health and Ecological Risk Assessment (HHERA) – purpose to confirm acceptable levels of risk on human health and the environment. To be completed for the refinery, RDA and marine functional areas.

6.4.8 Agreed Final Land Use

Gove Operations are to provide evidence on the consultation process with the relevant Traditional Owner representative on the final land use, and retention of assets and infrastructure, which may include:

- List of forums and dates relating to final land use discussion; and
- Written correspondence from relevant Traditional Owner supporting the final land use prior to implementation of the Closure Execution Plan.

6.5 Adaptive management

The principles of adaptive management, a systematic process for incrementally improving management practices by learning from the outcomes of past and current practices, can be applied to closure. If applied rigorously, it may reduce risk where there is uncertainty about closure outcomes and achieving closure criteria. The NT EPA Guidance on Adaptive Management (2018) states that:

'adaptive management involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, carefully selecting and implementing one or more of these alternatives in a timely way, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions. Management procedures are changed in steps until monitoring shows that the desired outcome is obtained'.

This description closely aligns with the closure pathway described in section 6.1. Exploring alternative ways or options to achieve the closure objectives is achieved though the **studies** process, that defines and refines these options based on the current knowledge base. However, during the implementation of the closure **actions**, the collection of monitoring data on environmental **receptors** may deliver results that trigger a change in the closure actions. Alternatively, demolition actions may uncover new information on contamination **sources,** for example areas that could not be tested due to access restrictions, such as higher levels of soil contamination or new potential exposure **pathways**. This new knowledge needs to be evaluated, and effectively integrated though adaption management to implement an evidence-based post closure monitoring programme and amend closure criteria and indicators. This interaction between the operational monitoring of closure **actions** and the post closure monitoring of final landform **performance** can be adaptive.

Table 17 is the adaptive management plan for the progression of all functional areas to the post closure monitoring to evaluate the performance of the final landform. It establishes a clear management objective, the relevant functional area, the performance parameters, trigger criteria, actions, and responses to ensure that all information that can be used to improve closure outcomes is integrated and the risk of constructing a final landform that does not meet the closure objectives is mitigated. Noting Gove Operations is in the process of revising the current Water Monitoring Plan, to better reflect the environmental risk profile following closure of the refinery and future closure actions. It is to be replaced by specific monitoring plans for surface water, groundwater, and marine.

Table 17. Adaptive Management Plan

Management Objective	Functional Area	Operational Monitoring Plan	Performance Parameters	Trigger Criteria	Action	Response
The final landform is 'stable' and surface water runoff is not causing unacceptable environmental harm to the surrounding marine environment.	Refinery RDA	Marine Water Monitoring Plan (to be prepared and implemented in 2020) - plan to detect any discharges that may cause environmental harm to marine environment. - Sampling intensity at least: 12 sites for RDA; and 6 Refinery.	Marine Water Quality Indicators listed in **Table 11**.	**Acceptable** No exceedances of parameters listed in **Table 11** for at least 2 wet seasons.	- On completion of all closure actions within the functional area commence post closure monitoring programme for **Marine Water Quality Indictors**	- Submit application for Certificate of Closure on completion of post closure monitoring.
				Trigger One monitoring site exceeds any parameters listed in **Table 11** for two consecutive sampling events for a functional area.	- Review all water monitoring data and erosion assessment data to identify source of contamination - Review rainfall and creek flow data, determine if erosion is linked to a flood event - If necessary, increase frequency of monitoring	- Continue monitoring until acceptable trigger criteria is achieved; or - Review 2 years of monitoring data to support revision of values in **Table 11**.
				Threshold Three monitoring sites at 2 monitoring locations exceed any indicator parameter listed in **Table 11** for two consecutive sampling events for a functional area.	- Instigate external reporting - Identify source of contamination - Assess requirement and options for new maintenance works - Undertake new works as required	- Complete new or maintenance works and continue monitoring until acceptable trigger criteria is achieved.
The final landform is 'stable' and sediment losses are not causing unacceptable environmental harm to the	RDA	Surface Water Monitoring Plan (to be prepared and implemented in 2020) - plan to detect any unacceptable sediment loss from closure domains.	Performance parameters include: - Total annual sediment losses (t/ha/yr)	**Acceptable** - Erosion rate at all monitoring sites meets the acceptable indicator value of less than 10 t/ha/yr	- On completion of all closure actions within the functional area commence post closure monitoring programme for **Erosion Rates Indictors**	- Submit application for Certificate of Closure on completion of post closure monitoring.

Management Objective	Functional Area	Operational Monitoring Plan	Performance Parameters	Trigger Criteria	Action	Response
surrounding marine environment.		- sampling intensity at least 3 RDA sites located at: Northern Outlet Drain (S1092) (catchment capped area) Duck Pond - (catchment Northern Ponds) New location for S1100 - (catchment liquor ponds) - Measure actual flow rates, continual sampling for turbidity and pH, and samples tested for TSS and metal(loid)s parameters for wet season flow events. - Lidar data verification	representing runoff from defined catchments	- Average vegetation coverage is greater than 70%		
				Trigger - Erosion rate at individual monitoring site exceeding the acceptable indicator value - Vegetation coverage less than 70%	- Review rainfall and creek flow data, determine if erosion is linked to a flood event - If necessary, increase frequency of erosion monitoring to quarterly at sites identified to have increased erosion severity - Assess whether erosion continuing or accelerating through comparison over multiple inspections	- Continue monitoring until acceptable trigger criteria is achieved; or - Review 2 years of monitoring data to support revision of values
				Threshold - All monitoring sites exceed the acceptable indicator value. - Vegetation coverage less than 70% and active erosion	- Instigate external reporting in accordance with MMP. - Assess requirement and options for remedial works - Undertake rehabilitation works as required	- Continue monitoring until acceptable trigger criteria is achieved.
Construction of final landform is not causing unacceptable environmental harm to the surrounding marine habitat.	Refinery	Marine Water Monitoring Plan (to be prepared and implemented in 2020) - Plan to detect any significant residual impact on oysters. - Current sampling intensity	Oyster indicators listed in **Table 13**.	**Acceptable** Observed trajectory towards reference site as listed in **Table 12**.	- On completion of all closure actions within the functional area commence post closure monitoring programme for **Oyster Indicators.**	- Submit application for Certificate of Closure on completion of post closure monitoring.
				Trigger Harbour Islet site exceeds values listed in **Table 12** for two consecutive sampling events.	- Review all water monitoring data to identify potential source of contamination - Review rainfall data, to determine if water quality impacted by stormwater runoff	- Continue monitoring until acceptable trigger criteria is achieved; or - Review 2 years of monitoring data

Management Objective	Functional Area	Operational Monitoring Plan	Performance Parameters	Trigger Criteria	Action	Response
					- Assess potential impacts associated with activities in Gove Harbour.	to support revision of values
				Threshold Harbour Islet site exceeds parameters listed in **Table 12** for three consecutive sampling events.	- Instigate external reporting - Identify source of contamination - Assess requirement and options for new maintenance works - Undertake new works as required	- Continue monitoring until acceptable trigger criteria is achieved.
The final land form is 'non-polluting' and contaminated ground water is effectively extracted or contained and is not causing unacceptable environmental harm to the surrounding native vegetation, groundwater resources, or marine environment.	RDA Refinery Mine	Groundwater Monitoring Plan (to be prepared and implemented in 2020) - Plan to detect impact on groundwater and the effective interception of contamination.	All parameters listed in **Table 14.**	**Acceptable** - All bores in one monitoring zone demonstrates increasing trends toward the indicator value for both wet and dry season sampling events.	- On completion of all closure actions within the functional area commence post closure monitoring programme for **Groundwater Indictors** - Complete contaminated site audit	- Submit application for Certificate of Closure on completion of post closure monitoring. - Remove groundwater bores and seepage trenches, where no longer required. - Ongoing management of groundwater bores in Post-relinquishment Management Areas.
				Trigger - More than 25% of bores in one monitoring zone demonstrates increasing trends toward the indicator values in both wet	- Review groundwater model to determine the trajectory of monitoring data, where available - Review metal(loid) parameters - Review any existing contaminated groundwater recovery systems.	- Continue monitoring until acceptable trigger criteria is achieved; or - Review 2 years of monitoring data

Management Objective	Functional Area	Operational Monitoring Plan	Performance Parameters	Trigger Criteria	Action	Response
				and dry season sampling events.		to support revision of values
				Threshold - More than 25% of bores in one monitoring zone exceed the indicator value in both wet and dry season sampling events	- Instigate external reporting - Assess requirement and options for contaminated ground water recovery systems - Undertake remedial works as required	- Continue monitoring until acceptable trigger criteria is achieved.
The final land form is 'non-polluting' and soil is not contaminated and is not causing unacceptable environmental harm to the surrounding native vegetation and marine environment.	Refinery	Soil Monitoring Plan (to be prepared in 2022) - Plan to detect and measure soil contamination levels.	Parameter as listed in **Table 15**.	**Acceptable** - All monitoring sites attain values in **Table 15**.	- On completion of all closure actions within the functional area commence post closure monitoring programme for **Soil Quality Indictors** - Complete contaminated site audit	- Submit application for Certificate of Closure on completion of post closure monitoring. - Third Party Certification – contamination
				Trigger - More than 25% of monitoring sites within a domain exceeding the values in **Table 15** for one monitoring event.	- Complete inspection of capped areas and review erosion and vegetation monitoring data - If necessary, increase frequency and number of monitoring sites - Review post closure maintenance plans	- Continue monitoring until acceptable trigger criteria is achieved; or - Review 2 years of monitoring data to support revision of values
				Threshold - All monitoring sites within a domain are exceeding the values in **Table 15** one monitoring event.	- Instigate external reporting - Assess requirement and options for soil remediation works or repairs to capping liners - Undertake works as required	- Continue monitoring until acceptable trigger criteria is achieved.

Management Objective	Functional Area	Operational Monitoring Plan	Performance Parameters	Trigger Criteria	Action	Response
Able to sustain an agreed final land use: Vegetation community established is effectively controlling erosion and provides potential habitat for native flora and fauna.	Mine RDA Refinery	Rehabilitation monitoring for each functional area and / or closure sub domains.	Parameter as listed in **Table 16**.	**Acceptable** - All monitoring sites demonstrate trajectory in **Table 16**.	- Progressive rehabilitation of functional area, all rehabilitation monitoring demonstrates attainment of rehabilitation completion criteria and **Vegetation Indictors**. - On completion of all rehabilitation monitoring commence post closure monitoring programme for **Vegetation Indictors.**	- Submit application for Certificate of Closure on completion of post closure monitoring.
				Trigger - More than 50% of monitoring sites are not on a trajectory towards the reference site or target for closure domain.	- Compare to reference site - Review climate data, determine if performance is linked to a climatic event - If necessary, increase frequency of monitoring to annually - Review relevant rehabilitation plans	- Continue monitoring until acceptable trigger criteria is achieved; or - Review 2 years of monitoring data to support revision of values
				Threshold - All monitoring sites are not on a trajectory towards the reference site or target for closure domain.	- Instigate external reporting - Assess requirement and options for rehabilitation works - Undertake maintenance works as required	- Continue monitoring until acceptable trigger criteria is achieved.

6.6 Post Closure Planning

6.6.1 Monitoring

Post closure monitoring programmes will demonstrate that the agreed final landform is safe, stable, and non-polluting. This evidence base will demonstrate attainment of the closure criteria within the MMP and support the Certificate of Closure application. The timeframe for completion of post closure monitoring is beyond the timeframe of this MMP.

Post closure monitoring plans are to be prepared to specifically measure the environmental performance of the final landforms by measuring the agreed closure indicators to ensure:

- Protection of the receiving marine environments and surrounding vegetation;
- Remediation of groundwater and soil; and
- Establishment of native or target vegetation community.

6.6.2 Maintenance

On completion of the Closure Execution Plan Rio Tinto will implement a post closure maintenance plan. The purpose of the plan is to:

- Ensure the integrity of the final landform prior to relinquishment;
- Identify potential final landform and waste containment failures;
- Ensure control measures, to manage access, contamination sources, surface water flows, remain functional;
- Maintain long term monitoring equipment and collect and store data; and
- Define legal process for approved budget and resourcing.

6.7 Partial Relinquishment Process

In circumstances where Gove Operations has attained the closure criteria for a parcel of land, prior to being in a position to apply for a Certificate of Closure for the whole site, Gove Operations may wish to apply for such parcel to be removed from the scope of the Authorisation and SML11 lease area. The relinquishment process will include:

- Gove Operations identifying the parcel of land it wishes to yield up and provide to DPIR:
    - Evidence in the form of indicators that the relevant closure criteria have been attained; or
    - Alternatively, agreement from the future custodians of the land that they were satisfied with the condition of the land.
- Gove Operations applying for a partial surrender of the identified parcel of land from SML11 lease area.
- Gove Operations and DPIR entering into written agreement recognising the partial surrender of the lease and release of that land from the Authorisation and the MM Act.

The balance of the land in the SML11 would remain subject to the Authorisation and the MM Act.

7. Post Relinquishment

RTA Gove will continue to manage the Post-relinquishment Management Areas, to ensure their integrity of infrastructure and encapsulation of waste in the long term.

8. Security Estimate

8.1 Closure Domains

Table 18 presents the closure domains for Gove Operations, as of 31 December 2018, they are the basis for the security estimate calculation. The rehabilitated area has increased by 510ha, and the remaining disturbed area decreased by 687ha due to progressive rehabilitation and refinement of mapping closure domains, from the areas used to calculate the 2014 closure cost estimate. Update on the rehabilitation progress and area will be provided within the Annual Environmental Mining Report, described in **Section 9.2**.

Table 18. Closure Domains as at end of 2018

Closure Domain	Total Area (ha)	Total Disturbed Area (ha)	Rehabilitated Area (ha)	Remaining Disturbed (ha)	Remaining Undisturbed (ha)	Status
Mine	20,018.0	5,143.6	3,474.8	1,668.8	14,874.4	Operational
Conveyor	282.5	84.6	0.0	84.6	197.9	Operational
Port	26.3	13.3	0.0	13.3	13.1	Operational
Refinery	199.3	161.2	0.0	161.2	38.1	In closure (includes some operational areas)
RDA	2050	963.3	177.5	785.8	1,086.7	In closure
Total	**22,576.1**	**6365.9**	**3652.3**	**2,713.6**	**16,210.2**	

8.2 Closure cost estimate

The cost estimate for Gove Operations closure, is based on the status of disturbance as at 31 December 2018.The closure cost estimate is calculated using the NT Government security estimate calculation tool template. The closure costs used to populate the calculation tool have been sourced from specific closure studies.

8.3 Security bond

Gove Operations are required to lodge a Security with DPIR under the MM Act.

In recognition of this MMP covering a 12 year period to create certainty as to RTA Gove's closure obligations, the parties have negotiated and entered into an Adjustment and Closure Deed to record details of the security changes over the term of this MMP as closure works are progressively undertaken.

The Security to be lodged with DPIR as security for these closure costs is, **AU$ 974,231,600.**

9. Reporting

9.1.1 Reporting requirements

To comply with the conditions of the MMP and WDL, the following reports are prepared:

- Water Monitoring Plan report submitted annually to DENR reporting the performance of managing surface water (including wastewater discharge across the refinery and RDA), groundwater quality and marine health monitoring under WDL. The annual reporting period is from 1 April to 31 March;
- Annual Return is the annual audit compliance report submitted to DENR reporting on compliance against WDL;
- Environmental Mining Report submitted annually to DPIR to report performance against this MMP for each calendar year, it is to be submitted before 30 June each year.

- Gove Operations produce a triennial review of the health and performance of the bore field. In response to the significant reduction in groundwater extraction (62% reduction) since closure of the refinery, the review period has been extended to 5-years, the next review is due in 2020.
- Annual reporting for National Pollutant Inventory (NPI) and National Greenhouse and Energy Reporting (NGER) under the *National Greenhouse and Energy Reporting Act 2007.*

Gove Operations also completes the Rio Tinto Social and Environmental (S&E) Surveys on an annual basis. This report assesses the performance of the Business Unit in terms of social performances, resources use, air emissions, land clearance and rehabilitation, biodiversity management and waste production. Rio Tinto uses information from the S&E Surveys in the development of the annual sustainability report.

9.1.2 Incident reporting

All incidents are managed according to the Gove Operations Incident and Action Management Procedure (GPM-EHS-020). This document sets requirements for managing all HSE and Community incidents at Gove operations site. The aim is to:

- define the reporting criteria and process for investigating and communicating incidents;
- ensure uniformity and consistency of the investigation and root cause analysis process; and
- ensure corrective and preventive actions are managed appropriately, including evaluation of effectiveness.

Gove Operations uses the Rio Tinto Business Solution (RTBS) to report incidents, identified hazards, near misses, inspections, audits, emergency exercises, complaints or requests from external parties. Incidents reported in RTBS are accessible to site personnel and reminders are sent to relevant personnel and their supervisors until corrective actions have been completed and reported.

9.2 Environmental Mining Report

An Environmental Mining Report is to be submitted annually to DPIR to report performance against MMP for each calendar year, it is to be submitted before 30 June each year. The Report will include:

- Annual highlights - community updates, bauxite mining production metrics, and summary of environmental performance.
- Closure programme summary – updates on closure studies and projects by functional area.
- Commitments tracking – current status of previous MMP commitments, EPBC referrals, Notice of Intent, or MMP amendments.
- Environmental Protection Management Systems performance – summary of compliance status and non-conformance information by EPMS, water monitoring data will include a full wet season summary, to align with the reporting to DENR.
- Spatial data on the extent of rehabilitation and closure domains.

MINE PRODUCTION

10. General Description

The bauxite mine is situated on an extensive series of plateaus located on the eastern side of the Gove Peninsula within SML11. The plateaus are 60 to 80 m above sea level, and extend from the east to the central areas of the peninsula. This large plateau region is defined by three main plateaus, namely the *Main Plateau*, *Eldo Plateau* and *Rocky Bay Plateau.*

Both the *Main* and *Rocky Bay Plateaus* have been actively mined, with mining at *Eldo Plateau* scheduled to commence in the coming years. Mining operations are undertaken 24 hours a day, seven days a week. The current mining rate is approximately 13 Million dry tonnes (Mdt) of bauxite per year, with opportunity to increase this if market and business demand exist. At this mining rate, there are sufficient reserves available within the existing leases to continue mining for approximately ten years (to 2029). A detailed description of the mining processes is provided in the following sub sections.

10.1 Mine Production Functional Area

Mine production functional area is approx. 20,426ha and contains the following closure domains listed in **Table 19.**

Table 19. Mine Production Functional Area Closure Domains

Domain	Domain No	Area Description	Domain Classification	Domain Area
Mine	M3a	Ore Body - Main	Exploration	677.7
Mine	M3b	Ore Body -Rocky Bay	Exploration	41.3
Mine	M3c	Ore Body - Eldo	Exploration	816.8
Mine	M13a	Mine Laterite Pits -Main	Extractive	20.8
Mine	M4	Gove Airport	Infrastructure	156.5
Mine	M5	Non RT Public Infrastructure	Infrastructure	115.3
Mine	M6a	Mine Infrastructure	Infrastructure	81.7
Mine	MH6	Crusher area	Infrastructure	7.7
Mine	M8a	Plateau Balance - Main	Lease Balance	2,153.2
Mine	M8b	Plateau Balance - Rocky Bay	Lease Balance	740.7
Mine	M8c	Plateau Balance - Eldo	Lease Balance	754.1
Mine	M11	Mine Lease Balance - off plateau	Lease Balance	8,689.9
Mine	M1a	Mining in Progress -Main Plateau	Pits	706.0
Mine	M1b	Mining in Progress - Rocky Bay	Pits	50.6
Mine	M2a	Cleared Mine Land - Main	Pits	800.9
Mine	M2b	Cleared Mine Land - Rocky Bay	Pits	151.0
Mine	M2c	Cleared Mine Land - Eldo	Pits	194.0
Mine	M7a	Mine Rehab -Main	Post Closure	3,257.7
Mine	M7b	Mine Rehab -Rocky Bay	Post Closure	213.5
Mine	M10a	Mine Haul Road -Main	Roads	233.5
Mine	M10b	Mine Haul Roads -Rocky Bay	Roads	13.1
Mine	M9a	Mine Landfill sites	Stockpiles & Dumps	6.3
Mine	M9b	Mine Tyre Dumps	Stockpiles & Dumps	6.7
Mine	M12a	Mine Topsoil Stockpiles -Main	Stockpiles & Dumps	110.9
Mine	M12b	Mine Topsoil Stockpiles -Rocky Bay	Stockpiles & Dumps	18.0
Mine sub total				20,018.0
Conveyor	MH4	Remnant vegetation	Area Balance	154.9
Conveyor	MH1	Conveyor Corridor	Infrastructure	83.1

Domain	Domain No	Area Description	Domain Classification	Domain Area
Conveyor	MH5	RT Nursery	Infrastructure	0.5
Conveyor	MH7	Workshop	Infrastructure	1.0
Conveyor sub total				239.5
Refinery	R2	Light Fuel Tank Farm	Infrastructure	2.5
Refinery	R4	Oily Water Facility	Infrastructure	1.2
Refinery	R5	Office Complex	Infrastructure	4.4
Refinery	R9	Seawater Channel	Infrastructure	1.1
Refinery	MH6	Export Conveyor and Pipelines	Infrastructure	19.9
Refinery	R13	Foreshore West/east	Infrastructure	5.8
Refinery	R14	Northern Beach	Infrastructure	1.3
Refinery	R16	Seawater Intake	Infrastructure	10.0
Refinery	R18	Mt Gorton & Sewage Plant	Infrastructure	1.7
Refinery	R20	Waste Water Neutralisation Plant	Infrastructure	0.6
Refinery	MH1	Conveyor Corridor - in refinery lease	Infrastructure	0.9
Refinery	MH2	Bauxite Stockpiles in refinery	Infrastructure	17.6
Refinery	MH3	Conveyor Laydown in refinery	Infrastructure	1.1
Refinery	P3	Port Office and Hydrate Shed	Infrastructure	2.9
Refinery	R17	Remnant vegetation	Lease Balance	38.1
Refinery	R15	Melville Bay Road	Roads	7.5
Refinery sub total				116.6
Port	P1	Export Wharf	Infrastructure	12.7
Port	P2	Cargo Wharf and Foreshore Road	Infrastructure	13.6
Port sub total				26.3

10.2 Environment

10.2.1 Geology and soils

The Mullaman Beds formation unevenly overlies the Bradshaw Complex, predominantly in the central and western parts of the Gove Peninsula, as a sequence of near horizontal sedimentary rocks up to 200m in thickness. These sediments are of Lower Cretaceous age and typically consist of arkosic medium-grained sandstone; some fine to coarse-grained sandstone; massive claystone and siltstone (Geoscience Australia).

The Mullaman Beds Formation were formed in high-energy fluvial and foreshore to shallow marine depositional environments in the paleo-valley of the Bradshaw Complex. The deposits are widespread along the western Gulf of Carpentaria, but on the Gove Peninsula, predominantly occur within a basin structure with lateral limits approximately the same as the bauxite-capped plateau (at the mine). The Mullaman Beds do not underlie operational areas of the refinery sites. It should be noted that the 'Mullaman Beds Formation' has been officially renamed by the Yirrkala Creek (upper part) and Walker Creek (lower part) Formations (Geoscience Australia).

Predominantly within the area of MLN955, laterite and bauxite overlie Cretaceous Mullaman Beds, and in some regions, subcrops of the Bradshaw Complex. The laterite has formed from typical laterisation processes common in tropical, wet environments where chemical weathering leaches a permeable aluminous parent material to produce the in-situ deposit. Erosional processes are likely to have redistributed some of the bauxite to areas of lower elevation where thickness can reach up to 10m. Average thickness of the mining horizon is approximately 3.5m. The fully developed laterisation profile, which encompasses the Gove operations bauxite deposit, is described in **Table 20**.

Table 20. Laterite Profile Beneath the Gove Operations Mine Area Plateau

Description		Thickness (m)
Topsoil	Loose Sand, gravely in part, contains organic debris.	Up to 2
Zone of Enrichment	Loose pisolitic bauxite. Cemented pisolitic bauxite. Tubular bauxite, partly cemented. Nodular bauxite, partly cemented. Pseudo-conglomeratic laterite, partly cemented.	Up to 10 Up to 3 Up to 2 Up to 3
Mottled Zone	Clay, mottled white and red, weakly cemented patches, may contain sandy zones.	Up to 3
Leached or Pallid Zone	Clay, white, grading downwards into weathered parent rock.	Up to 5

Unconsolidated Quaternary aged sediments form surficial deposits along coastal fringes and drainage features of the Gove Peninsula, and where present are the uppermost geological unit. These materials are listed and briefly described in **Table 21.**

Table 21. Description of Surficial Deposits

Type of Deposit	Associated Geomorphological Unit	Description
Dune	Coastal Fringe	Quartz and/or calcium carbonate sands.
Beach	Coastal Fringe	Quartz and/or calcium carbonate sands, some shingle.
Beach rock	Coastal Fringe	Calcareous sandstone and conglomerate.
Swamps	Coastal Fringe	Mainly mud, sandy in places. Support mangrove vegetation.
Alluvium	Drainage depressions on slopes of intermediate level.	Sand with some pisolitic gravel.

