Robe Mesa Project

Native Vegetation Clearing Permit (NVCP) Application

Supporting Document (Rev 2)

December 2024

Rev.	Date	Description	Prepared	Reviewed	Approved
					Study Manager
A	10 April 2023	Issued for Internal review	M. Carey	F Goddard	F Goddard
0	12 April 2023	Final (subsequently withdrawn)	M. Carey	F. Goddard	F. Goddard
1	21 June 2023	Final	M. Carey	F. Goddard	F. Goddard
2	2 December 2024	Updated final, based on RFI	M. Carey	F. Goddard	F. Goddard

Table of Contents

List of Tables

List of Figures

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- Closure and Rehabilitation
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- Environmental Management Plan
    - Biota Environmental Sciences
    - Bamford Consulting Ecologists
- Groundwater Assessment
    - AQ2 Pty Ltd
- Indigenous Heritage and Culture
    - Robe River Kuruma People
    - Robe River Kuruma Aboriginal Corporation
- Invertebrate Fauna (Subterranean and SREs)
    - Biota Environmental Sciences
- Noise Assessment
    - Lloyd George Acoustics Pty Ltd
- Surface Water Assessment
    - AQ2 Pty Ltd
- Terrestrial Fauna
    - Bamford Consulting Ecologists
- Vegetation and Flora
    - RPS Group
    - Biota Environmental Sciences
- Waste Characterisation
    - Graham Campbell & Associates Pty Ltd

Glossary and Abbreviations

Abbreviation/ Acronym	Description
2D / 3D	Two-dimensional / three-dimensional
ACH Act	*Aboriginal Cultural Heritage Act 2021*
AEP	Annual Exceedance Probability
AH Act	*Aboriginal Heritage Act 1972*
AHD	Australian Height Datum
ANFO	ammonium nitrate, fuel oil
BC Act	*Biodiversity Conservation Act 2016*
bcm	bank cubic metre
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
DGS Act	*Dangerous Goods Safety Act 2004*
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
ha	hectare
kL	kilolitre
km	kilometre
m	metre
M	million
m^3	cubic metre
mbgl	metres below ground level
Mining Act	*Mining Act 1978*
mRL	metres above RL (reduced level)
Mt	million tonnes
Mt/a	millions of tonnes per annum
Mt/y	millions of tonnes per year
MW	megawatt
N/A	Not Applicable
No./Nos.	number/numbers
PMP	Probable Maximum Precipitation
RIWI Act	*Rights in Water and Irrigation Act 1914*
ROM	run-of-mine
t/a	tonnes per annum
WRD	Waste Rock Dump
yr	year

1. INTRODUCTION

1.1 PURPOSE AND SCOPE

CZR Resources (CZR) proposes to develop the Robe Mesa Project (the Project), an iron ore mining operation based on the Robe Mesa deposit located in the West Pilbara, approximately 30 km southwest of Pannawonica (**Figure 1.1**).

The Robe Mesa Iron Ore project is part of a larger Yarraloola Iron Ore Project, whose ownership is a joint venture between Zanthus Resources Ltd (Zanthus), a wholly owned subsidiary of CZR Resources Ltd (CZR), which holds 85%, and ZanF Pty Ltd (ZanF) which holds 15%. Zanthus is the Operator of the Robe Mesa Project.

CZR recognises the Robe River Kuruma (RRK) People as the traditional owners of the land that Robe Mesa is located on, and the importance to the RRK People of leaving country as close as possible to the way that it was found. Working collaboratively, CZR and RRK signed the Robe Mesa Native Title Agreement on 21 December 2022 which includes a 'live' Cultural Heritage Management Plan to ensure the parties continue to work together to develop appropriate protection and management measures for the places it contains.

CZR acknowledges that within the vicinity of the Production Tenements there are many significant cultural places of great importance to RRK People. CZR and RRK have agreed the Productive Mining area boundaries and identified No-Go-Areas which must not be entered or impacted by CZR. The area of the Robe Mesa that has been identified for Productive Mining provides for a set back from the mesa edge or buffer that must not be entered or impacted. Additionally, northern aspects of the Robe Mesa and other selected areas off the mesa, also contain No-Go-Areas.

The Project involves the development of a mine, associated mine infrastructure and an access road to the North West Coastal Highway. The project would include a total disturbance of 270 ha. This document is to support a native vegetation clearing permit to facilitate development of the Project.

1.2 ENVIRONMENTAL APPROVAL STATUS

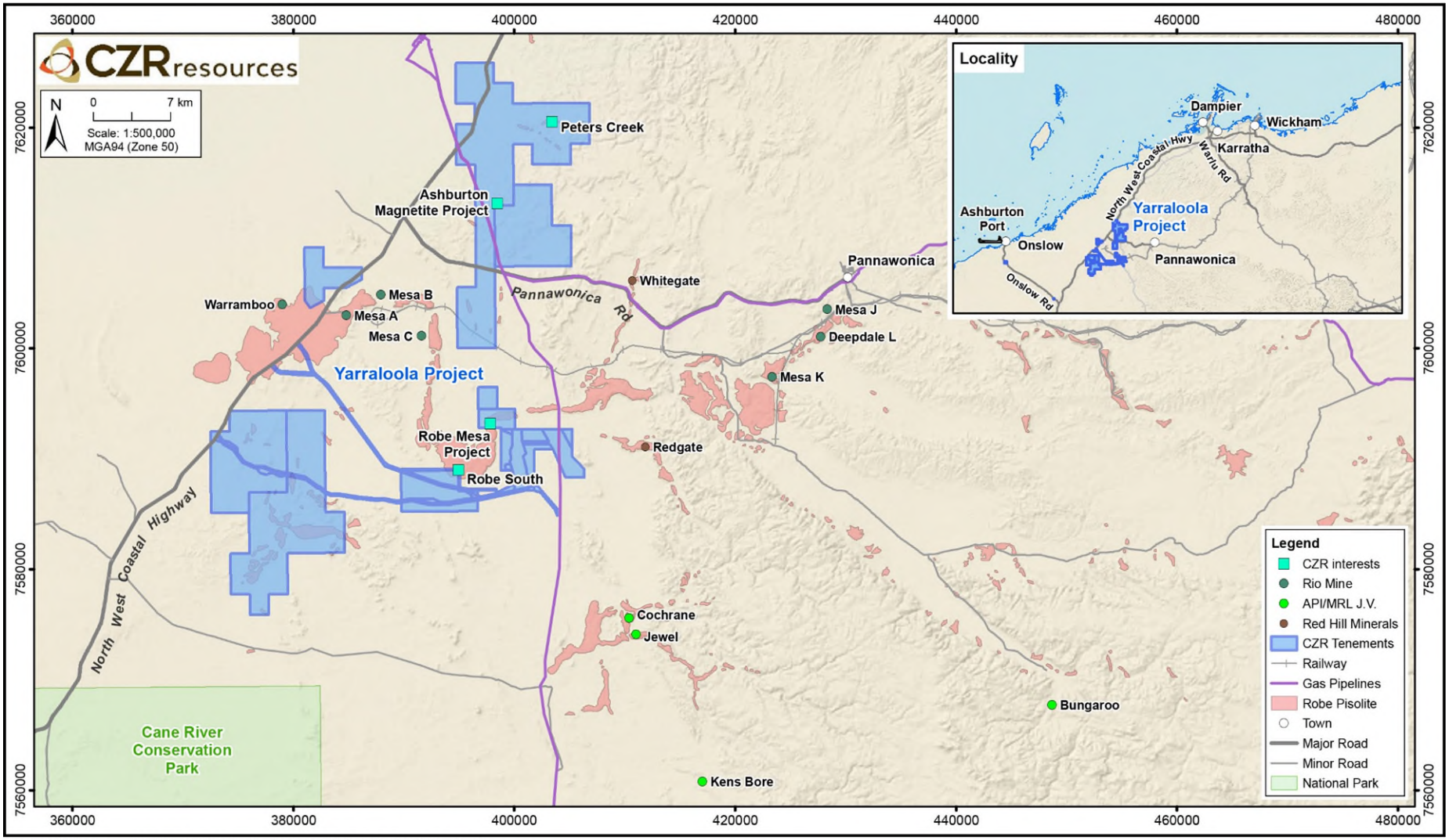
The principle legislation in Western Australia governing the environmental assessment of the Project is the Environmental Protection Act 1986 (EP Act). CZR has submitted the Project to be assessed via the Native Vegetation Clearing Permit (NVCP) process, under Section 51(E) of the EP Act.

Secondary environmental approvals include all other statute requirements that address environmental risk and provide for the regulation of key environmental aspects, including:

- Mining Proposal under the Mining Act 1978 (Mining Act), administered by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS).
- Environmental Licences under Part V of the EP Act to operate the prescribed premises required for the Project, administered by the Department of Water and Environmental Regulation (DWER).
- Groundwater Licences under the Rights in Water and Irrigation Act 1913 (RIWI Act), administered by DWER.

Relevant approvals and regulations required in support of the Project are summarised in **Table 1.1**. A summary of further legislative approvals and regulations that may be required is summarised below this table.

Figure 1.1: Regional Location of the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_01, Rev: A

Table 1.1: Other relevant environmental approvals

Relevant legislation	Environmental factor regulated/affected	Relevant approval/requirement and status of relevant approval
Environmental Protection and Biodiversity Conservation Act 1999	• Biodiversity: Matters of NES	Referral under EPBC Act – if project is considered likely to have a significant impact on MNES
Environmental Protection Act 1986 • (Part V) Native Vegetation Clearing Permit	• Flora and Vegetation • Terrestrial Fauna • Inland Waters	CZR are proposing that the project be assessed via the Native Vegetation Clearing Permit (NVCP) process, under Section 51(E) of the EP Act
Mining Act 1978 • Mining Proposal • Mine Closure Plan	• Biodiversity • Water Resources • Land and Soils • Rehabilitation • Social Surroundings	A Mining Proposal will be submitted to DEMIRS prior to any disturbance and will include auditable outcomes for key DEMIRS factors. These outcomes will be defined and approved by DEMIRS to ensure that the impacts on the key DEMIRS factors are mitigated to an acceptable level. A Mine Closure Plan will be submitted with the Mining Proposal and will be revised every 3 years or with subsequent Mining Proposal applications. It will include auditable closure and rehabilitation outcomes and criteria which will be defined and approved by DEMIRS to ensure that impacts on key DEMIRS factors are mitigated to an acceptable level. Environmental monitoring programmes during operations and for some time post closure will be conducted in accordance with the approved schedules to confirm the achievement of the set environmental outcomes. Annual Environmental Report on compliance with tenement conditions, commitments made in the MP and MCP submitted to DEMIRS for assessment.
Environmental Protection Act 1986 (Part V) • Works approval • Environmental Licence	• Emissions and discharges to air, land, and water from a Prescribed Premises • Environmental Pollution	Prescribed premises categories required for the Project include: • Category 5 - Processing or beneficiation of metallic or non-metallic ore • Category 64 - Class II or III putrescible landfill site • Category 85 - Sewage Treatment and Discharge
Rights in Water and Irrigation Act 1914 • Licence to construct a bore (26D) • Licence to take water (5C) • Bed and banks Licence	• Abstraction of groundwater the Hamersley Fractured Rock aquifer and/or Combined Fractured Rock West aquifer. • Groundwater quality and quantity • Groundwater Dependent Ecosystems	5C licence will be sought (pending detailed hydrogeological assessment currently underway) to take groundwater within the Hamersley Fractured Rock and/or Combined Fractured Rock West Aquifers. Groundwater Dependent Ecosystems are included by DWER in assessment of 5C Application. 26D Licence approved (CAW207170; CAW207770; CAW207771; CAW207772) to construct groundwater bores for exploration and monitoring.

Relevant legislation	Environmental factor regulated/affected	Relevant approval/requirement and status of relevant approval
Aboriginal Heritage Act 1972; or *Aboriginal Cultural Heritage Act 2021* • Section 18 Permit	• Aboriginal heritage • Disturbance to matters of Aboriginal heritage significance	CZR and Robe River Kuruma People have signed a Native Title Agreement that defines requirements for heritage surveys on CZR tenements. A Cultural Heritage Management Plan has also been developed with the Robe River Kuruma People.
Dangerous Goods Safety Act 2004 • Dangerous Good Licence	• Contamination of soils, groundwater, and surface water (hydrocarbon spills) • Fire risk (combustion of stored flammable goods)	The storage and management of hydrocarbons will be regulated under Part V of the EP Act and the Mining Proposal / MCP however the DG Licence provides additional mitigation for the design and storage of larger volumes of dangerous goods (if large volumes of hydrocarbons (>100,000 L) are required to be stored on site).
Health Act 1911 (Treatment of Sewage and disposal of Effluent and Liquid Waste) Regulations 1974 • Permit to construct apparatus for the treatment and disposal of sewage	• Treat and dispose sewage and wastewater	If discharge of wastewater does not trigger a prescribed activity under Part V of the EP Act, the Health Act Permit is the primary approval to regulate health and environmental matters associated with the treatment and potential discharge of waste water effluent on site.

1.3 PROPONENT

The Proponent for this Project is CZR Resources Limited (ACN 112 866 869, ABN 91 112 866 869).

The Robe Mesa Project is held 85% by Zanthus (a 100%-owned subsidiary of CZR Resources Ltd) and 15% by ZanF Pty Ltd (Private Company ACN 154 589 152 ABN 11 154 589 152), with CZR as the 100% owner of Zanthus, acting as the Operator of the tenements.

1.3.1 Environmental Record

CZR is committed to the protection of the environment. The business objective is to plan and implement the Robe Mesa Project in a way that minimise the impact on the environment.

To meet environmental objectives, CZR is committed to the following actions and practices:

- Maintaining an environmental management standard.
- All staff and contractors will be made aware of the environmental policy and procedures with an appropriate level of training provided.
- Act within the business towards reducing greenhouse gas emissions and environmental impact wherever possible.
- Reduce and where possible, prevent pollution.
- Facilitate recycling of materials and resources wherever possible.
- Pursue a progressive rehabilitation program by returning disturbed areas where possible to pre-existing conditions.
- Working to identify, assess and control environmental risks.

- Encourage open dialogue with employees, regulators and the public on environmental issues and be responsive to their concerns.
- Monitoring and review for continual improvement of the Company's environmental performance.

CZR Executive and Management have held Statutory Positions at operating mine sites throughout Western Australia and Australia. No CZR Director or Manager has previously been convicted, or paid a penalty, for an offence under a provision of the EPBC Act or the (WA) EP Act, or similar environmental protection or health-related legislation in Western Australia or elsewhere in Australia. Furthermore, CZR Executive and Management have not had a licence or other authority suspended or revoked due to a breach of conditions or an offence under the EPBC Act or the (WA) EP Act or similar environmental protection or health-related legislation in Western Australia or elsewhere in Australia.

1.4 ENVIRONMENTAL INVESTIGATIONS

CZR has undertaken substantial investigations across a wide range of environmental factors and has completed a detailed assessment of the risks that the project poses to the environment. Investigations that support the detailed environmental assessment undertaken in this document are summarised in **Table 1.2**.

Table 1.2: Summary of studies completed across the Robe Mesa Project

Environmental Factors	Studies undertaken and Reference	Survey Effort
Flora and Vegetation	Detailed Flora and Vegetation Assessment – Robe Mesa and Robe East extension RPS Group (2021)	• Two-phase detailed survey and targeted Threatened and Priority Flora survey (in accordance with EPA guidance) • Survey timing: June and September 2021 • Survey area: 1,165 ha
	Detailed Flora and Vegetation Survey – Robe Mesa Project Biota Environmental Sciences (2023)	• Single phase detailed survey (in accordance with EPA guidance), including consolidation of all site vegetation mapping from multiple surveys. • Survey timing: June-July 2022 • Survey area: 3,050 ha
	Follow-up Vegetation mapping of southern road realignment and infill areas Biota Environmental Sciences (2023)	• Single phase desktop survey • Survey timing: January-February 2023 • Vegetation mapping reconciliation and consolidation of all previous surveys associated with the Robe Mesa Project (RPS and Biota) • Survey area: 2,662 ha
	Follow-up *Triodia pisoliticola* PEC review CZR (2024)	• Review of the *Triodia pisoliticola* PEC, its distribution in the Pilbara, its identifying features its association with the Robe Mesa Project. • Report prepared by Dr Michelle Carey, who has been involved in the *Triodia pisoliticola* PEC regional surveys and identification across the West Pilbara since 2010.
Terrestrial Fauna	Fauna Assessment – Robe Mesa Iron Ore Project Bamford Consulting Ecologists (2024a) Updated in 2024	• Survey type: detailed survey and targeted survey of conservation significant species (in accordance with EPA guidance) • Survey techniques: Pitfall traps, funnel traps, bird censusing, motion sensitive cameras, bat detectors, hand searching, spotlighting, opportunistic invertebrates and SRE searches.

Environmental Factors	Studies undertaken and Reference	Survey Effort
		• Survey timing: Four (4) survey events - May and October/November 2021 - July and September 2022
	Robe Mesa Project, Fauna species Matters of National Environmental Significance Threats and Mitigation. Response to DEMRIS RFI. Memo report 14 Oct 2024. Bamford Consulting Ecologists (2024b).	• Threat assessment for the four species that the area supports, or is likely to support: Pilbara Olive Python, Ghost Bat, Pilbara Leaf-nosed Bat, Northen Quoll. • Mitigation measures described for each of the key threats to each of the four listed species is also provided.
	Robe Mesa Project. Response to comments provided by DEMIRS Feb and Aug 2024 Bamford Consulting Ecologists (2024c).	• DEMIRS and DWER (EPA Services) requested further information on Northern Quolls, conservation significant bats, Olive Python and Night Parrot. • Further information is provided based on the request.
Subterranean Fauna	Troglofauna Baseline Assessment – Robe Mesa Biota Environmental Sciences (2023c)	• Survey type: Three (3) phase Subterranean fauna assessment (in accordance with EPA guidance) • Survey effort: 372 traps installed across approx. 60 drillholes. • Survey timing: Three survey events - June-August 2021; - August-October 2021; - December 2021-Feburary 2023
	Troglofauna habitat modelling – Robe Mesa CZR (2023)	• Desktop assessment: Three-dimensional model of troglofaunal habitat • Timing: completed in March 2023 • Approach: The volume of habitat in the sections of palaeodrainage systems around the Robe Mesa orebody are being quantified based on geological modelling and estimations of the extent of channel iron formation (for areas outside the boundaries of the geological models).
	Robe Mesa Project Troglofauna habitat. Summary Memo Report Biota Environmental Sciences (2024a)	• Based on a DEMIRS request for further information on troglofaunal habitat and fragmentation concerns.
	Addendum to Biota (2023c) Biota Environmental Sciences (2024b)	• Troglofauna phase 3 sampling results and analysis.
	Stygofauna preliminary study Biota Environmental Sciences (2022)	• 3 available water bores in the vicinity of the project area were sampled for stygofauna (1 production bore and 2 monitoring bores)
Short Range Endemics	Short-range Endemic Invertebrate (SRE) Fauna Survey – Robe Mesa Project	• Survey type: Targeted SRE survey (in accordance with EPA guidance) • Survey timing: June 2022

Environmental Factors	Studies undertaken and Reference	Survey Effort
	Biota Environmental Sciences (2022)	• Survey area: 3,050 ha • 80 person hours targeted searching, over 34 sites • Molecular sequencing (DNA barcoding) to ID to species level
Hydrogeology and Hydrology	Hydrogeology and Surface Water Scoping Study – Robe Mesa AQ2 (2021)	• Preliminary desktop assessment of hydrology and hydrogeology values of the area
Surface Water	Surface Water Modelling AQ2 (2021)	• Preliminary desktop assessment of hydrology and hydrogeology values of the area
	Robe Mesa Haul Rd Surface Water Assessment AQ2 (2022)	<u>Scope:</u> • Desktop assessment of the surface water catchments feeding the haul road creek crossings • Estimates surface water flows at crossing points for a variety of rainfall return periods.
	Robe Mesa MOC and Mungarathoona Creek Surface Water Modelling AQ2 (2024a)	• 2D surface water modelling on Mungarathoona Creek covering the most recent alignment of the haul/access roads and the Robe Mesa Mine Operations Centre (MOC) areas.
Groundwater	Hydrological Investigations. H2 Level of Assessment AQ2 (2024b)	<u>Approach:</u> • Hydrogeological investigations on the pre-existing water supply bore, potential water supply bore for the Robe Mesa Project, including ground truthing 4-6 July 2022. Updated in November 2024.
	Water Balance CZR (2022)	• Water Consumption Calculations (operations, construction spreadsheet) • Water Supply – Demand Overview document prepared for traditional owners
	Robe Mesa Project Groundwater Operating Strategy AQ2 (2024c)	• Strategy prepared at the basic level of assessment in accordance with DWER Operational Policy 5.08 use of operating strategies in the water licensing process (DWER, 2020). • Groundwater Licence Operating Strategy has been prepared to meet DWER requirements to support CZR's 5C groundwater licence application.
	Robe Mesa Project Groundwater Level Monitoring – Results Memo AQ2 (2024d)	• Data from groundwater level monitoring dataloggers, installed in 4 bores at the project area on 15/08/23 have been assessed. • Each datalogger was set to record at 6 hourly intervals.
	Robe Mesa Project. Response to DWER Comments on MB13-3 GWL Application and H2 Report AQ2 (2024e)	• Memo report responding to comments by DWER on the H2 hydrological assessment report.

Environmental Factors	Studies undertaken and Reference	Survey Effort
Noise and Vibration Assessment	Environmental Nosie Assessment April 2023 Lloyd George Acoustics	• Model noise scenarios in the project area and consider noise mitigation where exceedances are calculated.
Waste Characterisation	Mine Waste and Low-Grade Ore Characterisation Investigations – Robe Mesa Project December 2022 Graeme Campbell and Associates	• Assessment of waste samples and Low Grade-ore samples • All samples classify as Non-Acid Forming (NAF), due to 'negligible-sulphides' (Total-S < 0.1 %) • All samples lacked appreciable enrichments in minor-elements

1.5 STAKEHOLDER ENGAGEMENT

Since acquiring tenements in 2014, CZR has consulted broadly during ongoing investigation, design, and evaluation of the Project. Key stakeholders identified and engaged in the last three years are listed below.

- State Government Agencies and Branches
    - Department of Energy, Mines, Industry Regulation and Safety (DEMIRS), Environment
    - DEMIRS, Mineral Titles
    - Department of Water and Environment Regulation (DWER), EPA Services
    - DWER, Part V EP Act approvals and licencing
    - DWER, Water Branch
    - Department of Planning, Lands and Heritage (DPLH)
    - Department of Biodiversity Conservation and Attractions (DBCA), Species and Communities
    - DBCA, Environmental Management Branch
    - Main Roads Western Australia (MRWA).
- Local Government Authority
    - Shire of Ashburton
- Indigenous Groups and representatives.
    - Robe River Kuruma Aboriginal Corporation
- Mining tenement holders
- Pastoral station owners.
    - Yarraloola Station

CZR has undertaken substantial investigations across a wide range of environmental factors and has completed a detailed assessment of the risks that the project poses to the environment. Investigations that support the detailed environmental assessment undertaken in this document are summarised in **Table 1.3**.

Table 1.3: Key Stakeholder Engagement - Robe Mesa Project

Date	Stakeholders (Key contact) and Description of Engagement	Stakeholder comments/issue	Proponent Response and/or resolution	Stakeholder Response
Robe River Kuruma People				
2020 onwards	Traditional Owners - Robe River Kuruma People. Native title agreement, Cultural Mapping, heritage clearances	Advocate for project. See opportunities for job creation, wealth enhancement, access to land post closure. Cultural Heritage Management Plan Concerns raised about Robe Pools and water use	Native title agreement with Cultural Heritage Management Plan co-developed and signed December 2022. Agreed to 50 m buffer zone on top of Mesa and identified No-Go-Areas. No mining below Water table and progressive backfilling of pit with waste material. Water supply-demand document prepared	Traditional Owners have endorsed the project and continue to work with CZR on heritage surveys
Department of Water and Environmental Regulation (DWER)				
2020 onwards	DWER, Water Emails and phone calls	26D licenses approved	Follow department guidance on submissions and procedures	Complying
2020 onwards	DWER, EPA Services (Troy Sinclair) Emails and phone calls	Introduction and updates on the project Field investigations - approach and outcomes	Arrange to meet to discuss project and scope of works.	Coordinate follow-up meetings – project interest
4 Dec 2020	DWER, EPA Services (Troy Sinclair and Liesl Rohl) Meeting. Early scoping meeting between DWER and CZR	Discuss the Project and Mike Bamford's approach to level 2 surveys. Present findings to date. Dr Mike Bamford from Bamford Consulting Ecologists BCE, in attendance to discuss proposed survey approach. Seeking further guidance on multi season detailed environmental investigations	DWER was interested in the findings to date.	Continue to be open to further discussions and learning more about the project

Date	Stakeholders (Key contact) and Description of Engagement	Stakeholder comments/issue	Proponent Response and/or resolution	Stakeholder Response
1 June 2022	DWER, EPA Services (Troy Sinclair) Meeting. Follow-up discussions about the Robe Mesa Project	Follow-up meeting to provide an update on the project and the field investigations. Dr Mike Bamford (BCE), attended to discuss survey outcomes to date. Broadly discuss possible approvals pathways	Discussed the surveys and future work. The NVCP pathway was discussed as a possible approvals option, given the small footprint and minimal impact to conservation significant fauna habitat.	
May 2023	DWER, Water (Natural Resource Management) (Stephanie Pham and Haley Brunel) Emails and phone calls	Groundwater licence application – 5C.	Information required and application process involved to transfer draw point PB13-3 from an existing APIM GWL to a new CZR licence.	Application for a groundwater Licence was submitted 1 June 2023 – Water Online Reference 056535)
2024	DWER (emails, phone calls and 9 Oct 2024 meeting)	Clarify technical queries with PB13 and 5C ground licence application	AQ2 provide response to DWER's RFIs	Groundwater Licence is pending the granting of other approvals (NVCP and Mining Proposal)
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)				
2020 onwards	DEMIRS, Resource Tenure Division (Michelle Baker) Emails and phone calls	Tenement applications and granting process. More recently, discussions have focussed on referral to DPLH for tenements associated with the De Grey Stock Route.	CZR continue to corporate with DEMIRS, providing information and support during tenement applications and complying with all tenement conditions.	Tenement approval ongoing
January 2023 onwards	DEMIRS, Resource and Environmental Compliance. (Corrine Chambers) Adam Buck (NV Branch) also in attendance. Meting, emails and phone calls	Discussions to introduce the project and scope of work to date regarding environmental investigations and findings.	CZR are keen to explore the possibility of seeking approval under a NVCP application, given the small project footprint size and minimal impacts (i.e., no dewatering, no disturbance to mesa edges etc.	Coordinate meeting with DEMIRS and CZR to discuss the project and possible approval pathways (23 Feb 2023)

Date	Stakeholders (Key contact) and Description of Engagement	Stakeholder comments/issue	Proponent Response and/or resolution	Stakeholder Response
April 2023 onwards	DEMIRS, Resource and Environmental Compliance (Tahlia Daley) Emails and phone calls	NVCP application process, queries about tenement granting dates and abjections resolved	CZR formally with draw NVCP application (12 April 2023) until tenements associated with the De Grey Stock Route have been resolved	CZR formally withdraw NVCP application
June 2023 onwards	DEMIRS, Resource and Environmental Compliance (Tahlia Daley) Emails	NVCP resubmission	Key tenements associated with the De Grey Stock Route have been resolved and CZR is re-submitting its NVCP application. Application also includes a significantly smaller Application Area from the original May 2023 application	Under review
2024	DEMIRS (emails, phone calls and 11 Sep 2024 meeting)	Clarify technical queries with NVCP	Prepared formal technical responses on outstanding queries regarding fauna, troglofaunal, PEC, surface water modelling	Under review
Department of Biodiversity, Conservation and Attractions (DBCA)				
March 2023 onwards	DBCA, Species and Communities (Catherine Bourke) Emails and phone calls	Discussions and emails to introduce the project and arrange to meet to discuss Subterranean PEC	CZR have provided DBCA (Species and Communities) with information on the project, including PowerPoint presentation, scoping document and DEMIRS minutes.	DBCA suggest submitting the NVCP application and once DEMIRS seek advice from the Species and Communities group – we meet with experts to discuss.
March 2023 on-wards	DBCA, Environmental Management Branch (Harley Taylor) Emails and phone calls	Discussions and emails to introduce the project and arrange to meet to discuss Subterranean PEC	CZR have provided DBCA (Species and Communities) with information on the project, including PowerPoint presentation, scoping document and DEMIRS minutes.	DBCA EMB suggest Species and Communities Brach is the most appropriate group to discuss projects undergoing a NVCP process.
Department of Planning, Lands and Heritage (DPLH)				
2023 onwards	Heritage (Kelly Fanning) Phone calls and emails	Port export road traffic volumes, dust, Onslow accommodation and services	More detail on future export requirements needed De Grey – Mullewa Stock Route No 9701 interface	Tenements granted and issues resolved

Date	Stakeholders (Key contact) and Description of Engagement	Stakeholder comments/issue	Proponent Response and/or resolution	Stakeholder Response
Local Government				
2020 onwards	Shire of Ashburton Port enquiries and updates on work	Port export road traffic volumes, dust, Onslow accommodation and services	More detail on future export requirements needed	
Pastoralists				
2014 onwards	Pastoralist - Yarraloola Station Notice of Traversing and work activities. Access agreement	Access to site	Agreed communication channels and notifications in place	Protocols being followed
Neighbouring Tenements (other industry)				
2014 onwards	Rio Tinto, Mineral Resources Notice of Traversing and work activities. Access agreement	Access to site	Agreed communication channels and notifications in place	Protocols being followed
2021 onwards	Other industry Red Hill Minerals Shared environmental surveying, exploration camp, cooperation agreement.	Supportive of mining, future processing, and export opportunities with CZR	Collaborative and cooperative arrangement	Advocating Robe Mesa Project
2022 onwards	Other industry API. Water exploration, gravel	Supportive of mining		Advocating Robe Mesa Project
2022 onwards	Other industry FMG Purchase and transfer of E08/2137, sharing of Exploration Camp	Supportive of mining, sale of tenement E08/2137 to CZR	Sharing of camp, purchase of surrounding tenement E08/2137	Positive E08-2137 transaction complete
2022 onwards	Other industry Miracle Iron (formerly Strike Resources Paulsens East Iron Ore Project).	Collaborative approach to export stranded deposits	Formation of Port of Ashburton Consortium (PAC) and establishment of Ashburton Link Pty Ltd	Advocating Robe Mesa Project

Date	Stakeholders (Key contact) and Description of Engagement	Stakeholder comments/issue	Proponent Response and/or resolution	Stakeholder Response
	Co-proponents in Ashburton Link Pty Ltd.			
2023 onwards	Other industry CSL Australia Co-proponents in Port of Ashburton Consortium, MoU		Formation of Port of Ashburton Consortium (PAC) and establishment of Ashburton Link Pty Ltd	Advocating Robe Mesa Project

2. PROJECT DESCRIPTION

The Robe Mesa Project is located within the Robe Valley Channel Iron Deposits (Robe Valley CID), adjoining Rio Tinto's Mesa F deposit.

The Project involves the development of a mine, associated mine infrastructure and an access road to the North West Coastal Highway. The project would include a total disturbance of 270 ha, comprising:

- Construction and operation of a mine pit (~68 ha)
- Construction and operation of a mine plant and associated infrastructure (~69 ha)
- Construction of a new access road and utilities corridor (~107 ha)
- Construction of a new accommodation camp (~25 ha)

2.1 MINIMISING ENVIRONMENTAL AND HERITAGE IMPACTS

Actions to minimize impacts to environmental and heritage values include:

- Restrict the entire Disturbance footprint to 270 ha.
- Retain mesa edges, setting back a minimum of 50 m (up to 250-300 m in places) to protect valuable mesa edge habitat.
- Heritage clearance of all potential disturbance areas
- Critical mine infrastructure will be positioned outside floodplains and away from drainage lines.
- No waste dump landforms, with waste rock progressively backfilled directly back into the mine pit during operations.
- No mine-pit dewatering, avoiding impacts to stygofauna habitat and GDVs.
- Traditional Owner endorsement of the mine plan and project
- Implementation of an Environmental Management Plan (CZR 2023, **Appendix 1-1**)
- Implementation of a Cultural Heritage Management Plan (RRKAC and CZR 2023)

2.2 LAND TENURE

The Application area is situated within one mining lease (M08/533) and eleven (11) miscellaneous licences, as outlined in **Table 2.1**. Tenement Summary Reports are provided in **Appendix 1-2**.

Part of the Application area (access road and village) is also situated on the Yarraloola Pastoral Station.

Table 2.1: Robe Mesa Project tenements

Tenement	Holder	Proposed Activities	Commence
M08/533	Zanthus Resources Pty Ltd 85%, ZANF 15%	Mine Void, Backfill, Plant Site, ROM Pad	04/01/2023
L08/295	Zanthus Resources Pty Ltd	Mine access road	02/06/2023
L08/297	Zanthus Resources Pty Ltd 85%, ZANF 15%	NPI, transport corridor	02/06/2023
L08/303	Zanthus Resources Pty Ltd 85%, ZANF 15%	Pipeline, production bore	02/06/2023
L08/304	Zanthus Resources Pty Ltd	Pipeline, access track and bore field	26/05/2023
L08/319	Zanthus Resources Pty Ltd	Mine access road	29/08/2023

Tenement	Holder	Proposed Activities	Commence
L08/320	Zanthus Resources Pty Ltd	Mine access road	19/07/2023
L08/321	Zanthus Resources Pty Ltd	Mine access road	08/08/2023
L08/322	Zanthus Resources Pty Ltd	Mine access road	24/08/2023
L08/323	Zanthus Resources Pty Ltd 85%, ZANF 15%	Accommodation village infrastructure	24/08/2023
L08/326	Zanthus Resources Pty Ltd 85%, ZANF 15%	Transport corridor	09/10/2023

2.3 APPLICATION AREA AND DISTURBANCE FOOTPRINT

The Application area is approximately 902 ha, within which is a proposed Disturbance footprint of 270 ha, as presented in **Figure 2.1**.

2.3.1 Mine Area

The Robe Mesa deposit is outcropping at surface and has a low strip ratio utilising conventional drill and blast, truck, and shovel (excavator) open pit mining practises. The open pit is ~1,200 m strike length, with widths of ~450 m to 610 m (measured perpendicularly between opposing walls, with depth varying to ~45 m to 65 m deep.

Excavation will be terminated at the nominated grade and will not exceed the current groundwater level. The planned minimum floor elevation is notionally 87.5 mRL.

The mesa edge and buffer zone will remain undisturbed, with a minimum 50 m edge setback and extends to several hundreds of metres in places. The initial two-three years of mining will be by single excavator and several haul trucks, with a second excavator and extra haulage fleet introduced as pit depth and southern zones are exposed.

Mine waste will remain on top of the mesa. No external waste dumps will be left at closure, with the pit progressively backfilled with waste. Waste generated in the early life of the pit will be re-handled.

All mining is above the water table, with no pit dewatering required.

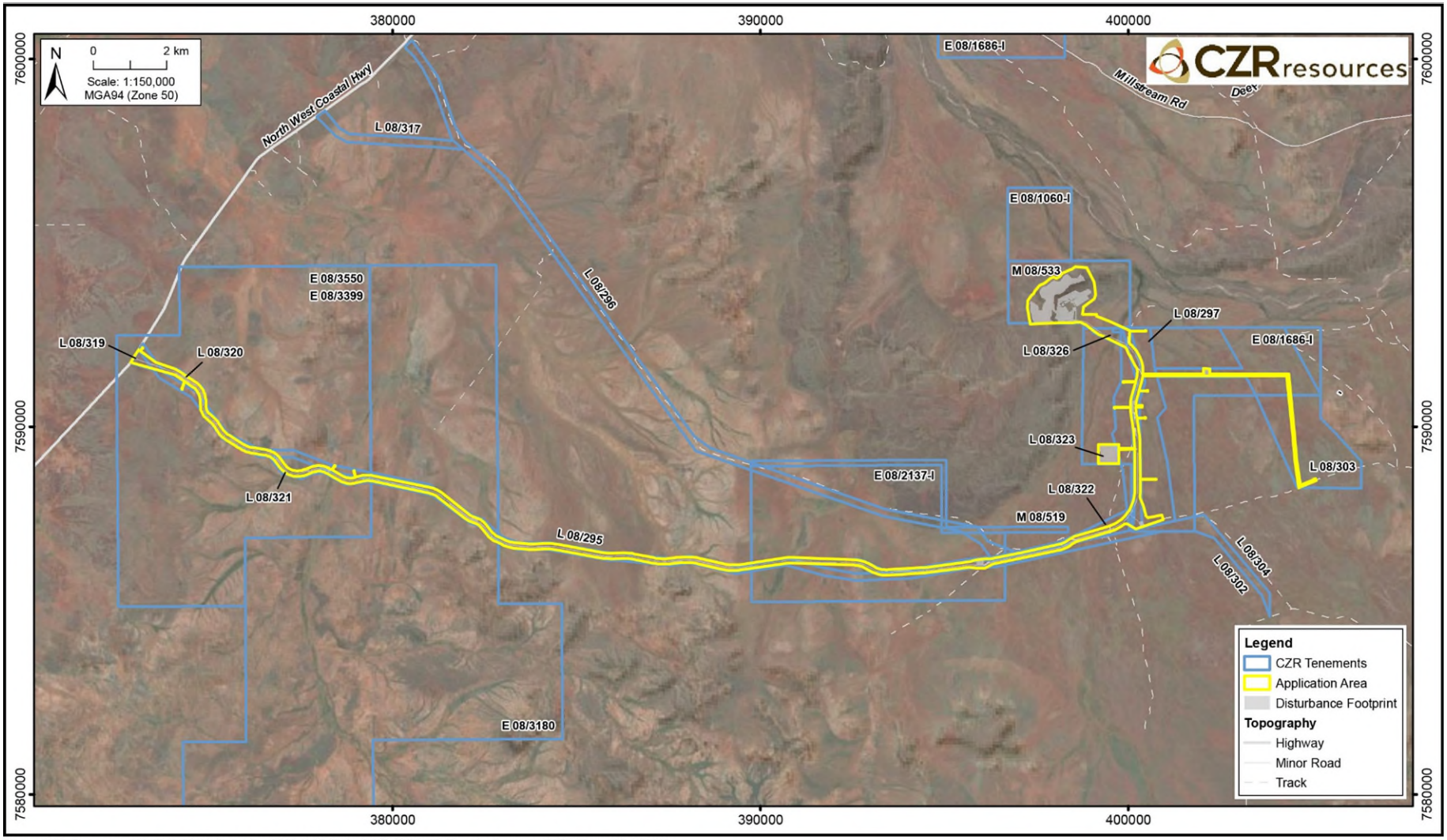
2.3.2 Plant Infrastructure

Mined ore will be hauled to a run of mine (ROM) pad. A front-end loader, will feed the dry processing plant (primary crushed, secondary, and possibly tertiary crushed, screened, sampled, and then stacked) to produce a 55.5% Fe fines only product.

