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Environmental Management Plan



Arafura Resources Limited

Nolans Project

Environmental Management Plan

May 2016

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Amendments

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Audit Summary

Section	Details

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Appendix D – Biodiversity Management Plan

Appendix E – Cultural Heritage Management Plan

Appendix F – Emergency Response Management Plan

Appendix G – Fire Management Plan

Appendix H – Hazardous Substances Management Plan

Appendix I – Waste Management Plan

Appendix J – Radiation Management Plan

Appendix K – Social Impact Management Plan

Appendix L – Water Management Plan

Appendix M – Weed Management Plan

1. Introduction

1.1 Purpose

This Environmental Management Plan (EMP) has been prepared by GHD for the Nolans Project (Project) on behalf of Arafura Resources Limited (Arafura Resources). The EMP has been developed in unison with EIS technical studies to establish specific safeguards and controls to be employed at the Project. It provides an environmental management system for the site to operate within and assigns responsibilities to proposed site personnel roles.

A precautionary approach to the management of environmental risks has been applied to the Project including monitoring, auditing and reporting. The approach has been designed to support continual improvement of the EMP with the intention of reducing Project environmental risks.

The EMP covers the construction (2.5 years) and operational (43 years) phases of the Project. The decommissioning phase will utilise a streamline version of this EMP which will have evolved through the Life of Mine (LOM).

The EMP has been developed in general accordance with the following documents:

- NT EPA *Terms of Reference for the Preparation of an Environmental Impact Statement Nolans Rare Earth Project, Arafura Resources Limited*, May 2015; and
- NT EPA Guideline for the Preparation of an Environmental Management Plan, May 2015.

1.2 Objectives

The EMP has been produced in unison with the Environmental Impact Statement (EIS) to capture mitigation measures and provide a management framework of potential environmental risks. The objectives of the EMP are to:

- Outline an Environmental Management System (EMS) including structure, roles and responsibilities, environmental training and education and summarise sub-environmental management plans;
- Summarise environmental monitoring across the Project including frequencies, analytes, quality assurance (where relevant) and reporting requirements;
- Establish management objectives and contingency measures for areas of key environmental risks; and
- Summarise previous period performance including internal reporting, external reporting, internal auditing, complaints register and a summary of sub-environmental management plan performance compliance (in future reviews of the EMP).

1.3 Structure

The EMP has been structured to be utilised and revised throughout the Project. It includes the following Sections:

- Section 2 Project Description
Summary of the Project details including operator details, title details, location, project activities during construction and operation.
- Section 3 Site Conditions
Summary of site conditions from previous assessments undertaken at the Project including the physical, cultural and socio-economic environment.

- Section 4 Project Risk Summary
Provides an outline of risk identified at the Project in relation to the environment.
- Section 5 Approval and Legislative Requirements
Outlines environmental approvals, Commonwealth and Northern Territory legislation and relevance to the Project.
- Section 6 Environmental Management System
Outlines the environmental management system, attribute responsibilities, internal and external reporting requirements and the management of non-conformance and complaints.
- Appendices
Sub-management plans including an outline of objectives, actions, monitoring and reporting and a Trigger, Action Response Plan (TARP) where relevant. The sub-management plans include:
 - Air Quality and Dust Management Plan;
 - Biodiversity Management Plan;
 - Cultural Heritage Management Plan;
 - Emergency Response Management Plan;
 - Fire Management Plan;
 - Hazardous Substances Management Plan;
 - Waste Management Plan;
 - Radiation Management Plan;
 - Social Impact Management Plan;
 - Water Management Plan; and
 - Weed Management Plan.

1.4 Document Review

The EMP is a strategic document which will be modified and updated prior to implementation at the Project. Updates are likely to be undertaken following:

- Formal review of the EIS by the Northern Territory Environmental Protection Authority (NT EPA);
- Provision of an NT EPA Assessment Report of the EIS and Supplementary providing Recommendations; and
- Throughout mine site authorisation processes with the Department of Mines and Energy (DME).

Scheduled EMP reviews will be undertaken annually as part of the internal annual reporting requirements, internal auditing plan and mine authorisation (Mining Management Plan) documentation. A summary of reviews is provided in Section 6.1.2.

2. Project Description

2.1 Operator Details

The Project will be operated by Arafura Resources or a designated subcontractor. Arafura Resources is an Australian resource company which is currently developing the Nolans Project. The company has several exploration tenements including the Aileron-Reynolds Rare Earths Project (includes the Nolans Project), Jervois Iron-Vanadium Joint Venture Project and Mount Porter Gold Joint Venture Project.

A summary of the operator details are provided in Table 2-1

Table 2-1 Operator Details

Company	Arafura Resources Limited
Contact	Brian Fowler NT General Manager and Sustainability
Street address	18 Menmuir Street, Winnellie, NT 0820
Postal address	PO Box 37220, Winnellie, NT 0820
Phone	08 8947 5588
Fax	08 8947 5599
Email	bfowler@arultd.com
ABN	22 080 933 455
ASX code	ARU
Web	http://www.arultd.com/

2.2 Title Details

The tenement titles associated with each component of the Project are provided in Table 2-2.

Table 2-2 Title Details

Title	Area (Ha)	Proposed Infrastructure	Activities
ML26659	1,401*	Mine Site including: • Open Pit; • Waste Rock Dumps (six); • Topsoil Stockpiles; • Long Term Stockpile; • Run of Mine Pad; • Primary Crusher; • Concentrator (Comminution and Beneficiation); • Tailing Storage Facility; and • Slurry Pipeline (to Processing Site).	Drill, blast and haul operation for ore and waste rock. Ore will then undergo crushing, grinding, magnetic separation and flotation and the slurry will be pumped to the Processing Site.
ML30704	2067	Processing Site including: • Rare Earth Intermediate Plant; • Sulphuric Acid Plant; • Water Leach Residue Storage Facility; • Neutralisation Residue Storage Facility; • Phosphate Residue Storage Facility; • Evaporation Ponds; • Gas Fired Power Station; • Slurry Pipeline (from Mine Site); • Potable Water Treatment Plant; • Waste Water Treatment Plant; • Dangerous Good Storage; • Cerium Carbonate Stockpile; and	Processing undertakes the initial extraction of rare earths from the Mine Site slurry feed. The process includes the addition of several chemicals including sulphuric acid, hydrochloric acid (33%), sodium hydroxide (caustic soda), sodium carbonate, carbonate, lime, and barium chloride. The Processing Site forms the centre of site support infrastructure including the Power Plant, Potable Water Treatment Plant and Wastewater Treatment Plant.
ML30703	1,381		

Title	Area (Ha)	Proposed Infrastructure	Activities
		Rare Earth Intermediate Feed Stockpile.	
EL29905	37,617	Borefield including: - Five Production Bores; - Powerlines (between bores and Power Station); - Potable Water Pipeline; and - Access Tracks.	Provision of raw water supply to the Processing Site for treatment and subsequent use in the processing circuit and as potable water.
ML30702	72	Accommodation Village including: - Portable accommodation (capacity to lodge 300 people); - Central Facility Buildings (kitchen, recreation and wet rooms); - Gymnasium and lap swimming pool; - Potable water pipeline; - Waste water collection and pumping station (to Processing Site); and - Powerline.	Accommodation Village for the operation of the site. The majority of personnel will be transferred to the Mine Site or Processing Site via bus.

Note: * This does not include the additional mine boundary identified in Figure 2-2 which includes an area to the northwest (117 ha) and an area to the southeast (745 ha).

2.3 Location

The Mine Site is located 10 km west of the Stuart Highway, 65 km west of the Darwin-Adelaide railway and 150 km by road from Alice Springs. The closest community to the Project in Aileron, situated approximately 13 km southwest of the Mine Site.

2.4 Project Activities and Summary

Arafura will mine, concentrate and chemically process Rare Earths at the Nolans Site to produce a Rare Earth intermediate product. The Rare Earth intermediate product will then transported to Alice Springs Rail Station for rail transport to East Arm Wharf in Darwin and transferred to an offshore refinery (Rare Earth Separation Plant) for final processing into Rare Earth products. The EMP covers the Nolans Site (Mine Site, Processing Site, Borefield and Accommodation Village).

Table 2-3 Project Activities and Summary

Component	Summary
Construction Phase	
Power Station	Construct 18.5 MW gas fired power station and link to the Amadeus Basin to Darwin high pressure gas pipeline.
Access Road	A 20 km sealed access road will be constructed from the Stuart Highway to the Mine Site and Processing Site. The intersection with the Stuart Highway will be approximately 5 km south of the Aileron Roadhouse.
Construction Camp	500-room temporary accommodation camp will be leased over the Project's construction period and will be removed following commissioning.
ESCP Measures	Installation of Erosion and Sediment Control measures in accordance with the Erosion and Sediment Control Plan (ESCP) provided within the Water Management Plan in Appendix K and in accordance with the Ground Disturbance Permit System provided within the Biodiversity Management Plan in Appendix D.
Kerosene Camp Creek Diversion	4 km diversion of Kerosene Camp Creek around the west of the Mine Site with flood protection bund.
Operation Phase	
Resource (measured, indicated and inferred)	47 Mt including: 1,217,000 t (2.6%) Rare Earth Oxides @ 1% cut-off grade; 5,410,000 t (11%) Phosphate Pentoxide; and 8,830 t (0.41 lb/t) uranium.
Product Shipment	Road transfer to Alice Springs Rail Station, rail transfer to East Arm Wharf then

Component	Summary
	shipment to offshore refinery.
Product Storage	Product stored in bulk bags at warehouse (covered) at the Processing Site prior to being transferred into shipping containers for shipment.
Period	2 years construction, 41 years operation.
Maximum Mining Rate	10 Mtpa (including ore and waste).
Mining Method	Open cut mining with drill, blast, load and haul.
Processing Method	Crush and concentrate to Rare Earth intermediate product for offshore processing.
Slurry Pipeline	Mineral concentrate pumped 8 km from Mine Site to Processing Site in banded HDPE slurry pipeline.
Recovery Water Pond	Recovery Water pond with sufficient freeboard to capture a 1:100 year, 72 hour event + 0.5 m.
Stormwater Retention Ponds	Stormwater Retention ponds with sufficient freeboard to capture a 1:100 year, 72 hour event + 0.5 m.
Process Water Ponds	Process Water ponds with sufficient freeboard to capture a 1:100 year, 72 hour event + 0.5 m.
Open Pit	One pit covering approximately 135 ha with a depth of 225 m below ground level.
ROM Pad	Storage of three months ore supply.
Tailing Storage Facility	Flotation Tailings Storage Facility (TSF) with Life of Mine (LOM) footprint of 245 ha and embankment height of 25.1 m.
Waste Rock Dumps	Six Waste Rock Dumps (WRDs) to store 158 million loose cubic metres (mlcm) with a height of approximately 50 m including: • Dump 1: 77.14 mclm / 212.613 ha; • Dump 2: 26.87 mclm / 101.638 ha; • Dump 3: 14.30 mclm / 68.2249 ha; • Dump 4: 22.60 mclm / 99.1927 ha; • Dump 5: 14.57 mclm / 70.3649 ha; and • Dump 6: 4.11 mclm / 38.0407 ha. The WRDs will be constructed with a 50 m standoff distance from the LOM pit shell.
Waste Rock Classifications	Mineralisation, pegmatite, schist and gneiss.
Long Term Stockpile (low grade stockpile)	
Topsoil Storage	Four topsoil storage locations with a height of 3 m.
Closure Plan	Land to return to pre-mining land use of pastoral (cattle) grazing. The WRD, TSF, RSF and open pit will remain onsite in perpetuity. All remaining items of infrastructure will be removed and surfaces rehabilitated (dependent upon stakeholder requirements).

2.5 Closure Plan

The Mine Closure Plan (MCP) summarises the rehabilitation and closure activities for the Project. It has been developed with reference to the Western Australia Department of Mining and Petroleum Guidelines for Preparing Mine Closure Plans (May 2015). In general, the conceptual closure of the Project will include:

- Open Pit – Pit to be left open with groundwater inflow expecting to act as a groundwater sink (i.e. evaporation is greater than groundwater inflow and precipitation) and fencing installed.
- TSF, RSF, Evaporation Ponds and WRDs – revegetated with a growing medium (cellular confinement system used as required), flow diversion banks installed to divert surface flows to a rock lined chute. The discharge from the rock lined chute will enter an energy dissipater then recessed rock pad to reduce scour and erosion potential.
- Infrastructure (plant, pipelines, equipment, buildings, hardstand, concrete footings and water storages) – removed from the Project. Any contaminated sediments/soils will be removed and

validation testing will be undertaken in accordance with the National Environment Protection (Assessment of Site Contamination) Measure and/or alternative assessment guidelines.

- Power Station, Borefield and Monitoring Bores – remain insitu dependent upon the outcome of stakeholder consultation and/or legal requirements.

The MCP is provided in Appendix W of the EIS.

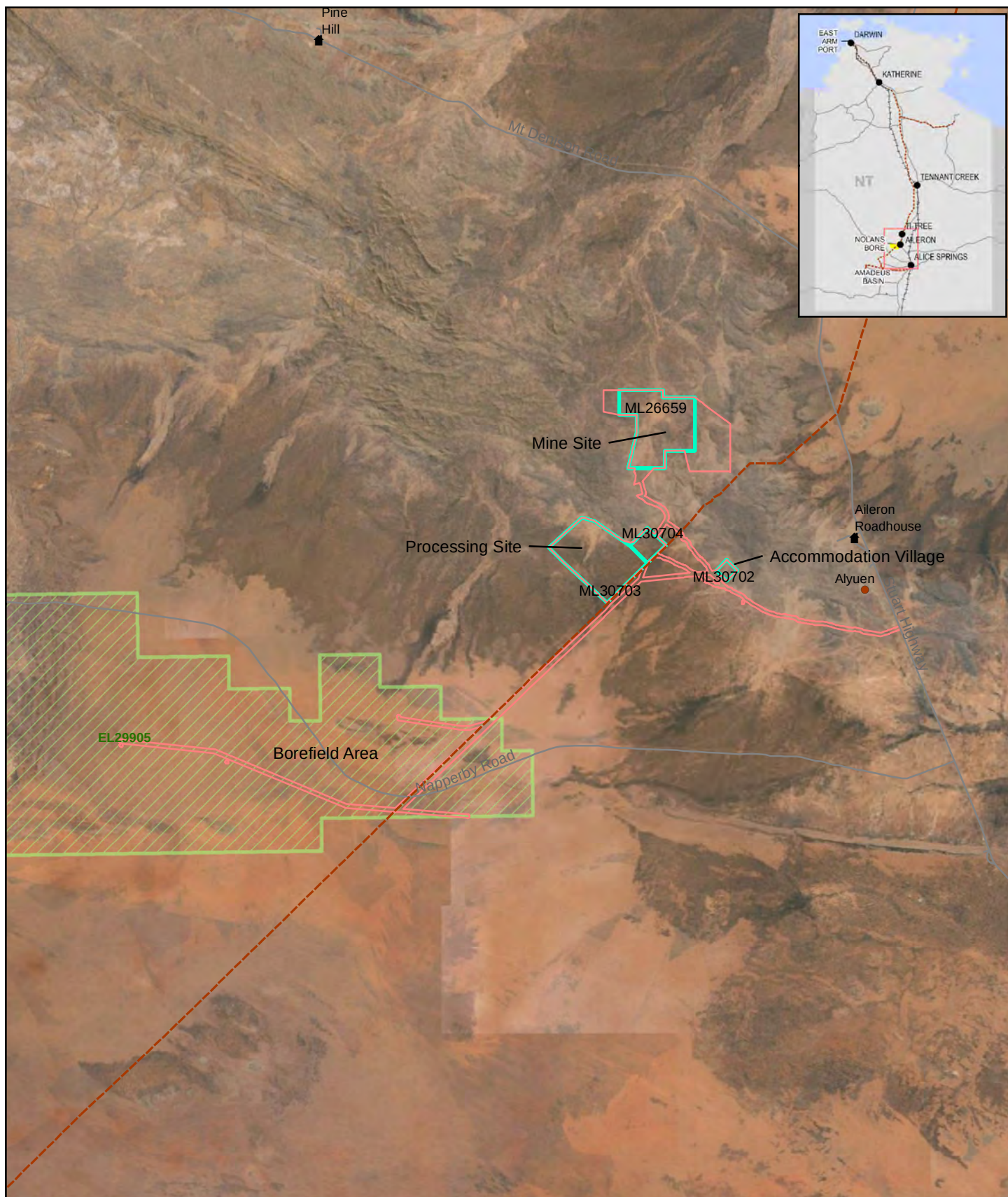
2.5.1 Care and Maintenance

Unanticipated events including processing issues or falling commodity prices may result in placing the Project into a care and maintenance phase. During a care and maintenance phase the Project would be operated by Arafura Resources with only essential monitoring and maintenance works being undertaken. This phase would include a consolidated EMP.

2.5.2 Unplanned Closure

The Project will operate under the *Mining Management Act* which requires the provision of a 'security' bond to the Department of Mines and Energy (DME). The site security is calculated following a review of the Mining Management Plan (MMP) and is based on actual disturbances to date. The DME provide a security calculation spreadsheet which includes predetermined Units of Measure (UOMs) to assist in the estimation.

If Arafura Resources is unable to rehabilitate the Project following unplanned closure the Project would be surrendered to DME and the site security would be utilised to fund rehabilitation by DME.

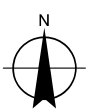


LEGEND

- Station
- Mineral Lease
- Outstation
- Exploration Licence
- Gas Pipeline
- Project Areas
- Major Roads

1:300,000 @ A4
0 2.5 5 7.5 10
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



Arafura Resources Limited
Nolans Project

Job Number 43-22301
Revision 0
Date 29 Apr 2016

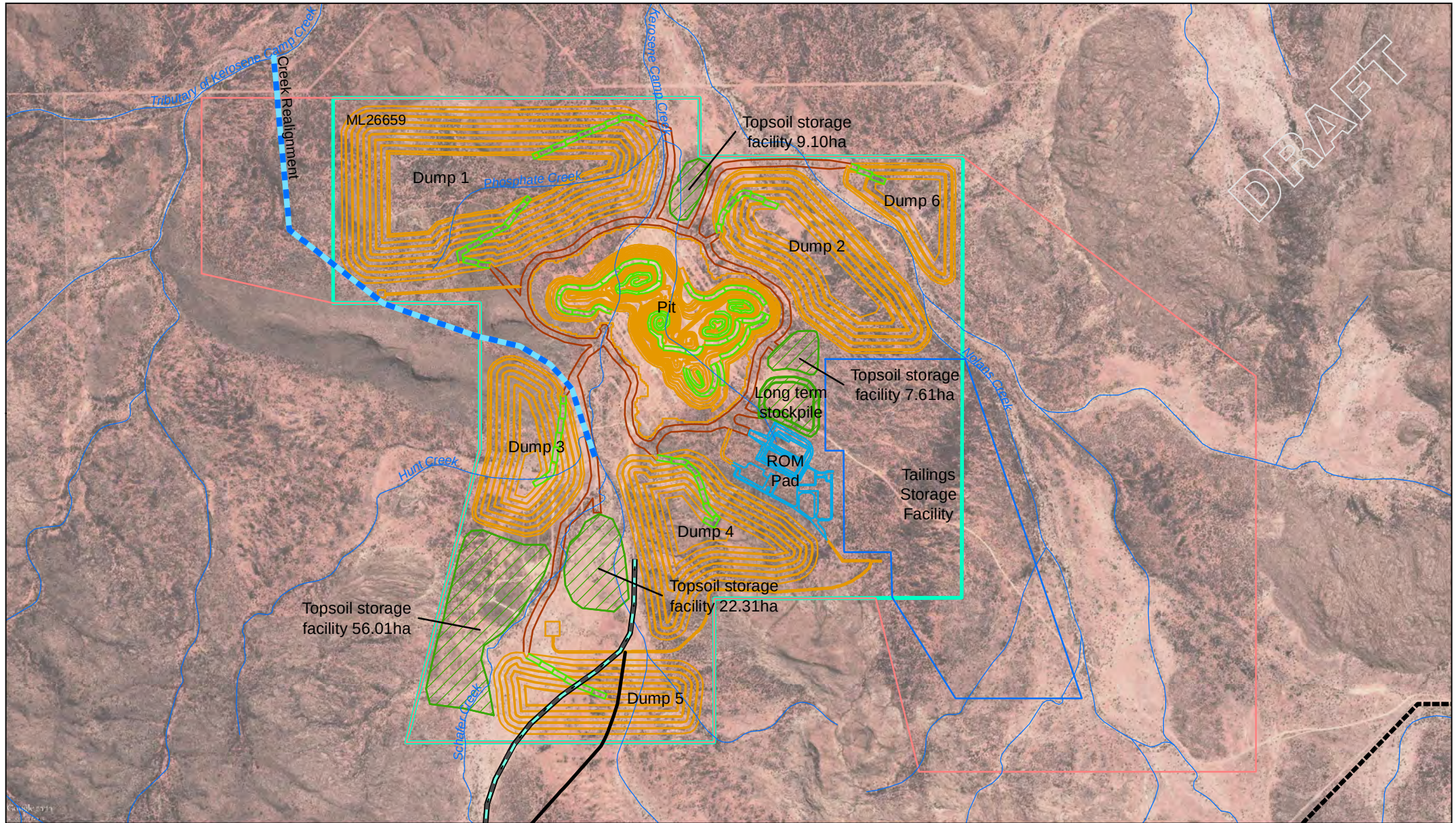
Project Overview

Figure 2-1

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Level 5, 66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drwmail@ghd.com W www.ghd.com