10.2.2 Surface Water Catchments

The Yirrkala Creek catchment flows to the northeast into Gunyapinya Swamp before discharging to the coastline north of Yirrkala. Shady Tree Creek is ephemeral and flows east from the mine area into the dune deposits of Rocky Bay or into Rocky Bay Creek that lies at the eastern end of Rocky Bay.

The Latram River catchment lies south and west of the mine and drains in an overall northwest direction, into the head of Melville Bay. Latram River provides important community recreation areas, aquatic ecosystem habitats and riparian areas. The conveyor corridor crosses numerous small creek beds, which mostly flow into the North River catchment.

10.2.3 Groundwater

The geology of the mined plateau consists of fluviatile sands and gravels (The Mullaman Beds) overlying an undulating granite basement (Bradshaw Granite), with a thin cap of bauxite and laterite covering the parent rock sequence at the surface.

The Mullaman Beds sequence forms the primary groundwater aquifer beneath the plateau and is used to supply potable water via 19 production bores. The following four units have been identified within the Mullaman Beds, based on geophysical logging of boreholes:

- Unit A – bauxite/laterite/sub-clay;
- Unit B – feldspathic to clayey sandstone;
- Unit C – clean quartzose sandstone, with shales and claystones at depth; and
- Unit D – interbedded sequence of sandstones, claystones and carbonaceous bands. Some cemented zones occur and pyritic nodules are common.

The borefield extracts groundwater for potable purposes from Unit C which is considered to be the best, highest yielding portion of the aquifer.

11. Mining Reserves and Plan

11.1 Reserves

Ore reserves and mineral resources are reported publicly in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, December 2004 (the JORC Code) as required by the Australian Securities Exchange (ASX). Ore Reserve information in the table below is based on information compiled by Rio Tinto appointed Competent Persons (as defined by the JORC Code). A Competent Person must have a minimum of five years relevant estimation experience, and is a member of a recognised professional body whose members are bound by a professional code of ethics.

Table 22 outlines the Ore Reserve estimates as of 31 December 2018 and summary data for year end 2017 are shown for comparison. The ore reserve figures are taken from the Rio Tinto 2018 public annual report. Metric units are used throughout. The figures used to calculate Rio Tinto's share of reserves are often more precise than the rounded numbers shown in the tables, hence small differences might result if the calculations are repeated using the tabulated figures.

Table 22. Gove Operations Mineral Resources and Reserves (2018)

	Proved Ore Reserves		Probable Ore Reserves		Total Ore Reserves		Rio Tinto Share Marketable Product
	Mdt	Al_2O_3 (%)	Mdt	Al_2O_3 (%)	Mdt	Al_2O_3 (%)	Mdt
Reserves at 31 December 2017	143.0	49.4	4.0	49.3	147.0	49.4	147.0
Reserves at 31 December 2018	137.9	49.25	3.8	49.48	141.70	49.26	141.7

11.2 Five year Mine Plan

The Five Year Mine Plan is the site plan that sets the basis for Gove mine operations to meet the customer requirements in terms of the quality for the next five years. This is generally a more detailed mine plan to provide clear guidance to operations on areas to mine on a quarterly / annual basis and project work necessary to deliver on this plan. **Figure 7** and **Table 24** in following section details the mine plan for 2019-2023.

Based on the current version of the Five Year Mine Plan, the annual bauxite mined from Gove is planned to increase from 13.0Mdt in 2019, to 13.3Mdt by 2022. Annual bauxite mining is currently planned to be sustained at this level for the remainder of the mine life. To deliver the Five Year Mine Plan, the following activities will be required.

11.2.1 Eldo Plateau Mining

Mining from Eldo Plateau is scheduled to commence in 2021. Eldo Plateau is immediately south of the Main Plateau, and is the only un-mined plateau on the Gove lease. The following activities will be required to support the commencement of mining and are listed below:

- Construction of a haul road and river crossing from the existing haul road network on the Main Plateau, across the Latram River, and onto the Eldo Plateau mining areas.
- A section of the Daliwuy Bay Road (public access road), may require re-location, as it currently traverses the planned mining area on Eldo Plateau. Throughout the planning and mining process, access will always be available to areas serviced by Daliwuy Bay Road.

Appropriate environmental, cultural heritage, community consultation and regulatory approvals will be conducted as part of the above activities, where required.

11.2.2 Main Plateau Mining

Mining will continue over the next five years on the main plateau and the following activities will be required to support the ongoing mining operations;

- Appropriate consultation with the key stakeholder groups will be conducted to enable both mining and ongoing operation in close proximity / adjacent of the Gove Airport and Bureau of Meteorology.
- Future mining activities within the Gove Gun Club firing range exclusion area will also require appropriate community consultation to enable mining activities in this area.
- Planned drilling activities south of Yirrkala Township and east of Galpu Road. Throughout the planned drill program, access and services will be maintained to Yirrkala Township and the surrounding areas.

11.2.3 Rocky Bay Plateau Mining

Rock Bay plateau mining is planned to recommence in 2022. The will be no major activities to recommence mining in this area apart from road repairs prior to hauling.

11.3 Life of Mine Plan (LOM)

The Life of Mine Plan (LOM) is the longer strategic looking plan that looks beyond the five year timeframe to the expected end of mine life. This is driven externally from the corporate leaders to ensure we get the best value from the operation over the longer term.

Following commencement of mining from Eldo Plateau, mining from the three plateaus will continue for the remainder of the mine life at a rate of 13.3Mdt per annum (from 2023 onwards). The LOM is presented in **Figure 8** and a summary of the current LOM schedule is outlined in **Table 23**.

As the mine operations are now entering within the ten year timeframe of closure, the Rio Tinto Closure Standard requires closure studies for operations that are ten years from closure to be undertaken, an Order of Magnitude Study for the mine production has commenced. To deliver the Life of Mine Plan (LOM), the following activities will be required:

- Multiple sections of Dhupuma Road (public access road), may require re-location, as it currently traverses the planned mining areas on both the *Main* and *Eldo Plateaus*. Appropriate community consultation, environmental, cultural heritage and regulatory approvals will be conducted as part of the road re-location planning process. Throughout the planning and mining process, access will always be available to areas serviced by Dhupuma Road.
- Multiple haul road crossing locations across Dhupuma Road (public access road), may be required, as it currently restricts access to planned mining areas on both the *Main* and *Eldo Plateaus*. Appropriate community consultation and regulatory approvals will be conducted as part of the road crossing planning process. Throughout the planning and mining process, access will always be available to areas serviced by Dhupuma Road.
- Mining activities south of Yirrkala Township and east of Galpu Road. Throughout the planned mining activities, access and services will be maintained to Yirrkala Township and the surrounding areas.

- There is ongoing project work to review the bauxite resources within the greater Gove mining area, with a focus on increasing the Gove Reserve. This includes all bauxite resources currently excluded from the mining reserve due to environmental or cultural heritage restriction. Through appropriate consultation processes with the various stakeholder groups (environment, community, cultural heritage, etc) these excluded bauxite Resources may be approved for mining. This may extend the current Gove mine life beyond 2029.

Table 23. Gove Operations Life of Mine Schedule

Areas to Be Mined	Unit	2023	2024	2025	2026	2027	2028	2029
Main Plateau	ha	124	85	111	157	179	161	146
Rocky Bay Plateau	ha	20	22	26	27	30	33	20
Eldo Plateau	ha	100	105	140	142	143	134	133
Totals	ha	244	212	277	326	352	328	299

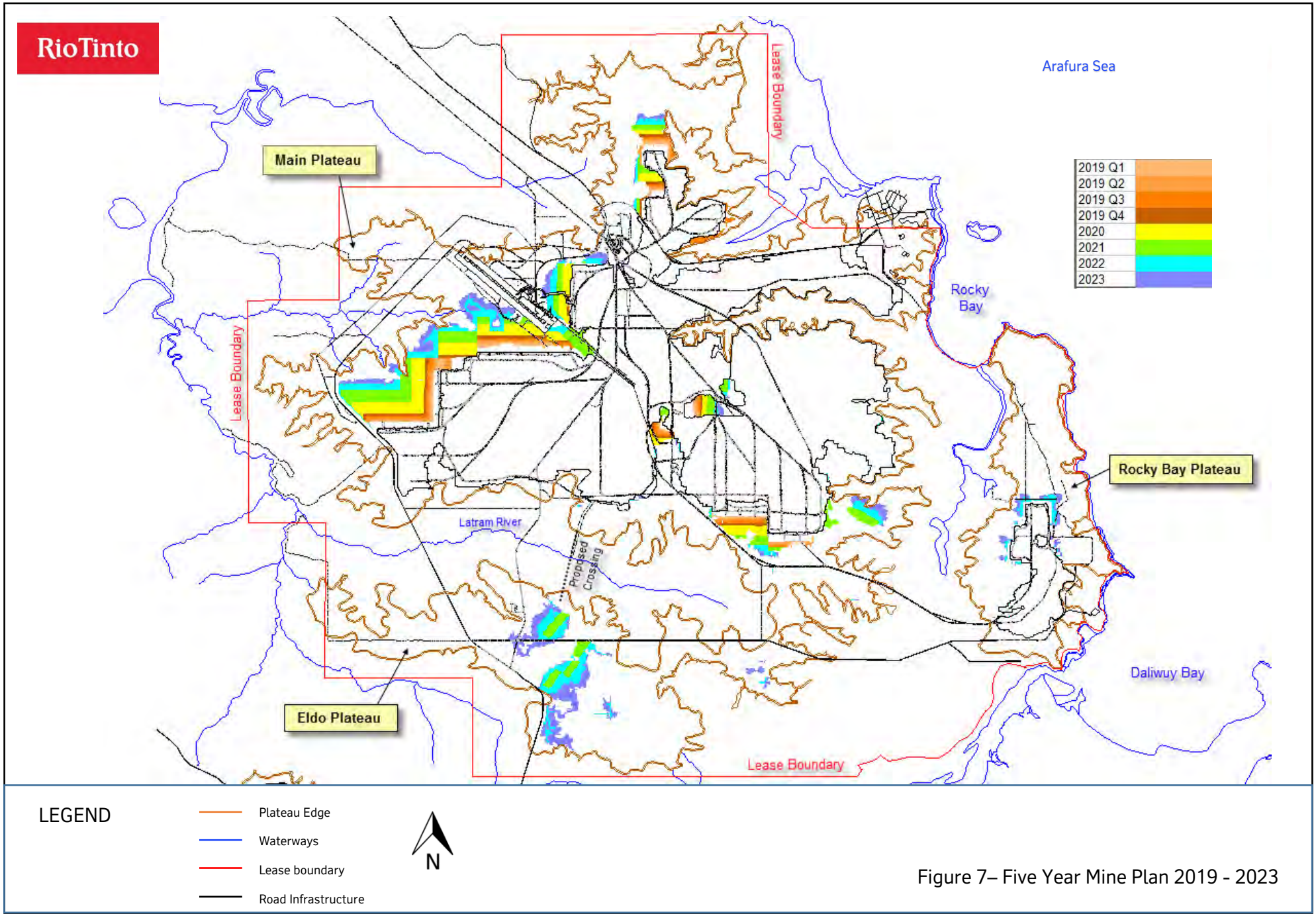


Figure 7– Five Year Mine Plan 2019 - 2023

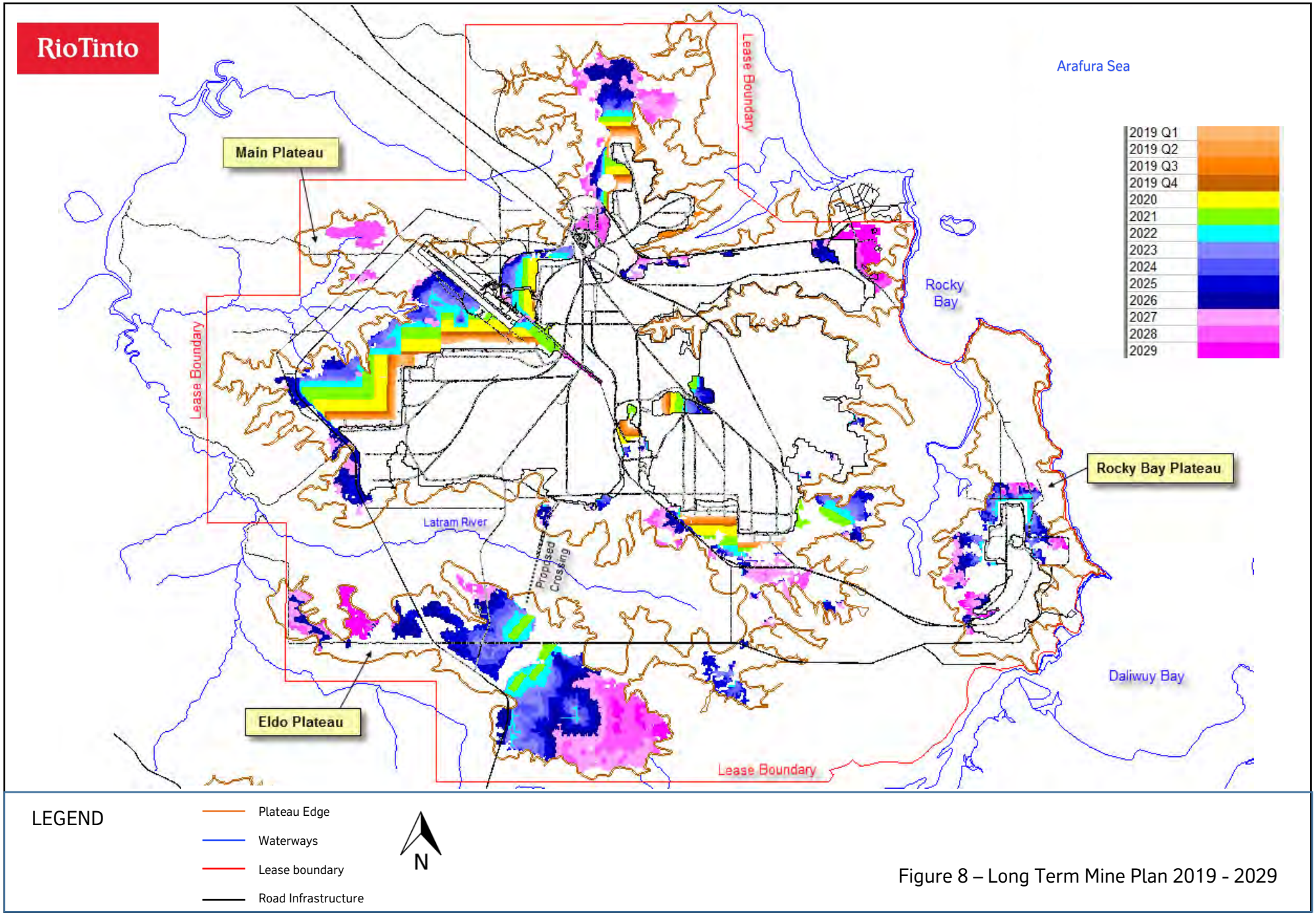


Figure 8 – Long Term Mine Plan 2019 - 2029

12. Authorised Activities - Mining

The bauxite mining operations use conventional open cut techniques that can be categorised into a number of key activity units:

- exploration and control drilling;
- timber clearing;
- overburden removal and placement;
- ore breakage/ripping;
- ore loading and haulage;
- landscaping; and
- ancillary activities such as road construction, pit services, dust suppression, mine workshop/equipment maintenance.

Details of each of these activities is provided in the sections below. **Table 24** summarises the mining performance metrics derived from the five year mine plan.

Table 24. Planned Mining Performance 2019-2023

			2019	2020	2021	2022	2023
	DESCRIPTION	UNIT	PLAN	PLAN	PLAN	PLAN	PLAN
CONTROL DRILLING	DRILL HOLES	each	1,200	300	300	300	300
	DRILL METERS	m	6,000	1,500	1,500	1,500	1,500
MINE PRODUCTION QUANTITIES	AREA TIMBER CLEARED	ha	75	136	145	214	266
	AREA MINED	ha	201	178	228	225	244
	OVERBURDEN THICKNESS (AVG)	m	0.27	0.29	0.26	0.36	0.44
	BAUXITE THICKNESS (AVG)	m	4.1	4.3	3.4	3.4	3.1
WASTE REMOVAL	OVERBURDEN REMOVED	Mt	0.7	0.7	0.9	1.2	1.4
MINING & HAULAGE	ORE RIPPED	Mdt	13.0	13.1	13.2	13.3	13.3
	ORE MINED AND HAULED	Mdt	16.9	17.03	17.16	17.29	17.29
	ORE CRUSHED	Mdt	13.0	13.1	13.2	13.3	13.3
	ORE GRADE - SILICA	%	5.0	5.0	5.5	6.0	6.5
	ORE GRADE - ALUMINA	%	49.0	48.8	48.4	49.0	49.2

12.1 Control Drilling

Although no major exploration activities are planned for the next 5 years, a current review to identify any gaps in the resource definition programme may require small drilling campaigns over the next few years.

12.2 Timber Clearing

Timber clearing is conducted approximately 3-5 years in advance of mining operations. Field studies over the years have confirmed that most tree species do not return within the freshly spread topsoil, partly due to species producing seed on a biennial or triennial basis. By clearing in advance it has been found to provide sufficient time for the damaged plant propagules and soil organisms to regenerate prior to the removal and replacement of overburden.

Timber clearing is generally performed during the dry season when soil moisture levels are low to prevent damage to plant propagules soil and soil organisms through compaction. Timber clearing occurs through the use of a heavy chain linking two D11 dozers. Once timber has been felled, it is raked into windrows and burnt. The timber is burnt to reduce the logs down to a manageable size to prevent damage to the equipment during overburden removal in the future. In some areas the timber maybe salvaged for mulching for use in rehabilitation within the refinery and RDA. Gove operations and the Gumatj Aboriginal Corporation have entered into an agreement whereby timber can be harvested from areas within the SML11 by the Gumatj to be processed at their saw mill.

12.3 Interference with waterways

Mining activities are located on the bauxite plateau and there is little or no interference with major waterways.

To allow access for mining activities haul roads are constructed to cross waterways. There are currently three waterway crossings: Rocky Bay Creek, Shady Tree Creek, Upper Latram (old Bulman Track Crossing), and the crossing along the current public road to Katherine. All culverts, bridges and storm water drainage works required are designed and constructed to engineering standards.

Mining activities that are expected to interfere with waterways, include the construction of a haul road crossing of Latram River for mining of Eldo plateau (location indicated in **Figure 7**), as described in **Section 10.2.1**, and potentially altering the flow of water from the plateau areas into the surrounding waterways.

12.4 Overburden Removal & Placement

The operations remove overburden to expose the ore body for mining and to prevent ore dilution. Forward planning is necessary to ensure the efficient use of machinery and prevent the double handling and unnecessary placement of soils in achieving rehabilitation objectives. For rehabilitation purposes, the mine operations have three categories of overburden, which are summarised in **Table 25**.

Table 25. Mine Overburden Categories

Overburden Category	Description
Topsoil Blend	The collection of both the A and B horizon (approx. 0-60 cm). This only occurs when the B horizon maintains a relatively stable soil structure that will not greatly inhibit vegetation development during rehabilitation.
Subsoil	Subsoils generally are the B-horizons (approx. 60cm - 100 cm) generally with a stronger redder colouration, fine textured, low in organic matter and nutrients and, as a result, is a poor medium for plant growth.
Red Soils	Red soils are considered deep subsoils up to 3 m and were formed by the deposition of eroded silty soil material in depressions that once formed lakes. These soils are extremely infertile and, as a result, are a poor medium for plant growth.

Soil removal is conducted by dozer, front end loader, and rear dump trucks. The majority of all overburden handling and placement generally occurs during the dry season where there is no possibility of soil damage or compaction through machinery trafficking. Typically, soils are

directly placed onto mined-out areas by rear dump truck at paddock dump spacing of 1m apart (toe from toe) to enable the creation of a soil profile approximately 0.4m deep.

12.5 Ore Breakage/Ripping

Once overburden is removed the ore body (bauxite) is ripped to an average depth of approximately 3.0m, the thickness of the ore, by dozers and pushed into mine face stockpiles. The method used to rip the bauxite horizon is to rip down a face angling at approximately 20 degrees. The ripping generally removes ore in a single diagonal slice (in the vertical sense). This ensures that the ripping crosses a number of lithologies of varying hardness.

The bauxite is then dozed into face stockpiles within about 10m of the ripped mine face. Ripping is restricted to the bauxite in order to minimise dilution. The site currently utilises a fleet of five Caterpillar D11 dozers for this activity. Ripping currently occurs within any of the current open faces on the Main plateau and Rocky Bay Plateau.

12.6 Loading and Haulage

12.6.1 Main Plateau

Ore from the mine face stockpiles is loaded by front end loader into rigid body haul trucks. Currently, the operations use three Caterpillar 992G and one Caterpillar 993K front-end loaders with 12.3m^3 buckets to load the haul trucks. The truck haulage fleet consists of eight 100 tonne class rear dump trucks (three Caterpillar 777 D's, one 777 F and four Caterpillar 777 G's). The ore is then carted to the crusher where it is tipped into the crusher hopper or stockpiled on the Run of Mine stockpile (ROM). Recently a by-pass circuit was installed to process screened materials from the mine area onto the overland system.

12.6.2 Rocky Bay

Rocky Bay activities are planned to recommence in 2022.Rocky bay haulage was conducted by a haulage contractor. Ore from the mine face stockpiles was loaded by front end loader into road trains. A fleet of road trains were used to cart the ore from Rocky Bay onto Hard Stand Stockpile where it was stockpiled. This material is then loaded on the mine fleet and tipped into the primary crusher. This ore can also be hauled by the main RTA haulage fleet as well.

12.6.3 Gulkula Mine

Gulkula Mining Company Pty Ltd (GMC) was formed on 15 November 2011 by the Traditional Owners of the land that includes the Dhupuma Plateau in North East Arnhem Land.

The Dhupuma Plateau Bauxite mine is located approximately 30km south by road from the Nhulunbuy Township on the Gove Peninsula.

GMC has an approved Exploration Agreement with the ALALT administered by the NLC over the Dhupuma Plateau Bauxite mine. GMC were granted an exploration licence in mid-2014 and was informed on 15 August 2016 by the NLC that the NLC has given its consent to the granting of a Mineral Lease (ML31025) to GMC at Dhupuma Plateau.

GMC have indicated that its mining operation will extract commercial value from mining bauxite over a period of 15 years and production will ramp up from 100,000 tonnes per annum (tpa) to 500,000 tpa over the first four years including an estimated disturbance of 35ha.

The Dhupuma Plateau Bauxite mine is a low impact, small scale bauxite mining operation as no bauxite is processed at the mine site.

GMC and Gove Operations entered into a bauxite purchase agreement in early 2018, where the ore mined from the Dhupuma Plateau Bauxite mine is sold to Gove Operations. Gove

Operations deliver the ore from the Dhupuma Plateau Bauxite mine to its stockpiles and thereafter crush, load, ship and on-sell.

Gove Operations engages a contractor to facilitate the transportation of the bauxite from the Dhupuma Plateau Bauxite mine site to the Rio Tinto hardstand stockpiles located on SML11.

Haulage occurs 7 days per week and consists of 40-80 trucking movements per day between 6am to 6pm.

Gove Operations works in consultation with the Department of Infrastructure, Planning and Logistics (DIPL) and the NLC to ensure compliance with relevant legislation in relation to hauling on a public road.

12.7 Landscaping

Landscaping is the term used to describe the flattening out of paddock dumped overburden on the mine floor to create an even topsoil cover layer of around 0.4m for rehabilitation purposes. The site uses Caterpillar D11 Dozers to conduct this work. Landscaping is generally performed throughout the dry season to minimise any impacts on soil quality.

12.8 Mine Worksop & Services

The mine workshop supports the fleet maintenance of the mining operations. The facilities consist of the following:

- mine workshop and offices;
- wash down facility;
- chemical storage shed;
- bulk oil facility;
- warehouse;
- HME fuel facility; and
- light vehicle fuel facility.

