Environmental Authority Amendment Supporting Document

Daunia West Infrastructure Project

Whitehaven Daunia Pty Ltd

Prepared by:

SLR Consulting Australia

SLR Project No.: 620.042120.00001

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Making Sustainability Happen

Revision Record

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Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Whitehaven Daunia Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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Executive Summary

Whitehaven Daunia Pty Ltd (Whitehaven Daunia) proposes to amend the Environmental Authority (EA) EPML00561913 for the Daunia Mine (DNM), located approximately 30 kilometres (km) southeast of Moranbah, Queensland.

An EA Amendment is sought by Whitehaven Daunia to authorise the construction and operation of the proposed Daunia West Infrastructure Project (the Project). The Project involves the construction and operation of an out-of-pit dump (OOPD) and associated infrastructure to the immediate south of Mining Lease (ML) ML 1781.

The OOPD is required to facilitate and support ongoing mining operations at DNM. There are currently no feasible short-haul OOPDs available on the existing DNM MLs, and as such, the Project is to be constructed adjacent to the Pandora Pit and on land that is currently subject to a specific-purpose ML Application under the *Mineral Resources Act 1989*.

Specifically, the following amendments to the EA are required:

- Addition of the new ML under the existing ‘Schedule 3 13: Mining black coal’,
- Update to Table E3 (Significant Residual Impacts to Prescribed Environmental Matters) to include the significant residual impacts for the Project,
- Include figures in EA appendix and conditions E21 and E22, to illustrate Project disturbance footprint and ensure the Project complies with conditions E21 and E22, and
- Additional condition to formalise Run-Of-Mine (ROM) coal production at DNM to be up to 6.5 million tonnes per annum (Mtpa).

To support the EA Amendment Application and determine potential impacts of the Project to environmental values, assessments for land resources, geochemistry, air quality, noise and vibration, surface water, groundwater, terrestrial ecology, aquatic ecology, groundwater-dependent ecosystems, greenhouse gas and waste management were undertaken. The impacts resulting from the Project along with mitigation and management measures are presented in this Supporting Document, and are summarised as follows:

Land Resources

A comprehensive desktop assessment and sampling program was undertaken to evaluate the potential impacts of the Project on land suitability, agricultural land classes, and grazing suitability. The assessment considered soil characteristics, topography, and land use patterns. Mitigation strategies include implementing the Permit to Disturb process, appropriate storage and management of hydrocarbons and hazardous materials, and adherence to WHC’s Topsoil Management Plan. These measures, combined with careful planning of disturbance activities to maintain water flow integrity, will ensure minimal impact on land resources. No significant residual impact on land resources is anticipated.

Geochemistry

A desktop assessment using historical DNM data was conducted to determine the geochemical nature of mineral waste expected to be placed in the proposed OOPD. The study focused on acid and metalliferous drainage (AMD) potential and associated environmental risks. Findings indicate that the OOPD material poses a low AMD hazard, with AMD generation rated as highly unlikely. Surface water runoff and seepage from the OOPD will be monitored for standard water quality parameters to confirm ongoing compliance. The geochemical risk is low and manageable through routine monitoring.

Air Quality

Air quality modelling was performed to assess potential impacts on sensitive receptors. Results indicate compliance with air quality limits at all sensitive receptors, except Olive Downs Homestead, which will be managed under a non-residency agreement. The Project is expected to have a low risk of air quality impacts, and existing EA conditions and management actions are deemed sufficient. No additional air quality mitigation measures are required.

Noise and Vibration

Noise and vibration modelling assessed operational impacts from the Project in conjunction with existing DNM activities. Results indicate compliance with EA noise limits at all sensitive receptors, except Olive Downs Homestead. Vibration impacts has been assessed as insignificant. No additional noise or vibration mitigation measures are warranted beyond current practices.

Surface Water

The surface water assessment reviewed sediment and water management systems, updated site water balance models, and evaluated floodplain risks for the Project. Impacts on surface water environmental values are considered insignificant. The DNM Water Management Plan will be updated to incorporate the proposed dams and ensure effective integration with existing systems. No significant residual impacts on surface water resources are anticipated.

Groundwater

Groundwater modelling and desktop assessment indicate that the Project will result in minor recharge to underlying strata, with an insignificant risk to groundwater quality, landholder bores, and final void water levels. No changes to existing groundwater management practices are required. Groundwater impacts are low and manageable within current frameworks.

Terrestrial Ecology

Field and desktop assessments identified potential impacts on terrestrial ecological values, including Matters of State Environmental Significance (MSES). Mitigation measures include pre-clearance surveys, noise reduction strategies, weed and feral animal management, and erosion control. Despite these measures, significant residual impacts on certain MSES will occur, requiring offsets under the *Environmental Offsets Act 2014*. These include 23.66 ha of Ornamental snake (*Denisonia maculata*) habitat, 16.26 ha of Of Concern RE 11.3.3, and 5.94 ha of regulated vegetation within defined watercourse distances. Offsets will be provided to address residual impacts.

Aquatic Ecology

The aquatic ecology assessment identified two MSES waterways providing fish passage within the disturbance footprint. While impacts to one waterway are largely avoided through culvert installation, 1.59 ha of the second waterway will be significantly impacted. An offset will be required under the *Environmental Offsets Act 2014* to compensate for this residual impact.

Groundwater-Dependent Ecosystems

A desktop study evaluated potential impacts on groundwater-dependent ecosystems (GDEs). Findings indicate that the Project will not significantly affect ecohydrological functions. Groundwater mounding beneath the OOPD will increase water availability to GDEs but is expected to be balanced by transpiration. No changes to existing operations are required as a result of the Project.

Greenhouse Gas

A greenhouse gas assessment estimated Scope 1, 2, and 3 emissions for the Project. Results demonstrate a net reduction in Scope 1 emissions due to shorter haulage distances, categorizing the Project as a low emitter, therefore a Greenhouse Gas abatement Plan is not required No changes to EA conditions or operational practices are required.

Waste

The Project’s waste streams, including vegetation clearing, general waste, and regulated waste, were reviewed against the existing Waste Management Plan. Current strategies are sufficient to manage these streams effectively. No additional waste management measures are necessary.

Whitehaven Daunia anticipates the EA Amendment Application to be deemed as a ‘major’ amendment not requiring an EIS by the Department of Environment, Tourism, Science and Innovation (DETSI) due to the proposed increase in disturbance area, operational scale and intensity. Further, the Project being located on a specific-purpose ML for which a separate ML Application has been lodged with the Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (DNRMMRRD).

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Acronyms and Abbreviations

ACCU	Australian Carbon Credit Units
AD	Acid drainage
ADR	Accepted development requirements
AEP	Annual exceedance probability
AGDE	Aquatic groundwater-dependent ecosystems
AHD	Australian height datum
ALA	Atlas of Living Australia
ALC	Agricultural Land Class
ALD	Assessment Level Decision
AMD	Acid and metalliferous drainage
ANC	Acid neutralising capacity
ANFO	Ammonium nitrate / Fuel oil
ANREU	Australian National Registry Emissions Unit
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australia and New Zealand Guidelines
AQO	Air Quality Objectives
AUSRIVAS	Australian River Assessment System
BAU	Business as Usual
BBN	Brigalow Belt North
BGL	Below ground level
BMA	BHP Mitsuibishi Alliance
BOM	Bureau of Meteorology
BVG	Broad Vegetation Communities
CCM	Critical Control Monitoring
CCS	Consistent Climate Scenarios
CEC	Cation exchange capacity
CER	Clean Energy Regulator
CFC	Chlorofluorocarbons
CHM	Conceptual hydrogeological model
CHPP	Coal handling and preparation plant
cm	Centimeter
CMB	Chloride mass balance
CO2	Carbon dioxide
CONCAWE	Conservation of Clean Air and Water Europe
CRD	Cumulative rainfall departure
CSIRO	Commonwealth Scientific and Industril Research Organisation
DAWE	Department of Agriculture, Water and the Environment
dBA	A-weighted decibels
dBC	C-weighted decibels
DBH	Diameter at breast height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEHP	Department of Environment and Heritage Protection

DERM	Department of Environment and Resource Management
DES	Department of Environment and Science
DESI	Department of Environment, Science and Innovation
DETSI	Department of Environment, Tourism, Science and Innovation
DEWHA	Department of the Environment, Water, Heritage and the Arts
DGV	Default guideline values
DISER	Department of Industry Science, Environment and Resources
DNM	Daunia Mine
DNRM	Department of Natural Resource Management
DNRME	Department of Natural Resources, Mines and Energy
DNRMMRRD	Department of Natural Resources, Mines and Manufacturing, and Regional and Rural Development
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DSITI	Department of Science, Information Technology, Innovation and the Arts
DWIP	Daunia West Infrastructure Project
EA	Environmental Authority
EC	Electrical conductivity
EERS	Emissions and Energy Reporting System
EETM	Emission Estimation Technique Manuals
EIS	Environmental Impact Statement
EMS	Environmental Management System
EP Act	*Environmental Protection Act 1994*
EPBC Act	*Environment Protection and Biodiversity Protection Act 1999*
EPC	Exploration Permit for Coal
EPP	Environmental Protection Policy
ERA	Environmentally Relevant Activities
ERF	Emissions Reduction Fund
ESA	Environmentally Sensitive Area
ESC	Erosion and sediment control
ESD	Ecologically Sustainale Development
ESP	Exchangable sodium percentage
EV	Environmental value
EVT	Endangered, vulnerable and threatened
FCCM	Fort Cooper Coal Measures
FRREMP	Fitzroy Regional Receiving Environment Monitoring Plan
FY	Financial year
GDE	Groundwater-dependent ecosystem
GHG	Greenhouse Gase
GIS	Geographic information systems
GJ	Gigajoules
GTDTHQ	Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy

GWBD	Groundwater Bore Database
GWI	Ground Water Imaging Pty Ltd
GWP	Global Warming Potential
Ha	Hectares
HCFC	Hydrochlorofluorocarbons
HEVAE	High Ecological Value Aquatic Ecosystem
HSE	Health, safety and environment
HV	Heavy vehicle
IECA	International Erosion Control Association
IESC	Independent Expert Scientific Committee
IPCC	Intergovernmental Panel on Climate Change
IPD	In-Pit Dump
KL	Kilolitres
km	Kilometers
L	Litres
LGA	Local government area
LOM	Life Of Mine
LPG	Liquified Petroleum Gas
LV	Light vehicle
m	Meters
MAW	Mine affected water
mbgl	Meters below ground level
MERFP Act	*Mineral and Energy Resources (Financial Provisioning) Act 2018*
MIA	Mine infrastructure area
ML	Mining lease
MLA	Mining lease application
mm	Millimeters
MMC	Model mining conditions
MNES	Matter of National Environmental Significance
MOL	Maximum operating level
MPA	Maximum potential acidity
MR Act	*Mineral Resources Act 1989*
MSES	Matter of State Environmental Significance
NA	Not applicable
NAF	Non acid forming
NC Act	*Nature Conservation Act 1992*
NCAS	National Carbon Accounting System
NDA	No data available
NDC	Nationally Determined Contribution
NEPC Act	*National Environment Protection Council (Queensland) Act 1994*
NEPM	National Environmental Protection Measure
NGA	National Greenhouse Accounts
NGER	National Greenhouse and Energy Reporting
NMD	Neutral and metalliferous drainage

NPI	National Pollutant Inventory
NSW	New South Wales
NUMA	Non-use Management Area
ODH	Olive Downs House
ODS	Ozone depleting substances
OODP	Out Of Pit Dump
PAF	Potentially acid forming
PCB	Polychlorinated biphenyls
PET	Plecoptera / Ephemeroptera / Trichoptera
Planning Act	*Planning Act 2016*
PM	Particulate matter
PMF	Probable maximum flood
PMLU	Post-mining land use
PMST	Protected Matters Search Tool
PRCP	Progressive Rehabilitation and Closure Plan
PW Sed Dam	Project sediment dam
QA	Quality assurance
QC	Quality control
QLD	Queensland
RBL	Rating Background Level
RCM	Rangal Coal Measures
RE	Regional ecosystem
REDD	Regional Ecosystem Description Database
RMJV	Red Hill Joint Venture
ROM	Run Of Mine
RPI Act	*Regional Planning Interests Act 2014*
SAT	Spot assessment technique
SDPWO	*State Development and Public Works Organisation Act 1971*
SLC	Special least concerned
SLR	SLR Consulting Australia Pty Ltd
SMC	Safeguard Mechanism Credits
SMP	Species Management Plan
SPRAT	Species Profiles and Threats Database
SRI	Significant residual impact
SWL	Standing water level
t	Tonnes
t CO_2-e	Tonnes of carbon dioxide equivalent
TAPM	The Air Pollution Model
TDS	Total dissolved solids
TEC	Threatened ecological communities
TGDE	Terrestrial groundwater dependent ecosystem
TLF	Train Load Out Facility
TSP	Total suspended particulates
TSS	Total suspended solids

VM	*Vegetation Management Act 1999*
Water Act	*Water Act 2000*
WBCSD	World Business Council for Sustainable Development
WHC	Whitehaven Coal Limited
Whitehaven Daunia	Whitehaven Daunia Pty Ltd
WMP	Water Management Plan
WMS	Water management system
WoNS	Weeds of National Significance
WQ	Water quality
WQO	Water quality objectives
WRI	World Resources Institute
μS	Microseimens

1.0 Introduction

1.1 The Application for Amendment

The Daunia Mine (DNM) is located approximately 30 kilometres (km) south-east of Moranbah in Central Queensland and extends across Mining Leases (ML) ML 1781, ML 70115 and part of ML 70116. The DNM is owned and operated by Whitehaven Daunia Pty Ltd (Whitehaven Daunia), a wholly owned subsidiary of Whitehaven Coal Limited (WHC).