No wet processing will occur, and no tailings storage facility is required.

Product will be stacked in a post-crusher stockyard with stockpiles built to product specification at the mine, prior to being loaded into road-trains for haulage off site.

Figure 2.1: Robe Mesa Project, Application area and Disturbance footprint



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_02, Rev: A ~ Imagery: ESRI, Maxar (Oct 2021)

2.3.3 Access Road

Ore will be hauled from Robe Mesa Processing Plant stockpile to the North West Coastal Highway via the purpose-built unsealed mine site access road, which will handle light vehicle and road trains.

Other access roads will be unsealed and provide light vehicle access to bore field, explosive magazine, borrow material and facilitate alternative access/egress from site in case of emergency. Corridors have been designed to capture all disturbance for roads, pipelines, and topsoil stockpiles, if required.

Several small borrow targets have been identified to support construction activities and general maintenance, including use for subbase, base pavement layers and sheeting material for road construction. Depending on availability, borrow will sourced every 5-7 km along the 37 km access road corridor.

2.3.4 Non-Process Infrastructure

Non-process infrastructure will include office buildings, workshops, 120-person village accommodation, sewerage treatment facilities, landfill facilities, a bore field and power plant.

Non-process infrastructure will also facilitate early construction of the access road and village (production bores, exploration camp, office buildings), including a mobile camp and associated facilities.

2.3.4.1 Village Accommodation

The Accommodation Village will be constructed to accommodate approximately 120 persons and will include a dry mess, dining room, social hub, ablution blocks etc. The Robe Mesa Village will be equipped with a wastewater treatment plant and associated spray fields (for the discharge of treated effluent). A Works Approval will be sought for the approval of these facilities prior to site activities commencing.

A small landfill facility for putrescible waste disposal will be established on L 08/297 near the proposed village. A Works Approval will be sought for the approval of this facility.

2.3.4.2 Buildings

An administration area with office workspace, ablutions, crib rooms, parking areas and other general office facilities will be required. Workshops for heavy mobile equipment will also be constructed adjacent the administration area with a warehouse, office, wash bay with oil/water separator and sediment control structures. The processing facility and haulage facility will also both have a small workshop and office.

The Explosives Magazine will be used to house the bulk ammonium nitrate and will be managed and located in accordance with safety guidelines when producing bulk ANFO for blasting operations.

2.3.4.3 Borefield, fresh water dams and water supply infrastructure

The existing Production Bore 13 (PB-13), 8km southeast of the project area, is a proven water supply for the Robe Mesa Project and was purchased from API Management Pty Ltd (APIM) in March 2023. Groundwater licence GWL180637 accommodates PB-13 and is currently issued to APIM for the abstraction of 95,000 kL pa for exploration and feasibility purposes. An amendment to GWL180637 will be sought to facilitate construction and operations of the Robe Mesa Project. Additional 26D and 5C licences may be sought to secure water supply alternatives, provide monitoring bore locations, and allow operational rotation of bores to appropriately manage the aquifer.

Groundwater will be circulated to the project area via pipeline along existing cleared tracks. Although groundwater at the project area is fresh and can be utilised without processing for site activities, a reverse osmosis plant will be installed to produce potable water for human consumption.

2.3.4.4 Fuel Storage facilities

Fuel storage facilities will include above ground, self-bunded tanks. Fuel tanks are designed and manufactured to AS1940 and AS1692.CAT.3 and fitted with spill grates for each tank to ensure the capture of any fuel spills whilst refuelling. The storage and handling of fuel is managed in accordance with the site Safety Management Plan and under the Dangerous Good Act 2004 (WA).

2.3.5 Topsoil and Subsoil stockpiles

Topsoil and sub-soil will be stored near the areas that will be cleared and used for progressive rehabilitation. Based on industry experience, topsoil and subsoil can be stripped to depths of 0.10 m and 0.30 m respectively, however topsoil to a depth of 0.20 m will be salvaged, for a maximum combined depth of 0.50 m.

Topsoil and subsoil will be stockpiled on flat areas that utilise future pit areas in addition to areas adjacent to infrastructure. Stockpiles will be paddock tipped and pushed up for a batter angle of natural rill. Topsoil will be stored at a maximum height of 2 m and subsoil 4 m.

2.3.6 Closure and Rehabilitation

Mine Closure and Rehabilitation are detailed in the Robe Mesa Project Mine Closure Plan, to be submitted with the Mining Proposal.

3. EXISTING ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT

3.1.1 Climate

The climate of the Pilbara region is arid tropical with summer rain, with an average of 300 millimetres (mm) rainfall annually, usually received in summer cyclonic or thunderstorm events, however winter rain is common (Kendrick 2001; Beard 1990).

Between February and May 2021, the four months immediately preceding the survey in June 2021, a total of 375 mm of rain was received which is approximately 66% more than the long-term average total for the same period. Historical rainfall data collected at the Pannawonica weather station (005069) located approximately 34 km east-northeast of the survey area (Bureau of Meteorology (BoM) 2021).

3.1.2 Geology and Landforms

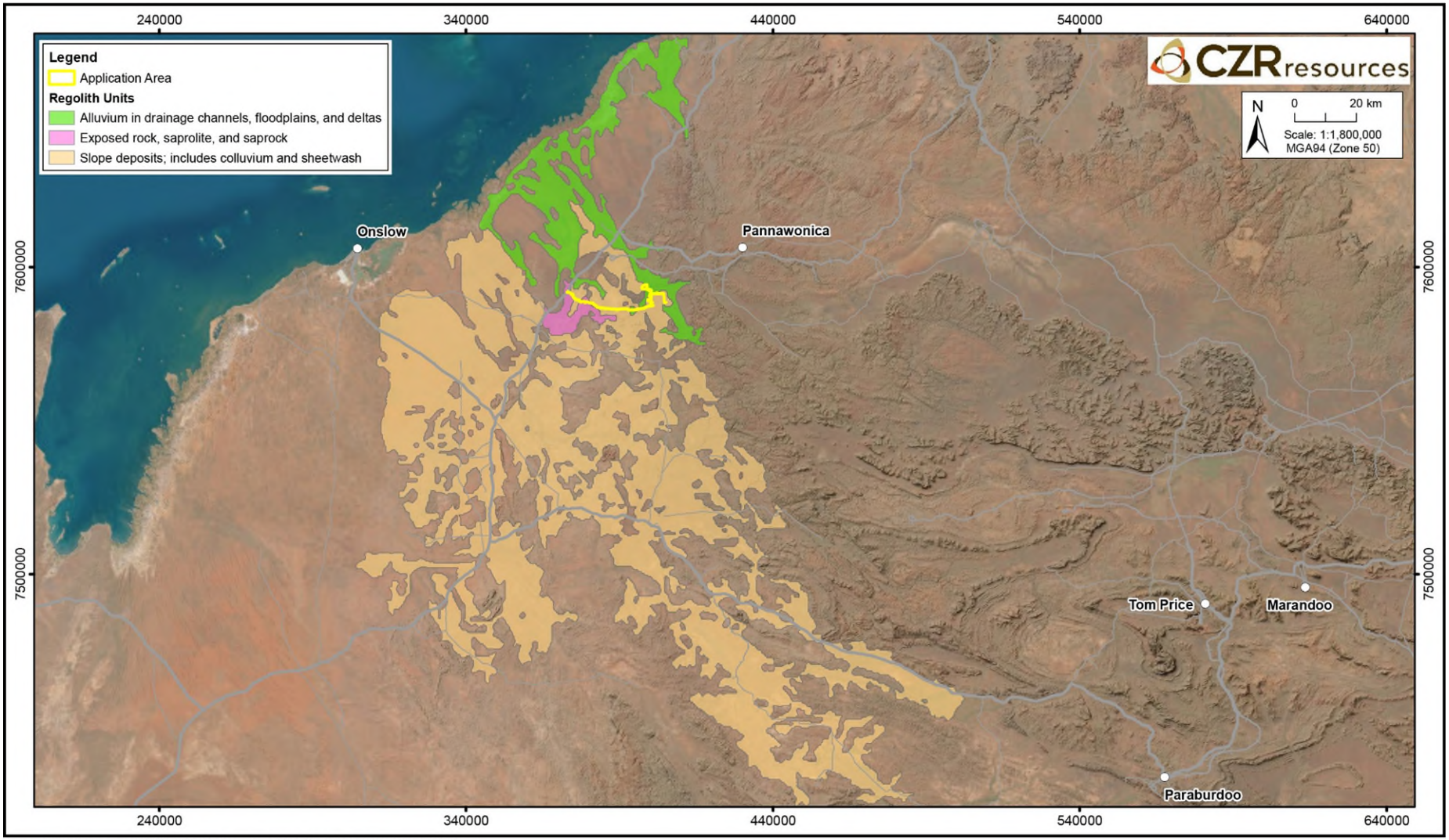
The geology of the Pilbara region comprises a basement of Archaen granite and volcanics overlain by massive deposits of Proterozoic sediments (Beard 1990) expressed as mountainous basalt, shale and dolerite ranges and plateaux dissected by gorges (Kendrick 2001). The Hamersley Basin, in which the survey area lies, overlies the older Archaean Pilbara Craton, and comprises mafic and felsic volcanics, shale, siltstone, sandstone and conglomerate, as well as dolomite and banded iron formation (van Vreeswyk et al. 2004).

The Application area overlays three regolith units, as summarised in **Table 3.1** and **Figure 3.1**. Most of the disturbance footprint (83%) is located within the 'slope deposits' regolith, a widely distributed unit of the Pilbara, mapped over 1 million ha.

At a more local scale, the Application area intersects eleven geological units (Geological Survey of Western Australia 1968), with most widespread units over the Application area being the units Tp, Qp, Qg, Ql:

- Tp. Pisolitic limonite deposits with fossil wood fragments. Occurs along old river channels.
- Qp. Eluvium and alluvium. Residual 'high level' clay and sandy clay plain with gilgais; intermittent veneer of alluvium; residual deposits of sand, gravel, and pebbles; sheet kunkar in places.
- Qg. Colluvium. Unconsolidated to loosely consolidated slope deposits; calcareous and ferruginous cement in older parts.
- Ql. Lacustrine deposits - clay, silt; saline in part, flood deposits. Unconsolidated fluviatile and sheet - flood deposits in levees and river terraces.
- Qpt. Eluvium. Residual, unconsolidated or loosely consolidated, low angle slope deposits; angular to subrounded shale and ironstone fragments; quartz and quartzite pebbles.
- Qr. Alluvium. Unconsolidated fluviatile deposits, mostly sand.
- Wd. Duck Creek dolomite. Calcitic dolomite, minor shale; with Collenia.
- Ma. Warramboo sandstone. Interbedded massive and flaggy quartz sandstone and shale.
- Wa. Ashburton formation. Interbedded shale, fine grained sandstone, greywacke; ferruginous and siliceous shale.
- Kn. Nanutarra formation. Shale, siltstone, micaceous siltstone; ferruginous and glauconitic quartz sandstone; some conglomerate; contains plant and marine fossils.
- Mk. Katanga conglomerate. Poorly sorted conglomerate with interbedded quartz sandstone.

Figure 3.1: Regolith of Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_03, Rev: A

Table 3.1: Geological units of the Robe Mesa Project

Regolith of WA (DMIRS0-017)	Survey extent (ha)	Extend in Application area		Extent in Disturbance footprint	
		ha	%	ha	%
Alluvium in drainage channels, floodplains, and deltas	149,421	152	0.1	27	0.02
Slope deposits; includes colluvium and sheetwash	1,056,586	656	0.1	223	0.02
Exposed rock, saprolite and saprock	15,142	94	0.1	20	0.13

3.1.3 Soils and Waste

Five broad soil types are found across the Application area, as per Northcote et al. (1960). The most abundant are Oc66 and Oc67, which comprise mainly hard alkaline red soils on pediplains and plains, with small areas associated with occasional patches of calcrete:

- Oc66 – Pediplains:

  Gently undulating pediplains extending out from breakaways capped by Robe pisolite deposits and other related formations. There may be a few small flat-topped residuals rising above the pediplains: chief soils are hard alkaline red soils (Dr2.33). Small areas of (Um5.11) soils may be associated with occasional patches of calcrete (kunkar). Minor soil occurrences include (Uf6.71), (Ug5.37), (Gn2.13) and stony (Gn2.12) soils.

- Oc67 - Plains:

  Dominant soils are hard alkaline red soils (Dr2.33). Associated are extensive areas of (Um5.52) soils with (Ug5.38) soils in central landscape positions. Small areas of (Gn2.12) soils also occur as well as (Um5.11) on calcrete (kunkar).

- B27 - Low terrace:

  Associated with mainstream channels: chief soils are loose sands (Uc1.22) with some (Um5.11) soils on patches of calcrete (kunkar).

- Oc65 - Low stony hills and steeply dissected pediments:

  Found in areas of fine-grained sandstone, shale, and dolomite. There may be small areas of ferruginous duricrust and Robe pisolite as a capping. The soils are often shallow and stony: chief soils are hard alkaline red soils (Dr2.33) with some (Uc5.11) soils. (Um5.11) soils may occur on calcrete (kunkar) in the narrow valley plains and on exposures of calcareous rocks. (KS-Gn2.11) soils occur on the small area of ferruginous duricrust and Robe pisolite.

- MY1 - Gently undulating plateau

  The boundary of this unit is frequently formed by breakaways, but it may at times merge beneath the adjacent plain. These areas are capped by the Robe pisolite iron ore formation. The chief soils are gravelly acid red earths (KS-Gn2.11) with (Dr2.33) soils on the pediments.

Characterisation of waste material from the Project by Graeme Campbell and Associates (GCA) (2022, **Appendix 2-1**) found that all the samples tested (1,218 samples) classified as Non-Acid Forming (NAF) and circum-neutral (pH 6-9) with low to moderate contents of soluble-salts.

Overall, the waste material is considered inert with no fibrous or potentially acid forming material present.

Analysis of waste material also identified the weather-surface zone, a waste unit with a shallow geologic-profile and a cobbly/blocky nature, as an important resource for physical-stabilisation (e.g., cladding / armouring) and rehabilitation applications.

3.1.4 Land Systems

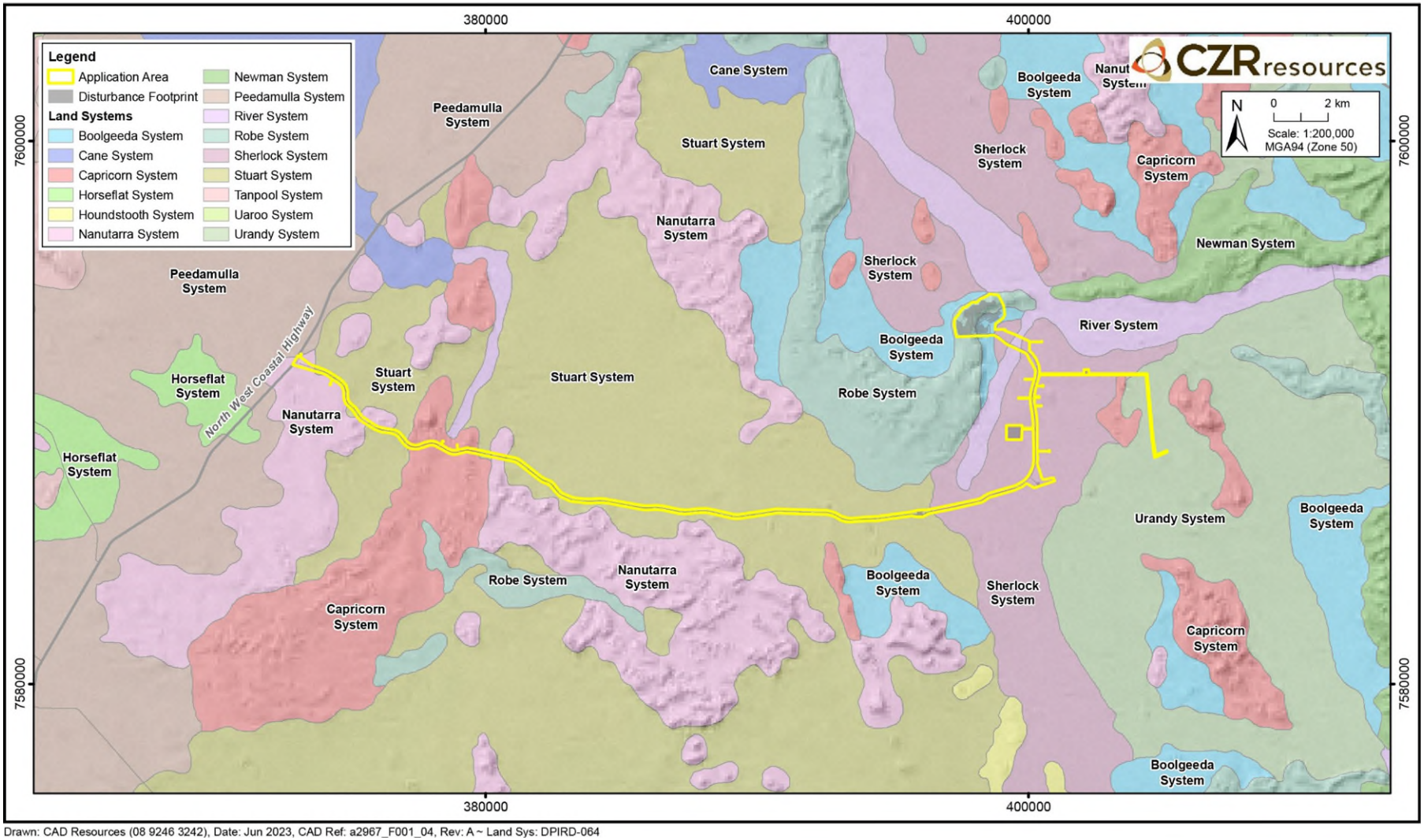
Land systems are composed of repeating patterns of topography, soils, and vegetation, which are described as a series of land units (Christian and Stewart 1953). A total of 105 land systems have been identified and mapped in the Pilbara bioregion by the then Department of Agriculture. Land systems mapping covering the survey area was prepared by van Vreeswyk et al. (2004).

A total of nine land systems are mapped within the survey area, all of which are well represented in the region, with their total mapped extents ranging from 15,493 ha (Sherlock) to 281,592 ha (Stuart). As **Table 3.2** shows, the Application area and Disturbance footprint intersect only very small portions of the extent of each land system in the Pilbara bioregion (**Figure 3.2**).

Table 3.2: Land Systems of the Robe Mesa Project

Land System Unit and Description	Land System Extent	Extent of Application area (ha). Proportion of surveyed extent (%)		Extent of Disturbance footprint (ha). Proportion of surveyed extent (%)	
	ha	ha	%	ha	%
202Pe Peedamulla: Gravelly plains supporting hard spinifex grasslands and minor snakewood shrublands.	59,201	0.1	0.0002	0.1	0.0001
296Bg Boolgeeda: Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	40,259	66.3	0.2	41.1	0.1
296Cp Capricorn: Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	117,459	42.5	0.04	9.9	0.008
296Nn Nanutarra: Low mesas and hills of sedimentary rocks supporting soft and hard spinifex shrubby grasslands.	77,493	48.3	0.1	7.0	0.009
296Ri River: Narrow, seasonally active flood plains and major river channels supporting tall shrublands or woodlands of acacias and fringing communities of eucalypts with tussock grasses/spinifex.	16,403	16.7	0.1	0.9	0.006
296Ro Robe: Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands.	31,872	140.9	0.4	73.0	0.2
296Sk Sherlock: Stony alluvial plains supporting snakewood shrublands with patchy tussock grasses and spinifex grasslands	15,493	257.6	1.7	65.9	0.4
296St Stuart: Gently undulating stony plains supporting hard and soft spinifex grasslands and snakewood shrublands.	281,592	307.9	0.1	67.2	0.02
296Uy Urandy: Stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands.	29,749	22.1	0.1	4.4	0.01

Figure 3.2: Land Systems of the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_04, Rev: A ~ Land Sys: DPIRD-064

3.1.5 Groundwater

Information in this section is based on the following supporting studies:

- AQ2 (2024b) Robe Mesa Project H2 Level of Assessment. Groundwater Abstraction from Bore PB13-3 for Mine Water Supply (replaced AQ2 2023, Appendix 3-1)
- AQ2 (2024c) Robe Mesa Project Groundwater Operating Strategy. Prepared to support Robe Mesa Project Groundwater Licence application
- AQ2 (2024d) Robe Mesa Project Groundwater Level Monitoring – Results Memo.
- AQ2 (2024e) RFI Response memo to groundwater licence review of H2 report.

The major aquifer systems in the Robe Mesa Project area are encountered within the following main hydrostratigraphic units:

- Valley-fill deposits (alluvium, elluvium and coluvium materials).
- Palaeochannel Channel Iron Deposits (CID) (Robe Pisolite).
- Weathered bedrock that may have formed from the creek/river erosion.
- Faults/shear zones within the bedrock (fractured rock).

Production Bore PB13-3, is the preferred groundwater abstraction site for the Project, has been drilled into fault Breccia within the Duck Creek Dolomite.

3.1.5.1 Groundwater characteristics

Depths to groundwater range from 82 to 115 mAHD across the project area, which at the PB13-3 site is approximately 13 mbgl on the plains. Regionally, the groundwater flow direction is from the south southeast to the north northwest towards the Robe River and subsequently the coast.

The main aquifers are recharged by infiltration of rainfall and surface water flows. Recharge would be seasonal (wet season) with most recharge occurring through the valley-fill sediments (alluvium and colluvium) and into the CID during significant rainfall/runoff events and limited recharge into the faulted/fractured aquifer.

Groundwater discharge is likely to occur by evapotranspiration from the shallow aquifers (i.e., valley-fill) when groundwater levels are elevated after wet season and by throughflow to creeks/river (due to valley-fill aquifer being hydraulically connected to the surface water features).

Water quality from PB13-3 is fresh, with salinity of 540 mg/L total dissolved solids and is slightly alkaline (pH of 7.9). The water is of potable quality, with all parameters tested well below the Australian Drinking Water Guidelines (ASWG) (version 3.8, September 2022).

Only one water quality parameter exceeded the ADWG aesthetic maximum value. Hardness was recorded at 250 mg/L $CaCO_3$, compared to the guideline maximum value of 200 mg/L $CaCO_3$. This has no health implications but may cause some carbonate scaling in pipework. The water is bicarbonate dominant with sodium, calcium, and magnesium important, which is often indicative of waters that are associated with dolomites, in this case the Duck Creek Dolomite. Water within this sub field also indicates younger water with active recharge (AQ2 2023).

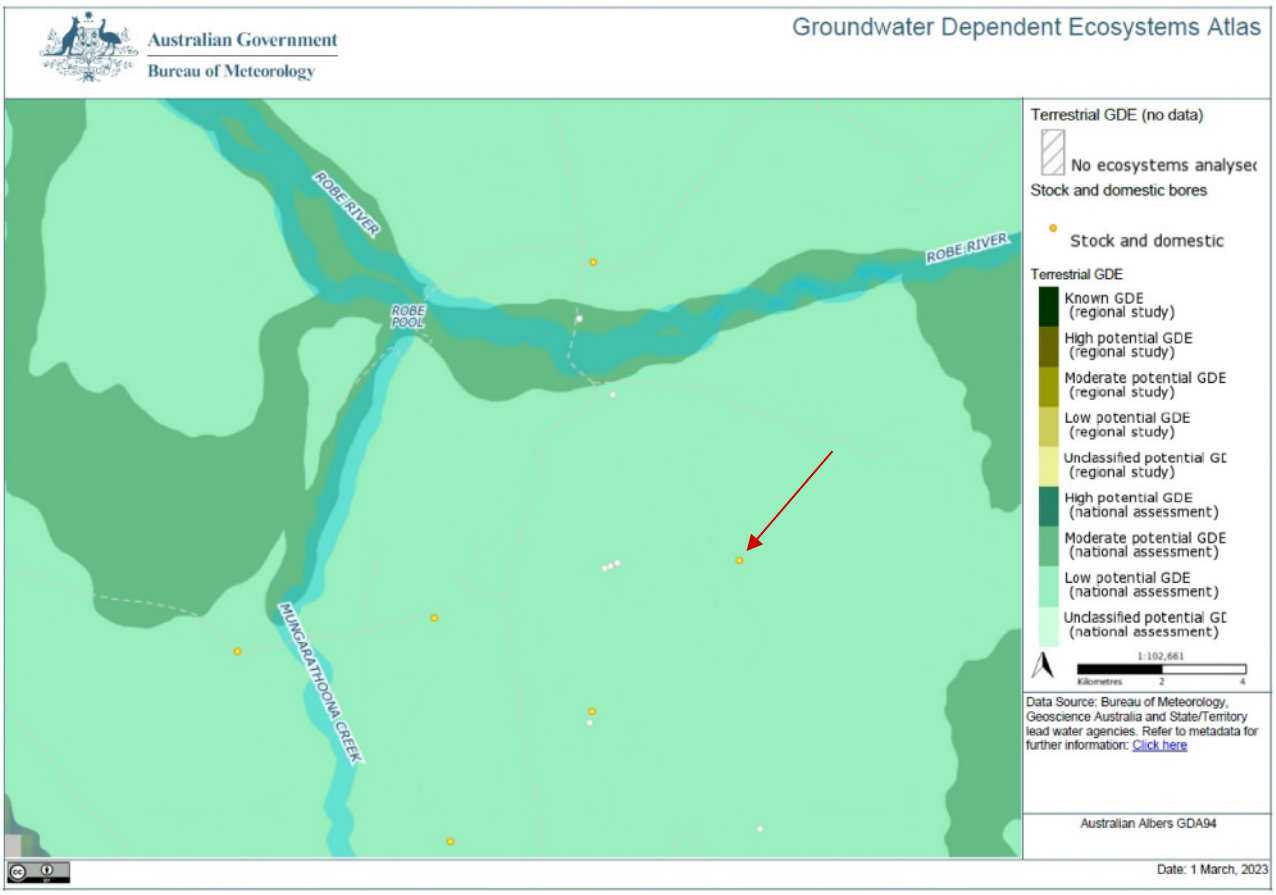
3.1.5.2 Water Use

The anticipated long-term (~7 years) mine water demand for the Robe Mesa project is estimated at 17 L/s (i.e., 540,000 kL/year) for construction, dust suppression, processing, and camp requirements.

The deposit is above the water table and no mine pit dewatering is required.

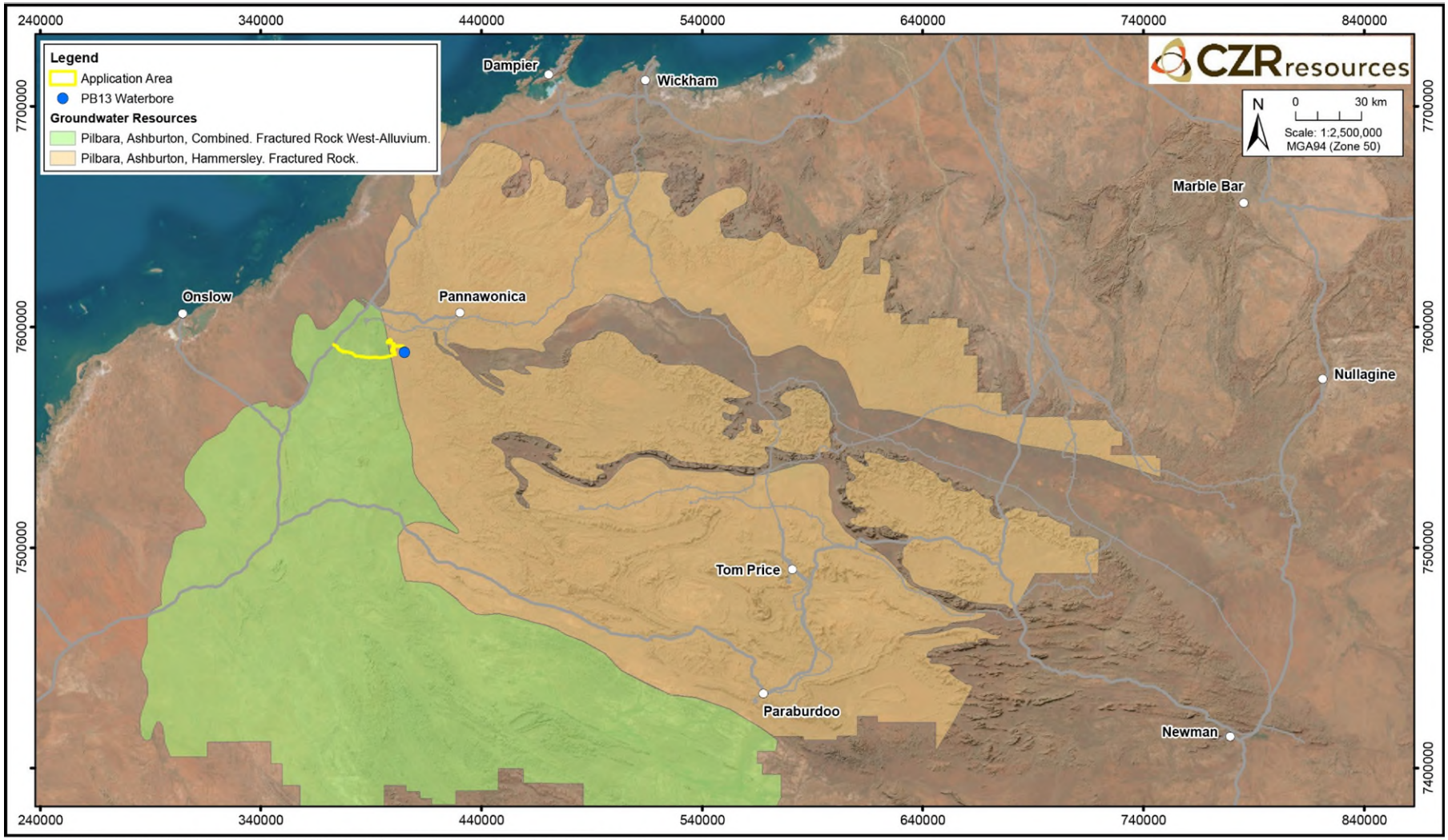
The existing production bore PB13-3, drilled into the faulted/fractured Duck Creek Dolomite aquifer system, is located approximately 8 km southeast from the proposed Robe Mesa mine and can fully meet the Robe Mesa Projects water demand. Given the production bore is 8km from the Project area. It is also away from any potential GDVs associated with Red Hill Creek and Robe River (**Figure 3.3**).

Figure 3.3: Desktop search GDEs with 5 km radius of PB13-3 (red arrow) (BOM GDE Atlas) (Source: AQ2:2022)



APIM currently holds a RIWI Act 5C Groundwater licence (GWL180637/3) for an annual allowance of 95,000 kL from the Pilbara Hamersley fractured rock aquifer for geotechnical investigation, mineral exploration and bore construction purposes (**Figure 3.4**). CZR is currently in the process of transferring PB13-13 into a new groundwater license for the Robe Mesa Project.

Figure 3.4: Location of PB13-3 and Groundwater Resources (DWER-084)



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_05, Rev: A ~ Groundwater Res: DWER-084

3.1.6 Surface Water

Information in this section is based on the following supporting studies:

- AQ2 (2021) CZR Robe Mesa – Preliminary Surface Water Modelling (**Appendix 3-2**)
- AQ2 (2022) Robe Mesa Study – Haul Road Surface Water Assessment (**Appendix 3-3**)
- AQ2 (2024a) Robe Mesa mine operations centre and haul road surface water modelling

3.1.6.1 Catchment and watercourses

Most of the Application area is located within the surface water management area for the Robe River and its tributaries. The Robe River is a significant river system in the region and drains east to west through the high relief areas of the Hamersley Ranges, between Mesa formations on the Southern Peneplain and onto gently sloping coastal plain prior to discharging into the Ocean (Ruprecht, 2000 and Beard, 1975) (**Figure 3.5** and **Table 3.3**).

A portion of the proposed Access Road is located within the Onslow Coastal Plain, a predominantly flat area with little or no defined drainage channels. The Ashburton and Cane Rivers discharge onto the Onslow Coastal Plain and although maintaining some channel across the coastal plain, both rivers have diminished flow capacity and an increasing tidal influence as they approach the coast (Bussemaker and Brunner 2017).

Table 3.3: Robe Mesa Project Catchments (DWER-028)

Catchment	Survey extent (ha)	Application area and proportion of survey extent		Disturbance footprint and proportion of survey extent	
		ha	%	ha	%
Robe River Catchment	758,253	541	0.07	197	0.03
Coastal Plain Catchment	424,037	361	0.09	72	0.02

Creeks in the region are ephemeral with runoff responding to the sporadic significant rainfall events.

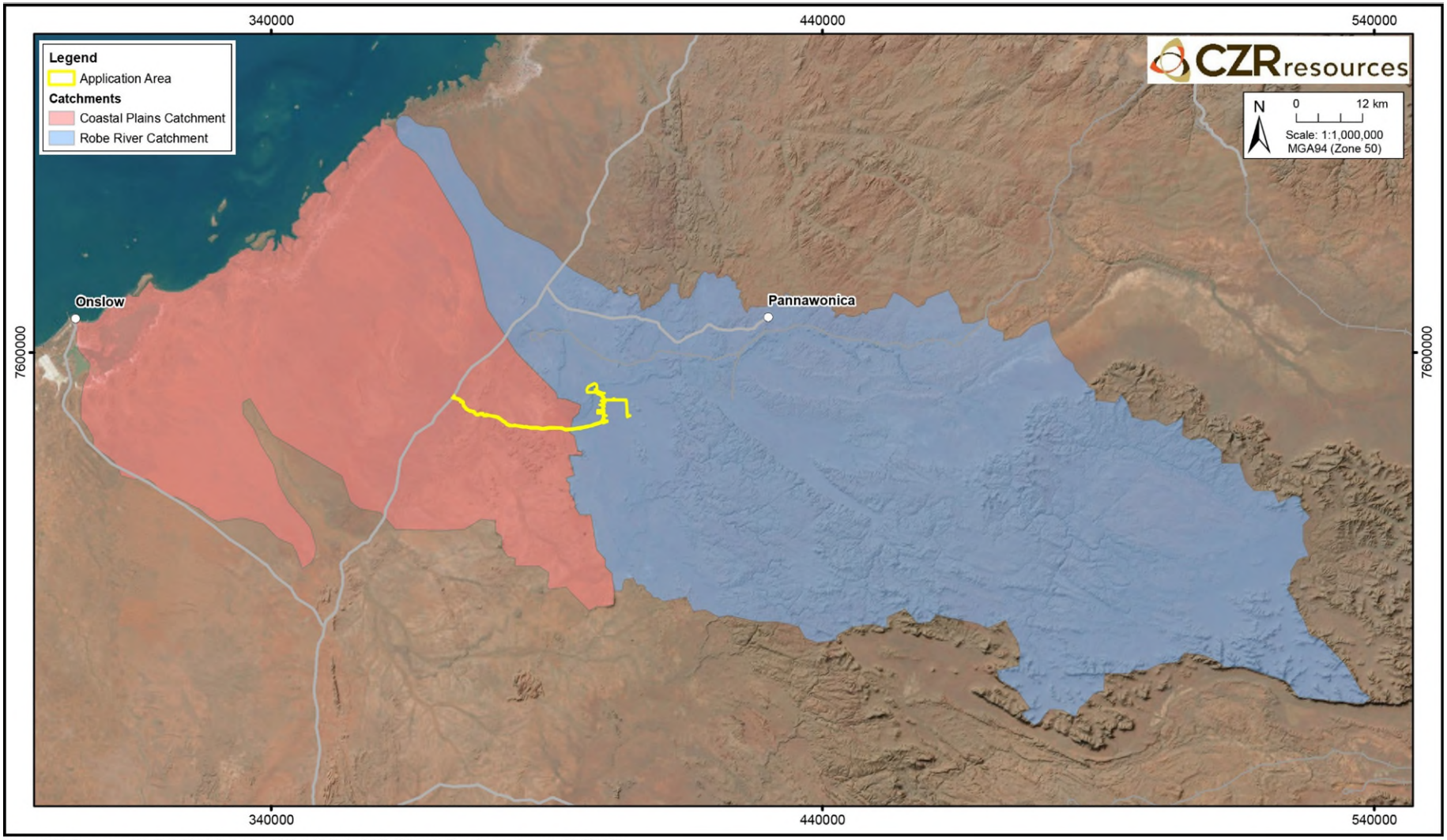
Mungarathoona Creek, one of the major Robe River tributaries, flows through the main Project tenement area from south to north and around the northern part of the Robe Mesa. The confluence of Mungarathoona Creek and Robe River occurs directly north of the Application area (approximately 1.8km northeast) and has resulted in a series of river pools at the junction (**Figure 3.6**).