12.9 Mine Landfill

A review of options for the safe management of old heavy mobile equipment tyres and conveyor belts was undertaken in 2015. The findings from this review concluded that there are no viable recycling/reuse options for these items. Consistent with the non-mineral waste management plan, old tyres and conveyor belt will be buried within identified mine landfill sites. However, Gove Operations are committed to identifying viable recycling options, this practice will only continue until a practical alternative can be identified.

13. Authorised Activities - Processing

The bauxite materials handling system consists of: crushing circuit located at the mine end, overland conveyor, overland stockpiles, reclaimers, export conveying circuit, wharf infrastructure, and ship loader. Bauxite production is planned to continue to increase over the next few years of operation.

13.1 Crushing and screening

Bauxite ore is delivered from the mine in varying sizes (from fine particles up to 1m^3 rocks) to a centrally located crushing and screening plant. Ore is dumped either directly into two twin hoppers of 150 tonne capacity each or fed by a loader from the ROM.

At the crushing plant, the ore is fed onto two separation screens. Material that is smaller than 100mm falls through the screen and drops onto conveyor belts located below, and by- pass

the primary crusher. All material larger than 100 mm is fed into the primary crusher where the ore is crushed. At this stage, approximately 60% of the bauxite ore is at final product size (i.e. 25mm or less).

A screening plant is utilised to separate the final crushing product from the oversized material. The bauxite of final product size is screened out and fed directly to a surge bin. The oversized material is discharged to the secondary crusher for further crushing to the required 25mm size.

13.2 Conveyor

The overland conveyor system transports the <25 mm bauxite from the crushing and screening plant to the refinery stockpiles. The overall length of the system is 18km and consists of five flights including the stockpile conveyor. The system is fully automated.

Two variable speed belt feeder conveyors extract ore from the 1700 tonne surge bin and discharge onto a short acceleration, or safety, overland conveyor. The acceleration conveyor contains a magnet for the removal of tramp metal (nuts, bolt etc) and a belt weigher, used for the automatic flow rate control of the two belt feeders.

13.3 Stockpiles

Bauxite ore conveyed from the mine is stockpiled at the eastern end of the refinery. Stockpiling is by an automated stacker conveyor. The bauxite is blended and reclaimed by rotating barrel reclaimers. The blending of bauxite is achieved by the combined function of stacking and reclaiming. During stacking, the bauxite is deposited in layers and reclaiming occurs from the cross-sectional face of the stockpile. By using this technique, uniform blended bauxite for the whole length of the stockpile is achieved. Storage capacity is nominally 384,000 wet tonnes total and normally operates in a range of 100,000 to 300,000 wet tonnes. The stockpile is separated into a north and south side which are reclaimed via a barrel and bucket wheel reclaimers.

13.4 Export Conveyor and Ship loader

From the stockpiles the bauxite is reclaimed via a barrel and bucket wheel reclaimers and conveyed to the ship loader.

14. Authorised Activities – Services

14.1 Harbour Tank Farm

The Harbour Tank Farm consists of nine tanks ranging in size from 15,000m^3 to 50,000m^3. These tanks have contained Caustic, Low Sulphur Fuel Oil and High Sulphur Fuel Oil. The Fuel Oil tanks now only have residual levels remaining and the Caustic tanks contain a combined volume of approximately 44 million litres of caustic at various strengths. This caustic will be consumed during 2019-2020.

14.2 Light Fuel Tank Farm

Light Fuel Tank Farm (LFTF) consists of four tanks, previously used to store diesel, petrol and aviation fuel, but now only store diesel. Three tanks are used to store the diesel and the aviation fuel tank is empty.

14.3 Port

A bauxite ship is loaded approximately every two days on average at the port facility. Bulk liquids including oil, petroleum products, and other agents for wastewater treatment, are pumped from vessels at the bulk cargo wharf to their relevant storage tanks in the port area.

Gove operations may undertake work to maintain the appropriate clearance for ships in the berth pocket at the export wharf. This includes flattening of high spots created by the ship propellers from normal use. The appropriate approval will be sought to complete these maintenance works, if required

14.4 Power Generation

Gove operations operates and maintains the power plant and infrastructure network. The power station consists of 24 separate 1MW high speed diesel generators, the network includes downstream transmission and distribution out of the power station.

Power is distributed via 24km of 22kV overhead line from the power station at the port to Nhulunbuy and then to the mine, bore fields and Yirrkala. The 22kV transmission is a dual redundant system. Transformers reduce the voltage to 240V for the town distribution network and other community supply.

Gove operations has an exemption from holding a licence under the *Electricity Reform Act 2000.*

14.5 Potable Water

Groundwater is extracted to provide potable water supply to Gove operations, the township of Nhulunbuy and local communities across the Gove Peninsula. The groundwater bores have been in operation since 1970, and in 2005, the field was expanded by the installation of the two Latram River production bores. Groundwater extraction from the Mullaman Beds aquifer is in accordance with Extraction Permit 305 issued by the NT Controller of Waters under the *Water Act* , the abstraction limit is 11,100 ML/year.

The 19 production bores are arranged into the following three areas:

- Airstrip – a row of ten production bores along the eastern margin of the airstrip;
- Shady Gum Creek – a row of seven production bores running east from near the centre of the airstrip towards Shady Gum Creek; and
- Latram River – two production bores west of current mining areas, near the Latram River.

The borefield also contains 26 observation bores to allow water level monitoring within the Mullaman Beds aquifer, as shown in **Figure 9**.

A borefield health and performance review is to be completed every 5 years, the next review will be issued in 2020. Previously, the reviews were completed every three years, however due to the significantly lower volumes of water abstracted from the borefield by Gove Operations following closure of the alumina refinery the reviews are to be undertaken every 5 years.

North River
Gunyipinya Swamp
Yirrkala Township
Yirrkala Creek
Gove Airport
Sandy Tree Creek
Latram River
Rocky Bay

S2011 Mine Office
OB10
OB13
OB1
OB11
OB2
OB15
OB27
PB08
PB07
PB06
PB09
PB10
OB6
PB13
PB14
PB15
PB05
OB7
PB11
PB12
OB22
OB8
PB04
OB9
OB5
PB17
PB02B
PB02
OB19
PB01B
PB16
OB12
PB18
OB3
OB17
OB14
OB4
OB23
PB19
OB18
OB26
OB20
OB16
OB21
OB24

PROJECT ID 60508262
CREATED BY RNM
APPROVED BY PAbbott
LAST MODIFIED 19 JUN 2017

RioTinto

N
DATUM GDA 1994, PROJECTION MGA ZONE 53
0 500 1,000 1,500 2,000
metres
1:40,000 (when printed at A3)

LEGEND

- Observation Bore
- Production Bore
- Surface Water Sample Site
- Roads
- Watercourse
- Surface Water Catchment Boundaries
- Lease Boundary

Data sources:
Rio Tinto Gove Operations and various; Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Base Data: Rio Tinto Gove Operations

Mine Area Groundwater Production and Observation Bores

RIO TINTO GOVE OPERATIONS

Figure 9

Map Document: P:\605X\60520921\4. Tech Work Area\4.99 GIS\02_MXDs\Draft_OPR_May2017\G60508262_Fig Y1_Mine_GWSW_Locs_v2_A3L.mxd (rob.mcgregor)

A3 size

14.6 Sewerage Treatment System

An aerated sewerage treatment unit at the refinery is operated to treat sewerage collected at the mine, refinery and RDA septic tanks. If required, waste water from these units are treated at the refinery. In 2017, improvements and modifications were made to the sewerage treatment to reflect the change in demand post curtailment.

The NCL operates a reticulated sewerage network within the township of Nhulunbuy and nearby Industrial Estate which incorporates a mix of gravity lines, receiving sumps and pressure pumps. The network transfers wastes from a community of approximately 3,500 residents to the sewer lagoons located on the edge of the SPLs, away from the residential area. NCL operates nine localised pump stations which feed into three major end-of-network units, with all locations serviced with a master/slave pump arrangement to ensure serviceability, longevity and redundancy within the network.

15. Mine Production Closure Plan

Closure of the mine involves the progressive rehabilitation of mined areas to a native vegetation community as agreed by the Traditional Owners. All associated infrastructure is to be rehabilitated with the exception of key roads that the Traditional Owners have requested for access to cultural areas.

The intention is for full relinquishment of the land and a planned transition of agreed assets and infrastructure to a qualified third party to take over their ownership and management. The current closure studies will identify requirements for site-specific trigger levels for groundwater and surface water, and any ongoing control measures.

Gove Operations have been progressively rehabilitating mined areas since 1970, areas of this rehabilitation have or are close to attainment of agreed mine rehabilitation criteria.

15.1 Closure Actions

A summary of the proposed closure actions as they relate to the closure objectives are included in **Table 26**.

Table 26. Mine Production Closure Actions

OBJECTIVES	ACTIONS
Safe	
Protect the safety and the wellbeing of our employees, contractors and communities.	Progressive remediation and rehabilitation of all areas, and completion of mine rehabilitation monitoring. All waste materials and contaminants will be disposed in accordance with relevant legislative requirements. Develop and implement Closure Project Execution Plan and HSE Management Plan. Audit Closure HSE Management Plan and maintain closure project risk register. Develop and implement post closure maintenance and monitoring programmes to demonstrate attainment of the closure criteria within the MMP and support the Certificate of Closure application. Negotiate arrangements for transfer of retained assets and any other ongoing obligations.
Stable	
Protect marine environment and native vegetation areas (receiving environments) from surface water runoff.	Design and construct surface water catchments and drainage guided by the pre-disturbance hydrology and topography. Implement rehabilitation monitoring to observe that sediment releases from erosion do not adversely impact the surrounding habitat or exceed acceptable erosion rates.

OBJECTIVES	ACTIONS
Non-polluting	
No long-term impacts on environmental values or unacceptable human health risks from known contamination sources and groundwater pathways.	Remove or treat all sources of contamination excluding retained infrastructure areas. Information from the Mine closure studies will be used to develop post closure site-specific trigger levels for pH and potential contaminants of concern, and post closure monitoring plan.
Agreed final land use	
Leave a positive legacy with key assets and infrastructure retained to support the social and economic future of the region. Return to a native landscape. Protection of sacred sites in close consultation with Traditional Owners.	All sacred site are protected area and access maintained, as specified by Traditional owners. Continual implementation of rehabilitation plans with monitoring programmes for species richness, presence of weeds, community structure, and habitat features to demonstrate attainment of specific targets. Subject to stakeholder consultation, agreed assets and infrastructure to be retained by future owners/custodians of land that benefit Traditional Owners and/or the community post cessation of mining activities.

15.2 Closure Studies

The Mine OoM study scope includes the following:

- completion of a Social and Economic Impact Assessment;
- final mine landform design and reconciliation of progressive rehabilitation areas to track attainment of closure objectives;
- rehabilitation plan for remaining mined land, and infrastructure areas; and
- decontamination and demolition plans for contaminated sites, and infrastructure specifically associated with bauxite mining, processing and shipment.

The timeframe for delivery of the Mine OoM study is late 2019 and followed by PFS in 2025 and FS in 2029.

15.3 Closure Criteria

Table 27. Mine Production Closure Criteria and Indicators

Objectives	Closure Criteria	Closure Indicators
Safe		
	Submission and acceptance of Certificate of Closure by the NT government under provisions of the NT Mining Management Act. Buried hazards are identifiable by adequate signage. Built structures that could present significant fall hazards are to be removed, unless exclusion controls are installed. New land manager provided with information relating to; exclusion control measures, relevant spatial data for contaminated sites and buried hazards.	Third Party Certification: - Execution - Contamination, if required
Stable		
	Observation of no active rill, gully or sheet erosion >5 m^2 across rehabilitation sites, as demonstrated by completion of mine rehabilitation monitoring and attainment of rehabilitation completion criteria.	Third Party Certification: - Execution
Non-polluting		
	Groundwater samples at any potentially contaminated sites have met groundwater quality indicators as listed in **Table 14** for a period of 5 years.	Groundwater Quality
Agreed final land use		
	Evidence of support from Traditional Owners on rehabilitation and final use. Evidence that rehabilitated areas are on a trajectory towards attainment of reference sites attributes as listed in **Table 16** for at least 5 years. Infrastructure removed, unless otherwise agreed by Traditional Owners or relevant Government authority.	Vegetation Agreed final land use

REFINERY

16. General Description

The refinery functional area includes the alumina refinery undergoing decommissioning for closure, operational infrastructure to support the export bauxite mining operations, and services assets for operations and the local community. Closure of the alumina refinery seeks to ensure minimal impacts on the mine production infrastructure and assets, and support a final land-use agreed to by the Traditional Owners. The Gumatj Traditional Owners supported a final land use with a mix of industrial and recreational areas, as described in a letter of intent signed in 2017, as submitted in the 2017 MMP amendment. This outlined retaining existing assets and infrastructure, with beneficial gain for the community and region (port, fuel tank farm, buildings) within an industrial use area. Establishing recreational areas for use by the wider community on moderately disturbed land and areas of undisturbed native vegetation to be retained and protected. The intention is for full relinquishment of the land and a planned transition of assets and infrastructure to qualified third parties. Closure studies and monitoring programmes will identify requirements for any addition or revision of site-specific indicators for groundwater quality, soil quality, water quality parameters for the marine receiving environment, and any ongoing control measures.

16.1 Refinery Functional Area

Refinery functional area is approx. 83ha for the initial alumina refinery, when the mine production ceases the area will include the approximately 116ha currently within the mine production area, **Table 28** lists the closure domain for the alumina refinery currently in closure.

Table 28. Refinery Functional Area Closure Domains

Domain	Domain No	Area Description	Domain Classification	Domain Area
Refinery	R6	Refinery Laydown Area	Infrastructure	7.6
Refinery	R7	Red and White Side - Caustic	Infrastructure	35.9
Refinery	R12	Lime Plant, Calcination and Silos	Infrastructure	8.9
Refinery	R1	Harbour Tank Farm	Infrastructure	8.1
Refinery	R3	Workshops	Infrastructure	15.5
Refinery	R8	Steam Power Station	Infrastructure	2.6
Refinery	R10	Stockpile Creek	River	3.1
Refinery	R19	Diesel Power Station	Infrastructure	1.0
Alumina refinery sub total				82.7
Refinery	R2	Light Fuel Tank Farm	Infrastructure	2.5
Refinery	R4	Oily Water Facility	Infrastructure	1.2
Refinery	R5	Office Complex	Infrastructure	4.4
Refinery	R9	Seawater Channel	Infrastructure	1.1
Refinery	MH6	Export Conveyor and Pipelines	Infrastructure	19.9
Refinery	R13	Foreshore West/east	Infrastructure	5.8
Refinery	R14	Northern Beach	Infrastructure	1.3
Refinery	R16	Seawater Intake	Infrastructure	10.0
Refinery	R18	Mt Gorton & Sewage Plant	Infrastructure	1.7
Refinery	R20	Waste Water Neutralisation Plant	Infrastructure	0.6
Refinery	MH1	Conveyor Corridor - in refinery lease	Infrastructure	0.9
Refinery	MH2	Bauxite Stockpiles in refinery	Infrastructure	17.6
Refinery	MH3	Conveyor Laydown in refinery	Infrastructure	1.1
Refinery	P3	Port Office and Hydrate Shed	Infrastructure	2.9

Refinery	R17	Remnant vegetation	Lease Balance	38.1
Refinery	R15	Melville Bay Road	Roads	7.5
Refinery (in mine production) sub total				116.6
Port	P1	Export Wharf	Infrastructure	12.7
Port	P2	Cargo Wharf and Foreshore Road	Infrastructure	13.6
Port (in mine production) total				26.3

16.2 Environment

16.2.1 Geology and soils

The refinery is underlain by granite-gneiss from the Melville Bay Metamorphics, expressed as limited outcrops in the area to the north of the refinery. At depth the granite-gneiss is extensively weathered and overlain by a residual clayey (kaolinitic) saprolite horizon. This layer is gradational and varies in thickness, but can be up to 2m in extent. The saprolite is overlain by unconsolidated marine sediments, predominantly consisting of clean, fine to coarse grained quartz and calcareous sand of variable thickness, reported to a maximum of around 18m. The surficial 2m of the profile is variable and is dependent on location, ranging from disturbed natural soils to compacted clayey gravelly sand (imported fill) underlying the refinery and its associated infrastructure. The sandy marine sediments form an unconfined surficial aquifer.

16.2.2 Surface Water Catchments

The refinery has 14 recognised stormwater sub-catchments, listed in **Table 29**, several sub-catchments drain into the three Containment Ponds, which are designed to detain runoff. During storm events, these Containment Ponds also provide surge capacity and allow contaminated surface water to be re-diverted to the RDA or to be tested (against WDL criteria) prior to release to the seawater channel.

Other sub-catchments drain to either the eastern, northern or western sections of the refinery seawater channel, with the exception of the Stockpile Creek sub-catchment and boundary/buffer catchments.

The seawater circuit of the refinery was the main process water intake and discharge system within the refinery catchment, with a design flow in the order of 12,000 m^3/hr. Many of these treated water discharge locations are no longer relevant as a result of closure, however the seawater channel remains operational.

Table 29. Refinery Surface Water Catchment Details

CATCHMENT	DISCHARGE PATHWAY
Eastern Pond – bunded areas	Report to the SCP
Southern Pond	
Western Pond	Report to the WCP
Northern Drain	
Eastern Pond – unbunded areas	Report to ECP
Stockpile creek - west	
Stockpile Creek	Melville Bay via S006
Western Channel	Melville Bay via Sea Water Channel at S001
Northern Channel	
Eastern Channel	
Light Fuel Tank Farm - West	
Light Fuel Tank Farm - East	Melville Bay via interceptor infrastructure at S044
Harbour Tank Farm	Melville Bay via bund network, controlled release valves, S096, S097, S098
Parkland	Direct flow into coastal environs

CATCHMENT	DISCHARGE PATHWAY
Northern Beach	
Mount Gorton	
Northern Drain – North and West	
Western Beach	

16.2.3 Refinery Groundwater

The peninsula on which the refinery is located is comprised of marine sediments, predominantly quartz and calcareous sands, deposited upon and between outcrops of granitic/gneissic bedrock. A varying thickness of weathered, oxidised clayey regolith (saprolite or laterite) and sandy marine sediments overlies the bedrock structure of the peninsula. In the northwest of the refinery rocky outcrops occur, where minimal marine sediments are present.

An isolated lens of fresh to brackish groundwater exists beneath the refinery peninsula within coastal sand deposits. Groundwater is generally encountered within 3 to 5m below ground surface and flows radially towards the coastline where it mixes at the seawater interface. Recharge is via direct rainfall infiltration and groundwater levels can fluctuate by up to one-metre between wet and dry seasons. Although likely to present some permeability, the saprolite and underlying parent granite material is often assumed to be an impermeable unit (aquitard). Macro porosity features, such as fracture-zones or zones of greater weathering exist within this deeper geology and where present, are presumed to control groundwater flowpaths within it.

17. Authorised Activities

The following activities are necessary for the progressive decontamination, demolition, remediation and rehabilitation of the alumina refinery.

17.1.1 Seawater Intake

Gove Operations have been extracting seawater to operate the refinery since 1972, for cooling and wastewater treatment purposes, the activity is compliant with the conditions of MLN955. Seawater extraction in the inner Gove Harbour for wastewater treatment will continue under this MMP. Currently pumps draw approximately 12,000 m^3 per hour. The annual total usage ranges from 1,200 to 2,200 ML, the volume is dependent on the operation of the WWNP.

17.1.2 Wastewater Neutralisation Plant (WWNP)

The SNL is currently neutralised with seawater at the WWNP, a precipitation process that reduces SNL pH and the concentration of some trace contaminants. The precipitate is settled and returned to the RDA ponds as ‘underflow solids’, while the neutralised effluent, ‘overflow’, is further diluted with seawater by the seawater channel and discharged into the inner Gove Harbour marine mixing zone. The WWNP operates under the conditions of the WDL issued by the DENR. In 2019 a pilot study to operate the WWNP using iron salts is to be undertaken, further information is provided in Section 21.2.3. An alternative discharge location is also being investigated to move from the current shallow water discharge location to a deeper water location with higher dispersion and dilution characteristics, and provide better control of the SNL inventory in the RDA.

17.1.3 Alumina Refinery Decontamination and Demolition

Activities are focused on planning and preparation for the progressive decontamination and demolition of the alumina refinery. This will involve removal of contaminated liquids and solids to the RDA, removal of salvageable equipment, isolation of the refinery from bauxite and WWNP operating assets and finally demolition of the inactive refinery assets.

17.1.4 Discharge Quality Improvement

Surface water runoff from the refinery functional area, including the mine production and refinery footprints has resulted in unacceptable discharge quality into the receiving environment.

Activities to improve the quality of discharges may involve further disturbance of areas already disturbed and/ or interference with waterways, for example the removal of old drainage structures, and installation of new appropriate erosion and sediment control structures.

The Stockpile Creek Discharge Quality Improvement Project (DQIP) aims to identify activities to address exceedances of WDL conditions from Stockpile Creek.

Rehabilitation of areas, including planting of vetiver grass in contaminated areas, to reduce sediment loss and improve surface water quality from the refinery catchment will be undertaken. These activities will involve localised disturbance of vegetation, soil and waterways to improve soil compaction and drainage aspects for the successful establishment of vegetation.

17.1.5 Contaminated Groundwater

Contaminated groundwater recovery systems are installed within refinery to extract and treat contaminated groundwater. Activities associated with the management of these systems involve the maintenance of groundwater bores, recovery pumps and valves, and associated pipes, containment and monitoring infrastructure. Installation of new bores may be triggered by analysis of monitoring results or through closure study outcomes, and relevant approvals/ permits will be obtained for such bores as required.

Monitoring groundwater bores are located across the refinery functional area to assist in the development of groundwater models and understand potential impacts on the receiving environment. Existing bores are to be maintained and should any new bores be required, the relevant approvals/ permits will be obtained.

18. Refinery Closure Plan

18.1 Closure Actions

A summary of the proposed closure actions as they relate to the closure objectives are included in **Table 30**.

Table 30. Refinery Closure Actions

OBJECTIVES	ACTIONS
Safe	
Protect the safety and the wellbeing of our employees, contractors and communities.	Progressive remediation and rehabilitation includes the following steps: - Manage critical safety and environmental (Phase 1). - Decommissioning and remove key services from within the alumina refinery footprint of approx. 83ha (Phase 1). - Decontamination and demolition of the alumina refinery, and construct interim landform approx. before 2027, with approx. 4ha concrete to be left in-situ (Phase 2). - Construction of final landform is dependent on bauxite mine closure in approx. 2029. - Decontamination and demolition of conveyor, stockpiles, wastewater treatment plant, and sea water channel. - Create final landform, including creation of recreational space across at least 20ha approx. before 2035. Waste materials and contaminants will be disposed in accordance with legislative requirements. Develop and implement Closure Execution Plan – Alumina Refinery and Closure HSE Management Plan for alumina refinery and interim landform. Prepare and implement Closure Execution Plan – Refinery and Closure HSE Management Plan for final landform Audit Closure HSE Management Plan and maintain closure project risk register. Develop and implement post closure maintenance and monitoring programmes to demonstrate attainment of the closure criteria within the MMP and support the Certificate of Closure application. Negotiate arrangements for transfer of retained assets and any other ongoing obligations.
Stable	
Protect the surrounding marine environment and native vegetation areas (receiving environments) from surface water runoff.	Design and construct surface water catchments and drainage that practically reflect the pre-disturbance hydrology and topography. Environmental design criteria include where practically possible: - Maximum vegetated embankment slopes of 1:6 (V: H). - Topography should reflect a natural land form. - Free draining landforms (no ponded water that creates permanent habitat for mosquito or cane toads breeding) The interim landform will use sediment ponds, silt fences, and the existing sea water channel as erosion and sediment controls to protect the receiving environments. These structures will be removed from the final landform, only if not required by the agreed final land use. Prepare and implement post closure monitoring plan to observe that sediment releases from erosion do not adversely impact the marine habitat, water quality parameters or exceed acceptable erosion rates.
Non-polluting	
No long-term impact on environmental values or unacceptable human health risks from known contamination sources and groundwater pathways.	Remove all sources of contamination or control by: - Safely dispose residual Bayer liquor, red mud and caustic related materials from the refinery and dispose of in the RDA. - Excavating contaminated soil and disposing within the RDA where it will be capped. - Treating soil to reduce pH to a level suitable for vegetation establishment. - Operate groundwater interception systems to extract and treat groundwater impacted from spills and/ or seepage until such time as the residual water quality no longer presents a material risk to the marine receiving environment. Updating of the groundwater model to track changes (extent and quality) of contaminated ground water plume beneath the alumina refinery.