The DNM is operated under Environmental Authority (EA) EPML00561913 and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval 2008/4418. The DNM received conditional approval on 26 October 2009 from the Coordinator-General pursuant to the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The location of DNM is shown in **Figure 1-1**.

This document is referred to as the "Supporting Documentation to the Amendment Application for Environmental Authority EPML00561913" (the EA Amendment Application) and has been prepared, in accordance with Section 226 of the *Environmental Protection Act 1994* (Queensland) (the EP Act), to support the EA Amendment Application for the Daunia West Infrastructure Project (DWIP) (hereafter referred to as the Project). This EA Amendment Application seeks authorisation for the proposed construction and operation of an Out-of-Pit Dump (OOPD) and associated infrastructure, located within Exploration Permit for Coal (EPC) 27334 and EPC 1951, to the west of, and adjacent to, ML 1781. An application for a new specific-purpose ML (infrastructure) within EPC 27334 and EPC 1951 has been lodged (ML 700085) to secure mining tenure for the Project.

This EA Amendment Application has been submitted, and is to be considered in conjunction with, the proposed Progressive Rehabilitation and Closure Plan (PRCP).

1.2 The Proponent

The proponent for the Project is Whitehaven Daunia Pty Ltd (Whitehaven Daunia). Whitehaven Daunia is a wholly owned subsidiary of Whitehaven Coal Limited (WHC) and is a registered suitable operator under the EP Act (Reference Number 100615990). WHC currently operates six (6) mines; five (5) open cut mines at Blackwater, Daunia, Maules Creek, Tarrawonga, Vickery and one underground mine at Narrabri. These sites produce thermal and metallurgical coal, primarily for export markets in Asia.

The contact details for the proponent are:

Whitehaven Daunia Pty Ltd
Level 28, 259 George St
SYDNEY NSW 2000
Phone: (02) 8222 1100
Website: https://whitehavencoal.com.au

Whitehaven Daunia acquired the DNM from BHP Mitsubishi Alliance (BMA) in April 2024. The company adheres to WHC's sustainability framework, which integrates environmental, social, and governance considerations into its operations. This includes aligning its Environmental Management System with ISO 14001 principles and implementing site-specific environmental management plans that address impacts on water, biodiversity, air quality, and cultural heritage. Compliance is monitored through regular audits and reporting mechanisms. WHC has set a target to reduce Scope 1 emissions intensity by 32% by FY2030, using FY2021 as the baseline. Whitehaven Daunia also focuses on community engagement and responsible environmental stewardship as part of its sustainability commitments.

The Whitehaven Coal Sustainability Report 2025 (WHCa, 2025) outlines the most recent environmental, social and governance practices of WHC, including water stewardship, biodiversity and land use, waste and recycling, and community support practices. In FY2025, there were no environmental enforcement actions against WHC for the third consecutive year, 17% of water used was recycled water, and $17.2 million was spent on 15 Aboriginal and Torres Strait Islander businesses.

1.3 Existing Daunia Mine Operations

Existing DNM operations are located on granted ML 1781, ML 70115 and part of ML 70116. EA EPML00561913 was issued for the existing mining operations (latest date of effect is 13 November 2025) and received approval under the EPBC Act in 2008 (2008/4418). In 2013, the DNM commenced operation as a metallurgical open-cut coal mine in the Bowen Basin, 30 km south-east of Moranbah and 170 km south-west of Mackay in Central Queensland.

DNM currently operates on a 30 year schedule with extraction of saleable product from the Leichhardt and Vermont seams of the Rangal Coal Measures. Overburden is removed using truck–shovel fleets, after which coal is processed through the on-site Coal Handling and Preparation Plant (CHPP) within the DNM Mine Infrastructure Area (MIA).

Product coal is conveyed to stockpiles and loaded at the Train Load-out Facility (TLF) on ML 70312 (held by Stanmore SMC Pty Ltd) for export via the Goonyella rail line to the Hay Point or Dalrymple Bay Coal Terminals. Supporting infrastructure includes out-of-pit overburden disposal areas on ML 1781 and ML 70115, water-management structures, haul and access roads, power reticulation, lay-down areas, maintenance workshops, fuelling facilities, warehouses, offices, amenities and remote go-lines positioned near pit boundaries as operationally required. **Figure 1-2** shows the existing infrastructure.

Further details regarding the existing DNM infrastructure and operations are provided in **Chapter 3.0.**

1.4 Project Overview and Objectives

The Project comprises the construction and operation of an OOPD to the west of and immediately adjacent to ML 1781, off lease from DNM. It is required to support ongoing open-cut mining operations.

The Project will also include the construction and operation of additional haul roads to transport material from the active mining area to the short haul OOPD, as well as supporting surface water infrastructure. The Project will be constructed on a new ML area located within EPC 27334 and EPC 1951 and will utilise existing infrastructure while continuing current operations at DNM. The materials stored within the OOPD include primarily spoil (i.e. overburden and interburden) from the ongoing operations at DNM. No rejects will be disposed into the OOPD.

The Project overlies sections of EPC 27334 and EPC 1951 and seeks to convert these sections into a specific purpose ML to allow the construction and operation of the Project. No resource extraction will be undertaken within the proposed specific purpose ML. The proposed ML which contains the Project is referred to as the 'Project Area'. The Project Area and Project overview is shown in **Figure 1-3**.

The key objectives of the Project are as follows:

- Improving mining efficiency such that the benefits of the mine in its entirety are maximised (e.g. maximum employment, maximum royalty generation, maximum community benefits),
- Continue to operate a mine that complies with all relevant statutory obligations and continues to improve operations to ensure best practice environmental management,
- Continue to operate a mine that does not compromise environmental and social indicators and standards,
- Make efficient use of current infrastructure where possible, and
- Use similar proven strategies to those adopted at DNM, for example:
  - Progressive rehabilitation,
  - Protection of water quality by appropriate management systems, and
  - Adoption of appropriate landform designs for a sustainable final land use.

Further description of the Project is provided in **Chapter 3.0**.

1.5 Structure of this Document

The structure of this document is outlined as follows:

- **Chapter 1.0** – Introduction, which includes details about the Proponent and a brief project overview and objectives,
- **Chapter 2.0** – Regulatory Considerations, which provides confirmation that this EA Amendment application has been prepared in accordance with regulatory requirements,
- **Chapter 3.0** – Project Description, which includes an overview of the Project location and description, providing context for the EA Amendment Application and associated technical assessments,
- **Chapter 4.0** – Rehabilitation, which outlines the rehabilitation strategy for the Project, referring to the revised Progressive Rehabilitation and Closure Plan for the DNM,
- **Chapter 5.0** – Project Justification and Alternatives, which provides justification for the Project and describes the Project alternatives considered. An assessment addressing the 'standard criteria' is also provided in this Chapter,
- **Chapters 6.0** to **16.0** – Environmental Assessments, which provides a summary of the technical assessments supporting this EA Amendment Application, and includes the following:
    - **Chapter 6.0** Land Resources
    - **Chapter 7.0** Geochemistry
    - **Chapter 8.0** Air Quality Assessment
    - **Chapter 9.0** Noise and Vibration
    - **Chapter 10.0** Surface Water Resources
    - **Chapter 11.0** Groundwater Resources
    - **Chapter 12.0** Terrestrial Ecology
    - **Chapter 13.0** Aquatic Ecology and Stygofauna
    - **Chapter 14.0** Groundwater Dependent Ecosystems (GDE) Assessment, and
    - **Chapter 15.0** Greenhouse Gas
    - **Chapter 16.0** Waste Management.
- **Chapter 17.0** – This section sets out Whitehaven Daunia's proposed amendments to the existing EA conditions, and
- Appendices provide the Technical Reports for each relevant environmental discipline supporting the EA Amendment Application.

2.0 Regulatory Considerations

2.1 Primary State Legislation

There are two (2) primary pieces of State legislation which are relevant to the EA Amendment for the Project and are outlined below. These are the:

- *Mineral Resources Act* 1989 (MR Act), and
- *Environmental Protection Act 1994* (EP Act).

2.1.1 Mineral Resources Act 1989

The MR Act is administered by the Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (DNRMMRRD) and provides for “the assessment, development and utilisation of mineral resources to the maximum extent practicable consistent with sound economic and land use management”. The principal objectives of the MR Act are to:

- Encourage and facilitate prospecting and exploring for and mining of minerals,
- Enhance knowledge of the mineral resources of the State,
- Minimise land use conflict with respect to prospecting, exploring and mining,
- Encourage environmental responsibility in prospecting, exploring and mining,
- Ensure an appropriate financial return to the State from mining,
- Provide an administrative framework to expedite and regulate prospecting and exploring for and mining of minerals, and
- Encourage responsible land care management in prospecting, exploring and mining.

The MR Act provides for the granting, conditioning and management of mining tenements, being prospecting permits, exploration permits, mineral development licences, MLs and mining claims.

Under the MR Act, Whitehaven Daunia hold ML 1781, ML 70115 and ML 70116, and surface area rights, which provide rights to access coal at the DNM. Also under the MR Act, Whitehaven Daunia are the holders of EPC 27334 and EPC 1951, within which the Project is to be located. It is proposed the area where the Project overlays these EPCs is converted to an ML, as the proposed Project relates to mining activities. For an ML to be issued relating to coal mining, the applicant must hold a prerequisite resource authority (e.g. EPC) or have the consent of the resource authority holder. As such, Whitehaven Daunia have applied for an ML over EPC 27334 and EPC 1951 (MLA 700085).

The proposed ML will be for the mine infrastructure and OOPD to support the development of DNM operations on the existing DNM MLs. As the proposed ML will allow for only the construction and operation of supporting mine infrastructure and no resource extraction, the ML Application (MLA) (ML 700085) is for a specific purpose ML only.

Whitehaven Daunia have lodged the MLA over the Project Area, i.e. a portion of EPC 27334 and EPC 1951 as shown in **Figure 1-3**. The MLA has been completed in accordance with the DNRMMRRD’s *Mining Lease application guide (March 2025)*. Following submission of the MLA, a public notification period will take place where third parties may make submissions before the Minister decides on the application.

2.1.2 Environmental Protection Act 1994

2.1.2.1 Overview of the EA Amendment process

The EP Act was established "to protect Queensland's environment, while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends". Resource activities carried out on mining tenure are approved via the grant of an EA under Chapter 5 of the EP Act. When deciding whether to grant or refuse an application for an EA or an amendment to an EA or deciding on the conditions of the EA, the Department of Environment, Tourism, Science and Innovation (DETSI), the administering authority, must consider certain matters set out in the EP Act.