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Data source: GA - Roads, Waterways, Placenames, Lakes (2015). ESRI - Shaded Relief (2009). Google Earth Pro - Imagery (Date extracted: 05/11/2015). ARL - Project Areas (2015). Created by: CM

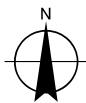


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0 250 500 750 1,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

- Powerline
- Potable Water Pipeline
- Water Supply Pipeline
- Diversion Channel
- Haul Road/Access Tracks
- Waterways
- Proposed Mine Site Boundary
- Topsoil Storage
- Mineral Lease



Arafura Resources Limited
Nolans Project

Mine Site

Job Number | 4322301
Revision | 0
Date | 29 Apr 2016

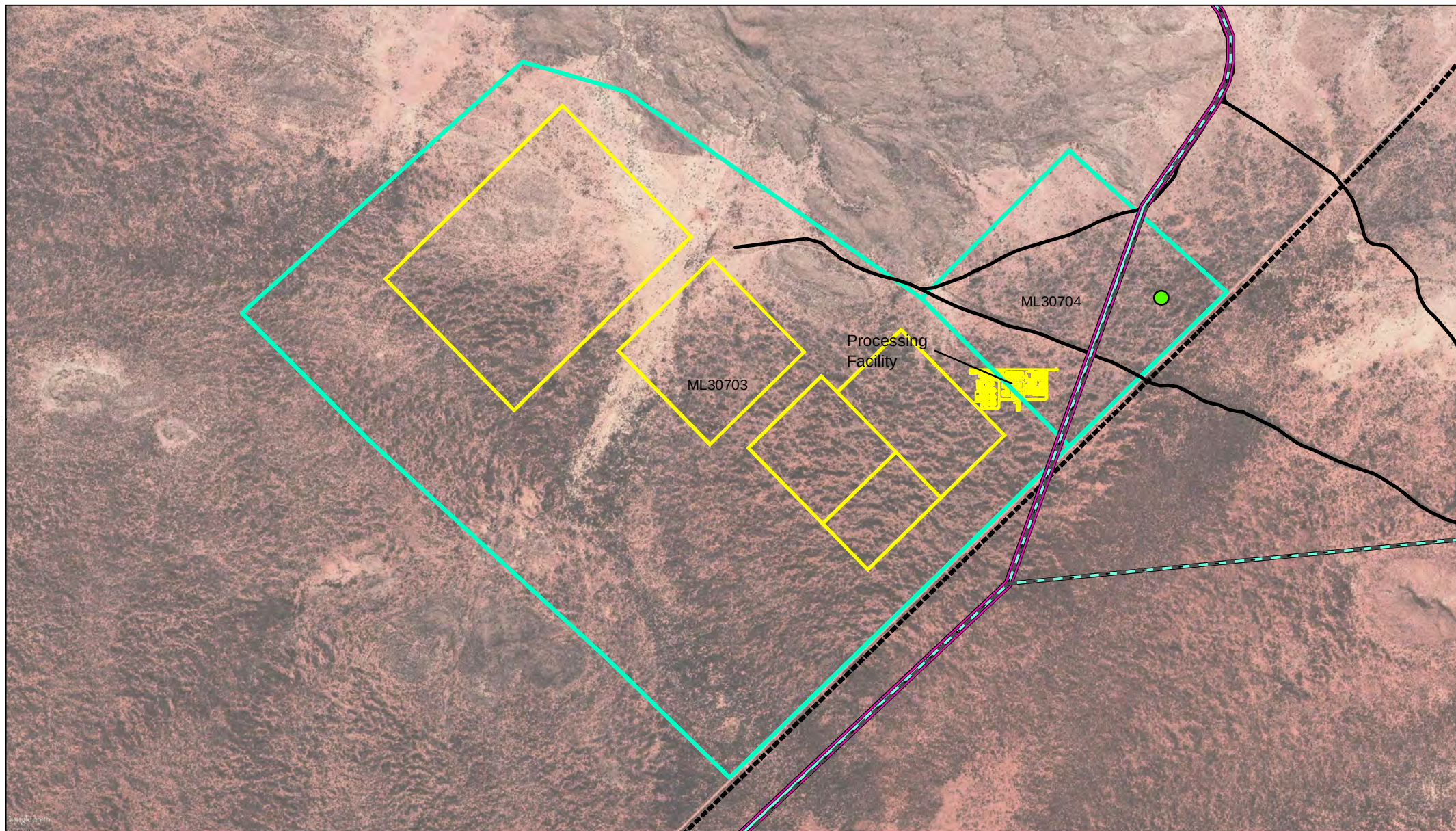
Figure 2-2

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Data source: Google Earth Pro - Imagery (Date extracted: 29/04/2015). ARL - Proposed Pipelines, Proposed Mine Site, Proposed Diversion Channel Options, Tailings Storage Facility (2015). Created by: CM

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Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

- Power Station
- Powerline
- Potable Water Pipeline
- Water Supply Pipeline
- Existing Gas Pipeline
- Access Road
- Treatment Plant Facilities
- Mineral Lease



Arafura Resources Limited
Nolans Project

Processing Site

Job Number	4322301
Revision	0
Date	29 Apr 2016

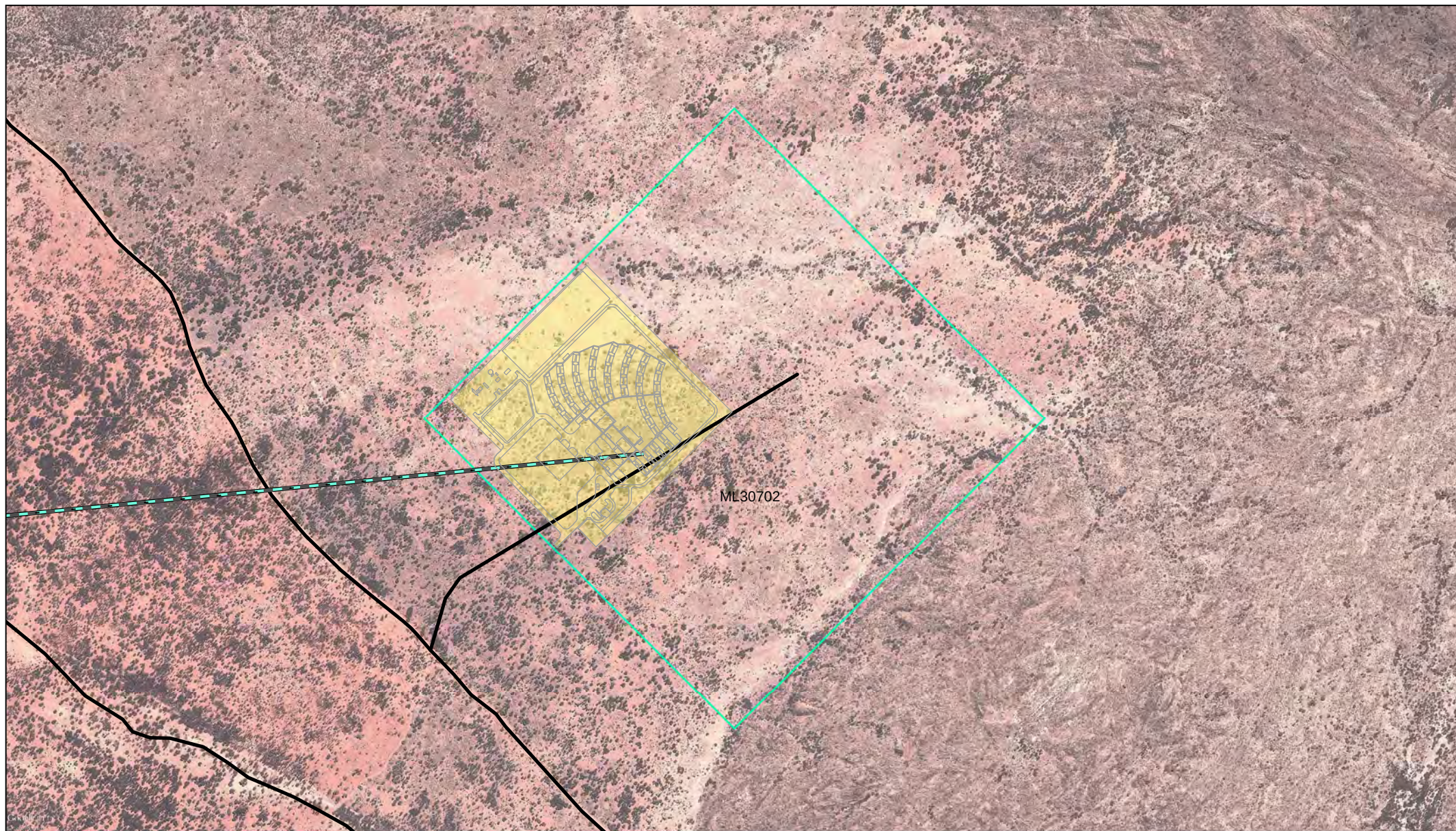
Figure 2-3

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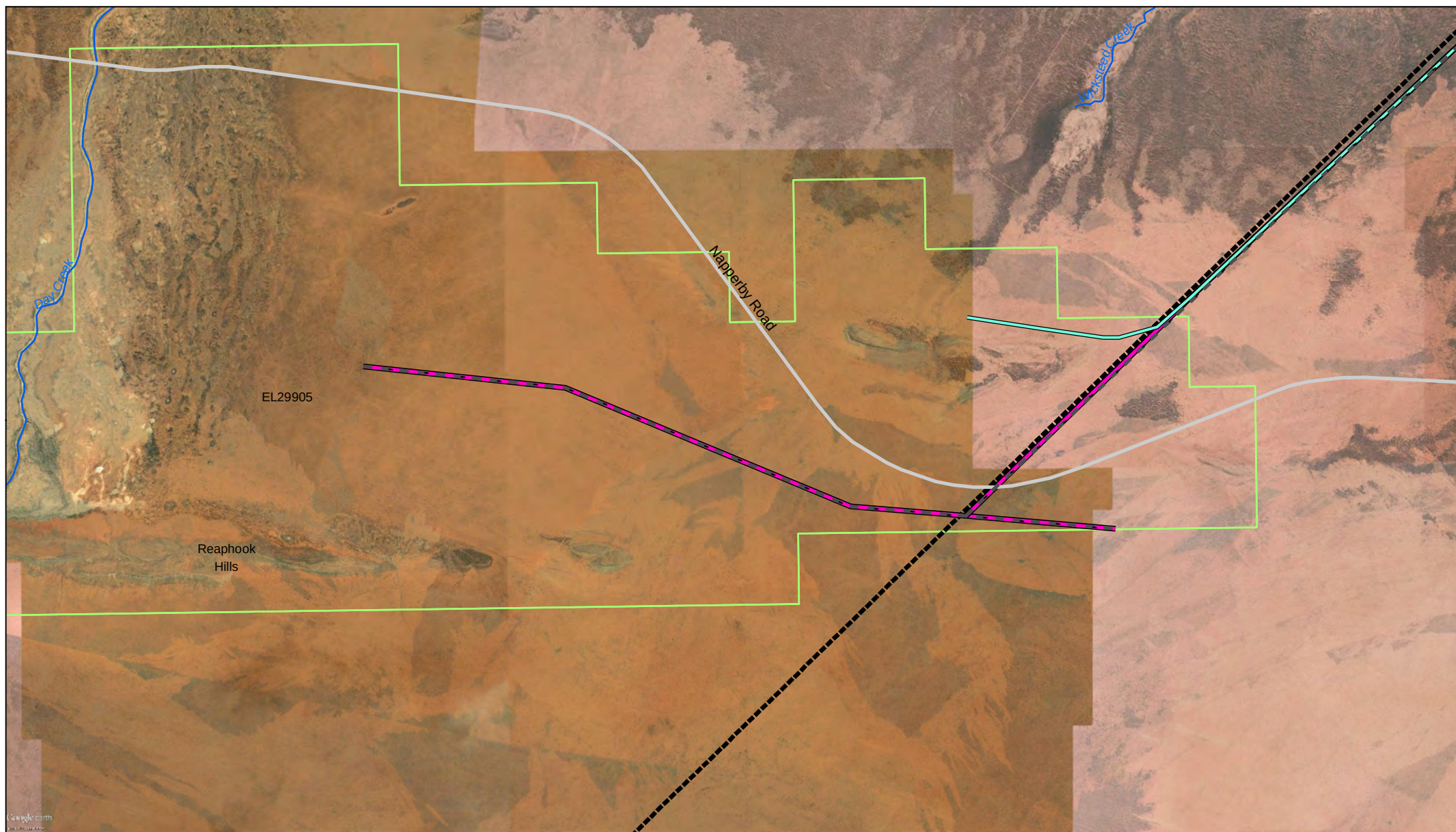
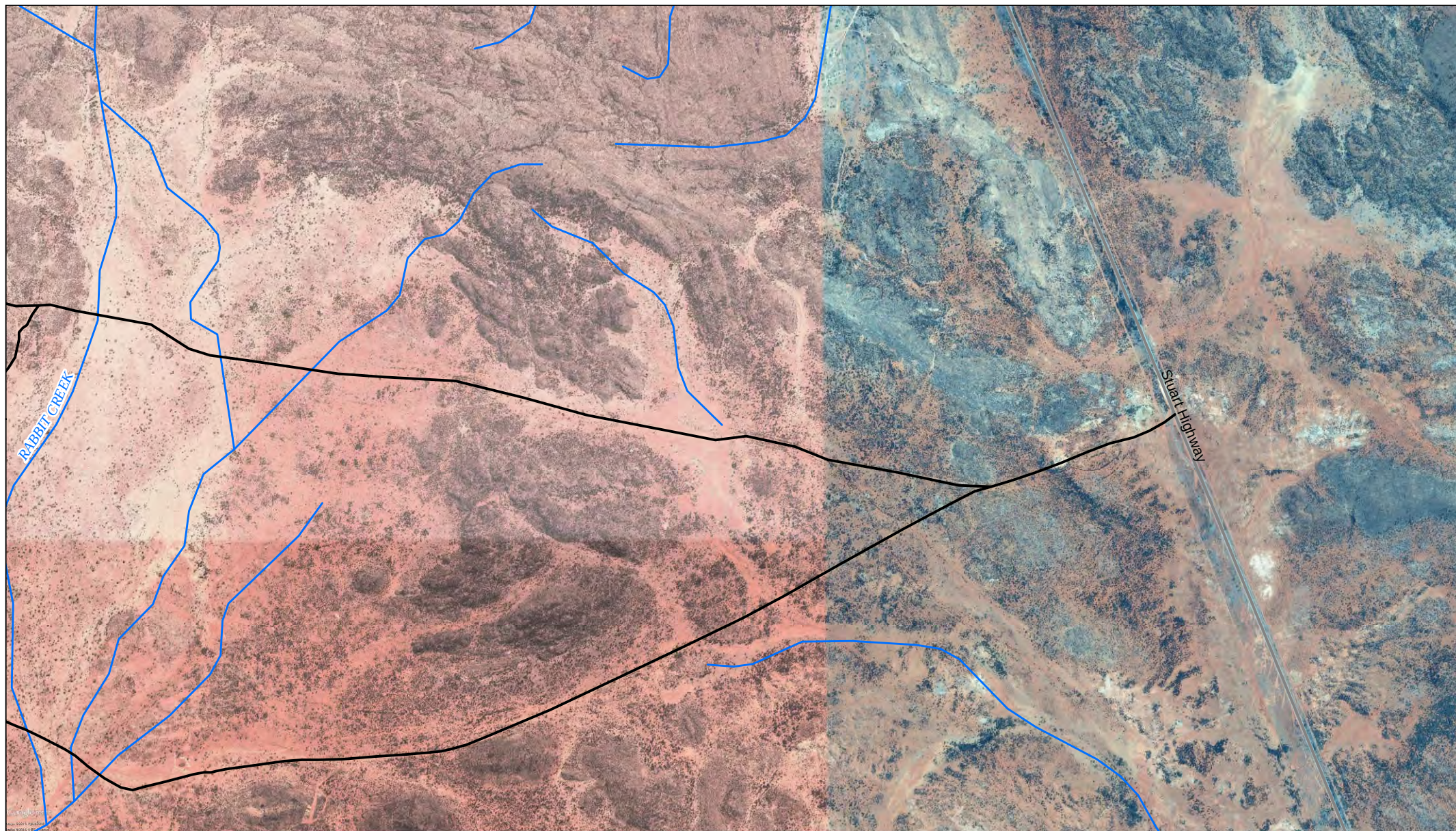
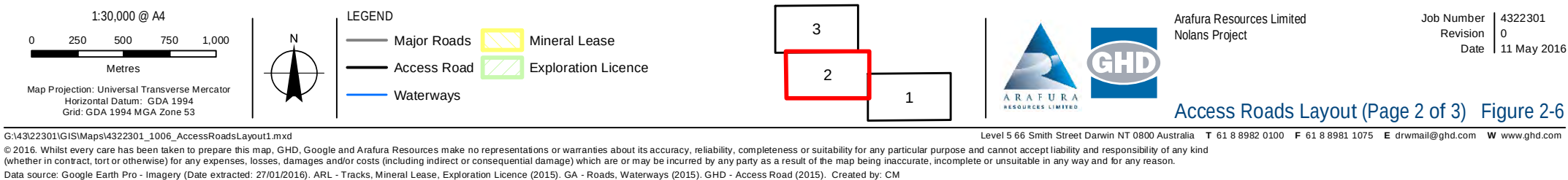
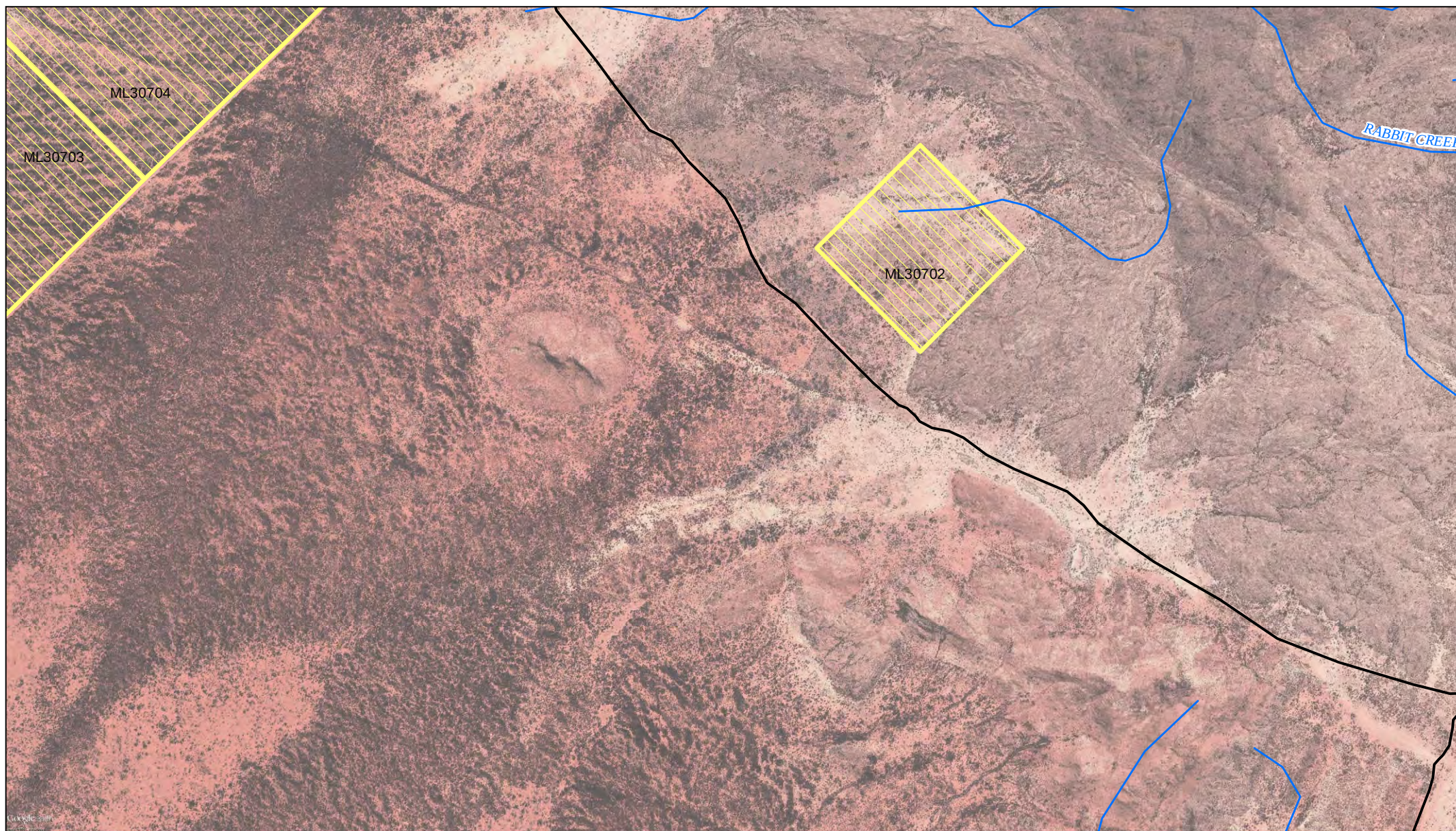
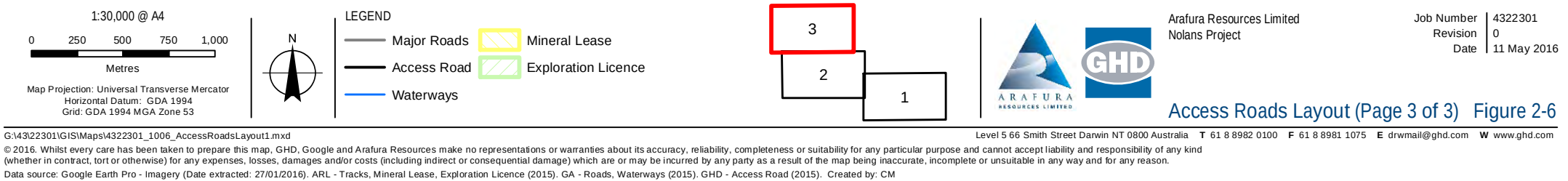
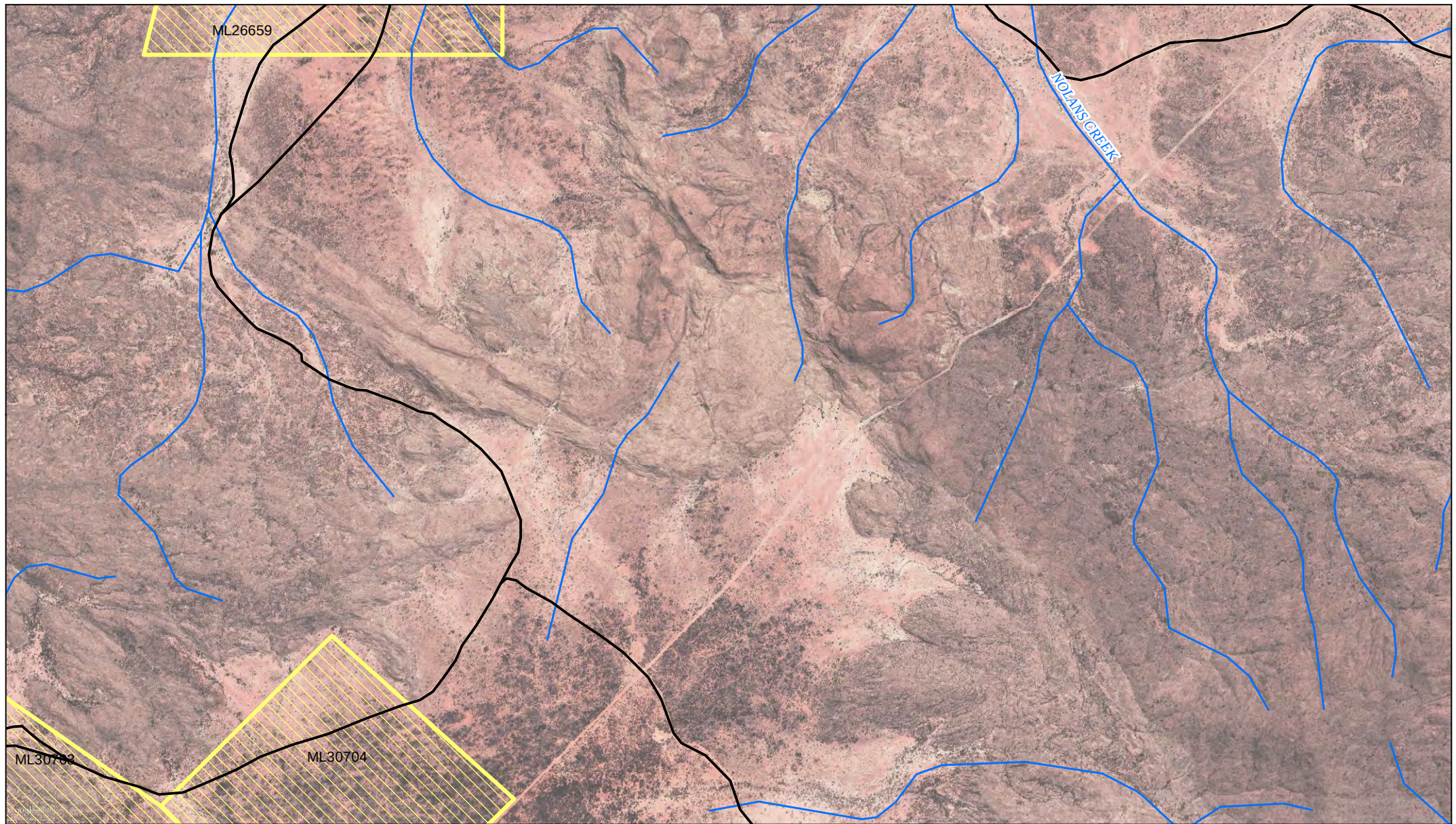