Unnamed Pool is approximately 1000 m northeast of the project and Robe Pool and Chalyarn Pool are approximately 1,600 m and 2,100 m further east of the mine area respectively.

There are no Ramsar Wetlands in the Application area, with the closest Ramsar Site located approximately 440 km northeast (Eighty Mile Beach).

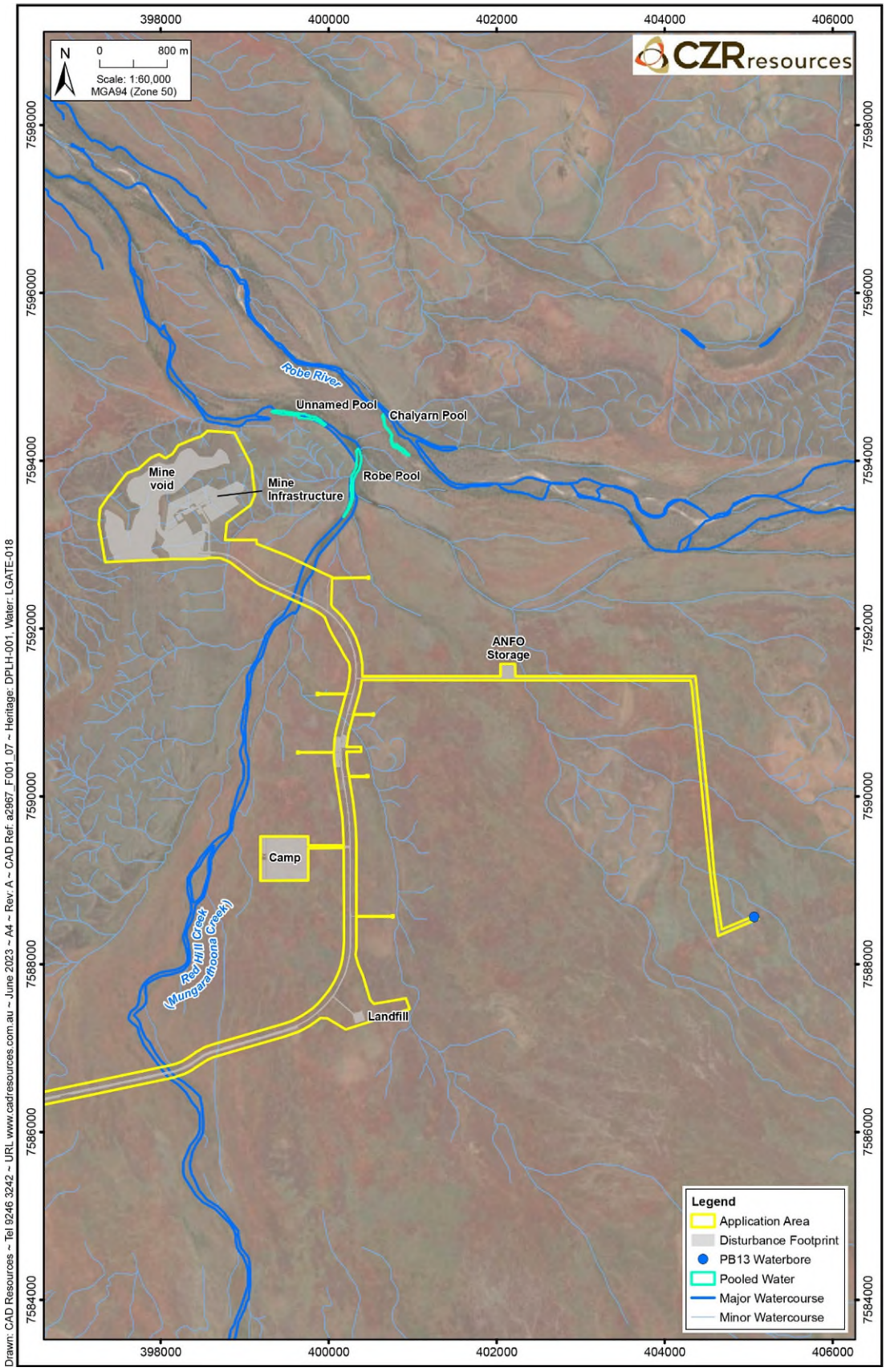
The closest significant wetlands (as listed on the Directory of Important Wetlands, DBCA-045) are located 125 km west (Exmouth Gulf East Wetlands) and 225 km east (Fortescue Marshes) of the Application area.

Figure 3.5: Catchments of the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_06, Rev: A ~ Catchments: DWER-028

Figure 3.6: Watercourses and River pools of the Robe Mesa Project



3.1.6.2 Flood Modelling

Flood modelling by AQ2 (2021 and 2024a), using hydraulic 2D flood modelling of Robe River and Red Hill Creek has been completed to estimate inundation of the Project area. The 2D flood model was developed using HEC-RAS V6.0.0 modelling software (AQ2 2021) and based on data from the Yarraloola gauging station (DWER station 707002, 2021b), 20 km downstream of the Project and at the North West Coastal Hwy crossing.

Flood Frequency Analysis of the Yarraloola gauging station flow data from 1989-2021 was used to estimate Robe River peak flows for various AEP events (including the 1% AEP), as shown in **Table 3.4**. The 1% AEP event flood depth predictions from the pre-development model are shown in **Figure 3.7** and **Figure 3.8**, relative to the proposed infrastructure footprints. A velocity map is shown in **Figure 3.9**, which provides an indication of areas subject to potential scour.

The 1% AEP event flood depth predictions from the pre-development model are shown in **Figure 3.7** and **Figure 3.8**, relative to the proposed infrastructure footprints. A velocity map is shown in **Figure 3.9** which provides an indication of areas subject to potential scour.

Table 3.4: Robe River Peak flow estimates (m3/s) (AQ2 2021 and 2024)

Catchment	Annual Exceedance Probability (AEP)			
	10%	5%	2%	1%
Robe River –to Yarraloola	3,000 m^3/s	5,870	11,480	17,100

Key observations from the flood predictions (AQ2 2024a):

- The predictions indicate that during a 1% AEP flood event, the majority of the mine operations area has been positioned outside of the flood extents of Mungarathoona Creek, with a portion of the southeast section of this area may be prone to inundation during large flood events (**Figure 3.7**).
- The Haul Road alignment between the process plant and the village (about 4km) is within the Mungarathoona Creek floodplain with flood inundation predicted to be above 0.5m (**Figure 3.8**).
- The predicted inundation of the camp area and the camp area access road is predicted to be up to 0.5 m (**Figure 3.8**).
- The maximum flood depth of the Robe River in the main channel to the northeast (through the gap in the mesas) is predicted to be about 8 m and in the nearby pools is up to 10 m.
- Within the planned disturbance areas, any inundation in the proposed mine operations area footprint (or flows against any flood protection bunding) is only predicted to be subject to low flow velocities (<0.5 m/s). The velocity where Mungarathoona Creek crosses the proposed road alignments is predicted to be in the order of 2.0 m/s (**Figure 3.9**).

Model results show key infrastructure areas have been placed in locations outside the floodplains of the major adjacent creeks or where flow depths are manageable (<0.5 m) (**Figure 3.10** and **Figure 3.11**). Where the floodplain extends over infrastructure footprints, the following flood mitigation measures will be considered:

- Mine operations centre – predevelopment flood levels are predicted to extend marginally over the lowest points of the plant footprint. Levelling the area for construction is likely to raise the footprint above the predicted flood levels.
- Camp area – potential inundation managed by a low flood protection bund around the perimeter of the camp.
- Road crossings – creek crossing have been designed as a combination of a flood way with culverts to provide some degree of trafficability in lower flow events (

- **Figure 3.12**).

Local runoff from the mesa to the north and west of the mine operations centre will be managed via a small scale flood protection bund that will direct upstream runoff around the infrastructure area and back to Mungarathoona Creek. Surface water flow within the infrastructure area will report to two sediment basins. The basins will be monitored for sediment loads and periodically cleaned as required, as part of wet season preparation (**Figure 3.13**).

Velocity maps generated from flood modelling (AQ2 2021 and 2024a) have shown that because inundation at the proposed Disturbance footprint will be avoided in most situations as infrastructure is generally outside the flood zone, the site is only predicted to be subject to low velocities (<0.5m/s), which will reduce the risk of erosion and downstream sedimentation (**Figure 3.11**).

Difference flood depth and velocity maps (post-development max values minus pre-development max values) are presented in **Figure 3.14** and **Figure 3.15** respectively. These figures indicate that the impact of the road on the predicted flood levels will be 0-5cm lower than baseline and velocities to be 0-5cm per second slower than baseline, therefore no material impact is expected on the Robe Pools.

Figure 3.7: 1% AEP Pre-development flood mapping at the mine operations centre (Source: AQ2 2024a)

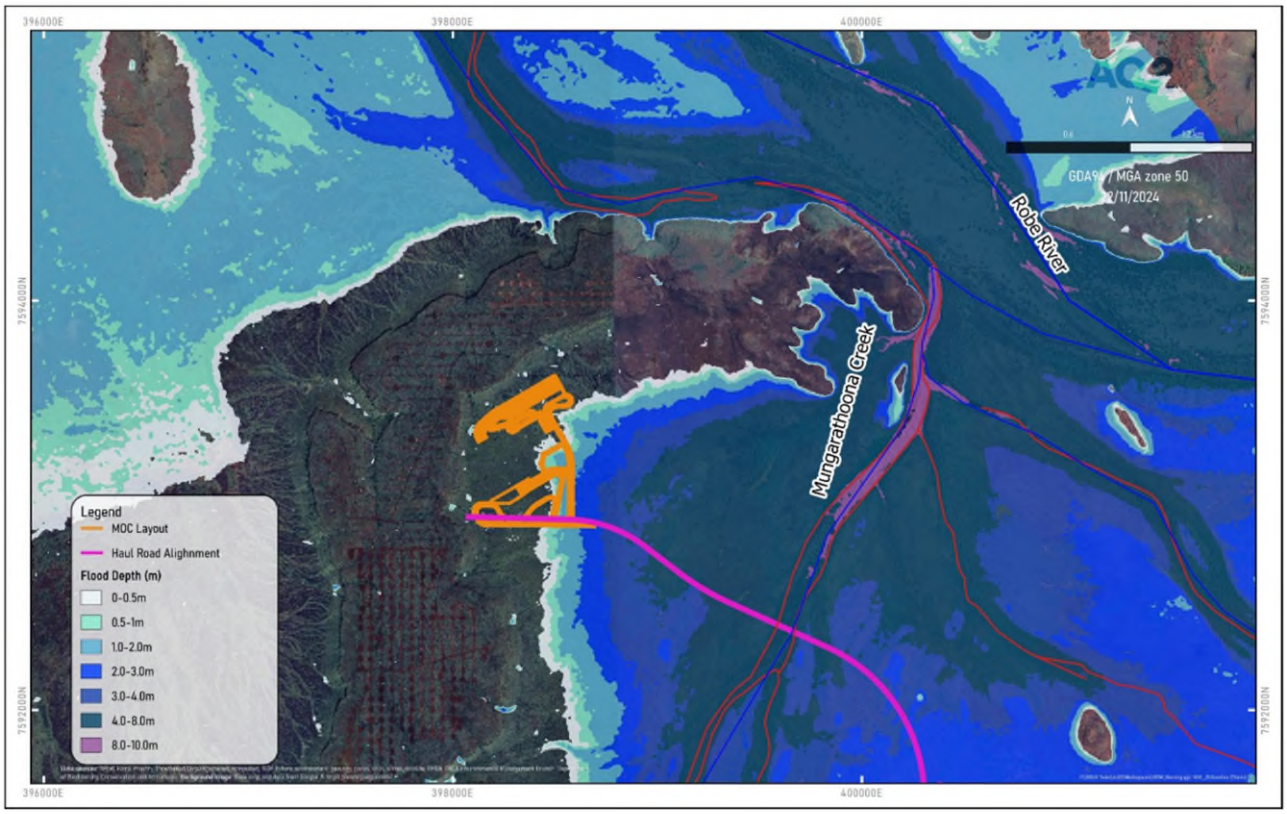


Figure 3.8: 1% AEP Pre-development flood mapping at camp (Source: AQ2 2024a)

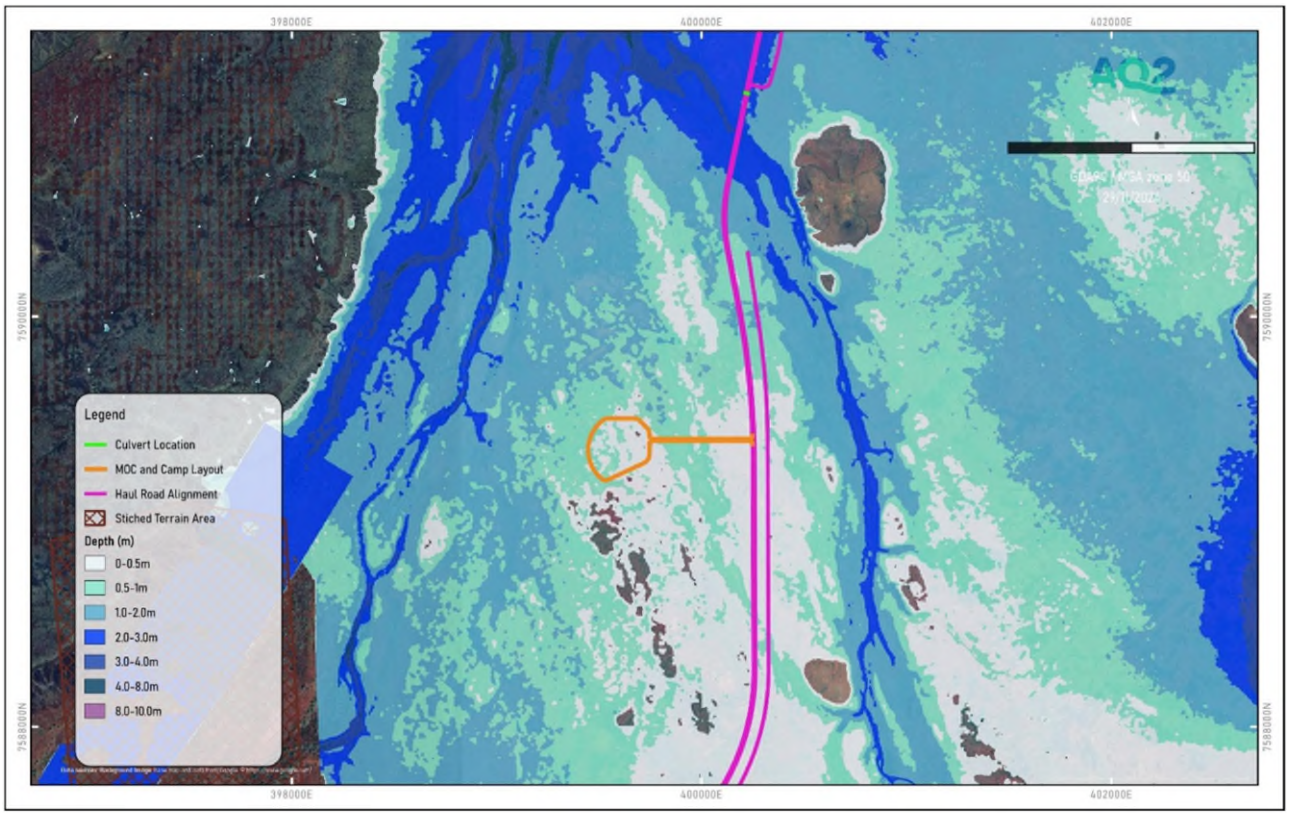


Figure 3.9: Baseline Flood Velocity 10% AEP (Source: AQ2 2024a)

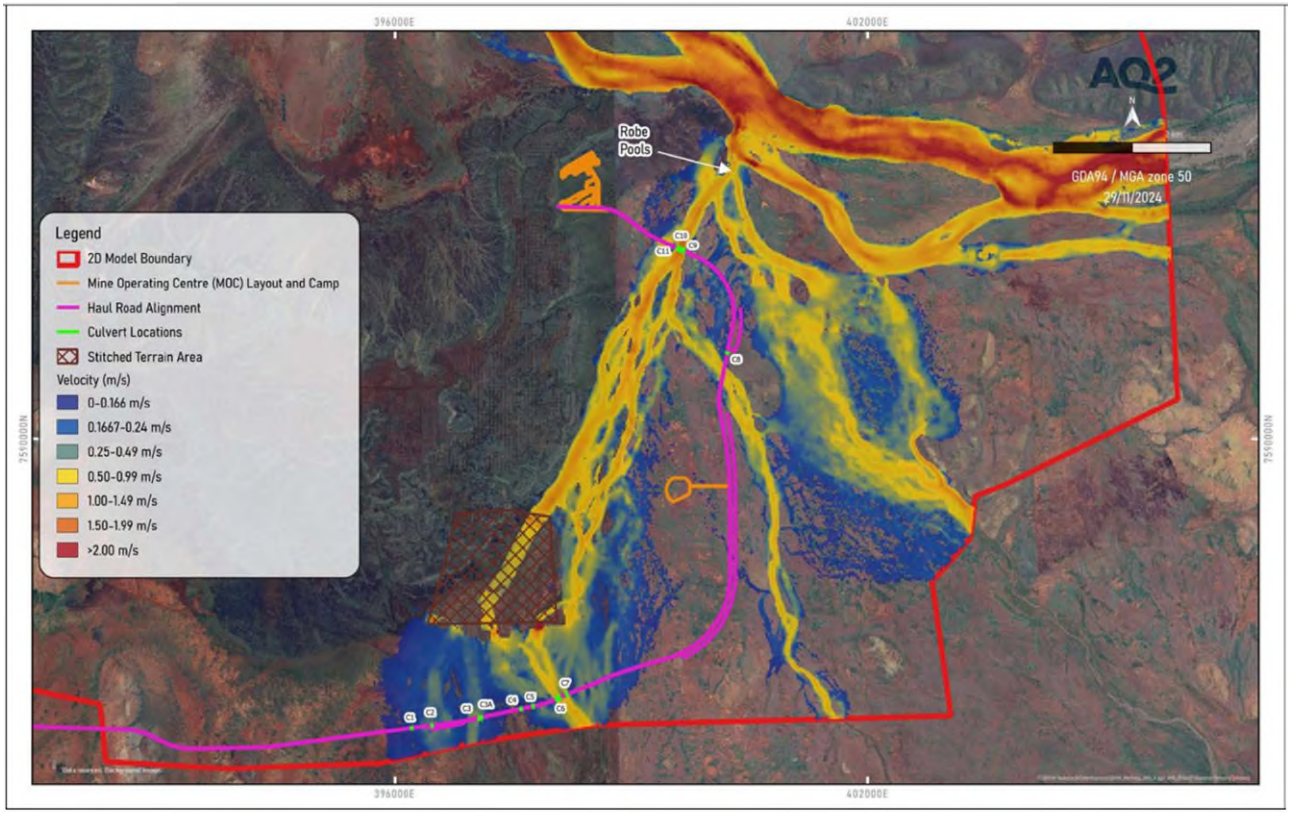


Figure 3.10: Post-development Flood depth 10% AEP (Source: AQ2 2024a)

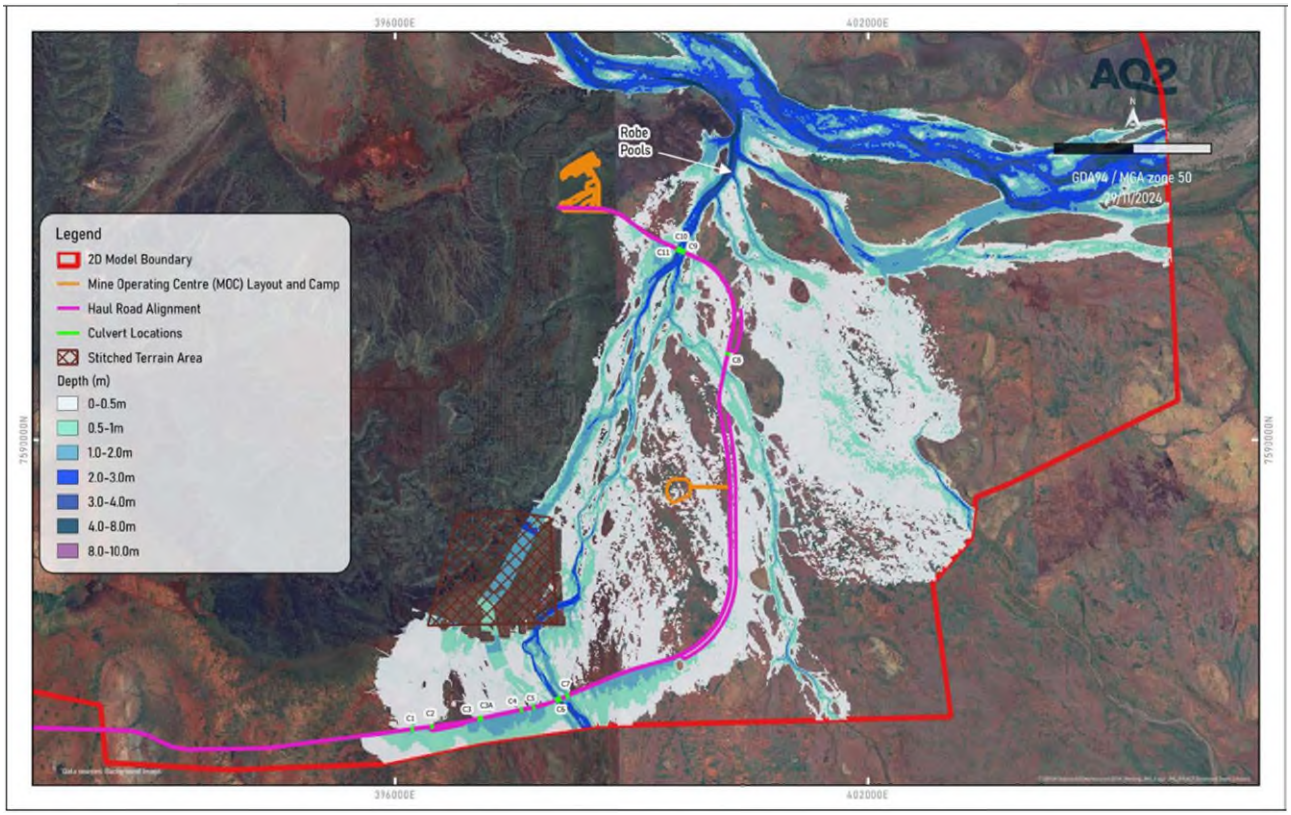


Figure 3.11: Post-development Flood velocity 10% AEP (Source: AQ2 2024a)

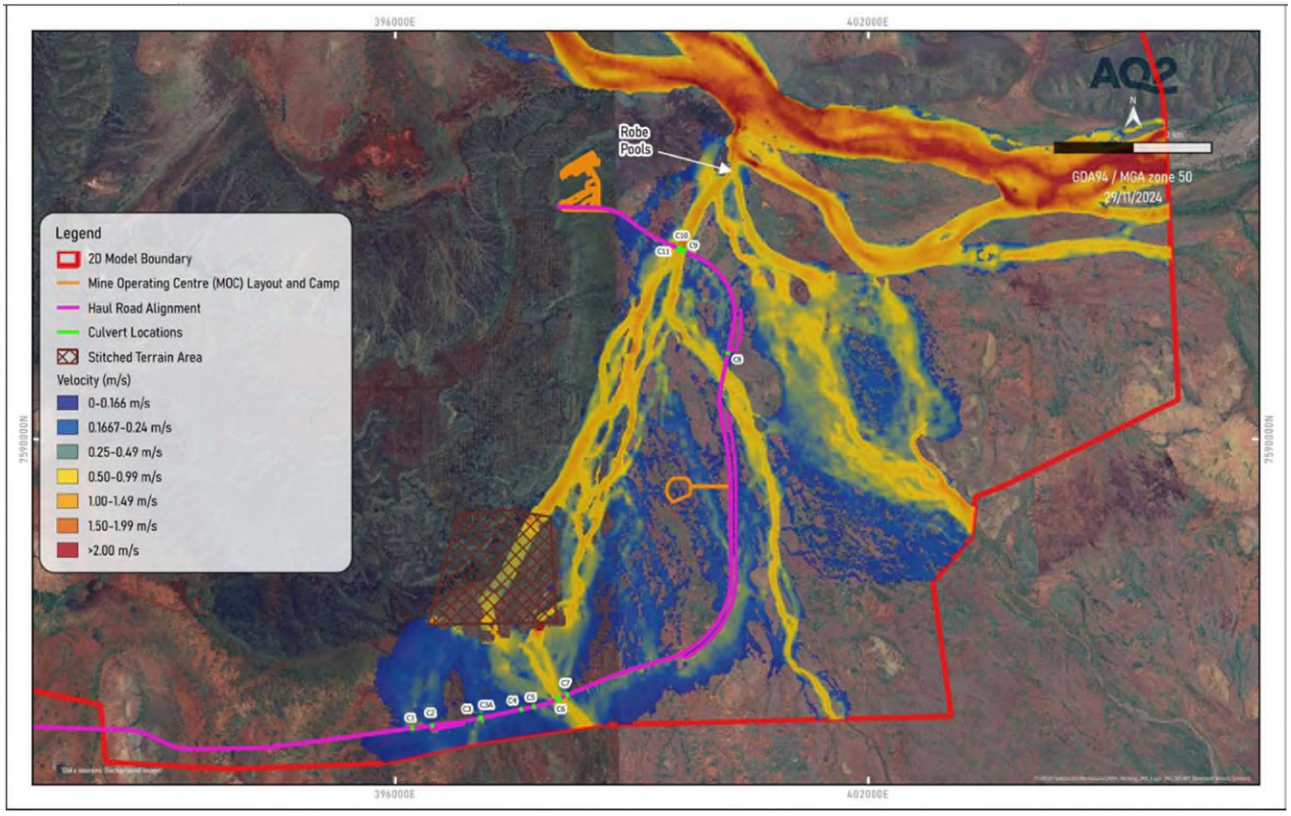
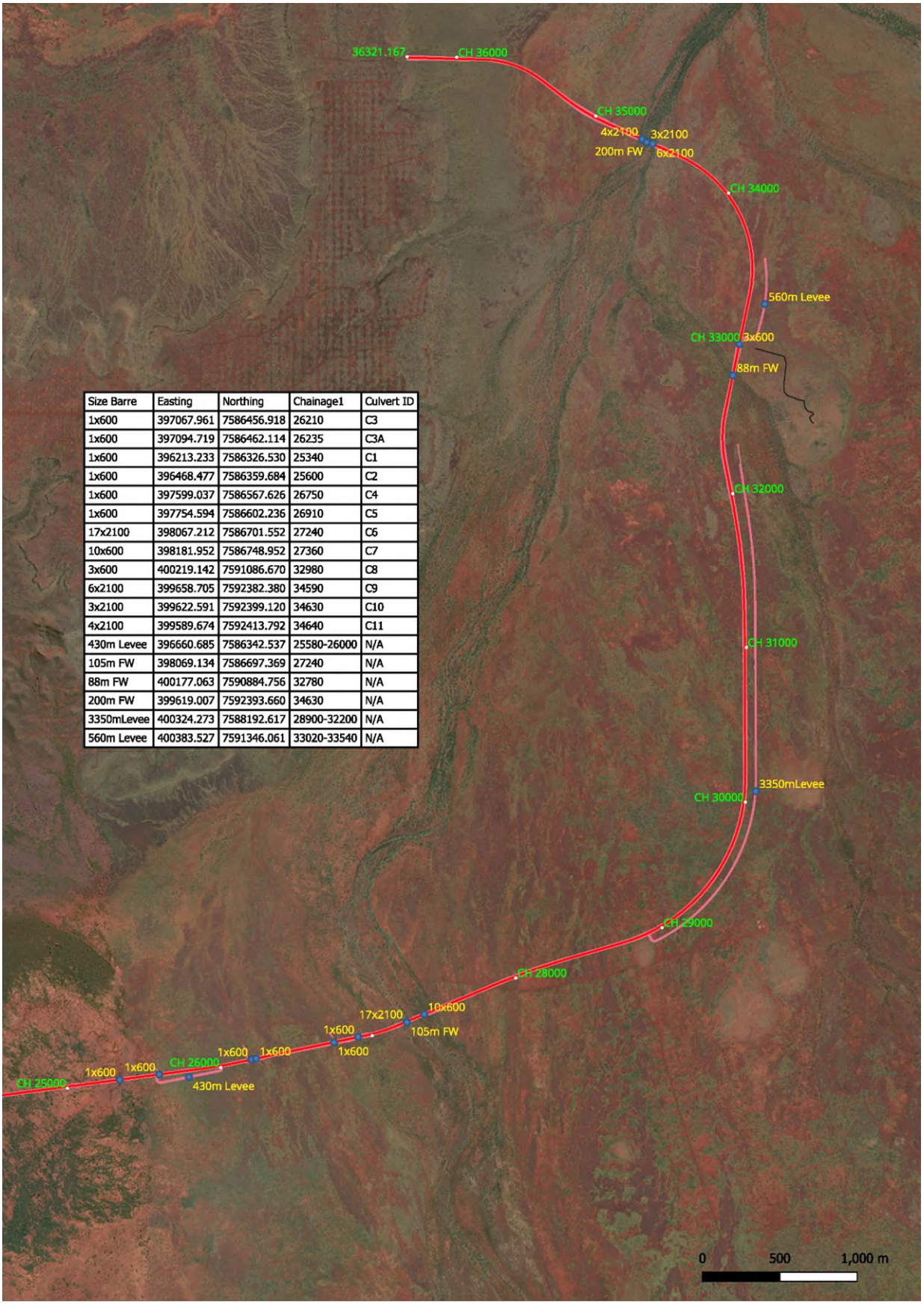


Figure 3.12: Flood management infrastructure Haul Road (Source: Shawmac)



Size Barre	Easting	Northing	Chainage1	Culvert ID
1x600	397067.961	7586456.918	26210	C3
1x600	397094.719	7586462.114	26235	C3A
1x600	396213.233	7586326.530	25340	C1
1x600	396468.477	7586359.684	25600	C2
1x600	397599.037	7586567.626	26750	C4
1x600	397754.594	7586602.236	26910	C5
17x2100	398067.212	7586701.552	27240	C6
10x600	398181.952	7586748.952	27360	C7
3x600	400219.142	7591086.670	32980	C8
6x2100	399658.705	7592382.380	34590	C9
3x2100	399622.591	7592399.120	34630	C10
4x2100	399589.674	7592413.792	34640	C11
430m Levee	396660.685	7586342.537	25580-26000	N/A
105m FW	398069.134	7586697.369	27240	N/A
88m FW	400177.063	7590884.756	32780	N/A
200m FW	399619.007	7592393.660	34630	N/A
3350mLevee	400324.273	7588192.617	28900-32200	N/A
560m Levee	400383.527	7591346.061	33020-33540	N/A

Figure 3.13: Flood management infrastructure mine operations centre (Source: Shawmac)

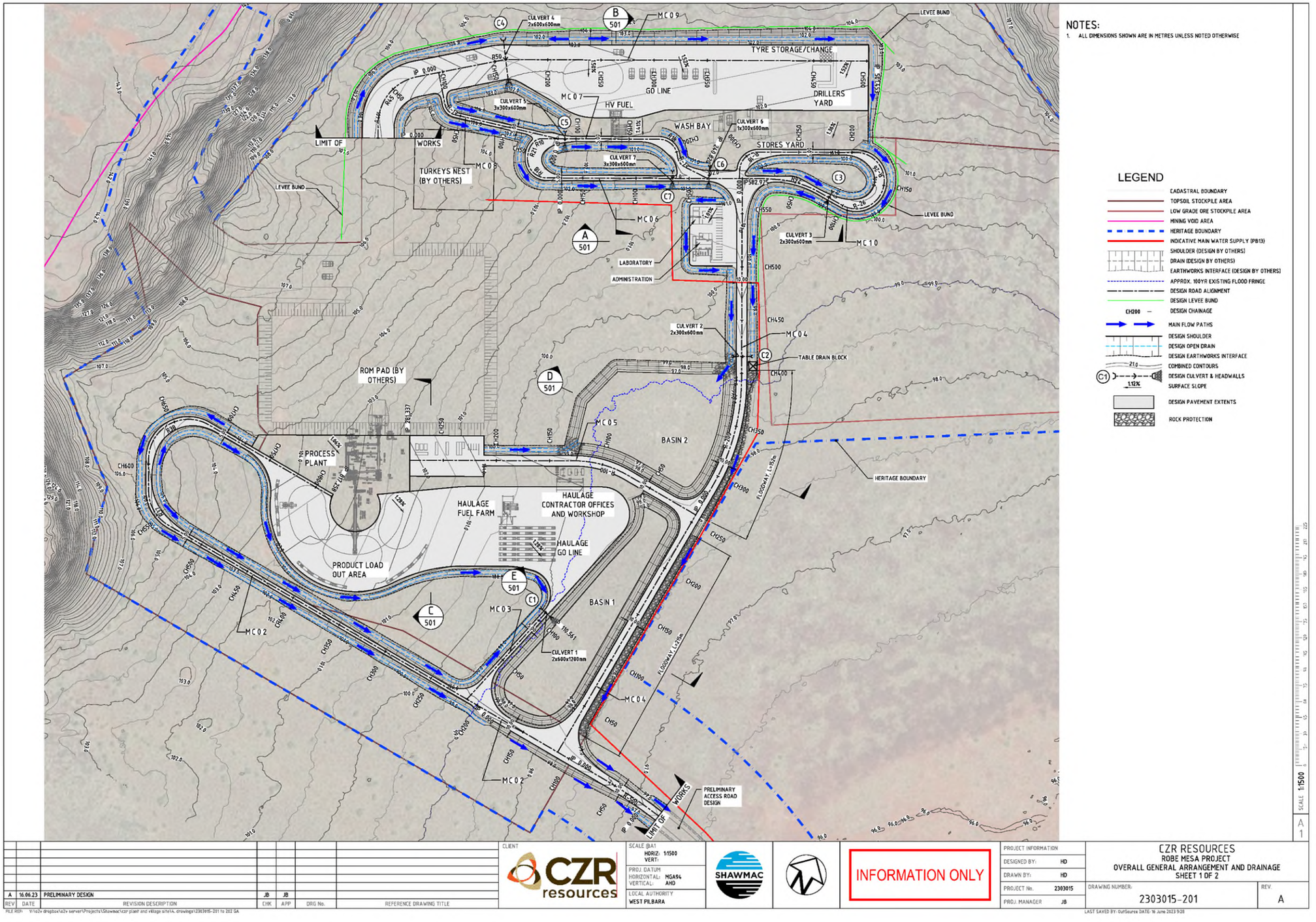


Figure 3.14: 10% AEP Flood Depth Difference Map (Source: AQ2 2024a)

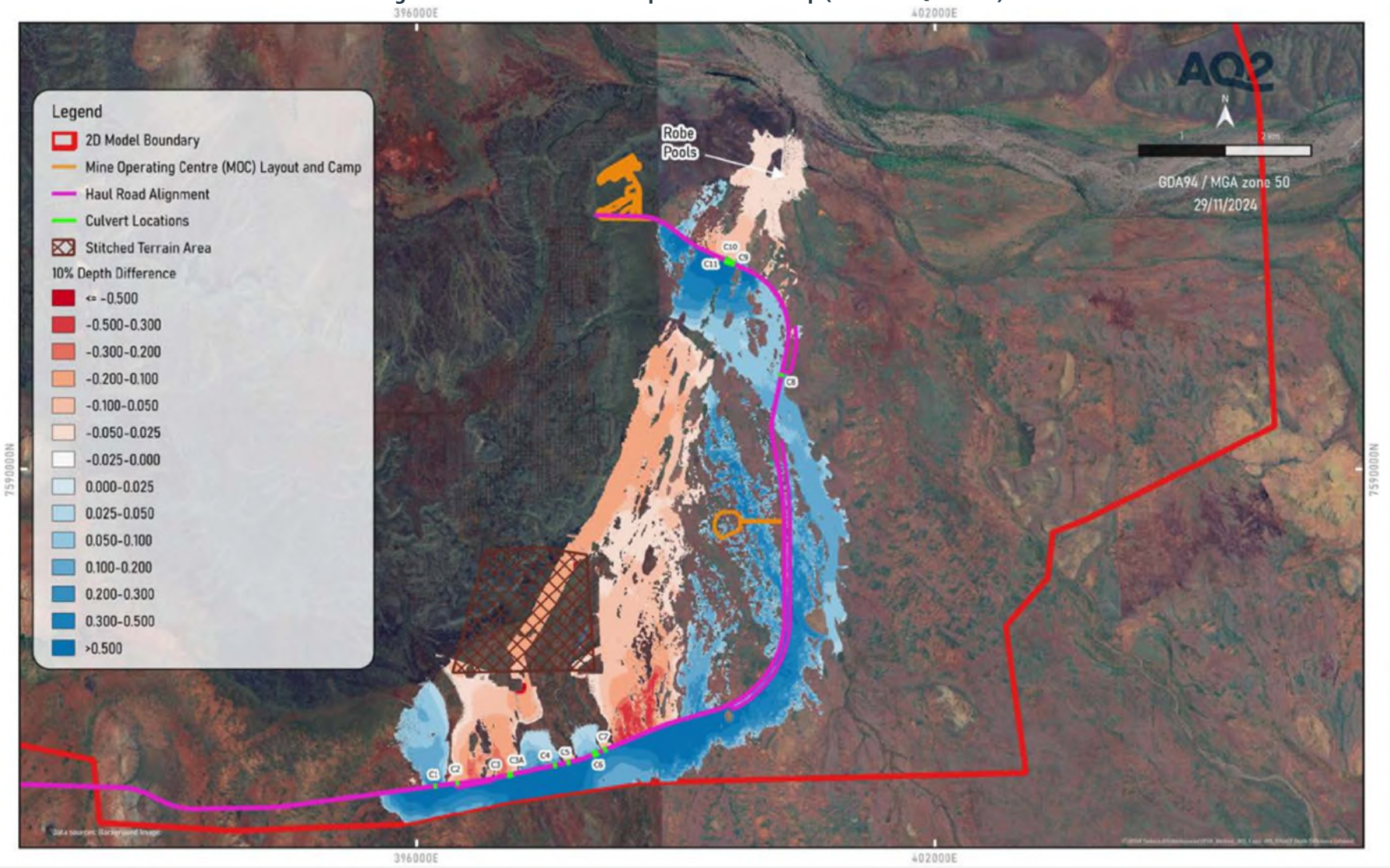
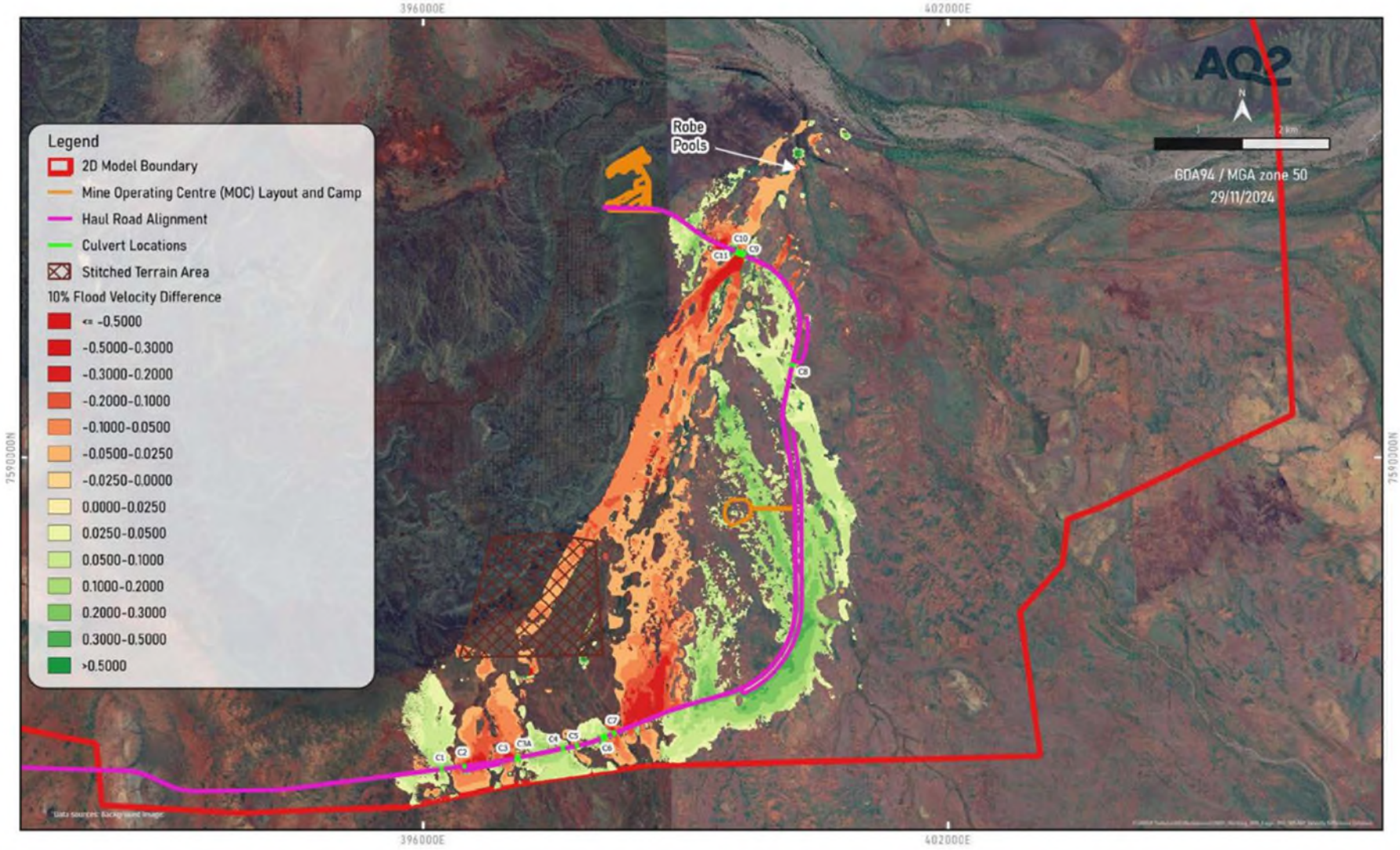


Figure 3.15: 10% AEP Flood Velocity Difference (Source: AQ2 2024a)



3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Biogeographic region

The Interim Biogeographical Regionalisation of Australia (IBRA) currently recognises 89 bioregions and 419 biological subregions within Australia. The Application area lies within the Hamersley (PIL03) subregion of the Pilbara bioregion (PIL) (Department of Energy and the Environment 2016).