The EP Act utilises several mechanisms to achieve its objectives. These include:

- New EA, Major and Minor EA Amendment Application processes, including where applicable, an Environmental Impact Statement (EIS) process for resource projects,
- Environmentally Relevant Activities (ERAs),
- Allowing for improvement through Transitional Environmental Programs,
- Provision of Environmental Protection Policies (EPPs).
- Regulating contaminated land, and
- Creating a general environmental duty.

In particular, the EP Act authorises the holder of an EA to apply to DETSI for amendment to an EA under Section 224 at any time. The EA Amendment Application process is described below:

- EA Amendment Application,
- Assessment Level Decision,
- Information stage (if requested by DETSI),
- Notification stage (if required),
- Decision Stage (including Notice of Decision),
- Draft EA issued,
- Objections and Referral to the Land Court (if objections received),
- Land Court Process (if required), and
- EA Approved with Conditions.

An EA Amendment is required where there is a proposed change to the nature and extent of authorised activities on an associated ML(s) and/or the conditions of the EA need to be amended. A Major EA Amendment Application (not requiring an EIS) for a resource activity will require public notification, as per Section 230 of the amended EP Act. This requirement was amended by the *Environmental Protection and Other Legislation Amendment Act 2023*. Operations at DNM are carried out under the conditions of the EA.

Under the EP Act, the DNM operates under EA EPML00561913, on ML 1781, ML 70115 and part of ML 70116. The current EA is dated 7 January 2025 and includes authorisations for impacts to environmental values and management measures for these impacts.

Whitehaven Daunia seeks an amendment of EA EPML00561913 to authorise the construction and operation of the Project, and the inclusion of a new special purpose ML into the EA.

2.1.2.2 EIS Trigger Criteria Assessment

DETSI must determine whether an EIS is required when considering an EA Amendment Application for a resource activity. Section 143 of the EP Act describes the circumstances under which a resource activity may be assessed by an EIS process. The criteria that informs the decision-making process under Section 143 of the EP Act are outlined in the DETSI guideline, *Criteria for environmental impact statements for resource projects under the Environmental Protection Act 1994 ESR/2016/2167, Version 3.02* (DETSI, 2025, EIS Trigger Guideline).

An assessment of the Project against the EIS triggers under Appendix B of the EIS Trigger Guideline is set out in **Table 2-1**. The assessment concluded that the Project will not trigger the triggers in Appendix B of the EIS Trigger Guideline and therefore will not need an EIS.

Additionally, Whitehaven Daunia considers that the Project does not warrant an EIS with respect to the significance of impacts, uncertainty of possible impacts, or high level of public interest. The Project will require a specific purpose MLA on EPC 27334 and EPC 1951 located immediately south-west of DNM. No resource extraction will be undertaken within the new MLA area.

Table 2-1 EIS trigger assessment for the Project

DETSI EIS Triggers	Trigger (Yes/ No)	Justification
For greenfield (new) mine proposals		
Would the application involve the removal of two million tonnes per year or more of run-of-mine (ROM) ore or coal?	No.	The Project is not a greenfield mine.
Would the application involve the removal of one million tonnes per year or more of ROM ore or coal on or under a floodplain or in a coastal hazard area?	No.	The Project is not a greenfield mine.
Would the application involve the introduction of a novel or unproven resource extraction process, technology or activity?	No.	The Project is not a greenfield mine.
For proposals to amend/alter an existing mine		
For mines already removing 2–10 million tonnes per year ROM ore or coal, would the application increase the current annual removal rate by more than 100% or 5 million tonnes per year (whichever is the lesser)?	No.	The Project includes activities associated with the construction and operation of an OOPD on a new ML area. No extractive activities will be undertaken within the new ML area. The OOPD will facilitate ROM coal production up to 6.5 Mtpa and product coal output up to 5.2 Mtpa, which does not increase the current annual removal rate by more than 100% or 5 million tonnes per year. An additional condition to formalise the ROM coal production at DNM to be up to 6.5 million tonnes

DETSI EIS Triggers	Trigger (Yes/ No)	Justification
		per annum (Mtpa) will also be included as part of the amendment.
For mines already removing over 10 million tonnes per year ROM ore or coal, would the application increase the current annual removal rate by more than 50% or 10 million tonnes per year (whichever is the lesser)?	Not applicable (NA).	NA.
For mines already removing more than 20 million tonnes per year ROM ore or coal, would the application increase the current annual removal rate by more than 25%?	NA.	NA.
Would the application involve an extension into and significant impact on a Category A or B environmentally sensitive area, which is not already authorised by the State?	No.	The Project will not result in a significant impact to Category A or B environmentally sensitive areas, as discussed in **Chapter 12.0.**
Would the application involve a substantial change in mining operations—such as from underground to open cut, or (for underground mining) a change in operations from one causing little subsidence to one likely to cause substantial subsidence?	No.	The Project will not result in a change to the existing and authorised process to extract and process coal.
Would the application introduce a novel or unproven resource removal process, technology or activity?	No.	The Project will not result in a change to the existing and authorised process to extract and process coal. As such no novel or unproven resource extraction process will be introduced.
For petroleum and gas activities		
Would the application involve a total disturbance area of greater than 2000 hectares at any one time during the life of the proposed project? This includes areas occupied by well pads (single or multi-directional), access tracks and roads, water storages, and process plants?	NA.	The Project does not relate to a petroleum or gas activity.
Would the application involve the construction of a high-pressure pipeline over 300 kilometre or greater?	NA.	The Project does not relate to a petroleum or gas activity.
Would the application involve the construction of a liquefied natural gas plant?	NA.	The Project does not relate to a petroleum or gas activity.

2.1.2.3 Assessment Level Decision

Within 10 business days after receiving an EA Amendment Application, DETSI must make an Assessment Level Decision (ALD). The ALD process will determine whether the EA Amendment Application is a minor or major amendment (with or without an EIS). A major amendment for an EA under Section 223 of the EP Act “means an amendment that is not a minor amendment”. An assessment of the proposed EA Amendment for the Project against the minor amendment (threshold) criteria is presented in **Table 2-2**. This assessment demonstrates that the proposed EA Amendment is not a minor amendment and is therefore considered a major amendment under the EP Act.

Table 2-2 Minor EA amendment threshold criteria

Minor Amendment Threshold Criteria	Major Amendment Triggered	Project Relevance
The proposed amendment:		
(a) is not a change to a condition identified in the authority as a standard condition, other than - (i) a change that is a condition conversion; or (ii) a change that is not a condition conversion but that replaces a standard condition of the EA with a standard condition for the ERA to which the EA relates; or (iii) a change that will not result in a change to the impact of the relevant activity on an environmental value; and	No	The proposed amendment is not a change to a standard condition.
(b) does not significantly increase the level of environmental harm caused by the relevant activity; and	Yes	The proposed amendment will result in new disturbance areas in addition to those already authorised under EPML00561913, and may increase the level of environmental harm.
(c) does not change any rehabilitation objectives in the EA in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the EA; and	No	The proposed amendment will not change the rehabilitation objectives for DNM. New rehabilitation domains will be established due to the additional ML area and associated disturbance.
(d) does not significantly increase the scale or intensity of the relevant activity; and	Yes	The proposed amendment will likely significantly increase the scale or intensity of mining activities authorised under EA EPML00561913. An additional condition to formalise the ROM coal production at DNM to be up to 6.5 million tonnes per annum (Mtpa) will also be included as part of the amendment. In addition, the Project includes the construction and operation of

Minor Amendment Threshold Criteria	Major Amendment Triggered	Project Relevance
		infrastructure to support mining operations at DNM.
(e) does not relate to a new relevant resource tenure for the EA that is – (i) a new mining lease; or (ii) a new petroleum lease; or (iii) a new geothermal lease under the Geothermal Energy Act 2010; or (iv) a new greenhouse gas injection and storage lease under the Greenhouse Gas Storage Act 2009; and	Yes	The proposed amendment involves the application for specific purpose ML to support the construction and operation of new infrastructure integral to authorised mining activities within existing DNM MLs.
(f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area; and	Yes	The proposed amendment will increase surface area of the activity by greater than 10% of cumulative disturbance area.
(g) for an EA for a petroleum activity: (i) involves constructing a new pipeline that does not exceed 150km in length; or (ii) involves extending an existing pipeline by no more than 10% of the existing length of the pipeline; and	No	The proposed amendment does not relate to a petroleum activity.
(h) if the amendment relates to a new relevant resource tenure for the EA that is an exploration permit or greenhouse gas permit – the amendment application seeks an EA that is subject to the standard conditions for the relevant activity, to the extent it relates to the permit.	No	The proposed amendment does not relate to a new resource tenure that is an exploration permit or greenhouse gas permit.

2.1.2.4 Progressive Rehabilitation and Closure Plan

Under the EP Act, a PRCP is required for mining and extractive industries to ensure that the land affected by mining is restored to a safe and stable condition after operations cease. The PRCP must be prepared in accordance with *Guideline – Progressive rehabilitation and closure plans* (DESI, ESR/2019/4964, Version 3.00, 04 April 2023) and include details of the company's rehabilitation plans and schedule for progressive rehabilitation during mining operations and final rehabilitation and closure of the site after mining is complete. The PRCP consists of two parts:

- The rehabilitation planning component, and
- The PRCP schedule.

The rehabilitation milestone criteria set out the requirements that must be met to achieve the agreed post-mining land uses (PMLU) and non-use management areas (NUMA). The PRCP schedule details the locations of PMLUs and NUMAs, rehabilitation and management milestones, milestone criteria and a rehabilitation schedule, which are legally binding. Land is considered rehabilitated to a stable condition if it is safe and structurally stable, there is no environmental harm being caused on or in the land, and the land can sustain a post-mining land use.

Transitional PRCP

Under Part 27 of the EP Act, EA holders must provide a PRCP to DETSI that, subject to some exceptions, complies with Section 126C and Section 126D of the EP Act for the activities authorised by the EA. A transition notice for the DNM was issued by DETSI and a transitional PRCP for the DNM was submitted on 29 June 2023. A change application and a response to the DETSI information request was subsequently submitted to DETSI on 24th November 2025. At time of writing, the transitional PRCP is at the information stage of approval.

PRCP Amendment

The EA Amendment for the Project has been submitted in a joint application with a PRCP Amendment. The major and minor amendments guideline ESR/2015/1684 outlines that should amending the PRCP or EA would make either document inconsistent with the other, then both must be amended to ensure they remain consistent with each other.

This EA Amendment will change the ‘final site design’ currently included in the transitional PRCP and will therefore require both the PRCP and EA to be amended simultaneously (joint PRCP schedule and EA Amendment Application) to ensure both documents remain consistent with each other.

Whitehaven Daunia has responded DETSI’s Information Request for the EA Amendment and PRCP Amendment, and the updated EA Amendment Application and PRCP have been jointly submitted to, and are in consideration by DETSI.

2.2 Other State Legislation

The following legislation has also been considered for the Project.

2.2.1 Water Act 2000

The *Water Act 2000* (Water Act) provides for the management of waters and watercourses and the construction, control and management of works that affect watercourses. The purpose of the Water Act is to advance sustainable management and efficient use of water resources by establishing a system for planning, allocation and use of water.

2.2.1.1 Surface water

The Isaac River, which is the main watercourse in proximity to the DNM, is a declared watercourse under the Water Act. Queensland Globe spatial data indicates there is an unmapped watercourse that passes from the centre of DNM on ML 1781 to the southeast of EPC 27334, ultimately flowing into the Isaac River approximately 9.5 km southeast of the Project Area. No watercourse diversions or modifications to existing or approved watercourse diversions are proposed for the Project. There are no approved diversions at DNM or proposed diversions for the Project.

The *Water Plan (Fitzroy Basin) 2011* (the Water Plan) outlines the use of water within the basin under the Water Act. The plan defines the availability of water and provides a framework for sustainable management such as targets for environmental flow objectives and regulating the taking of overland flow. The Project is to align with the Water Plan outcomes provided in Chapter 3 of the Water Plan.