OBJECTIVES	ACTIONS
	Implement post closure monitoring plan to: - Measure groundwater quality parameters. - Observe potential contaminants of concern concentrations of total recoverable hydrocarbons (TRH) and polycyclic aromatic hydrocarbons (PAH) in the groundwater in area of the light fuel tank farm. - Measure soil quality parameters, including pH, and concentrations of metal(loid)s (including aluminium, arsenic, gallium, molybdenum and vanadium).
Agreed final land use	
Leave a positive legacy with key assets and infrastructure retained to support the social and economic future of the region. The final land use is mix of industrial and commercial use with areas for recreation use across approximately 220ha. Protection of sacred sites in close consultation with Traditional Owners.	Banyan tree site is located within protected area and immediate surrounding area restored. Rehabilitation plan, to be developed based on retained assets and infrastructure, will include: - Banyan Park developed for recreation areas Subject to stakeholder consultation, agree assets and infrastructure to be retained by future owners/custodians of land such as port facilities, roads, fuel storage, and buildings.

18.2 Closure Studies

The studies for closure of the alumina refinery are in the FS stage, which includes a phased approach from project development and evaluation into the implementation and execution stage. Noting the mine production area within the refinery functional area are addressed by the mine production OoM, refer to **Section 15.2**. The FS details the rehabilitation of the alumina refinery in two main study phases:

Phase 1 (2018-2021)

- decommissioning;
- isolation of the alumina refinery from existing bauxite operations;
- removal of salvageable equipment; and
- management of safety and environmental threats.

Phase 2 (approximately 2022-2027, timeframe to be confirmed by the RDA Strategy PFS)

- decontamination;
- demolition; and
- remediation and rehabilitation of the footprint.

Decommissioning of the alumina processing assets involves removing energy sources in a planned and controlled manner. Predominantly these energy sources are electrical, network communications, water and air. The intention is to achieve a zero energy state for the redundant assets prior to Phase 2.

In some cases, services and utilities will need to be re-routed outside of the alumina refinery footprint and re-connected to ensure continuity of supply during and after the alumina refinery asset isolation. On completion of Phase 1 the redundant alumina refinery assets will be completely separated from the bauxite materials handling operations. This will be achieved via a physical barrier to prevent unauthorised access and the 'air gapping' of all energy pathways connecting the alumina refinery assets with the materials handling assets.

Where possible high value salvageable equipment will be removed during Phase 1 as opportunities are identified.

Asset management plans will be developed and implemented to secure the site, up until Phase 2, from any failures that may jeopardise bauxite operations, release hazardous material to the environment, endanger personnel or cause significant increase in demolition costs.

As part of developing asset management plans the condition of all refinery assets capable of containing hazardous materials will be identified and checked for structural integrity. Additionally, the contents of each of these assets will be characterised and quantified to define the environmental risk the contents present. This information will be used to build a risk profile for each asset.

Any asset assessed as a critical environmental or safety risk, now or before demolition, will have further analysis, a control specified and costed for implementation in Phase 1. Controls may include structural rectification, partial or full decontamination, and partial or full demolition. Any asset assessed as a high risk, now or before demolition, will have a plan to manage the risk up until demolition in Phase 2.

18.3 Closure Criteria

Table 31. Refinery Closure Criteria and Indicators

Objectives	Closure Criteria	Indicators
Safe		
	Submission and acceptance of Certificate of Closure by the NT government under provisions of the NT Mining Management Act. Buried hazards are identifiable by adequate signage. Below ground excavations filled in or sealed unless demonstrated as necessary to support an end land use. Built structures that could present significant fall hazards are to be removed, unless exclusion controls are installed. All concrete left in-situ are to be incorporated into a built structure or covered with a minimum of 1m of earth. New land manager provided with information relating to exclusion control measures, relevant spatial data for contaminated sites and buried hazards.	Third Party Certification: - Engineering - Execution - Contamination - HHERA
Stable		
	Evidence marine water quality parameters as listed in **Table 11** are achieved for Melville Bay, as measured by post closure water quality monitoring plan (to be implemented after 2038) for a period of 5 years.	Marine Water Quality
Non-polluting		
	Evidence that the level of potential contaminants of concern in oysters is comparable to background data and/or on a trajectory towards the reference site for a period of 5 years, for the parameters listed in **Table 13**. Groundwater samples have met groundwater quality indicators as listed in **Table 14** for a period of 5 years. Soil testing indicates compliance with **Table 15** for a period of 5 years.	Oysters Groundwater Quality Soil Quality
Agreed final land use		
	Infrastructure removed, unless otherwise agreed by Traditional Owners. Industrial land use with at least 20ha of recreation use zoned area. Evidence that rehabilitated areas are on a trajectory towards attainment of reference sites attributes as listed in **Table 16** for at least 5 years or target vegetation community benchmarks.	Vegetation Agree Final Land Use

RESIDUE DISPOSAL AREA

19. General Description

The RDA functional area contains a complex of red mud and liquor ponds within the southern portion of the RDA. This portion of the facility is active, as it continues to receive underflows from the wastewater treatment plant located in the refinery and contaminated refinery water runoff and the runoff from the uncapped red mud ponds. The wastewater treatment plant reduces liquor pond storage volumes by treating contaminated water and releasing it via the sea water channel. Contaminated water inventories are recharged by rain falling on contaminated sites (refinery, red mud ponds, liquor ponds) compounding efforts to reduce volumes of stored liquor. The progressive capping of the red mud ponds with HDPE liners commenced in 2008 due to increasing wastewater inventory presenting unacceptable risk that future inventories would exceed available storage volume. Capping of red mud ponds increases their stability and provides better control of the water balance and environmental risks.

The northern portion of the RDA, includes the northern ponds, these were the original red mud storage used until 1978. Rehabilitation of the northern ponds included encapsulating the red mud with earth capping and vegetation establishment in the late 1990's. In 2011, a new RDA lease was executed with the Traditional Owners, and areas of the northern ponds were removed from the lease area, and are within the sub lease issued to the Yirrkala Business Enterprise.

The eastern portion of the RDA includes an existing borrow area (historically referred to as Pond 9), that was utilised to provide capping materials for Pond 4. The area further to the east, has been identified as the future borrow area, is the potential source of critical clean topsoils and subsoils for the capping of red mud ponds and the creation of final landforms across the refinery and RDA.

The RDA functional area southern portion surrounds the Dimbuka Rock sacred site, and access is to be maintained and the final landform embankments surrounding the sacred site need to be sympathetic to the significance of the site as a landmark.

The closure options for the RDA are constrained by the proximity of Dimbuka Rock, the legacy of tailings management, and the close proximity to the receiving environment and sensitive receptors. These constraints are largely attributable to the age of the facility and its operation under environmental and construction standards and polices that pre-date contemporary expectations. The option selected, best manages environmental risks and applies proven technologies. Closure involves capping the red mud ponds, treating the liquor and demolishing the liquor ponds, remediation of the northern pond, using earth materials from embankment walls and borrow areas for capping and creation of final land forms, and the rehabilitation of the borrow areas.

At this point in time, Gove Operations foresees that part of the domain will be a post relinquishment management area at the conclusion of rehabilitation at the RDA. The closure of these areasincludes demonstrating that capping successfully contains the waste material and attainment of the specific closure criteria. It is recognised that the landscape will be permanently altered in some parts, and may not be amenable to beneficial re-use. In these cases, the goal is to ensure the sites remain safe, stable and non-polluting. Capping will provide sufficient barrier against the infiltration of water as well as preventing the direct contact with the contaminated materials such as red mud, precipitates and other contaminated residues. The surface water runoffs from the capped areas will not be contaminated and can be released into the environment without any further treatment.

Closure studies and monitoring programmes will identify requirements for any addition or revision of site-specific indicators for groundwater quality, soil quality, water quality parameters for the marine receiving environment, and any ongoing control measures.

19.1 RDA Functional Areas

RDA functional area is approx. 2,098ha and contains the domains as listed in **Table 32** and the highlighted rows indicate potential post relinquishment management areas.

Table 32. RDA Functional Area Domains

Domain	Domain No	Area Description	Domain Classification	Domain Area
RDA	RDA20	Pond 8 Borrow Pit	Extractive	116.8
RDA	RDA21	Pond 6 South Borrow Pit	Extractive	5.3
RDA	RDA23	Pond 7 Borrow	Extractive	8.9
RDA	RDA27	Old Borrow	Extractive	1.7
RDA	RDA19	Pond 8 Contractors	Infrastructure	2.3
RDA	RDA22	Pond Offices	Infrastructure	5.4
RDA	RDA26	Pipelines	Infrastructure	9.1
RDA	RDA14	RDA non-operational areas	Lease Balance	1,145.1
RDA	RDA4	Macassar Soak & Drainage Channel	River	1.9
RDA	RDA6	Duck Pond	River	5.8
RDA	RDA29	Northern Outlet Drain	River	22.0
RDA	RDA24	P8 to Borrow Haul Road	Roads	8.0
RDA	RDA28	Dimbuka Rocks	Sacred Site	1.0
RDA	RDA5	Melville Bay Rd Scale Dumps	Stockpiles & Dumps	4.0
RDA	RDA25	P8 Borrow stockpile area	Stockpiles & Dumps	4.7
RDA	RDA1	Northern Pond (West) - on lease	TSF & Dams	32.3
RDA	RDA2	Northern Pond (East) - on lease	TSF & Dams	12.9
RDA	RDA3	Northern Pond (Taylor's Pond) - on lease	TSF & Dams	5.9
RDA	RDA7	Red Mud Pond - Pond 2	TSF & Dams	25.8
RDA	RDA8	Water Treatment System	TSF & Dams	13.6
RDA	RDA10A	Red Mud Pond - Pond 3 capped	TSF & Dams	65.0
RDA	RDA10B	Red Mud Pond - Pond 4 capped	TSF & Dams	112.5
RDA	RDA10C	Red Mud Pond - Pond 5 dry stack	TSF & Dams	78.1
RDA	RDA10D	Red Mud Pond - Pond 6 dry stack	TSF & Dams	19.1
RDA	RDA11A	Red Mud Pond - Pond 5 Wet Disposal	TSF & Dams	50.9
RDA	RDA11B	Red Mud Pond - Pond 6 Wet Disposal	TSF & Dams	73.9
RDA	RDA12	Red Mud Pond - Pond 6	TSF & Dams	10.1
RDA	RDA13	Liquor Pond - Pond 7	TSF & Dams	80.3
RDA	RDA17	Liquor Pond - Pond 6 South	TSF & Dams	103.0
RDA	RDA18	Liquor Pond - Pond 8	TSF & Dams	72.5
Total				2,097.9

19.2 Geology and soils

Beneath the RDA, including the Northern Ponds, the granite-gneiss has been weathered to saprolite and overlying laterite and unconsolidated sediments. In areas of prior and current surface drainage (which are more deeply weathered and likely to occur along joints in the granite) the saprolite and laterite/unconsolidated sediment layers tend to be developed to a greater depth. In some areas the drainage channels are infilled with Quaternary-age alluvium, which comprises mainly reworked and transported granitic material. In coastal areas beach sands and marine sediments overly the Bradshaw Complex granite-gneiss.

19.3 Surface Water Catchments

The RDA catchment is divided into four main drainage systems: Duck Pond Creek catchment, Wallaby Beach Creek catchment, Macassar Creek catchment and Crawford Creek catchment, as described in **Table 33**. Surface water discharges across these catchments including capped red mud ponds and embankments. The catchment areas are grouped by two main areas; the Northern Ponds and Southern RDA. The northeast sub-catchment of the Northern Ponds flows to Wallaby Beach, whilst the remaining southwest catchment runoff converges into the RDA channel and flows to Duck Pond Creek. The Southern RDA surface water flows are released to the environment via Duck Pond Creek, Macassar Creek, and Crawford Creek. Crawford Creek receives runoff from the Northern Outlet Drain (NOD), and borrow areas.

Table 33. Residue Disposal Area Surface Water Catchment Details

Area	Catchment	Sub-Catchment	Catchment Details	Water Contamination Risks	Receiving Catchment(s)
Northern Ponds	Northern Ponds	Southwest	Two main sub-catchments drain surface runoff from capped and rehabilitated surfaces of the Northern Ponds: - southwest to converge with RDA channel flows and into Duck Pond Creek. - northeast to discharge via Wallaby Beach Creek.	Potential contaminants include those entrained from eroded capping areas or as a result of seepage flows into drainage channels. May incorporate caustic impacted runoff or groundwater. Risks may be posed by YBE operations, including vehicle, plant and facility maintenance.	Duck Pond Creek (then Drimmie Arm).
		Northeast			Wallaby Beach Creek (then Arafura Sea).
Southern Residue Disposal Area	Process Water / Liquor Catchments	Open RDA Ponds	Supernatant Liquor (SNL) storage and uncapped red-mud storage within the containment ponds of the RDA. Rainfall within RDA embankments effectively increases stored SNL volumes.	SNL stored in the RDA Ponds has a pH 10.4 and contains elevated concentrations of certain metals. Pumped discharge only to process/neutralisation systems (Labyrith and WWNP), which are no longer operational.	None – discharge to process facilities only.
		Labyrinth Discharge	The RDA Labyrinth system was formerly used to process seawater neutralised SNL.	NA - Not operational.	Labyrinth flow previously pumped to the refinery for discharge to Seawater Channel.
	RDA External East Catchment	Northern Outlet Drain	External north facing embankments, access roads and capped areas west of the ridge on Pond 3 drain to the Northern Outlet Drain.	Sediment entrainment and resulting turbidity arising from recently capped surfaces. Naturally elevated metal concentrations associated with capping-derived suspended sediment loads.	Crawfords Creek / estuary.
		South & East Embankments / Toe Roads	Outward facing embankments and perimeter roads drain to natural and constructed discharge points south and east of the RDA.	Sediment / turbidity arising from high velocity embankment flows and/or cleared land/roads. Surface expressions of SNL seepage pose caustic impact risks.	
		Capping Borrow Area	Cleared Borrow Pit areas southeast of Pond 8 drain to Crawfords Creek catchment.	Sediment / turbidity arising from cleared areas.	

Area	Catchment	Sub-Catchment	Catchment Details	Water Contamination Risks	Receiving Catchment(s)
	RDA External West Catchment	Duck Pond Creek	The Duck Pond acts as a detention and settling pond for surface water flows from: - Northern Ponds southwest catchment - capped areas of Pond 3 - from roads and external embankments	The 'Duck Pond' is a series of constructed peak-flow detention ponds and sediment traps. Discharge from these flow into 'Duck Pond Creek', a tidally influenced estuarine channel (constructed). Contaminant risks may include SNL impacted runoff or seepage affected groundwater. Sediment / turbidity arising from high velocity embankment flows and/or cleared land/roads.	Duck Pond Creek (then Drimmie Arm).
		Macassar Creek	Outward facing embankments and perimeter roads of P5 and P6S drain to natural or constructed discharge points. Groundwater impact (seepage) may potentially affect surface water quality at these locations.	Localised impacts in areas suspected or known to exhibit seepage and/or surface expressions of SNL impacted groundwater.	Macassar Creek / Drimmie Arm.

19.4 RDA Groundwater

The RDA was originally topographically low-lying and was likely dominated by tidally influenced estuary features and multiple granite outcrops. The areas surrounding the RDA include coastal environments to the north and estuarine or harbour environments to the south.

The hydrostratigraphy, described for the RDA comprises three relatively distinct sequences. In the majority of areas (i.e. where granite outcrop occurs at surface and is not overlain by alluvial or marine sediments) the three units grade into each other, with the hydrostratigraphic variability (e.g. the hydraulic conductivity of the unit) being due to the differing degree of weathering in the granite. **Table 34** provides a summary of the units.

Table 34. RDA hydrostratigraphy units

Unit type	Description
Unit 1 – the upper unit	This upper unit is discontinuous across the site. Where present the unit has a typical thickness of one to six metres, comprising alluvium, marine deposits, laterite and highly weathered granite. This unit occurs across the RDA and is noted to be thicker in areas of current and prior drainage (i.e. areas in which the processes of physical and chemical weathering of the granite have occurred to greater depth);
Unit 2 – Saprolite (weathered granite).	This unit comprises weathered granite, where the feldspar minerals have mostly weathered to clay but remain in-situ. The unit is generally in the order of 5 to 15m thick. This unit tends to have a lower hydraulic conductivity than the overlying unit (Unit 1) due to the entrained clay content and in areas where the unit is logged as containing sand and gravel the hydraulic conductivity often remains low due to the clay content within the matrix. In some areas the hydraulic conductivity is relatively high (i.e. closer to the hydraulic conductivity of Unit 1) even when the matrix lithology is clay-dominated. In these areas the higher hydraulic conductivity is likely to be related to the secondary porosity created by fractures or joints.
Unit 3 – Fresh granite.	The top of this unit is typically defined by drilling refusal and is most accurately defined at those sites where drilling via tricone bit has occurred (as refusal of hollow flight augers, for example, is likely to occur at slightly shallower depths) and the hole has subsequently been cored. In bores where the fresh granite has been cored, the rock is described as being a pale grey, coarsely crystalline granite gneiss with garnet inclusions and dark grey and pink phenocrysts.

There is no groundwater level data available for the RDA pre-development. However, it is conceptualised that the groundwater flow direction would have honoured the topography and the groundwater levels in the central area of the granite batholith, at least for Unit 1, would have been ephemeral. Meaning that groundwater occurred in the central area of the batholith as a result of wet season recharge, but that the upper groundwater units (Unit 1 and the upper portion Unit 2) would have drained during the dry season as groundwater flowed towards the lower coastal areas. The natural groundwater regime has been highly modified due to the presence of the RDA over much of the area of the granite batholith and the natural groundwater flow system will have been overprinted by the water level in the RDA ponds with flow in the groundwater system being radially away from the ponds.

20. Authorised Activities

The following activities are necessary for the progressive decontamination, demolition, remediation and rehabilitation of the RDA.

The closure actions for the RDA are focused on providing a safe, stable, non-polluting land form and reduce long term environmental risk by reducing potential for:

- release of contaminants from known sources to the environment;
- direct contact with known contaminants; and
- indirect contact/ingestion of known contaminants.

20.1.1 RDA storage

Although the RDA no longer receives Bayer residue waste from the refinery, it continues to receive underflow solids, from the Wastewater Neutralisation Plant (WWNP), as well as storm water runoff from the refinery footprint. Stormwater run-off from the RDA ponds is also required to be captured and treated to regulatory water quality standards prior to release to the environment for the protection of Melville Bay.

Water balance and SNL inventory management across the RDA is a critical environmental concern. Capping of ponds is underway to reduce water catchment area that reports to the RDA and improvements are being made to the wastewater treatment process.

Table 35 lists the authorised use and function of the ponds within the RDA until they are progressively closed, meaning the pond is either capped or emptied of SNL and demolished. Operation of the RDA is in accordance with Rio Tinto's D5 Standard to manage risks associated with tailings and water storage facilities. This standard requires Gove Operations to undertake an annual review of operational documentation in order to provide written confirmation that operation conforms to the intent of the design. Additionally, a qualified specialist conducts an independent review of the operations, at least every two years.

Gove Operations completes annual water balance modelling (OPSIM) to assist in the management of environmental risk. Gove Operations is committed to managing the RDA to an annual wet season within a design standard for a 1 in 200 year average return interval wet season.

The annual wet season allowance sets the acceptable storage volume to be available at 1 December each year. A water balance model determines the relationship between volumetric change needed for the historical dataset (over approximately 130 years), and then these numbers are statistically extrapolated to determine the design 1 in 200 wet season allowance. Wet season allowance considers the wet season rather than a single event. Typically wet seasons are measured from November to March. All of the historical rainfall for this period is analysed to estimate the magnitude of a 1 in 200 year average return interval wet season design standard.

Table 35. Gove Operations RDA Storage (January 2019)

Area	Ponds	Storage Capacity (GL)	Catchment Area (ha)	Average Evaporative Surface Area (ha)	Function	Status	Current Inventory (GL)
Southern RDA	Pond 2	0.49	28	21	WWNP Underflow Solids Management	Inactive	0.06
	Pond 3	Nil	60	Nil	Red mud storage	Capped/Inactive	Nil
	Pond 4	Nil	112	Nil	Red mud storage	Capped/Inactive	Nil
	Pond 5	1.17	115	62	Red mud and SNL storage	Inactive	0.07
	Pond 6	4.75	91	77	Red mud, SNL storage and WWNP Underflow Solids Management	Inactive, will become active with hydrotalcite deposition	3.13
	Pond 6 South	5.93	76	64	SNL storage	Active water storage	2.70
	Pond 6 South Decant	0.87	11	10	SNL storage	Active water storage	0.60
	Pond 7	8.95	70	65	SNL storage	Active water storage	6.43
	Pond 8	6.11	52	47	SNL storage	Active water storage	3.34
Northern Ponds	Western / Eastern ./ Taylors	Nil	180	Nil	Red mud storage	inactive/rehabilitated	Nil
Refinery	Containment Ponds / Channels	Nil	26	Nil	Contaminated Water	Active water management	Nil
Total		**28.27**	**821**	**346**			**16.33**

20.1.2 Seepage Recovery

Groundwater contamination from the RDA is a known environmental risk that will continue to be managed by Gove Operations. The Gove Refinery Closure Study completed in 2016 included a full review of the conceptual groundwater model at the refinery and RDA. This work included a review of all previous work done as well as all available data from boreholes, geophysical surveys and other available data sources. The resulting conceptual model from the review showed a very high correlation with the location of seepage expression at the surface with pre-construction surface drainage features.

Seepage recovery is one component of Gove Operations Seepage Management Strategy that includes five other pillars to reduce future environmental impacts from the RDA. Seepage recovery focuses on monitoring, definition and mitigation of seepage. There is an extensive network of groundwater bores across the RDA that are monitored to define the lateral extent of seepage and movement. This information is used to design and install seepage recovery systems. Currently, there are 15 seepage zones that are monitored and 5 operational seepage recovery systems. The location of the seepage monitoring zones and recovery systems are presented in **Figure 10**.

The seepage recovery systems create a hydraulic containment by lowering the standing water levels, reducing saturation of shallow soils, and removing contaminated mass from impacted water bearing geological units. The RDA Seepage Recovery System Verification Monitoring Plan, monitors the performance of 5 seepage recovery systems against a number of Key Performance Indicators including: operational reliability, hydraulic capture of seepage, abstraction of SNL seepage impacted groundwater and improved groundwater quality. Parameters that are measured as part of this verification plan include:

- recording abstraction rates and system operation up-time;
- gauging of groundwater elevation;
- continuous monitoring of water elevation;
- in-situ measurements of groundwater quality parameters; and
- collection of samples of the abstracted groundwater from sumps and monitoring wells.

After several years of operational learnings, a ‘proof of concept’ seepage recovery system consists of a permeable interception trench with a pump installed in a sump at the near centre of the trench and a down gradient parallel bentonite slurry wall. Five systems based on this design have been constructed, they include:

- **Pond 2** - east embankment (P2-E);
- **Pond 6** - southeast embankment (P6-S);
- **Pond 6 South** - west embankment (P6S-W);
- **Pond 6 South** - east embankment (P6S-E); and
- **Pond 7** -south embankment (P7-S).

The following systems are expected to be installed during this MMP:

- **Pond 7** – borrow pit
- **Pond 8** - east embankment; and
- **Pond 5** – northwest embankment.

Other areas of potential concern will require further investigation to determine if additional action is required.

20.1.2.1 SNL Seepage

Operation of the RDA is thought to have affected the underlying aquifer through changes in water chemistry due to seepage and infiltration of SNL and by artificially raising surrounding groundwater elevations due to the increased hydraulic head exerted from the ponds. The hydrogeological regime across the RDA consists broadly of radial flow away from the ponds, seepage zones identified at a number of locations around the perimeter embankments, as shown in **Figure 10**.

Several priority seepage zones have been identified in relation to vegetation stress and tree death external to the perimeter embankments. Seepage investigations at the RDA have applied a variety of approaches to develop improved interpretation of the mechanisms, locations and significance of SNL seepage zones. Differential hydraulic pressure measurements between wells screened in shallow alluvium, underlying saprolite and deeper fractured/weathered zones of the granite bedrock, have confirmed that a range of seepage mechanisms are likely to exist.

Several proven and suspected shallow seepage flow-paths are aligned with pre-existing wetland channel features. The locations of pre-development surface water features and estuarine channels have been interpreted using historic aerial photographs. An outline of the current embankment layout was superimposed onto a 1958 aerial photograph and several drainage features buried by the current RDA facility were mapped. This interpretation is reproduced in **Figure 11**.