Figure 2-5







3. Site Conditions

3.1 Climate

3.1.1 Rainfall and Evaporation

The mean annual rainfall is approximately 316.7 mm, with a seasonal pattern of more summer rainfall than winter rainfall. Average monthly rainfall totals range from 4.7 mm in August to 65.8 mm in February. Average three-monthly rainfall totals range from 18.3 mm in June/July/August to 178.7 mm in December/January/February. However, any month can receive relatively large rainfall totals, or little or no rain at all.

Evaporation is greatest during months of higher mean rainfall with the highest average evaporation occurring in December and January at 375 mm. Rates of evaporation are significantly lower from May to August coinciding with lower mean rainfall and temperatures. The annual average evaporation is 3,000 mm, approximately 847% greater than the annual average rainfall of 316.7 mm.

The rainfall and evaporation rates are provided in Table 3-2.

Rainfall Statistics

Rainfall at the site is generally characterised by infrequent and intense rainfall events, single events can deliver > 50 mm within 24 hour. The Bureau of Meteorology Intensity–Frequency–Duration (IFD) indicates 305 mm for a 1 in 100 year, 72 hour rainfall event. A summary of the IFDs are provided in Table 3-1.

Table 3-1 IFD Rainfall Depth (mm) (Source: BOM IFD AR&R87 Tool)

Duration	Return Period (Years)						
	1	2	5	10	20	50	100
5	5	6	9	10	12	15	17
6	5	7	10	12	14	17	19
10	7	10	14	16	19	24	27
20	11	15	21	25	30	37	43
30	14	19	27	32	38	47	54
1	19	25	37	44	53	66	76
2	24	32	47	57	69	86	100
3	26	35	53	64	79	99	115
6	31	42	64	79	97	123	145
12	36	50	78	97	120	155	182
24	45	62	97	121	151	194	229
48	56	77	120	148	185	238	281
72	60	83	129	161	200	257	305

3.1.2 Temperature and Humidity

The Project area experiences hot and arid conditions. The hottest months are November to March, with monthly mean daily maximum temperatures above 35 °C, and monthly mean daily minimum temperatures not dropping below 18 °C. The coolest months are May to August, with monthly mean daily maximum temperatures remaining at or below 25.5 °C, and monthly mean daily minimum temperatures not rising above 9.5 °C.

The average humidity at the Project is 40% at 09:00 and 25% at 15:00, this is consistent across the year with monthly afternoon humidity readings being 15% lower than the morning. The highest levels of humidity are experienced in June at 53%. This coincides with lower temperatures occurring.

The temperature and humidity rates are provided in Table 3-2.

3.1.3 Wind

The winds at the Project are predominant south easterly wind direction throughout the year. The average wind speeds range from 2.50 to 3.17 m/s (9.0 to 11.4 km/h) with an annual average of 2.86 m/s (10.3 km/h).

The wind roses are provided in Figure 3-1 and speeds are summarised in Table 3-2.

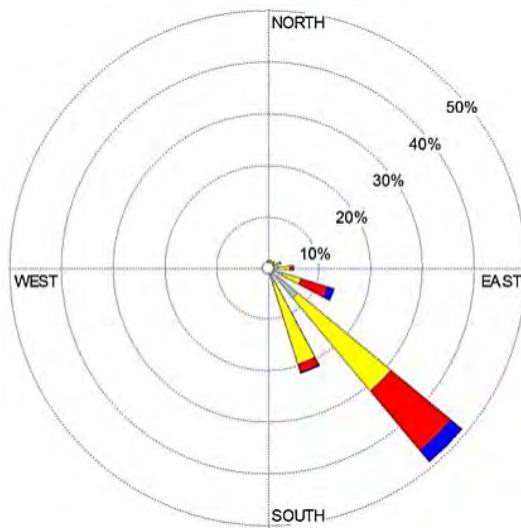
Table 3-2 Summary of Climate Statistics (BoM 2015; Territory Grape Farm NT 1987-2014)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)												
Highest	280.4	342.2	109.2	151.7	136.3	53.8	34.2	39.4	96.6	56.8	119.2	119.2
95 th percentile	159.0	244.2	96.9	89.9	100.1	48.7	21.3	26.9	41.7	51.3	81.4	109.9
Mean	62.4	65.8	21.9	18.0	23.3	8.7	4.9	4.7	10.3	15.3	30.9	50.5
5 th percentile	3.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	8.9
Lowest	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Evaporation (mm)												
Total	375	300	290	210	150	125	145	180	200	300	350	375
Temperature (°C)												
Maximum ¹	37.3	36.2	34.3	30.5	25.5	22.2	22.5	25.3	30.5	33.3	35.6	36.3
Minimum ²	21.9	21.6	19.5	14.6	9.5	6.2	5.2	7.1	12.1	15.6	18.8	21.1
Humidity (%)												
Mean 9 am	38	40	37	37	47	53	51	38	32	32	34	37
Mean 3 pm	24	28	27	25	27	28	28	22	21	21	22	26
Wind (km/h)												
Mean 9 am	17.0	18.1	19.7	18.9	15.2	12.8	14.3	17.3	18.2	19.6	18.2	18.0
Mean 3 pm	15.8	16.7	16.6	14.9	14.2	13.5	14.0	16.0	15.5	14.8	14.1	14.5

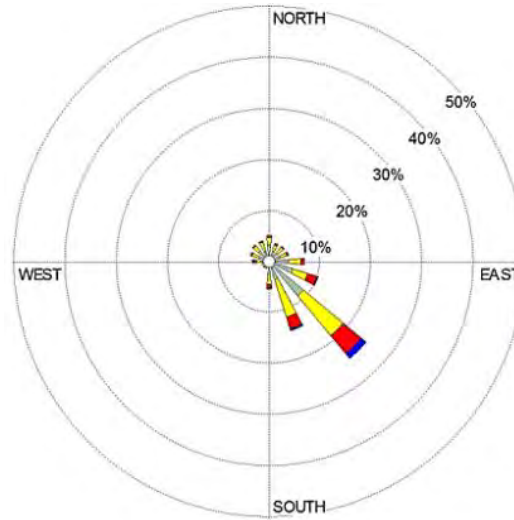
Notes: ¹ Monthly mean maximum temperature is the average of the available daily maxima for that month.

² Monthly mean minimum temperature is the average of the available daily minima for that month.

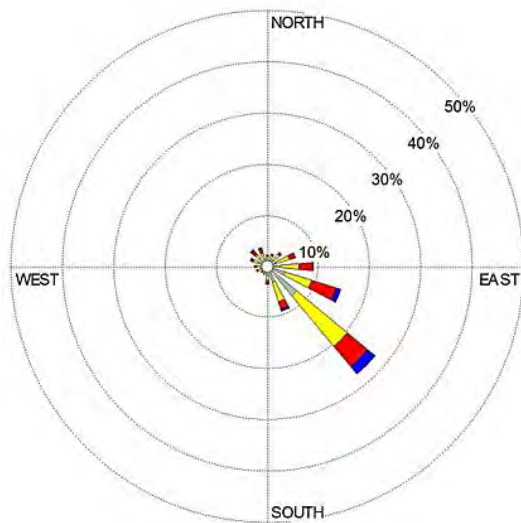
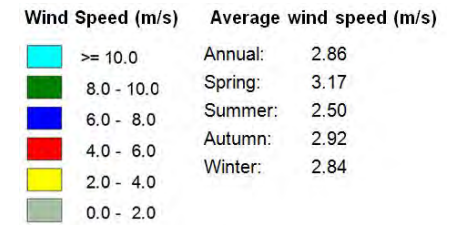
Highest values are indicated in bold.



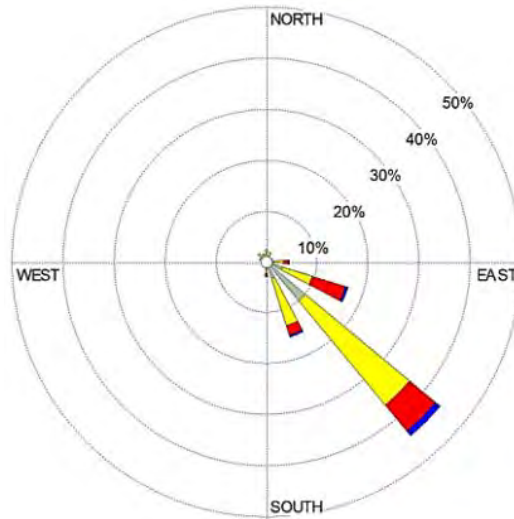
Spring (September – November)



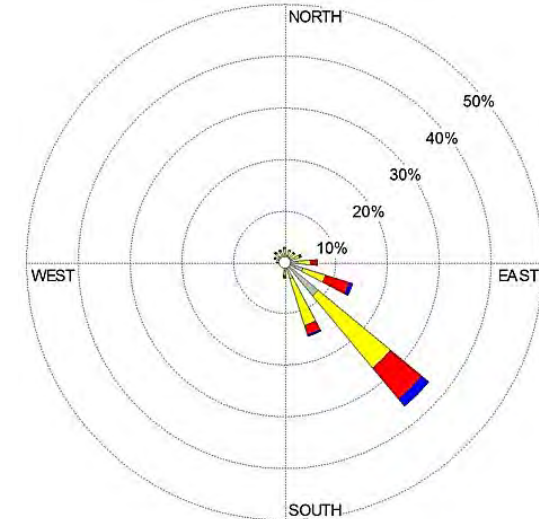
Summer (December – February)



Autumn (March – May)



Winter (June – August)



Annual

Figure 3-1 Annual and Seasonal Wind Roses (Source: BOM, Territory Grape Farm Station No. 015643)

3.2 Soils and Geology

3.2.1 Soils

A geotechnical assessment of the Mine Site was undertaken by Lycopodium Minerals in 2010 (Lycopodium Minerals, 2010). The assessment indicated soils at the Mine Site generally comprise clayey sand (colluvium) from surface to approximately 1m Below Ground Level (BGL). Laboratory testing undertaken on samples indicated 62% sand, 34% silt/clay and 4% gravel. A layer of gravelly sand to sandy gravel is present below the colluvium. The test pits met refusal on gneiss at depths ranging from 0.2 to 2.4 m BGL.

For the purposes of erosion and sediment control a precautionary approach has been undertaken and assumes the soils are dispersive following disturbance.

3.2.2 Geology

The basement geology at the Project can be summarised by three significant units including:

- Proterozoic Arunta Block granites and gneiss outcrop forming the bulk of the hills and ranges adjacent to the Mine Site (including Reynolds Range and Yalyirambi Range) and basement rocks beneath the basins;
- Proterozoic Vaughan Springs Quartzite and Treuer Member outcropping as the Hann Range and Reaphook Hills as a distinct, almost linear feature across the southern plain, as isolated hills outcropping from the plain at the southern fringe of the Yalyirambi Range and as basement rocks beneath only a minor section of the Southern Basins; and
- Ngalia Basin sedimentary rocks are also present, but comprise relatively little outcrop in the study area and form the basement of the majority of the Whitcherry Basin section of the Southern Basins.

The geology across the Project is illustrated in Figure 3-2.

Acid, Metalliferous and Saline Drainage Potential

A total of 200 stage one and 25 stage two Acid Metalliferous Drainage tests were undertaken. The results of static Net Acid Generation (NAG) tests indicate the majority of material is non-reactive and Non Acid Forming (NAF). One recorded sample was recorded as Potential Acid Forming (PAF) with a relatively low Maximum Potential Acidity (MPA) and low Acid Neutralising Capacity (ANC). Final kinetic NAG pH showed that single addition NAG pH is suitable for identifying PAF and reaction times are relatively slow. The tests ultimately indicated there was a very low risk of acid generation either during short-term storage of ore or long-term storage of waste rock.

The abundance of NAF and Acid Consuming Material (ACM) provides a conservative cut-off value of 0.3% Sulphur (S) or 10 kg/t Sulphuric Acid (H_2SO_4) for PAF material. Confirmatory field NAG testing will be carried out on samples with a sulfur content of greater than 0.15% S, unless pre-production testing provides sufficient information for a revised cut-off.

The 25 leachate tests indicates most of the waste rock was non-sulfidic and relatively benign, with small amounts of material with slightly elevated sulfur. Although neutralised by the excess ANC the material may, however, contain metals such as zinc that form soluble carbonates when their sulfide forms are oxidised and neutralised with carbonate minerals. Leachate salinity was low and fluoride was elevated in one sample, hence the risk of generation of saline or fluoride-rich leachate is low.

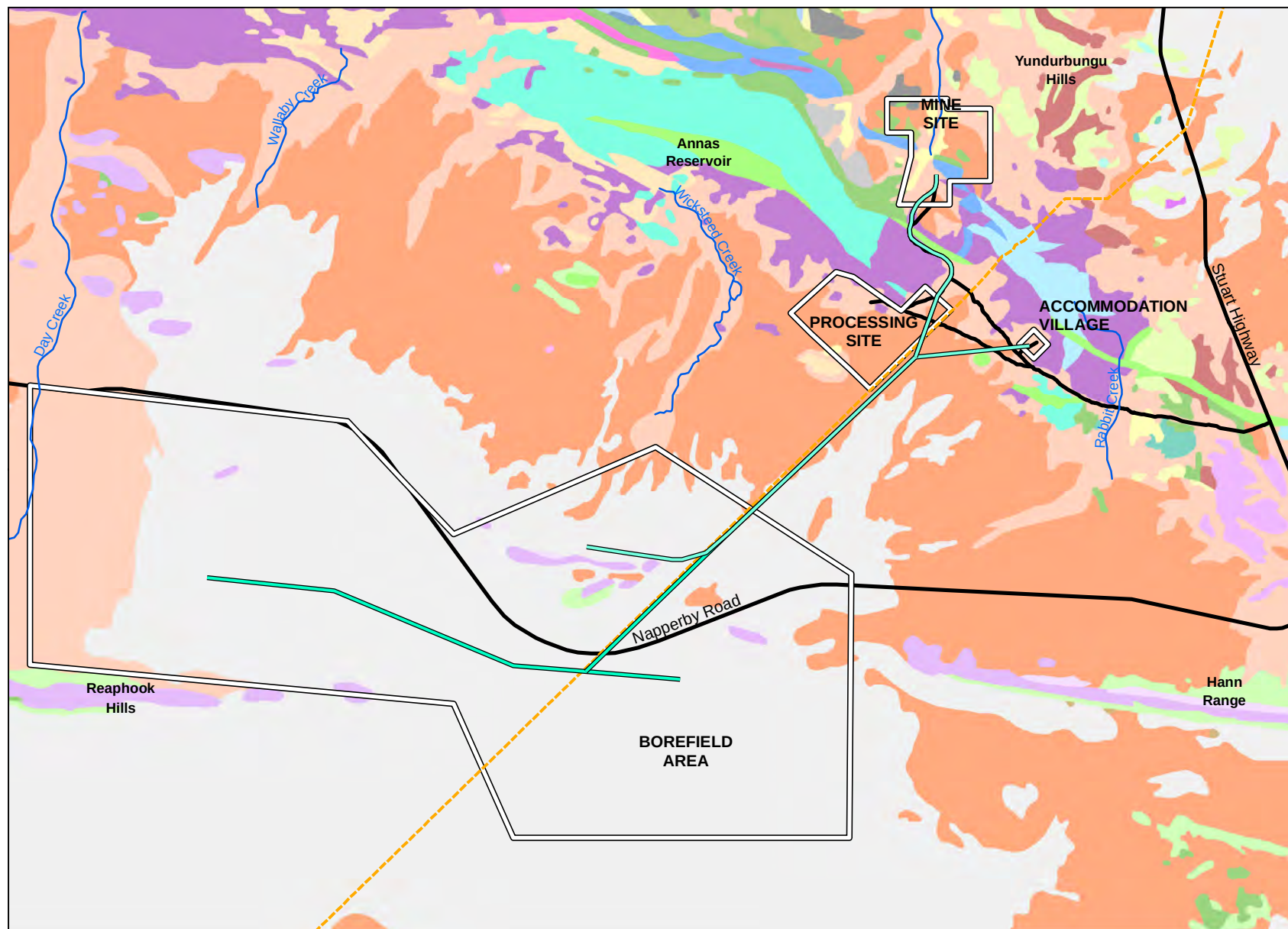
Although one sample of pegmatite produced Australian Standard Leaching Procedure (ASLP) leachate with a lead concentration 5.8 times the average groundwater concentrations. The critical leachate constituents appear to be aluminium and zinc which were consistently elevated against

ambient groundwater concentrations. Site specific groundwater values will be developed for future assessments of potential impact.