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water and Wetland Biodiversity)) outlines the objectives of the EP Act with regards to water. In particular, the 'Isaac River Sub Basin Environmental Values and Water Quality Objectives '(DEHP, 2011) outlines the Environmental Values (EVs) and Water Quality Objectives (WQO) for the region. WQOs define objectives for the physical, chemical and biological characteristics of the water (e.g. nitrogen content, dissolved oxygen, turbidity, toxicants, fish). The WQOs aid in the development of EA conditions, where applicable. EVs define the uses of the water by aquatic ecosystems and for human uses (e.g. drinking water, irrigation, aquaculture, recreation). The Project is to not adversely impact the relevant EVs. The EVs for the Project have been identified and assessed in **Chapter 10.0**.

In 2019, the *Environmental Protection Regulation 2019* (EP Reg) was amended to include Section 41AA. The aim of Section 41AA is to achieve no net decline in water quality in the surface water basins that feed into the Great Barrier Reef. Since June 2021, all new or expanding projects that potentially impact the waters for the Great Barrier Reef are required to provide information about their Dissolved Inorganic Nitrogen and Total Suspended Solids load. This Project has been assessed against the *Guideline – Environmental Protection Act 1994: Reef discharge standards for industrial activities* (DES, 2022) based on relevant information required for this EA Amendment Application to address Section 41AA of the EP Reg. The assessment also considers the provisions of the Water Act and subordinate legislation mentioned above and is provided in **Chapter 10.0**.

2.2.1.2 Groundwater

Water resources within the Project Area are captured under the Water Plan. The plan covers surface water (zone WQ1301) associated with the Isaac River, and groundwaters (zone WQ1310 – Fitzroy Basin groundwaters). The Project is not likely to impact groundwater within the Isaac Connors Groundwater Management Area, Chemistry Zone 34 of the Fitzroy Basin under the Water Plan.

The statutory right of a tenure holder to take or interfere with underground water is granted as part of the ML approval under the MR Act, if the taking or interference with that water is necessarily and unavoidably obtained in the process of extracting the mineral resource. This water is termed 'associated water'. The Project does not propose any groundwater extraction and is not anticipated to impact on groundwater resources, as detailed in **Chapter 11.0**.

2.2.2 Environmental Offsets Act 2014

The *Environmental Offsets Act 2014* (Offsets Act) provides the framework for environmental offsets in Queensland. The Offsets Act is supported by the *Environmental Offsets Regulation 2014* (Offsets Regulation) and the *Queensland Environmental Offsets Policy (*current Version 1.17). The 'Significant Residual Impact Guideline' is also relevant to determining when an impact will be a significant residual impact for the purposes of the Offsets Act.

Under the Offsets Act, an administering agency, being the entity that may grant or has granted an authority under another Act for a prescribed activity, may impose an offset condition on that authority only if satisfied:

- The prescribed activity will, or is likely to have, a significant residual impact on a prescribed environmental matter, and

- All reasonable on-site mitigation measures for the prescribed activity have been or will be undertaken.

Ecological offsets will be required for the Project. Offset matters are considered in detail in **Chapter 12.0** and **Chapter 13.0.**

2.2.3 Planning Act 2016

The *Planning Act 2016* (Planning Act) provides the framework for Queensland's planning and development assessment system. Under the Planning Act, development approvals are required for assessable development, unless an exemption applies. Development approvals under the Planning Act are generally not required for works on a mining lease, unless the works are in relation to a Queensland heritage place (as defined under the *Queensland Heritage Act 1992)* or building work (as defined in the *Building Act 1975*), as per Section 4A of the MR Act. No Project activities are located outside of the existing DNM MLs, the proposed ML, or are in relation to a Queensland heritage place or building work as mentioned above. As such, the Planning Act does not apply to the Project.

2.2.4 Regional Planning Interest Act 2014

The *Regional Planning Interests Act of 2014* (RPI Act) identifies and protects areas of regional interest throughout Queensland and aims to strike an appropriate balance between protecting priority land uses and delivering a diverse and prosperous economic future for our regions. The four areas of regional interest identified under the RPI Act include:

- Priority Agricultural Areas,
- Priority Living Areas,
- Strategic Environmental Areas, and
- Strategic Cropping Areas.

The Project is located outside of zones mapped as Priority Agricultural Areas, Priority Living Areas, Strategic Environmental Areas and Strategic Cropping Areas under the RPI Act.

2.2.5 Fisheries Act 1994

The main purpose of the *Fisheries Act 1994* is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of ecologically sustainable development and promote ecologically sustainable development.

The Project is anticipated to impact on a waterway that provides fish passage, as detailed further in **Chapter 13.0** and **Appendix A.** The assessments concluded that the Project would significantly impact an aquatic Matter of State Environmental Significance (MSES) (i.e. waterway that provides fish passage) but will have no impact on aquatic Matters of National Environmental Significance (MNES) under the EPBC Act. Whitehaven Daunia acknowledge the impact and propose a financial offset in line with the Offsets Act. Activities associated with the Project will be assessed and conditioned through the EA Amendment process, with no separate, stand-alone approval required under the *Fisheries Act 1994*.

2.2.6 Nature Conservation Act 1992

The object of the *Nature Conservation Act 1992* (NC Act) is the conservation of nature, while allowing for the involvement of indigenous people in the management of protected areas in which they have an interest under Aboriginal tradition or Island custom. The NC Act provides for the dedication and declaration of protected areas, protection of native wildlife and its habitat amongst other provisions.

The NC Act prescribes classes of wildlife and sets out restrictions on the taking or harm to native wildlife without a valid permit. Under the NC Act permits and licences can be required to authorise interference with native wildlife. This includes for clearing native plants, tampering with animal breeding places and catching and relocating wildlife. There are, however, certain exemptions that may be applicable.

2.2.7 Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) regulates the clearing of vegetation in Queensland in a way that (DES, 2020):

- Conserves remnant vegetation that is an endangered, of concern or a least concern regional ecosystem,
- Conserves vegetation in declared areas,
- Ensures the clearing does not cause land degradation,
- Prevents the loss of biodiversity,
- Maintains ecological processes,
- Manages the environmental effects of the clearing to achieve the above matters,
- Reduces greenhouse gas emissions, and
- Allows for sustainable land use.

Under the VM Act, clearing of remnant vegetation (Category B), high value regrowth (Category C), and reef catchment regrowth (Category R) vegetation requires development approval under the *Planning Act 2016*, unless an exemption applies. Such as clearing carried out as part if an approved mining activity on a mining lease. Accordingly, any clearing of remnant vegetation conducted on a mining lease as part of the Project, will not require development approval under the Planning Act.

The VM Act does not apply to the Project, however the framework established under the VM Act for the description of mapping of regulated vegetation including remnant and high value regrowth applies. Under the VM Act, Regional Ecosystems (REs) are classified into three classes which are: Endangered RE, Of Concern RE, or Least Concern RE. These classifications are taken from the RE description database and respective definitions in the VM Act.

Chapter 12.0 and **Appendix B**, provide details of the RE's identified within the Project Area.

2.2.8 Biosecurity Act 2014

The purposes of *Biosecurity Act 2014* are:

- To provide a framework for an effective biosecurity system for Queensland that helps to minimise biosecurity risks and facilitates responding to impacts on a biosecurity consideration, including responding to biosecurity events, in a timely and effective way,
- To ensure the safety and quality of animal feed, fertilisers and other agricultural inputs, and

- To help align responses to biosecurity risks in the State with national and international obligations and requirements for accessing markets for animal and plant produce, including live animals and plants.

The *Biosecurity Act 2014* provides a regulatory framework to safeguard the economy, agriculture, tourism, and the environment from pests, diseases, and contaminants. All people in Queensland, including Whitehaven Daunia, have a general biosecurity obligation under the *Biosecurity Act 2014* to ensure they do not spread a pest, disease or a contaminant. No approvals or permits are anticipated to be required for the Project. All biosecurity obligations relevant to the Project will be managed appropriately and in compliance with the *Biosecurity Act 2014*.

Whitehaven Daunia has a Weed and Feral Animal Management procedure that provides a framework for site management of weeds and pest species. This procedure, amongst other measures, provides a framework for addressing the requirements of the *Biosecurity Act 2014.*

2.3 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, or MNES. The nine (9) MNES protected under the EPBC Act are:

- World Heritage properties,
- National Heritage places,
- Wetlands of international Importance (listed under the Ramsar Convention),
- Listed threatened species and ecological communities,
- Listed migratory species (protected under international agreements),
- Commonwealth marine areas,
- The Great Barrier Reef Marine Park,
- Nuclear actions (including uranium mines), and
- A water resource (that relate to coal seam gas development and large coal mining development).

A person proposing to take an action must refer a proposed action if it has, will have, or is likely to have a significant impact on MNES. If the Minister decides that significant impacts are likely, the Minister will make a ‘controlled action’ decision and the action will require further assessment and approval under the EPBC Act. It is an offence to undertake a controlled action without the approval of the Commonwealth Environment Minister.

The existing DNM operates under EPBC Act approval 2008/4418. The Project requires a new specific purpose ML to support infrastructure and OOPD integral to the existing operations at DNM and therefore meets the definition of a ‘large coal mining development’. A referral for the Project is planned to be submitted to the Commonwealth Environment Minister in February 2026 and the public will be notified subsequently. Following the public notification period, the Commonwealth Environment Minister will decide whether the Project is a controlled action and if so, provide further assessment requirements.

2.4 Cultural Heritage and Native Title

2.4.1 Queensland Heritage Act 1992

The Qu*eensland Heritage Act 1992* is the primary legislation by which Queensland's historic heritage places are identified and protected. Searches of the Queensland Heritage Register (https://apps.des.qld.gov.au/heritage-register/map/, accessed 6 May 2025) did not identify any sites within or in close proximity to the Project Area.

2.4.2 Aboriginal Cultural Heritage 1993

The Barada Barna People are the statutory Aboriginal Party for the Project Area in accordance with the *Aboriginal Cultural Heritage Act 1993*. Whitehaven Daunia and the Barada Barna People have entered into a cultural heritage management agreement to satisfy the Duty of Care provisions in accordance with the *Aboriginal Cultural Heritage Act 1993*.

2.4.3 Native Title Act 1993

The Project Area is located within the traditional lands of the Barada Barna People (QCD2016/007). Native title has been extinguished over the Project Area.

2.5 Assessment Methodology

2.5.1 Overview of Assessment Methodology

The assessment methodology comprised the following key stages:

- Identification of environmental assessments to be conducted for the specific technical disciplines,
- Baseline assessments including conceptual modelling and surveys,
- Assessment of pre-mitigation impacts to identify where there was the potential for impacts that required the development of routine, or Project-specific environmental management strategies (in accordance with the mitigation hierarchy),
- Identification of environmental management strategies and measures, including consideration of the efficacy and reliability of those measures, and
- Assessment of post-mitigation impacts to determine the residual environmental impacts of the Project, and specifically, determine if there are any significant residual impacts (SRIs) that require the provision of an environmental offset.

Further details on technical assessment methodologies are provided in summary in **Chapters 6.0** to **Chapter 16.0**, and in detail in the appendices.

2.5.2 Environmental Assessments

Environmental assessments have been undertaken for the following critical matters:

- Land Resources,
- Geochemistry,
- Air Quality,

- Noise and Vibration,
- Surface Water Resources,
- Groundwater Resources,
- Terrestrial Ecology,
- Aquatic Ecology (including Stygofauna),
- Groundwater Dependent Ecosystems, and
- Waste Management.

These assessments were completed with reference to relevant legislation, standards and guidelines. The environmental assessments are provided in summary in **Chapters 6.0** to **Chapter 16.0**, and in detail in the appendices.

2.6 Community Engagement and Project Consultation Activities

The key consultation activities undertaken with DETSI and proposed for DCCEEW are summarised in **Table 2-3**.

Table 2-3 DETSI and DCCEEW Consultation Activities

Date	Agency	Consultation Purpose	Location
November 2025	DETSI	Pre-lodgement	Brisbane
February 2026	DCCEEW	Pre-lodgement	Canberra
May 2026	DCCEEW	Preliminary Documentation Guidelines	Canberra

There has been ongoing community consultation has been undertaken which involves the following stakeholders:

- Isaac Regional Council
- Barada Barna Aboriginal Corporation
- Underlying and surrounding landowners
- Neighbouring resource companies
- Third party infrastructure holders, and
- Local community.