The Pilbara bioregion is a major centre for biodiversity within Western Australia. In recognition of this high species diversity and the high levels of endemism in the region, the Hamersley subregion is considered one of the 15 national biodiversity hotspots in Australia. A description of the Pilbara region and the Hamersley subregion and their extent in the Application area is provided in **Table 3.5**.

This appears to be related to the diversity of geological, altitudinal, and climatic elements in the region, as well as being a function of its location in a transitional zone between the floras of the Eyrean (central desert) and southern Torresian (tropical) bioclimatic regions (see for example van Leeuwen and Bromilow (2002) for a detailed discussion of the significance of the Hamersley Range).

According to the 2019 Statewide Vegetation Statistics (Government of WA 2019), the Hamersley (PIL3) subregion is 5,608,386 ha in size and represents approximately 32% of the Pilbara region. The Hamersley subregion is described by Kendrick (2001) as "a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale, and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges. Drainage into either the Fortescue (to the north), the Ashburton to the south, or the Robe to the west".

Table 3.5: Description of the IBRA region and subregion within the Robe Mesa Project

Description	Current Extent*	Extent in Application area		Extent in proposed Disturbance footprint	
		ha	%	ha	%
PIL Pilbara Bioregion (PIL)					
The Pilbara bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses (Bastin and ACRIS 2008).	17,731,764.8 ha (99.6% remaining)	902	0.005	270	0.002
Hamersley Subregion (PIL03)					
Mountainous area of Proterozoic sedimentary ranges and plateaus, dissected by gorges (basalt, shale, and dolerite). Mulga low woodland over bunch grasses on fine textured soils in valley floors and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2003).	5,608,386.0 ha (99.5% remaining)	902	0.02	270	0.005

*Source: Government of WA (2019)

3.2.2 Pre-European Vegetation

Broad-scale vegetation mapping for the locality has been prepared at the 1:1,000,000 scale based on the work of J.S. Beard for the Pilbara (Beard 1975a). The survey area includes four of Beard's vegetation associations (**Figure 3.16**, **Table 3.6**).

The haul road corridor and mine area are dominated by the Stuart Hills 583 association, which comprises sparse Kanji (*Acacia pyrifolia*) shrubs over hard spinifex (*Triodia basedowii* and *T. wiseana*) hummock grasslands.

Sparse Mulga (*Acacia aneura* complex) woodlands of the Stuart Hills 29 association dominate the Mine Infrastructure area.

Very small areas of the Application area fall within the Stuart Hills 620 and Stuart Hills 93 associations, which both comprise hummock grasslands with scattered shrubs or mallee.

3.2.3 Vegetation

Information in this section and the subsequent section (Section 3.2.4 Flora) is based on the following supporting studies:

- RPS (2021). Detailed Flora and Vegetation Assessment. Robe Mesa and Robe East extension deposits (**Appendix 4-1**)
- Biota (2023a) Robe Mesa Project Detailed Flora and Vegetation Survey (**Appendix 4-2**)
- Biota (2023b). Robe Mesa Project: Haul Road Realignment and Associated Vegetation Extrapolation and Consolidation (**Appendix 4-3**)

The primary landforms found throughout the survey area comprised:

- Drainage lines, ranging in scale from major drainages supporting riparian Eucalyptus, Acacia and Melaleuca open forests and woodlands, through to minor drainages of scattered *Corymbia hamersleyana* over mixed Acacia shrubs and *Triodia epactia*;
- Hills and slopes with stony substrates supporting spinifex hummock grasslands; these usually had an overstorey of *Acacia* spp. and *Senna* spp. shrubs over a hummock grassland typically dominated by *Triodia wiseana*;
- Stony or gravelly plains, sometimes with clay soils, supporting Snakewood (*Acacia xiphophylla*) shrublands over tussock/annual grasses; and
- Stony or gravelly plains higher in the landscape supporting spinifex hummock grasslands with a sparse to open cover of shrubs and occasional *Corymbia* trees.

Photographs of the vegetation units of the application area are provided in **Figure 3.17** to **Figure 3.21**.

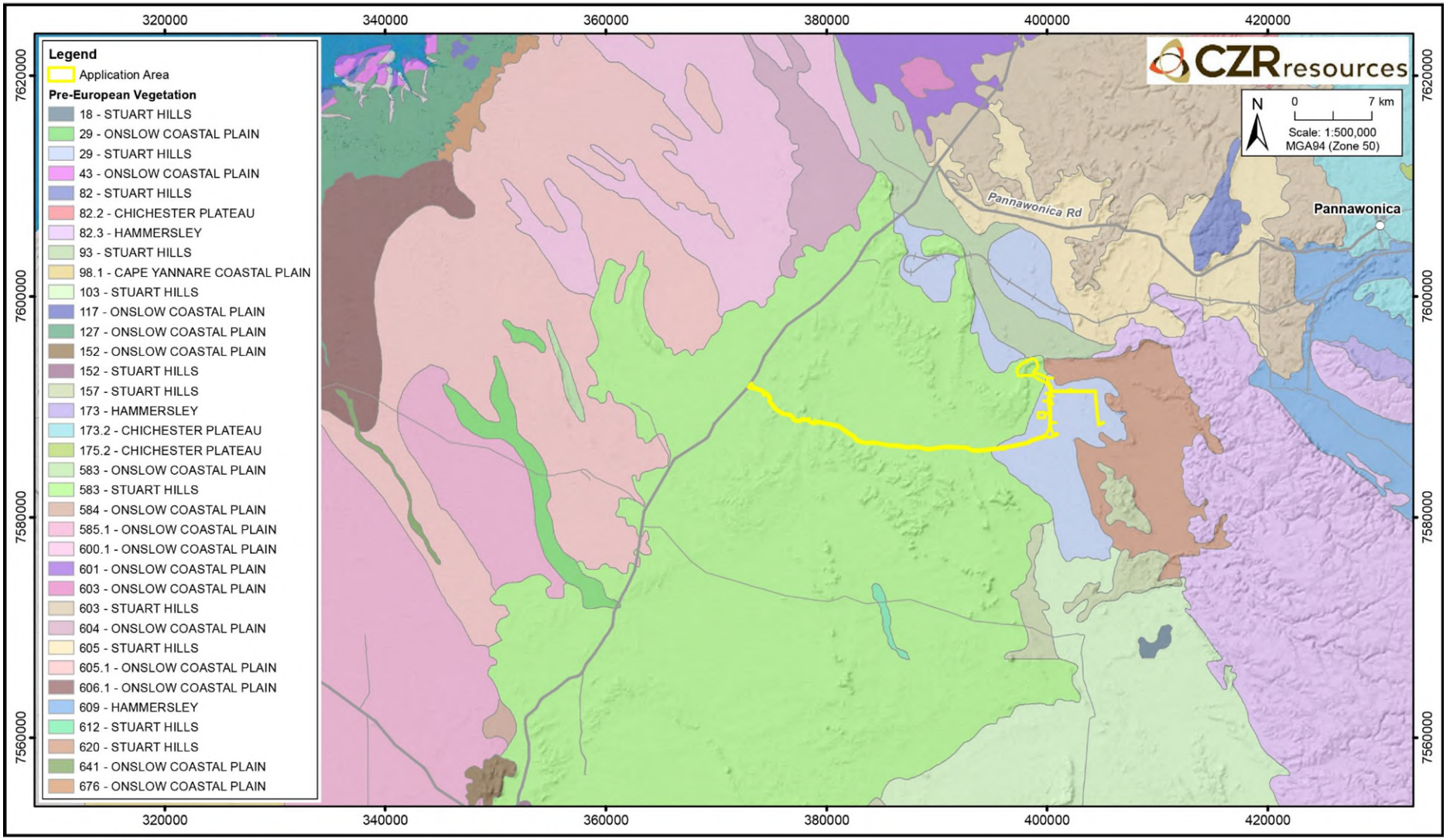
Based on the broad landforms, twenty-two (22) native vegetation units were mapped across the ~6,800 ha survey area, of which 18 were mapped within the Application area and proposed Disturbance footprint. A summary of each mapped vegetation unit and any local significance is presented in **Table 3.7** and **Figure 3.22**.

Table 3.6: Description of Beards vegetation associations within the Robe Mesa Project

Description	Current Extent in Bioregion PIL (ha) (% remaining) *	Current Extent in Subregion PIL03 (ha) (% remaining) *	Extent in Application area and proportion of survey extent		Extent in Disturbance footprint and proportion of survey extent	
			ha	%	ha	%
Stuart Hills 583						
Hummock grasslands, sparse shrub steppe; kanji and *Acacia bivenosa* over hard spinifex *Triodia basedowii* and T. *wiseana*.	243,111.7 ha (100% remaining)	240,724.2 ha (100% remaining)	628	0.3% of PIL bioregion 0.3% of PIL03 subregion	194	0.08% of PIL bioregion 0.08% of PIL03 subregion
Stuart Hills 29						
Sparse low woodland; mulga, discontinuous in scattered groups.	1,131,712.0 ha (99.9% remaining)	170,747.6 ha (99.2% remaining)	274	0.02% of PIL bioregion 0.2% of PIL03 subregion	76	0.007% of PIL bioregion 0.04% of PIL03 subregion
TOTAL			**902**	**0.07% of PIL bioregion 0.2% of PIL03 subregion**	**270**	**0.02% of PIL bioregion 0.07% of PIL03 subregion**

*Source: Government of WA (2019)

Figure 3.16: Beard's Vegetation Associations of the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_10, Rev: A ~ PreEuroVeg: DPIRD-006

Table 3.7: Vegetation mapping of the Robe Mesa Project

Unit ID	Description	Significance - species associated with the vegetation unit	Survey extent (ha)	Application area and proportion of survey extent		Disturbance footprint and proportion of survey extent	
				ha	%	ha	%
A1	*Acacia xiphophylla* tall shrubland over *Triodia epactia* open hummock grassland.	*Eragrostis crateriformis* (P3).	790.1	86.6	11.0	18.5	2.3
A2	*Acacia xiphophylla* tall shrubland over *Triodia wiseana* very open hummock grassland.	N/A	83.8	5.9	7.0	1.9	2.3
A3	Mixed *Acacia* spp. over *Triodia wiseana*.	N/A	686.0	60.1	8.8	8.9	1.3
A4	Mixed *Acacia* spp. over *Triodia epactia*.	*Eragrostis crateriformis* (P3).	1,388.3	155.9	11.2	37.8	2.7
A5	Mixed *Acacia* spp. over *Triodia longiceps*.	N/A	564.5	76.2	13.5	15.3	2.7
A6	*Acacia arida* over *Triodia wiseana.*	N/A	139.0	92.3	66.4	65.0	46.8
A7	*Acacia bivenosa* over *Triodia wiseana*.	N/A	209.5	23.8	11.4	13.8	6.6
A8	Asy.EcrTe - *Acacia synchronicia* Mid Open Shrubland over *Triodia epactia* Open Hummock Grassland (with intermittent clay pans with ephemeral Open Forbland and Open Tussock Grassland)	N/A	140.6	31.0	22.0	12.3	8.8
C1	*Corymbia hamersleyana* over mixed *Acacia* spp. over *Triodia epactia*.	*Eragrostis crateriformis* (P3).	548.8	78.5	14.3	30.1	5.5
C2	*Corymbia candida* subsp. *candida* over mixed *Acacia* spp. over *Triodia epactia*.	*Eragrostis crateriformis* (P3) and *Goodenia nuda* (P4)	593.3	78.8	13.3	20.7	3.5
C3	*Corymbia deserticola* subsp. *deserticola* over mixed *Acacia* spp. over *Triodia epactia*.	N/A	11.3	-	-	-	-
C4	*Corymbia zygophylla* over mixed *Acacia* spp. over *Triodia* spp.	N/A	162.4	23.7	14.6	7.0	4.3
C5	*Corymbia hamersleyana* over mixed *Acacia* spp. over *Triodia epactia*.	*Eragrostis crateriformis* (P3).	597.3	55.8	9.3	11.7	2.0

Unit ID	Description	Significance - species associated with the vegetation unit	Survey extent (ha)	Application area and proportion of survey extent		Disturbance footprint and proportion of survey extent	
				ha	%	ha	%
E1	*Eucalyptus leucophloia* subsp. *leucophloia* over mixed *Acacia* spp. over *Triodia wiseana*.	N/A	332.1	65.6	19.8	13.3	4.0
E2	*Eucalyptus victrix* (*Eucalyptus camaldulensis* subsp. *refulgens*) and *Melaleuca* spp. over mixed *Acacia* spp. over **Cenchrus* spp.	*Eragrostis crateriformis* (P3); and species associated with GDV.	179.2	13.9	7.8	1.5	0.8
E3	El.Aa.TwTp - *Eucalyptus leucophloia* Low Isolated Clumps of Trees over *Acacia arida* Isolated Clumps of Shrubs over *Triodia wiseana* and *T. pisoliticola* Sparse Hummock Grassland	*Triodia pisolitico*la (P3);	16.8	13.1	77.8	0.5	2.7
E4	El.AtuGr - *Eucalyptus leucophloia* Low Open Woodland over *Gossypium robinsonii* and *Acacia tumida* var. *pilbarensis* Tall Open Shrubland over *Acacia arida* Mid Open Shrubland Over *Triodia wiseana*, (*Triodia pisoliticola*) Open Hummock Grassland	*Triodia pisoliticola* (P3)	1.8	1.4	75.1	-	-
E5	AsyAsc.Te - *Eucalyptus victrix* and *Corymbia hamersleyana* Low Isolated Trees over *Acacia synchronicia* and *A. sclerosperma* subsp. *sclerosperma* Tall Sparse Shrubland over a mixed Low Open Shrubland / Forbland over *Triodia epactia* Sparse Hummock Grassland	Species associated with GDV	94.1	-	-	-	-
M1	MaEc.Mg.Cv - *Melaleuca argentea* and *Eucalyptus camaldulensis* subsp. *refulgens* Mid Open Forest over *Melaleuca glomerata* Tall Open Shrubland over *Cyperus vaginatus* Open Sedgeland	Species associated with GDV	0.3	-	-	-	-
S1	*Senna* spp. and *Acacia bivenosa* over *Triodia wiseana*.	N/A	100.6	5.3	5.3	1.1	1.1
T1	*Triodia longiceps* open hummock grassland.	N/A	159.2	19.3	12.1	2.6	1.6
T2	*Triodia epactia* hummock grassland.	N/A	44.0	8.0	18.2	2.6	6.0
D1	Cleared areas.	N/A	30.5	7.3	23.9	4.8	15.8

Figure 3.17: Photographs of drainage line vegetation (units E2 and C5)

Figure 3.18: Photographs of hills and slopes vegetation (units E1 and A6)

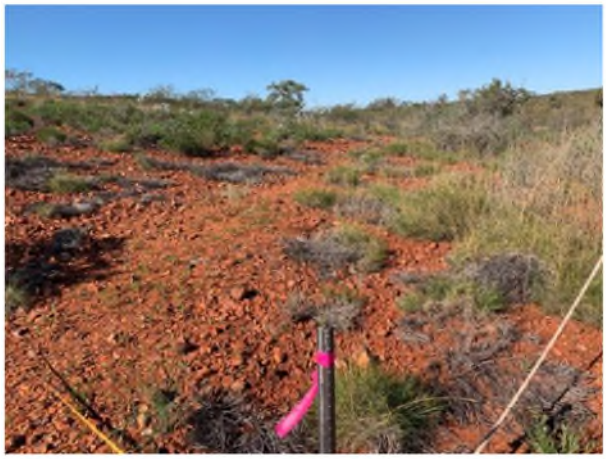
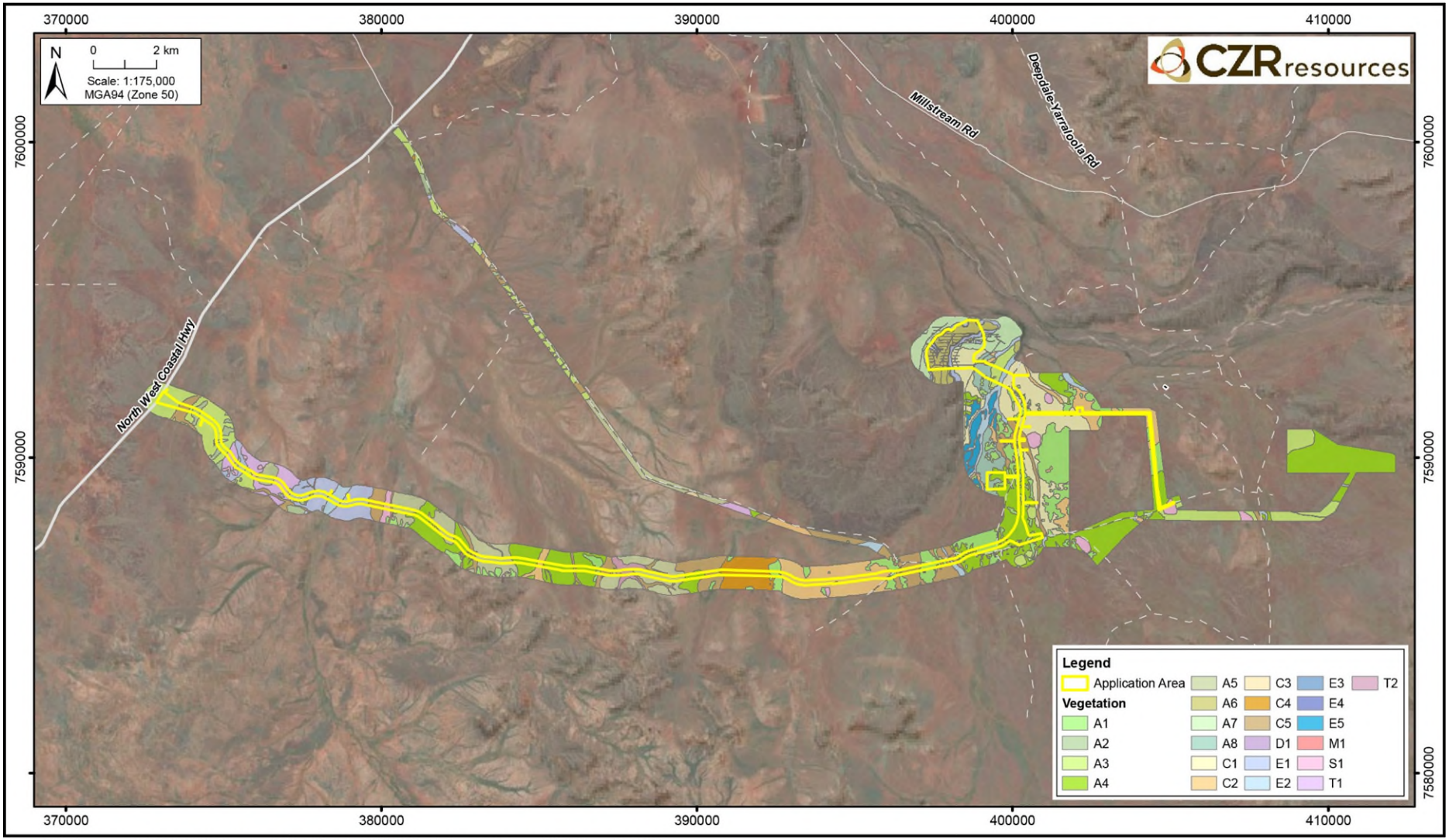


Figure 3.19: Photographs of snakewood on plains vegetation (units A1 and A2)

Figure 3.20: Photographs of stony plains vegetation (units T1 and T2)

Figure 3.21: Photographs stony plains vegetation (units C2 and C3)

Figure 3.22: Vegetation mapping of the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_11, Rev: A ~ Imagery: ESRI, Maxar (Oct 2021)

3.2.3.1 Conservation Significant Vegetation

Only two Threatened Ecological Communities are listed for the Pilbara: the "The meda grasslands on cracking clays (Hamersley Station, Pilbara)" and the "Ethel Gorge aquifer stygobiont community". Neither of these occur within the locality and do not occur within the Application area.

Forty-three PECs are listed for the Pilbara bioregion (DBCA 2022), with the broad DBCA management buffer of one vegetation-related PEC falling within the Application area (**Figure 3.23**):

- The Priority 3 "*Triodia pisoliticola* (previously *Triodia* sp. Robe River) assemblages of mesas of the West Pilbara" PEC intersects the EAA. "This community is typically restricted to mesas and cordillo landforms where the plant assemblages are dominated by or contain *Triodia pisoliticola* and are indicative of inverted landscapes; that is, where *Triodia pisoliticola* occurs in combination with species that are considered 'out-of-context' from their normal habitat. The community is a combination of *Triodia pisoliticola* with *Acacia pruinocarpa, A. citrinoviridis* on slopes or peaks of mesas. These two Acacias are generally found associated with Pilbara creeklines and their occurrence is probably indicative of the genesis of the mesa surfaces in wetlands, then erosion of the landscape and 'inversion of the landscape' such that the mesa slopes and peaks that were previously low in the landscape become high points" (DBCA 2022).

Following field inspection, the habitat and the vegetation was considered unlikely to support the *Triodia pisoliticola* PEC. This community typically occurs on the edges and upper slopes of geologically distinct mesas immediately below the mesa edge breakaway. The elevated area that was assessed presented as more of a steep rocky hill with large boulders, rather than a mesa with exposed vertical faces on the margins. The vegetation was also mapped as A6 and appeared to comprise an *Acacia arida, Senna glutinosa* subsp. *pruinosa* tall open shrubland over *Triodia wiseana* open hummock grassland; whereas characteristic indicator species of the PEC, such as *Acacia pruinocarpa* and *A. citrinoviridis*, were not observed.

Triodia pisoliticola plants are present within two mapped vegetation types of the Robe Mesa Project Disturbance envelope (RPS 2021), El.Aa.TwTp and El.Aa.TwTp. The presence of *Triodia pisoliticola* alone does not necessarily represent the PEC.

The description of the *Triodia pisoliticola* PEC has been revised and refined by DBCA, in consultation with APIM, since 2011. In general, the following components potentially represent the *Triodia pisoliticola* PEC (Western Botanical 2015; and Newland Environmental 2021):

Species composition and abundance elements:

- *Triodia pisoliticola* – must be dominant. It is not automatically considered PEC just because *Triodia pisoliticola* is present.
- *Acacia citrinoviridis* and/or *Acacia pruinocarpa* – must be present (not required to be dominant). Ideal to have both species present with *Triodia pisoliticola*.
- Other species considered within the PEC include *Gossypium robinsonii*, *Petalostylis labicheoides* and *Stylobasium spathulatum* – but must also be present with *Acacia citrinoviridis* or *Acacia pruinocarpa*).
- It is not considered PEC if *Eucalyptus leucophloia* is dominant, although this species may be scattered (in very low abundance) within the PEC.

Landform elements

- Mesa and cordillo landforms.
- Robe pisolite mesas and breakaway slopes.

Two vegetation types mapped with the Robe Mesa project Disturbance envelope contained *Triodia pisolitica* (Vegetation E3 and E4). Of these, only E3 was recorded within the proposed disturbance footprint, and represented 0.5 ha disturbance (**Table 3.8**). This vegetation type is associated with the mesa edge and the disturbance proposed is associated with the access ramp to the mesa top. A minimal disturbance footprint is required within this vegetation type.

Following field inspections, it was noted by Biota (2023) that the vegetation was considered unlikely to support the *Triodia pisoliticola* PEC. This community typically occurs on the edges and upper slopes of geologically distinct mesas immediately below the mesa edge breakaway. Potential areas of the Robe Mesa Project area presented more as steep rocky hills with large boulders, rather than a mesa with exposed vertical faces on the margins. Characteristic indicator species of the PEC, such as *Acacia pruinocarpa* and *A. citrinoviridis*, were also not observed.

Table 3.8: Vegetation mapping of the Robe Mesa Project

Unit ID*	Description (including RPS 2021 vegetation unit code)	Significant species associated vegetation unit	Survey extent (ha)	Disturbance envelope (Application area) (ha)	Disturbance footprint (ha)
E3	El.Aa.TwTp - *Eucalyptus leucophloia* Low Isolated Clumps of Trees over *Acacia arida* Isolated Clumps of Shrubs over *Triodia wiseana* and *T. pisoliticola* Sparse Hummock Grassland	*Triodia pisolitico*la (P3)	16.8	13.1	0.5
E4	El.AtuGr - *Eucalyptus leucophloia* Low Open Woodland over *Gossypium robinsonii* and *Acacia tumida* var. *pilbarensis* Tall Open Shrubland over *Acacia arida* Mid Open Shrubland Over *Triodia wiseana*, (*Triodia pisoliticola*) Open Hummock Grassland	*Triodia pisoliticola* (P3)	1.8	1.4	-

It should also be noted that the part of the Application area that sits within the buffer of the *Triodia pisoliticola* PEC does not require clearing (**Figure 3.23**). This section of the Application area will accommodate the already cleared pad associated with the existing production bore PB13-3. The pipeline route running north to the project site will lay along an existing track within the Application area. The water supply bore, and pipeline have been provided in the application for project completeness, in order that the Application area incorporates all components of the Mining Proposal.

3.2.3.2 Groundwater Dependent Vegetation

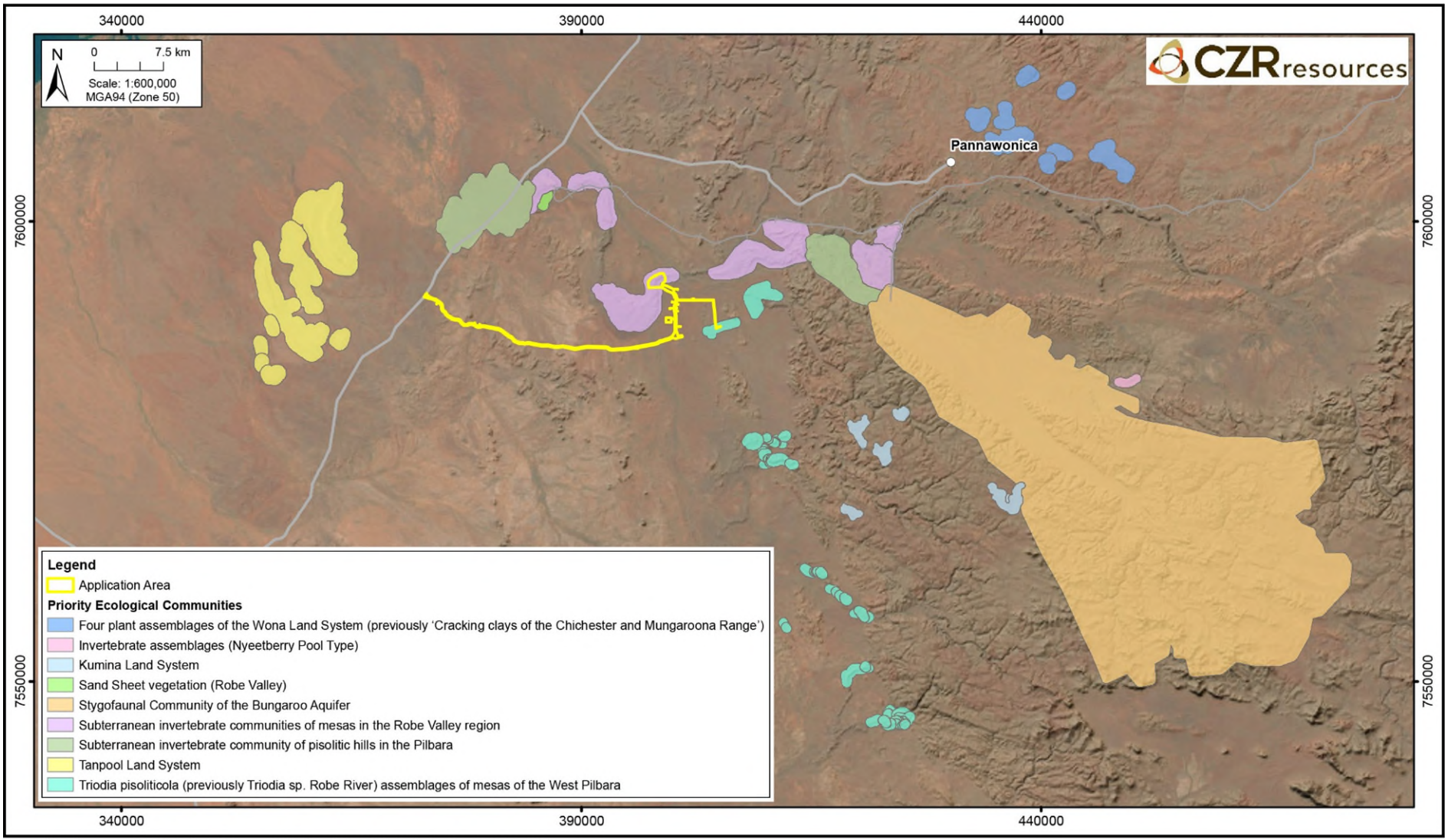
Three vegetation units (E2; E5; and M1) represent groundwater dependent vegetation, comprising drainage systems that support *Eucalyptus victrix* (low to moderate dependence), *Eucalyptus camaldulensis subsp. refulgens* (moderate dependence) and/or *Melaleuca argentea* (high dependence). These three species are all indicator species of groundwater dependent vegetation (Rio Tinto 2020). Of these vegetation units, only E2 is mapped within the Application area and only represents 0.5 ha of the disturbance footprint (associated with drainage crossing points along the transport corridor).

The Robe Mesa Project will not be dewatering the mine pit as current groundwater levels are approximately 50-60 m below the mesa surface and mine pits will extend no more than 40 m below the mesa surface.

There will be no drawdown of groundwater contours in and around the mine area. The groundwater supply for the project is based on an existing Production Bore (PB13-1), which is located approximately 8km southeast away from the Robe River pools and the mine area and any groundwater dependent vegetation, with no E2 vegetation unit mapped in the vicinity. There are no GDVs or GDEs associated with this location of PB13-3 (**Figure 3.3**).

PB13-3 is currently licensed under GWL180637 to sustainably abstract up to 95,000 kL pa.

Figure 3.23: Ecological communities of the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_12, Rev: A ~ PEC: DBCA

3.2.3.3 Condition

The condition of the vegetation ranged from 'Excellent' to 'Completely Degraded', with most (over 95%) ranked from 'Very Good' or better condition. Poor condition sites are generally associated with existing tracks and other pastoral infrastructure.

3.2.4 Flora

A total of 422 confirmed native flora species from 161 genera. The most common families recorded included Fabaceae, Malvaceae, Poaceae, Asteraceae, Amaranthaceae, Chenopodiaceae, Convolvulaceae, Cyperaceae.

3.2.4.1 Conservation Significant Flora

Three flora species, *Aluta quadrata, Quoya zonalis* and *Thryptomene wittweri*, are listed as Threatened for the Pilbara bioregion (**Table 3.9**). Based on their known distribution and habitat preferences, none of these species would occur within the Application area (**Figure 3.24**).

No Threatened flora species were recorded from the survey area based on their preferred habitats.

Table 3.9: Threatened Flora species listed for the Pilbara bioregion.