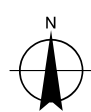
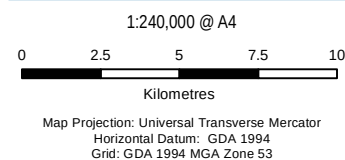
Leachate from WRDs is considered unlikely to pose significant risks to the existing groundwater and/or ephemeral surface water systems adjacent the Project.

Based on the overall geochemistry of the waste rock and ore, the risk of acid, metalliferous or saline drainage is low and the material can generally be managed as NAF waste. The Acid and Metalliferous Drainage Management Plan (AMDMP) will be implemented and provide contingency for management of the nominally 1 % PAF material.

The AMDMP is provided in Appendix L of the EIS.



Geology - Napperby	
	Aeolian sand
	Alluvium
	Calc-silicate rock, marble, gneiss, schist
	Calcrete
	Coarse porphyritic granitic augen gneiss with mantled feldspars
	Colluvium
	Cordierite gneiss, mafic granulite
	Cordierite gneiss, quartzofeldspathic gneiss, garnet-biotite gneiss, sillimanite gneiss
	Cordierite granulites, metaquartzite, calc-silicate rock, felsic granulite, garnet-biotite gneiss
	Deeply weathered granite, felsic granulite, felsic gneiss, schist, dolomite
	Dyke or vein; quartz
	Fanglomerate
	Felsic granulite, mafic granulite, amphibolite, garnet-biotite gneiss, sillimanite gneiss, cordierite granulite
	Ferricrete
	Garnet-biotite gneiss, cordierite gneiss, sillimanite gneiss, calc-silicate rock, mafic granulite
	Garnet-cordierite-biotite... granulites, tourmaline metaquartzite
	Granite, granodiorite
	Mafic granulite, felsic granulite, quartzofeldspathic gneiss
	Marble, calc-silicate rock, para-amphibolite, chlorite schist, quartzite, sillimanite schist
	Medium even-layered granitic gneiss, minor porphyritic granite
	Mica-quartz sandstone, siltstone, shale, slate
	Quartz-rich metasediment, cordierite gneiss, mafic granulite
	Quartzofeldspathic gneiss, biotite gneiss, sillimanite gneiss, cordierite granulite, garnet-biotite gneiss
	Red earth
	Retrogressively metamorphosed rock in the Arunta Block
	Schist, gneiss, quartzite, quartz-rich metasediment
	Schist, phyllite, andalusite hornfels, tourmaline-quartz pods
	Sillimanite gneiss, amphibolite, garnet amphibolite
	Sillimanite schist and gneiss
	Sillimanite-biotite-cordierite granulites
	Thick-bedded quartzite, ferruginous quartzite, granule and pebble conglomerate
	Undivided
	Very coarse rutile-biotite metaquartzite
	White siltstone, thin-bedded, fine sandstone. Possible interbedded evaporites



LEGEND

- Proposed Pipelines and Easement
- Gas Pipeline
- Waterways
- Roads
- Site Boundaries



Arafura Resources Limited
Nolans Project

Job Number | 4322301
Revision | 0
Date | 29 Apr 2016

Geology

Figure 3-2

G:\43\2301\GIS\Maps\4322301_1007_Geology.mxd

Level 5 66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drnmail@ghd.com W www.ghd.com

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Data source: GA - Roads, Waterways, Placenames (2015). ARL - Study Areas, Proposed Pipelines (2015). NTG - Geology (2013) Created by: CM

3.3 Flora

3.3.1 Regional

The Project is located within the Burt Plain Bioregion, on the Aileron and Napperby pastoral stations which have been used for grazing since the early 1880s. The bioregion covers an area of 73,605 km², which represents approximately 5% of the Northern Territory (NRETAS 2005). It is characterised by arid to semi-arid plains and low rocky ranges with some of Australia's best established and most extensive mulga (*Acacia aneura*) and other acacia woodlands (NRETAS 2005).

There are five broad vegetation types that have been mapped within the bioregion (Wilson *et al.* 1990), the most abundant being Acacia Woodland. Other broad vegetation types recorded within the bioregion include Eucalyptus low woodland with tussock grass understory, Eucalyptus woodland with hummock grass understory, Hummock Grassland and Tussock Grassland (NRETAS 2005).

Conservation Significance

Lake Lewis is situated approximately 42 km southwest and considered a Site of Conservation Significance (SOCS No. 54) by the Department of Land Resource Management (formerly a branch of Department of Natural Resources, Environment, The Arts and Sport). The significance status is National Significance in relation to providing an important ecosystem for waterbird species, endemic and restricted range plant species and supports a fish population during times of flood.

3.3.2 Project Specific

A total of 14 vegetation communities were identified across the Project. These vegetation communities each display a degree of variation which is to be expected given the influence of differing geology, soils, hydrology, fire regimes and grazing pressures.

The dominant vegetation types at the Project are Mulga shrublands, which occur on alluvial fans and plains containing clayey red earths and Triodia hummock grasslands which grow on sandy plains. In more fertile riparian areas and associated floodplains there is evidence of impacts associated with cattle grazing including weed invasion, reduction in ground cover species richness and soil erosion. In particular there is a high abundance of Buffel Grass (*Cenchrus ciliaris*).

Vegetation communities identified and mapped within the study area and their relative abundance are summarised in Table 3-3 and distribution shown in Figure 3-3.

Table 3-3 Project Vegetation Communities

Nolans Project 2010/11 and 2015 Mapping				Albrecht and Pitts (2004) Mapping	
Vegetation Type	Description	Area (ha)	Area (%)	Vegetation Type	Description
1	Riparian woodland along water courses and drainage channels.	261.1	4.6	22	Large sandy red gum along creeklines.
2a	Mulga shrubland on sandy red earths over spinifex.	46.4	0.8	16	Mulga in valleys with red earth soils.
2b	Mulga shrubland on sandy red earths over tussock grasses.	1756.8	30.8	16	Mulga in valleys with red earth soils.
2c	Mulga shrubland on sandy red earths over chenopods.	41.6	0.6	16	Mulga in valleys with red earth soils.
3a	Mixed woodland over tussock grasses on alluvial plains.	780.2	13.7	17	Ironwood and fork-leaved corkwood on alluvial flats.
3b	Mixed Woodland over spinifex on alluvial plains.	31.2	0.5	N/A	Not described by Albrecht and Pitts 2004.
3c	Mixed Woodland over a highly disturbed understorey dominated by Buffel Grass (<i>Cenchrus ciliaris</i>).	21.8	0.4	N/A	Not described by Albrecht and Pitts 2004.

Nolans Project 2010/11 and 2015 Mapping				Albrecht and Pitts (2004) Mapping	
4	<i>Triodia schinzii</i> hummock grassland on red clayey sands	0*	0*	N/A	Not described by Albrecht and Pitts 2004
5	Hakea/Senna shrubland on calcareous alluvial plains and low rises.	232.5	4.1	N/A	Not described by Albrecht and Pitts 2004.
6	Eucalyptus (mallee)/ <i>Acacia kempeana</i> shrubland with <i>Triodia</i> on rocky slopes.	59.9	1.0	1	Hillside spinifex and mallee on quartzite slopes.
7	<i>Acacia</i> / <i>Triodia</i> shrubland on rocky outcrops.	226.6	4.0	1 & 3	Hillside spinifex and mallee on quartzite slopes; hillside spinifex on hills of granite, gneiss or schist.
8	<i>Acacia</i> /Senna shrubland on rocky gneiss or schist outcrops with no spinifex.	3.2	0.05	4	Witchetty Bush and/or Mulga on rocky hills of granite, gneiss or schist.
9	<i>Acacia kempeana</i> and/or Mulga shrubland on gravel.	126.3	2.2	5	Witchetty Bush and/or Mulga on gravelly rises of granite, gneiss, schist or quartz.
10	Claypans with chenopods and herbs.	0.3	0.005	25	Claypans often with a fringing sandy herbfield.
11	Cottonbush chenopod shrubland on highly erodible duplex soils.	13.5	0.2	18	Needlebrush and Cottonbush on erodible sandy-clay flats.
12	<i>Triodia basedowii</i> hummock grassland on sand plains.	851.9	14..9	14	Rises of loose sand with hard spinifex.
13	Senna shrubland on quartz.	16.6	0.3	8	Whitewood and Senna on gravelly rises associated with silcrete outcrop.
14	Coolabah swamp associated with claypans.	2.6	0.04	24	Coolabah associated with claypans.
2a/2b	Mulga shrubland on sandy red earths over tussock grasses / Mulga shrubland on sandy red earths over spinifex.	1155.1	20.3	16	Mulga in valleys with red earth soils.
2b/3a	Mulga shrubland on sandy red earths over tussock grasses / Mixed woodland over tussock grasses on alluvial plains.	11.8	0.2	N/A	Not described by Albrecht and Pitts 2004.
3a/12	Mixed woodland over tussock grasses on alluvial plains / Cottonbush chenopod shrubland on highly erodible duplex soils.	20.2	0.4	N/A	Not described by Albrecht and Pitts 2004.
3b/2b	Mixed woodland over spinifex on alluvial plains / Mulga shrubland on sandy red earths over tussock grasses.	25.6	0.4	N/A	Not described by Albrecht and Pitts 2004.
TOTAL		5,704			

Note: * Vegetation type was recorded only along the transport corridor that is no longer part of the study area.

Weed Status

There is a low to moderate level of infestation of weeds within the Project site. The most common introduced species is Buffel Grass (*Cenchrus ciliaris*). This species was recorded predominantly within floodplain and riparian vegetation types and in areas that have been disturbed by cattle and/or by mining exploration.

Buffel Grass (*Cenchrus ciliaris*) is an environmental weed that has spread rapidly in arid and semi-arid regions of Australia (Miller *et al* 2010). Buffel Grass (*Cenchrus ciliaris*) invasion represents a key threatening process for biodiversity in the region due to its rapid spread and potential to increase fire severity.

A summary of weeds identified onsite and within the bioregion is provided in Table 3-4.

Table 3-4 Weeds Summary at the Project and within the Bioregion

Name		Classification					Presence	
Common	Scientific	WONS	Class A	Class B	Class C	Env	Bioregion ^A	Project ^B
Caltrop	<i>Tribulus terrestris</i> s.lat.			✓	✓			✓
Khaki Weed	<i>Alternanthera pungens</i>			✓	✓		✓	
Cobblers Pegs	<i>Bidens bipinnata</i>					✓		✓
Rubber Bush	<i>Calotropis procera</i>			✓	✓		✓	
Saffron Thistle	<i>Carthamus lanatus</i>			✓	✓		✓	
Buffel Grass	<i>Cenchrus ciliaris</i>					✓		✓
Mossman River Grass	<i>Cenchrus echinatus</i>			✓	✓		✓	
Purple-top Chloris	<i>Chloris barbata</i>							✓
	<i>Chloris virgata</i>							✓
Paddy Melon	<i>Citrullus lanatus</i>					✓		✓
Couch Grass	<i>Cynodon dactylon</i> var. <i>dactylon</i>					✓		✓
Thornapples – Native Thornapple	<i>Datura</i> spp – <i>Datura leichhardtii</i>			✓	✓		✓	
Summer Grass	<i>Digitaria ciliaris</i>							✓
Patterson's Curse	<i>Echium plantagineum</i>		✓		✓		✓	
Pitted Lovegrass	<i>Eragrostis barrelieri</i>							✓
Hairyflower lovegrass	<i>Eragrostis trichophora</i>					✓		✓
Lovegrass	<i>Eragrostis minor</i>							✓
Malvastrum	<i>Malvastrum americanum</i>					✓		✓
Prickly Pears – Devil's Rope Pear	<i>Opuntia</i> spp. – <i>Opuntia imbricata</i>			✓	✓		✓	
Parkinsonia	<i>Parkinsonia aculeata</i>	✓		✓	✓		✓	
Mesquite	<i>Prosopis pallida</i>	✓	✓		✓		✓	
Castor Oil Plant	<i>Ricinus communis</i>			✓	✓		✓	
Athel Pine	<i>Tamarix aphylla</i>			✓	✓		✓	
Mimosa Bush	<i>Vachellia farnesiana</i> var. <i>farnesiana</i>					✓		✓
Coffee Senna	<i>Senna occidentalis</i>			✓	✓		✓	
Milk Thistle	<i>Sonchus oleraceus</i>							✓
Bathurst Burr	<i>Xanthium spinosum</i>			✓	✓		✓	
Noogoora Burr	<i>Xanthium strumarium</i>			✓	✓		✓	
Total		2	2	13	15	7	14	14

Notes: ^A Sourced from Neave et al 2006.
^B Sourced from GHD survey data.
WONS: Weed of National Significance

Threatened Species

No flora species listed as threatened under the EPBC or TPWC Acts were recorded at the Project during the EIS surveys.

3.4 Fauna

3.4.1 Regional

The fauna population densities of the Burt Plain Bioregion are influenced by fire regimes and the introduction of predator species. There are 19,500 records for 359 vertebrate species for the Burt Plain Bioregion (Neave et al 2006). These include the following:

- Birds (16,341 records and 183 species; 51.0% of all species);
- Mammals (1,643 records and 63 species; 17.5% of species);
- Reptiles (1,436 records and 104 species; 29.0% of species); and
- Frogs (80 records and 9 species; 2.5% of species).

3.4.2 Project Specific

The EIS surveys identified:

- A total of 124 indigenous terrestrial vertebrate fauna species were recorded during the GHD 2010 baseline fauna survey, including 16 mammals, 78 birds, 27 reptiles, 2 frogs and 1 invertebrate. Three introduced fauna species (all mammals) were also recorded; and
- A total of 130 indigenous terrestrial vertebrate fauna species were recorded during the GHD 2015 baseline fauna survey, including 21 mammals, 78 birds, 28 reptiles, 2 frogs and 1 invertebrate. Five introduced fauna species (all mammals) were also recorded.

Threatened Species

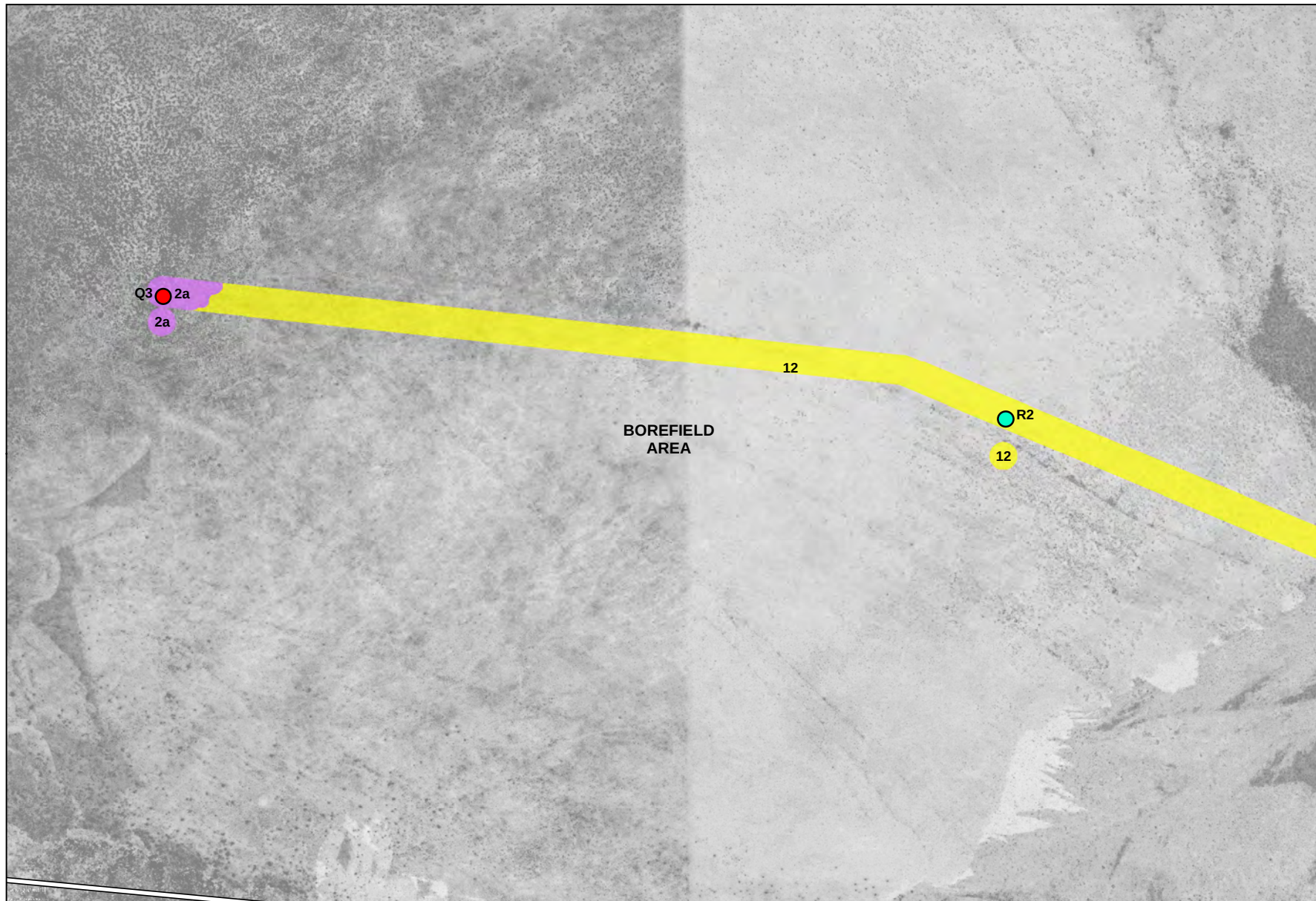
Threatened fauna species are those that are known or considered likely to occur within the Study area and that are listed as threatened (or a related category) under the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and/or Northern Territory's *Territory Parks and Wildlife Conservation (TPWC) Act 2000*. A total of 9 threatened species have been identified across the Project during EIS surveys including 4 mammals, 4 birds and 1 reptile as detailed in Table 3-5 and identified locations provided on Figure 3-4.

Table 3-5 Threatened Fauna Species

Name		Status		Area Identified ^A	Extents
Common	Scientific	EPBC	TPWC		
Mammals					
Brush-tailed mulgara	<i>Dasycercus blythi</i>	VU	VU	Borefield area	Likely to occur across much of the sandplain habitat in the south of the Study area (i.e., the borefield area).
Black-footed Rock-wallaby (MacDonnell Ranges race)	<i>Petrogale lateralis</i>	VU	NT	Mine Site and Borefield	Mine site and scattered outcrops in the borefield. Species restricted to steep rocky habitats, particularly the larger rocky outcrops and ranges.
Spectacled hare-wallaby	<i>Lagorchestes conspicillatus</i>	-	NT	Borefield area	Detected by tracks only, which require confirmation. May occur across much of the sandplain habitat in the south of the Study area.
Northern Nailtail	<i>Onychogalea unguifera</i>	-	NT	Processing Site	Detected by tracks and scats only, which require confirmation. Could occur anywhere in

Name		Status		Area Identified ^A	Extents
Common	Scientific	EPBC	TPWC		
Wallaby					open woodland or shrubland.
Birds					
Emu	<i>Dromaius novaehollandiae</i>	-	NT	Borefield area	Detected by tracks. Likely to occur across the entire Study area.
Australian bustard	<i>Ardeotis australis</i>	-	NT	Haul route (2010)	Seen in open grassland, but species known to use other habitats also. Likely to occur across the entire Study area.
Flock bronzewing	<i>Phaps histrionica</i>	-	NT	Haul route (2010)	Seen in sandplain habitat along the haul route, but this is not necessarily its preferred habitat. May occur across the entire Study area.
Bush Stone-curlew	<i>Burhinus grallarius</i>	-	NT	Processing site and Mine site	Suitable habitat occurs across much of the Study area.
Reptiles					
Great Desert Skink	<i>Liopholis kintorei</i>	VU	VU	Borefield area	Detected by motion-sensing camera at burrow/latrine system. May occur across much of the sandplain habitat in the south of the Study area.