3.0 Project Description

3.1 Overview of Existing Operations

3.1.1 Background

Whitehaven Daunia owns and operates the DNM, located approximately 30 km south-east of Moranbah in Central Queensland, within the local government area (LGA) of Isaac Regional Council. Approximately 2 km south and 15 km north of the DNM lies the Isaac River and the Peak Downs Highway, respectively. The existing mining activities at DNM occur on ML 1781, ML 70115 and ML 70116 and are presented in **Figure 1-1**.

The DNM is an open-cut mining operation that utilises a truck and shovel fleet, producing a hard coking coal product for the export market. The DNM is approved for a 30 year mine plan covering defined multi-seam extents commencing in 2013 and scheduled to end in FY2041. The final postmining landform (FY2042) is shown in **Figure 3-14**.

The DNM was approved with conditions on 26 October 2009 by the Coordinator-General under the SDPWO Act and now operates under EA EPML00561913 and EPBC approval 2008/4418. The following sections provide an overview of existing operations at the DNM, while specific details of the Project are described in **Section 3.2**.

3.1.2 Mining Tenure and Land Ownership

Details of relevant DNM mining tenure is outlined in **Table 3-1** and shown on **Figure 3-1**.

Table 3-1 DNM Mining Tenure

Tenure	Holder	Grant Date	Expiry Date
ML1781	Whitehaven Daunia Pty Ltd	22 December 1983	31 December 2031
ML70115	Whitehaven Daunia Pty Ltd	28 August 1997	31 December 2031
ML70116	Whitehaven Daunia Pty Ltd (50%) Stanmore SMC Pty Ltd (50%)	08 July 2004	31 December 2031
EPC1951	Whitehaven Daunia Pty Ltd (50%) Stanmore SMC Pty Ltd (50%)	19 June 2013	18 June 2025
EPC27334	Whitehaven Daunia Pty Ltd	1 April 2020	1 April 2030

There is a portion of land abutting the southwest boundary of ML 1781 which is held by Coking Coal One Pty Ltd under EPC 830, a subsidiary of Bowen Coking Coal Limited. Details of relevant land ownership is outlined in **Table 3-2**.

Table 3-2 Relevant Underlying Landholders and Titles for DNM

Landowner / Counterparty	Holder
Whitehaven Daunia Pty Ltd	3RP894192 (freehold)
Whitehaven Daunia Pty Ltd	6GV318 (land lease)
Private Landowner	3GV90 (freehold)
Private Landowner	3RP866478 (freehold)

Landowner / Counterparty	Holder
Private Landowner	2GV165 (land lease)
Private Landowner	2GV165 (land lease)
Stanmore SMC Pty Ltd	4SP190266 (freehold)
Isaac Regional Council	Unnamed Road parcel (splits 3GV90)
The State of Queensland (Represented by Department of Transport and Main Roads)	40SP130132 (land lease)
Aurizon Network Pty Ltd	26SP130069 (land lease)
Aurizon Network Pty Ltd	2GV83 (land lease)
Easement	AGV99
	BSP162522
	AGV100
	BGV99

3.1.3 Resource Characterisation

3.1.3.1 Regional Geological Setting

The DNM is located in the northern part of the Bowen Basin, a foreland sedimentary basin of approximately 200,000 km^2 as presented in **Figure 3-2**. The Bowen Basin is orientated north-northwest to south-southeast and contains the largest coal reserves in Australia. The southern half of the Bowen Basin is covered by the Surat Basin, and the Galilee Basin is present to the west (Geoscience Australia, 2017).

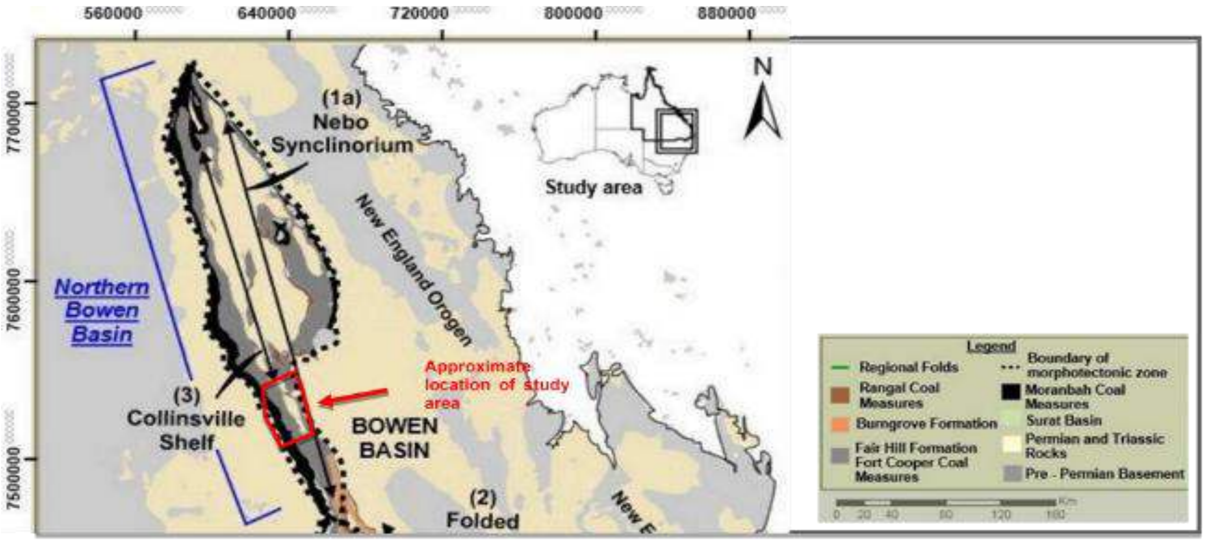


Figure 3-2 Structural setting of the Bowen Basin (after Dickins and Malone, 1973)

Basin geology within the Collinsville Shelf includes the basal Permian aged Back Creek Group, which generally comprises of generally fine-grained clastic sedimentary rocks deposited in a fluvial to shallow marine environment. The Back Creek Group is conformably overlain by the Blackwater Group, which includes the Moranbah Coal Measures, Fort Cooper Coal Measures and Rangal Coal Measures. The economic seams at DNM are contained in the Rangal Coal Measures. The Permian strata occur as outcrops on the eastern and western edges of the Basin and are unconformably overlain by the Triassic aged consolidated sedimentary rocks of the Rewan Group.

The Permian and Triassic units are covered by a thin veneer of unconsolidated to semi-consolidated Cenozoic sediments (Tertiary to Quaternary alluvium and colluvium). The alluvial sediments are localised along rivers and creeks (i.e., Isaac River). Volcanic intrusions and extrusions are also present within the region.

The generalised regional stratigraphy is summarised in **Table 3-3**. The surface geology is shown in **Figure 3-3** and is based on the Clermont (SF5511) and St Lawrence (SF5512) 1:250k geological maps, as compiled within the Queensland Geology Detailed Surface Mapping (DNRME, 2017). The solid geology for the Project Area is based on published geological mapping (1:500k) is presented in **Figure 3-4**.

Table 3-3 Regional Stratigraphy

Period		Stratigraphic Unit		Description	Max Thickness (m)
Cenozoic		Isaac River Quaternary alluvium (Qa)		Flood plain alluvium comprising clay, silt, sand, and gravel.	~ 50 m
		Regolith - alluvium, colluvium and other sediments in floodplains, alluvial fans, and high terraces (Qr, Qr\b and TQa)		Colluvial and residual deposits comprising poorly sorted clay, silt, sand, gravel and black soils, silts and muds derived from weathered basalts.	~ 20 m
		Suttor Formation (Tu)		Mudstone, sandstone, conglomerate, siltstone, oil shale, lignite, and basalt.	~100 m
Triassic		Mimosa Group	Clematis Group (Re)	Cross-bedded quartz sandstone, some quartz conglomerate and minor red-brown mudstone.	~100 m
			Rewan Group (Rr) (Rewan Formation and Sagittarius Sandstone)	Rewan Formation: green lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerate (at base). Sagittarius Sandstone: lithic sandstone interbedded with mudstones and siltstones with scattered carbonaceous plant material.	~840
Permian	Late	Blackwater Group	Rangal Coal Measures (Pwj)	Coal seams, carbonaceous shale and mudstone, tuff, siltstone, and mudstone.	~200
			Fort Cooper Coal Measures (Pwt) (Fair Hill Formation)	Coal, brown and green sandstone, conglomerate, carbonaceous shale, tuff.	~350
			Moranbah Coal Measures (Pwb)	Quartzose to sublabile locally argillaceous sandstone, siltstone, mudstone, carbonaceous mudstone, and coal.	~ 400
	Early to Middle	Back Creek Group (Pb)		Quartzose to lithic sandstone, siltstone, carbonaceous shale, minor coal and sandy coquinite.	~400

3.1.3.2 Local Geology

Cenozoic Sediments

Surface geology mapping indicates that Tertiary-Quaternary sediments are present across the area of the OOPDs and along the flood plain of the Isaac River. These deposits typically comprise unconsolidated clay, silt, sand, and gravel and are generally less than 20 m in thickness. Detailed information on the nature and thickness of the Tertiary-Quaternary sediments between the OOPD and the Isaac River (and the base of weathering) is currently limited.

Isaac River Alluvium (Quaternary)

Quaternary alluvium is present along the course of the Isaac River in broad tract between 1.5-2 km wide to the south-west of DNM and becoming wider downstream. This flood-plain alluvium typically comprises clay, silt, sand and gravel (**Figure 3-3** symbolised as Qa), and is typically less than 20 m thick (AGE, 2013). **Figure 3-3** presents a slightly revised extent for the Isaac River alluvium based on geophysical surveys, slope break analysis and soil mapping completed for the Winchester South Project (SLR, 2020) and indicates that the mapped extent of the Isaac River Alluvium extends just beneath part of the southwestern margin of the OOPD footprint.

The extent and thickness of shallow unconsolidated sediments was assessed at the Winchester South Project, located directly to the southwest of DNM by Ground Water Imaging Pty Ltd (GWI) (GWI, 2019). GWI undertook a geophysical survey which entailed AgTEM and DC-ERT transects adjacent to the Isaac River to improve understanding of the extent, permeability, and depth of alluvium. Detailed subcrop geology information was also identified as part of the survey. The results from the survey are summarised as follows:

- Groundwater in the weathered rock horizon has high salinity. This weathered horizon is absent within the recent alluvium allowing for clear delineation of the extent of alluvium within the geophysical data across the survey area,
- A shallow 8 m -10 m embayment of flat layered alluvium covers coal measures to the east of the survey extent. This alluvium has been mapped in previous reports (Douglas Partners, 2012) as a Cenozoic Sand Plain with somewhat different extents,
- The Isaac River Alluvium has a limited extent beyond the modern river channel,
- There is currently very limited data from monitoring bores within the mapped extent of the Isaac River alluvium in the vicinity of the Project. Poitrel Mine monitoring bore OBS8 located 1.5 km south-west of the Project and directly adjacent to the Isaac River (east bank), recorded 8 m of alluvium comprising clay and sandy clay, and
- The log for Winchester South drill hole WSN206, located within the mapped alluvial extent south-west of the Project boundary, records sand to a depth of 22 m, overlying siltstone. Drill holes intercepting Isaac River alluvium around the Olive Downs Project site to the south indicate that it comprises a heterogeneous distribution of fine to coarse grained sands interspersed with lenses of clays and gravels (SLR, 2021a). These sediments, while spatially variable, generally comprise four layers:
  - Upper soil and clay layer (0 m – 13 m thick),
  - Sand and sandy clay unit (0 m – 24 m thick),
  - Sand and gravel unit (0 m – 8 m thick), and
  - Basal clay unit (0 m – 10 m thick).

Quaternary and Tertiary Alluvium

Surface geology mapping as presented in **Figure 3-3**, indicates that the surficial material covering the area of the OOPD comprises Tertiary-Quaternary deposits (TQa) of unconsolidated to partially consolidated sediments comprising sand, silt, clay and minor gravel. These are older high-level alluvial deposits. Review of the bore log for MB20DNM05A, shows the Tertiary material on the west of the lease boundary to be approximately 8 m thick, directly overlying weathered Permian strata. Beyond the higher-level alluvial deposits, areas of Quaternary colluvium and are present.