Species	Significance		Distribution overlaps survey area
	State	Commonwealth	
Aluta quadrata	EN	-	No – restricted to southern Pilbara / northern Gascoyne (>200 km southeast)
Quoya zonalis (Pilbara Foxglove)	EN	EN	No – restricted to ranges of hills west of Marble Bar.
Thryptomene wittweri (Mountain Thryptomene)	VU	VU	No – known from a few widely separated locations on mountain tops in the southern Pilbara, western Gascoyne, and western Little Sandy Desert (>200 km southeast)

EN – Endangered; VU - Vulnerable

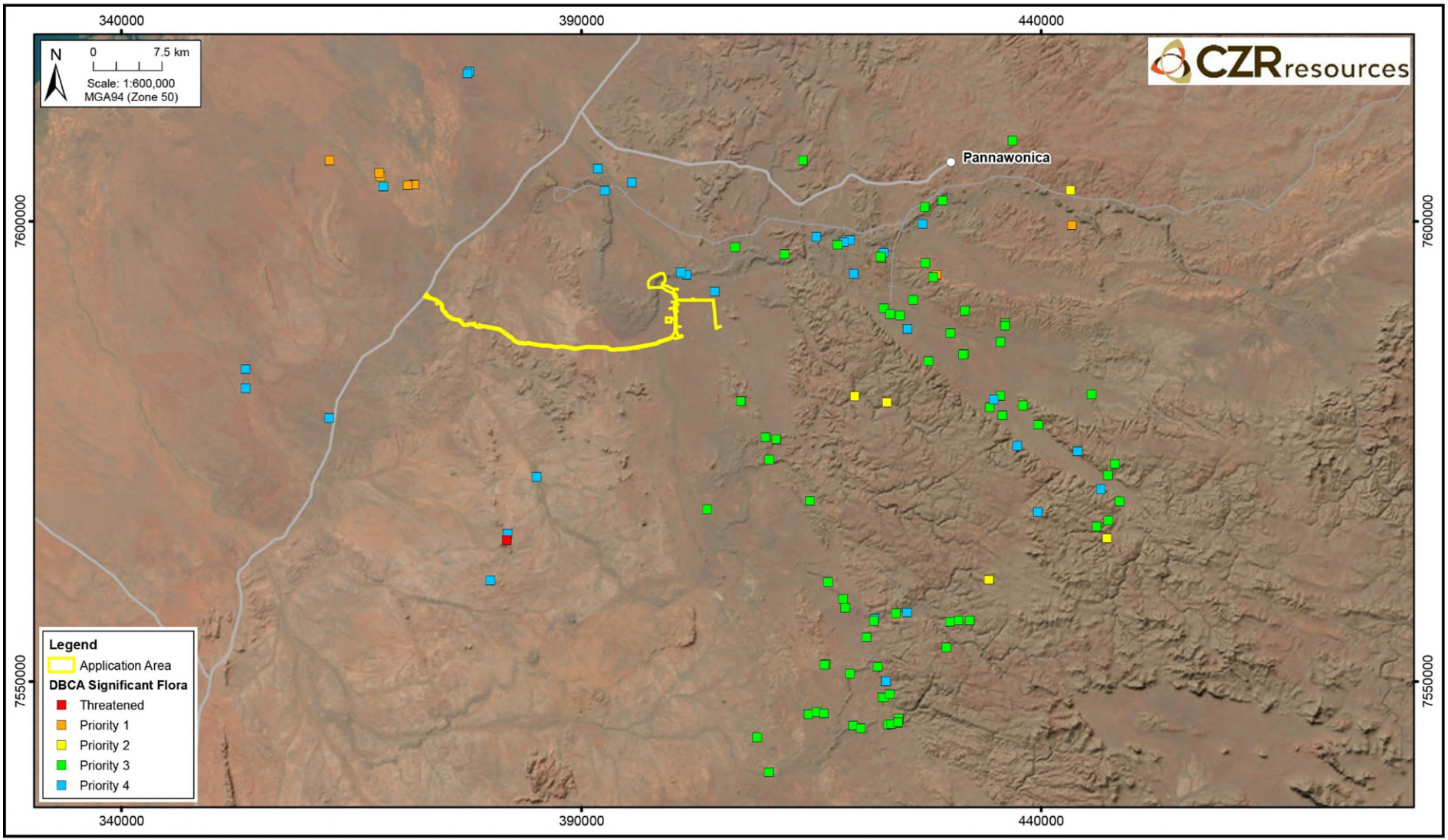
Six Priority Flora species were considered likely to, or may, occur, based on local records or potential habitat. These six species above formed the basis for targeted searches during surveys of the Application area (RPS 2021, Biota 2023a):

- *Eragrostis crateriformis* (P3) was known to occur from previous surveys (RPS 2021).
- *Rhynchosia bungarensis* (P4) was recorded from numerous locations in the vicinity.
- *Triodia mallota* (P1) has potential to occur if suitable shale habitat was present.
- *Eragrostis surreyana* (P3) often occurs with *Rhynchosia bungarensis* (P3).
- *Solanum* sp. Red Hill (S. van Leeuwen et al. PBS 5415) (P3) may occur if suitable hills habitat was present.
- *Triodia pisoliticola* (P3) was recorded locally on the edges of mesas.

Three Priority species were confirmed from the surveys, *Eragrostis crateriformis* (P3) (**Figure 3.25**), *Goodenia nuda* (P4) (**Figure 3.26**) and *Triodia pisoliticola* (P3) (**Figure 3.27**).

The three recorded Priority Flora are described below and their distribution across the survey area is presented in **Figure 3.28** and **Figure 3.29**.

Figure 3.24: Threatened and Priority Flora regional mapping, DBCA search.



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_13, Rev: A ~ Flora: DBCA

Eragrostis crateriformis (P3)

Eragrostis crateriformis is an annual grass growing to 40 cm tall and commonly found in clayey loam or clay on creek banks and depressions in the landscape (**Figure 3.25**).

Eragrostis crateriformis (P3) was recorded from 376 locations across the survey area (**Figure 3.28** and **Figure 3.29**), of which 70 records (18.6% of survey records) are within the Disturbance footprint (from 122 within the Application area). A total of 3,481 individuals were recorded from six vegetation types within the Application area (A1, A4, C1, C2, C5, E2).

Figure 3.25: Photograph of *Eragrostis crateriformis* (P3)

Goodenia nuda (P4)

Goodenia nuda is an erect to ascending herb growing to 0.5 m high with yellow flowers (**Figure 3.26**). The species occurs on hardpan plains and along drainage lines on red clayey loam throughout the Pilbara region (WAH 2021).

A total of 117 individuals were recorded at 26 locations within the survey area within one vegetation unit, C2 (**Figure 3.28** and **Figure 3.29**). No records of *Goodenia nuda* are within the Disturbance footprint (or Application area).

Triodia pisoliticola (P3)

Triodia pisoliticola is a 'soft' spinifex grass growing to 1 m high with sprawling pale green foliage (**Figure 3.27**). The species occurs on the slopes and crests of ironstone hills and mesas, on red-brown sandy loams with ironstone pebbles, stones, and outcropping rock (WAH 2021; Barrett and Trudgen 2018). Most of the known records are on the edges and tops of mesas capped with Robe Pisolite (Barrett and Trudgen 2018).

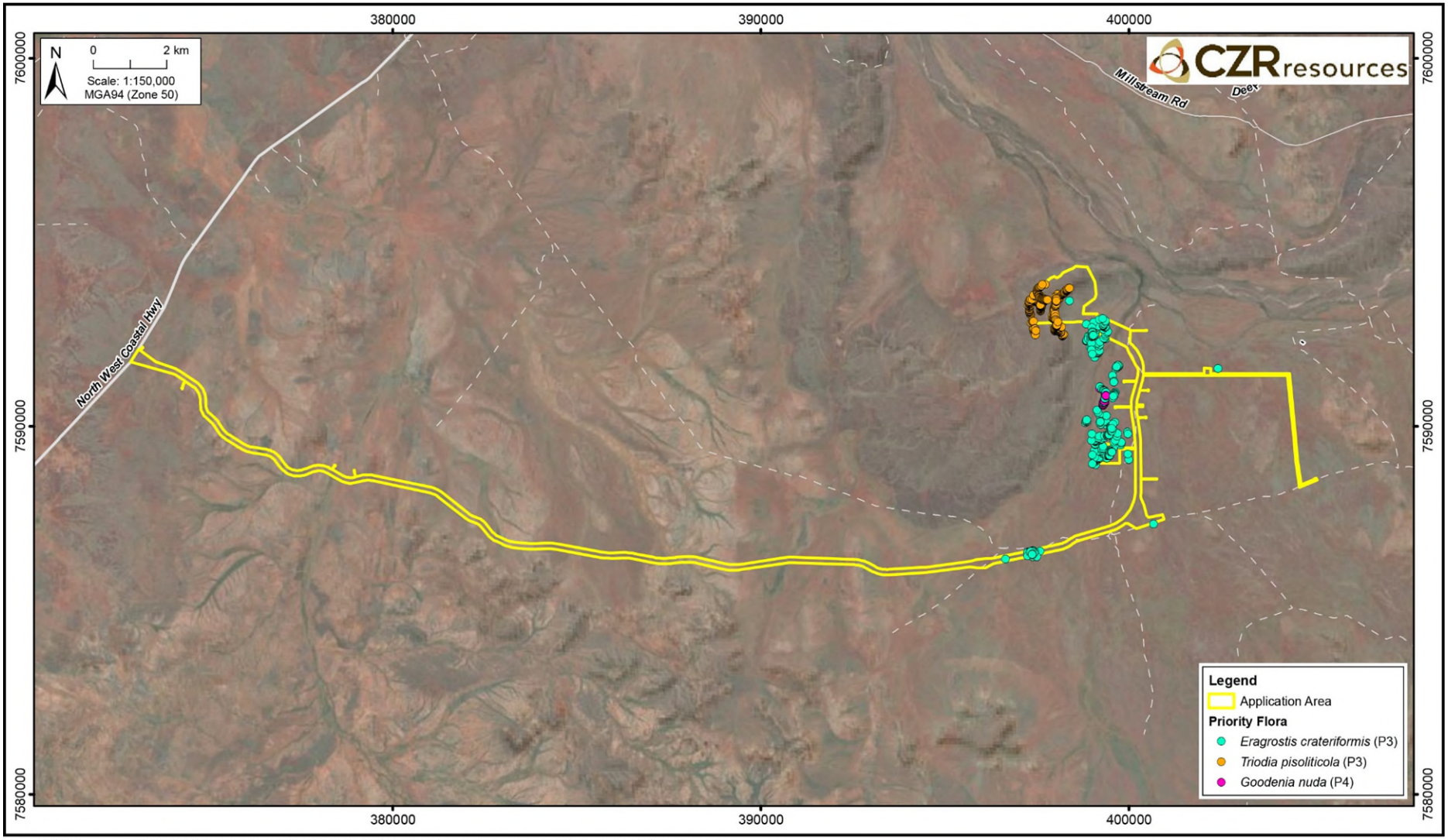
The species occurs in the west Pilbara region, with a range of about 200 km in the Robe River Valley.

More than 12,000 individuals were recorded from 412 locations within the survey area within two vegetation units, E3 and E4 (**Figure 3.28** and **Figure 3.29**). Of the 412 recorded locations, only 21 of these (5.1%) are within the Disturbance footprint.

Figure 3.26: Photograph of *Goodenia nuda* (P4) on clay flats

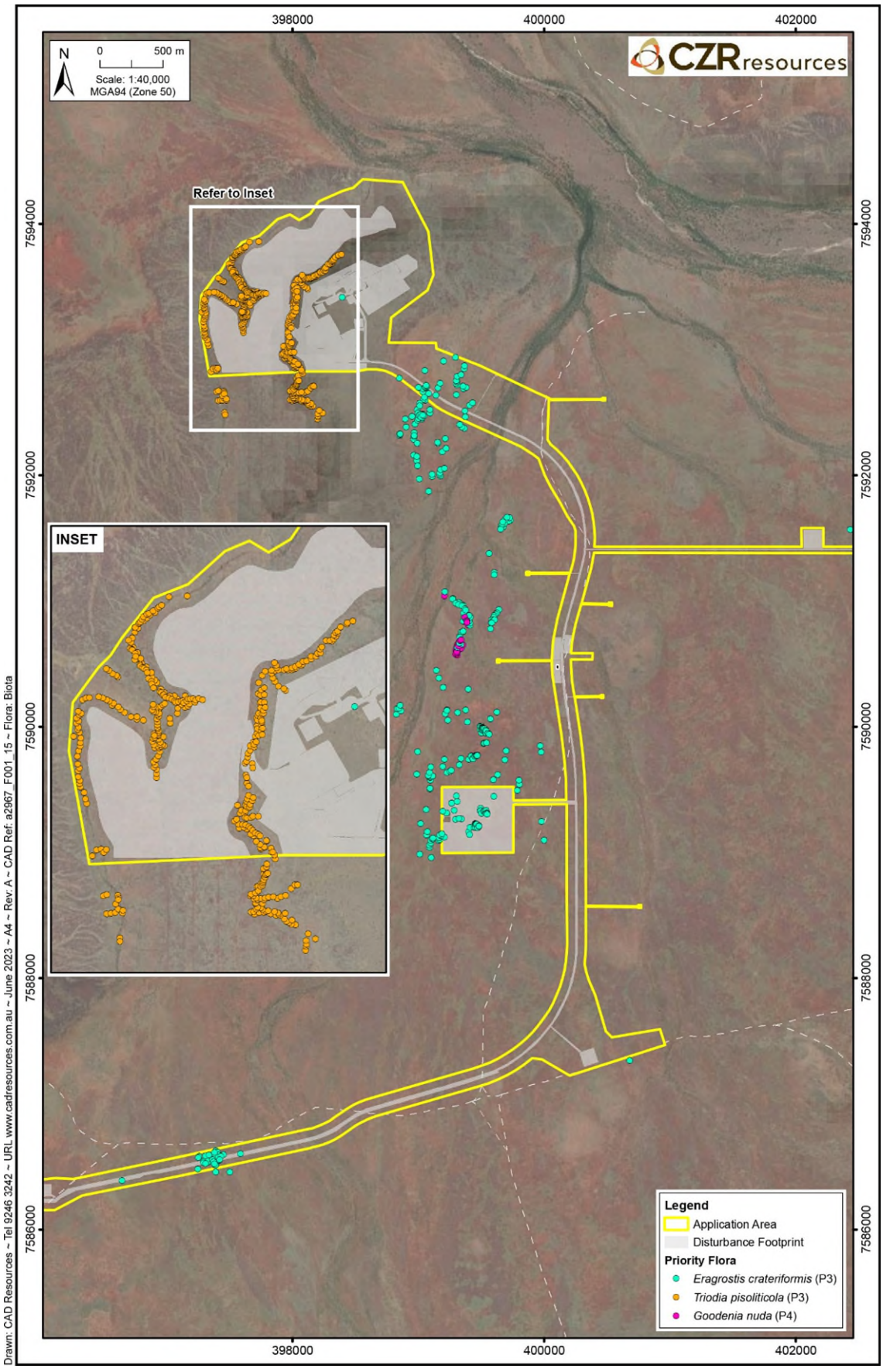
Figure 3.27: Photograph of *Triodia pisoliticola* (Source: Barrett and Trudgen 2018)

Figure 3.28: Priority Flora records from the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_14, Rev: A ~ Imagery: ESRI, Maxar (Oct 2021), Flora: Biota

Figure 3.29: Priority Flora records from the Robe Mesa Project, Inset Map



3.2.4.2 Weeds

Eighteen weed species were recorded from the survey area (as well as sterile material referred to as **Cenchrus* sp., which is assumed to represent one of the three recorded *Cenchrus species). None of the species recorded are listed as WoNS (Thorp and Lynch 2000) or are Declared Pests under the WA Biosecurity and Agriculture Management Act 2007 (the BAM Act) (DPIRD 2022).

3.2.5 Terrestrial Fauna

Information in this section is based on the following supporting studies:

- Bamford Consulting Ecologists (2024a). CZR Resources Ltd. Robe Mesa Iron Ore Project Fauna Assessment (replaced BCE 2023). (BEC 2023, **Appendix 5-1**). Report amended in 2024 based on response to RFI.
- Lloyd George Acoustics (2023). Environmental Noise Assessment - Robe Mesa Project (**Appendix 6-1**)
- Bamford Consulting Ecologists (2024b). Robe Mesa Project, Fauna species Matters of National Environmental Significance Threats and Mitigation. Response to DEMRIS RFI. Memo report 14 Oct 2024.
- Bamford Consulting Ecologists (2024c). Robe Mesa Project. Response to comments provided by DEMIRS Feb and Aug 2024

3.2.5.1 Habitat

The Project area encompasses a mesa, scattered rocky hills, plains and drainage systems that range from minor creeklines to large river systems. Eight major Vegetation and Substrate Associations (VSA) or habitat types were identified in the overall project area, of which six are within the Disturbance footprint (**Table 3.10, Figure 3.30, Figure 3.31**).

These VSAs have been mapped based on project vegetation mapping (Biota 2023a and 2023b). This mapping combines vegetation types from Biota (2023a) and RPS (2021) which has been interpreted to match up vegetation types with corresponding BCE VSAs.

The mine is restricted to the mesa tops, which have low habitat value. The mine plant and other infrastructure is predominately within the VSA3 habitat, which is the most extensive habitat type of the project area.

The corridor to the North West Coastal Highway and the mine passes mostly over slightly undulating plains with scattered bloodwood over spinifex on gravelly loam (VSA3) (**Figure 3.30**).

Figure 3.30: Typical plains and rocky hills habitats of the access road route

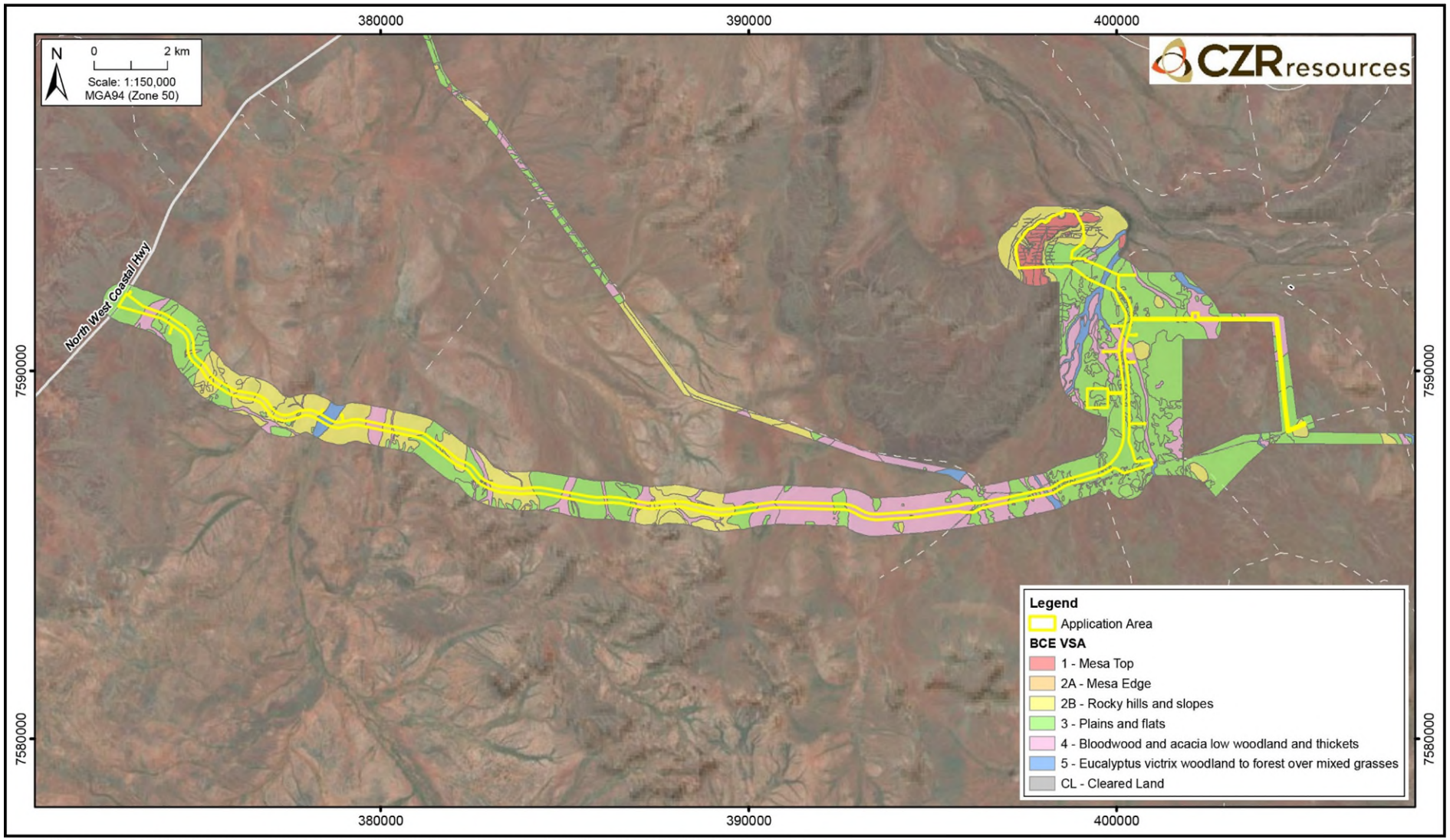
Table 3.10: Habitat types (VSAs) of the Robe Mesa Project

Unit ID	Description	Typical photo	Survey extent (ha)	Application area (ha)	Proportion of Surveyed Extent in Application area (%)	Disturbance footprint (ha)	Proportion of Surveyed Extent in Disturbance footprint (%)
Mesa Tops VSA1	Acacia low shrubland with scattered eucalypts over spinifex on shallow gravelly soil with some exposed rock. Often patches of several hectares with spinifex and no other vegetation. Occurs in the mining area.		139.0	92.3	66.4	65.0	46.8% of VSA1 surveyed extent is in Disturbance footprint. VSA1 represents 24.1% of total Disturbance footprint area
Mesa Edges VSA2a	Exposed rock often vertical with caves and overhangs. Scattered eucalypts, Rock Fig, shrubs, and spinifex where plants able to 'get a hold'. Scree slope variable in width; steep with lot of loose rock but bout 50% spinifex cover and occasional shrub. A major feature of the margin of the mesa.		16.8	13.1	77.8	0.5	2.7% of VSA2a surveyed extent is in Disturbance footprint. VSA2a represents 0.2% of total Disturbance footprint area
Rocky Hills and Slopes VSA2b	Lower scree slope around mesa edge, but also occurs as isolated rocky and in some cases gravelly hills.		1,411.7	199.5	14.1	48.7	3.5% of VSA2b surveyed extent is in Disturbance footprint. VSA2b represents 18.1% of total Disturbance footprint area

Unit ID	Description	Typical photo	Survey extent (ha)	Application area (ha)	Proportion of Surveyed Extent in Application area (%)	Disturbance footprint (ha)	Proportion of Surveyed Extent in Disturbance footprint (%)
Plains and Flats VSA3	These are very extensive. Mostly scattered acacia thickets (*Acacia xiphophylla*) over spinifex (*Triodia*) on gravelly loam soil to sandy loam flats. Some slightly rocky rises merged with VSA 2B.		3,637.6	418.0	11.5	109.6	3% of VSA3 surveyed extent is in Disturbance footprint. VSA3 represents 40.7% of total Disturbance footprint area
Minor drainage and shallow valleys VSA4	Bloodwood and acacia low woodland and thickets on alluvial loams along minor drainage lines and in shallow valleys of plains.		1,458.5	158.3	10.9	39.4	2.7% of VSA4 surveyed extent is in Disturbance footprint. VSA4 represents 14.6% of total Disturbance footprint area
Floodplains and drainage lines VSA5	*Eucalyptus victrix* woodland to forest over mixed grasses, including Buffel Grass, on alluvial loams; effectively floodplain of larger drainage lines.		179.5	13.9	7.8	1.5	0.8% of VSA5 surveyed extent is in Disturbance footprint. VSA5 represents 0.6% of total Disturbance footprint area

Unit ID	Description	Typical photo	Survey extent (ha)	Application area (ha)	Proportion of Surveyed Extent in Application area (%)	Disturbance footprint (ha)	Proportion of Surveyed Extent in Disturbance footprint (%)
Gallery Forests near Pools VSA6 **Not in Application area or Disturbance footprint**	*Melaleuca* and *Eucalyptus* gallery forest along seasonal and permanent pools on brown loam and gravel.		29.7	0.01	0.02	0.0	0% of VSA6 surveyed extent is in Disturbance footprint. VSA6 represents 0% of total Disturbance footprint area
Pools VSA7 **Not in Application area or Disturbance footprint**	Main Robe Pool is permanent and supports Typha and Phragmites beds, with some submerged aquatics. Substrate is loam and clay so water turbid with suspended sediments. Also, semi-permanent pools of Warramboo Creek where the southern access route option crosses.		5.6	0.0	0.0	0.0	0% of VSA7 surveyed extent is in Disturbance footprint. VSA7 represents 0% of total Disturbance footprint area

Figure 3.31: Habitat Mapping of the Robe Mesa Project



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_16, Rev: A ~ Imagery: ESRI, Maxar (Oct 2021) ~ VSA: Bamford Consulting

3.2.5.2 Fauna assemblages

A total of 147 vertebrate fauna species were recorded in the project area (May and October 2021 and July and September 2022) (Bamford Consulting Ecologists 2022) (**Table 3.11**). This assemblage, including two introduced predators (fox and cat), represented typical and widespread species of the west Pilbara region.

Two species of frog are present, largely confined to low points in the landscape, with breeding taking place in pools and claypans. Adults will disperse widely, and individuals are likely to move across the project area. At least one species may be moderately abundant in the project area, particularly along the mesa edge and may breed in ephemeral pools adjoining the mesa.

The reptile assemblage comprises 43 species, with differing suites of species and abundance in different habitats (Bamford Consulting Ecologists 2022). The mesa top supports a limited number of species at low levels of abundance due to shallow soils and few microhabitats compared with the mesa edge and slopes. It is unlikely that any species are locally-confined to the mesa top, whereas there are species limited to the other habitats (mesa edge, sandy flats and forests along drainage lines; Bamford Consulting Ecologists 2022).

The avifauna of the project area is rich at 80 species, but again; the mesa top supports a very limited number of species at low levels of abundance due to a lack of habitat structural complexity (Bamford Consulting Ecologists 2022). No bird species are likely to be confined to the mesa top, but the tall, thick spinifex and woodlands on the lower slopes and outwash of the mesa may be locally important with higher levels of abundance of many species (Bamford Consulting Ecologists 2022).

The mammal fauna of the project area comprises 17 native species. The mesa edge is notable for a rich assemblage including several species of conservation significance. Mammal diversity and abundance on the mesa top is much lower due to the structural simplicity of the habitat. Some mesa edge species may forage across the mesa top, but rely more heavily on dense vegetation of lower slopes for foraging (Bamford Consulting Ecologists 2022).

Table 3.11: Confirmed vertebrate fauna assemblage of the Robe Mesa Project (Feral/Introduction)

Taxon	Species	Number of species in each status category		
		Local	Regular visitor	Irregular visitor
Fish	3	3		
Frogs	2	2		
Reptiles	43	43		
Birds	80	59	19	2
Mammals	17 (2)	17 (2)		
Total	**145 (2)**	**124 (2)**	**19**	**2**

3.2.5.3 Significant Terrestrial Fauna

Three species listed under both the State *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) occur in the project area:

- Northern Quoll (*Dasyurus hallucatus*);
- Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*); and
- Ghost Bat (*Macroderma gigas*) (BCE 2022).

Although the listed Pilbara Olive Python (*Liasis olivaceus barroni*) was not detected during field investigations, which is understandable they as highly cryptic, DBCA deem that they are almost certainly present within the area, with recent records less than 1km from the mine pit (Bamford Consulting Ecologists 2024a).

All three recorded species and the Pilbara Olive Python are strongly associated with the mesa edge as core habitat, both for denning and roosting opportunities, and foraging resources. None of the species are restricted to the project area and all three recorded species are routinely recorded in the Robe River valley. No known maternity roosts for either bat species are present in the project area, and the Northern Quoll is present in numbers, typical of similar habitat in the locality (Bamford Consulting Ecologists 2022). The temporary bat roosts that are present are associated with the mesa edge and are located within the project No-Go-Areas.

Local watercourses such as Mungarathoona Creek, just east of the mine area, and Warramboo Creek at the southern haul road route, also provide suitable habitat for all four listed species, with rocky areas including mesas may be used for shelter during the cooler months (Bamford Consulting Ecologists 2024a).

3.2.5.4 Northern Quoll

In addition to the large number of records across the region, there have been several recent nearby records including Mesa A (Biota 2005) (12 km NW) and North of Red Hill (Biota 2009) (7 km S). Field investigations recorded Northern Quolls on cameras and with secondary evidence from tracks and scats. Records were mapped on mesa edges and drainage lines (**Figure 3.32**).

As with similar locations in the region, this species was most abundant around the mesa edge, with records also along the major drainage lines, and records of individuals moving across the flats. There were also records from some isolated hills in the project area, and along major drainage lines to the south-west. The BCE (2023 and 2024a) report does note the risk of population fragmentation due to the proposed haul road to the east of the mesa, but not specifically for Northern Quoll, and does consider the risk of mortality on that road (including for Northern Quoll). The risk of roadkill exists because Northern Quoll will readily cross roads, although this appears to be poorly documented except for the recognised risk of roadkill.

Mining infrastructure was also used for shelter (presenting a risk to the animals in some cases). The main risk from the proposed mine would appear to be deaths on roads and possibly from animals occupying infrastructure, rather than through a loss of movement across the landscape. Northern Quoll will use underpasses (Ecoscape 2021, Bleby et al. 2022) as a risk mitigation action for some mining projects in the Pilbara (Bleby et al. 2022). The position of the access haul road on the eastern side of the mesa and across Mungarathoona Creek lends itself to underpasses at the creek itself (where the creek will need to be crossed), and along the mesa edge.

The proposed road design includes 11 banks of culverts, primarily located to manage surface flow. However, given that the habitat types that intersect the haul road at drainage crossing points are sometimes also associated preferred dispersal and foraging habitat for Northern Quolls (drainage line habitat), these culvert locations also act as useful underpass locations for animals to cross safely and for preferred habitat to remain connected and unrestricted. The number and size of culverts varies along the road corridor depending on predicted flow rates at different locations, ranging from one 600mm culvert, up to seventeen 2100mm culverts at one location (**Figure 3.12**).

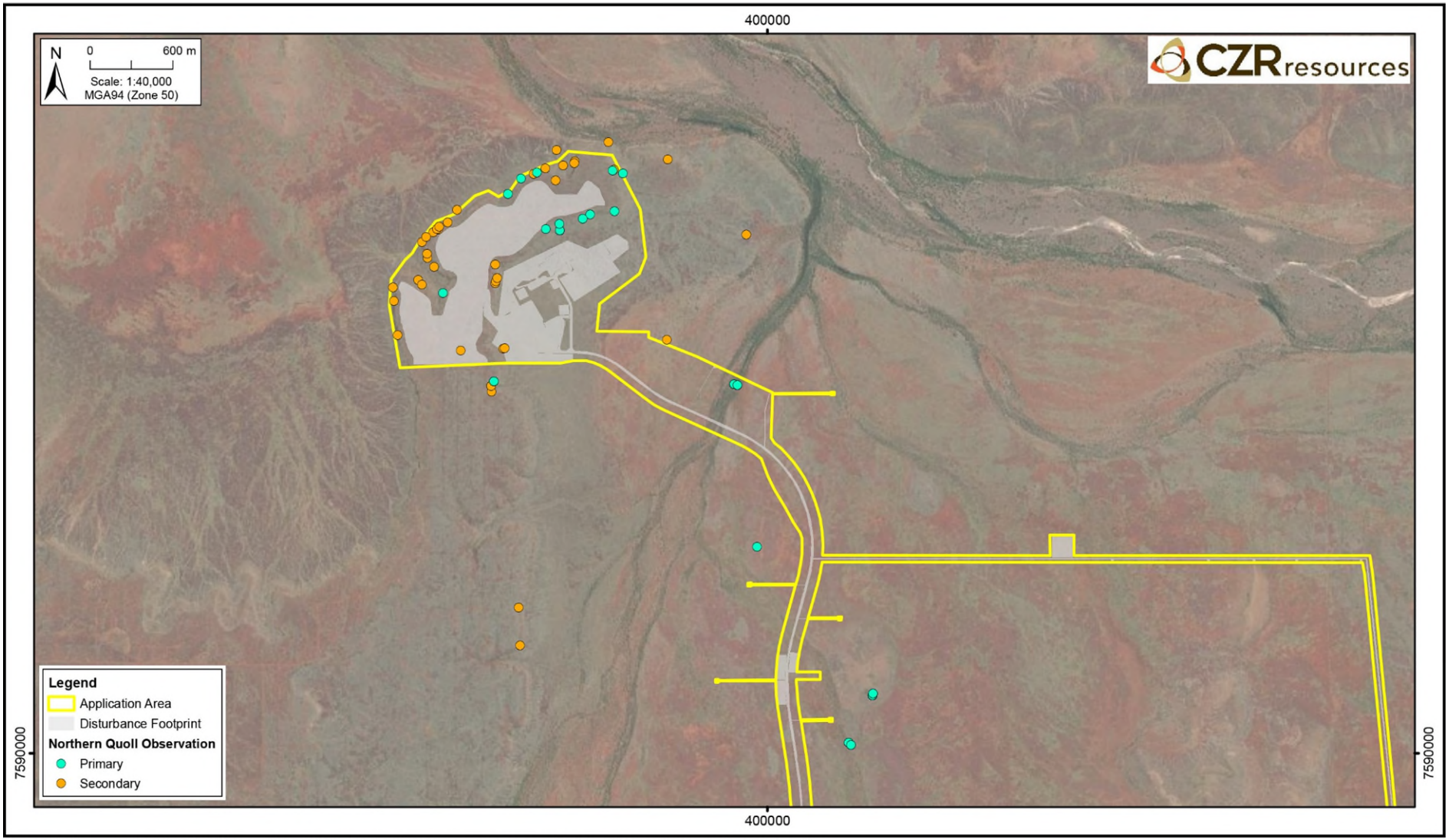
The proposed ramp connecting the mine pit to the mine operations centre, will intersect the mesa edge habitat and will therefore require an underpass-type structure to allow fauna such as the Northern Quoll to safely traverse along the mesa edge. Underpasses usually take the form of a culvert, as culverts allow for the free movement of a wide range of native species (MRWA 2010). Fencing can also be used to maximise the potential use of the underpass and to help prevent fauna moving on the roadway (MRWA 2010).

Although the use of underpasses by Northern Quolls is poorly-studied, the concept of fauna underpasses is not new, with knowledge on the installation and use of fauna underpasses increasing, based on experience in

Australia and first principles of animal behaviour (MRWA 2010). Monitoring the effectiveness of the mesa edge underpass at the Robe Mesa Project would be valuable, and would contribute to the current knowledge base.

Disturbance to mesa edge habitat will be restricted to no more than 0.5 ha from the ramp. There are no Northern Quoll records from the location of the proposed haul road ramp, as the habitat at this location is not as steep and is therefore more like rocky hills than mesa edges. Occasional road crossings through minor drainage lines will represent the disturbance extent of this habitat type also.

Figure 3.32: Northern Quoll observations



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3.2.5.5 Conservation Significant Bats

The Pilbara Leaf-nosed Bat has been recorded extensively across the Robe Valley (Rio Tinto 2019), with historic records concentrated around areas of significant roost sites, often associated with disused mine infrastructure. Previous surveys of potential roosts across Mesa F have found no Pilbara Leaf-nosed Bat roosts (Rio Tinto 2019).

A further inspection of cave structures by BCE (2023) considered the mesa edges of the Robe Mesa Project not suitable for maternity roosts.

Pilbara Leaf-nosed Bat records were in low numbers and were generally made late at night or about an hour before sunrise, suggesting the animals had travelled some distance from a roost site before they were detected (**Figure 3.33**).

There are multiple existing records of the Ghost Bat in the region, including one confirmed maternity roost in a gully on Mesa F over 2 km south of the project area and away from the Disturbance footprint. This roost supported about 70 animals in 2017 (Bat Call WA 2017).

Ghost Bat records were scattered around the margins of the mesa in the Project area (**Figure 3.33**), but numbers seen were always low, with the highest night count at the project area being three animals. Evening bat-watches took place in the breeding season in 2021 and 2022 and results suggest that the caves along the mesa edge in the project area are occasional used by small numbers of non-breeding animals. This is consistent with the structure of the caves, which were generally shallow, going back up to about 10 m but lacking the vertical interior chamber suggested to be important for maternity roosts.

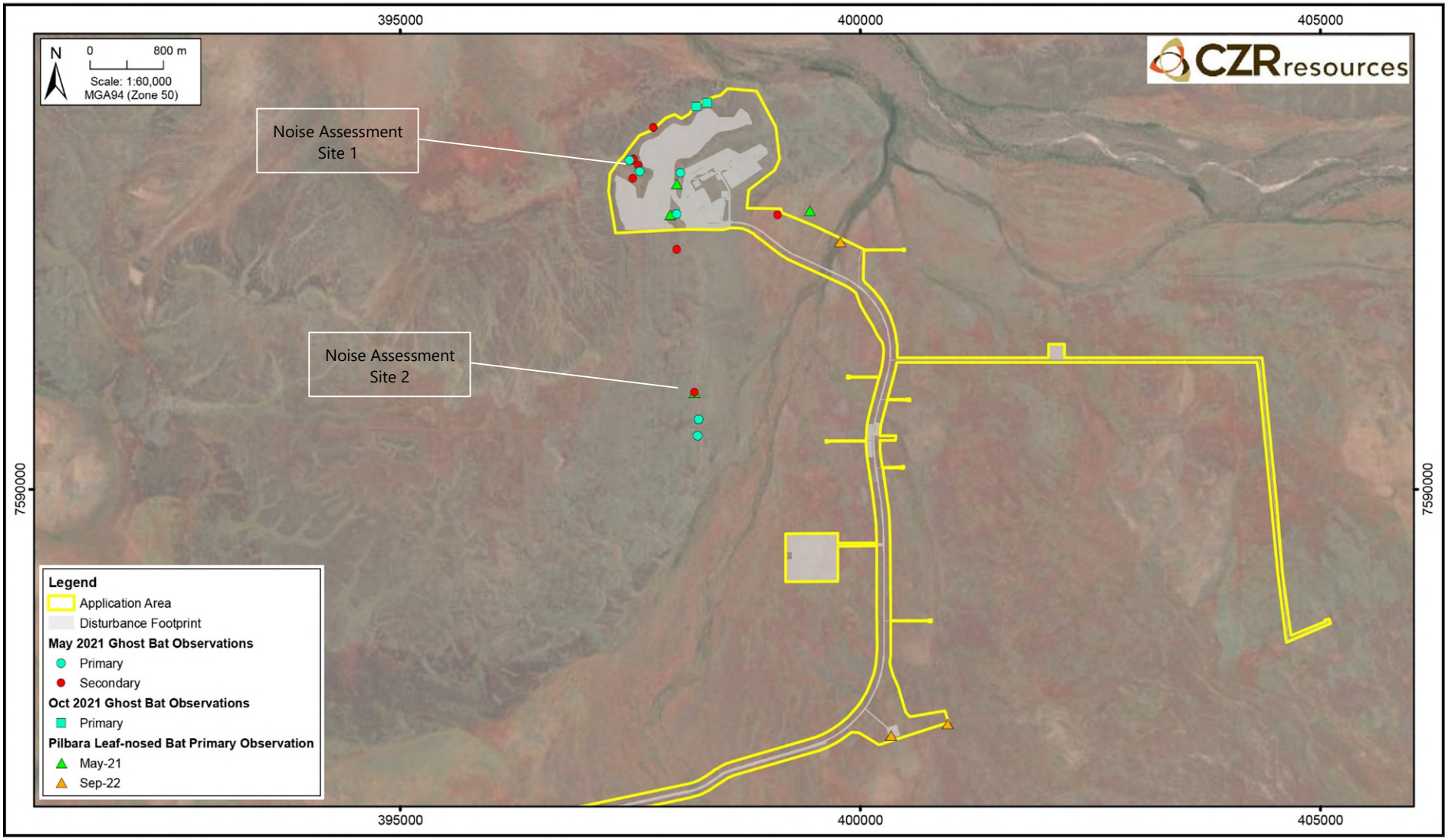
Cave assessment:

Caves were assessed around the mesa but were not assigned categories as outlined in the DCCEEW conservation advice on the species (Threatened Species Scientific Committee (2016). The mesa landscape did not lend itself to the use of such categories as the mesa edge was a breakaway with more or less continuous overhangs, depressions, undercuts and shallow caves. It was thus difficult to recognise discrete locations. It was noted, however, that there was a large valley in the west with several probably interconnected caves, and that the western and northern mesa edge was a higher breakaway with more crevices than the eastern/southern edge. ARUs were deployed in May 2021 (10 locations), October/November 2021 (10 locations), July 2022 (4 locations) and September 2022 (5 locations). However, devices either failed or recorded no significant bat species in October/November 2021 and July 2022. Thus, useful data only from May 2021 (outside breeding season) and September 2022 (breeding season).