Note: ^A Identified in GHD 2010 and/or 2015 field surveys
EN = Endangered, VU = Vulnerable, NT = Near Threatened.

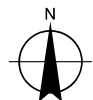


Vegetation Community		
1	Riparian woodland along water courses and drainage channels	
2a	Mulga shrubland on sandy red earths over spinifex	
2a / 2b	Mulga shrubland on sandy red earths over tussock grasses / Mulga shrubland on sandy red earths over spinifex	
2b	Mulga shrubland on sandy red earths over tussock grasses	
2b / 3 a	Mulga shrubland on sandy red earths over tussock grasses / Mixed woodland over tussock grasses on alluvial plains	
2c	Mulga shrublands on sandy red earths over chenopods	
3	Mixed Woodland over tussock grasses	
3a / 12	Mixed woodland over tussock grasses on alluvial plains / Cottonbush chenopod shrubland on highly erodible duplex soils	
3b	Mixed woodland over spinifex on alluvial plains	
3b / 2b	Mixed woodland over spinifex on alluvial plains / Mulga shrubland on sandy red earths over tussock grasses	
3c	Mixed woodland over a highly disturbed understorey dominated by <i>Cenchrus ciliaris</i>	
5	Hakea/Senna Shrubland on Calcareous Alluvial Plains and Low Rises	
6	Eucalyptus (mallee)/Acacia kempeana/Triodia Shrubland on Rocky Slopes	
7	Acacia/Triodia shrubland on rocky outcrops	
8	Acacia/Senna shrubland on rocky gneiss or schist outcrops with no spinifex	
9	Acacia kempeana and /or mulga shrubland on gravel	
10	Claypans with chenopods and herbs	
11	Cottonbush chenopod shrubland on highly erodible duplex soils	
12	<i>Triodia basedowii</i> hummock grassland on sandplains	
13	Senna shrubland on quartz	
14	Coolabah swamp associated with claypans	

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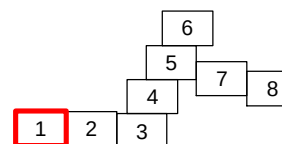
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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

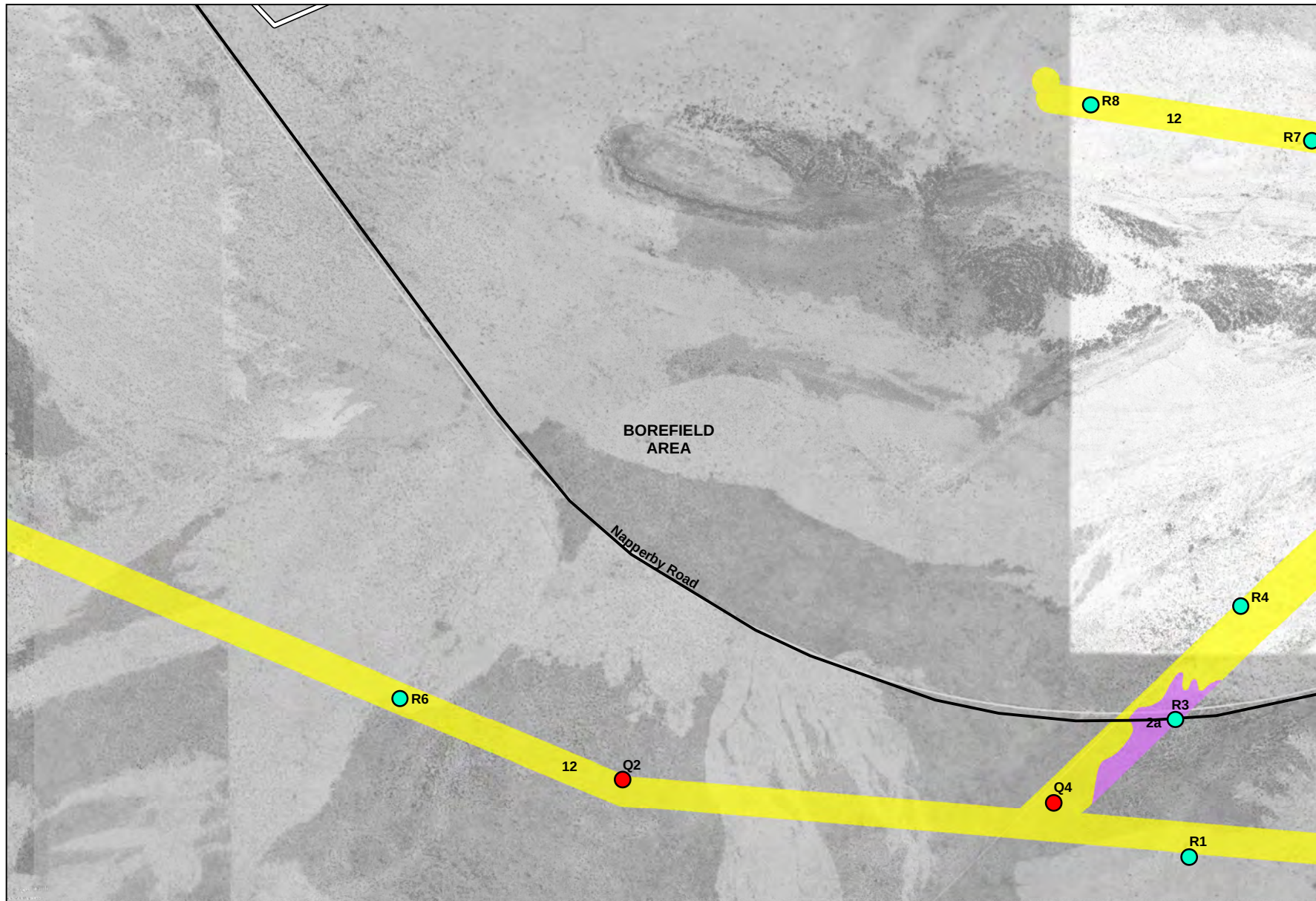
- Checksites
- Quadrats 2015
- Quadrats 2011
- Existing Roads
- Site Boundaries



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Nolans Project
Flora and Vegetation Survey

Job Number | 4322301
Revision | 0
Date | 29 Apr 2016

Vegetation Mapping **Figure 3-3 (Page 1 of 8)**

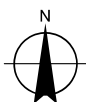


Vegetation Community		
1	Riparian woodland along water courses and drainage channels	
2a	Mulga shrubland on sandy red earths over spinifex	
2a / 2b	Mulga shrubland on sandy red earths over tussock grasses / Mulga shrubland on sandy red earths over spinifex	
2b	Mulga shrubland on sandy red earths over tussock grasses	
2b / 3 a	Mulga shrubland on sandy red earths over tussock grasses / Mixed woodland over tussock grasses on alluvial plains	
2c	Mulga shrublands on sandy red earths over chenopods	
3	Mixed Woodland over tussock grasses	
3a / 12	Mixed woodland over tussock grasses on alluvial plains / Cottonbush chenopod shrubland on highly erodible duplex soils	
3b	Mixed woodland over spinifex on alluvial plains	
3b / 2b	Mixed woodland over spinifex on alluvial plains / Mulga shrubland on sandy red earths over tussock grasses	
3c	Mixed woodland over a highly disturbed understorey dominated by <i>Cenchrus ciliaris</i>	
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9	Acacia kempeana and /or mulga shrubland on gravel	
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12	<i>Triodia basedowii</i> hummock grassland on sandplains	
13	Senna shrubland on quartz	
14	Coolabah swamp associated with claypans	

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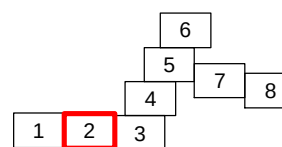
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- Quadrats 2011
- Existing Roads
- Site Boundaries



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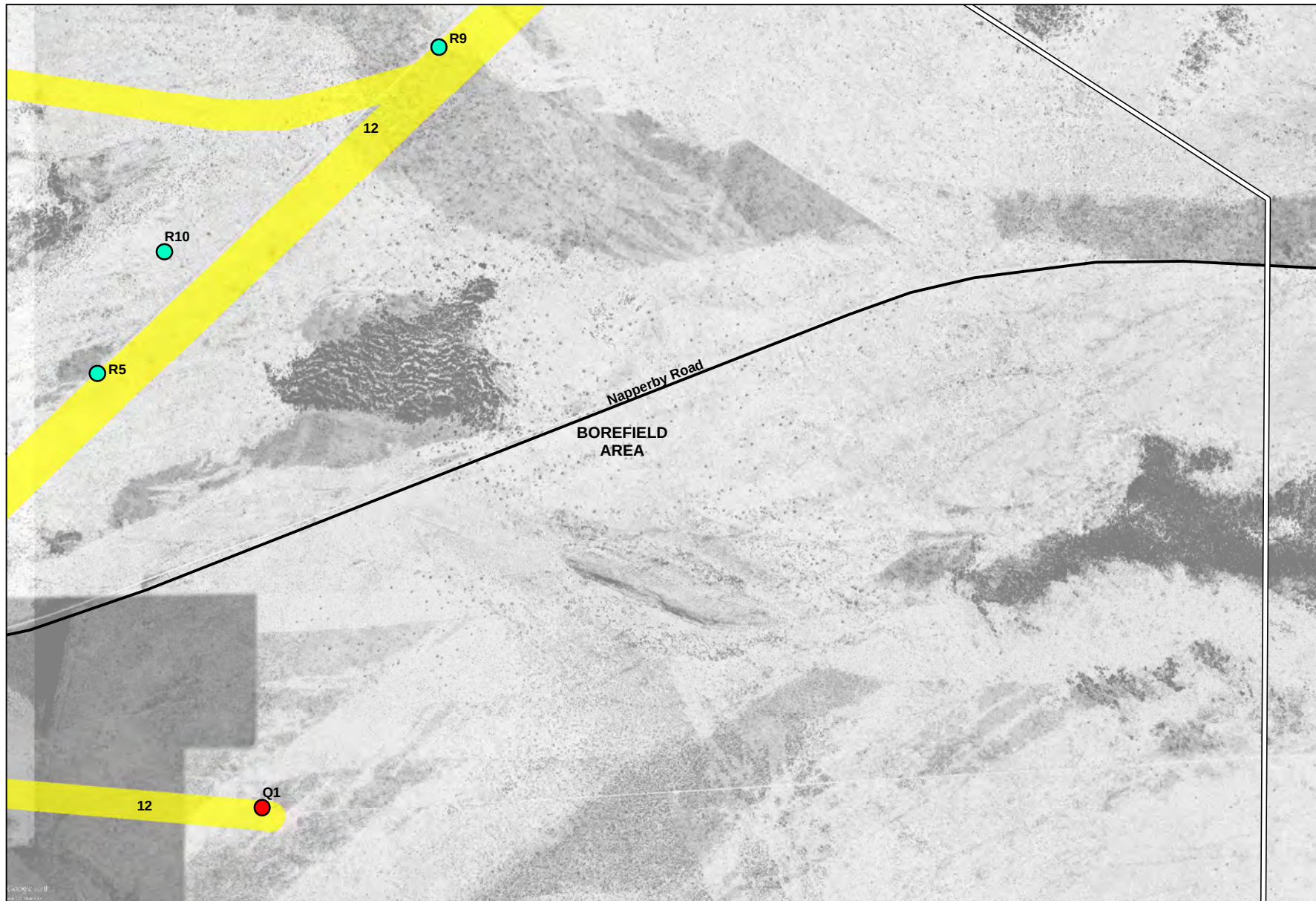
Vegetation Mapping Figure 3-3 (Page 2 of 8)

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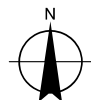
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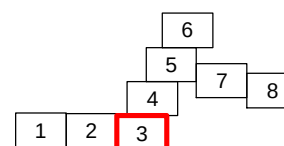


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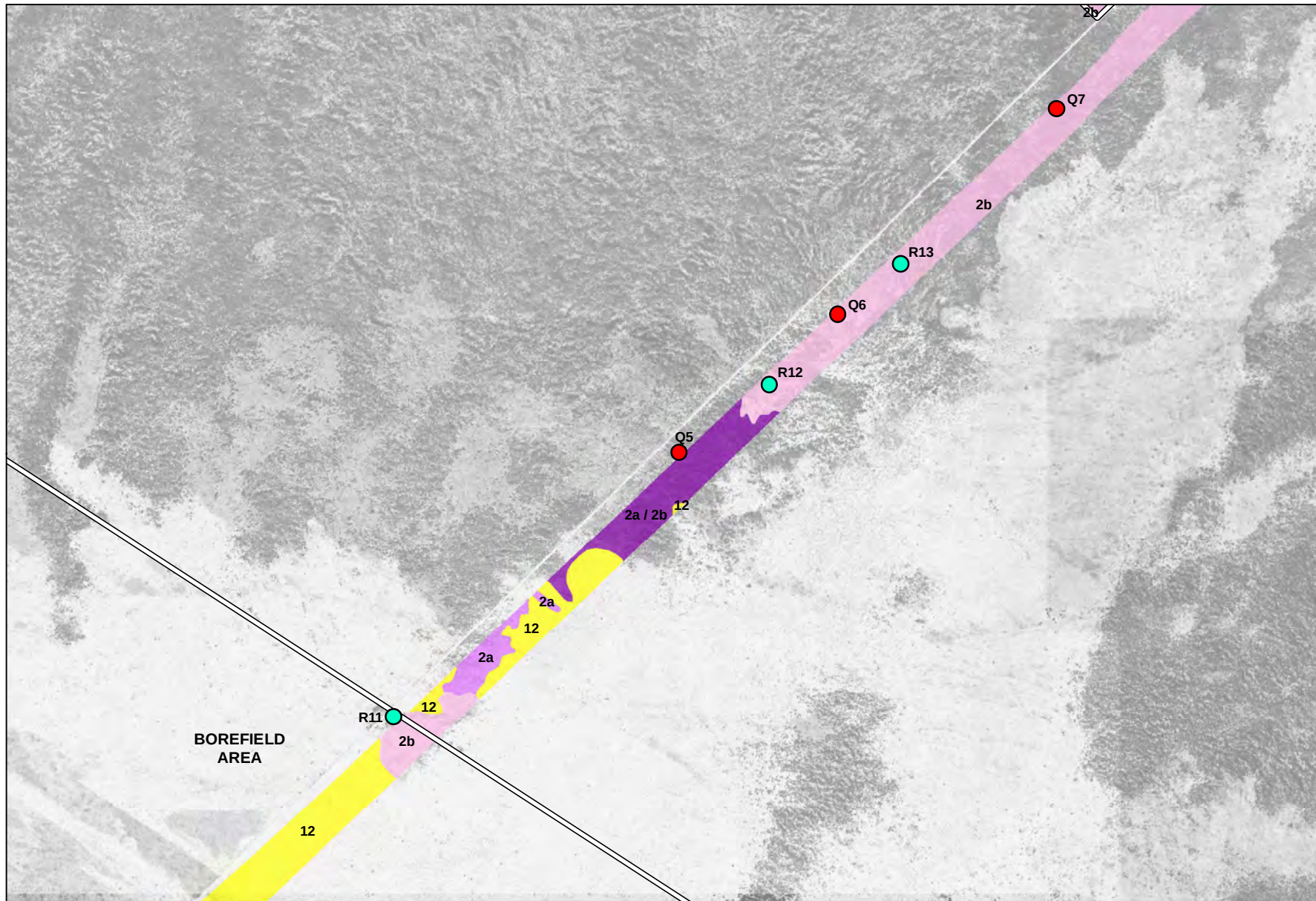
Vegetation Mapping Figure 3-3 (Page 3 of 8)

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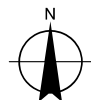


Vegetation Community		
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2a / 2b	Mulga shrubland on sandy red earths over tussock grasses / Mulga shrubland on sandy red earths over spinifex	
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13	Senna shrubland on quartz	
14	Coolabah swamp associated with claypans	

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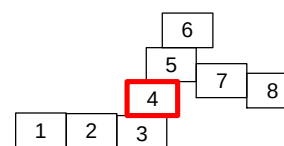
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● Quadrats 2011

— Existing Roads
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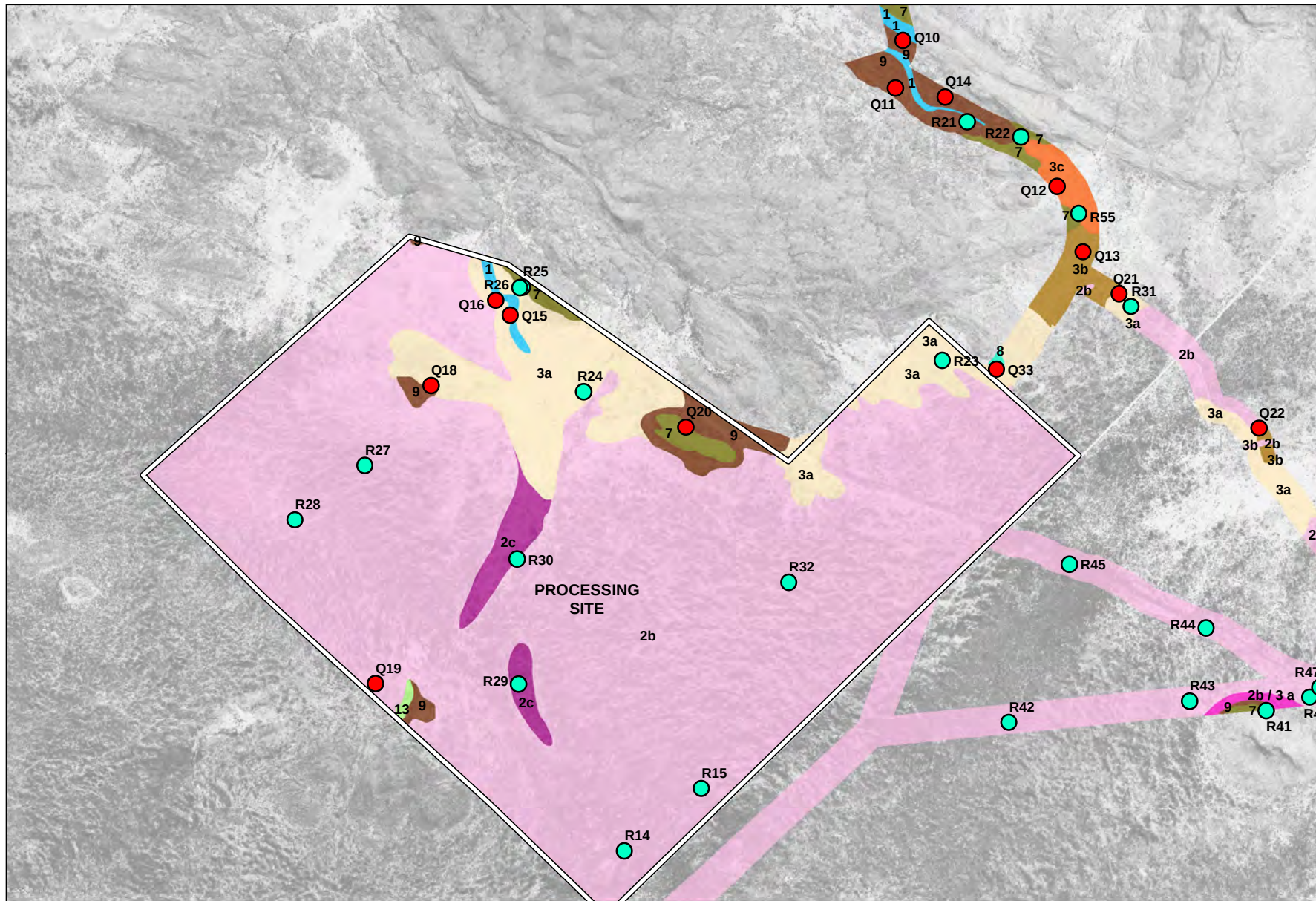
Vegetation Mapping Figure 3-3 (Page 4 of 8)

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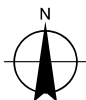