Beneath the Tertiary-Quaternary alluvial and colluvial deposits regolith is present which is derived from weathering of the Permian strata. Near DNM, Permian units are highly weathered to a depth, on average, of 25 mBGL. In recent previous groundwater studies (e.g. HydroSimulations 2018, SLR 2019, 2020 and 2021b) these residual Quaternary sediments outside of the defined Isaac River Alluvium (Qa) are grouped with the Tertiary units and all termed “regolith”, as they are essentially regarded as functioning as a single hydrogeological unit.

Detailed information on the nature and thickness of the Tertiary-Quaternary sediments and the base of weathering between the OOPD and the Isaac River is currently limited, but the inferred extent and combined thickness of the alluvial deposits and regolith is presented in **Figure 3-5** based on DNM site geological data and the CSIRO Soil and Landscape Grid of Australia (CSIRO, 2015) data.

Triassic Strata

The Triassic aged strata include the Rewan Group (Rr), which unconformably overlies the Permian coal measures to the east of DNM. It also subcrops to the west of DNM because of faulting and deformation of the Permo-Triassic strata. The Rewan Group comprises Late Permian to Early Triassic strata with pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerates. The Rewan Group is generally absent in the DNM Area, only sub cropping on the northeastern boundary of the DNM mining lease.

Permian Coal Measures (Blackwater Group)

Permian coal-bearing sedimentary rocks of the Blackwater Group form the main economic resource of the numerous mines located in the Project Area. In order of increasing age (top to bottom), the major coal measures in the Project Area are:

- Rangal Coal Measures (Pwj),
- Fort Cooper Coal Measures (Pwt), and
- Moranbah Coal Measures (Pwb).

Rangal Coal Measures

Coal resources at DNM are contained within the 100 m thick Rangal Coal Measures (Pwj), which is underlain by the Fort Cooper Coal Measures and overlain in places by the Rewan Group. The Late Permian Rangal Coal Measures comprise light grey, cross-bedded, fine to medium grained labile and well cemented sandstones, grey siltstones, mudstones, shale and coal seams.

The Leichhardt and Upper Vermont Seams within the Rangal Coal Measures are the target seams at DNM. The Leichhardt Seam (DL1) is typically 5 m thick and the Upper Vermont Seam (DV4) typically 3.5 m thick at DNM. These two seams are separated by approximately 10 m - 35 m of siltstone and sandstone interburden as shown in **Figure 3-6**. In the north of DNM, the Upper Vermont Seam splits into upper and lower plies (DV2 and DV1 respectively).

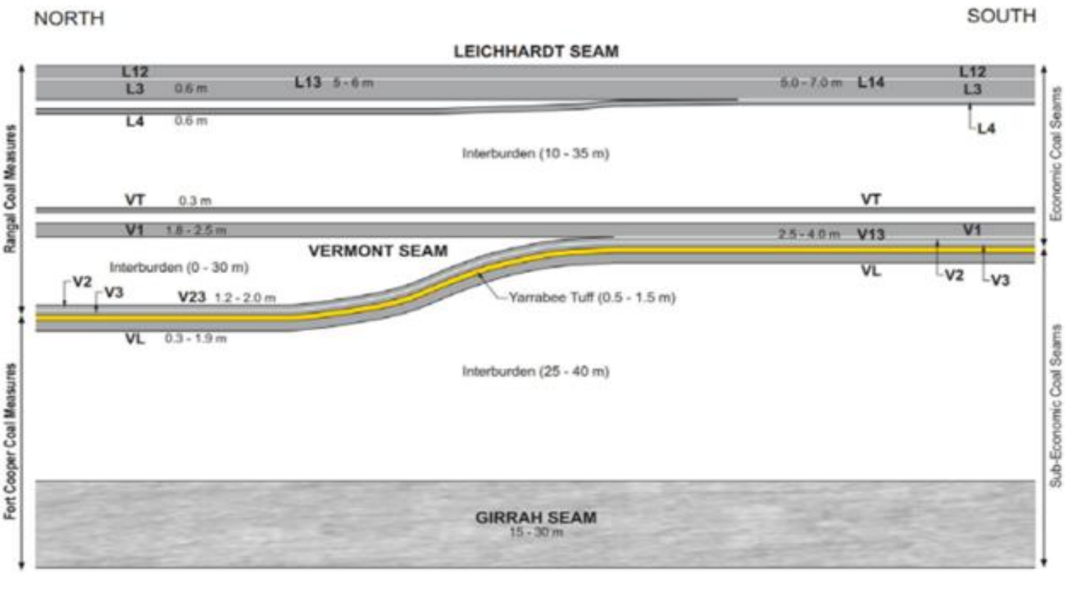


Figure 3-6 Schematic correlation of coal seams at Daunia Mine (BHP, 2019)

Fort Cooper Coal Measures

The Fort Cooper Coal Measures (Pwt) underlie the Rangal Coal Measures at DNM, and subcrop along the northwestern boundary of DNM. Regionally, the Fort Cooper Coal Measures have a maximum thickness of approximately 350 m. Drilling logs indicate the Fort Cooper Coal Measures comprise lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff and tuffaceous mudstone.

The transition between the Rangal Coal Measures and the Fort Cooper Coal Measures is marked by the Yarrabee Tuff, which immediately overlies the Lower Vermont Seam as depicted in **Figure 3-6**. The Yarrabee Tuff is a basin-wide marker bed comprised of weak, brown tuffaceous claystone, with a thickness ranging from 0.5 m - 1.5 m at DNM.

Moranbah Coal Measures

The Moranbah Coal Measures (Pwb) are the lowermost coal-bearing sequence of the Blackwater Group. The Moranbah Coal Measures comprise volcanic lithic sandstones, with lesser siltstone, mudstone, conglomerate and coal. Their depth of burial in relation to DNM mining activities means the Moranbah Coal Measures are not relevant to this groundwater assessment.

Mineral Resources and Ore Reserves

Coal resources and reserves estimates for the DNM were reported as part of the Whitehaven Coal Annual Report 2025 (WHC, 2025b) in accordance with the reporting guidelines of the 2012 Joint Ore Reserves Committee of The Australasian Institute of Mining and Metallurgy, Australasian Institute of Geoscientists, and Minerals Council of Australia (JORC Code 2012). The JORC classified Mineral Resources identified for DNM are summarised in **Table 3-4** and **Table 3-5**.

Table 3-4 JORC Classified Resources for DNM (April 2025)

Mining Method	Resources (millions of tonnes - Mt)			
	Measured	Indicated	Inferred	Total
Open-cut	81	20	3	104

Table 3-5 JORC Classified Reserves for DNM (April 2025)

Mining Method	Reserves (millions of tonnes - Mt)			
	Proved Coal Reserves	Probable Coal Reserves	Total Coal Reserves	Proved and Probable Marketable Coal Reserves
Open-cut	60	12	72	59

3.1.4 Mining Methods and Sequence

No resource extraction will be undertaken within the proposed ML area and no additional coal extraction is proposed as part of the Project. Current and future mining is approved under the existing EA and contained within existing ML 1781 and ML 70115. The Project relates specifically to a new specific purpose ML (infrastructure) that is to be used for supporting infrastructure only (i.e., OOPD). Current activities undertaken within ML1781 and ML70115 will continue in accordance with existing environmental approvals. The following sections describe the existing mining activities located on ML 1781 and ML 70115.

3.1.4.1 Mining Method

The DNM employs open-cut mining methods utilising truck/shovel equipment. This method takes advantage of the fault bounded blocks and relatively shallow depth to coal at DNM and is a proven mining method that operates efficiently and offers operational flexibility. Operations run seven days per week on a 24-hour basis.

Mining activities commence with vegetation clearing and topsoil stripping. All topsoil is stripped using earthmoving equipment, and relocated using front end loaders, trucks and/or scraper fleet, and is stockpiled in preparation of progressive rehabilitation activities. Direct respread of the topsoil is the preferred method where practical to minimise topsoil handling. This reduces loss of viable topsoil normally caused by damage to soil structure and propagules.

Drilling and blasting operations are used for overburden removal. When hard rock is encountered, drilling and blasting is used to break up the overburden into suitable sizes for loading and hauling. Similarly, through seam blasting is undertaken as required.

The strip-mining technique is currently in practice at the DNM. The strips are constructed along the strike of the coal seams. The number of strips open at any given time depends on the coal production schedule and equipment productivity requirements. Coal mining of the upper and lower seams uses a combination of excavators and loaders. Once coal is exposed, it is loaded by excavators and loaders into trucks for hauling along the network of haul roads to the ROM coal stockpiles in the north-west of ML 70116. The ROM coal is then screened, crushed and stored in the raw coal stockyard for processing. Reject material from coal handling and processing is mixed with fine tailings for co-disposal to In-Pit Dumps (IPDs). The product coal is then stockpiled via conveyor and transported to the TLF for rail out via the rail spur located on ML 70312 (held by Stanmore SMC Pty Ltd) and Goonyella Line to the Hay Point Coal Terminal.

3.1.4.2 Mine Sequence

Across the deposit at the DNM, the depth to the top of the Leichhardt coal seam varies between about 40 m and 80 m. Interburden between the Leichhardt and Upper Vermont seams result in a maximum pit depth of approximately 120 m to access the Upper Vermont seam, which is the limit of economic coal. The overall average stripping ratio of overburden (bcm) to ROM coal is 7 to 1. In-situ overburden densities average 2.3 t/bcm but vary with material type.

Mining at the DNM commenced in the northeastern part of the deposit to establish the initial box cut before advancing to the north along strike and down dip, taking the blocks of coal on the eastern limit of the deposit. Once mining progressed to the northern extent of the deposit, the mining face was moved to the west and then south along the western limit of the deposit. From about Year 10 to Year 15, mining will occur as a 2-pit operation. The second pit enables the removal of coal along the western limit of the deposit.

By about the end of Year 15, mining will have reached the economic limits of a truck and excavator fleet in the northern part of the deposit. At that point, mining returns to the eastern limit of the deposit, with a new box cut to the south-west of the eastern OOPD spoil dump. Mining then progresses into the southernmost economic limits of the deposit.

Overburden produced during the first few years will be trucked to an OOPD located to the east of the deposit, on the Daunia East Mining Lease (i.e. ML 70115). Overburden was scheduled to be placed back into the pit from approximately Year 3. Approximately 35 Mbcm are to be placed in OOPD spoil dumps in the first 5 years. A further 55 Mbcm is scheduled to be placed into the pit over the corresponding period.

A summary of the mining sequence is outlined below.

- Vegetation is cleared and stockpiled,
- Topsoil is stripped from all areas to be disturbed, using scrapers or bulldozers and rear dump trucks, and if not used immediately, it is stockpiled for later use,
- Topsoil stockpiles are located at the base of spoil dumps, to facilitate later spreading over disturbed areas,
- Competent overburden is drilled and blasted, then excavated in benches using large hydraulic excavators and loaded into rear dump trucks,
- Two box cut areas are planned (each along the eastern boundary of the resource). Material from the box cuts is used to:
    - Construct haul roads,
    - Backfill mine voids, or
    - Transported to nearby OOPD spoil dumps.
- The exposed coal is drilled and blasted (or thin seams ripped by a dozer) and then loaded into rear dump trucks for transport to the CHPP via the mine haul road,
- A combination of in pit and out of pit dumping is used, preferring in pit dumping wherever sufficient room is available,
- The dumps are progressively shaped to their final landform based on a maximum overall slope from dump crest to dump toe of 10 per cent (%),
- The dumps are topsoiled and revegetated either to native bushland or pasture,
- Drainage structures such as graded banks direct runoff to dams constructed at the base of the dumps to collect sediment and contain mine water if the pits require water to be pumped from them,
- At the completion of mining, voids will either be completely backfilled or rehabilitated with 1 in 6 (17%) slopes and drainage protection, with rock armouring applied where required. The base of the rehabilitated final voids in the south will slope down to a maximum depth of 100 m below the existing surface level. Other voids will be either progressively backfilled or backfilled at when mining operations stop, and
- All approved final voids will be located outside of the Q1000 floodplain.