Locations in these two surveys were around the mesa, close to pools along drainage lines, at isolated rocky hills, on the plains and alongside a tree-lined dry creekbed. Very few records were obtained even when units were placed to a previously recorded maternity roost site, but this probably reflects annual variation in the use of that site.

In May 2021, there were single records on the flats, near a drainage line (upper end of Mungarathoona Creek), on both eastern and western sides of Mesa F, and outside a cave system previously identified as a maternity roost site. It was concluded that 'the cave structures within Mesa F appeared suitable for seasonal roosting Pilbara Leaf-nosed Bats, but were probably not suitable for maternity roosts. Pilbara Leaf-nosed Bat records were generally made late at night or about an hour before sunrise, suggesting the animals had travelled some distance from a roost site before they were detected'. Such usage would be consistent with the caves of the mesa serving as temporary nocturnal roosts outside the breeding season for the PLnB (nocturnal refuge – priority 4), although they may also be used by small numbers of animals as diurnal roosts (priority 3). The most likely location of priority 3 roosts would be in the western valley.

Figure 3.33: Conservation significant bats observations



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_19, Rev: A ~ Imagery: ESRI, Maxar (Oct 2021) ~ Fauna: Bamford Consulting

In September 2022 (Table 25 in the report), there were no records around the mesa, a single record along Mungarathoona Creek, and multiple records around the camp and particularly at the tree-lined dry creekbed in the south (Figure 32 of the report). The timing of recordings at the creekbed (within 17 minutes of last light) suggests a moderately large roost (probably a maternity roost), probably in hills to the south (indicated by the lack of large numbers of records elsewhere in the project area at the time). An ARU set at the large valley in the east of the mesa detected no PLnB, and nor did an ARU set on an isolated hill nearby. While not conclusive, this suggests limited roosting activity during the breeding season in Mesa F at least at the time of the surveys. Thus, the caves may have limited value as impermanent roosts during the breeding season. As noted during the May 2021 investigations, the caves appeared to be shallow and to lack the depth and high humidity favoured by the species.

Overall, it would appear the PLnB roosts nearby and enters the project area to forage, and probably occasionally to roost in small numbers, particularly outside the breeding season. There will be buffer zones to protect the mesa edge and major drainage systems, and hydrological impacts will be minimised.

3.2.5.6 Noise assessment

A noise assessment was undertaken by Lloyd George Acoustics (LGA 2023) to determine any noise impacts at the following locations:

- Site 1. A mesa edge location, to test the effectiveness of the pit setback from the mesa edge. At this site, a mock cave site was modelled, to compare noise levels at a cave entrance with levels 10 m inside the mesa edge (**Figure 3.33**).
- Site 2. The known Ghost Bat maternity roost, south of Project area (off the project tenement) (**Figure 3.33**)

Note, the noise assessment also included the mine village.

Predicted noise emissions were generated from proposed operations using computer noise modelling (*SoundPLAN 8.2*) and assessed against noise level limits in accordance with relevant criteria. Noise and vibration calculations regarding blasting were also undertaken to provide guidance for managing this activity close to the sensitive fauna receptors.

With no legislated noise criteria for fauna, noise levels were assessed based on relevant studies on the impact of noise on fauna. While the response to noise and vibration may vary among species (Busnel and Fletcher 1978), a study undertaken by Bullen and Creese (2014) suggests that sound levels up to 70 dB(A) are unlikely to result in Ghost Bats leaving their roost. As such a similar criterion was applied to the test sites when assessing the operational noise at the Robe Mesa Project.

To simulate the worst-case scenario, a mobile plant was modelled at the western edge of the 50 m buffer zone, closest to the Site 1 test site. The noise modelling at operations was demonstrated to comply with the fauna site criteria level of 70 dB(A) at both the mock 'cave entrance' and 'interior' at Site 1. Compliance at the known Ghost Bat maternity came and the village south of the operations is also demonstrated (**Table 3.12**, **Figure 3.34**).

The noise levels from the Haul truck fleet have been predicted. At the nearest point, the haul route passes within 800 m of Village accommodation, and it is estimated that 6 truck passes will occur per hour (3 loaded and 3 empty). The noise modelling demonstrates that compliance at Ghost Bat sites and the mine worker village is achieved with respect to noise from truck haulage.

Table 3.12: Predicted external noise levels, mining operations.

Location	Predicted level		Limit Level	Compliance
	Operations (dB LA10)	Haulage fleet, dB LAeq		
Site 1. Mesa edge test site (simulating a cave entrance location)	55	17	70 dB(A)	Complies
Site 1. Mesa edge test site (simulating internal cave location)	45	17	70 dB(A)	Complies
Site 2. Known GB Maternity Bat site (~2 km south of Project area – off footprint)	18	22	70 dB(A)	Complies
Robe Mesa Project Village	28	37	*55 dB(A)	Complies

*Based on an internal level of 40 dB(A), a 15 dB(A) reduction is assumed when estimated noise internally

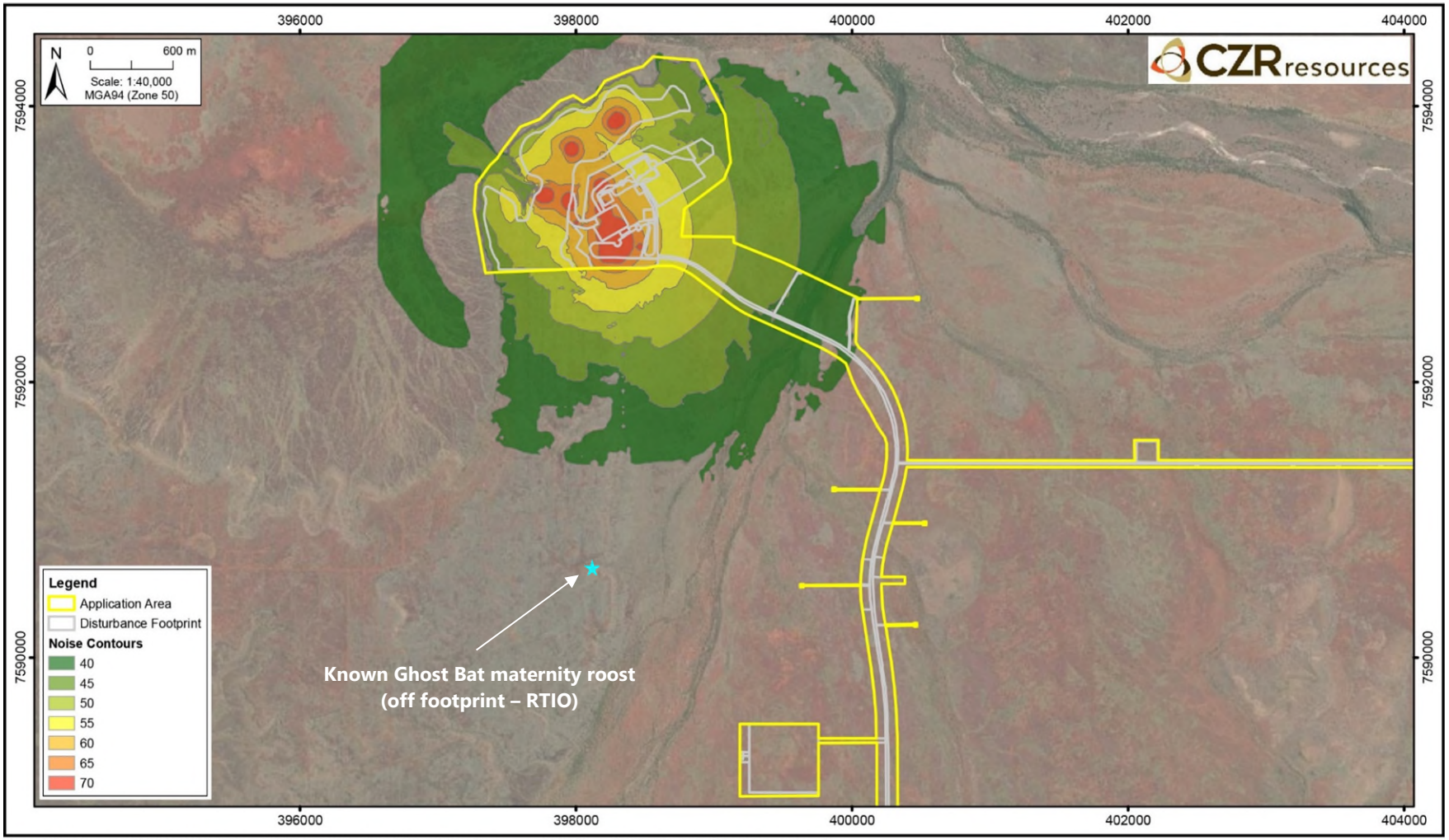
The noise assessment undertaken by Lloyd George Acoustics (LGA 2023) determined noise impacts at the mesa edge and the known Ghost Bat maternity roost site south comply with relevant criteria and studies (Bullen and Creese 2014), with noise impact contours not extending to the maternity roost site.

Noise modeling at operations and haulage was demonstrated to be well below the site criteria level of 70dB.

Sites at the mesa edge, setback just 50 m from operations (worst case scenario), found noise emission predictions to be in the range between 45 and 55bB during operations. Note, there is no roost identified in this location, the site was selected as a typical mesa edge, where foraging may occur. The No Go mesa edge setback will use a 50m set back distance as a minimum, with up to 200-300m setback in some areas from the mesa edge.

Noise emissions at the known maternity Ghost bat roost, which is off tenement (RTIO) and more than 2 km south of the Project area, are predicted to be between 18 and 22 dB for operations and haulage respectively (LGA 2023). These levels are extremely low, well under any exceedance threshold and are comparable to current background levels (**Table 3.12**, **Figure 3.34**).

Figure 3.34: Mining operations noise contours (dB L_{A10})



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_20, Rev: A ~ Imagery: ESRI, Maxar (Oct 2021) ~ Noise: Lloyd George Acoustics

Noise impact review

In a review of potential mining activity impacts at a nearby mine, Biota (2014) sought the opinion of nationally recognised bat zoologist Sue Churchill and Western Australian bat specialist Bob Bullen to obtain their independent views on likely impacts, changes to behaviour and the extent to which light (and noise) may impact the persistence of a Pilbara leaf-nosed bat colony.

Churchill noted in the Biota (2014) report, that although there is potential for noise to disturb roosting bats, it is unlikely to affect foraging bats. Note, the maternity roost recorded in **Figure 3.34**, is over 2 km from the mining operation, with only foraging activities recorded closer to the Robe Mesa Project. Churchill also noted that Pilbara leaf-nosed bats typically spread out and forage in all directions from their roost and are easily capable of flying around a noise disturbance on route to a water supply (pers comm, 14 February 2014). Furthermore, given that Pilbara leaf-nosed bats have a generalized and flexible foraging and commuting route, it is likely that they would modify their routes in response to adverse noise disturbance.

Bob Bullen noted that increased noise levels may affect bat physiology or behaviour, but noted that there is potential for Pilbara Leaf-nosed bat to become habituated to noise depending on the changes in noise level (Bat Call WA opportunistic observations). However, Bullen noted that no empirical evidence is currently available to support these views.

Preliminary data collected by Specialised Zoological (2010, 2012) (in Biota 2014) also suggests a lower sensitivity to noise and vibration, with Pilbara Leaf-nosed bat activity at one site (at Eastern Ranges) not reduced from baseline levels following the construction and operation of a haul road and a primary crusher within 500 m. Note, the known maternity roost is at least 2 km from the mining operations at the Robe Mesa Project area.

Light impact review

Light spill will be novel to the landscape and has been demonstrated elsewhere to result in large scale invertebrate mortality and an increase in the abundance of native predators.

In a Biota (2014) review of impacts to Pilbara Leaf-nosed Bats, it was noted by Sue Churchill (specialist opinion) that lights are unlikely to adversely affect Pilbara Leaf-nosed Bats during foraging. In fact artificial lighting is likely to attract insects thereby allowing Pilbara Leaf-nosed Bats to exploit the higher than normal concentrations of prey. Churchill surmised that these bats are opportunistic foragers and are not constrained in their dispersal routes or foraging patterns. They have only a generalised foraging route and they modify this on a nightly basis depending on the availability of food and water. It is therefore likely that they would modify their foraging and commuting routes in response to adverse light disturbance.

Bob Bullen (specialist) believed that there is potential for Pilbara Leaf-nosed Bats to be attracted to artificially lit areas (Norm McKenzie pers. comm and Bat Call WA personal observations) (in Biota 2014). Increased insect activity near lights may in turn result in the attraction of Pilbara Leaf-nosed Bats due to increased availability of prey. Opportunities Observations noted by Bat Call WA found a potential for Pilbara Leaf-nosed Bats to become habituated to light, with bats noted as hunting in artificially lit areas, indicating that they have become used to the presence of light.

CZR is aware of the National Light Pollution Guidelines for Wildlife (DCCEEW 2023), which aims to ensure that artificial light does not disrupt within, or displace from, important habitat, or impact critical behaviours such as foraging, reproduction and dispersal.

DCCEEW (2023) prescribes best practice lighting design principles, which will be considered and incorporated during the detailed design phase:

1) Start with natural darkness and only add light for specific purposes.
2) Use adaptive light controls to manage light timing, intensity and colour.
3) Light only the object or area intended – keep lights close to the ground, directed, and shielded to avoid light spill.

4) Use the lowest intensity lighting appropriate for the task.
5) Use non-reflective, dark-coloured surfaces.
6) Use lights with reduced or filtered blue, violet and ultraviolet wavelengths.

Key management measures described by DCCEEW (2023) will also be considered and incorporated where possible. The most effective measures for mitigating the impact of artificial light on bats, in general, include:

- maintaining dark refuge sites
- avoiding, removing, redirecting or shielding artificial lights in foraging areas and along commuting routes
- keeping artificial light intensity as low as practicable, noting that low-intensity artificial light (comparable to full moon light levels) can disrupt behaviour of bats.
- Implement appropriate mitigation where and when bats are likely to be present.
- Avoid artificial light directed onto roost sites and indirect spills into roosts.
- Direct artificial light downwards and/or shield luminaires near foraging areas and commuting corridors.
- Maintain darkness along commuting corridors and between roosts, water sources and foraging areas

Buffers and setbacks

Bullen (in Biota 2014) notes that the persistence of Pilbara leaf-nosed Bat records close to active mine areas offers circumstantial evidence that, at certain levels of mining-related disturbance, the occurrence and foraging behaviour of Pilbara leaf-nosed Bat may not be adversely affected (Specialised Zoological 2010, 2012, Biota 2013b, 2014), with available data demonstrating that Pilbara leaf-nosed Bats have been recorded close to active mines (to within 40 m).

Furthermore, in a 2013 blasting trial, Biota (2013a) found very little evidence that any disturbance behaviour detected that could be associated with the trial blasts. Only three of the 51 calls recorded were concurrent with blast timing and all represented single individuals. Even if some bats took flight but were not detected, the results still imply that the great majority of the colony was not disturbed even by the strongest blast at 12.2 mms-1 (Biota 2013a). There was no evidence detected that blasting significantly disturbed the colony as a whole to the point where most or all bats took flight within the cavern during daylight hours. Most daylight calls that were recorded appeared to be associated with the installation and set up of equipment during the trial and download of data following blasts. This is consistent with past observations (Biota 2012), which suggest human or other disturbance directly within the cavern may be more significant than vibration levels generated by the simulated production blasts in this study. Call data from long-term monitoring units found that activity on the evenings of the two-day blasting trial was in keeping with normal baseline levels. The data also demonstrated that activity following the trial was within baseline range, indicating no ongoing effects of the trial on the colony after its completion

As stated previously, the mesa edge buffer at the Robe Mesa Project will use a minimum 50m set back distance, with up to 200-300m setback in some areas (**Figure 3.35**). Based on previous studies summarised above, and CZRs impact assessment of noise at the Robe Mesa Project, and recommended light mitigation strategies from DCCEEW (2023), noise, vibration and light impacts on bats foraging at the mesa edge is expected to be very low.

Figure 3.35: Mine pit setback at the Robe Mesa Project

3.2.5.7 Pilbara Olive Python

This species is considered likely a resident of the project area.

The DBCA threatened database search identified 24 records within the surrounding area. The majority of these records lie further east along the Robe River with the nearest being 5km from the project area. The Rio Tinto Mesa H report (2019) documented an additional six along the Robe Valley including one record at the northern stretch of Mungarathoona Creek at a permanent waterhole which is located within 300 metres of the project area. Biological surveys undertaken by environmental consultants have recent records within the vicinity at Mesa H (Astron 2016), Bungaroo (Astron 2016a) Middle Robe/East Deepdale (Astron 2016b) and Yarraloola (Biologic 2014). While the species was not detected during field investigations, the species is almost certainly present as a resident. The major watercourses (such as Mungarathoona Creek just east of the mine area and Warramboo Creek at the southern haul road route) provide suitable habitat, and rocky areas including the mesa of the mine area may be used for shelter during the cooler months.

Threats to the Pilbara Olive Python are primarily associated with vehicle strike in preferred habitat areas such as mesa edges and drainage lines. Mitigation measures include managing traffic frequency and speed and establishing underpasses that direct Pilbara Olive Pythons between preferred habitats whilst avoiding direct road crossings. Management actions to minimise the risk of impacts to the Pilbara Olive Python are described in Section 5 (risk assessment) and Section 6 (outcomes and monitoring).

3.2.5.8 Night Parrot

The Night Parrot is considered to be only a vagrant in the area. This was due to the lack of suitable habitat as described in the DBCA (2024) guidelines for the species; so this was considered but not made clear. The guidance describes at length the need for roosting and foraging habitat.

Roosting habitat (spinifex; often long unburnt) was present and widespread, with some areas long unburnt, but such an environment can be found across vast tracts of the country. Foraging habitat is more likely to be limited, and consists of species-rich grasslands and herbfields often associated with paleo-drainage systems. Such landscapes do not occur in the project area or nearby. This is not to say the Night Parrot could never be present, hence the conclusion that it might occur as a vagrant. The definition of 'vagrant' used by BCE is a 'species that occurs within the project area unpredictably, in small numbers and/or for very brief periods. Therefore, the project area is unlikely to be of importance for the species'.

3.2.6 Subterranean Fauna

Information in this section is based on the following supporting studies:

- Biota Environmental Sciences (Biota) (2023c) Robe Mesa Troglofauna Baseline Assessment Report (**Appendix 7-1**)
- CZR (2023) Work Completed for the Review of Troglofauna Habitat at Robe Mesa (**Appendix 7.2**)
- Biota Environmental Sciences (Biota) (2024a). Robe Mesa Project Troglofauna habitat. Summary Memo Report based on a DEMIRS request for further information on troglofaunal habitat.
- Biota Environmental Sciences (Biota (2024b), updated Biota (2023c). Troglofauna phase 3 sampling results and analysis.

3.2.6.1 Priority Ecological Community (PEC)

The project area mesa forms part of the State-listed PEC - 'Subterranean invertebrate communities of mesas in the Robe Valley region' (**Figure 3.23** and **Figure 3.36)**.

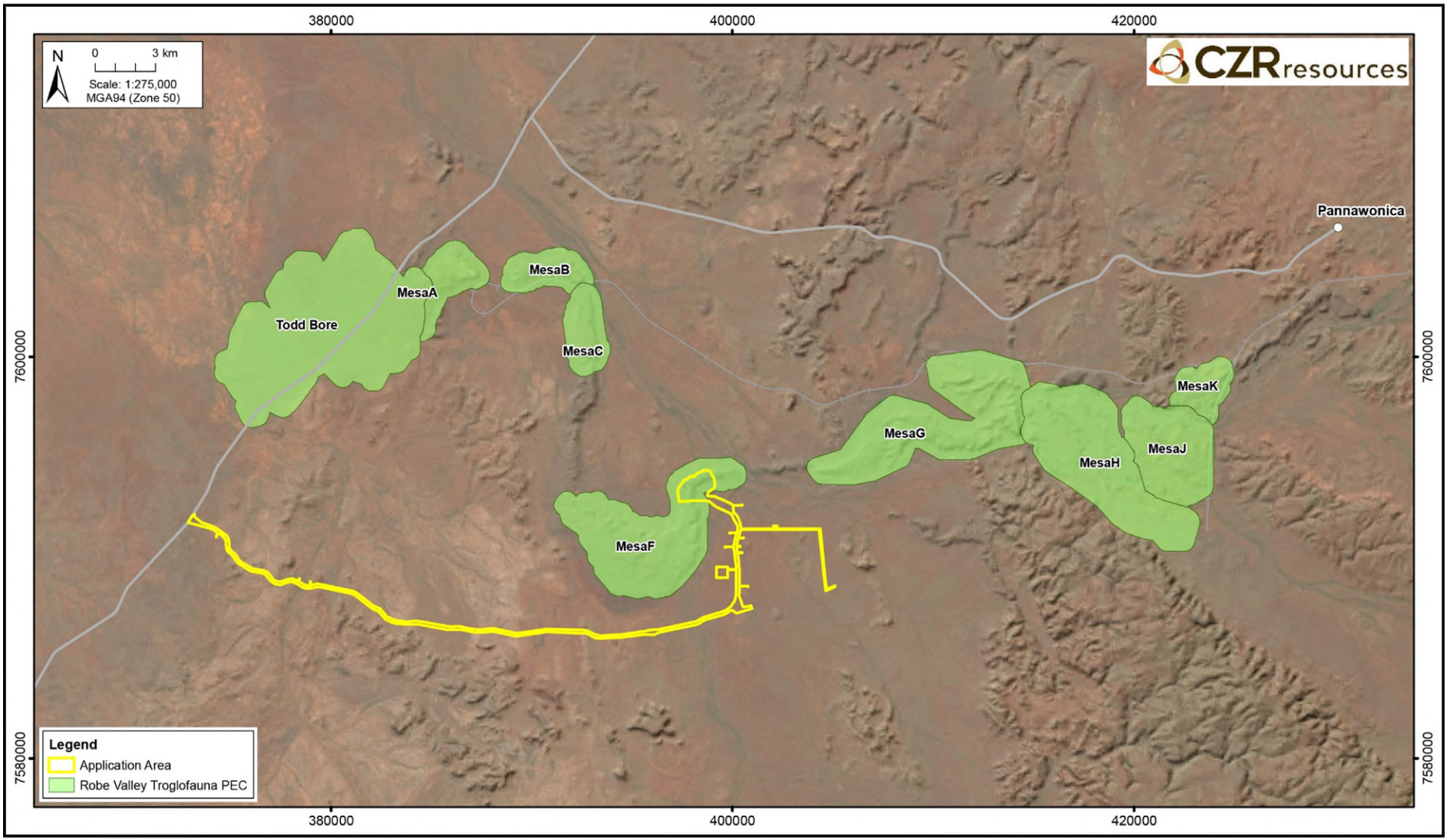
The PEC is categorised by the Department of Biodiversity, Conservation and Attractions (DBCA) as Priority One: "Poorly-known ecological communities, which are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g., within active mineral leases) or for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements and/or are not well defined and appear to be under immediate threat from known threatening processes across their range".

3.2.6.2 Overview of Receiving Environment

Biota (2023, 2024b) were commissioned to undertake subterranean assessments of the Project area, largely based on their extensive experience in sampling and identifying troglofauna across the Robe Valley over the last 20 years. Given the known significance of the Robe valley for troglofauna, the project tenure was sampled in accordance with current EPA technical guidance for subterranean fauna (EPA 2021).

Three phases of sampling for troglofauna have been completed in the CID mesa landform of the project area, also in accordance with EPA technical guidance for subterranean fauna surveys (EPA 2021). A total of 102 troglofauna specimens were collected from 22 drillholes across the three phases of sampling completed within the project tenure. The range of higher taxonomic ranks recorded are typical of the troglofauna assemblage recorded in other mesas in the Robe valley (Biota 2023).

Figure 3.36: Robe Valley subterranean fauna PEC and local mesa formations



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DNA sequencing has been completed for the specimens from all three phases of sampling to assign species identifications (Biota 2024a and 2024b) The sequenced specimens from the project tenure are genetically distinct from similar specimens recorded at other mesas in the Robe Valley. This corroborates previous studies that demonstrate that mesas in the Robe Valley are habitat isolates, and there is no gene flow between mesas.

At least 17 species from seven orders have been recorded in the last 3 phases on sampling (Biota 2024b) (**Table 3.13** and **Figure 3.37**).

Seven of the 17 species have only been recorded within the project mine pit (Biota 2024b). Only one of the 17 species, the pseudoscorpion *Indohya alexanderi*, has been recorded from another nearby mesa. Considering the Robe Valley troglofauna have been extensively surveyed over the past 15 years and are well represented in genetic databases, it is evident that the troglobitic community recorded during the survey is essentially endemic to Mesa F.

Two specimens, *Draculoides* sp. H-SCH200 and *Armadillide* sp. H-ISA064, are recorded both inside and outside the conceptual pit. Other species, *Japygidae* sp. H-DJA023, *Scolopendrellidae* sp. H-SYM039 and *Scolopendrellidae* sp. H-SYM040, are found outside the mine pit, but in connected CID in the vicinity of the Disturbance footprint (i.e. within the same CID habitat).

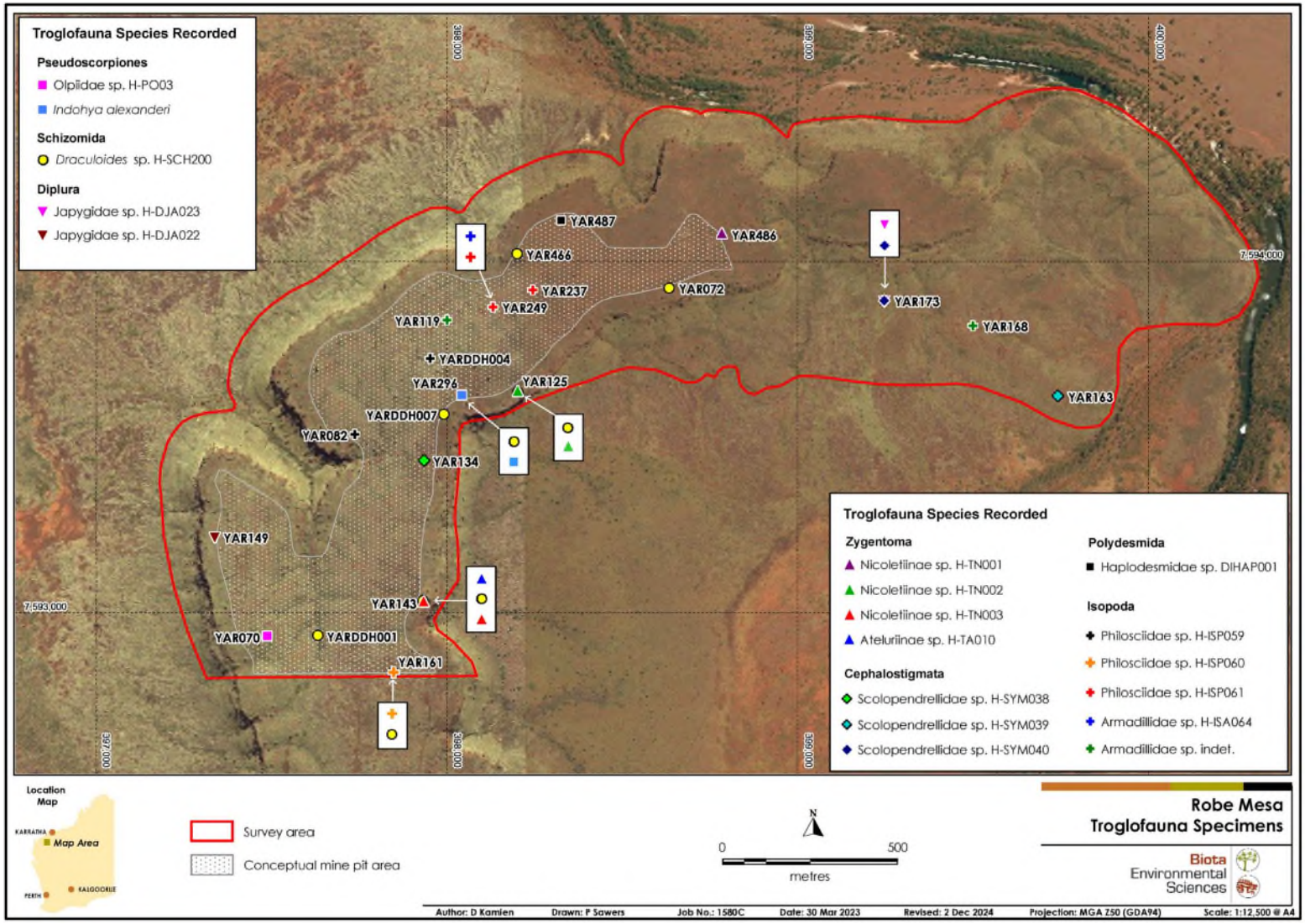
Geological modelling (CZR Resources 2023) and extensive subterranean fauna research completed in the region (Biota 2023a), indicates that similarly suitable habitat is likely to occur throughout Mesa F, which is contiguous with that of the Robe Mesa Project area (Biota 2006, 2011b). It is therefore very likely that the species recorded during the survey would also occur throughout Mesa F. Data from other extensively sampled mesas in the locality demonstrate the same patterns, with any given species typically occurring across the extent of each mesa landform (Biota 2006, 2011b). The recorded locations of *Draculoides* sp. H-SCH200 and *Armadillidae* sp indet both inside and outside the conceptual pit further support this argument. It is also possible that collections of unsequenced *Draculoides* sp. nov. 'Mesa F'.2, *Japygidae* sp. and *Armadillidae* sp. obtained from previous surveys at Mesa F (Biota 2006, 2011b), represent the same species as those recorded during the current survey (Biota 2023a).

It is therefore very likely that the species recorded from the project tenure, and those apparently only occurring within the pit outlines, would also occur throughout Mesa F. This would be entirely consistent with the findings demonstrated for all other CID mesa landforms in the Robe valley where longer-term sampling has better documented the fauna.

Table 3.13: Troglobitic fauna recorded within the conceptual pit outline (Biota 2024b).

Taxon	Sites	Significance
Olpiidae H-PO03	YAR070	Confirmed SRE species
Scolopendrellidae sp. H-SYM038	YAR134	Confirmed SRE species
Philosciidae sp. H-ISP059	YAR082, YARDDH004	Confirmed SRE species
Philosciidae sp. H-ISP060	YAR161	Confirmed SRE species
Philosciidae sp. H-ISP061	YAR237, YAR249	Confirmed SRE species
Armadillide sp. H-ISA064	YAR249	Confirmed SRE species
Haplodesmidae sp. DIHAP001	YAR487	Confirmed SRE species

Figure 3.37: Troglofauna species recorded from the Robe Mesa Project (Biota 2024b)



3.2.6.3 Troglofauna habitat characterisation

A detailed assessment of troglofauna habitat has been modelled by CZR (2023), building on similar work by API Management (APIM), for the West Pilbara Iron Ore Project (WPIOP) Stage 1 Deposits (APIM 2015) and with technical assistance from Red Hill Resources.

Troglofauna habitat is primarily a function of available space, maintenance of a constantly high humidity and the potential for nutrient input from surface systems (Humphreys 1991, Wilkens et al. 2000, Biota and DC Blandford & Associates 2013).

Robe Valley mesas are frequently vuggy, fractured and often contain small-scale caverns, which allow for percolation of water and nutrients from surface habitats, thereby representing suitable habitat for subterranean fauna (Biota 2006, 2011b, 2016a) (**Figure 3.38**).

The gradual isolation of mesa landforms in the Robe Valley through the dissection and erosion of Robe Pisolite paleochannels has been occurring for 10 million years ago (Ramanaidou et al. 2003), which has led to the formation of unique troglobitic communities within each disconnected mesa (Biota 2006, Harvey et al. 2008, Biota 2011b, 2016a).

Stratigraphically, the Project area comprises two channels of pisolitic ironstone (CZR Resources 2023) with the conceptual pit outline is located predominately within the Robe Pisolite upper CID (**Figure 3.39** and **Figure 3.40**).

Locally, the Robe Mesa (located within the broader Mesa F landform) preserves two channels with well-formed CID iron ore mineralisation (MCU and MCL) both of which are enveloped by a transitional unit which is mineralised but less sorted and lower in Fe grade (MMU and MML). The mineralised channels are separated by an interstitial waste unit which is characterised by sandy ironstone rocks and clay rich lenses. Directly underlying the lower mineralised channel is a thin ferruginous silty ironstone unit above a clay rich basement rock.

Each stratigraphic unit provides a different level of troglofaunal habitat value (Biota 2023c) (**Table 3.14**).

The basal rock units underlying the lower pisolitic channel (WIB and WCB units) have been determined to not represent main troglofauna habitat, due their high clay content, lack of vuggy structure and position underneath the recorded water table. The interstitial waste units which separate the upper and lower pisolitic channel are also not considered to be main troglofauna habitat, though they may fulfill a function in maintaining humid microclimates through impeding water penetration and storing recharge within the structure. This is primarily due to the increased clay content and absence of well mineralised, vuggy rock texture.

Figure 3.38: Diamond core of CID-upper layer depicting vugs and fractures (CZR 2023)

Figure 3.39: Typical schematic cross section of the Robe Mesa Project (CZR 2023)

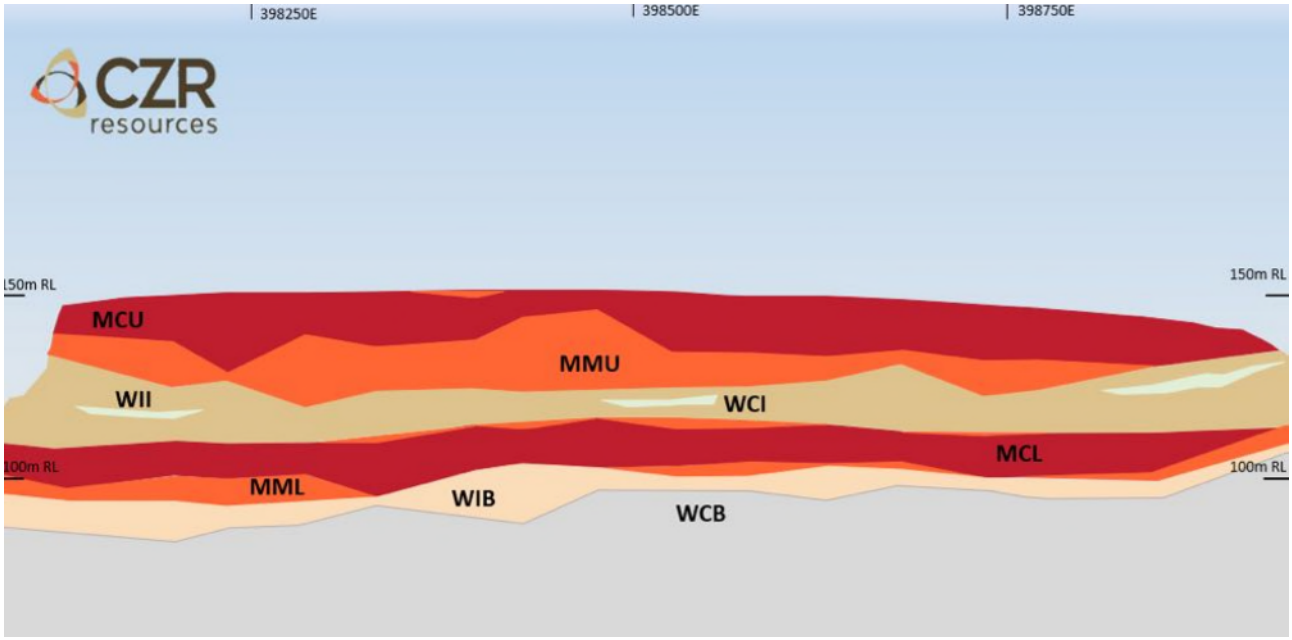


Figure 3.40: Typical schematic cross-section indication nominal pit design (CZR 2023)

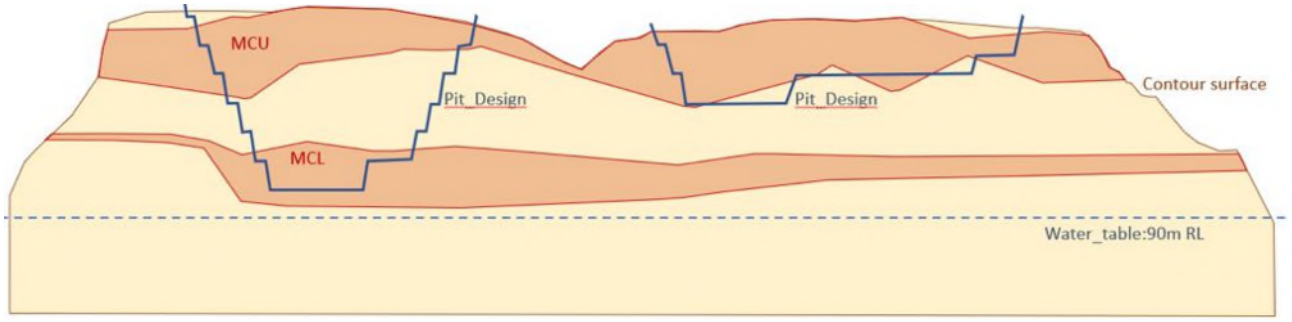


Table 3.14: Robe Mesa Project stratigraphy

Geology Code	Unit Name	Description	Habitat Suitability Characteristics*
MCU	CID – upper	Pisolitic ironstone - strongly mineralised	High
MMU	Mixed zone – upper	Pisolitic ironstone - poorly sorted	High
WII	Interstitial waste	Sandy ironstone with some mixed pisolite	Low
WCI	Interstitial clay	Clay rich lenses within interstitial waste	Low
MCL	CID – lower	Pisolitic ironstone - strongly mineralised	High
MML	Mixed zone - lower	Pisolitic ironstone - poorly sorted	High
WIB	Silty ironstone-basal	Clay rich ironstone	Low
WCB	Basal clay	Claystone basal unit	Low

*Based on advice from Biota Environmental Sciences

3.2.6.4 Habitat volumes

To quantify the habitat volumes from Robe Mesa, 3D-wireframining was employed to create solids which represents the geological units representing troglofauna habitat (CZR Resources 2023). The abundant downhole drill data at Robe Mesa allowed for accurate geological contacts to be modelled and the pit design provided by Snowden Optiro was used to refine the solids so they accurately represented the volumes which would be removed by proposed mining activity. Using some high-level assumptions, the geological units from Robe Mesa were able to be projected across the Mesa F landform, so that the true extent of contiguous Troglofauna habitat could also be assessed (**Table 3.15**).