Several pre-development surface water features or former estuarine channel alignments are interpreted to affect seepage flows beneath RDA embankments in two ways:

- Where sand (or loose silt) deposits were inadequately removed prior to construction of the pond embankments and/or where embankment construction materials were not adequately keyed into less permeable ground (such as the underlying saprolite profile) the more permeable remnant channel features may act as preferential pathways for SNL seepage beneath the embankments.
- Natural surface water drainage features are often associated with alignments of fractured or weathered zones of the underlying bedrock surface. In the case of the RDA facility, the historic drainage features and estuary channels may have been coincident with alignments of bedrock features that exhibit relatively greater permeability.

While most seepage indicators cannot be used individually to accurately delineate or quantify seepage pathways or flow-rates, the compilation of multiple lines of evidence has been used to successfully inform the conceptual seepage model. Several lines of evidence are now available from multiple seepage-zone investigations and this collation of information is being used to inform and prioritise the design and implementation of seepage recovery systems.

PROJECT ID	60557568
CREATED BY	RNM
APPROVED BY	ATreasure
LAST MODIFIED	26 FEB 2018

1:15,000 (when printed at A3)
DATUM AGD 1984 AMG Zone 53

0 200 400 600 800
metres

Data sources:Rio Tinto Gove Operations and various

LEGEND

- Critical - 1 (<40)
- Critical - 2 (40>55)
- Critical - 3 (55>75)
- Critical - 4 (>75)

RDA Seepage Zones and Recovery Systems

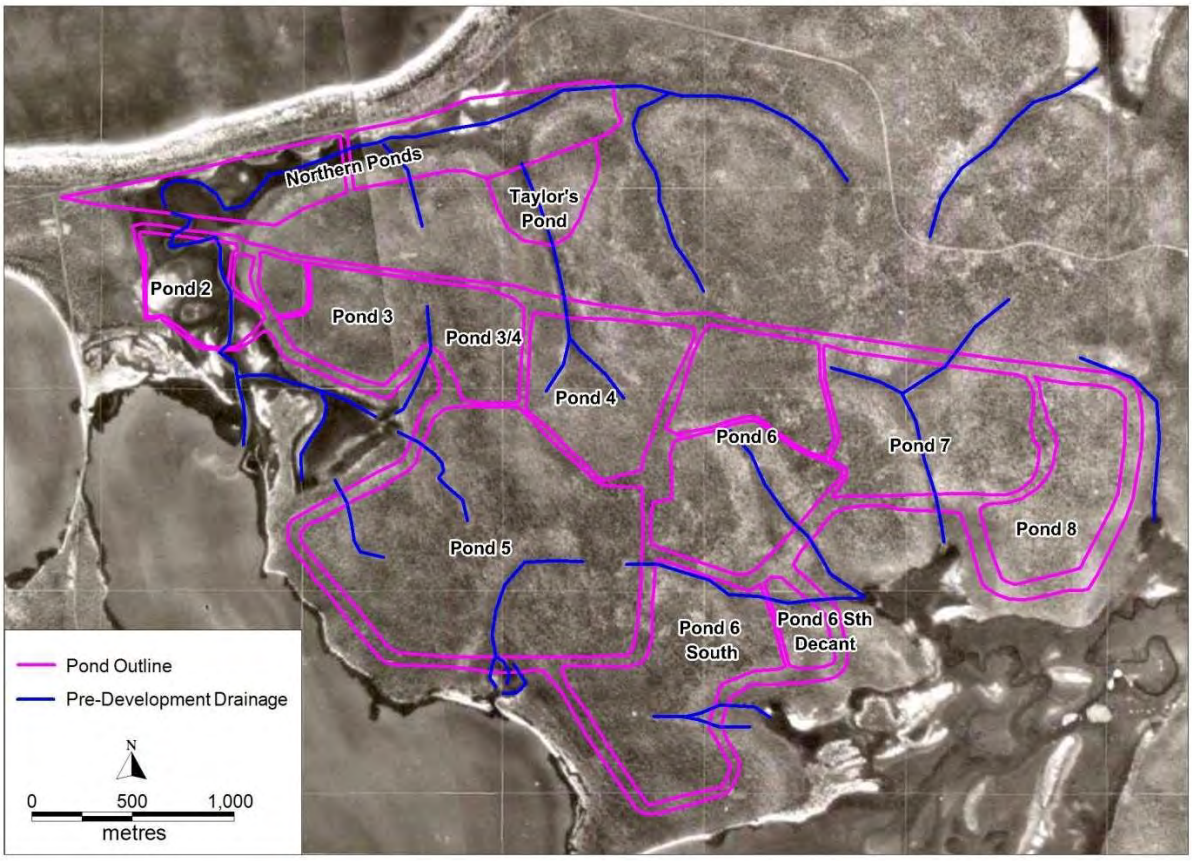
RIO TINTO GOVE OPERATIONS

Figure
10

Map Document: \\AUPER1FP001.au.aecomnet.com\Projects\605X\60520921\4. Tech Work Area\4.99 GIS\02_MXDs\2018_04_AndrewTreasureReport\G60557568_Fig 1_2018ScoreCardRiskAssessment_v1_A3.mxd (rob.mcgregor)

A3 size

Figure 11. RDA Interpreted Pre-Development Hydrology



20.1.3 Capping

Capping controls SNL generation by reducing runoff from the exposed red mud catchment. While SNL freely evaporates from the liquor storage ponds, there are inputs to the SNL inventory from direct rainfall into the ponds, and surface water runoff from red mud ponds and refinery. The capping of the red mud ponds enables increased control of the water balance and ongoing reduction of SNL inventory stored in the liquor ponds.

Other beneficial outcomes from capping include:

- the lowering of the seepage flux to groundwater; and
- stability of the red mud.

Capping activities may include:

- mud-farming to reduce moisture content and increase consolidation of residue to create a workable surface for supporting heavy machine equipment;
- reshaping existing residue surface and embankments to ensure long term stability, minimise erosion of soils used to form the cap, and provide effective surface drainage;
- forming drainage to support water shedding off the final cap;
- construction of subsoil seepage interception drains, where required;
- installation of geomembrane liner such as High Density Polyethylene (HDPE) to encapsulate waste at ponds 3 (currently installed), 4 (currently installed), 2, 5 and 6;
- installation of cap to encapsulate waste at the Northern Ponds;
- installing drainage systems to limit percolation and possible contamination of the clean runoff water from the underlying residue or seepage;

- covering the HDPE liner with a cap of earth material to hold the liner in place, protect the liner from UV degradation, wind damage, abrasion, and achieve a targeted life of at least 200 years;
- installing surface water management infrastructure to shed uncontaminated surface water runoff into the receiving environment;
- extracting earth materials from borrow areas to form the earth cap;
- hydro mulching and planting shrub species to establish vegetation on the cap to stabilise earth materials;
- ongoing maintenance, such as removal of deep rooted tree species to protect the liner; and
- stockpiling mulch supplied from timber clearing for mining activities.

The capping sequence is expected to be as described in **Table 36**, however completion of the RDA PFS may alter this sequence.

20.1.4 Surface Water Management Infrastructure

To support the final closure landform installation of surface water infrastructure may require permanent structures to be located within and outside the RDA lease boundary. Location of these structures outside the lease boundary will be negotiated with the Traditional Owners.

Construction of final land form surface water infrastructure is expected to alter the inflows in to the receiving environment.

20.1.5 Discharge Quality Improvement

Surface water runoff from the RDA functional area and areas previously relinquished has resulted in unacceptable discharge quality into the receiving environment.

Activities to improve the quality of discharges may involve further disturbance of areas already disturbed and/ or interference with watercourses, for example the removal of old drainage structures, and installation of new culverts and /or appropriate erosion and sediment control structures.

The Northern Ponds DQIP involves the implementation of the sediment and erosion control measures to address the runoff pathways from three areas, where capping materials have been eroded and red mud residues are exposed. The Northern Ponds DQIP is focussed on immediate control measures that will complement the longer-term closure plan being developed by the RDA PFS. Some of Northern Ponds is located outside Gove Operations current lease area, prior to commencement access arrangements will need to be obtained from the relevant stakeholders.

Rehabilitation of areas to reduce sediment loss and improve surface water quality from the RDA catchment will be undertaken. These activities will involve localised disturbance of vegetation, soil and waterways to improve soil compaction and drainage aspects for the successful establishment of vegetation.

20.1.6 Borrow Areas

Borrow areas are exploited to source earth material, comprising top soils and clay substrates for use as earth caps to secure and protect the HDPE liners; and other rehabilitation and remediation activities across the refinery and RDA.

The existing borrow area is approximately 116 hectares, it primarily provided material for capping, and the progressive rehabilitation of the existing borrow area is scheduled to commence in 2019.

The Gove Refinery Closure Study estimated approximately 5.5 million m^3 of earth material is required for capping and closure activities across the refinery and RDA. Approval to disturb the future borrow area to source this material was lodged with the Commonwealth via an EPBC Act referral (EPBC 2017/8114 Borrow Area Development Project) in December 2017. The Project sought approval to clear 314ha of native vegetation. Commencing with disturbance of the Pond 5 borrow area (82ha) followed by the progressive clearing of the remaining 232ha. In February 2018, the Project was determined to be a 'controlled action', due to the potential significant residual impacts upon the Black-Footed Tree-Rat. Further assessment of the impacts was required, as well as assessment by the EPA under the NT *Environmental Assessment Act*. Gove Operations is undertaking further surveys to develop an occupancy model for the northern population of the Black-Footed Tree-Rat. Commencement of this Project is dependent upon the granting of these approvals.

20.1.7 Rehabilitation

A Rehabilitation Plan for the borrow areas is expected to be completed in 2019. This plan considered the concerns of local stakeholders for the rehabilitation of the area, which focused on the following:

- avoiding the creation of additional mosquito breeding habitat to reduce the incidence of vector-borne diseases amongst the local community;
- limiting the creation of additional cane toad breeding habitat, thereby reducing pressure on local endangered fauna such as the Merten's Water Monitor; and
- minimising changes to pre-construction hydrology.

The rehabilitation objectives are:

- relinquishment of a safe, stable and uncontaminated site compatible with the surrounding landscape;
- establish native vegetation community exhibiting sustainable growth and development;
- all rehabilitation and closure requirements outlined in the leases and agreement are completed to the satisfaction of the Traditional Owners; and
- no on-going impacts on groundwater levels, quality and availability.

Progressive rehabilitation is scheduled to commence 2019/20.

Land form construction and revegetation will be undertaken by an appropriately qualified and licensed contractor. Appropriate HSE management plans will be established prior to the commencement of rehabilitation activities.

Rehabilitation of seepage impacted areas around the RDA, will be undertaken. These activities involve the treatment of the impacted soils, based on finding from the topsoil free and top soil creation trials, and the establishment of native vegetation.

20.1.8 Mulch Stockpiles

Mulch is required for addition to the earth material for capping activities and the rehabilitation of the borrow area. Mulch is to be collected from various sources including the vegetation cleared for mining, clearing of the borrow area and other maintenance programmes such as maintaining power line easements. Mulch stockpiles are to be located on the RDA lease area and management in accordance with Gove Operations procedures.

20.1.9 Waste Disposal in RDA

Settlement of sediment occurs around the Melville Bay public boat ramp, outside of Gove Operations lease area, to the east of the seawater outfall. The local fishing club undertakes projects to remove this sediment from the area (approximately 500m^3 for each event) to improve the visual amenity, and obtains the necessary environmental permits to conduct this

work. Gove Operations will receive the sediment for disposal into the RDA. First, sediments will be removed from the boat ramp and temporarily stored to dry out. Once dried, sediments will be transported to the RDA for final disposal, this may occur periodically through the MMP.

Historically areas of the RDA have been used to dispose of waste from the operations and the town. The waste materials from the demolition of the refinery and RDA, and potential marine dredging is to be disposed of in the RDA capped ponds.

21. RDA Closure Plan

21.1 Closure Actions

A summary of the proposed closure actions as they relate to the closure objectives are included in **Table 36**.

Table 36. RDA Closure Actions

<table>
<tr><th>Objectives</th><th>Actions</th></tr>
<tr><td>Safe</td><td></td></tr>
<tr><td>Protect the safety and the wellbeing of our employees, contractors and communities.</td><td>Progressive decontamination and demolition includes the following steps, with indicative timeframes for completion:
<table>
<tr><th>Action</th><th>Approximate timeframe for completion (subject to change)</th></tr>
<tr><td>Treatment of liquor, dewatering until 2033 (alternative discharge option would reduce timeframe)</td><td>2033</td></tr>
<tr><td>Pond 5 - shape to final land form and capping (HDPE)</td><td>2024</td></tr>
<tr><td>Pond 2 – shape to final land form and capping (HDPE)</td><td>2028</td></tr>
<tr><td>Pond 8 - empty, demolished and salvage embankment material, remediate pond floor and create landform</td><td>2029</td></tr>
<tr><td>Northern Ponds – shape to final land form, remediated and capping (earth)</td><td>2029</td></tr>
<tr><td>Pond 7 - empty, demolished and salvage embankment material, remediate pond floor and create landform</td><td>2032</td></tr>
<tr><td>Pond 6S - empty, demolished and salvage embankment material, remediate pond floor and create landform</td><td>2035</td></tr>
<tr><td>Pond 3 and 4 – shape to final land form and capping (HDPE)</td><td>2038</td></tr>
<tr><td>Decontamination and removal of all agreed infrastructure (except for required seepage interception schemes)</td><td>2038</td></tr>
<tr><td>Pond 6 – shape to final land form and capping (HDPE)</td><td>2038</td></tr>
</table>
Waste materials and contaminants will be disposed in accordance with relevant legislative requirements. Caustic red mud is to be contained within capped red mud ponds.
Develop and implement Closure Execution Plan and Closure HSE Management Plan for each pond and final landform.
Audit Closure HSE Management Plan and maintain closure project risk register.
Develop and implement post closure maintenance and monitoring programmes to demonstrate attainment of the closure criteria within the MMP and support the Certificate of Closure application.
Negotiate arrangements for transfer of retained assets and any other ongoing obligations.</td></tr>
<tr><td>Stable</td><td></td></tr>
<tr><td>Protect the surrounding marine environment and native vegetation areas (receiving environments) from surface water runoff.</td><td>Design and construct surface water catchments and drainage guided by the pre-disturbance hydrology and topography. Environmental design criteria include:
- All landforms designed and constructed for very low probability of slope failure with serious consequences.
- Erosion does not affect functionality of the final landform.
- Free draining landforms (no ponded water that creates permanent habitat for mosquito or cane toads breeding).</td></tr>
</table>

OBJECTIVES	ACTIONS
	Implement post closure maintenance and monitoring plans to observe that sediment releases from erosion do not adversely impact the marine habitat, water quality parameters or exceed acceptable erosion rates.
Non-polluting	
No long-term impact on environmental values or unacceptable human health risks from known contamination sources and groundwater pathways.	Manage all sources of contamination by: - Treating and safely disposing of liquor from ponds. - Operating seepage interception schemes until such time as the residual water quality no longer presents a material risk to the receiving environment. - Capping red mud ponds or other contaminated sites. - Treating soil to reduce pH to a level suitable for vegetation establishment. Updating of the groundwater model to track changes (extent and quality) of contaminated ground water plume beneath the southern and northern RDA. Implement post closure monitoring plan to: - Measure groundwater quality parameters. - Measure soil quality parameters, including pH, and concentrations of metal(loid)s (including aluminium, arsenic, gallium, molybdenum and vanadium).
Agreed final land use	
Leave a positive legacy with key assets and infrastructure retained to support the social and economic future of the region. The final land use classification is industrial that will be revegetated to control erosion and provide habitat for native flora and fauna. Approximately 490ha is to be managed as a Post - relinquishment Management Area. Protection of sacred sites in close consultation with Traditional Owners.	Dimbuka Rock sacred site (6273-18) is located within protected area and immediate surrounding area restored, and access maintained. Rehabilitation plan for the following specific areas: - Capped area – grass / shrub land communities that control erosion and protect integrity of the HDPE liner - Liquor ponds – suitable vegetation for stabilisation and erosion control, preferably native - Borrow Area – native vegetation - Monitoring programmes for species richness, presence of weeds, foliage projection coverage, community structure, erosion, and habitat features to demonstrate attainment of specific targets for the capped areas, liquor ponds, borrow area and northern ponds. Subject to stakeholder consultation, agree assets and infrastructure to be retained by future owners/custodians of land that benefit Traditional Owners and/or the community post mining activities.

21.2 Closure Studies

21.2.1 RDA – Pond 5 Capping

The study into closure and capping of Pond 5 is within the FS stage and due for completion in 2019.

21.2.2 RDA - Closure Sequence Plan

The RDA PFS to determine the optimal closure sequence and the schedules for implementation for the RDA, including the Northern Ponds and Off-lease areas, is expected to conclude in late 2019. This will then inform the pond-by-pond closure sequence of the RDA, and a FS study will be completed for each pond.

The closure sequence plan for the RDA is based on the following:

- A design service life of at least 200 years, not the 1,000 years adopted by ANCOLD (2012), as it is more realistic to achieve this based on the service life of materials. This will apply to the Post - relinquishment Management Areas, given the ongoing management obligations for RTA Gove; and
- Post-closure access to the site will be granted for any maintenance and repair.

21.2.3 RDA - Wastewater Treatment

SNL is currently neutralised with seawater in the Wastewater Neutralisation Plant (WWNP). The WWNP treats about 200 m^3/h SNL on average, at an utilisation of 80%. Due to the dilution of liquor in the RDA, and resultant decrease in dissolved aluminium (Al) concentration the plant has been unable to run at higher rates. The lower dissolved Al concentration results in lower concentrations of hydrotalcite and concomitant lower rates of removal of contaminants.

In order to overcome the declining dissolved Al concentration of the SNL the current practice at Gove Operations is to supplement the aluminium content in SNL with residual Bayer Spent Process Liquor (BSPL) from the refinery in order to maintain a suitable treatment rate (200m^3/h). However, the BSPL supply is expected to be exhausted during 2020.

When BSPL supply expires the current WWNP process will not be viable at rates of 200 m^3/hour. An alternative long-term treatment method must be developed and implemented to empty and demolish the liquor ponds, this is a critical task for closure.

The potential alternative long-term treatment methods for SNL evaluated include:

- use of adsorbents, specifically iron salts to provide an alternative phase to hydrotalcite to adsorb contaminants;
- optimised evaporation to assist with reducing the inventory of water at the RDA; and
- an alternate discharge location in deep water where ocean currents will provide high dilution and dispersal rates that would further reduce the risk of any potential environmental impacts.

Studies are progressing with various pilots and models to determine the best strategy for long-term liquor treatment.

Investigation will continue into the use of reverse osmosis treatment process for implementation when the volumes of contaminated groundwater are significantly lower. These system are not effective in treating high volume flows but would be applicable in the post closure scenario.

21.2.4 RDA - Topsoil Creation

Soil remediation projects include research into the potential to neutralise red mud, and localised decontamination and revegetation projects for areas affected by seepage.

The research projects to neutralise red mud include the topsoil free trials located in the Northern Ponds, which have now concluded.

The top soil creation trial was established in 2017 by the University of Queensland and is ongoing. Early monitoring is indicating a significant reduction of the pH over the first 6 months, with high alkaline pH reduced to near neutral pH. Investigations continue with focus on salt leaching.

The benefits from the research include a reduction in potential borrow area for the capping and closure activities, and reduction of contaminated waste.

Gove Operations in partnership with the University of Queensland are investigating an applied research programme. Focusing on the broad scale treatment and reuse of the red mud in the Northern Ponds.

21.3 Closure Criteria

Table 37. RDA Closure Criteria and Indicators

Objectives	Closure Criteria	Indicators
Safe		
	Submission and acceptance of Certificate of Closure by the NT government under provisions of the NT Mining Management Act. Buried hazards are identifiable by adequate signage. Below ground excavations filled in or sealed unless demonstrated as necessary to support an end land use. Built structures that could present significant fall hazards are to be removed, unless exclusion controls are installed. New land manager provided with information relating to; exclusion control measures, relevant spatial data for contaminated sites and buried hazards. Third party expert certification that specified capping material and thickness is in place, and evidence that an effective maintenance program is in place, so that future changes will not increase exposure risk in the long term. Certification from third party expert engineer that required contour banks, channel linings, HDPE liners, engineered structures and surface armour are in place and functioning and that an effective maintenance program is in place.	Third Party Certification: - Engineering - Execution - Geo Tech - HHERA
Stable		
	Evidence marine water quality parameters as listed in **Table 11** are achieved for Melville Bay, as measured by post closure water quality monitoring plan (to be implemented after 2038) for a period of 5 years. Erosion rates from the final landform have been maintained at or below 10 t/ha/year for a period of 5 years . Also supported by relevant survey data indicating no significant impact on the receiving environment from sediment deposition.	Marine Water Quality Erosion Rates
Non-polluting		
	Groundwater samples have met groundwater quality indicators as listed in **Table 14** for a period of 5 years.	Groundwater Quality
Agreed final land use		
	Evidence of Traditional Owner support for the final land use. Evidence that rehabilitated areas are on a trajectory towards attainment of reference sites attributes as listed in **Table 16** for at least 5 years or target vegetation community benchmarks. Redundant infrastructure removed, unless otherwise agreed by Traditional Owners	Vegetation Agreed Final Land Use

22. Marine

22.1 Description

The inner Gove Harbour marine environment has been impacted by the deposition of hydrotalcite and sediment runoff that has been intermittently discharged via the refinery seawater channel over the life of the refinery. The sediment has impacted upon the visual amenity of the marine functional area, located within the inner Gove Harbour. Gove Operations has investigated the sediment to determine an appropriate course for closure. Monitoring of the area indicates that the sediment is not impacting the environmental values.

Sampling of the inner Gove Harbour marine sediment indicates that hydrotalcite makes up approximately 15-20% of the content, and this is decreasing. The remaining sediment content is mainly the natural clay minerals, micas, carbonates and quartz, which are also abundant in the natural background sediment for Gove Harbour. The latest sediment survey (2017) conducted by the Australian Institute of Marine Science (AIMS) estimated that there is approximately 1.2 Mm^3 of soft, unconsolidated sediment in inner Gove Harbour with approximately 136,000 m^3 containing elevated concentrations of metal(loid)s attributed to the refinery discharge

Relevant characteristics of the sediment of inner Gove Harbour are:

- the sediment is fine-grained and anoxic;
- the metal concentrations (gallium, arsenic, vanadium, and zinc) are highest at the point of discharge and decrease with distance from discharge point;
- biodiversity of benthic organisms is low;
- the area of elevated concentrations of ammonium and sulfide in sediment pore water is more extensive than the area containing elevated concentrations of metal(loid)s; and
- the cyanobacterial and algal mat cover might prevent the impact of sediment on overlying water quality. That is, the dissolved oxygen levels in the water column above the sediment are good, and the mat cover limits the exchange of ammonium and sulfide from the sediment pore water into the overlying water column.

Assessment of the sediment characteristics suggest that disturbance of the sediment should be avoided, due to its fine particle size and anoxic nature. It is expected that any physical intervention on a broad scale to remove the sediment may cause localised deoxygenation of the water and cause a significant environmental impact.

Modelling studies and field campaigns completed by the AIMS investigated the potential for affected sediment to be redistributed through natural oceanographic processes, which would facilitate natural attenuation over time without any physical intervention. These natural processes included tidal currents and wind-generated ocean waves.

The key points of interest from this investigation were:

- extreme weather events were not likely to initiate the resuspension or erosion of the impacted sediment;
- the dominant migration pattern for natural deposition processes in the area is from outside the inner Gove Harbour, with a natural sediment deposition rate of 1.2-3.0mm per year in the affected area; and
- the removal of the impacted sediment by natural process was unlikely.

Based on this information Gove Operations is not intending to remove the impacted sediment by dredging. The next step is to collect more monitoring data to complete a level 2 Human

Health and Ecological risk assessment to better understand the risks posed by leaving the sediment in situ. Also to observe the area once discharging of seawater via the refinery seawater channel has ceased to determine whether natural deposition processes begin to dominate once discharging has stopped, and over the long term the area has the potential to naturally remediate the visual amenity of the area.

22.2 Marine Functional Areas

Marine functional area is approx. 54.8ha situated outside of the lease areas and contains the domains as listed in **Table 38**.