Vegetation Community	
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2a	Mulga shrubland on sandy red earths over spinifex
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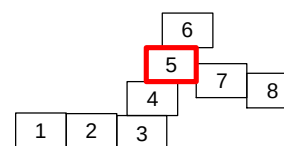
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Horizontal Datum: GDA 1994
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Vegetation Mapping **Figure 3-3 (Page 5 of 8)**

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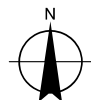


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2a	Mulga shrubland on sandy red earths over spinifex	
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14	Coolabah swamp associated with claypans	

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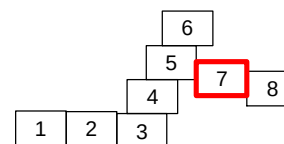
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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53



LEGEND

- Checksites
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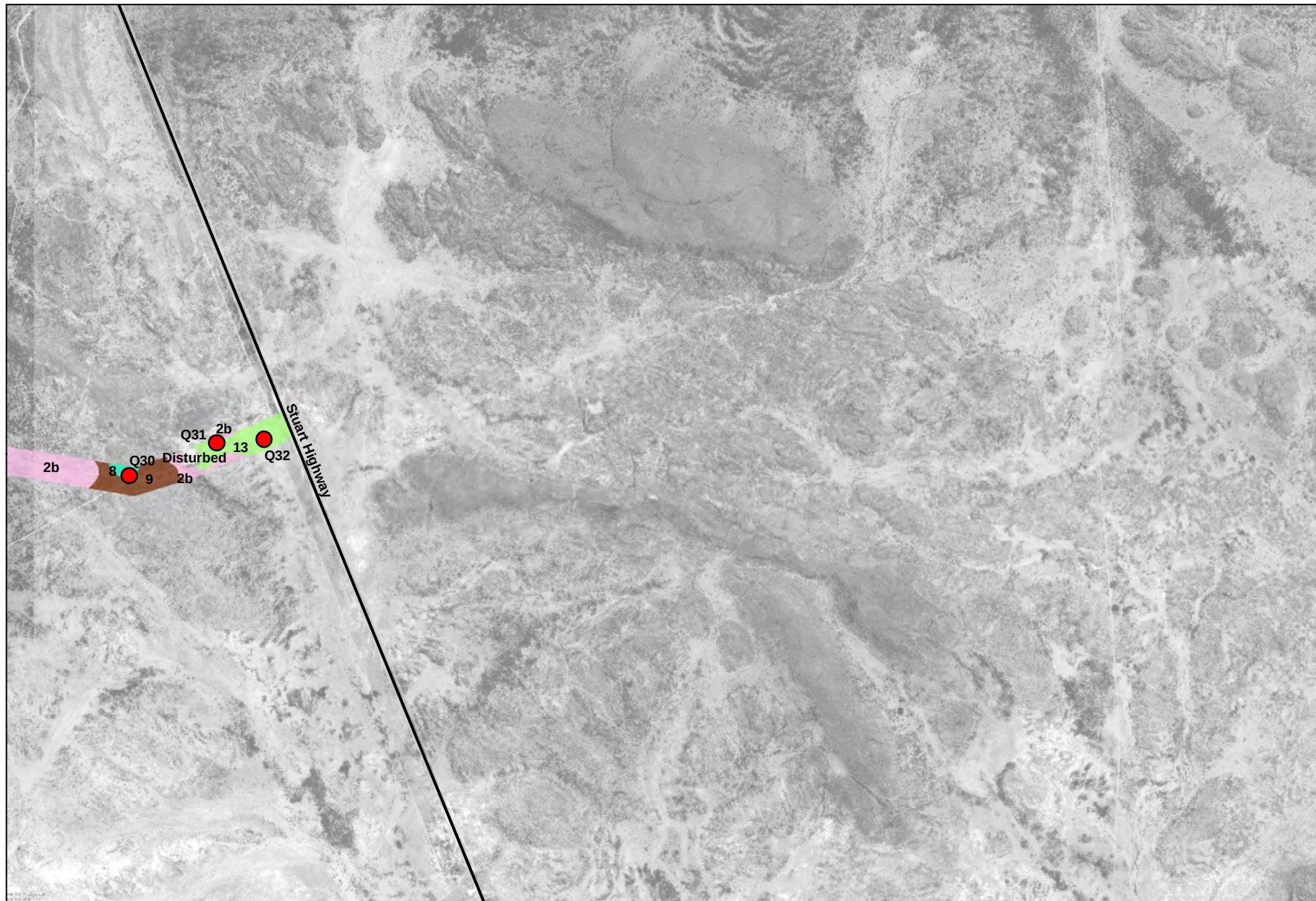
Vegetation Mapping Figure 3-3 (Page 7 of 8)

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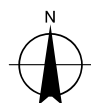


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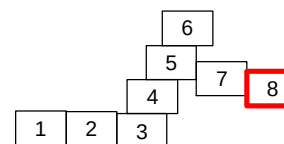
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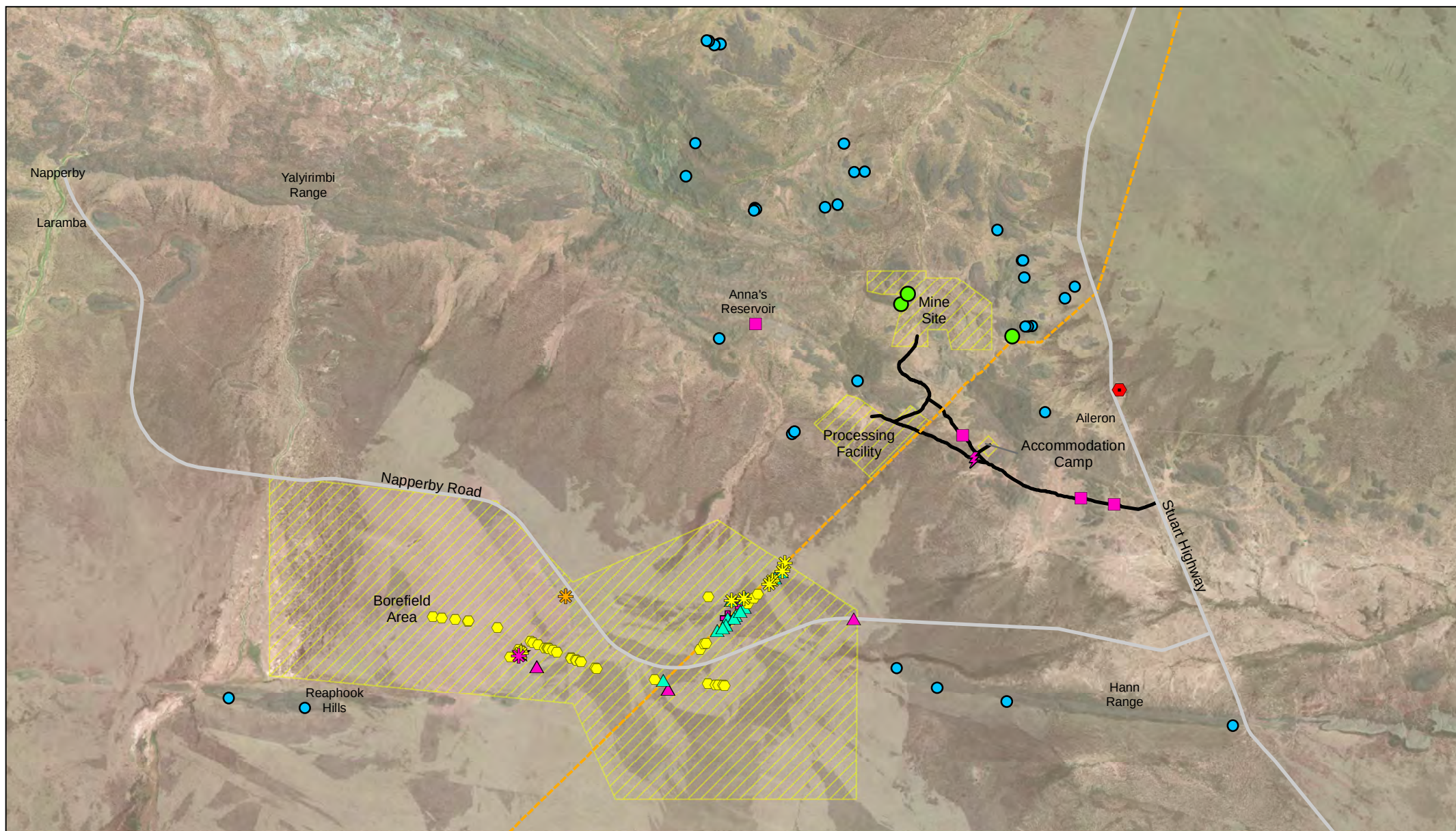
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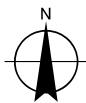
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Vegetation Mapping **Figure 3-3 (Page 8 of 8)**



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Map Projection: Universal Transverse Mercator
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Grid: GDA 1994 MGA Zone 53



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| ▲ Australian Bustard, 2015 | ✚ Emu, 2015 | ✳ Great Desert Skink (DLRM) | ▲ Emu |
| ● Black-footed Rock-wallaby, 2010 | ✳ Great Desert Skink, 2015 | ● Malleefowl (DLRM) | ● Black-footed Rock-wallaby, 2015 |
| ★ Brush-tailed Mulgara, 2015 | ⚡ Northern Naitail Wallaby, 2015 | ✳ Bustards | — Roads |
| ■ Bush Stone-curlew, 2015 | ✚ Spectacled Hare-wallaby, 2015 | ● Mulgara Burrows | — Gas Pipeline |
| | | | — Access Roads |
| | | | ▨ Study Area |



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Threatened and near threatened fauna
observations within the project area **Figure 3-4**

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Data source: GA - Imagery (2008), Roads, Gas Pipeline (2015). GHD - Fauna Survey Sites, Proposed Mine Site, Proposed Treatment Plant, Proposed Accommodation Village, Borefield Area (2015). Created by: CM

3.5 Water

3.5.1 Surface Water

Mine Site

The Mine Site is situated within the Ti-Tree Basin which has a large catchment area.

Kerosene Camp Creek is the main creek which flows through the Mine Site, the creek flows from south to north across the Site. Kerosene Camp Creek is fed by several creeks across the Mine Site. The catchment area of Kerosene Camp Creek and its tributaries upstream of the Mine Site is 18 km².

Nolans Creek joins Kerosene Camp Creek approximately 500 m downstream of the Mine Site northern boundary. However, Nolans Creek transects the Mine Site flowing adjacent to the FTSF and between Waste Rock Dump 2 and 6 and has an upstream catchment of 26 km².

Kerosene Camp Creek joins the Woodforde River approximately 12 km from the Mine Site northern boundary. Woodforde River ultimately becomes a flood-out approximately 6 km north of Ti-Tree, approximately 62 km north of the Mine Site northern boundary with the potential to discharge to the Hanson River.

Process Site

The Process Site is situated on the head waters of the Southern Basin. This site has poorly defined natural waterways and/or drainages.

Accommodation Village

The Accommodation Village is situated on a plain with rocky hills nearby to the eastern side. This area has poorly defined natural waterways and/or drainages.

Borefield

The Borefield is situated within the Southern Basin. No major creek/river system is present within the Borefield itself. Day Creek is the closest watercourse situated approximately 10 km west of the Borefield and flows in a southerly direction.

Napperby Creek is the next closest watercourse located 30 km to the west of the Borefield and also flows in a southerly direction directly into Lake Lewis.

3.5.2 Groundwater

Groundwater extraction will occur at the Project via two methods including groundwater extraction from five production bores (SB008, SB015, SB021, SB025 and SB027) within the Southern Basins and pit sump dewatering in the Ti-Tree Basin. The water supply will be utilised through the life of the Project (approximately 41 years), following the closure of the mine pumping will cease. The pit will remain open and act as groundwater sink in perpetuity (evaporation losses exceed inputs from runoff, precipitation and groundwater inflows).

Basins

The Borefield and Processing Site are located within the Southern Basins and the Borefield targets the Reaphook Palaeochannel. Groundwater within the basins generally flows westwards. The Mine Site and Accommodation Village are within the Ti-Tree Basin which also comprises palaeochannels. The divide between the basins is located at the ridge line to the north of the Processing Site.

Declaration of Beneficial Uses

The Mine Site and Accommodation Village are located within the Ti-Tree Water Control District (WCD) within the Western Zone. WCDs are proclaimed areas where the Department of Land Resource

Management (DLRM) have identified a need to manage water resources (surface and groundwater) to avoid stressing groundwater reserves, river flows or wetlands. DLRM manage the Ti-Tree

The Ti-Tree WCD covers approximately 14,000 km² within which the majority of water supplies for the 1000 people are sourced from groundwater. It was initially declared in 1983 and groundwater in the WCD continues to be utilised for agriculture, horticulture and stock and domestic water use (DLRM, 2016).

Mining is exempt from licencing under the *Water Act*. However, extraction and dewatering activities are governed under the *Mining Management Act* run by the Department of Mines and Energy (DME) who have a memorandum of understanding with the DLRM to manage activities so they do not affect other water users.

3.6 Groundwater Modelling

3.6.1 Model

A class 1 numerical groundwater model was developed using graphical user interface (GUI) GMS 10.1 with MODFLOW-NWT with Upstream Weighting (UPW) and Newton (NWT) solver, Evaporation package (EVT1), General Head boundary package (GHB1), the Drains (DRN1) package and the Recharge (RCH1) package and automated parameter estimation (PEST) packages. The model simulates aquifer conditions to develop a steady-state (existing) and predicts impacts from the Project including operations and 100 and 1000 years post closure.

The model was run for a 41 year operation with the extraction of 4.5 GL/year.

3.6.2 Modelled Impacts

The hydrogeological model indicates that there will be drawdown due to pit dewatering and extraction at the Borefield. Levels of drawdown range dependent upon distance from the extraction. The Borefield generally recovers across the closure period but the drawdown associated with the pit continues to expand post closure due to it acting as a groundwater sink. A summary of predicted impacts is provided in Table 3-6.

The Hydrogeological Assessment is provided in Appendix K of the EIS.

Table 3-6 Summary of Modelled Impacts

Area	Impact
Mine Site	
Riparian Vegetation	The riparian vegetation immediately adjacent to the mine area (upstream to the point of the diversion and downstream in Kerosene Camp Creek to the confluence of Nolans Creek) is highly likely to be catastrophically impacted by the mining operations (i.e. riparian vegetation will die and not recolonise the area).
Groundwater Users	Pine Hill Station bores (RN010759 and RN012624) are likely to experience a drawdown increasing to 0.05 m at the LOM and 0.1 m 1,000 year post closure. Groundwater availability for drinking water, stock, horticulture and viticulture within the Ti-Tree Basin is highly unlikely to be measurably impacted (i.e. less than 0.012 m predicted drawdown). Drawdown at the Aileron Station (homestead and roadhouse physical location) will be impacted by the proposed mine dewatering and remain impacted beyond mine closure. Drawdown is likely to commence following the end of mining and increase from 0 m in approximately 2291 to 0.7 m 1,000 years post closure. However, the water supply for Aileron Station is from the Sothorn Basins and is detailed below.
Southern Basins	
Riparian Vegetation	Modelled drawdown from the Borefield peaks in the order of 1.5 m in the vicinity of Day Creek during extraction. The drawdown rebounds rapidly once extraction ceases. The depth to groundwater currently is generally 20 m and it is considered likely that current vegetation would be capable of extending root systems during the extraction period. Napperby Creek is approximately 18 km further west than Day Creek is from the Borefield and as such drawdown is significantly reduced. Drawdown peaks at 0.7 m at

Area	Impact
	the LOM and recovers to 0.1 m 1,000 years post closure. The predicted drawdowns are negligible in the Lake Lewis area and not likely to be measureable. However, the peak decreases in groundwater availability for evapotranspiration in the Lake Lewis area of the Southern Basins is 3% or 712 m ³ /day (8 L/s) and this rebounds to approach steady state with a decrease of approximately 0.5 % or 103 m ³ /day (1 L/s).
Groundwater Users	Alyuen Community water supplies will be impacted by the groundwater extraction in the Borefield. Drawdown is likely to peak at the end of mining at 0.6 m and decrease to 0.4 m 1,000 years post closure. Laramba and Napperby groundwater supply (drinking water) situated on the western side of Day Creek north of the Reaphook Range is expected to experience a peak drawdown of 1.3 m at the LOM and decrease to 0.1 m 1,000 years post closure.

3.7 Sacred, Archaeological and Heritage Sites

3.7.1 Sacred Sites

Sacred site clearances have been undertaken in the study area and Authority Certificates were issued by the Aboriginal Areas Protection Authority (AAPA) in 2008 (C2008/205) and 2013 (C2013/205). Copies of the AAPA Certificates are attached to the Indigenous and Historic Cultural Heritage Assessment in the EIS.

There are a number of sacred sites in or near the study area. Sacred sites are usually associated with creeks, waterholes, and/or geological outcrops; which archaeological surveys has also found to contain archaeological materials and features.

One Restricted Works Area 8 (RWA8), associated with sacred site 5552-30, has been recorded within the project footprint. The features of sacred site 5552-30 described in the Authority Certificate issued by the AAPA.

3.7.2 Heritage Survey

The Aboriginal and historic (non-Aboriginal) cultural heritage values of the study area were assessed by AHMS Heritage Advisors in 2015. The works included a site survey of key infrastructure (Mine Site, Process Site, Accommodation Village, Borefield, water supply and power distribution lines). A summary of identified items is provided in Table 3-7.

Table 3-7 Identified Aboriginal Sites and Isolated Artefacts (AHM, 2016)

Site features	Site name	Archaeological Significance
Artefact scatter	NP-3, NP-15	High
	NP-12, NP-13, NP-14, NP-19, NP-28,	Moderate
	NP-4, NP-5, NP-7, NP-8, NP-16, NP-17, NP-18, NP-20, NP-22, NP-24, NP-25, NP-30	Low
Artefact scatter; quarry	NP-6, NP-11, NP-26, NP-27, NP-31	High
	NP-21	Moderate
Artefact scatter; quarry; reduction area	NP-9, NP-10	High
Artefact scatter; engraving	NP-1	High
Artefact scatter; habitation structure; grinding surface	NP-2	High
Artefact scatter; quarry; grinding surface	NP-23	High
Rockshelter; artefact scatter	NP-29	High
Site complex; artefact scatter; quarry	NP-32	High
Flake	NP-ISO-1-1, NP-ISO-7-2, NP-ISO-8, NP-ISO-10, NP-ISO-11-1, NP-ISO-18-1,	-

Site features	Site name	Archaeological Significance
	NP-ISO-18-2, NP-ISO-19, NP-ISO-20, NP-ISO-22-2, NP-ISO-22-3	
Grindstone	NP-ISO-1-2, NP-ISO-13-1, NP-ISO-25	-
Bifacial flaked artefact	NP-ISO-1-3, NP-ISO-23, NP-ISO-24	-
Retouched flake	NP-ISO-2, NP-ISO-3, NP-ISO-5-1, NP-ISO-29-1	-
Distal flake	NP-ISO-4	-
Distal retouched flake	NP-ISO-5-2	-
Core	NP-ISO-5-3, NP-ISO-6, NP-ISO-7-1, NP-ISO-9, NP-ISO-12-1, NP-ISO-12-2, NP-ISO-13-2, NP-ISO-14, NP-ISO-15, NP-ISO-16-1, NP-ISO-16-2, NP-ISO-17, NP-ISO-21-1, NP-ISO-22-1, NP-ISO-26, NP-ISO-28-1, NP-ISO-28-2, NP-ISO-29-1, NP-ISO-30-1, NP-ISO-30-2	-
Transverse broken flake	NP-ISO-11-2	-
Pounder	NP-ISO-21-2	-
Muller	NP-ISO-27	-

4. Project Risk Assessment

The Project is in the initial stages of developing a robust and technically defensible EIS. The EIS has been developed through a risk based approach identifying and analysing risks and determining mitigation measures. The EMP has been developed in unison with the EIS and its associated technical studies, the project risk assessment is provided within Chapter 5 of the EIS.

The EMP will take ownership of the project risk assessment following the completion of the EIS process (i.e. following receipt of the NT EPA Assessment Report). The risk assessment will be continually updated in unison with EMP reviews as detailed within Section 6.1.2.

A summary of the EIS risk assessment is provided below.

4.1 Risk Assessment

The environmental risk assessment identified 81 risk events, of which several had potential impacts on multiple environmental receptors. As a result, 135 impact pathways were identified and assessed through the environmental risk assessment process.

The separate social risk assessment identified and assessed 22 socio-economic risk events, of which 18 were potential negative impacts and four were potential positive impacts.

The residual risk rating for most risks was rated as Low. Those rated Medium or High were the subject of particular attention in the development of further control measures and management plans. The risk profile across the study areas is presented in Figure 4-1, which highlights the distribution of project risks. There were no risks identified and assessed with an Extreme risk rating.