Outcomes from 3D habitat modelling for the CZR managed portion of the Mesa F landform (M08/533):

- The residual habitat remaining in M08/533 after proposed mining is~33,000,000 bcm, which represents 68% of the pre-mining habitat volume in M08/533.
- Habitat impact is much less in the lower CID units, ~87% of the habitat remaining post mining in M08/533.

Outcomes from 3D habitat modelling for the entire contiguous habitat of the Mesa F landform:

- The total troglofauna habitat volume for the entire Mesa F landform is ~452,400,000 bcm, of which the habitat of M08/533 represents ~10% of this contiguous landform.
- The proposed mining volume for the Robe Mesa Project, ~15,500,000 bcm, represents 3.5% of the total contiguous troglofaunal habitat within the Mesa F landform.

Table 3.15: Troglofauna habitat volume determination results from 3D modelling (wireframing)

Geological unit	Pre-Mining Troglofauna Habitat volume (bcm)	Proposed volume of Troglofauna habitat removed for Robe Mesa Project (bcm)	Post Mine Trog Habitat volume (bcm)	Proportion of Trog habitat remaining post mine (%)
Robe Mesa Project Tenure (M08/533)				
MCU	14,556,666	8,314,862	6,241,804	42.9
MMU	7,336,353	3,635,652	3,700,701	50.4
MML	5,964,179	595,314	5,368,865	90.0
MCL	20,993,787	2,962,026	18,031,761	85.9
Total	*48,850,985*	*15,507,854*	*33,343,131*	*68.3*
Robe Mesa and Mesa F landform				
MCU	153,427,263	8,314,862	145,112,401	94.6
MMU	67,947,034	3,635,652	64,311,382	94.6
MML	37,368,049	595,314	36,772,735	98.4
MCL	193,715,073	2,962,026	190,753,047	98.5
Total	*452,457,419*	*15,507,854*	*436,949,565*	*96.6*

3.2.6.5 Proposal habitat loss and fragmentation

As outlined above, while it is unlikely that any species of troglofauna would be restricted in distribution to the proposed pit area, questions have been raised in regard to the effect of habitat fragmentation and proportional habitat loss from Mesa F, of which the project tenure forms part.

It must be recognised in any such consideration that troglofauna occur in a three-dimensional environment (Biota and DC Blandford & Associates 2013). This means that while a planar, two-dimensional view such as a map is helpful to conceptualise impact footprints, the most informed assessment is provided by considering volumetric change to the mesa landform and the CID strata as a whole.

In the case of the Robe Mesa project, this indicates that troglofauna habitat removal for the proposed pit would represent:

- 13% of the available habitat within the project tenure by volume; and
- 3.5% of the estimated total habitat present within the entire Mesa F landform.

Even at initial assessment, the loss of 3.5% of the habitat of an ecological community would appear unlikely to represent a significant impact. Further; for context on past EPA advice to the Minister for the Environment on similar Robe valley projects, the loss of up to 50% of the habitat of a mesa was deemed acceptable (EPA 2007), provided that the persistence of troglofauna in the retained habitat could be demonstrated. Conditioned monitoring that has been conducted for these past approved projects has indeed demonstrated this, yielding data to support both maintenance of key habitat parameters and the ongoing persistence of troglofauna species in retained portions of mined mesas (MWH 2014, Biota 2019b, 2020a). Given these observations, it would seem to be an acceptably low risk that the relatively small loss of 3.5% of the troglofauna habitat would lead to any significant impact on the subterranean biodiversity values at Mesa F.

Similarly, habitat fragmentation does not appear to be a credible impact pathway. This too must consider the three-dimensional habitat perspective and that the proposed pit would still leave a surrounding margin of connected habitat on the mesa edge that is also vertically connected to underlying CID strata below the pit floor. Such connections have been shown to continue to support troglofauna during mining operations in the Robe valley (Biota 2020b). These observations suggest that the likelihood of fragmentation significantly affecting the troglofauna of Mesa F is also low.

3.2.7 Short Range Endemics

Information in this section is based on the following supporting studies:

- Biota (2022) Robe Mesa Project Short-range Endemic Invertebrate Fauna Survey. (**Appendix 7-3**)

The targeted survey for potential SRE invertebrates was conducted in June 2022 for the road and infrastructure sites by Biota (2022), as well as the mine area in May 2021, July, and September 2022 by BCE (2023). All SRE surveys were conducted in accordance with EPA technical guidance for sampling shore range endemic invertebrate fauna (EPA 2009).

Survey methods included habitat assessment, 124 person hours dedicated to SRE fauna searches at 44 sites and molecular sequencing (DNA barcoding) to identify specimens to species level.

Four broad fauna habitats were identified in the survey area:

- River/Flood Plains;
- Alluvial Plains;
- Colluvial Plains;
- Mesa tops and
- Low Stony Hills.

All SRE habitats were common in the locality, being contiguous between the survey area and surrounds.

Specimens were collected from two taxonomic groups that have a higher potential to contain SRE species; mygalomorph spiders (eight taxa) and land snails (two taxa).

Of the 10 nominal SRE species recorded, six of the mygalomorph spider taxa are potential SREs known solely from the survey area. However, the habitat attributes of the survey area and wider locality make it unlikely that these nominal species would be restricted to the survey area.

The findings for the land snail specimens were consistent with this, with the two species represented being confirmed as widespread and not SREs.

3.3 SOCIAL ENVIRONMENT

3.3.1 Current Land use

The Application area is situated within one mining lease (M08/533) and ten (10) miscellaneous licences, as outlined in **Table 2.1**. Part of the Application area (including the access road and accommodation village) is also situated within the Yarraloola Pastoral Station, with the remaining area (mine and plant infrastructure) located within Unallocated Crown Land.

3.3.2 Indigenous Cultural Heritage

The Application area is part of the overall cultural landscape of the Robe River Kuruma People and in this respect remains an important part of Robe River Kuruma culture and cultural record.

Robe River Kuruma Country is home to places of special significance to the Robe River Kuruma People, including ceremonial sites, song lines, the Robe River Jajiwurra, permanent pools and natural resources.

Since 2014 CZR continues to coordinate heritage surveys across the Application area. The ACHMP Application area for the Robe Mesa Project does not include any part of a protected area, in accordance with section 137(2)(a)(iii) of the Aboriginal Cultural Heritage Act 2021 (WA) (ACHA).

For RRK People, this Country and this landscape is imbued with cultural heritage and values where their ancestors once lived and where ancestral and spirit beings continue to live. There are tangible values that are associated with artefact scatters, caves, and scarred tress – those recorded during archaeological surveys. These places serve as a physical reminder of the cultural life of the RRK People's ancestors and the connection that exists now with present RRK generations.

The natural features of the Application area are important to RRK People. The Robe River (Jajiwurra), the mesa edges, flora and fauna are all integral to the cultural landscape of the RRK People where they have hunted, gathered, lived, conducted ceremonies, shared stories and have been a part of this Country for thousands of years.

The tangible and spiritual world are inseparable for Robe River Kuruma people. Spirit beings made and continue to maintain the physical world, holding malevolent and benevolent relationships with Traditional Owners. Robe River Kuruma people carry a great honour and burden of responsibility to ensure that they and others care for country.

Major waterways (rivers and larger creeks), permanent and semi-permanent waterholes and springs are associated with the creation serpent. For Robe River Kuruma people, this serpent entity created and continues to inhabit, maintain, and sustain country. The serpent or snake is often referred to generically as warlu (snake). The presence of the warlu in water is essential for the health of country.

RRK have an intense interest in what CZR intend to do with the water in, around and near their country. They want to know how it might be managed and what changes might result.

Best practice cultural heritage management, in terms of avoidance of harm to cultural heritage and where harm cannot be avoided proper management of the disturbance of these values, is integral to the management of these significant cultural places in the Robe Mesa Application area (**Figure 3.41**).

It should be noted that mining operations will not intersect the water table and no mine pit dewatering is proposed for the Robe Mesa Project.

An Aboriginal Cultural Heritage Management Plan (ACHMP) has been agreed between the Robe River Kuruma Aboriginal Corporation (RRKAC) on behalf of the Robe River Kuruma People and CZR for the Robe Mesa Project. Cultural heritage impacts will be managed in accordance with the ACHMP for the Robe Mesa Project.

3.3.3 Non-indigenous and Natural Heritage

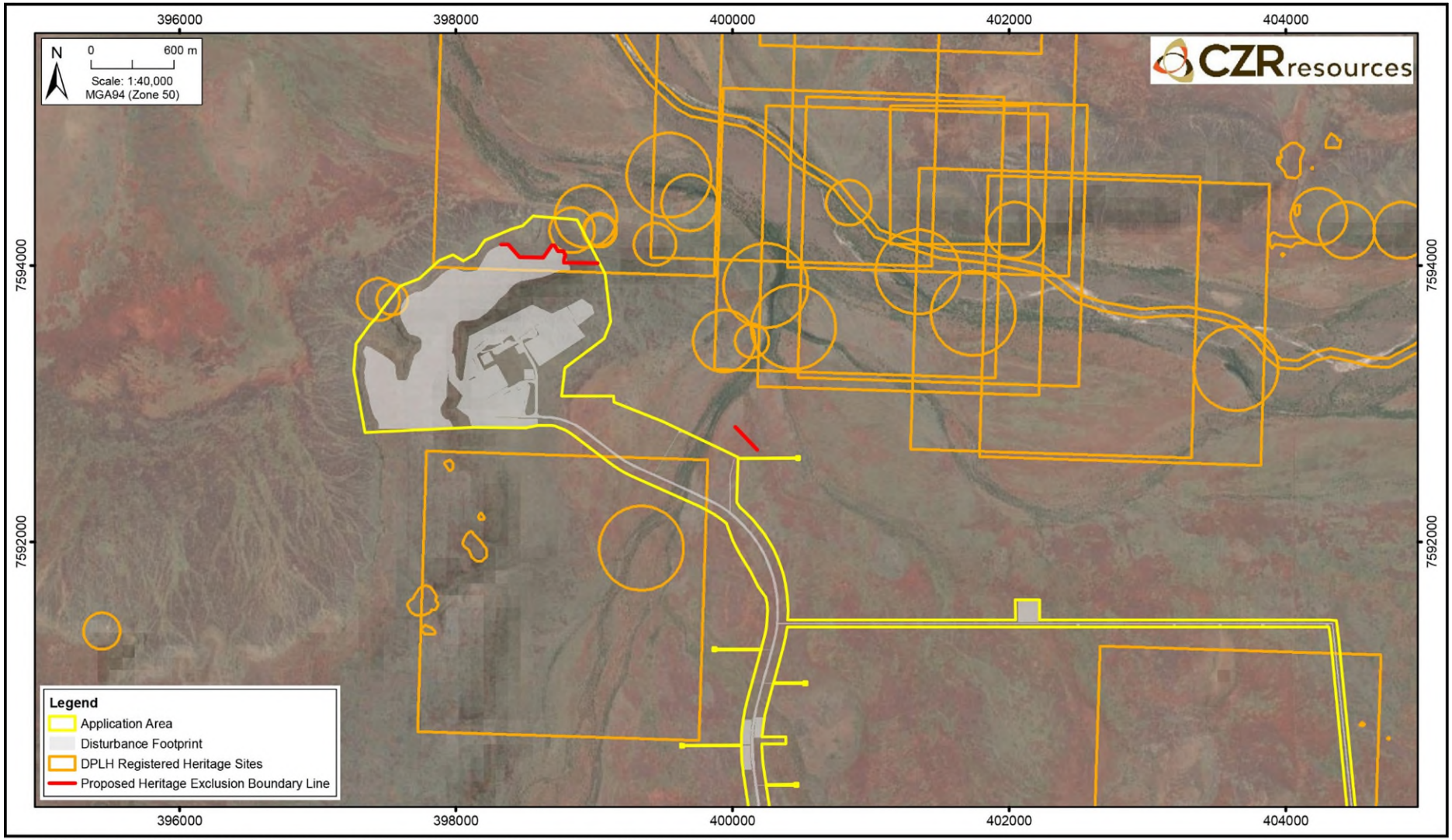
The closest conservation reserve to the survey area is the Cane River Conservation Park, which is 17.4 km south at its closest point.

The Pilbara region has 7.75% of its surface under some form of conservation tenure. At a subregional level, the Hamersley (PIL3) has 14.10% in conservation reserve (Kendrick 2001). The subregion contains almost all Karijini National Park and the eastern half of Cane River Conservation Park. The conservation category and purpose of these reserves is detailed in **Table 3.16** and presented in **Figure 3.42**.

Table 3.16: Conservation Reserves within the Hamersley (PIL3) subregion

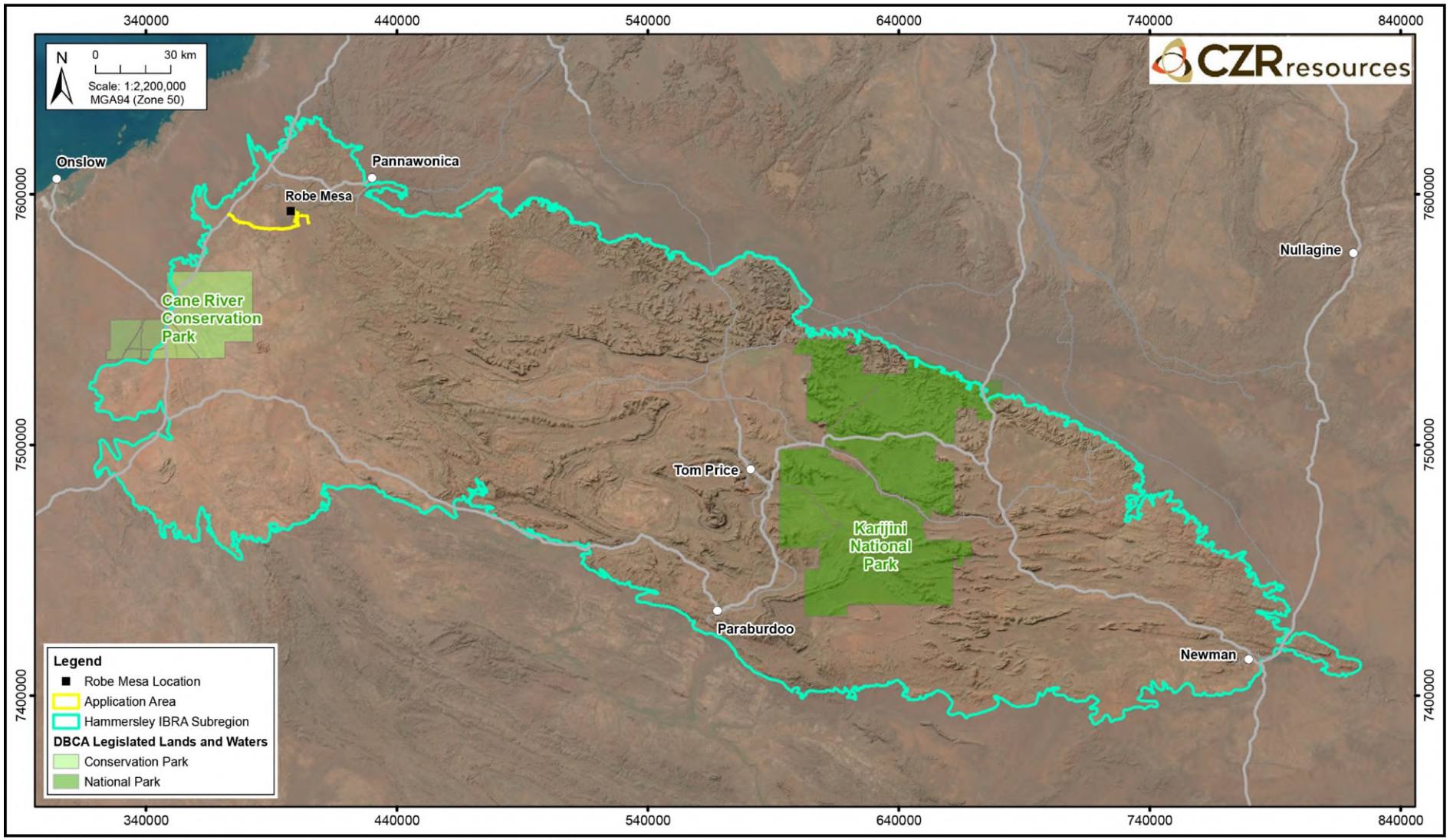
Class	Name	Category	Purpose
A	Karijini National Park	National Park	Conservation of fauna and flora, recreation
-	Cane River Conservation Park	Conservation Park	Conservation of fauna and flora, recreation

Figure 3.41: No-Go-Areas and Registered Heritage Sites



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_24, Rev: A ~ Imagery: ESRI, Maxar (Oct 2021) ~ Heritage: DPLH

Figure 3.42: Reserves in the IBRA Hamersley subregion



Drawn: CAD Resources (08 9246 3242), Date: Jun 2023, CAD Ref: a2967_F001_25, Rev: A ~ Parks: DBCA-011

4. ASSESSMENT AGAINST CLEARING PRINCIPLES

The proposed clearing of 270 ha has been assessed against the ten clearing principles, as provided in Schedule 5 of the EP Act. This assessment is presented in the following sections.

4.1 PRINCIPLE A: BIOLOGICAL DIVERSITY

Native vegetation should not be cleared if it comprises a high level of biological diversity.

Table 4.1: Principle A. Native vegetation should not be cleared if it comprises a high level of biological diversity.

Assessment	Description
Supporting studies	• CZR and Biota (2023). Environmental Management Plan – **Appendix 1-1** • RPS Group (2021). Detailed Flora and Vegetation Assessment – **Appendix 4-1** • Biota Environmental Sciences (2023a). Detailed Flora and Vegetation Survey – **Appendix 4-2** • Biota Environmental Sciences (2023b). Vegetation mapping consolidation and Infill – **Appendix 4-3**
Assessment	Implementation of the Project will result in clearing approximately 270 ha of native vegetation (proposed Disturbance footprint) from within the Application area (902 ha). The Pilbara bioregion and Hamersley subregion is considered a major centre for biodiversity within Western Australia. High species diversity and high levels of endemism have identified this region as one of 15 national biodiversity hotspots. Potential direct impacts to the Pilbara Bioregion are outlined in Section 3.2.1. It is proposed that the Disturbance footprint will impact 0.002% of the Pilbara bioregion (PIL) and 0.005% of the Hamersley Subregion. (PIL03) Detailed and targeted surveys from Biota (2023a) and RPS (2021) confirmed a combined 421 native taxa, representing approximately 29% of the total number of taxa recorded for the Hamersley (PIL03) subregion (based on information provided in RPS 2021). Despite the intense survey effort from experienced botanists, RPS (2021) and Biota (2023a) recorded no Threatened flora taxa within or adjacent to the Application area. Three Priority Flora species, as currently listed by the DBCA, were recorded within the survey area, all of which are well represented and dispersed in the region: • ***Triodia pisoliticola*** **(P3)** Priority 3 species, *Triodia pisoliticola*, was recorded from 412 locations of the survey area, within two vegetation units (E3 and E4), of which 21 sites (5.1%) are within the Disturbance footprint. This taxon is known from approximately 58 regional public records, two of which occur within conservation estate. The species occurs with a range of about 250 km across the Robe Valley. The two vegetation units containing *Triodia pisoliticola*, (E3 and E4), have been mapped across 18.6 ha of the Application area and surrounds, of which 0.5 ha is within the proposed Disturbance footprint, representing 2.7% of the mapped vegetation units containing *Triodia pisoliticola*.

Assessment (cont.)

- ***Goodenia nuda* (P4)**

  Goodenia nuda, was recorded from 26 locations of the survey area, none of which are within the Disturbance footprint. The species known range is approximately 750 km throughout the Pilbara, the Gascoyne, and Little Sandy Desert regions.

  This taxon is known from approximately 116 regional records, three of which occur within conservation estate.

  The one vegetation unit containing *Goodenia nuda* (C2), has been mapped across 593.3 ha of the Application area and surrounds, of which 20.7 ha is within the proposed Disturbance footprint, representing 3.5% of the mapped vegetation unit that may contain *Goodenia nuda* (noting that no *G. nuda* was recorded within the Disturbance footprint or Application area).

- ***Eragrostis crateriformis* (P3)**

  Eragrostis crateriformis was recorded from 376 locations of the survey area, of which 70 locations are within the Disturbance footprint (18%). *Eragrostis crateriformis* is associated with six vegetation units mapped within the Application area.

  The species has a known range that extends over 2,000 km, from the Exmouth gulf to Alice Springs.

  This taxon is known from 49 regional records, 6 of which occur within conservation estate.

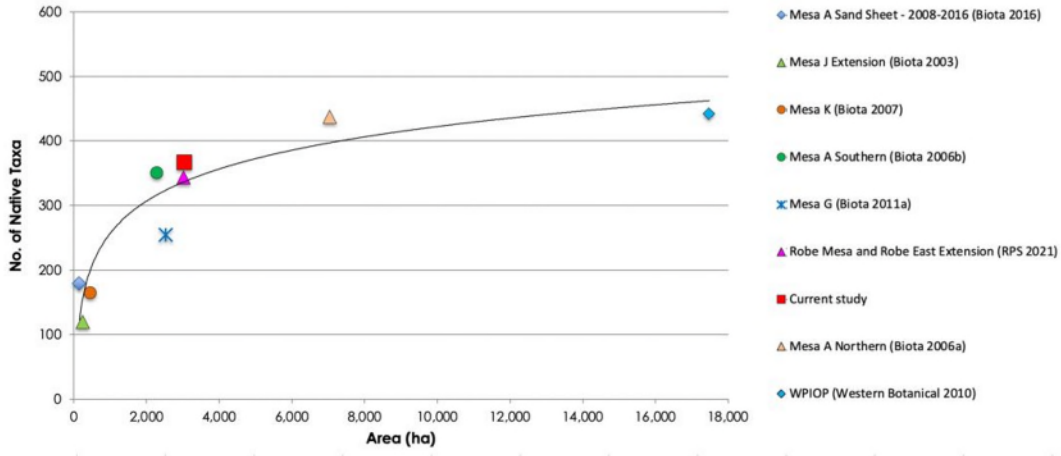
  The six vegetation units containing *Eragrostis crateriformis* have been mapped across 4,097.1 ha of the Application area and surrounds, of which 120.4 ha is within the proposed Disturbance footprint, representing 3 % of the mapped vegetation unit known to contain *Eragrostis crateriformis*.

Field surveys, observations and desktop assessments indicate that the landform types, vegetation associations and native flora occurring within the Application area is well represented in the region.

The Application area is unlikely to represent an area of higher biodiversity than that of the surrounding areas.

Species richness recorded by Biota (2023a) and RPS (2021) for the Robe Mesa Project, compared to various other survey areas in the west Pilbara is shown in **Figure 4.1**. The number of species recorded by botanists for this Project was in line with other survey areas of a similar size in the locality.

Figure 4.1: Species richness. Biota (2023a) is presented as 'current study'.



Outcome (cont.)	The proposed Disturbance footprint of 270 ha is a relatively small footprint for the Pilbara region, representing 0.005% of the Hamersley subregion. All vegetation types that are within the proposed disturbance footprint are considered widespread. Three Priority species will be disturbed by the project. These three species were all recorded in very high numbers throughout the broader survey extent (off footprint) and have a high likelihood of occurrence on similar soil types and geologies outside the project area throughout the subregion. CZRs EMP will implement management actions to manage impacts to biodiversity (see Sections 5 and 6). The Robe Mesa Project is not at variance with this Principle.

4.2 PRINCIPLE B: SIGNIFICANT HABITAT

Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Table 4.2: Principle B. Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia

Assessment	Description
Supporting studies	• CZR and Biota (2024). Environmental Management Plan – **Appendix 1-1** • Bamford Consulting Ecologists (2024a). Fauna Assessment – **Appendix 5-1** • Bamford Consulting Ecologists (2024b). Fauna species Matters of National Environmental Significance Threats and Mitigation. • Lloyd George Acoustics (LGA) (2023). Nosie Assessment – **Appendix 6-1**
Assessment	**Terrestrial fauna habitat** The Project area encompasses a mesa, scattered rocky hills, plains and drainage systems that range from minor creeklines to large river systems. Eight major habitat types were identified in the overall project area, of which six are within the Disturbance footprint (**Table 3.10**). All habitat types are widespread in the region and widely mapped across the survey area. Locally, the Disturbance footprint represents a very small proportion of the total mapped extent for each habitat type (BCE 2023), with all but one habitat type having more than 96% of the surveyed area outside the Disturbance footprint: • 53.2% of the local mapped extent of VSA1 (139 ha) is outside the Disturbance footprint. • **97.3% of the mapped extent of VSA2a Mesa Edges (17 ha) is outside the Disturbance footprint.** • 96.5% of the mapped extent of VSA2b (1,412 ha) is outside the Disturbance footprint. • 97% of the mapped extent of VSA3 (3,638 ha) is outside the Disturbance footprint. • 97.3% of the mapped extent of VSA4 (1,459 ha) is outside the Disturbance footprint. • 99.2% of the mapped extent of VSA5 (180 ha) is outside the Disturbance footprint. • 100% of the mapped extent of VSA6 (30 ha) is outside the Disturbance footprint. • 100% of the mapped extent of VSA7 (6 ha) is outside the Disturbance footprint. 147 vertebrate fauna species were recorded in the project area, three of which are listed as Threatened under State BC Act: Northern Quoll (*Dasyurus hallucatus*); Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*); and Ghost Bat (*Macroderma gigas)*. All three species are strongly associated with the mesa edge as core habitat, both for denning and roosting opportunities and foraging resources. The mesa edge habitat is small and restricted to the area immediately surround the mesa. None of the species are restricted to the project area and all three are routinely recorded in the Robe River valley. No known maternity roosts for either bat species are present in the project area and the Northern Quoll is present in relatively small numbers, typical of similar habitat in the locality (Bamford Consulting Ecologists 2022). The temporary bat roosts that are present are associated with the mesa edge and are located within the project No-Go-Areas.

Assessment (cont.)	Disturbance to mesa edge habitat will be restricted less than 0.5 ha, to allow for a haul road to connect the plant site (on the plains) with the mine pit (on the mesa top). There are no Northern Quoll records from the location of the proposed haul road, as the habitat at this specific location is more like rocky hills than mesa edges. **Noise impacts** A noise assessment undertaken by Lloyd George Acoustics (LGA 2023) determined noise impacts at the mesa edge and the known Ghost Bat maternity roost site south comply with relevant criteria and studies (Bullen and Creese 2014). Noise modeling at operations and haulage was demonstrated to be well below the site criteria level of 70dB. Sites at the mesa edge, setback just 50 m from operations, found noise emissions predictions to be in the range of 45-55bB during operations and the known maternity Ghost bat roost (off tenement, over 2 km south of the Project area) predicted noise emissions of 18 and 22 dB for operations and haulage respectively (LGA 2023).
Outcome	Direct disturbance to mesa edge habitat is avoided with a minimum 50 m setback distance. The Disturbance footprint will be predominately located on habitat that is extremely widespread in the region and considered to be of lower habitat value. Mesa tops (65 ha) and stony plains (109 ha) represent two thirds (65%) of the proposed Disturbance footprint and accommodate low species richness, compared with other habitat types of the region. Noise modelling at operations was demonstrated to comply with the fauna site criteria at the mesa edge. CZRs EMP will implement management actions throughout the life of mine to manage potential impacts to habitat (see Sections 5 and 6). The Robe Mesa Project is not at variance with this Principle.

4.3 PRINCIPLE C: RARE FLORA

Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

Table 4.3: Principle C. Native vegetation should not be cleared if it includes, or is necessary for the continuous existence of, rara flora.

Assessment	Description
Supporting studies	• RPS Group (2021). Detailed Flora and Vegetation Assessment – **Appendix 4-1** • Biota Environmental Sciences (2023a). Detailed Flora and Vegetation Survey – **Appendix 4-2**
Assessment	Three flora species, *Aluta quadrata*, *Quoya zonalis* and *Thryptomene wittweri*, are listed as Threatened for the Pilbara bioregion (see section 3.2.4). Based on their known distribution and habitat preferences, none would occur within the Application area as they all have restricted distributions and occur in habitats that don't occur within the area of the Project (RPS 2021; Biota 2023a). No Threatened flora were recorded during the survey, despite targeted searches over three survey events. RPS (2021) surveys in June 2021 proceeded an exceptional wet period, with the four months immediately preceding the survey, a total of 375 mm of rain was received, approximately 66% more than the long-term average for that same period. Equally, Biota (2023a) noted that conditions at the time of their June 2022 survey followed a period of significantly more rainfall in May 2022 (293.6 mm) than the long-term monthly median for this month (14.2 mm). A total of 455.6 mm of rainfall was received in the six months prior to the field survey (December 2021 to May 2022), which is more than double the long-term median for the same period (206.7 mm; 1971-2022). Hence, conditions at the time of all survey events were considered optimal for flora sampling.
Outcome	Despite comprehensive targeted searches over multiple survey events, no Threatened Flora have been recorded within the Application area. Habitats of known Threatened Flora of the Pilbara region do not occur within the Robe Mesa Project area. The proposed clearing is not at variance with this principle.

4.4 PRINCIPLE D: THREATENED ECOLOGICAL COMMUNITIES

Native vegetation should not be cleared if it comprises the whole, or a part of, or is necessary for the maintenance of a threatened ecological community.

Table 4.4: Principle D. Native vegetation should not be cleared if it comprised the whole or a part of, is necessary for the maintenance of a Threatened Ecological Community.

Assessment	Description
Supporting studies	• CZR and Biota Environmental Sciences (2024). Environmental Management Plan – Biota 2023 represented **Appendix 1-1** • Biota Environmental Sciences (2023c). Troglofauna Baseline Assessment – **Appendix 7-1** • CZR Resources (2023). Troglofauna Habitat Mapping – Appendix 7-2 • Biota Environmental Sciences (2024a). Robe Mesa Project Troglofauna habitat. Summary Memo Report • Biota Environmental Sciences (2024b) Addendum to Biota (2023c) Troglofauna phase 3 sampling results and analysis.
Assessment	The Application area does not occur within a Threatened Ecological Community. The nearest TECs to the Robe Mesa Project include Cameron's Cave Troglobitic Community, 250 km south west of the applications and the Ethel Gorge aquifer stygobiont community, 430 km to the south east. The project area mesa forms part of the State-listed PEC - *'Subterranean invertebrate communities of mesas in the Robe Valley region'*. Eight of the 13 species have only been recorded within the project mine pit (Biota 2023a). Two specimens, *Draculoides* sp. H-SCH200 and *Armadillidae* sp indet, are recorded both inside and outside the conceptual pit. The remaining species, *Japygidae* sp. H-DJA023, *Scolopendrellidae* sp. H-SYM039 and *Scolopendrellidae* sp. H-SYM040, are found outside the mine pit, but in connected CID in the vicinity of the Disturbance footprint (i.e., within the same CID habitat). Geological modelling (CZR Resources 2023) and extensive subterranean fauna research from the region (Biota 2023a), indicates that similarly suitable habitat is likely to occur throughout Mesa F, which is contiguous with that of the Robe Mesa Project area (Biota 2006, 2011b). It is therefore very likely that the species recorded during the survey would also occur throughout Mesa F. Outcomes from 3D troglofaunal habitat modelling for the CZR managed portion of the Mesa F landform (M08/533) had found: • The habitat remaining in M08/533 after mining is~33,000,000 bcm, which represents 68% of the pre-mining habitat volume in M08/533 (**Robe Mesa Project will retain 68% of troglofaunal habitat from M08/533**) Outcomes from 3D habitat modelling for the entire contiguous habitat of the Mesa F landform: • The proposed mining volume for the Robe Mesa Project, ~15,500,000 bcm, represents 3.4% of the total contiguous troglofaunal habitat within the Mesa F landform (i.e., **Robe Mesa Project will remove 3.4% of troglofauna habitat from the Mesa F landform**).

Outcome	No Threatened species or ecological communities listed under the BC Act were recorded within the Application Area. An EMP has been developed to help manage potential impacts to subterranean fauna and will guide the management and monitoring approach for the Robe Mesa Project (see Sections 5 and 6). The Robe Mesa Project is part of a large contiguous troglofauna habitat landform (Mesa F) and is only proposing to remove 3.4% of the potential troglofaunal habitat within this landform. The Robe Mesa Project is unlikely to be at variance with this principle.

4.5 PRINCIPLE E: REMNANT NATIVE VEGETATION

Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Table 4.5: Principle E. Native vegetation should not be cleared if it is significant as remnant native vegetation in an area that has been extensively cleared.

Assessment	Description
Supporting studies	• RPS Group (2021). Detailed Flora and Vegetation Assessment – **Appendix 4-1** • Biota Environmental Sciences (2023a). Detailed Flora and Vegetation Survey – **Appendix 4-2** • Biota Environmental Sciences (2023b). Vegetation mapping consolidation and Infill – **Appendix 4-3**
Assessment	Potential direct impacts to Pre-European Vegetation Associations are outlined in Section 3.2.2. Based on the proposed Disturbance footprint, there will be a 0.007% reduction in the regional extent of the Stuart Hills-29 vegetation association and a 0.08% reduction in the regional extent of the Stuart Hills-583 vegetation association. Both vegetation associations are widespread in the region, representing 1,131,712 ha and 243,111 ha respectively, with both associations having at least 99.9% of their pre-European extent remaining. Hence, the vegetation proposed to be cleared does not represent a significant remnant of native vegetation in an area that has been extensively cleared.
Outcome	The proposed clearing is not at variance with this principle.

4.6 PRINCIPLE F: WATERCOURSE OR WETLAND

Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Table 4.6: Principle F. Native vegetation should not be cleared if it is growing in, or in associated with, an environment associated with a watercourse or wetland.

Assessment	Description
Supporting studies	• CZR and Biota (2023). Environmental Management Plan – **Appendix 1-1** • AQ2 (2023). Hydrological Investigations – **Appendix 3-1** • AQ2 (2021). Hydrogeology and Surface Water Study – **Appendix 3-2** • AQ2 (2022). Robe Mesa Haul Rd Surface Water Assessment – **Appendix 3-3** • RPS Group (2021). Detailed Flora and Vegetation Assessment – Appendix 4-1 • Biota Environmental Sciences (2023a). Detailed Flora and Vegetation Survey – Appendix 4-2 • AQ2 (2024a). Robe Mesa MOC and Mungarathoona Creek Surface Water Modelling

Assessment	Watercourses and wetlands are outlined in Section 3.1.6 . Groundwater dependent vegetation are discussed in Section 3.2.3. There are no Nationally Important Wetlands or RAMSAR wetlands located within the Application area, with the closest National Important Wetland, the Exmouth Gulf East wetlands, located approximately 125 km west of the Application area (DBCA-045). The other Nationally Important Wetland in the region is the Fortescue Marshes, which is located 225 km east of the Application area. The nearest Ramsar Wetland is located over 430 km northeast of Application area at Eighty Mile Beach. There are three river pools in the vicinity of the Application area, Unnamed Pool is approximately 1000 m northeast, Robe Pool is approximately 1,600 m east and Chalyarn Pool is approximately 2,100 m further east of the mine area. These pools are protected by a mesa landform exclusion zone that separates the river pools (and the riparian zone more broadly) and the mine area. There will be no activity associated with the river pools and access to these sites will be restricted. There are some minor ephemeral outwash plains and drainage lines within the Application area, running periductular to the proposed access road. Potential local impacts to vegetation growing in association with drainage lines will be minimised by the implementation of a watercourse management condition. Three vegetation units (E2; E5; and M1) represent groundwater dependent vegetation, comprising major drainages supporting *Eucalyptus victrix* (low to moderate dependence), *Eucalyptus camaldulensis* subsp. *refulgens* (moderate dependence) and/or *Melaleuca argentea* (high dependence). These three vegetation units combined represent 273.7 ha of the survey area, of which only a very small proportion (1.5 ha, 0.6%) will be impacted by the proposed Disturbance footprint. Large trees will be avoided where possible during construction. Note, the Robe Mesa Project does not require dewatering the mine pit to access the resource. Current groundwater levels are approximately 50-60 m below the mesa surface and mine pits will not extend more than 40 m below the mesa surface. There will be no drawdown of groundwater contours in and around the mine area. The groundwater supply for the project is based on an existing Production Bore (PB13-1), which is located approximately 7 km southeast away from the Robe River pools and the mine area and any groundwater dependent vegetation, with no E2 vegetation unit mapped in the vicinity. PB13-3 is currently licensed under GWL180637 to sustainably abstract up to 95,000 kL pa.
Outcome	No wetlands or GDVs will be impacted from the Robe Mesa Project. Apart from necessary creek crossings, drainage lines will also be avoided. CZRs EMP has proposed a series of management and monitoring actions to manage potential impacts to drainage and wash plain vegetation within the Application area (see Sections 5 and 6). The Robe Mesa Project is unlikely to be at variance with this principle.