Table 38. Marine Functional Area Domains

Domain No	Domain Description	Domain Classification	Domain Area (ha)
P4	Outfall Impact Zone (Not included in Lease surface area)	Off lease	54.8

23. Authorised Activities

23.1.1 Mixing Zone

Discharges via the sea water channel into the mixing zone in accordance with WDL will continue under this MMP. The WDL defines a mixing zone immediately south of the seawater channel. The mixing zone has been monitored since 2007 as part of the Marine Health Monitoring programme (MHMP) which commenced in 2004. The mixing zone is developed using the hydrodynamic and water quality models for Melville Bay, developed by the AIMS, and known characteristics of water, sediment and benthos quality in Gove Harbour. With the closure of the alumina refinery no further discharge of hydrotalcite are expected to occur as it is captured within the WWNP. However, there will be a continuing discharge of treated SNL from the WWNP into the upper section of the eastern seawater channel which discharges to Melville Bay via the licenced discharge location S001.

24. Marine Closure Plan

24.1 Closure Actions

A summary of the proposed closure actions as they relate to the closure objectives are included in **Table 39**.

Table 39. Marine Closure Actions

Objectives	Actions
Safe	
	The marine sediment in the inner Gove Harbour has been impacted over the life of operation to the extent that there is an area that has elevated metal concentrations. A detailed sampling and monitoring plan developed to allow measurement of changes over time to determine the best management solution for the sediment by 2026.
Stable	
	Sediment monitoring program, including, sediment quality parameters, sediment ecotoxicity and bathymetric surveys
Non-polluting	
	Marine water quality parameters currently monitored for compliance with WDL conditions and site specific trigger levels.
Agreed final land use	
	Engagement with Traditional Owners regarding the agreement on the best management solution for the sediment, with the possibility of the sediment to remain in situ.

24.2 Closure Studies

The Marine OoM was finalised in 2018 to better understand the long term environmental impact caused by the inner Gove Harbour marine sediment.

From 2019-2025 a new Marine Sediment Monitoring Programme, designed by the AIMS and CSIRO will commence to inform any future studies. Monitoring under the Marine Health Monitoring Programme, as part of the Water Monitoring Plan will also continue.

24.3 Closure Criteria

Table 40. Marine closure criteria

OBJECTIVES	CLOSURE CRITERIA	CLOSURE INDICATORS
Safe		
	Evidence that the impacted sediment has a low risk to human health.	Third Party Certification: - HHERA
Stable		
	Evidence that the area and volume of contaminated sediment is decreasing.	To be confirmed from completion of Marine Sediment Monitoring Programme
Non-polluting		
	Evidence that the inner Gove Harbour marine sediment has no significant impacts on marine water quality indicators in **Table 11**. Evidence that the level of potential contaminants of concern in oysters is comparable to background data and/or on a trajectory towards the reference site for a period of 5 years, for the parameters listed in **Table 13**.	Marine Water Quality Oyster
Agreed final land use		
	Evidence of consultation with traditional owners and community on access and use of the area	Agreed Final Land Use

ATTACHMENT A – CULTURAL HERITAGE

25. Cultural Heritage

25.1 Sacred Sites

Gove operations currently has nine known sacred sites listed on the Sacred Sites Register, which are located within, overlap with and/or are adjacent to the Gove operations leases. Gove operations keep records of approved AAPA Certificates associated with development activities within the Gove operations lease boundaries. Additional AAPA Certificates are obtained as required when new works are proposed to be undertaken within the Gove operations leases.

25.2 Rocky Bay Jungle

The Rocky Bay Jungle, south of Yirrkala, contains a mixture of dry monsoon vine thickets and wet monsoon vine forests. Due to the significance of the vegetation in the Rocky Bay Jungle, the area was nominated for listing on the Register of the National Estate (now maintained as a non-statutory archive). Borneo Teak *(Intsia bijuga)* has been recorded in the Rocky Bay Jungle boundary area, this is Critically Endangered species by the NT. To protect the areas located within MLN955 they have been 'excluded' from the Mine Plan and as such no future mining will occur in this area.

25.3 Wurrwurrwuy Aboriginal Stone Arrangement

The Wurrwurrwuy Aboriginal Stone Arrangement, located on MLN 955 (SML 11 Part 1) is a 'declared place' on the NT Heritage Register. This site is currently managed by Dhimurru within the IPA. The site was first recorded in 1967.

On 19 August 2013, the Secretary of the Heritage Branch Department of Sustainability, Environment, Water, Population and communities wrote to Rio Tinto advising that the Wurrwurrwuy Aboriginal Stone Arrangement had been recorded on the Australian National Heritage List in accordance with section 324JJ of the EPBC Act.

The Aboriginal stone pictures hold outstanding heritage value to the nation as a rare example of stones arranged to depict secular objects rather than the arranged stones being associated with ceremony and the sacred. The stone pictures depict aspects of the Macassan Trepang industry and the internal arrangements of Macassan praus.

25.4 ELDO Tracking Station

On October 2013, the Heritage Council updated the Heritage Register for the site known as the ELDO Tracking Station to be a site of the status "not declared". The site is located on MLN 955 (SML 11 Part 1) and is identified as Eldo Tracking Station file number HAC2001/174 on the NT Heritage Register.

25.5 Archaeological and Heritage Sites

Various other cultural and historical places have been recorded within Gove operations lease areas and remain undisturbed. Historic heritage places and objects (i.e. not of Aboriginal or Macassan creation or production) have no legislative protection in the NT unless they are declared a Heritage Place pursuant to the *Heritage Act*.

Gove operations share results and reports associated with archaeological surveys with the Department of Tourism and Culture so that findings can be included in the NT Heritage Register (https://nt.gov.au/property/land/heritage-register-search-for-places-or-objects

ATTACHMENT B – PHYSICAL ENVIRONMENT

26. Physical Environment

This section describes the environmental aspects of Gove Operations interactions with the people and places surrounding the township of Nhulunbuy on the Gove Peninsula in north-eastern Arnhem Land. This description of the environment context of the operations is used to inform the management actions and plans.

26.1 Tidal Data

The port facilities are located in Melville Bay with the Arafura Sea to the north, tidal data is important for shipping activities.

The tides at Gove are semi-diurnal, with a range up to 3.8m. Tidal data extracted from the Gove Storm Tide Study by Systems Engineering Australia Pty Ltd (2007) is presented in **Table 41**. The same study documents predicted storm surge levels associated with 1:100 and 1:1,000 Annual Exceedance Probability Storm Tides Inundation as approximately 2.8m and 3.0m respectively.

Table 41. Tidal Levels at Gove Harbour

TIDE	LEVEL (AHD M)	LEVEL(NHD M)
Highest Astronomical Tide (HAT)	1.9	3.8
Mean High Water Springs (MHWS)	1.1	3
Mean Sea Level (MSL)	0.0	1.9
Mean Low Water Springs (MLWS)	-1.1	0.8
Lowest Astronomical Tide (LAT)	-1.8	0.1

26.2 Winds

Mean surface winds over most of the year are dominated by easterly and south-easterly winds. However, over the wet season, north-westerly winds associated with the monsoon season are prevalent. Analysis of data collected from Gove airport between 1966 and 2016 (source: weather station 014508, BoM), identified the following key observations:

- Dry season wind speeds are generally within the 10 km/h to 30 km/h range with a higher frequency of 30 km/h to 40km/h winds when compared to the wet season. Prevailing winds are from the eastern and south-eastern directions; and
- Wet season wind speeds are predominately within the 10 km/h to 30 km/h range with prevailing winds from the east, north and north-west. Winds from the south and southwest directions are minimal.

26.3 Seismicity

The Gove Peninsula has a much lower rate of historical seismicity than most other regions of Australia[1]. ES&S (2007)[2] listed all recorded earthquakes that occurred within 200km of Gove operations during the past century. The largest estimated intensity at the Gove site is MMI intensity III, due to the M_L 3.2 Gove Peninsula earthquake on 9 April 2001 at a distance of 40km from the site. This may be the only earthquake that has been felt at the Gove site. During the historical period of the past century, the site is not known to have been shaken by any earthquake having damage potential at the site.

[1] URS Ground Motion Response Spectra and Time Histories, Gove Site Report. 2011

[2] ES&S Gove Peninsula Seismic Hazard Assessment. June 2007.

26.4 Significant Ecosystems / Habitats

Gove operations extends over a large area, covering a wide range of landforms and vegetation communities, **Table 42** defines the ecosystems within the lease areas. The Monsoon Vine Thicket is the only listed ecosystem, and there are areas of regionally important mangroves, Gove operations has adopted specific management actions for their protection. There are no other ecosystems listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Territory Parks and Wildlife Conservation Act 2006* (TPWC Act) or International Union for Conservation of Nature (IUCN) listing. There are no major wetlands within the lease, though local floodplains, paperbark swamps, mangrove forests, spring fed rainforests and seagrass beds support a number of significant fauna and flora species and are of regional significance.

Table 42. Gove Operations Ecosystems

Ecosystem	Description
Pelagic	Open sea environments.
Coastal marine	A broad group of sub-tidal coastal environments with seafloors ranging from soft sediments, sand, coral and seagrass meadows.
Shorelines and Mud Flats	Intertidal largely un-vegetated habitats comprising tidal mud flats, sandy beaches, tidal sand flats, and rocky shores.
1a: Mangroves	Closed to low open mangrove forests particularly in estuarine areas and along the shores of Melville Bay.
1b: Salt Flats	Saline samphire flats and swamps dominated by mangrove fern (Acristichum speciosum).
2a: Foredunes	Elongated sand dunes parallel to the shore generally vegetated with tussock or hummock grasses, salt tolerant vines, herbs and shrubs and or Casuarina copses.
2b: Monsoon Vine Thickets	Coastal monsoon vine thickets on fringing dune ridges extending to hind dune swales on beach sands. Typically dominated by the genera Aglaia, Celtis, Cordia, Canarium, Diospyros, Premna, Emmenosperma, Scaevola, Sterculia, Pouteria, Strynchnos and Thespesia.
2c: Coastal Woodlands	Mixed Eucalypt coastal woodlands on consolidated coastal sand masses. Deep sandy soils on dune swales and headlands. Dominated by Corymbia and Eucalyptus with a shrub layer typically of the genera Pandanus, Erythrophleum, Buchanania, Brachychiton, Livistonia, Planchonia and Acacia.
3a: Tetrodonta Woodlands	Eucalyptus tetrodonta dominated woodlands on deep sands or lateritic soils. Accompanied by E.polycarpa and E.miniata on sands and E.alba on granite derived soils. On the lateritic plateau E.tetrodonta tends to form more pure stands with an Acacia/Pandanus shrub layer. This is the main ecosystem impacted by mining.
3b:Melaleuca/Pandanus Woodlands	Melaleuca dominated communities on sand plains on the seaward side of the Tetrodonta Woodlands. Includes Melaleuca woodlands with grassy understorey and drainage depressions/soaks with a more mesic shrub layer.
Drainage Lines & Swamps	Gallery forests and drainage lines with permanent water.

26.4.1 Monsoon Vine Thicket

Monsoon vine thicket known as 'Rocky Bay Jungle' is a significant ecosystem located within the mining lease area. Rocky Bay Jungle was listed as an "indicative place" (Place ID 100753) on the Register of the National Estate Database (now maintained only as a non-statutory archive). Gove operations have 'excluded' this area in the Mine Plan and as such no future mining will occur in this area.

The Rocky Bay Jungle includes both a dry semi-deciduous monsoon vine thicket community and a wetter evergreen vine forest located close to a large freshwater swamp. The area contains flora and fauna species of significance both on a national and regional perspective some of which are described in the following sections, including a listed threatened species protected under the EPBC Act.

The nominated area covers approximately 300ha on the sandy shores and adjacent hinterland of Rocky Bay about 3km south of Yirrkala. Parts of the mine lease, including sections of the main plateau containing potential ore reserves are encompassed in the boundary.

26.4.2 Mangroves

Mangroves are regionally important and occur within the lease area and in the deltaic tidal swamps of Macassar and Crawford Creeks around the RDA, as well as a discontinuous fringe along the shore of Melville Bay. Mangrove areas are habitat for a number of threatened species. Coastal habitats are also important habitat for a wide variety of migratory and marine species listed under the EPBC Act.

26.5 Significant Fauna Species

There are a number of threatened vertebrate and invertebrate fauna species currently listed for the bio-region. Below is a summary of those species that are of significance to Gove operations. Those species that have been recorded during surveys on or adjacent to operations are highlighted in grey in **Table 43**. Gove operations has active mitigation measures to manage the impacts of our operation on the: Gove Crow Butterfly, Merten's Water Monitor, and Black-Footed Tree-Rat.

26.5.1 Gove Crow Butterfly

The Gove Crow Butterfly is restricted to north-east Arnhem Land and is currently known only from approximately six locations, all associated with monsoon vine forest or tall mixed paperbark *(Melaleuca spp.)* forest with rainforest elements in the understorey. This species has been recorded on MLN955 adjacent to the Rocky Bay Jungle. The site where Gove Crow Butterfly has been recorded is located outside any potential mining areas. In February 2018, the Commonwealth removed the Gove Crow Butterfly from EPBC Act Endangered category of the threatened species list. A National Recovery Plan has been prepared for the Gove Crow butterfly by the NT Government. This recovery plan sets out the actions necessary to stop the decline of, and support the recovery of, the listed threatened species.

26.5.2 Mertens Water Monitor

The Merten's Water Monitor, (*Varanus mertensi*) listed as 'Vulnerable' in the NT, was recorded during fauna surveys associated with the Pond 8 expansion in 2009. *Varanus mertensi* is widespread in the NT, occupying all of the Top End river systems. The most important conservation issue it faces is its propensity to eat cane toads and to die from the ingested toxins. Gove operations maintain buffer zones around the RDA to ensure the riparian areas are protected from construction and operational impacts.

26.5.3 Black-Footed Tree-Rat

The Black-Footed Tree-Rat is listed as Vulnerable under the TPWC Act and the subspecies, *M Mesembriomys gouldii gouldii*, is listed as Endangered under the EPBC Act and is listed as Vulnerable on the IUCN Red List of Threatened Species. The species was rediscovered on the Gove mining lease in 2008, during pre-clearing surveys of the Rocky Bay region. Based on recommendations by Government at the time (the species then held a Near Threatened status and a 200 hectare (ha) exclusion zone was established around this tree-rat population. The size of this exclusion zone was based on the limited information about the species available at the time. This involved estimations about the food and habitat requirements for a minimum-sized population (ten individuals), whereby two individuals shared an average home range of 40ha. This determined a minimum exclusion zone of 200ha. In 2015, a comprehensive camera survey was completed to develop an occupancy model for this species. In order to predict how the future removal and addition (rehabilitation) of habitat will affect the tree-rat population, these projected changes in environmental values, based on the long-term mine plan, were

incorporated into the occupancy model. This revealed that the proposed clearing of habitat for mining activities was mostly compensated by the anticipated improvements in tree-rat habitat achieved through progressive rehabilitation. The overall assessment was that the impacts of mining on the tree-rat population were negligible with no significant impacts. On this basis the exclusion zone in the Rocky Bay has been removed and mining is to be undertaken in accordance with the Significant Species Management Plan for the Black-footed Tree-rat.

Table 43. Gove Operations Significant Fauna Species (2018)

Feature	Scientific Name	State	Federal	IUCN
Leatherback Turtle	*Dermochelys coriacea*	CR	EN	VU
Hawksbill Turtle	*Eretmochelys imbricata*	VU	VU	CR
Northern Quoll	*Dasyurus hallucatus*	CR	EN	EN
Loggerhead Turtle	*Caretta caretta*	VU	EN	EN
Northern Hopping Mouse	*Notomys aquilo*	VU	VU	EN
Green Turtle	*Chelonia mydas*	NT	VU	EN
Ghost Bat	*Macroderma gigas*	NT	VU	VU
Irrawaddy Dolphin	*Orcaella brevirostris*	LC	Cet/Mig	VU
Olive Ridley Turtle	*Lepidochelys olivacea*	VU	EN	VU
Great Knot	*Calidris tenuirostris*	VU	CR	VU
Eastern Curlew	*Numenius madagascariensis*	VU	CR	VU
Dugong	*Dugong dugon*	NT	Mar/Mig	VU
Partridge Pigeon (eastern)	*Geophaps smithii*	VU	VU	VU
Golden Bandicoot	*Isoodon auratus*	EN	VU	VU
Northern Brush-tailed Phascogale	*Phascogale pirata*	EN	VU	VU
Water Mouse, False Water Rat,	*Xeromys myoides*	DD	VU	VU
Black-Footed Tree-Rat	*Mesembriomys gouldii*	VU	EN	NT
Australian Snubfin Dolphin	*Orcaella heinsohni*	DD	Cet/Mig	VU
Gouldian Finch	*Erythrura gouldiae*	VU	EN	NT
Red Goshawk	*Erythrotriorchis radiatus*	VU	VU	NT
False Killer Whale	*Pseudorca crassidens*	LC	Cet/Mig	DD
Bare-rumped Sheath-tail Bat	*Saccolaimus saccolaimus nudicluniatus*	DD	VU	LC
Ruddy Turnstone	*Arenaria interpres*	NT	Mar/Mig	LC
Red Knot, Knot	*Calidris canutus*	VU	CR/Mar/Mig	NT
Curlew Sandpiper	*Calidris ferruginea*	VU	CR/Mar/Mig	NT
Greater Sand Plover	*Charadrius leschenaultii*	VU	VU/Mar/Mig	LC
Lesser Sand Plover	*Charadrius mongolus*	VU	CR/Mar/Mig	LC
Bar-tailed Godwit	*Limosa lapponica*	VU	Mar/Mig	NT
Whimbrel	*Numenius phaeopus*	NT	Mar/Mig	LC
Grey Plover	*Pluvialis squatarola*	NT	Mar/Mig	LC
Beach Stone-Curlew	*Esacus magnirostris*	LC	Mar	NT
Flatback Turtle	*Natator depressus*	DD	VU/Mar/Mig	DD
Pale-vented Bush Hen	*Amaurornis moluccana*	NT	-	-
Yellow Spotted Monitor	*Varanus panoptes*	VU	-	-
Mertens Water Monitor	*Varanus mertensi*	VU	-	-
Gove Crow Butterfly	*Euploea alcathoe enastri*	NT	-	-
Emu	*Dromaius novaehollandiae*	NT	-	LC
Banded Fruit-Dove	*Ptilinopus cinctus*	NT	-	LC
Australian Bustard	*Ardeotis australis*	NT	-	LC
Bush Stone Curlew	*Burhinus grallarius*	NT	-	LC
Fawn Antechinus	*Antechinus bellus*	EN	-	LC
Northern Brown Bandicoot	*Isoodon macrourus*	NT	-	LC
Black-necked Stork	*Ephippiorhynchus asiaticus*	LC	-	NT

FEATURE	SCIENTIFIC NAME	STATE	FEDERAL	IUCN
Brush-tailed Possum	*Trichosurus vulpecula arnhemensis*	NT	-	-

CR - Critically Endangered | EN - Endangered | VU - Vulnerable | NT - Near threatened | DD - Data Deficient | NE – Not Evaluated

Mar – Marine species under EPBCT Act | Mig - Migratory -migratory species under the EPBC Act | Cet - Cetacean - listed under the Convention on the Conservation of Migratory Species, and classed as migratory species under the EPBC Act

26.6 Significant Marine Species

26.6.1 Marine Invertebrates

No marine invertebrate species listed as threatened under NT or Commonwealth legislation have been observed within the Melville Bay and surrounding fringing coral reefs. The *scleractinian* corals and giant clam (*Tridacna squamosal)* that are found in these waters are listed in Convention on International Trade in Endangered Species (CITES) Appendix II. No fish species recorded for the area are listed as threatened, although the pipefish (*Choeroichthys brachysoma)* are listed under the EPBC Act and all pipefishes and seahorses (family Syngnathidae unidentified) are listed under CITES Appendix II.

26.6.2 Marine Vertebrates

Four (Flat-back, Green, Hawksbill and Olive Ridley) of the six species of marine turtles that occur in NT waters have been recorded in Melville Bay and the adjacent area. All four marine turtle species are listed as threatened under the EPBC Act. Conservation status of these species is also of broad public interest and of special concern to Yolngu people.

The Estuarine Crocodile is a listed marine/migratory species under the EPBC Act and is listed as 'Least Concern' under the TPWC Act and by the IUCN. It is also listed under the Bonn Convention (CMS 1979) and is listed under CITES Appendix II.

Only one sea snake species (*Hydrophis elegans*) has been recorded from the area, although 25 species of sea snakes are present in the region, and additional species are likely to be present. All sea snake species are listed under the EPBC Act and this species also is listed as 'Least Concern' under the TPWC Act.

All native bird species, parts of (e.g. feathers), and their eggs are protected under NT legislation within three nautical miles of the coast, and under Australian Government legislation from there to the Exclusive Economic Zone line. Several migratory species are protected under international agreements, including JAMBA and CAMBA, although none are listed as vulnerable or endangered under NT legislation. The Rajah Shelduck, Sooty Oystercatcher (northern), Little Tern (west Pacific), Great-billed Heron, Black-Necked Stork and Beach Thick-Knee, are listed as of 'Least Concern' under the NT legislation.

The three species of dolphin recorded in Melville Bay and the adjacent area are the Indo-Pacific Humpback Dolphin, Bottlenose Dolphin and Australian Snubfin Dolphin. In addition, the False Killer Whale and Dugong also occur in the area. All cetacean species are protected in Australian waters and all of the species occurring in Melville Bay and the adjacent area are listed under CITES.

In addition, the Dugong is listed as 'Vulnerable' in the IUCN Red List of Threatened Species. The Dugong is listed on the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) and on Appendix 1 of CITES. In the NT, Dugongs are listed as 'Near Threatened' under the TPWC Act. The other cetaceans are listed as 'Least Concern' under the TPWC Act.

26.7 Significant Flora Species

There are a number of threatened flora species currently listed for the bio-region. Below is a summary of those species which are of significance to the operations. Those species that have been recorded during surveys in and/or adjacent to the operations are highlighted in grey in **Table 44**.

Table 44. Gove Operations Significant Flora Species (2018)

Feature Name	Scientific Name	State	Federal	IUCN
Borneo Teak	*Intsia bijuga*	CR	-	VU
Roxy	*Erythroxylum pusillum*	EN	-	-
Coastal Shrub or Tree	*Hernandia nymphaeifolia*	VU		
Riparian Monsoon Vine Tree	*Pternandra coerulescens*	VU		
Mangrove *spp*	*Rhizophora lamarkii*	NT	-	-
Mangrove *spp*	*Bruguiera sexangula*	NT		LC

CR - Critically Endangered | EN - Endangered | VU - Vulnerable | NT - Near threatened | DD - Data Deficient

26.7.1 Borneo Teak (Intsia bijuga)

Borneo Teak *(Intsia bijuga)* has been recorded in the Rocky Bay Jungle boundary area, which lies within the mining lease. This area is currently excluded from mining operations and unlikely to be impacted.

26.7.2 Roxy (Erythroxylum pusillium)

Erythroxylum pusillium was found during pre-clearing flora surveys in May 2007 within the mine area (Mine Grid Area 5-2) and is restricted to an area covering approximately 0.68 ha on MLN955. This species has now been listed as "Endangered" under the TPWC Act in 2012. Current management measures in place for the protection of this isolated population include a 200 m radius buffer zone and a biannual monitoring programme of the existing population.

Gove operations is implementing a "Translocation Plan" that involves propagating cuttings taken from the existing population and planting them within a suitable compensatory introduction sites on the mine lease, away from mining activities. Once multiple populations have been successfully established, the translocation (salvage dig) of the existing population can be undertaken with confidence and mining operations can resume in the excluded area.

26.8 Exotic Plant Species

There are a number of weeds species currently listed (Nationally/NT) for the bio-region. **Table 45** summarises the current significant declared weed species under the NT *Weeds Management Act*, recorded at Gove operations. The shaded species in the table are those which are also declared as a Weed of National Significance.