The Life-of-Mine (LOM) mining sequence for FY2027 to FY2041 is shown in **Figure 3-7**.

3.1.5 Run of Mine and Product Coal Production Schedule

ROM coal production will be up to 6.5 Mtpa and product coal output will be up to 5.2 Mtpa. The final production sequence will depend on economic, scheduling and infrastructure constraints.

3.1.6 Existing and Authorised Mine Infrastructure

The DNM operates as an open-cut truck-and-shovel operation extracting metallurgical coal from the Rangal Coal Measures, specifically the Leichhardt and Vermont seams. ROM coal is washed in the on-site coal handling and processing plant, where it is sized, processed and stockpiled.

Existing infrastructure at the DNM includes a conveyor system to the TLF for rail out via the rail spur located on ML 70312 (held by Stanmore SMC Pty Ltd) and Goonyella Line to the Hay Point Coal Terminal, OOPD located on ML 70115 and ML 1781, and a CHPP on ML 70116.

Existing water management infrastructure and supporting infrastructure (i.e., roads, powerlines, laydown area, workshops and offices) are also located primarily within ML 1781 and ML 70115. The mine houses maintenance workshops, fuelling and refuelling facilities, warehousing, offices, and amenities located near the central industrial area. Some remote “go-lines” (parking and servicing areas for trucks) are located adjacent to or within pit boundaries as operationally required. The key mine infrastructure is described below and provided in **Figure 1-2**.

3.1.6.1 Coal Handling and Preparation

The CHPP at the DNM is located on ML 70116.

The key elements of the CHPP include:

- Receiving, sizing and processing ROM coal at a nominal rate of 800 t/h (6.5 Mt/a),
- Stacking the semi hard coking coal and PCI coals separately, each at a rate of up to 700 t/h, onto two separate product coal stockpiles each with up to 75,000 t capacity,
- Reclaiming the product coal from different stockpile sections at a controlled rate up to 4,500 t/h and discharging into the existing 350 t capacity train load out bin,
- Loading the trains at a rate of 4,000 t/hour (equivalent to loading 10,000 t trains in 2.5 hours),
- Transferring the coal rejects and dewatered tailings from the CHPP at a rate of up to 430 t/h and discharging into a rejects bin for collection by mining hauls trucks for disposal into the spoil dumps,
- Stockpiling and load out up to 4.0 Mt/a of product coal, and
- Producing the following saleable products:
    - Coking Coal: 8.0% ash,14.0% moisture as shipped,
    - PCI Coal: 9.5% ash at not greater than 8.5% total moisture, and
    - Small volumes of thermal coal.

The existing CHPP has an installed design capacity that is sufficient to handle ROM coal production from the mining of DNM.

ROM coal is transported by dump truck to the ROM coal stockpiles in the north of ML 70116. ROM coal is then fed to the crushing station where it is crushed, screened and stacked. The

CHPP is fed by a single feed conveyor. Product coal is conveyed through a transfer station to two stacking conveyors and then to the product coal stockpiles. The product coal is reclaimed by dozers and loaded into a conveyor head hopper, to be conveyed to a batch weighing bin to the TLF.

A reject conveyor discharges coarse and fine rejects to the reject bin. Process plant water is recycled to minimise raw water make-up requirements for DNM. Coarse rejects and dewatered tailings from the CHPP is co-disposed with overburden to existing IPDs.

No changes to coal handling and processing are required for the Project. There will be no change to the CHPP or ROM stockpiles as part of the Project. A schematic of the CHPP is presented in **Figure 3-8**.

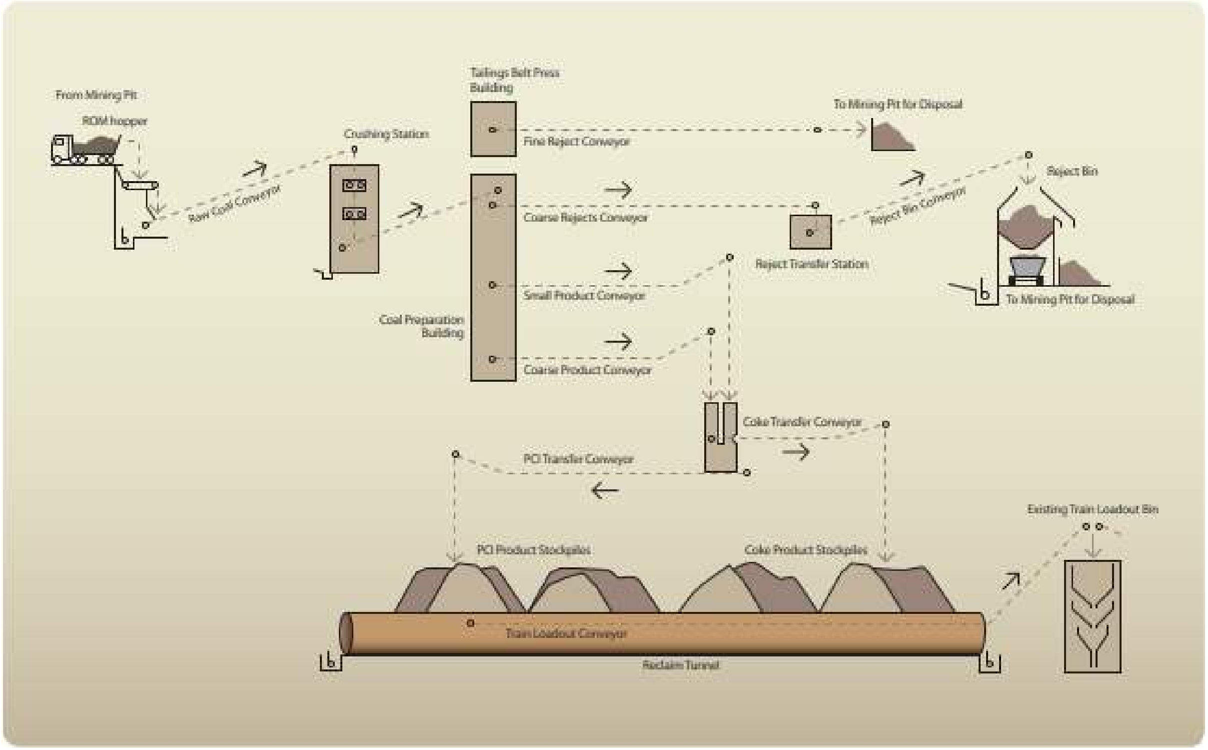


Figure 3-8 Schematic overview of CHPP

3.1.6.2 Blasting

Blasting may be undertaken for both coal and overburden. The range of blast sizes for DNM is approximately 200,000 bank cubic metres (bcm) for coal blasts and range from 500,000 to 750,000 bcm for overburden. An explosives contractor provides explosives and undertakes all blasting activities. Over the LOM, the number of bulk explosives (Ammonium Nitrate/Fuel Oil (ANFO)) used per annum is estimated to be approximately 30,000 tonnes. The storage, transportation and use of explosives is accordance with Australian Standard AS 2187.2-2006 Explosives - Storage and use - Use of explosives, the *Explosives Act 1999*, and WHC's policies and procedures.

3.1.6.3 Water Supply

A summary of the existing water supply components at DNM is provided below.

Mine Water

The major water demands for DNM (coal processing and dust suppression) are principally met by Mine Affected Water (MAW) captured from pit rainfall runoff and OOPD catchments. MAW is also utilised at DNM as part of the fire protection system. The mine water management strategy for DNM is based on the following principles:

- Capturing runoff from disturbed areas into sediment dams and using this water preferentially for dust suppression, or as process water in the CHPP,
- Maximise reuse of mine water for dust suppression and/or coal handling and processing activities,
- Provide an ability to pump water collected in the mine pits to MAW dams to maximise pit operability, and
- Transferring water between the mine pits and the CHPP to optimise the use of water on site.

Raw Water

The DNM can obtain raw water from Sunwater via the Burdekin Pipeline when rainfall at site is inadequate. The raw water supply can supplement the site water requirements at a maximum supply rate of 6.3ML/day. The annual allocation for DNM is 1,910 ML per annum.

The GoldSim Water Balance Model for DNM predicts an average of 1,350 ML of raw water will be required each year for the LOM to FY2040. Raw water consumption is minimised by maximising the reuse of on-site MAW in the mining process and by employing techniques to minimise losses due to seepage and evaporation.

Potable Water

The quality of surface water runoff at DNM is not suitable for potable water and therefore only treated raw water is used. Raw water for potable purposes is sourced from the Braeside/Burdekin pipelines and is treated at a rate of approximately 60 KL/day at the on-site Water Treatment Plant to standards outlined in the Australian Drinking Water Guidelines (2011).

Treated Sewage Effluent

Sewage generated from activities at site is treated through a three-tank expanded modular sewage treatment plant, and effluent pumped to Dam 2.

3.1.6.4 Mine Waste Management

Overburden and waste rock are managed through IPDs, which backfill mined-out pit sections to reduce final disturbance, and OOPDs authorised under the existing environmental authority on ML 1781 and ML 70115. Coarse rejects and dewatered tailings from the CHPP are co-disposed with overburden in existing IPDs. Waste rock is progressively backfilled into the pit throughout operations. At present, operations are constrained by the limited capacity of short-haul dump locations, which has resulted in longer, inefficient haulage distances; this inefficiency will be worsened once the Pandora Pit mining commences, as material will need to be transported over greater distances to reach dump sites.

3.1.6.5 Topsoil Handling and Rehabilitation Areas

Topsoil and subsoil stripped prior to pit development are stored in approved stockpiles on ML 1781 and ML 70115 for ongoing and future rehabilitation. Progressive rehabilitation reshapes spoil areas, replaces topsoil and establishes vegetation in accordance with final land-use criteria.

3.1.6.6 Mining Equipment

The equipment fleet at DNM is a mix of contractor and WHC owned fleets. The mining equipment currently utilised at DNM is summarised in **Table 3-6**.

Table 3-6 Mining Equipment

Model	Quantity at DNM
Load and Haul	**81**
Shovels	1
Excavator - 600T	3
Excavator - 400T	4
Excavator - Clean Up	2
UC Haul Truck	7
MC Haul Truck	27
Dozer	19
Wheel Dozer	1
Loader - Clean Up	3
Grader	6
Water Truck	6
Scrapers	2
Services	**17**
Water Truck	2
Drills (Contract)	4
MPU	3
Stemming Truck	2
Excavator - Clean Up	2
Dozer	1
Loader - Clean Up	1
Grader	2

3.1.6.7 Transport Network

Site Access

The DNM is currently accessed via a dedicated all-weather access road that links directly to the Peak Downs Highway. The mine's entry is along the Millennium and Poitrel Access Road, which branches off the Peak Downs Highway near Moranbah.

Roads (Heavy Vehicle and Light Vehicle)

A network of Heavy-Vehicle (HV) haul roads connects active pit areas with the ROM hopper and spoil dumps. These roads are built to WHC standard for safe manoeuvring of large mining trucks. Adjacent or parallel Light-Vehicle (LV) roads serve the general workforce and tie the major industrial areas (CHPP, admin buildings, workshops) to the active mining zones.

Train Load-Out and Rail Spur

The existing conveyor and TLF connect to a rail spur located on ML 70312 (held by Stanmore SMC Pty Ltd) and the broader Goonyella rail network, transporting product coal to the Hay Point Coal Terminal. This arrangement has been in operation since DNM's inception and is approved as part of existing operations.

Rail Load-Out and Transport

Rail infrastructure is shared with the adjacent Red Mountain Joint Venture (RMJV) network. Product coal from DNM is loaded through the existing TLF and transported to port via the broader Queensland rail network. The TLF lies to the north of the CHPP, integrated with site product stockpiles.

3.1.6.8 Power Supply

An existing 66 kV power distribution system supplies the CHPP, pumping systems and major site facilities. A Single-Wire Earth Return line traverses the ML is part of pre-existing external utilities (an Ergon Energy asset).

3.1.6.9 Workshops, Laydown Areas and Buildings

Maintenance workshops, wash-down pads, refuelling infrastructure, warehouses and administrative offices are located near the main industrial precinct. Laydown areas, used for storing equipment and materials, also form part of the existing authorised facilities.