4.7 PRINCIPLE G: LAND DEGRADATION

Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Table 4.7: Principle G. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciated land degradation.

Assessment	Description
Supporting studies	• CZR and Biota (2023). Environmental Management Plan – **Appendix 1-1** • AQ2 (2021) Surface Water Study of the Robe Mesa Project Area – **Appendix 3-2** • Graeme Campbell and Associates (2022) Waste Characterisation – **Appendix 2-1** • RPS Group (2021). Detailed Flora and Vegetation Assessment – **Appendix 4-1** • Biota Environmental Sciences (2023a). Detailed Flora and Vegetation Survey – **Appendix 4-2** • AQ2 (2024a). Robe Mesa MOC and Mungarathoona Creek Surface Water Modelling
Assessment	The characteristics of the soil system as described in Section 3.1.3 are considered unlikely to cause appreciable land degradation, degrade surface or groundwater quality, or increase the incidence or intensity of flooding. The Application area is generally underlain by highly permeable stoney soils and red loamy earth. Water infiltration is typically very effective and efficient with no evidence of flooding and erosion in the area based on current exploration activities. Soils of the Application area, like many soils of the Pilbara region, may be at risk from wind erosion following clearing. This will be managed by ensuring that clearing is undertaken immediately prior to the commencement of construction. Any potential dust issues following clearing and construction will also be managed in best practice management where required. Clearing is not likely to cause land degradation due to: • the small area of clearing and progressive rehabilitation and backfilling of the pit • the large extent of vegetation remaining and surrounding the local and regional area. • cleared areas will either be stabilised through immediate development or rehabilitation. • the implementation of best practice engineering to stabilise the road and manage surface water flow into and from the surrounding environment. Velocity maps generated from flood modelling (AQ2 2021 and 2024a, see section 3.1.6) have shown that because inundation at the proposed Disturbance footprint will be avoided in most situations as infrastructure is generally outside the flood zone, the site is only predicted to be subject to low velocities(<0.5m/s), which will reduce the risk of erosion and downstream sedimentation. AQ2 (2024a) predictions also indicate that the impact of the road on the predicted flood levels will be 0-5cm lower than baseline and velocities to be 0-5cm per second slower than baseline, therefore no material impact is expected on the Robe Pools (see section 3.1.6). Potential local impacts to vegetation growing in association with drainage lines can be minimised by implementation of watercourse management procedure. Based on the climatic, hydrological and land system characteristics of the Application area, it is considered unlikely that the proposed clearing will degrade surface water quality, or increase the incidence or intensity of flooding.

Assessment (cont.)	**Waste material** Waste characterisation performed by Graeme Campbell Associates, indicate inert waste material with no fibrous or potentially acid forming material present. **Weeds** Nineteen weed species were confirmed within the Application area and surrounds during vegetation and flora surveys (RPS 2021, Biota 2023a). Weeds have the potential to out-compete native vegetation and reduce biodiversity. None of the species recorded are listed as WoNS (Thorp and Lynch 2000) or are Declared Pests under the WA *Biosecurity and Agriculture Management Act 2007* (the BAM Act) (DPIRD 2022). **Cenchrus* spp. (e.g. **C. ciliaris* and **C. setiger)* and Mimosa Bush (**Vachellia farnesiana)* are considered to be serious environmental weeds in WA (CALM 1999). The significant threat posed by **Cenchrus* spp. in particular has also been recognised by the Commonwealth, with ecosystem degradation, habitat loss and species decline in arid and semi-arid Australia caused by the invasion of these species. Six of the species recorded have a 'High' ranking for Ecological Impact (**Cenchrus ciliaris, *C. setiger, *Echinochloa colona, *Malvastrum americanum, *Setaria verticillata* and **Vachellia farnesiana) and* 10 have a 'Rapid' ranking for Invasiveness (**Argemone ochroleuca* subsp. *ochroleuca, *Bidens bipinnata, *Cenchrus ciliaris, *C. echinatus, *C. setiger, *Echinochloa colona, *Malvastrum americanum, *Setaria verticillata, *Solanum nigrum* and **Vachellia farnesiana)* (Department of Parks and Wildlife 2013c). Several species (**Cenchrus ciliaris, *C. setiger, *Echinochloa colona, *Malvastrum americanum, *Setaria verticillata and *Vachellia farnesiana)* were ranked by the Department of Parks and Wildlife as priority widespread weeds (Department of Parks and Wildlife 2013c). These comprise weed species that are considered to have the potential for high ecological impact and are rapidly invasive, but which are already too widespread in the region to be feasible to control at the species level. Management of these species is targeted at the protection of specific assets on high conservation areas. Implementation of weed management procedures will minimise the risk of weed infestations within the Application area.
Outcome	CZRs EMP and Closure Management Plan provide management and monitoring actions to ensure land degradation (especially downstream) is avoided (see Sections 5 and 6). The Robe Mesa Project is unlikely to be at variance with this principle.

4.8 PRINCIPLE H: CONSERVATION AREA

Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Table 4.8: Principle H. Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Assessment	Description
Supporting studies/ Reference	• GIS Database (DBCA – 020) • RPS Group (2021). Detailed Flora and Vegetation Assessment – **Appendix 4-1**
Assessment	The Application area is not within or near any conservation areas (DBCA-020). The nearest DBCA (formerly DPaW) managed lands include the Cane River Conservation Park, located approximately 35 km south west of the Application area and the Millstream Chichester National Park, which is approximately 110 km east of the Application area.
Outcome	The proposed clearing is unlikely to impact on the environmental values of any conservation area.

4.9 PRINCIPLE I: SURFACE OR UNDERGROUND WATER

Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Table 4.9: Principle I. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Assessment	Description
Supporting studies	• CZR and Biota (2023). Environmental Management Plan – **Appendix 1-1** • AQ2 (2023). Hydrological Investigations – **Appendix 3-1** • AQ2 (2021). Hydrogeology and Surface Water Study – **Appendix 3-2** • AQ2 (2022). Robe Mesa Haul Rd Surface Water Assessment – **Appendix 3-3** • RPS Group (2021). Detailed Flora and Vegetation Assessment – **Appendix 4-1** • Biota Environmental Sciences (2023a). Detailed Flora and Vegetation Survey – **Appendix 4-2** • AQ2 (2024a). Robe Mesa MOC and Mungarathoona Creek Surface Water Modelling • AQ2 (2024b) Hydrological Investigations. H2 Level of Assessment. Updated November 2024. • AQ2 (2024c) Robe Mesa Project Groundwater Operating Strategy • AQ2 (2024d) Robe Mesa Project Groundwater Level Monitoring – Results Memo • AQ2 (2024e) Memo report responding to RFI for groundwater licence
Assessment	**Surface Water:** The 270 ha Disturbance footprint is predominately located within the broader extent of the 758,253 ha Robe River Catchment. Part of the access road is also located within the 424,037 ha Coastal Plains Catchment. There is an estimated 25 ha of vegetation units that comprise minor or medium drainage lines or outwash plains within the proposed Disturbance footprint (vegetation units C5, E2, T2, M1), most of which is associated with road crossings that will be designed and managed to avoid downstream impacts to surface water. **Groundwater:** The deposit is above the water table and no mine pit dewatering is required. There will be no groundwater drawdown contours at sensitive GDV or GDE locations. Groundwater requirements for construction and operations can be sourced from the existing production bore PB13-3, drilled into the faulted/fractured Duck Creek Dolomite aquifer system, is located approximately 8 km southeast from the proposed Robe Mesa mine and has the potential to fully meet the Robe Mesa Projects water demand. PB13-3 is 8 km from the Robe River and Mungarathoona Creek and any groundwater abstraction. Recent groundwater quality analysis at PB13-3, determined that the groundwater is fresh of potable quality. All parameters tested were well below the Australian Drinking Water Guidelines (ADWG) values (Version 3.8, September 2022), with the exception of hardness, which has no health implications. A Groundwater Operating Strategy for the Robe Mesa Project has been developed and approved by DWER, to meet the requirements to support a Groundwater Licence for PB13-3. The Stragey document has been prepared at a basic level of assessment in accordance with DWER Operational policy (DWER 2020). A Groundwater Monitoring Procedure will also be implemented and will incorporate groundwater levels and water quality monitoring during the minor works program. Groundwater will be monitored and managed in accordance with RIWI Act licence conditions as well as internal groundwater monitoring procedures.
Outcome	The proposed clearing is unlikely to be at variance with this Principle.

4.10 PRINCIPLE J: FLOODING

Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Table 4.10: Principle J. Should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Assessment	Description
Supporting studies	• AQ2 (2021). Hydrogeology and Surface Water Study – Appendix 3-2 • AQ2 (2022). Robe Mesa Haul Rd Surface Water Assessment – Appendix 3-3 • AQ2 (2024a). Robe Mesa MOC and Mungarathoona Creek Surface Water Modelling
Assessment	Refer to Surface Water Section 3.1.6 The 1% AEP event flood depth predictions from the pre-development model are: • The process plant and ROM infrastructure is located outside of the 0.5 m flood depth area, with only shallow flow <0.5 m potentially within a small corner of the plant footprint. • The Haul Road alignment crosses Mungarathoona Creek floodplain with flood inundation predictions summarised as: - Flood depths exceeding 0.5 m over a 4 km length, with flood depths up to 3.5 m at the deepest location. - Sheet flow with flood depths less than 0.5 m over a further 2.6 km length. • The maximum flood depth of the Robe River in the main channel to the north-east (through the gap in the mesas) is predicted to be about 8 m and in the nearby pools is up to 10 m. A velocity result maps presented Section 3.1.6 provide an indication of areas subject to potential scour. Within the planned disturbance areas, it is noted that any inundation in the proposed plant footprint (or flows against any flood protection bunding) is only predicted to be subject to low flow velocities (<0.5 m/s). The velocity where Mungarathoona Creek crosses the proposed road alignment is predicted to be between 1.5 and 2.0 m/s.
	Generally, flood mitigation measures for planned or potential infrastructure could include: • install infrastructure on a pad above the flood levels or install flood protection bunding, or • reconsidering the location of the infrastructure to be outside of the floodplain, or • accept a higher level of flood risk for temporary infrastructure depending on the severity of the impact on operations and other consequences.
Outcome	Flood modelling shows key infrastructure areas have been placed in locations outside the floodplains of the major adjacent creeks or where flow depths are manageable (<0.5 m). Where the flood plain extends over infrastructure footprints, the following flood mitigation measures could be considered by CZR: • Plant area – predevelopment flood levels are predicted to extend marginally over the lowest points of the plant footprint. Clearing and levelling of the area for construction is likely to raise the footprint above the predicted flood levels. • Camp area – potential inundation of the camp area could be managed by a low flood protection bund around the perimeter of the camp. • Road crossing of Mungarathoona Creek - crossing may be constructed as a combination of a flood way with culverts to provide some degree of trafficability in lower flow events. The Proposed clearing is unlikely to be at variance with this Principle.

5. RISK ASSESSMENT

5.1 APPROACH

A risk assessment has been undertaken of the potential environmental impacts within the Application area. The risk assessment approach is based on DEMIRS guidance documentation (DMIRS 2020 and 2020a) and uses a consequence and likelihood rating system to determine the most appropriate risk rating for each impact. Details of the risk assessment approach are discussed below.

5.1.1 Consequence

Consequence refers to an environmental outcome or impact arising from a risk event occurring. An assessment of consequence will indicate the seriousness of a risk event, which may be expressed in terms of environmental implications (**Table 5.1**).

5.1.2 Likelihood

Likelihood refers to the probability of an environmental risk event occurring. Risks that have a higher likelihood (i.e., frequent occurrences) have a greater chance of an environmental impact occurring (**Table 5.2**).

5.1.3 Risk rating determination

The risk rating is determined for a particular risk by combining the consequence level with the likelihood level. The results of the risk evaluation process are summarised in a risk matrix table (**Table 5.3**), noting that the main feature is to divide the matrix table into four ratings of risk classifications are:

- Extreme risks: Unacceptable. Risk event will not be tolerated.
- High risks: May be acceptable. Subject to multiple regulatory controls. Risk event may be tolerated and may be subject to multiple regulatory controls.
- Medium risk: Acceptable, generally subject to regulatory controls. Risk event is tolerable and is likely to be subject to some regulatory controls.
- Low risk: Acceptable, generally not controlled. Risk event is acceptable and will generally not be subject to regulatory controls.

Table 5.1: Consequence descriptors (DMIRS 2020a)

Insignificant	Minor	Moderate	Major	Severe
Biodiversity: Alteration or disturbance to an isolated area with no effect on habitat or ecosystem. Loss of an individual plant / animal of conservation significance.	Alteration or disturbance to <10% of a habitat or ecosystem resulting in a recoverable impact within 2 years. Loss of multiple plants / animals of conservation significance.	Alteration or disturbance to 10- 40% of a habitat or ecosystem resulting in a recoverable impact within 2-5 years. Loss of <50% known local population of plant / animal of conservation significance.	Alteration or disturbance to 40- 70% of a habitat or ecosystem resulting in a recoverable impact within 5-15 years. Loss of >50% known local population of plant / animal species with possible loss of entire local population.	Alteration or disturbance to >70% of a habitat or ecosystem resulting in a recoverable impact >15 years. Local loss of conservation significant or listed species. Extinction of a species.
Water Resources: Negligible change to hydrological processes, water availability or water quality.	Short-term modification of hydrological processes, water availability and quality within project tenure, but no change in beneficial use.	Medium-term modification of hydrological processes, water availability and water quality within project tenure, but no change in beneficial use. Short-term modification of hydrological processes, water availability and water quality outside project tenure, but no change in beneficial use.	Long-term modification of hydrological processes, water availability and water quality within project tenure, but no change in beneficial use. Medium-term modification of hydrological processes, water availability and water quality outside project tenure, with change in beneficial use.	Long-term or permanent modification of hydrological processes, water availability or water quality outside project tenure, with impacts to a water-dependent environmental value and/or change in beneficial use.
Land and Soils: Clean-up by site personnel, rectified immediately. Confined to immediate area around source.	Clean-up by site personnel, remediation within 1 year. Confined to operational area.	Clean-up by site personnel, remediation within 1-3 years. Minor impact outside disturbance envelope or minor impact to soil stockpiles.	Clean-up requiring external specialist, remediation within 3-10 years. Impact has migrated outside the disturbance envelope or contamination of soil stockpiles.	Clean-up requiring external specialist. Remediation >10 years, or permanent residual impact. Impact outside the tenement boundary.
Rehabilitation & Closure: Site is safe, stable a non-polluting. Post mining land use is not adversely affected.	Site is safe, all major landforms are stable, and any stability or pollution issues are contained and require no residual management. Post mining land use is not adversely affected.	Site is safe and any stability or pollution issues require minor, ongoing maintenance by end land-user. Post mining land use cannot proceed without some management.	Site cannot be considered safe, stable, or non-polluting without long-term management or intervention. Post mining land use cannot proceed without ongoing management.	Site is unsafe, unstable and/or causing pollution or contamination that will cause an ongoing residual affect. Post mining land use cannot be achieved.

Table 5.2: Likelihood descriptors (DMIRS 2020a)

Descriptor	Frequency	Probability
Absolutely Certain	Twice or more per year	Event will occur during the Project / period under review. High number of known incidents.
Likely	Once per year	Event likely to occur during the Project / period under review. Regular incidents known.
Possible	Once in 5 years	Event may occur in some instances during the Project / period under review. Occasional incidents known.
Unlikely	Once in 10 years	Event is not likely to occur during the Project / period under review. Some occurrences known.
Rare	Once in 20 years	Event occurs in exceptional circumstances during the Project. Very few or no known occurrences.

Table 5.3: Risk Matrix (DMIRS 2020a)

		Most Credible Consequence Level				
		6 - Insignificant	**7 - Minor**	**8 - Moderate**	**9 - Major**	**10 - Severe**
Likelihood	**5 - Almost Certain**	M-11	H-16	H-20	E-23	E-25
	4 - Likely	M-7	M-12	H-17	H-21	E-24
	3 - Possible	L-4	M-8	M-13	H-18	H-22
	2 - Unlikely	L-2	L-5	M-9	M-14	H-19
	1 - Rare	L-1	L-3	L-6	M-10	M-15

Extreme	High	Medium	Low

5.2 POTENTIAL IMPACTS

The projects impact pathways and ultimate potential impacts on species and comm an impact assessment of the proposed works for each relevant environmental factor. The potential direct and indirect impacts for each of these factors is summarised in **Table 5.4**.

Table 5.4: Potential impacts

Impact Pathway	Potential Impacts
Terrestrial Fauna	
Ground disturbance (Mine pit, stockpiles, haul road, processing, infrastructure)	• Direct impacts on individuals (plant and equipment) • Habitat loss beyond approved limit • Habitat degradation (altered surface hydrology)
Noise and Vibration (Mine pit, stockpiles, haul road, processing, infrastructure)	• Behavioural changes (disturbance response) • Habitat degradation (structurally altered)
Light spill (Mine pit, stockpiles, processing, infrastructure)	• Behavioural changes (altered foraging)
Linear infrastructure (Haul road, infrastructure)	• Individual mortality (vehicle interaction) • Habitat degradation (altered surface hydrology)
Human habitation (Infrastructure)	• Behavioural changes (altered foraging) • Individual mortality (human interaction)
Changed fire regimes (Haul Road, infrastructure)	• Individual mortality (increased fire frequency) • Habitat degradation (increased fire frequency)
Increase in introduced fauna. (Infrastructure)	• Increased predation and/or competition
Increase in environmental weeds. (Haul road, infrastructure)	• Habitat degradation (altered vegetation structure)
Subterranean Fauna	
Ground disturbance (Mine pit, stockpiles)	• Loss of subterranean fauna habitat beyond approved limit • Habitat degradation (altered surface hydrology)
Vibration (Mine pit, infrastructure)	• Habitat degradation
Flora and Vegetation	
Ground disturbance (Mine pit, stockpiles, haul road, infrastructure)	• Direct impacts on individuals (plant and equipment) • Loss of vegetation types beyond approved limit
Dust (Mine pit, haul roads, infrastructure)	• Vegetation degradation (shading, altered transpiration)
Linear infrastructure (Haul road, infrastructure)	• Vegetation degradation (altered surface hydrology)

Impact Pathway	Potential Impacts
Changed fire regimes (Haul Road, infrastructure)	• Vegetation degradation (increased fire frequency)
Increase in environmental weeds. (Haul road, infrastructure)	• Vegetation degradation
Cultural Heritage values	
Ground disturbance (Mine pit, stockpiles, haul road, infrastructure)	• Direct disturbance
Noise and Vibration (Mine pit, stockpiles, haul roads, infrastructure)	• Site degradation (structurally altered) • Reduced amenity
Access to sensitive areas (river pools) (Mine pit, stockpiles, haul road, infrastructure)	• Site disturbance and cultural insensitivity at heritage sites

5.3 RISK ASSESSMENT AND RATING

The risk assessment process identified ten potential impacts (**Table 5.5**), eight of which had a residual risk rating as a Medium and two rated as Low. **No Extreme or High residual risks were identified**.

The risks ranked from Low to Medium, are all considered acceptable, with some level of regulatory control required.

Table 5.5: Robe Mesa Project environmental risk assessment

Item	Impact	Inherent Risk			Management Actions Risk Treatments / Controls	Timing	Residual Risk		
		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating
1	Loss of fauna habitat, vegetation, or sites of cultural significance beyond approved ground disturbance limits	Major	Possible	H18	1. Final mine pit design to be spatially limited to observe the mesa edge buffer and No-Go Areas.	Pre-construction	Major	Unlikely	M14
					2. Final design of project footprint to reduce extent of habitat cleared, including utilising existing tracks and co-locating infrastructure, where feasible.	Pre-construction			
					3. Develop and implement ground disturbance approval procedures, requiring supervisor approval prior to proceeding.	Construction			
					4. Approved clearing limits to be delineated on ground and spatially managed via GPS technology.	Construction			
					5. Implement rehabilitation procedures for decommissioned areas of the project footprint, in accordance with the project's Mine Closure Plan (CZR Resources 2023b).	Post-operations			
2	Loss of subterranean fauna habitat beyond approved limits	Major	Possible	H18	1. Final mine pit design to be spatially limited to observe the mesa edge buffer, No-Go Areas, with pit depth to be limited to the upper and lower CID units.	Pre-construction, Operations	Major	Unlikely	M14
3	Direct impacts on significant terrestrial fauna and flora	Major	Possible	H18	1. Final design of mine pit and associated infrastructure footprint to observe mesa edge buffer and No-Go Areas.	Pre-construction	Major	Unlikely	M14
					2. Final alignment of project haul road and any associated materials sourcing areas to avoid known locations of Priority fauna and flora.	Pre-construction			
					3. Drill and blast activities to be constrained to the approved mine pit boundaries.	Operations			

Item	Impact	Inherent Risk			Management Actions Risk Treatments / Controls	Timing	Residual Risk		
		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating
					4. Culverts under roads and directional fencing should be established to facilitate movement around the project area. The use of steep batters may also be used to guide animals to entrance.	Construction, Operations			
4	Altered surface hydrology, degrading fauna habitat and vegetation	Moderate	Possible	M13	1. Incorporate culverting or other appropriate drainage treatments into the final design of the haul road at locations where it crosses significant drainage lines, to ensure no backwater upstream of the crossing point or reduction in natural hydrology downstream.	Pre-construction	Moderate	Unlikely	M9
					2. Ensure run-off from active mining areas, including the mine pit and any temporary stockpiles, is managed by bunding, diversion drains, or other appropriate drainage treatments to minimise sediment transport from areas of ground disturbance.	Operations			
5	Increased feral fauna distribution and abundance, increasing predation pressure	Moderate	Possible	M13	1. Best practice waste management procedures and facilities, particularly for food waste.	Construction, Operations	Moderate	Unlikely	M9
					2. Prohibiting all personnel from feeding of fauna or disposal of food outside of allocated disposal points.	Construction, Operations			
					3. Maintain a register to record the presence of feral animals on site.	Construction, Operations			
					4. Implementation of targeted feral fauna control in areas of higher risk, principally around the camp mess and crib rooms, as well as the infrastructure sites and haul road. Regular inspections of the area and reporting of opportunities sightings will guide annual control event target sites and timing.	Construction, Operations			

Item	Impact	Inherent Risk			Management Actions Risk Treatments / Controls	Timing	Residual Risk		
		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating
6	Altered surface hydrology, degrading subterranean fauna habitat	Moderate	Possible	M13	1. Direct return of waste material in-pit, minimising any temporary stockpiling time, with materials strategically deployed directly against undisturbed subterranean fauna habitat within the mesa edge buffer.	Operations	Moderate	Unlikely	M9
					2. Ensure earthworks and roads minimise any obstruction to natural surface water flow.	Construction			
7	Weed introduction and spread, degrading fauna habitat and vegetation	Moderate	Likely	H17	1. Implement Weed Hygiene and Control Procedure, including awareness training, the use of Weed Hygiene Certificates and implementing weed control measures.	Construction, Operations	Moderate	Unlikely	M9
					2. Weed monitoring to record changes in target weed populations, their location, extent and the effect of any control methods.	Operations, Closure			
8	Noise, light spill, and vibration, changing fauna foraging behaviour	Moderate	Possible	M13	1. Design of site lighting to incorporate light sources with little or no short wavelength (blue and ultraviolet) light and motion-sensitive activation and deactivation where safety considerations permit.	Pre-construction	Moderate	Unlikely	M9
					2. Lighting to be directed to required areas only and incorporate shielding to reduce unneeded light spill into natural areas.	Construction, Operations			
					3. Lighting should not be directed into natural areas and should use non insect-attracting fittings	Planning, Construction, Operations			

Item	Impact	Inherent Risk			Management Actions Risk Treatments / Controls	Timing	Residual Risk		
		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating
					4. Blasting limited to daylight hours and will avoid the any nominated exclusion zones	Operations			
					5. Drill and blast practices will be modified near the pit edge if rock shelters are identified along the mesa escarpment. If any rock shelter found sits within the minimum distance for 95% probability of compliance with 20 mm/sec vibration, no blasting will occur, with only dozer rip and excavator free-dig activities performed.	Construction, Operations			
					6. Plant, vehicles, and generators will be maintained according to manufacturer specifications.	Construction, Operations			
					7. Vehicle and machinery traffic will be confined to defined roads and tracks where practicable.	Construction, Operations			
					8. Vehicle speed limits shall be imposed and enforced on all roads and tracks.	Construction, Operations			
9	Changed fire regimes, degrading fauna habitats and vegetation	Minor	Possible	M8	1. Implementation of a hot works permitting system to control any works where sparks or other potential ignition sources are generated, such that there is no risk of adjacent intact vegetation being ignited.	Construction, Operations	Minor	Unlikely	L5

Item	Impact	Inherent Risk			Management Actions Risk Treatments / Controls	Timing	Residual Risk		
		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating
					2. Ensure adequate firefighting equipment and personnel are available on site.	Construction, Operations			
					3. Development and readiness resourcing for fire emergency response procedures.	Construction, Operations			
					4. Liaise with DBCA during their controlled burning season and ensure they are aware of the need to protect sensitive habitat around the project area (i.e. riparian vegetation).	Construction, Operations			
10	Other general construction and operations impacts	Minor	Possible	M8	1. Implement dust monitoring and management procedure to track and minimise dust emissions across project area	Construction, Operations	Minor	Unlikely	L5
					2. Site induction for all personnel to specify environmental management requirements and conservation significant values	Construction, Operations			
					3. Implement Ground disturbance approval procedure.	Construction			
					4. Pre-clearing checks across potential habitats (i.e. creek lines and mesa edge/ramp), including trapping for NQ and POP immediately prior to clearing. Maintain watch at the commencement of disturbance	Construction			
					5. Fire prevention and emergency response procedures.	Construction, Operations			
					6. Onsite speed limits, with speed restrictions of 60 km/hr implemented within key habitat locations (e.g. creek locations and the mesa edge)	Construction, Operations			
					7. Establish wildlife crossing signs, with speed limits clearly signposted at key locations (e.g. creek locations and the mesa edge) on the road network	Construction			

Item	Impact	Inherent Risk			Management Actions Risk Treatments / Controls	Timing	Residual Risk		
		Consequence	Likelihood	Risk Rating			Consequence	Likelihood	Risk Rating
					8. Prohibit off-road driving over uncleared fauna habitat and vegetation unless authorised by environmental personnel.	Construction, Operations			
					9. Minimise the use of barbed wire fencing (in consultation with land managers). 10. Implement reporting protocols for any fauna roadkill	Construction, Operations			

6. ENVIRONMENTAL OUTCOMES AND MONITORING

CZR will implement monitoring to measure the effectiveness of the management actions in achieving the project's environmental outcomes and to identify when additional mitigation or contingency responses may be needed.

Table 6.1 sets out the monitoring needed to measure the effectiveness of the management actions in meeting their related targets.

Table 6.1: Monitoring frequency and reporting

Environmental Outcomes	Monitoring/Measurement tool	Timing/Frequency	Reporting
• Project ground disturbance will not exceed 270 ha. • No loss of fauna habitat outside of the project development envelope. • No loss of flora and vegetation outside of the project development envelope. • No loss of habitat critical to significant fauna species due to the project. • No loss of significant flora species due to the project. • No direct disturbance of sites of cultural heritage significance.	• Cumulative ground disturbance extents captured and tracked via GPS technology or regular aerial imagery and GIS capture. • Verification of onsite ground disturbance against final project design and authorised extent boundary.	• Daily assessment of ground disturbance activities during clearing and construction • Quarterly assessment during construction and operations.	• Internal ground disturbance procedures and ground disturbance permitting process. • Annual environmental reporting of land clearing activities. • Review management actions (and revise if required). • Reporting on the review and revision of management actions.
• Mine pit ground disturbance will not exceed 68 ha. • No loss of subterranean fauna habitat outside of the project development envelope.	• Pit shell extent monitoring and volume tracking during active mining.	• Monthly during operations.	• Annual environmental reporting. • Review management actions (and revise if required). • Reporting on the review and revision of management actions.
• No significant decline in habitat condition outside of the project development envelope. • No significant decline in vegetation condition outside of the project development envelope.	• Establish and monitor representative vegetation condition sites around the periphery of the mesa foot slopes.	• Annually during operations	• Annual environmental reporting. • Review management actions (and revise if required). • Reporting on the review and revision of management actions.

Environmental Outcomes	Monitoring/Measurement tool	Timing/Frequency	Reporting
• No significant decline in subterranean fauna habitat condition outside of the mine pit.	• Monitor microclimate within the mesa edge buffer.	• Ongoing during operations.	• Annual environmental reporting. • Review management actions (and revise if required). • Reporting on the review and revision of management actions.
• No introduction or spread of introduced fauna due to the project.	• Waste management procedure compliance records. • Monitor/inspect for the presence of feral fauna at higher risk areas, including camp, crib, infrastructure sites and haul roads. • Records of engaging appropriately licensed feral fauna control contractor and scope of activities.	• Quarterly during construction and operations. • Annual control measures implemented, with timing and location dependant on outcomes of the prior inspections. Frequency of control measures will in part be guided by licenced feral fauna control contractor.	• Annual environmental reporting. • Review management actions (and revise if required). • Reporting on the review and revision of management actions.
• No introduction or spread of environmental weeds due to the project.	• Inspection and auditing of clean down point facilities and cleaned equipment. • Targeted weed monitoring at higher risk locations and current earthworks areas. • Targeted weed monitoring on completion of works.	• Quarterly review of clean down records. • Quarterly weed monitoring during construction and annual weed monitoring during operation.	• Annual environmental reporting. • Review management actions (and revise if required). • Reporting on the review and revision of management actions.
• Minimise impacts on conservation significant fauna from noise, light and vibration	• Monitoring the activity for conservation significant fauna during key phases over the life of the project • Visual inspections of light spill during works • Vehicle and equipment maintenance records	• Fauna monitoring during key stages of the project (construction, initial blast, regular operations, closure etc.)	• Incident reporting • Equipment and vehicle inspection and maintenance records • Annual environmental reporting

Environmental Outcomes	Monitoring/Measurement tool	Timing/Frequency	Reporting
	• Blast plans and records	• Annual inspections during operational phase for all other records and inspections	

7. ENVIRONMENTAL MANAGEMENT

The project management actions that CZR will implement throughout the life of the project are set out in **Table 6.1** and are further detailed in the Project Environmental Management Plan (EMP).

7.1 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

An Environmental Management Plan (EMP) has been developed, which documents environmental outcomes and the management actions to be implemented to achieve these outcomes during the construction and operation of the project (CZR 2024, **Appendix 1-1**). Key aspects of the EMP includes:

- management actions to avoid, reduce and minimise any potential environmental impacts of the project on key environmental values;
- specifying timing for implementation of these management actions; and
- specifying monitoring and reporting procedures to provide for continuous improvement, consistent with an adaptive management approach.

While the EMP is the primary document setting out environmental outcomes for the project and how these will be achieved, two related matters are addressed in other CZR documents:

- Cultural heritage protection - Cultural Heritage Management Plan.
- Project closure and rehabilitation – Mine Closure Plan.

CZR recognises that incremental knowledge gain over time and the evolving nature of project implementation, may lead to changes in risk profiles for potential impacts. An adaptive management approach will therefore be adopted for the implementation of this EMP, which will involve:

- Developing and implementing additional mitigation actions (should these become necessary);
- Monitoring and evaluating data in comparison to management targets and environmental criteria, noting that these targets and criteria will be developed based on future monitoring data specific to the development envelope; and
- Systematically adapting, as necessary, management and mitigation actions and monitoring to meet the environmental objectives.

This will be supported by the implementation of an Environmental Management System (EMS) for the project and associated procedures, to ensure that management actions contained in the EMP are embedded in all work practices.

Revision of these EMP will be undertaken on an as-needs basis following annual review and reporting of relevant monitoring data and the adequacy with which existing management actions are achieving the intended environmental outcomes.

7.2 IMPLEMENTATION RESPONSIBILITY

While CZR has ultimate responsibility for project implementation, much of the day-to-day delivery and operation of the project will be undertaken by contractors.

CZR will ensure that all service contracts for the project are binding on all contractors regarding implementing the content of this EMP as relevant to their activities onsite. Compliance reporting will also be contractually required, to enable CZR to consolidate environmental management data into annual reporting.

8. CONCLUSION

Baseline studies since 2020 have contributed significantly to the scientific understanding of environmental significance of the Application area and allowed CZR to design the project in a way that identifies, prevents, and minimises adverse environmental impacts.

The investigations have relied on the technical skills and experience specialised consultants and covered a range of environmental factors and aspects relevant to the project, including terrestrial and subterranean fauna; flora and vegetation; noise; vibration/blasting; geotechnical / geochemical analysis of soils and waste; hydrogeology and hydrology; and ethnographic and archaeological investigations.

The results of these investigations, consultations and risk assessments have all been considered in developing the project.

As part of an adaptive management approach, CZR will continue to work closely with technical experts across a range of environmental factors (i.e., bat and other fauna specialists, hydrologists, botanists) to better understand the issues and to refine/adapt management measures accordingly.

By avoiding core habitat for many of the conservation significant species, implementing adaptive management that responds to ongoing monitoring, adopting measures detailed in the management and monitoring procedures developed by CZR, and through provisions under other (WA State) regulatory mechanisms (such as the EP Act, RIWI Act, *Mining Act 1978* (Mining Act), *Aboriginal Heritage Act 1972* (AH Act)), CZR is of the view that the Robe Mesa Project can be implemented without material risk the environmental values of the area.

An assessment of the impacts of the Project against the ten clearing principles has determined that the clearing is not at variance or is unlikely to be at variance with these principles.

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10. APPENDICES (at time of Rev 1 assessment)

1. Environmental Management		
Appendix 1-1	Biota Environmental Sciences and CZR Resources (Biota and CZR) Robe Mesa Iron Ore Project Environmental Management Plan (EMP).	Biota & CZR (2022)
Appendix 1-2	Tenement Summary Reports M08/533; L08/281; L08/295; L08/297; L08/303; L08/304; L08/319; L08/320; L08/321; L08/322; L08/323; L08/324	
2. Waste Characterisation and Management		
Appendix 2-1	Graeme Campbell and Associates Pty Ltd (GCA) Robe Mesa Project: Mine-Waste & LG-Ore Characterisation Investigation – Implications for Mining-Stream Management. 9 December 2022	GCA (2022)
3. Hydrogeology and Hydrology		
Appendix 3-1	AQ2 Pty Ltd (AQ2) Robe Mesa Project H2 Level of Assessment. Groundwater Abstraction from Bore PB13-3 for Mine Water Supply. March 2023	AQ2 (2023)
Appendix 3-2	AQ2 Pty Ltd (AQ2) Robe Mesa Project Surface Water Assessment. 385C_ 005a. 31/08/2021	AQ2 (2021)
Appendix 3-3	AQ2 Pty Ltd (AQ2) Robe Mesa Study – Haul Road Surface Water Assessment. 385F_ 016a. 15/06/2022	AQ2 (2022)
4. Flora and Vegetation		
Appendix 4-1	RPS Group (RPS) Detailed Flora and Vegetation Assessment. Robe Mesa and Robe East extension deposits. AU213001831.001. Rev 0. 25 October 2021.	RPS (2021)
Appendix 4-2	Biota Environmental Sciences (Biota) Robe Mesa Project Detailed Flora and Vegetation Survey. 1651B. Rev 0. February 2023.	Biota (2023a)
Appendix 4-3	Biota Environmental Sciences (Biota) Robe Mesa Project: Haul Road Realignment and Associated Vegetation Extrapolation and Consolidation. 1651C_Rev0. 23 March 2023.	Biota (2023b)
5. Terrestrial Fauna		
Appendix 5-1	Bamford Consulting Ecologists (BCE) CZR Resources Ltd. Robe Mesa Iron Ore Project Fauna Assessment. Rev0. 1670. 5th April 2023.	BCE (2023)
6. Noise		
Appendix 6-1	Lloyd George Acoustics (LGA) Environmental Noise Assessment. Robe Mesa Project. Reference: 23027867-01. 5 April 2023	LGA (2023)
7. Invertebrate Fauna		
Appendix 7-1	Biota Environmental Sciences (Biota) Robe Mesa Troglofauna Baseline Assessment Report. 1580_RevA. April 2023.	Biota (2023c)
Appendix 7-2	CZR Resources (CZR) Work Completed for the Review of Troglofauna Habitat at Robe Mesa Deposit. Rev0. March 2023.	CZR (2023)
Appendix 7-3	Biota Environmental Sciences (Biota) Robe Mesa Project Short-range Endemic Invertebrate Fauna Survey. RevA. 1670. December 2022.	Biota (2022)