Table 45. Gove Operations Weed Species

Weed Species	Scientific Name	NT Declarations (Class)	Lease Location
Bellyache Bush	*Jatropha gossypfolia*	A/C (Outside B Zone)	RDA, Northern Ponds
Common Lantana	*Lantana camara*	A/C	RDA, Northern Ponds
Gamba Grass	*Andropogon gayanus*	A/C (Outside B Zone)	Not Yet Recorded
Ornamental Rubber Vine	*Cryptostegia madagascariensis*	A/C	Mine
Hyptis	*Hyptis suaveolens*	B/C	All
Grader Grass	*Themea quadrivalvis*	B/C	All
Snakeweed	*Stachytarpheta cayennensis*	B/C	All
Pink Snakeweed	*Stachytarpheta mutabalis*	B/C	Mine
Spiny Head Sida	*Sida acuta*	B/C	RDA
Flannel Weed	*Sida cordifolia*	B/C	All
Sickle Pod	*Senna obtusifolia*	B/C	All
Candle Bush	*Senna alata*	B/C	Overland Conveyor
Coffee Senna	*Senna occidentalis*	B/C	RDA, refinery

Weed Species	Scientific Name	NT Declarations (Class)	Lease Location
Perennial Mission Grass	*Cenchrus polystachios (formerly Pennisetum polystachion)*	B/C	All
Mossman River Grass	*Cenchrus echinatus*	B/C	Refinery, RDA
Caltrop	*Tribulus terrestris*	B/C	Refinery, Mine, RDA
Khaki Weed	*Alternanthera pungens*	B/C	Refinery, Mine, RDA
Neem	*Azadirachta indica*	B/C	Refinery, RDA
Giant Rat Tail Grass	*Sporobolus Pyramidalis*	-	RDA Pond 3 Cap

There are two Rubber Vine species in Australia, and both are declared Class A (to be eradicated) and Class C (not to be introduced to the NT) weeds in accordance with the NT *Weeds Management Act*. *Cenchrus polystachios* and *Andropogon gayanus* are also included in a national Threat Abatement Plan to address the key threatening process of ecosystem degradation due to invasion of northern Australia by five introduced grasses.

26.9 Exotic Animal Species

There are a number of pest fauna species currently listed for the bio-region. Those species that are listed as a key threatening process under the EPBC Act or the National Introduced Marine Pest Information System (NIMPIS) are highlighted in light grey. In late 2016 a new pest marine pest species, Colonial Sea Squirt (*Didemnum perlucidum*), was detected on marine pest traps located at the Export and Cargo Wharfs. This species is not yet listed on the National Introduced Marine Pest Information System (NIMPIS) but is known to display pest characteristics in tropical waters. This pest has been previously recorded in the Gove region and Darwin. Below is a summary of those species which are of significance to the operations both in terrestrial and marine area, see **Table 46**. A number of marine pest species have been added to the site list as potential threats. Parts of the mine operations and north-east Arnhem Land are currently infested with the invasive Yellow Crazy Ant. Yellow Crazy Ants are currently identified in a national EPBC Threat Abatement Plan to reduce the impacts of Tramp Ants on biodiversity in Australia and its territories.

Table 46. Gove Operations Exotic Animal List 2018

Pest Species	Scientific Name	Lease Location
Yellow Crazy Ant	*Anoplolepis gracilipes*	Mine
Cane Toad	*Bufo marinus*	All
Feral Cats	*Felis catus*	All
Feral Buffalo	*Bubalis bubalis*	All
Wild Dog	*Canis lupus familiaris, Canis lupus dingo* or hybrids	All
Feral Cattle	*Bos taurus, Bos indicus*	Mine
Colonial Sea Squirt	*Didemnum perlucidum*	Cargo/Export Wharf
Black-Striped Mussel	*Mytilopsis sallei*	Not Detected
Asian Green Mussel	*Perna viridis*	Not Detected
Hydroid	*Plumularia setacea*	Not Detected
Acorn Barnacle	*Megabalanus tintinnabulum*	Not Detected
Aquarium Caulerpa	*Caulerpa taxifolia*	Not Detected
Bryozoan	*Bugula neritina*	Not Detected
Star Ascidian	*Botryllus schlosseri*	Not Detected
Colonial Ascidian	*Botrylloides leachi*	Not Detected
Caribbean Serpulid Tubeworm	*Hydroides sanctaecrucis*	Not Detected
Knotted Thread Hydroid	*Antennella secundaria*	Not Detected

ATTACHMENT C – ENVIRONMENTAL PROTECTION MANAGEMENT STRATEGIES (EPMS)

Table 47. Summary Significant Environmental Risks (2019)

Standard	Impact	Location	Risk Scenario	Risk ranking	Relevant EMPS
E11 Water quality protection and water management	Contamination of water resources.	RDA / Refinery	Seepage of liquor from ponds.	Critical	- EPMS01 - EPMS02 - EPMS03 - EPMS07 - EPMS08
E15 Hazardous materials and non-mineral waste management	Contamination of soil and water resources.	Mine / Refinery	Significant release of hazardous materials (e.g. diesel) from underground pipelines through corrosion and/or catastrophic failure resulting in environmental impacts	Critical	- EPMS01 - EPMS02 - EPMS03 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	RDA	Overtopping of Pond 5 wall due to the combined impacts from high rainfall events, prolonged rainfall, increased catchment area, undersize drain, and decrease liquor storage capacity.	High	- EPMS01 - EPMS03 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	Refinery / Gove Inner Harbour	Exceedance of WDL limits from Wastewater neutralisation plant at outfall discharge point S001 due to instrument failure, incorrect operation and / or operating conditions.	High	- EPMS01 - EPMS03 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	Refinery / Gove Inner Harbour	Exceedance of WDL limits from Wastewater neutralisation plant at outfall discharge point S001 due to ponds overflowing during heavy rainfall events (contaminated water from Western Pond, Southern Containment Pond and / or Oily Water Pond).	High	- EPMS01 - EPMS03 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	Refinery / Gove Inner Harbour	Exceedance of WDL limits for Total Petroleum Hydrocarbon (TPH) and oil sheen due to overflowing of hydrocarbon sumps, pipe leaks, or Tank farm bunds discharge, power station, diesel pipeline over seawater channel bursts/ leaks into seawater channel.	High	- EPMS01 - EPMS03 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	Refinery	Surface water runoff from Stockpile Creek during heavy rainfall events may exceed turbidity WDL trigger/limits at Stockpile creek discharge point S006 to Melville Bay.	High	- EPMS01 - EPMS03

Standard	Impact	Location	Risk Scenario	Risk ranking	Relevant EMPS
E11 Water quality protection and water management	Contamination of water resources.	RDA	Exceedance in discharge quality likely to modify the chemistry of Duck Pond or Wallaby Beach or Crawford's Creek release point resulting in breach WDL conditions.	High	- EPMS01 - EPMS03 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	Mine	Uncontrolled release from Dissolved Air Flotation (DAF) unit during heavy rainfall event exceeding the internal discharge water quality guideline values at sample site s2011.	High	- EPMS01 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	Refinery	Failure of pipeline of diesel line and oily water line within seawater channel due to deterioration of components resulting in discharge to seawater channel.	High	- EPMS01 - EPMS03 - EPMS07
E14 Land management and rehabilitation	Loss of biodiversity and/or flora and fauna habitat.	Mine	Significant residual impact from clearing vegetation for drilling/mining on listed ecosystems, or flora and fauna species.	High	- EPMS05 - EPMS06 - EPMS10
E15 Hazardous materials and non-mineral waste management	Contamination of water resources.	RDA	Pond wall failure causing uncontrolled release from red mud and/or liquor ponds.	High	- EPMS01 - EPMS03 - EPMS07 - EPMS08
E15 Hazardous materials and non-mineral waste management	Contamination of marine and foreshore environments.	Refinery / Port	Uncontrolled release from shipping vessels of diesel, hydrocarbons, chemicals or cargo due to spill or major collision of vessels.	High	- EPMS03 - EPMS07
E15 Hazardous materials and non-mineral waste management	Contamination of marine and foreshore environments.	Refinery / Port	Uncontrolled release when unloading diesel from ship to shore, due to failure of loading arm swivel joints and/or connection coupling.	High	- EPMS01 - EPMS03 - EPMS07
E15 Hazardous materials and non-mineral waste management	Contamination of marine and foreshore environments.	Refinery / Port	Catastrophic failure of tank or piping resulting uncontrolled release into receiving environment.	High	- EPMS01 - EPMS02 - EPMS03 - EPMS07
E16 Biodiversity protection and natural resource management	Decline in biodiversity values and/or fauna habitat.	All	Yellow Crazy Ants spread into native vegetation through clearing operations.	High	- EPMS05 - EPMS10 - EPMS11
E16 Biodiversity protection and natural resource management	Decline in biodiversity and/or flora and fauna habitat.	Mine / RDA	Uncontrolled fire entering rehabilitation areas and timber cleared areas resulting in damage to habitats.	High	- EPMS05 - EPMS06

Standard	Impact	Location	Risk Scenario	Risk ranking	Relevant EMPS
E12 Air quality protection	Decline in flora and fauna habitat.	RDA	Dust from Mud farm coming airborne in high winds causing smothering and causing vegetation stress.	Moderate	- EPMS04 - EPMS05 - EPMS10
E11 Water quality protection and water management	Contamination of water resources.	Refinery	Surface water runoff from Export Stockpile during heavy rainfall events created brown colour water that is high in turbidity discharging into seawater channel may breach turbidity WDL trigger/limit at Outfall station S001.	Moderate	- EPMS01 - EPMS03
E11 Water quality protection and water management	Contamination of water resources.	Refinery	During delivering of large quantities of hazardous and/or dangerous goods from supplier (barge) to site, incident occurs resulting in loss of containment causing contamination to environment.	Moderate	- EPMS03 - EPMS07
E11 Water quality protection and water management	Contamination of water resources.	RDA	Failure of Pond capping liner resulting in significant discharge of process waste to the stormwater drain and to the environment.	Moderate	- EPMS01 - EPMS03 - EPMS06 - EPMS07 - EPMS08
E11 Water quality protection and water management	Contamination of water resources.	RDA	Weather conditions (heavy rainfall) exceed design capacity of RDA ponds causing a significant release of liquor to the environment.	Moderate	- EPMS01 - EPMS03 - EPMS07 - EPMS08
E15 Hazardous materials and non-mineral waste control	Contamination of marine and foreshore environments.	Refinery	Failure of hoses whilst discharging of bilge water from the tugs to the vac truck and whilst decanting lube oils to the on-board systems. Sewerage farm failure resulting in odour and raw sewerage discharging to water.	Moderate	- EPMS07 - EPMS08 - EPMS09
E15 Hazardous materials and non-mineral waste management	Contamination of soil and water resources.	All	Minor hydrocarbon/chemical spills and/or releases from HME equipment or handling (forklift)	Moderate	- EPMS07
E15 Hazardous materials and non-mineral waste management	Contamination of soil and water resources	All	Waste streams, both hazardous and non-hazardous, incorrectly managed, including generation and disposal, resulting in contamination from materials such as asbestos, hydrocarbons, or other chemicals. Contaminated general waste inadvertently sent to township resulting in contamination (10-20 litres).	Moderate	- EPMS01 - EPMS02 - EPMS03 - EPMS07 - EPMS09
E16 Biodiversity protection and natural resource management	Decline in biodiversity and/or flora and fauna habitat.	All	Introduction and spread of foreign species (pest/weeds) into the environment resulting in negative ecosystem change.	Moderate	- EPMS05 - EPMS06 - EPMS10

STANDARD	IMPACT	LOCATION	RISK SCENARIO	RISK RANKING	RELEVANT EMPS
					- EPMS11
E16 Biodiversity protection and natural resource management	Decline in biodiversity and/or flora and fauna habitat.	All	Clearing of vegetation resulting in the loss or impacting on significant habitat and or species (Flora-Fauna).	Moderate	- EPMS05 - EPMS10
E16 Biodiversity protection and natural resource management	Biodiversity loss from loss of fauna.	All	Injury and/or mortality to species during mining operations including clearing and haulage.	Moderate	- EPMS10
E16 Biodiversity protection and natural resource management	Biodiversity degradation.	All	Excessive sediment loss arising from construction activities or alteration of natural topography, watercourse and vegetation.	Moderate	- EPMS05 - EPMS06 - EPMS10

27. Water Quality Protection

27.1 EPMS - Surface Water

EPMS 01 – Surface Water	
Context & Activities	
Mine Production - The risk to surface water within the mine area is low, continued rehabilitation and sediment controls will be sustained during this reporting period. Refinery/RDA - Surface water management at the refinery and RDA continues to be a high risk for the operations and is managed to comply with the WDL. - Refinery closure activities and preparation works will include the decontamination of the alumina refinery infrastructure, vessels and pipelines prior to full decommissioning, salvage or demolition activities. The gradual removal of residual SNL sources will reduce the level of risk posed to surface water over time. - At the RDA multiple rehabilitation, seepage recovery systems, capping and closure projects will continue to incorporate surface water quality improvement aspects.	
Objectives	**Targets**
- Treat wastewater streams to meet WDL discharge conditions/limits. - Maintain regulatory compliance reporting requirements	- Zero non-compliance events against WDL conditions/discharge limits. - Regulatory reports submitted within required timeframes
Control Measures	
Surface water quality: - Clean surface water shall be diverted away from cleared areas to reduce volumes of sediment contaminated water being generated - All potentially contaminated storm water shall be treated prior to discharge to the environment (sediment and hydrocarbons as applicable) - All drainage structures and sedimentation basins will be inspected and maintained on a regular basis Water Balance/Accounting: - Catchment maps of surface waters will be utilised to predict downstream water quality impacts and for investigating community complaints regarding water quality - A water balance of all water inputs, uses, outputs and losses for the operation must be maintained - Water-related infrastructure shall be part of workplace inspection programs and maintenance performed where necessary to maintain a leak-free condition - All leaks are to be reported as per incident reporting procedure - Site Emergency Response Plans must include contingencies for water related emergency events including pipeline failures and flood Wastewater: - Hydrocarbon water treatment facilities will be regularly inspected and maintained by area owners to prevent the discharge of pollutants - Vehicle and equipment wash down facilities will be regularly inspected and maintained by area owners (including cleaning out sumps) - The Wastewater Neutralisation Plant (WWNP) and Sewage Treatment Plant (STP) will be operated in accordance with their respective Operations and Maintenance Manuals	
Monitoring	
Wastewater effluent analysis as documented in the WDL conditions Water levels in water storage facilities and discharge flows Mine: precipitation; fresh water usage; and groundwater extraction Refinery: precipitation; fresh water usage; seawater intake; and aquifer interception; and RDA: precipitation; SNL/wastewater; and aquifer interception	
Recording	
Copies of relevant governing body approvals/licences Hydrological and wastewater Laboratory Analysis Results Catchment maps Metrological data and storage facility levels Incidents related to surface waters	

EPMS 01 – Surface Water
Reporting
Internal - Water accounts and water balance modelling - Annual reporting in S&E Water Section - Number of surface water-related incidents during reporting period, and detail of response/closure; - Surface water-related audit findings during reporting period, and detail of response/closure; External - Water data from S&E survey reported publicly through the RT Sustainable Development Report - Annual water emission data reported publicly through the National Pollutant Inventory reporting process. - Annual Audit and Compliance Report (AACR) and associated data to EPA - Annual Water Monitoring Report (EPA)
Corrective Actions
Should monitoring/incident investigations identify that additional or alternative management intervention is required; the following management contingencies may be initiated: - decrease or suspension of controlled wastewater discharges - Increased/alternative water treatment activities - increase water reuse; and - increase water storages
Associated Documents
Civil Works: Stormwater Design Data (GSM-ENG-4058-905) Control of Chemical and Hazardous Substances Procedure (GPM-EHS-024) First Strike Oil Spill Response Plan (APM-SRG-001) Mine – Major Chemical Release ERP (FRM-MIN-028) Dissolved Air Floatation Operating Instruction Manual (OIM-520-001) Pond Safety Trigger Action Response Plans (FRM-RDA-055) Port – Major Chemical Release ERP (FRM-PRT-045) RDA – Operating, Monitoring and Maintenance Manual (OIM-RDA-001) RDA - Pond Wall Failure ERP (ERP-EMM-007) RDA – Specific Emergency Plan (SEP-RDA-001) RDA Seepage Recovery System Verification Monitoring Plan RDA Tailings and Water Storage Management Plan (APM-RDA-008) Refinery Water Management Procedure (OIM-702-001) Seepage Management Strategy Sewage Treatment Plant Operations and Maintenance Manual (OIM-702-003) Site Emergency Response Procedure (GPM-EHS-010) Gove Operations Waste Discharge Licence Water Monitoring Plan

27.2 EPMS - Groundwater

EPMS 02 – GROUNDWATER	
CONTEXT & ACTIVITIES	
At the mine, groundwater abstraction from the bore field will continue through the duration of the reporting period according to the approved licence. At the RDA, activities will focus on the continued monitoring of the groundwater systems. Over the reporting period, installation of seepage recovery systems and commencement of capping projects will continue to manage and mitigate the groundwater risks. At the refinery, activities will focus on the ongoing monitoring, investigation, design and optimisation of contaminated groundwater recovery systems.	
OBJECTIVES	**TARGETS**
- Ensure groundwater abstraction does not exceed licence limits. - Contain and treat any identified impacted groundwater sources. - Maintain regulatory compliance reporting requirements	- No exceedance of abstraction limits. - Containment/treatment systems are in place for identified impacted groundwater. - Regulatory reports submitted within require timeframes
CONTROL MEASURES	
Mine Production - All water extraction points must be correctly permitted and approved - Water abstraction points will be monitored for quality, metered for usage and recorded for reporting purposes - Water-related storage and distribution infrastructure shall be part of workplace inspection programs and maintenance performed where necessary to maintain a leak-free condition - All leaks are to be reported as per incident reporting procedure - Monitoring program for bore field groundwater readings and health assessment Impacted Groundwater - Implementation of the Seepage management strategy for RDA site - Implement operational controls to prevent uncontrolled release of contaminants to the environment - Install impervious drainage paths to secondary containment system - Install primary bunding and secondary containment with impervious lining in accordance with Australian standards - Continued operation of the existing groundwater recovery systems with regular review and expansion if required - Maintain a contaminated site register which documents all know groundwater contamination and remediation plans	
MONITORING	
Groundwater abstraction health assessment. Weekly abstraction meter readings for all production bores Monthly gauging of observation and monitoring bore levels Bore field/ recovery system infrastructure, inspections, maintenance and replacement work Fresh water use flow meters Seepage recovery volumes Groundwater quality as per the Water Monitoring Plan	
RECORDING	
Copies of relevant governing body approvals for groundwater abstraction Borefield extraction data and laboratory analytical results Groundwater quality and analysis of trends Hydrological/hydrogeological modelling and flow paths (GIS) Groundwater-related audit findings during reporting period, and detail of response/closure Number of groundwater-related and spill incidents during reporting period, and detail of response/closure.	
REPORTING	
Internal - Number of groundwater-related incidents during reporting period, and detail of response/closure; - Groundwater-related audit findings during reporting period, and detail of response/closure;	

EPMS 02 – GROUNDWATER
- Volume of seepage recovered during reporting period - Groundwater quality and analysis of trends - Details of groundwater remediation projects implemented during reporting period External - Annual water monitoring reports – groundwater quality (EPA).
CORRECTIVE ACTIONS
Should monitoring/incident investigations identify that additional or alternative management intervention is required; the following management contingencies may be initiated. - Reductions in fresh water use - additional groundwater interception trenches - additional vertical interception bores; and - increased seepage recovery
ASSOCIATED DOCUMENTS
Civil Works: Stormwater Design Data (GSM-ENG-4058-905) Control of Chemical and Hazardous Substances Procedure (GPM-EHS-024) Hazardous and Underground Pipeline and Tanks Procedure (GPM-EHS-115) Marine Health Monitoring Plan (APM-EHS-039) Pond Safety Trigger Action Response Plans (FRM-RDA-055) RDA – Operating, Monitoring and Maintenance Manual (OIM-RDA-001) RDA Seepage Recovery System Verification Monitoring Plan RDA Tailings and Water Storage Procedure (APM-RDA-008) Refinery Water Management Procedure (OIM-702-001) Seepage Management Strategy Site Emergency Response Procedure (GPM-EHS-010) Borefield Abstraction Licence Non Mineral Waste Management Procedure (GPM-EHS-030) Water Monitoring Plan

27.3 EPMS - Marine

EPMS 03 – MARINE	
CONTEXT & ACTIVITIES	
The Marine Health monitoring programme will continue to be implemented throughout the reporting period. The program includes consideration of all releases to the marine environment as a result of Gove Operations activities, including; - surface water discharge - ground water seepage - and atmospheric deposition and; - effects of shipping movements. The MHMP is a process that allows Gove Operations to assess ecological change, modification to physical and chemical properties of the receiving marine waters and sediments and trigger continuous improvement.	
OBJECTIVES	**TARGETS**
- Ensure that wastewater discharges from operation do not affect the receiving environment. - Maintain regulatory compliance reporting requirements	- Zero non-compliance events against WDL conditions/trigger levels. - Regulatory reports submitted within required timeframes
CONTROL MEASURES	
Implementation of the; - Marine Health Monitoring programme. - Marine Sediment Monitoring programme. - EPMS01 Surface Water - EPMS11 Exotic Species - EPMS08 Chemically Reactive Mineral Waste	
MONITORING	
Marine health monitoring data will include: - assess seawater quality - assess marine sediment quality - conduct ecotoxicity investigations	
RECORDING	
Marine health monitoring data will include: - Seawater quality and analysis of trends; - Marine sediment quality and analysis of trends; - Oyster monitoring data and analysis of trends; - Audit findings and corrective actions; and - Number of marine-related incidents during reporting period, and detail of response/closure.	
REPORTING	
Internal - Number of marine-related incidents during reporting period, and detail of response/closure; - Marine-related audit findings during reporting period, and detail of response/closure; External - Annual Audit and Compliance Report (AACR) and associated data to EPA - Annual Marine Health monitoring report (EPA)	
CORRECTIVE ACTIONS	
Should monitoring identify that additional or alternative management intervention is required, the following management contingencies may be initiated: - increase water monitoring activities; - undertake impact assessment; and - implement any additional mitigation measures identified.	
ASSOCIATED DOCUMENTS	
Gove Operations Waste Discharge Licence Marine Health monitoring (APM-EHS-039) Control of Chemical and Hazardous Substances Procedure (GPM-EHS-024) First Strike Oil Spill Response Plan (APM-SRG-001)	

EPMS 03 – MARINE
Pond Safety Trigger Action Response Plans (FRM-RDA-055)
Port – Major Chemical Release ERP (FRM-PRT-045)
RDA – Operating, Monitoring and Maintenance Manual (OIM-RDA-001)
RDA - Pond Wall Failure ERP (ERP-EMM-007)
RDA – Specific Emergency Plan (SEP-RDA-001)
RDA Seepage Recovery System Verification Monitoring Plan
RDA Tailings and Water Storage Management Plan (APM-RDA-008)
Refinery Water Management Procedure (OIM-702-001)
Seepage Management Strategy
Sewage Treatment Plant Operations and Maintenance Manual (OIM-702-003)
Site Emergency Response Procedure (GPM-EHS-010)
Water Monitoring Plan

28. EPMS - Air Quality Protection

EPMS 04 – AIR QUALITY	
CONTEXT & ACTIVITIES	
Mine Production - Fugitive emission associated with mining, crushing, and bauxite conveying will continue to be the primary source of emissions for the duration of the authorisation. - These emissions will continue to be managed under the auspices of operational action plans. Refinery - Point source emission from the alternate power generation system (APG) will continue to be the primary source of emissions for the duration of the authorisation. - Parts of the bauxite processing system within the Refinery lease will also be a source of fugitive emissions from bauxite stockpiles and handling operations to the ship loader. - These emissions continue to be managed under the auspices of operational action plans. RDA - Fugitive emission associated with the uncapped residue disposal areas will be the primary source of emissions until closure of the dry-stacking area has been completed. - These emissions will continue to be managed under the auspices of both operational and closure action plans.	
OBJECTIVES	**TARGETS**
- Ensure air emissions from the site do not affect surrounding communities. - Satisfy all Commonwealth Government reporting requirements	- No community grievances pertaining to air quality, particularly dust - Regulatory reports submitted within required timeframe
CONTROL MEASURES	
Maintain an Air Emission register for all site emission sources, documenting their physical characteristics and risk profiles to enable adaptive management Development of specific Air Emission Plans when activities/areas are assessed as having significant risk following a risk assessment process or complaints. Where required, unsealed roads, access routes and exposed ground surfaces will be watered during the dry season Continuous rehabilitation of mined out areas and progressive rehabilitation of closed footprint areas Implementation of road speed limits and regular maintenance schedules adjacent to sensitive receptors. The emission profile of equipment and machinery shall be considered when evaluating and sourcing any new equipment Air emission controls on equipment will be maintained in good working order.	
MONITORING	
Visual monitoring of excessive emission/dust during routine inspections of areas Periodic monitoring of emissions where grievances or concerns have been received	
RECORDING	
Air emission data recorded in the site air quality/emissions database. Community grievances related to air quality; Audit findings and corrective actions Incidents reports regarding air emissions	
REPORTING	
Internal - Community grievances related to air quality; - Fuel handling and consumption reported monthly. - Annual reporting in S&E Air Section - Number of air quality-related incidents during reporting period, and detail of response/closure; - Air quality-related audit findings during reporting period, and detail of response/closure; External - Air emissions data from S&E survey reported publicly through the RT Sustainable Development Report - Annual air emission data reported publicly through the National Pollutant Inventory reporting process. - Energy Efficiency Opportunities (EEO) and National Greenhouse and Energy Reporting (NGER)	
CORRECTIVE ACTIONS	
Should monitoring/incident investigations identify that additional or alternative management intervention is required; the following management contingencies may be initiated:	