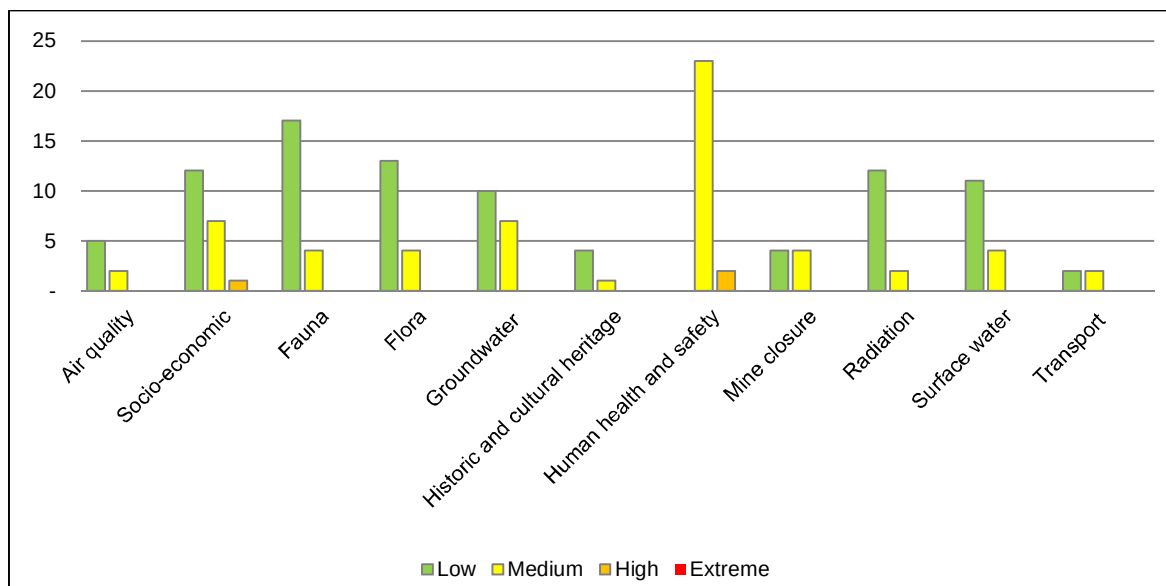


Figure 4-1 Residual Risk Ratings by Aspect

Key risk areas that have been subject to further detailed impact assessment and risk management planning include the following:

- Health and safety of project personnel from interaction with equipment as well as mobile and fixed plant, during construction and operation activities;
- Dust fallout and deposition, including impacts to flora and nearby sensitive receptors, from wind erosion of exposed surfaces and vehicle movement along haul roads;
- Flora, vegetation communities and fauna habitat from spread of weeds and feral animals due to vehicle movements and inappropriate waste management;

- Groundwater quality from seepage, embankment failure or overtopping of tailings, residue storage facilities and process liquor evaporation ponds;
- Decline in availability of water to existing and/or future users within the Southern Basin due to progressive water table drawdown from Project Borefield groundwater extraction;
- Social and family tensions from increased disposable income and distribution of benefits payments in the local communities;
- Employment impacts to existing local businesses (e.g. retail, hospitality, council) due to recruitment of project personnel; and
- Wellbeing of project personnel due to living away from home and lack of family / support networks.

After the application of additional control measures, the residual risk profile is presented in Figure 4-2. It demonstrates:

- Majority of risks are improbable or may occur only in exceptional circumstances; and
- Maximum credible consequence of most risks is no greater than a minor impact.

There are however, a range of Medium level risks which will be actively managed through identified control measures. No risk was assessed as having an initial or residual risk rating of Extreme. The top three risks have a residual risk rating of High, and have been acknowledged as key areas for management by the project, these include:

1. Vehicle incident associated with the transport of materials and personnel off-site on public roads;
2. Mobile equipment incident on site, including all operational areas and vehicle types; and
3. Project personnel mental health issues, including potential for self-harm, associated with or exacerbated by living away from home and lack of family / support networks.

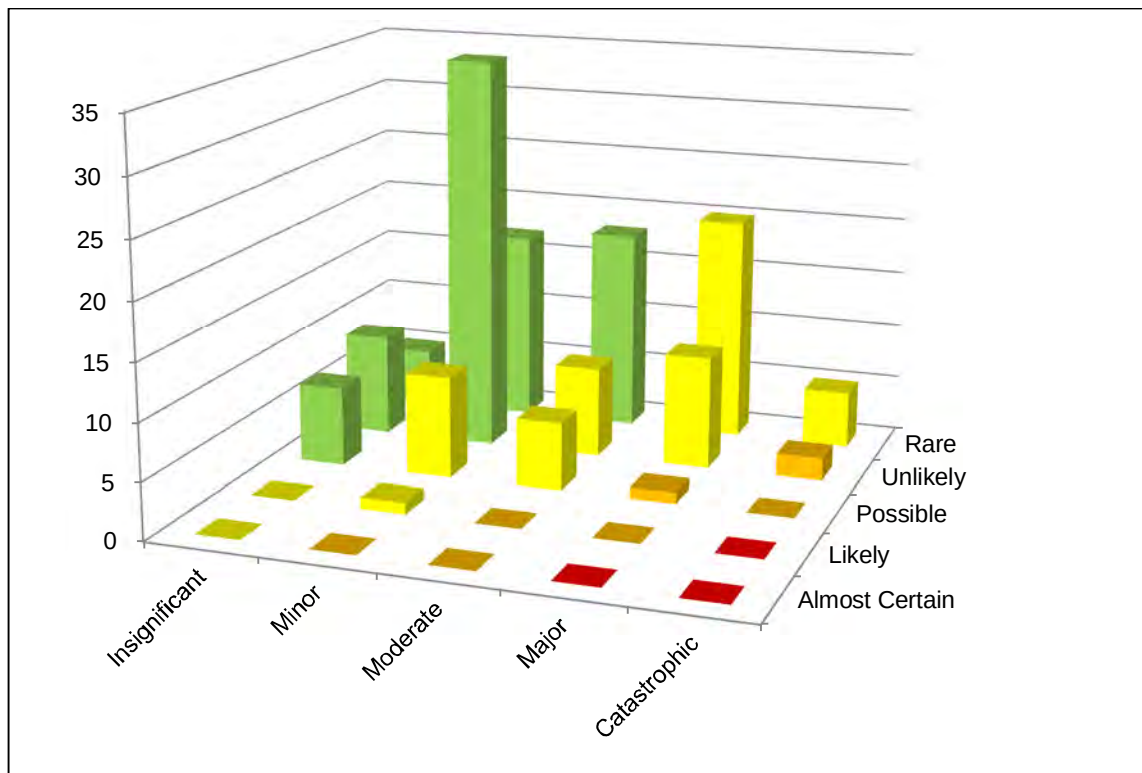


Figure 4-2 Distribution of residual risk ratings

4.1.1.1 Conclusion

A risk based approach was adopted to identify and assess the potential impacts associated with the Project, in terms of their credible worst case consequence and the likelihood of that consequence occurring.

The risk assessment was conservative in approach, to provide repeatable results. A summary was developed of the findings that describe the activities of the Project and the prioritisation of the associated risks. The results of the risk assessment have been reported in the individual impact assessment reports for each environment and study aspect, providing justification for the rating and outlining additional control measures to manage the risk.

The risk identification and additional control measures have been used to inform the Environmental Management System and associated sub-management plans.

5. Approval and Legislative Requirements

5.1 Environmental Approvals

The Project is situated within the Northern Territory where it is subject to Northern Territory legislation and commonwealth legislation. The Northern Territory Environmental Protection Authority (NT EPA) administers the Territory legislation and the Department of the Environment (DotE) administer the commonwealth legislation.

The Project was initially introduced to Department of Natural Resources, Environment, the Arts and Sport (NRETAS) and Department of the Environment, Water, Heritage and the Arts in 2008 who have subsequently been renamed the NT EPA and DotE respectively. The Project has evolved since its initial introduction and was reintroduced in late 2014/early 2015 and the EIS has progressed based on this recent Project description. A summary of historical and future approval processes are provided in Table 5-1.

Table 5-1 Summary of Project Approvals

Date	Entity	Documentation	Details
March 2008	Arafura Resources	Notice of Intent	Introduction of the Project including: • Project Location and Description; • Legislation; and • Site Descriptions, Potential Impacts and Mitigation.
August 2008	Arafura Resources	EPBC Referral (EPBC 2008/4371)	Introduction of the Project including: • Project Location and Description; • Legislation; and • Site Descriptions, Potential Impacts and Mitigation.
November 2008	NRETAS	Guidelines for the Development of an EIS	EIS development guidelines and requirements for assessment.
September 2008	Department of the Environment, Water, Heritage and the Arts	Decision on Assessment Approach: Bilateral Agreement	EPBC Referral determined to be a controlled action due to related nuclear actions (Section 21 and 22A). The decisions required the Project to be assessed under the bilateral agreement with the Northern Territory Government.
August 2010	Arafura Resources	Guidelines Extension Request	Arafura requested an extension for the submission period of the EIS to the Minister for Lands, Planning and Environment.
December 2010	NRETAS	Extension Approval	The Minister for Lands, Planning and Environment granted a two year extension and the Guidelines were reissued.
September 2012	Arafura Resources	Guidelines Extension Request	Arafura requested an extension for the submission period of the EIS to the Minister for Lands, Planning and Environment.
November 2012	NRETAS	Extension Approval	The delegate for the Minister for Lands, Planning and Environment granted a two year extension and the Guidelines were reissued with minor amendment.
December 2014	Arafura Resources	Notice of Intent Amendment (Section 14a)	Reintroduction of the Project to the NT EPA providing a summary of key changes between the previously submitted Project description in 2008.
December 2014	NT EPA	Statement of Reasons	NT EPA assessed the NOI amendment and determined the Project required further assessment under the Environmental Assessment Act to the level of an Environmental Impact Statement.

Date	Entity	Documentation	Details
February 2015	Arafura Resources	EPBC Referral withdrawn (EPBC 2015/7436)	Introduction of the Project including: - Project Location and Description; - Legislation; and - Site Descriptions, Potential Impacts and Mitigation.
February 2015	Arafura Resources	EPBC Referral (EPBC 2008/4371)	Introduction of the Project including: - Project Location and Description; - Legislation; and - Site Descriptions, Potential Impacts and Mitigation.
March 2015	Department of the Environment	Decision on Assessment Approach: Bilateral Agreement	EPBC Referral determined to be a controlled action due to related nuclear actions (Section 21 and 22A) and presence of threatened species (Sections 18 and 18A). The decisions required the Project to be assessed under the bilateral agreement with the Northern Territory Government.
May 2015	NT EPA	Terms of Reference for the Preparation of an EIS	EIS development guidelines and requirements for assessment.
<i>tbc</i>	Arafura Resources	Draft Environmental Impact Statement	Detailed assessment of the Project to address NT EPA Terms of Reference.
28 day Public and Government Review of the EIS			
<i>tbc</i>	NT EPA	Request for Further Information	Request for additional details and provision of Public and Government Review comments.
<i>tbc</i>	Arafura Resources	Supplement to the Draft Environmental Impact Statement	Supplementary information to address NT EPA request for further information.
<i>tbc</i>	NT EPA	Assessment Report	NT EPA summary of the EIS and supplementary information and determination of recommendations to be implemented.
<i>tbc</i>	Arafura Resources	Mining Management Plan	Management documentation for the Project including revised Environmental Management Plan.
<i>tbc</i>	DME	Mine Authorisation	Approval documentation for mining to commence. The approval is dependent upon a satisfactory Mining Management Plan and provision of site security bond.

5.2 Legislation

The site will be constructed, operated and decommissioned in accordance with Territory and Commonwealth legislation. A summary of Commonwealth and Northern Territory legislation is provided in Section 5.2.1 and 5.2.2.

5.2.1 Commonwealth Legislation

A summary of Commonwealth Legislation and relevance to the Project is provided in Table 5-2.

Table 5-2 Commonwealth Legislation

Title	Details	Relevance
Environment Protection and Biodiversity Conservation Act 1999	Under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), any development requires assessment if it has the potential to affect one or more of eight Matters of National Environmental Significance (MNES). The MNES include: - World Heritage properties; - National Heritage places; - Wetlands of international	The Nolans Project was referred to the Department of the Environment (DotE) on 18 February 2015. On 16 March 2015, DotE determined the proposed action was a controlled action and required assessment under the <i>EPBC Act</i> before it could proceed. The controlling provision was listed threatened species and communities (Section 18 and 18A) and nuclear actions (Sections 21 and 22A).

	importance (listed under the Ramsar Convention); - Listed threatened species and ecological communities; - Migratory species protected under international agreements; - Commonwealth marine areas; - The Great Barrier Reef Marine Park; and - Nuclear actions (including uranium mines). The environment under the EPBC Act includes: - Ecosystems and their constituents; - Natural and physical resources; - Qualities and characteristics of locations, places and areas; - Heritage values of places; and - Social, economic and cultural aspects.	The DotE also determined that accredited assessment at the level of Environmental Impact Statement under the <i>Northern Territory Environmental Assessment Act</i> was applicable.
Native Title Act 1993	This Act recognises native title in lands over which Native Title is not extinguished and where persons able to establish Native Title are able to prove continuous use, occupation or other classes of behaviour and actions consistent with a traditional cultural possession of those lands. The objectives of the Native Title Act 1993 are to: - Provide for the recognition and protection of native title; - Establish ways in which future dealings affecting native title may proceed and to set standards for those dealings; - Establish a mechanism for determining claims to native title; and - Provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of native title.	There is one native title determination covering part of the Project area (DCD2013/001 – Napperby Perpetual Pastoral Lease) and two registered claimant applications (DC2014/002 – Aileron Pastoral Lease and DC2007/002 – Aileron).
Aboriginal and Torres Strait Islander Heritage Protection Act	This Act makes provision for the preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginal people in accordance with Aboriginal tradition.	No Aboriginal areas or objects at the Project are currently subject to a Declaration under this act.
National Environment Protection Council Act (NEPC Act)	The National Environment Protection Council (NEPC) comprises environment ministers from the Australian Government and each State and Territory and was established under the NEPC Act and corresponding legislation in the other jurisdictions (e.g. National Environment Protection Council (Northern Territory) Act). The purpose of NEPC is to ensure that: - Australians enjoy the benefit of equivalent protection from air, water or soil pollution and from noise wherever they live; and - Business decisions are not distorted and markets are not fragmented by variations in major environment protection initiatives between member governments.	Ambient Air Quality NEPM standards have been adopted for the Project. Arafura Resources will also comply with compulsory annual reporting if the Project's emissions exceed thresholds outlined in the Act and supporting Regulations.

	NEPC has powers to make National Environment Protection Measures (NEPMs) on: • Ambient air quality; • Ambient marine, estuarine and fresh water quality; • The protection of amenity in relation to noise (but only if differences in environmental requirements relating to noise would have an adverse effect on national markets for goods and services); • General guidelines for the assessment of site contamination; • Environmental impacts associated with hazardous wastes; • The re-use and recycling of used materials; and • Motor vehicle noise and emissions (in consultation with the National Transport Commission). The Air NEPM sets national standards for the six key air pollutants to which most Australians are exposed: carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, lead and particles.	
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5.2.2 Northern Territory

A summary of Northern Territory legislation and relevance to the Project is provided in Table 5-3.

Table 5-3 Northern Territory Legislation

Title	Summary	Relevance
Environmental Assessment Act 1982 and Environmental Assessment Administrative Procedures Act 1984	The Environmental Assessment Act 1982 and the Environmental Assessment Administrative Procedures Act 1984 ensure each matter affecting the environment is fully examined and taken into account in, and in relation to: • Formulation of proposals; • Carrying out of works and other projects; • Negotiation, operation and enforcement of agreements and arrangements (including agreements and arrangements with authorities of the Commonwealth, the States and other Territories); • Making of, or the participation in the making of, decisions and recommendations; and • Incurring of expenditure.	In March 2008, Arafura submitted a Notice of Intent to the former NT Department of Natural Resources Environment and the Arts (now NT EPA) for consideration under the Environmental Assessment Act 1982 (EA Act). NRETAS The Project was determined to require assessment to the level of an Environmental Impact Statement (EIS) and guidelines issued on 26 November 2008. The guidelines expired on their two year anniversary and were subsequently extended on two occasions (5 August 2010 and 12 November 2012). Arafura submitted an amendment to the initial 2008 NOI under Section 14A of the EA Act in December 2014. The NT EPA considered the alteration to require revised Terms of Reference (guidelines) for the preparation of an EIS in May 2015. The EMP documentation has been developed to address Section 6 of the Terms of Reference and capture several management plans required throughout.
Mining Management Act 2012	The objectives of the MM Act are to ensure that the development of mineral resources in the Northern Territory is in accordance with best practice health, safety and environmental standards and to protect the environment and health and safety of all persons on mining sites. Under the MM Act, an application for an authorisation to carry out mining activities	Following the acceptance of the Project through the NT EPA a MMP will be submitted to DME for approval. The MMP will include NT EPA recommendations from formal assessment and include this Environmental Management Plan. If an environmental incident occurs that is likely to causes minor environmental impact with some minor actual or potential harm to

	must be accompanied by a MMP. A MMP includes information relating to the description of mining activities, the management system to be implemented for the management of health, safety and environmental aspects, costing of closure activities and particulars of organisational structure. Plans of any existing or proposed mine workings and infrastructure must also be included. Under Section 29 of the <i>MM Act</i> the Operator must report an environmental incident or serious environmental incident as soon as reasonable practicable. Under Section 43 of the <i>MM Act</i> a financial security may be required by the Minister for the purpose of securing costs and expenses in relation to the Minister causing an action to be taken to prevent, minimise or rectify environmental harm. Mine operators are expected to calculate rehabilitation costs and present these as part of the MMP. Costs are verified and reassessed when revised MMPs are submitted.	the environment it will be reported to DME through a Section 29 Notification of Environmental Incident. A Section 29 Notification of Environmental Incident form is provided within the Hazardous Substances Management Plan (Appendix H) and Emergency Response Management Plan (Appendix FF).
Mineral Titles Act 2010	The objectives of the Mineral Titles (MT) Act is to establish a framework for granting and regulating mineral titles that authorise exploration for, and extraction and processing of, minerals and extractive minerals. The act also aims to facilitate the commercialisation of activities conducted under mineral titles by authorising the creation and transfer of interests in the titles, and to authorise other activities relating to minerals or extractive minerals to be conducted without mineral titles.	Arafura Resources have established several tenures through the <i>Mineral Titles Act</i> including the following leases which form the Nolans Project: • ML26659 (Mine Site); • ML30704 (Processing Site); • ML30703 Processing Site); • EL29905 (Borefield); and • ML30702 (Accommodation Village).
Northern Territory Environmental Protection Authority Act 2012	The Northern Territory Environment Protection Authority Act 2012 commenced on 1 January 2013. The Act establishes the new Northern Territory Environment Protection Authority (NT EPA) as an independent regulatory authority and makes consequential amendments to the Waste Management and Pollution Control Act and the Environmental Assessment Act. Amendments to the Waste Management and Pollution Control Act identify the NT EPA as the entity responsible for administration of the regulatory functions of that Act. Amendments to the Environmental Assessment Act identify the NT EPA as the entity responsible for administration of the assessment functions and impose additional transparency and reporting responsibilities of the Environment Minister and the responsible Minister for specific projects.	
Northern Territory Aboriginal Sacred Sites Act 1989	The Northern Territory Aboriginal Sacred Sites Act 1989 is administered by the Aboriginal Areas Protection Authority (AAPA). The Act provides for the location, recognition, description and protection of sacred sites under Aboriginal tradition. All sacred sites (even if not registered) are protected under the Act and it is an offence to enter or carry out work on a sacred site without permission or a certificate issued by the AAPA. The certificate sets out conditions under which the work may be carried out.	An AAPA Authority Certificate (D89/199; 89/1915) was issued to Arafura on 27 October 2008. The certificate covers the Mine Site, access tracks from the Stuart Highway and Accommodation Village. The Authority Certificate identified three Restricted Works Areas (RWA) centred on sacred sites at the Mine Site, Processing Site and access track. A second AAPA Authority Certificate (2012/1913) was provided on 18 October 2013 covering the southern portion of the Project area including the Process Site and Borefield. A total of 20 RWAs were

		identified. Data provided by the AAPA has informed no-go areas for the Project and management is detailed within the Cultural Heritage Management Plan provided in Appendix E.
Waste Management and Pollution Control Act 1998	The purpose of the Waste Management and Pollution Control Act 1998 is to protect the environment through objectives and approvals, encouraging effective and responsible waste management and reduction and response to pollution. This Act facilitates the implementation of national environment protection measures made under the National Environment Protection Council (Northern Territory) Act 1999, and incorporates environmental compliance plans and audits. Section 14 of the Act establishes a process for notifying the NT EPA (the administering agency for the Act) about incidents causing, or threatening to cause pollution. Schedule 2 of the Act requires environment protection / licensing for certain activities.	If an incident and/or spill occur which is likely to cause material environmental harm or serious environmental harm a Section 14 Incident Report Form shall be submitted to the NT EPA within 24 hours. The Incident Report Form is provided within the Hazardous Substances Management Plan (Appendix HH) and Emergency Response Management Plan (Appendix FF).
Waste Management and Pollution Control (Administration) Regulations 2012	These regulations deal with administrative issues such as fees for licensing and approvals and payment of "on the spot fines".	Construction activities will generate waste, noise and air pollution. Specifications of the Act will be applicable to the project (Section 5).
Other Legislation: • National Environment Protection Council (Northern Territory) Act 1994; • Heritage Act 2011; • Territory Parks and Wildlife Conservation Act 2006; • Soil Conservation and Land Utilisation Act 1980; • Weeds Management Act 2001; • Bushfires Act 2009; • Fire and Emergency Act 1996; • Dangerous Goods Act 1998; • Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2011; • Traffic Act 2012; • Control of Roads Act; • Crown Lands Act NT and Regulations; • Dangerous Goods Act and Regulations; • Electrical Workers and Contractors Act and Regulations; • Energy Pipelines Act and Regulations; • Fisheries Act and Regulations; • Litter Act; • Local Government Act; • Marine Pollution Act and Regulations; • Minerals (Acquisition) Act; • Mineral Royalty Act; • Mineral Titles Act and Regulations; • Weeds Management Act 2001; • Radiation Protection Act • Water Act; and • Work Health and Safety (National Uniform Legislation) Act 2011.		