EPMS 04 – AIR QUALITY
- Suspension of emission source activities - Increased/alternative cleaner production activities (CPA) - Upgrades to existing pollution control equipment (PCE); and - Installation of additional pollution control equipment (PCE)
ASSOCIATED DOCUMENTS
Air Quality Management Procedure (GPM-EHS-092) Greenhouse Gas and Energy Efficiency (GPM-EHS-117) RDA Operating, Monitoring and Maintenance Manual (OIM-RDA-001) Community Enquiry, Complaint and Incident Management (GPM-CAF-003) Materials Handling - Reducing Excessive Bauxite Dust Emission (WI-MHD-135) 776 Water Tanker – Watering Haul Roads (WI-520-038)

29. Land Management and Rehabilitation

29.1 EPMS - Land Use

EPMS 05 – LAND USE	
CONTEXT & ACTIVITIES	
Mine Production - Timber clearing and land disturbance will continue at the mine until closure of the operations. - Disturbance activities as part of bauxite processing will be primarily for ongoing maintenance purposes. Refinery - Land disturbance activities for closed areas of the refinery will be limited to project related activities or maintenance. RDA - Major land disturbance related to the capping of the RDA ponds will be limited to borrow areas, for soil material resources.	
OBJECTIVES	**TARGETS**
- Ensure that all land development activities are complaint with authorised land use. - Ensure all land disturbance activities are approved.	- Zero non-compliances with permitted land use activities. - Zero unauthorised land disturbances
CONTROL MEASURES	
Vegetation Clearing Permit approvals process Cultural heritage and Lease Compliance Assessment process Land use classifications, lease conditions and authorised activities Notification and approval from Traditional Owners, access permits from NLC and/or certificate for disturbance from AAPA, where required Obtain approvals from EPA and/or Commonwealth regulatory authorities where required. Maps in relevant areas of excluded areas and buffer zones EPMS 06 – Land rehabilitation plan EPMS 10– Biodiversity protection management plan	
MONITORING	
Routine and random on-the-ground audits of areas by permit approvals personnel Annual aerial photographs of the site, and digitising actual areas disturbed Comparison of disturbance versus Land Classes and Land Use Type (purpose) Audits of operational controls for clearing and legal compliance Continual update of internal land use classes (Permitted, Restricted, and Exclusion) Update of Vegetation Clearing Permit register as required Annual update of Closure Plan incorporating any significant new disturbances	
RECORDING	
Copies of all approved and denied vegetation clearing permits. Regulatory approval documents. Areas disturbed, rehabilitated and stabilised (GIS) Land disturbance-related audit findings during reporting period, and detail of response/closure Number of Land disturbance-related incidents during reporting period, and detail of response/closure	
REPORTING	
Internal - Annual reporting of footprint status for closure provisioning - Annual reporting in S&E Land Section. - Number of land use-related incidents during reporting period, and detail of response/closure; - Land use-related audit findings during reporting period, and detail of response/closure; External - Land disturbance data from S&E survey reported publicly through the RT Sustainable Development Report	
CORRECTIVE ACTIONS	
Should monitoring/incident investigations identify that additional or alternative management intervention is required; the following management contingencies may be initiated: - Suspension of land development activities	

EPMS 05 – LAND USE
- Rehabilitation of unauthorised developed area; and - Establishment of exclusions and restrictions
ASSOCIATED DOCUMENTS
Excavation Permit & Survey Request Procedure (GPM-ENG-83-07-14) Excavation Permit Form (FRM-ENG-049) Mining Management Plan – Authorisation Approved Leases and associated conditions RDA Operating, Monitoring and Maintenance Manual (OIM-RDA-001) Vegetation Clearing Procedure (GPM-EHS-104) Vegetation Clearing Permit Application Form (FRM-EHS-087) Leadership Audit – Vegetation Clearing (FRM-EHS-438) Land Disturbance Procedure – Pre-mining (APM-MIN-028) Yolngu Access Request to RT Lease Areas (FRM-CAF-029) Mine Operations – Culturally Significant Site Identification (FRM-MIN-013) Cultural Heritage Management System procedures Guide (GPM-CAF-005) Communities and Heritage permit Guideline and Application (GPM-CAF-011) Cultural Heritage and Site Preservation Policy (POL-CAF-003) Land Use Stewardship (GPM-EHS-093)

29.2 EPMS - Land Rehabilitation

EPMS 06 – LAND REHABILITATION	
CONTEXT & ACTIVITIES	
Mine Production - The mine operations will continue to conduct continuous rehabilitation activities throughout the reporting period. - As the mine and bauxite processing operations are entering the ten year window of closure a number of closure studies to refine rehabilitation and closure requirements will be conducted. Details of these projects are covered in the closure section of this MMP. RDA - At the RDA, progressive capping/rehabilitation of remaining residue disposal areas will continue under the auspices of the closure projects as covered in the closure section of this MMP. Refinery - At the refinery, progressive rehabilitation is expected to commence once demolition and remediation closure activities have been completed. This work will continue under the auspices of the refinery closure projects as covered in the closure section of this MMP.	
OBJECTIVES	**TARGETS**
- Conduct continuous rehabilitation of areas no longer required for operations to reduce future liability. - Ensure rehabilitated areas are meeting the expectations of the stakeholders final land use requirements.	- > 100 ha of continuous rehabilitation of planned mined-out areas. - Rehabilitated land is trending towards agreed completion criteria.
CONTROL MEASURES	
Mine Production - Clear timber 3-5 years in advance of mining operations to promote healthy soils for continuous rehabilitation - Soil removal and handling activities to be planned to correspond with the dry season where possible - Recovery of topsoil from disturbed areas for immediate reuse or for stockpiling as part of the continuous mine rehabilitation strategy - Locate soil stockpiles close to future rehabilitation areas to minimise excessive handling - Amelioration of other soil material resources where possible for use in future progressive rehabilitation; - Placement of soil covers over disturbed areas at a depth that optimises rehabilitation success - Annual seed collection and storage of native local provenance species	

EPMS 06 – LAND REHABILITATION
- Landform shaping and ripping of soil profiles to prevent water ponding, erosion and encourage infiltration prior to onset of wet season; - Direct seeding and/planting of native vegetation on rehabilitation areas annually, during the wet season RDA - Revegetation and stabilisation of pond wall outer batters - Research into improvement to rehabilitation processes and capping of completed areas of the RDA.
MONITORING
Monthly surveys and inspections of rehabilitation activities to access performance Weekly/monthly monitoring and recording of mine soil movement Monitoring and recording of timber clearing areas in advance of soil removal Recording of long-term soil stockpiles in a Soil Inventory Database for the mine Monitoring up to 18 months after rehabilitation works to assess their success Long-term rehabilitation monitoring of the performance against objectives focuses on vegetation, stability, and habitat attributes
RECORDING
Annual inventory reconciliation of seed stocks Annual inventory review of topsoil material stockpiles against closure requirements (GIS) Annual inventory review of mulch stockpiles against closure requirements for RDA; and Monthly review of soil related incidents – contaminated soils, incorrect movement and placement of soils Rehabilitated area locations in GIS Photo journals, including photographs from monitoring activities Revegetation records; species used, volumes of seed used, soil characteristics etc.
REPORTING
Internal - Monthly reporting of actual mine rehabilitation against planned - Annual reporting in S&E Land Section. - Number of rehabilitation-related incidents during reporting period, and detail of response/closure; - Rehabilitation-related audit findings during reporting period, and detail of response/closure; External - Land data from S&E survey reported publicly through the RT Sustainable Development Report - Rehabilitation progress updates provided at TO Leaders Forum and annual tour conducted.
CORRECTIVE ACTIONS
Should monitoring identify that additional or alternative management intervention is required, the following management contingencies may be initiated: - up-grade of areas where completion criteria trends are not being met. - amelioration of soils to support vegetation - review of soil handling practices.
ASSOCIATED DOCUMENTS
Mine - 18 month rehab monitoring procedure Mine- Long Term Monitoring Procedures Mine - Rehabilitation Manual and procedures. 590 RTD - pushing Overburden (WI-520-017) 992G/993K FEL – Loading Overburden into Rear Dump Trucks (WI-520-026) Dozer – Landscaping and Ripping Overburden (WI-520-056) Dozer – Pushing up Overburden and Topsoil (WI-520-058) Rear Dump Truck – Removing and Tipping Overburden (WI-520-073) Mine – Overburden Management Procedure (APM-MIN-019) RDA Borrow Area Rehabilitation Plan

30. Hazardous Materials, Mineral and Non-minerals Waste Management

30.1 EPMS - Hazardous Materials

EPMS 07 - Hazardous Materials	
Context	
Hazardous materials will continue to be used, stored and handled whilst mining and bauxite processing operations continue until closure. Contaminated sites will continued to be managed through the operational and closed areas of the business.	
Objectives	**Targets**
- Ensure that no banned hazardous materials are used by the operations. - Provide secure containment of all hazardous materials in accordance with regulatory requirements.	- Zero banned products introduced to site. - Zero non-compliances with hazardous material storage facilities.
Control Measures	
Hazardous materials used are processed through ChemAlert approval process prior to introduction to site Maintenance of a Contaminated Sites Register Register of Hazardous Materials Inventory Register of the Underground Hazardous Material Infrastructure Hazardous material are managed by qualified contractors in Gove Operations Integrity testing of hazardous materials storage infrastructures Segregation requirements are met during storage Appropriate information made available for the safe handling of hazardous materials Hazardous materials are appropriately eliminated to avoid environmental harm Spill response procedures exist for significant hazardous release events. Complete the planned closure of refinery operations in a way that mitigates and reduces the environmental risk of temporary storage, transport and the disposal associated with all hazardous materials handled and generated during closure.	
Monitoring	
Level and inventory mass balance checks of bulk storage facilities. Integrity and pressure testing. Line inspections and routine bunding checks. Audits at least every two years as part of the HSE Audit programme Conduct routine housekeeping and hazardous materials management leadership audits Leachate and groundwater bore monitoring will be carried out according to the site Water Monitoring Plan.	
Recording	
Level and inventory data. Contaminated Sites Register - contains all required information on known contaminated sites both current and legacy sites (also stored in GIS) Hazardous Materials Register – contains the location, type and quantity stored across the Gove operations. Underground Hazardous Materials Register – contains locations, design data, type of product, inspection requirement, integrity testing requirement and risk assessments. Number of hazardous materials related incidents during reporting period, and detail of response/closure	
Reporting	
Internal - Number of hazardous material related incidents during reporting period, and detail of response/closure; - Hazardous materials-related audit findings during reporting period, and detail of response/closure;	
Corrective Actions	
Should monitoring identify that additional or alternative management intervention is required, the following management contingencies may be initiated: - review of hazardous materials management activities to minimise risk; - investigate additional hazardous materials minimisation opportunities; and - upgrade or improvement to storage facilities.	

EPMS 07 - Hazardous Materials
Associated Documents
Control of Chemical and Hazardous Substances Procedure (GPM-EHS-024) Site Emergency Response Plan (BRP-EHS-002) Underground Hazardous Pipelines and Tanks (GPM-EHS-115). Waste Management Procedure (GPM-EHS-030); Excavation Permit and Survey Request Procedure (GPM-ENG-83-07-14) Excavation Permit (FRM-ENG-049) Excavation Permit Checklist (FRM-ENG-050)

30.2 EPMS - Chemically Reactive Mineral Waste

EPMS 08 – Chemically Reactive Mineral waste	
Context & Activities	
Mine Production - There are no chemically reactive mineral waste (CRMW) risks identified at the mine. Refinery/RDA - With the closure of refining operations, SNL and bauxite residue are no longer produced but will continue to be stored in the RDA. - Some chemically reactive mineral waste streams may also be produced during the decontamination of the alumina refinery prior to demolition occurring (eg scale, limestone). Considered as process waste, these streams will be disposed of into the RDA.	
Objectives	**Targets**
- Provide secure containment of all mineral waste streams. - Ensure mineral waste storage facilities are remediated to meet the expectations of stakeholders.	- Zero major releases to the environment of contained mineral wastes. - Progressively remediate closed minerals waste storage facilities
Control measures	
Maintain a Mineral Waste Inventory comprising quantities, location and representative characteristics of chemically reactive mineral waste stored on site. RDA - Appropriate design, construction and operation of facility to ensure structural integrity is maintained. - Chemically reactive mineral waste facilities that are no longer in operation should be remediated. - Progressive rehabilitation of reactive mineral waste facilities should be identified in operating plans and conducted according to EPMS-006. - Conduct monitoring programs to confirm impact predictions, and determine if performance criteria are being met to validate the success of mitigation programs; - Independent external review of the mineral waste management strategies, disposal facilities, monitoring programmes, remediation budgets and plans at least every four years where significant mineral waste and impact drainage or other geochemical hazards exist. - Ensure pond closure sequencing is modelled using OPSIM and is used to determine short, medium and long term projects and water transfer within the RDA. - Maximise current containment and storage without increasing footprint. - Maximise inventory reduction. - Facility designed in accordance to the tailings characterisation work. - Limit seepage and construct a low permeability layer. Installation of monitoring bores and if required, recovery bores. - Maintain a calibrated operational simulation model for the purpose of investigating most efficient methods and target drawdown rates to reduce stored inventory and move towards the Liquor Management Strategy	
Monitoring	
The RDA Operating, Monitoring and Maintenance Manual contains an extensive scope of monitoring activities conducted at the RDA. Gove Operations water monitoring plan also contains the detailed water quality-monitoring program for the RDA and refinery areas to meet compliance with WDL conditions.	
Recording	
Rainfall and pond water level data Road, spillway and wall inspection records	

EPMS 08 – CHEMICALLY REACTIVE MINERAL WASTE
Monthly monument survey data, piezometer readings and ground water levels. Seepage pump rates and volumes Pond pumps, delivery systems (pipelines) and rates. Surface drainage and seepage systems performance
REPORTING
Internal - Weekly Dashboard indicating pond level and storage capacity - Annual reporting in S&E Waste Section. - Monthly geotechnical assessment report. - Number of CRM waste-related incidents during reporting period, and detail of response/closure; - Waste-related audit findings during reporting period, and detail of response/closure; External - Mineral waste data from S&E survey reported publicly through the RT Sustainable Development Report - Waste transfers are reported annually in the National Pollutant Inventory report.
CORRECTIVE ACTIONS
Should monitoring/incident investigations identify that additional or alternative management intervention is required; the following management contingencies may be initiated: - Drainage corrective earth works; - Road or spillway corrective earth works; - Re-vegetation and stabilisation works; and - Additional monitoring systems corrective works.
ASSOCIATED DOCUMENTS
Alumina Refinery - Mineral Waste Management Plan 2018 Civil Works: Stormwater Design Data (GSM-ENG-4058-905) Waste Management Procedure (GPM-EHS-030). Control of Chemical and Hazardous Substances Procedure (GPM-EHS-024) Hazardous and Underground Pipeline and Tanks Procedure (GPM-EHS-115). Marine Health Monitoring Plan (APM-EHS-039) Pond Safety Trigger Action Response Plans (FRM-RDA-055) RDA – Operating, Monitoring and Maintenance Manual (OIM-RDA-001) RDA Seepage Recovery System Verification Monitoring Plan RDA Tailings and Water Storage Procedure (APM-RDA-008) Refinery Water Management Procedure (OIM-702-001) Seepage Management Strategy RDA - Pond Wall Failure ERP (ERP-EMM-007) RDA – Specific Emergency Plan (SEP-RDA-001) Refinery Water Management Procedure (OIM-702-001) Seepage Management Strategy Site Emergency Response Procedure (GPM-EHS-010) Waste Discharge Licence Water Monitoring Plan (WMP) Acid Sulphate Soil Management (GPM-EHS-103) Mineral Waste Management Plan

30.3 EPMS - Non-Mineral Waste

EPMS 09 – Non-Mineral Waste	
Context	
Both hazardous and non-hazardous waste will continue to be generated as part of the ongoing bauxite operations and will continue to be managed as per current site procedures until closure.	
Objectives	**Targets**
- Minimise the impacts and the generation of waste streams. - Ensure environmentally safe handling, treatment and effective disposal of all waste materials	- No significant incidents related to waste management. - No major audit non-conformance against waste management
Control Measures	
Implementation of waste segregation to avoid creating larger volumes of waste than necessary Maintain a site Waste Register and Inventory of all waste streams All skip bins and waste wheelie bins are colour coded and have the waste stream clearly identified on the outside of the receptacles Maintain a high standard of housekeeping in all areas All waste disposed to offsite landfill or sent to third party must meet regulatory requirements.	
Monitoring	
Routine housekeeping and waste management leadership audits Review of waste records; and Waste Management Procedure is audited as part of the business HSE Audit programme	
Recording	
Monthly waste production data Waste transferred to offsite facilities for final disposal.	
Reporting	
Internal - Annual reporting in S&E Waste Section. - Waste tracking (e.g. quantities to landfill). - Number of waste-related incidents during reporting period, and detail of response/closure; - Waste-related audit findings during reporting period, and detail of response/closure; External - Waste data from S&E survey reported publicly through the RT Sustainable Development Report - Waste transfers are reported annually in the National Pollutant Inventory report.	
Corrective Actions.	
Should monitoring/incident investigations identify that additional or alternative management intervention is required, the following management contingencies may be initiated: - increase waste treatment activities; - increase waste reuse and/or recycling; and - increase waste storage.	
Associated Documents	
Control of Hazardous Substances (GPM-EHS-024) Spill Response Procedure (GPM-EHS-010) Control of Chemical and Hazardous Substances Procedure (GPM-EHS-024) Wastewater neutralisation plant routine checklist (CHK-642-003) RDA routine checklist (CHK-RDA-001) Start-up WWNP when shutdown for short term (WI-642-018) Collection and disposal of waste oil (CAR-PRT-040) Clinical waste management (APM-EHS-043) Used earth moving tyre storage and disposal (APM-MIN-006)	

31. Biodiversity Protection and Natural Resource Management

31.1 EPMS - Biodiversity Protection

EPMS 10 – BIODIVERSITY PROTECTION

CONTEXT & ACTIVITIES

Mine Production

- The endangered Black-footed Tree-Rat at the mine operations will continue to be managed in accordance with of the Significant Species Management Plan.
- The endangered plant *Erythroxylum pusillum* will also continue to be managed under the auspices of the current Translocation Plan, approved by the regulator. An update to this plan will occur in 2019 and will be submitted to the regulator as a Significant Species Management Plan for approval.

RDA

- At the RDA, the future borrow pit extensions, further studies will be conducted, in regards to the endangered Black-footed Tree-Rat and approvals sought for these works.

Refinery

- The management of marine biodiversity will continue to managed under the auspices of the Marine Health Monitoring Program.

OBJECTIVES	TARGETS
- Protect high conservation biodiversity features (species and habitats) - Minimise impact on those features adjacent to operational areas	- No unauthorised disturbance of known high conservation biodiversity features - No major audit non-conformance against biodiversity management.

CONTROL MEASURES

Conduct pre-clearing flora and fauna impact assessments prior to substantial disturbance activities
Maintain a site species database
Permission to disturb vegetation and fauna habitat must be authorised through the Vegetation Clearing Permit process
Areas of high biodiversity features, have Significant Species Management Plan (s) in place
Exclusion and buffer zones maintained around high biodiversity features adjacent to operations
Allocated speed limits to minimise fauna fatalities, injuries or disturbance by moving vehicles.
EPMS 03 – Marine water quality management plan
EPMS 05 – Land use management plan
EPMS 06 – Land rehabilitation plan
EPMS 11 – Exotic species management plan

MONITORING

Species database to record sightings/survey records of listed species
Significant Species Management plan monitoring
Short and Long-term monitoring plan of rehabilitation sites; and
Marine Health Monitoring programme.

RECORDING

Photographic journals
Biodiversity Surveys and reports
Data associated with site monitoring programs
Incident reports; and
Vegetation Clearing Permits records

REPORTING

Internal

- Annual reporting in S&E Biodiversity Section .
- Number of biodiversity-related incidents during reporting period, and detail of response/closure;
- Biodiversity-related audit findings during reporting period, and detail of response/closure.

External

- Progress against Significant Species Management Plans every 5 yrs or as changes occur.
- Land data from S&E survey reported publicly through the RT Sustainable Development Report

EPMS 10 – BIODIVERSITY PROTECTION
CORRECTIVE ACTIONS
Should monitoring/incident investigations identify that additional or alternative management intervention is required; the following management contingencies may be enacted: - suspension of operational or disturbance activities - exclusion or additional buffers around areas - rehabilitation of unauthorised clearing areas - upgrades to rehabilitation areas; and - decrease or suspension of controlled water discharges to the environment
ASSOCIATED DOCUMENTS
Black-Footed Tree-Rat Significant Species Management Plan (Mine) *Erythroxulum pusillium* Translocation Plan (Mine) Gove Crow Butterfly Recovery Plan (NT Government) Land Disturbance Procedure – Pre-Mining (APM-MIN-028) Management of Injured Fauna and Fauna Affected by Operations (GPM-EHS-119) Mine Forward Development Plan (APM-MIN-007) Vegetation Clearing Approval (GPM-EHS-014) Vegetation Clearing Permit Application (FRM-EHS-087)

31.2 EPMS - Exotic Species

EPMS 11 – EXOTIC SPECIES	
CONTEXT & ACTIVITIES	
Weed management programs will be continue to be implemented throughout the Gove operations as per current site annual weed action plans. Mine Production - The mine operations will continue manage Yellow Crazy Ants as per the current site action plan. Refinery - Marine pest management will continue to as part of the marine health-monitoring program for the refinery.	
OBJECTIVES	**TARGETS**
- To prevent the introduction of exotic species both terrestrial and marine - Control the spread of any exotic species (terrestrial or aquatic), because of operations	- No recording of new exotic species - Minimise the spread of current site exotic species
CONTROL MEASURES	
Maintain an updated list of exotic species, which are managed on the leases or are a potential threat in the region. Develop a priority exotic species lists annually to target control strategies across all functional areas (mine, refinery and RDA) Develop and update specific annual Action Plans for all functional areas Use the most updated and best practice control methods. Engage appropriate licensed and/or trained contractors involved in conducting control activities Use only local native seed or certified seed in revegetation activities Use only approved chemicals in control activities Plant and equipment entering the operations from overseas/interstate must be inspected for the presence of exotic species as part of pre-purchase inspections All plant and equipment shall inspected for the presence of soil and/or weeds prior to entering different lease areas of the operations Refinery - Marine pest surveys as part of the marine health Monitoring program EPMS 03 – Marine water quality management plan	
MONITORING	
Annual/monthly pest and weed mapping and monitoring surveys Reports of new pest and weed infestations through the incident reporting system annual review of site priority exotic species lists	

EPMS 11 – EXOTIC SPECIES
annual review of control strategies from the previous season control actions update of control methods as required; and update training and awareness packages as changes occur
RECORDING
Locations of exotic species infestations (GIS) Control methods and records Photographic records Monthly field sheets and marine pest trap results Incident reports
REPORTING
Internal - Progress of control and/or preventative programmes - Number of exotic species-related incidents during reporting period, and detail of response/closure; - Exotic species-related audit findings during reporting period, and detail of response/closure. External - Weed collection data report externally to regulator
CORRECTIVE ACTIONS
Should monitoring/incident investigations identify that additional or alternative management intervention is required; the following management contingencies may be initiated: - quarantine and access restriction - implementation of biosecurity response action; and - increased equipment hygienic protocols
ASSOCIATED DOCUMENTS
Control of Chemicals and Hazardous Substances (GPM-EHS-024) Land Disturbance Procedure – Pre-Mining (APM-MIN-028) Marine Health Monitoring (APM-EHS-039) Mine Forward Development Plan (APM-MIN-007) Mobilisation of Contractor Equipment & Materials Guidance Notes (GDL-CMS-004) Vegetation Clearing Approval (GPM-EHS-014) Vegetation Clearing Permit Application (FRM-EHS-087) Vehicles & Driving (GPM-EHS-027) Weed Management (APM-EHS-025) 776 Water Tanker – Cleaning Overburden from Rear Dump Trucks.(WI-520-035) Yellow Crazy Ant Management Plan