6. Environmental Management System

6.1 Environmental Management Structure

The Environmental Management Framework outlines the mechanisms used to deliver commitments made within the EIS. The Environmental Management Plan (EMP) has been designed to cover the construction and operation phase. It will form part of the Mining Management Plan (MMP) for the site. The EMP includes several Sub-management Plans to assist in providing transparent, effective and accountable means of managing Project risks. An overview of the EMP and Sub-management Plans is provided in Figure 6-1.

6.1.1 EMP Initiation and Approval

The EMP forms part of the EIS submission documentation and will be updated be modified prior to implementation at the Project. The updates will include:

- Formal review of the EIS by the Northern Territory Environmental Protection Authority (NT EPA);
- Provision of an NT EPA Assessment Report of the EIS and Supplementary providing Recommendations; and
- Mine Site authorisation processes with the Department of Mines and Energy (DME).

A summary of the EMP initiation process prior to being implemented is provided in Table 6-1.

Table 6-1 Summary of EMP Initiation

Submission	Assessment Body	Approvals	Approvals
Draft Environmental Impact Statement	NT EPA	NT EPA Government Agencies Members of the public	n/a
Supplementary to the EIS <i>Additional information submitted as required.</i>	NT EPA	NT EPA Government Agencies	NT EPA issue Assessment Report
Mining Management Plan	DME	DME Government Agencies	DME issue Mine Authorisation

6.1.2 EMP Review

The EMP and Sub-EMPs will be continually revised throughout the Project life to keep documentation relevant and up to date. The reviews will take into account EIS, Supplementary and mine authorisation commitments/requirements in addition to other legislation and/or legal requirements.

They are considered to be 'living' documents controlled electronically by Arafura Resources. The HSEC Manger is responsible for ensuring the EMP and Sub-EMPs are current and that is reflects current legislation and/or requirements of the NT EPA and DME.

Scheduled EMP reviews will be undertaken annually as part of the internal annual reporting requirements, internal auditing plan and mine authorisation (Mining Management Plan) documentation. A summary of EMP Sub-management Plans is provided in Table 6-2.

Table 6-2 Summary of EMP Documentation

Management Plan	Complete EMP	Review Summary		
		Frequency	Responsibility	Approval
Acid and Metalliferous Drainage Management Plan	EIS Appendix L	Annual	HSEC Manager	General Manager

Management Plan	Complete EMP	Review Summary		
		Frequency	Responsibility	Approval
Air Quality and Dust Management Plan	Appendix C			
Biodiversity Management Plan	Appendix D			
Cultural Heritage Management Plan	Appendix E			
Emergency Response Management Plan	Appendix F			
Fire Management Plan	Appendix G			
Hazardous Substances Management Plan	Appendix H			
Mine Closure Plan	EIS Appendix W			
Waste Management Plan	Appendix I			
Radiation Management Plan	Appendix J			
Social Impact Management Plan	Appendix K			
Water Management Plan	Appendix L			
Weed Management Plan	Appendix M			

Note: Reviews will be undertaken annually, upon regulatory feedback, following non-compliance with an internal or external audit or after a change to the project description or activities.

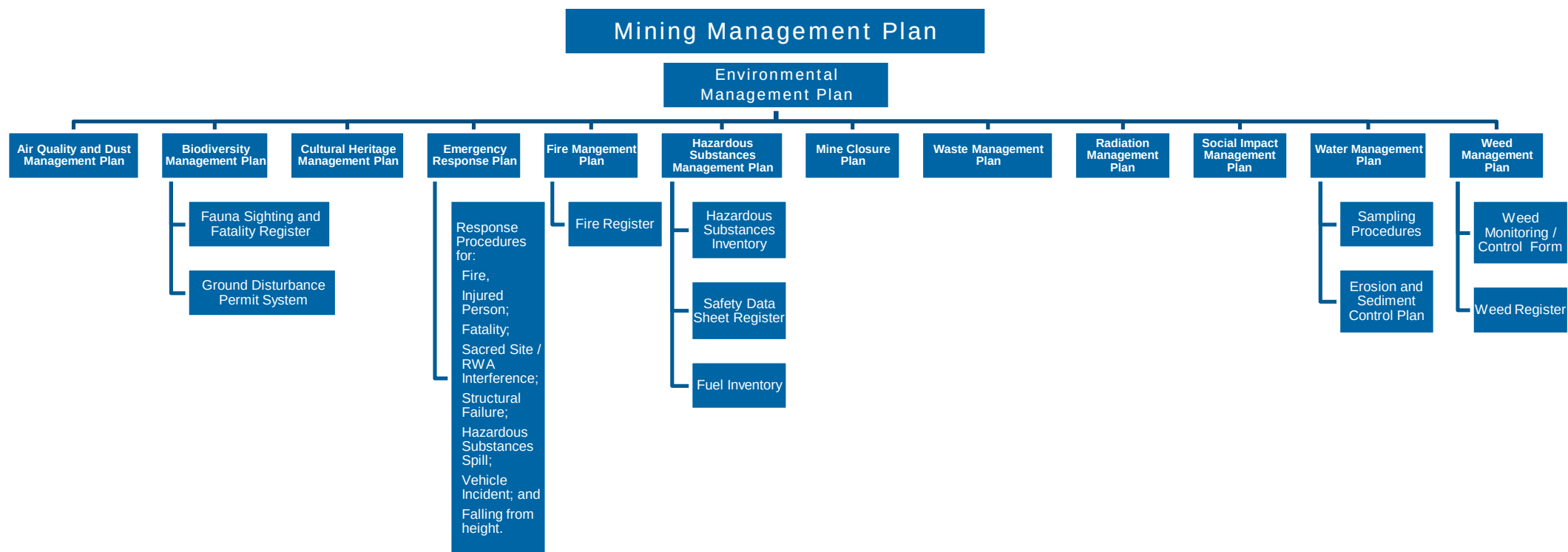


Figure 6-1 Environmental Management Structure

6.2 Roles and Responsibilities

Arafura Resources will ensure sufficient resources to implement, maintain and improve the EMP throughout the Project. The key roles and responsibilities for environmental and emergency management are provided in Table 6-3.

Table 6-3 Roles and Responsibilities

Role	Responsibilities
General Manager	• Ensure the EMP is implemented and is effective. • Assist the HSEC Manager with regulator and/or community consultation (i.e. complaints). • Manage disaster response and business continuity planning along with providing necessary resources for Emergency Response at the Project.
Area Managers	• Ensure site conformance with the EMP and Sub-management Plans.
Emergency Response Team Coordinator	• Implement Emergency Response Management Plan, assign Emergency Team responsibilities and provide appropriate training.
HSEC Manager	• Establish, implement and maintain the EMP. • Confirm the Project environmental objectives and targets are being met. • Update the EMP with applicable approval conditions following the NT EPA EIS request and provision of an Environmental Assessment Report. • Review and evaluate construction and operation contractor's EMP to ensure consistent with Arafura EMP. • Liaise with the NT EPA and DME regarding any substantial amendments to the EMP and Sub-management Plans utilised as part of the EIS and mine authorisation approvals. • Approve minor amendments to the EMP and Sub-management Plans (minor amendments' being amendments that clarify or improve practices / procedures or add more stringent requirements / controls). No increase in or introduction of new environmental risks or impacts to be approved. • Liaise with regulators and other agencies as required in unison with the General Manager. • Undertake HSEC Manager role in emergency response procedures. • Ensure that the requirements of the EMP and Sub-management Plans have been addressed in all contractor environmental management documentation. • Undertake regular audits (or appoint an appropriately qualified representative) of environmental performance.
Site Personnel	• Comply with site induction and/or additional procedures relevant to works through Sub-management Plans.
Sub-contractors	• Comply with the EMP and legislative requirements. • Obtain any additional permits from statutory authorities other than the applicable approvals. • Implement a project environmental management system in accordance with this EMP and Sub-management Plans. • Collect data and documentation to facilitate auditing by the HSEC Manager and/or appointed representative.

6.3 Environmental Training and Induction

6.3.1 Site Induction

The site induction will address key components as outlined within following EMP Sub-management Plans including:

- Air Quality and Dust Management Plan;
- Biodiversity Management Plan;
- Cultural Heritage Management Plan;
- Emergency Response Management Plan;
- Fire Management Plan;

- Hazardous Substances Management Plan;
- Waste Management Plan;
- Radiation Management Plan;
- Social Impact Management Plan;
- Water Management Plan; and
- Weed Management Plan.

6.4 Reporting – Internal

Project reporting will be undertaken to relevant internal and external stakeholders (including regulators) as required. Internal reporting has been designed to capture the overall effectiveness of the EMP. The data from internal reporting will be utilised to fulfil external reporting requirements to the Department of Mines and Energy and Central Land Council. The EMP internal reporting will be undertaken by the HSEC Manager.

6.4.1 Inspections

The Area Managers and/or appointed representative will undertake regular site inspections to assess Project risk including:

- Walkover of high risk locations including fuel farms, chemical storage shed, sewage treatment plant and stormwater ponds to identify any new risks / unmanaged risks;
- Issuing Ground Disturbance Permits.
- Walkover of construction activities to ensure the Ground Disturbance Permit procedure is being adhered; and
- Provision of HSEC advice to personnel and/or contractors as required.

- **Responsibility:** Area Managers and/or Appointed Representatives
- **Documentation:** Inspection Checklists (to be developed).
- **Issued to:** HSEC Team

6.4.2 Monthly Report

A Monthly Report will be developed by all Area Managers throughout the construction and operation phase in line with Arafura Resources' business reporting processes.

- **Responsibility:** Area Managers
- **Approval:** General Manager
- **Documentation:** Monthly Report
- **Issued to:** Arafura Resources Management Team

6.4.3 Annual Performance Review

The EMP and sub-plans will be updated and modified annually. The modifications will be based on performance data from the previous 12 months and will summarise significant historical results.

- **Responsibility:** HSEC Manager
- **Approval:** General Manager
- **Documentation:** EMP Annual Performance Review

- **Issued to:** Arafura Resources Management Team

6.5 Reporting – External

6.5.1 Mine Authorisation (Mining Management Plan)

The EMP will form appendices of the Mining Management Plan (MMP). The MMP is required to be reviewed and amended in accordance with the mine authorisation. The EMP will be revised annually and included within the MMP. The DME will be responsible for reviewing the MMP, including the implementation of mitigation measures and the monitoring program as part of the mine authorisation.

- **Responsibility:** HSEC Manager
- **Approval:** General Manager
- **Documentation:** Mining Management Plan
- **Issued to:** All Site Managers

6.5.2 Statutory Incident Reporting

External incident reporting will be provided in accordance with legislative requirements across the Project. A summary of incident reporting requirements is provided in Table 6-4.

The General Manager is responsible for all external incident reporting communications. Statutory incident reporting will be summarised within future EMP.

Additional statutory reporting requirements will potentially be identified through the EIS and mine authorisation processes.

Table 6-4 Regulatory Body Reporting Requirements

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
Northern Territory Environmental Protection Authority (NT EPA)	Incident which causes, or is threatening or may threaten to cause pollution resulting in material environmental harm or serious harm. Qualifying triggers requiring submittal of Section 14 Incident Report to NT EPA are any of the following: • is not trivial or negligible in nature; or • consists of an environmental nuisance of a high impact or on a wide scale; or • results, or is likely to result in \$50,000 or more in taking action to prevent or minimise environmental harm or rehabilitate the environment; or results in actual or potential loss or damage to value of \$50,000 or more of the prescribed amount (whichever is the greater).	< 24 hrs post incident ntepa@nt.gov.au pollution@nt.gov.au	The Section 14 Incident Report Form requires the following details: • Incident causing or threatening to cause pollution; • Location occurred and area impacted; • Date and time; • How the pollution has occurred, is occurring or may occur; • Attempts made to prevent, reduce, control, rectify, investigation and/or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident; and • Operator details. The form is to be signed by the HSEC Manager and/or General Manager for submission. The Section 14 Incident Report Form is provided within the Hazardous Substances Management Plan in Appendix H.

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
Department of Mines and Energy (DME)	Incident which causes minor environmental impact with some minor actual or potential harm to the environment.	As soon as practicable. Mineral.Info@nt.gov.au	The Section 29 Notification of Environmental Incident Form requires the following details: • Site and operator details. • Location occurred and area impacted (GPS coordinates); • Date and time; • Description of incident • Emergency and remedial actions taken. • Nature of impact and severity; • Current situation; • Details of sampling undertaken; and • Notification status internally and externally. The form is to be signed by the HSEC Manager and/or General Manager for submission. The Section 29 Notification of Environmental Incident Form is provided within the Hazardous Substances Management Plan in Appendix H.
NT WorkSafe	Incident which results in either: • Death of a person; • Serious injury or illness; or • Dangerous incident.	Immediate verbal communication. Tel: 1800 019 115 Written notification < 48 hrs post incident. ntworksafe@nt.gov.au	The NT WorkSafe Incident Notification Form requires the following details: • Person submitting details; • Incident details including date, time and human injury details; • Work activity being undertake at the time of incident; • Witness(es) details; • Details of injured / deceased persons; • Summary of injury or illness; and • Future remedial actions. The form is to be signed by the HSEC Manager and/or General Manager for submission. The NT WorkSafe Incident Notification Form is provided within the Hazardous Substances Management Plan in Appendix H.
Heritage Branch	Exposure and/or interference with unidentified natural, cultural or indigenous heritage.	As soon as practicable. Tel: 08 8951 9247 heritage@nt.gov.au	No standard notification form is available. However, the following should be provided within the initial notification: • Type of natural, cultural or indigenous heritage; • Location of the site (grid reference); • Type and method of interference (exposed and/or damaged); • Name and organisation of discoverer; and • Photograph of site.
Central Land Council	Entrance and/or damage of sacred site or restricted works area.	As soon as practicable. Tel: 08 8951 6338 istoll@clc.org.au	No standard notification form is available. However, the following should be provided within the initial notification: • Location of the site (grid reference); • AAPA certificate pertaining to the site; • Summary of damage; • Name and organisation of discoverer; • Type and method of interference (exposed and/or damaged); and • Photograph of damage.

Entity	Trigger	Timeframe and Contact Details	Incident Reporting Details
Aboriginal Areas Protection Authority	Entrance and/or damage of sacred site or restricted works area.	As soon as practicable. Tel: 08 8999 5511 enquiries.aapa@nt.gov.au	No standard notification form is available. However, the following should be provided within the initial notification: • Location of the site (grid reference); • AAPA certificate pertaining to the site; • Summary of damage; • Name and organisation of discoverer; • Type and method of interference (exposed and/or damaged); and • Photograph of damage.

6.6 Auditing Plan

6.6.1 Internal Auditing Plan

Internal auditing will be undertaken by the HSEC Manager and/or suitably qualified representative. The audit will assess the implementation of each sub-environmental management plan and/or EMP requirements.

Prior to the audit, a checklist will be developed that includes:

- Mitigation / commitment being assessed;
- Conformance with each mitigation measure / commitment; and
- Corrective actions required and responsibility.

The HSEC Manager shall ensure that investigations are initiated into non-conformances to determine whether mitigation measures are possible and appropriate. Incidents, non-conformance and spills be logged within registers provided in Appendix A.

Frequency during construction will be as required and annually during operations.

6.6.2 External Auditing Plan

The implementation of the EMP will be audited by a suitable qualified, experienced and independent team within two years of the Project commencing. The external environmental audit will:

- Assess the environmental performance of the Project including compliance with:
 - EIS Assessment Report recommendations;
 - Mine Authorisation approval conditions;
 - EMP sub-plan commitments;
 - EMP reporting requirements including Inspections, Monthly Reports, Annual Performance Review, Mining Management Plan and Statutory Incident Reporting (if occurred); and
 - Approved EMP sub program commitments.
- Review environmental performance and recommend appropriate measures or actions to improve the HSEC performance of the action.

The non-conformance will be recorded and corrective actions captured within the Arafura resources incident and corrective action reporting system.

6.7 Incident Reporting

Incidents which occur at the Project will be logged and reviewed as part of the ongoing continual improvement of the EMP. Reviews of incidents will be undertaken as part of the monthly reporting, annual performance review and Mining Management Plan revisions.

The incident and non-conformance register is provided in Appendix A.

6.8 Complaints

The Project has the potential to impact upon the local community both negatively and positively. The mitigation measures developed through the Sub- management Plans are designed to mitigate and reduce environmental impacts. Should complaints be received from the general public in relation to the Project they will be logged within the complaints register including:

- Date;
- Name and location of complainant;
- Contact details;
- Complaint;
- Aspect;
- Flow-up Actions / Mitigation Measures; and
- Close-out Approval.

All complaints will be investigated to determine the source of the complaint, identify any underlying cause, establish additional investigation measure (if required), summarise corrective actions and undertake follow-up to ensure corrective actions are undertaken. The outcomes of investigations will be shared with the complainant and summarised in monthly reporting and the Annual Performance Review.

The complaints form and register is provided in Appendix B.

6.9 Emergency Response Management

The management of emergency responses will be undertaken in accordance with the Emergency Response Management Plan (ERP) provided in Appendix F. The ERP outlines standardised responses to the most likely emergency situations pertaining to the Project including:

- Fire – Building, Machinery or Explosion;
- Human Health – Injured Person;
- Human Health – Fatality;
- Sacred Site / RWA Interference;
- Structural Failure;
- Hazardous Substances Spill;
- Vehicle Incident; and
- Falling from height.

In addition, the ERP provides a process for the management of remote working and HSEC investigation framework following an incident.

Appendices

Appendix A – Incident and Non-conformance Registers

Table A1 Incident and Non-conformance Register

Incident / Non-conformance			Management Response			
No.	EMP / Sub-plan	Details	Corrective Action	Responsibility	Completion Date	Close-out Summary

Appendix B – Complaint Form and Register

Complaint Form

Details of Complaint				
Arafura Staff Details				
Name		Date		Time
Complainant Details				
Name				
Address				
Phone Number				
Email Address				
Complaint Type	☐ Letter ☐ Email ☐ Phone ☐ Site Visit ☐ Internal Audit ☐ External Audit			
Project Area	☐ Mine Site ☐ Accommodation ☐ Processing Site ☐ Power Station ☐ Borefield			
Complaint Summary				

Action Taken				
Responsible Person				
Follow-up of Actions Required				
Complainant Advised	☐ Yes	☐ No	☐ Not Required	Date
Closeout Summary				
Complainant Advised	☐ Yes	☐ No	☐ Not Required	Date
Procedure Modification	☐ Yes	☐ No		
Complaint Logged	☐ Yes	☐ No		

Table B1 Complaint Register

Complaint					Management Response				
No.	Date	Type	Project Area	Summary	Responsible Person	Follow-up of Actions	Complainant Advised	Close-out Summary	Complainant Advised

Complaint					Management Response				
No.	Date	Type	Project Area	Summary	Responsible Person	Follow-up of Actions	Complainant Advised	Close-out Summary	Complainant Advised

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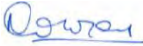
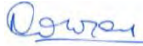
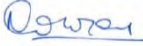
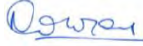
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