3.1.6.10 Workforce and Operational hours

The DNM operational hours are 24 hours per day, seven days per week, 365 days per year. The operational workforce projected at DNM for FY2024 and FY2025 is approximately 720 full time equivalent employees and contractors.

3.1.7 Environmental Authority

The DNM operates under EA EPML00561913 and EPBC approval 2008/4418 on ML 1781, ML 70115 and part of ML 70116. The DNM was approved on a 30-year mine plan across defined multi-seam extents. The latest revision of the EA for DNM took effect on 13 November 2025 and covers the following Environmentally Relevant Activities (ERAs):

- Schedule 3: 13 Mining black coal,
- Ancillary 08 Chemical storage 1,
- Ancillary 31 Mineral processing 2,
- Ancillary 62 Resource recovery and transfer facility operation 1, and
- Ancillary 63 Sewage Treatment 1.

3.2 Proposed Project

3.2.1 Introduction

Whitehaven Daunia proposes the construction and operation of an OOPD to the west of, and adjacent to, ML 1781, off-lease from DNM (the Project). The Project is required to support ongoing open-cut mining operations at DNM. The Project also includes the construction of additional haul roads to provide access to the short haul OOPD, and one mine-affected water (MAW) dam and one clean water dam to manage predicted run-off from the OOPD.

The Project will be constructed off-lease on EPC 27334 and will utilise existing infrastructure while continuing current operations at DNM (see **Section 3.1**). The Project Area and disturbance footprint is shown in **Figure 3-9**. The Project Area spans 500 hectares (ha), of which, 305 ha is comprised of the direct disturbance footprint. Approximately 282 ha of the OOPD is located on the existing DNM ML, ML 1781, with the remaining 39 ha to reside on the existing ML 1791 (**Table 3-7**).

Table 3-7 Project Area and Disturbance Footprint Areas

	Area (hectare)
Total Project Area (ML Application Area)	**500**
Undisturbed Footprint within Project Area	195
Disturbance Footprint within Project Area	**305**
OOPD within Project Area	282
Mine-Affected Water Dam	14
Sediment Dam	4
Haul Road	4
OOPD within existing ML1781	**39**
OOPD total area	**321**
Total area for rehabilitation	**344**

There will be no blasting undertaken in the Project Area.

The following sections describe the project's components and activities that comprise the Project, specifically, those that are to be implemented in addition to the existing operations.

3.2.2 Project Mining Tenure

3.2.2.1 Mining Lease Application Area

The pre-requisite tenure for the MLA comprises of EPC 27334, and a part of EPC 1951. Whitehaven Daunia has lodged an MLA to secure tenure for the OOPD supporting the operations within the existing ML 1781.

The OOPD (the primary activity addressed by this EA Amendment), will be located entirely within the boundaries of the proposed MLA area, with 39 ha located on ML 1781 and is not subject to this EA Amendment. Supporting infrastructure which includes new haul roads for transporting material to the OOPD along with dams which will be situated both within both the existing ML and in the new ML area. Portion of the haul roads within the DNM ML remain under the existing EA, and any off-lease sections will be authorised under the new ML. The MLA was lodged by Whitehaven Daunia on 30 October 2025.

The MLA extent is shown on **Figure 3-9**. The MLA extent (3GV90) is freehold land owned by a private landowner. The mining tenure associated with the Project is provided in **Table 3-8** (tenure for existing operations are provided in **Section 3.1**).

Table 3-8 Project Mining Tenure

Tenure	Holder	Grant Date	Expiry Date
EPC 1951	Whitehaven Daunia Pty Ltd	19 June 2013	18 June 2025
EPC 27334	Whitehaven Daunia Pty Ltd	1 April 2020	1 April 2030

3.2.3 Project-Specific Infrastructure and Operations

3.2.3.1 Out-of-Pit Dump

Description and Rationale

Operational Necessity

The proposed OOPD comprising 282 ha on the MLA and a maximum height of 250 meters Australian Height Datum (m AHD), will provide a dedicated area for the overburden material to accommodate the open-cut mining operations at DNM, in line with the proposed 6.5 Mtpa ROM production capacity. There is insufficient existing short haul dump capacity at DNM to efficiently manage this volume of waste rock, without the Project coal extraction being significantly constrained.

Haulage Efficiency and Emissions

The selected location provides shorter haulage distance from the mining areas compared to a previously proposed OOPD locations. Additionally, minimising the haulage distance, will reduce the consumption of diesel fuel and thereby greenhouse gas (GHG) emissions from haul trucks. The shorter haul distances will also reduce the duration of trucking onsite which will reduce the overall dust and noise emissions along the haul routes.

Environmental Considerations

The location of the OOPD was determined through assessments aimed at avoiding sensitive ecological areas, including koala and greater glider habitats. This provides a lessened impact to sensitive habitats when compared to the alternative location.

Further information regarding the Project Justification is presented in **Chapter 5.0** of this Report.

Design and Construction

The proposed OOPD is necessary to facilitate and support ongoing mining operation at DNM because of the space constraints within existing MLs. The OOPD will be developed in the southwest of the new ML area in close proximity to the current approved ML area.

Site preparation will include vegetation clearing and formalising of access tracks and haul roads. The OOPD footprint is proposed to disturb 282 ha. The OOPD will have a maximum height of 250 m AHD. Overburden will be used for construction material.

The OOPD will be designed to a maximum final slope angle of around 3H:1V (≈18°) or flatter to ensure long-term erosion control. Construction of benches (10 - 20 m lift) to break slope length and manage run-off. The OOPD is to achieve a factor of safety of ~1.3-1.5 to ensure permanent stability. The construction of the OOPD will be undertaken in accordance with relevant legislation, *WHC Mining Waste Management Plan* (WHC-DNM-PLN-006, April 2024) and the *WHC Coal Landform Design Guideline* (WHC Document number 012714007).

Drainage and runoff will be managed through appropriately designed contour drains and drop structures. The final landform will be shaped to ensure long-term stability and compatibility with surrounding land uses.

Construction Schedule

The life of the OOPD is approximately seven years (up to and including rehabilitation). The preparation for development of the OOPD is estimated to commence in approximately FY2028. The indicative progressive management of overburden is outlined on **Figure 3-10** to **Figure 3-13**. The OOPD will be a future elevated landform, the conceptual final landform is shown in **Figure 3-14**. The total volume of waste material to be deposited into the OOPD is approximately 86,354,000 m^3, with annual deposition detailed in **Table 3-9**.

Table 3-9 Estimated annual volume of deposition materials into OOPD

Year	Estimated Volume of Deposition Materials into OOPD (m^3)
2027	10,970,000
2028	24,531,000
2029	20,073,000
2030	19,520,000
2031	5,944,000
2032	1,821,000
2033	2,988,000
2034	507,000
Total	**86,354,000**

Topsoil Management

Stockpile locations and volumes will vary throughout the life of the operation as stockpiled topsoil is used on rehabilitation and new stockpiles are created as mining advances. The spatial location of stockpiles is recorded in a geographic information system and a volume inventory is maintained.

The average thickness of stripped topsoil measures approximately 300 millimetres (mm), with a nominal 200 mm respread on the batters. Considering a bulking factor of 1.1, a maximum topsoil stockpile height of 2.5 m is expected resulting in a total footprint of approximately 18 ha.

Protective measures to ensure sufficient topsoil is available for rehabilitation and amelioration of long-term stockpiles/windrows will include standard terrace and chute channels and erosion protection fabrics and grassing of topsoil stockpiles. Development and management of topsoil stockpiles will be in accordance with the WHC Topsoil Management Procedure.

Flood Protection

There will be no levees constructed for the Project, however, there will be drains and similar surface water management infrastructure.

3.2.3.2 Haul Roads

Additional haul roads will be constructed over the life of the Project. These heavy vehicle haul roads will typically have a gradient of 8% –10% or less, with adequate drainage features on either side to prevent water build-up. Road widths will be sized to allow two-way traffic flow and the safe passage of oversized vehicles with estimated width of 35 m to accommodate a Cat 797 vehicle width in accordance with the WHC Haul Road Design Guidelines and DNM Specification. Crossfall will typically be provided to assist runoff, and regular maintenance—such as grading, watering, and compaction—helps maintain road integrity and minimise dust. The indicative haul routes over the life of the Project is shown in **Figure 3-15** to **Figure 3-18**.

3.2.4 Use of Existing Infrastructure and Ongoing Operations

Site Access and Transport

The Project Area will be accessed from the existing mine's entry point along the Millennium and Poitrel Access Road, which branches off the Peak Downs Highway near Moranbah. There are no proposed changes to access roads to the DNM site.

Power Supply and Transmission

The Project will be serviced through the existing power supply and transmission infrastructure at the DNM, as such there will be no changes to the power supply and transmission.

Water Demand and Supply

Water required for the Project will be sourced from the existing DNM operations, as such there will be no changes to water supply.

Mine Water Management Infrastructure

The Project will not require any changes to existing mine water management infrastructure. Water sourced from pit dewatering at DNM will continue to be managed under the Mine Water System. The Project will not impact this process.

Mining Equipment

The equipment fleet at DNM is a mix of contractor and WHC owned fleets as detailed in **Section 3.1.6.6**.

Workforce and Accommodation

The current workforce arrangements at the DNM will remain in place for the Project. The operational workforce requirements for the Project will also remain consistent with current operations at DNM. The Project is not anticipated to require a significant change in the existing DNM workforce or workforce accommodation arrangements. The Project will utilise the existing DNM workforce as a continuation of existing operations. The current operational workforce at DNM for FY2024 and FY2025 is estimated up to 720 full time equivalent employees and contractors. The current workforce arrangements at the DNM will remain in place for the Project. The DNM workforce will continue to primarily utilise camp accommodation.

3.2.5 Final Landform

There will be no residual voids for the Project. The OOPD will remain a future elevated landform.

4.0 Rehabilitation

This chapter describes the proposed rehabilitation strategy for the Project, which consists specifically of the final landform for the OOPD, associated haul roads and surface water infrastructure to be placed on the new ML. The rehabilitation approach has been developed to demonstrate that the Project disturbance areas can be returned to safe, stable and non-polluting landforms that can support the nominated PMLUs.

Rehabilitation planning for the Project is aligned with the overarching rehabilitation and closure framework established for the DNM under the existing EA EPML00561913 and the current PRCP.

4.1 Progressive Rehabilitation and Closure Plan

A PRCP has been prepared for the DNM in accordance with the requirements of the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (MERFP Act), the EP Act, and the *Guideline - Progressive Rehabilitation and Closure Plans (PRC plans)* (the PRCP Guideline).

The PRCP provides a framework to:

- Require the holder of an EA to plan for how, where and when activities will be carried out on land in a way that maximises the progressive rehabilitation of the land to a stable condition; and
- Define the condition to which the holder must rehabilitate the land before the EA may be surrendered.

The DNM PRCP was first submitted in July 2023 under the previous BMA mine plan, and established the baseline domains, proposed PMLUs, and Non-Use Management Areas (NUMAs) for the DNM. Whitehaven Daunia submitted an updated transitional PRCP to align with the updated LOM Plan.

A PRCP amendment application has been submitted following the approval of the PRCP Schedule by DETSI which incorporated the Project.

4.2 Key Information

Key information relevant to rehabilitation planning for the Project is outlined in **Table 4-1**.

Table 4-1 Key rehabilitation information

Key Aspect	Overview
Site topography	The OOPD footprint is situated on gently undulating land adjacent to ML1781. The area will be reshaped into a permanent elevated spoil dump, designed to a maximum final slope angle of around 10% (≈6°) or flatter.
Climate	The site experiences a subtropical climate with summer-dominated rainfall and extended dry periods. Average annual rainfall is approximately 600 mm, with evaporation exceeding rainfall for much of the year.
Geological setting	Overburden material comprises Permian mudstones, siltstones, claystones and sandstones from the coal measures. These materials will be used to form the OOPD landform.
Site hydrology and fluvial networks	An unnamed waterway traverses through the centre of the Project Area. It is classified as a low-risk waterway for barrier works and is expected to flow seasonally. Whitehaven Daunia proposes a financial offset for this Key Aspect (refer to **Chapter 13.0**).

Key Aspect	Overview
Groundwater	The Project Area is within the Fitzroy Basin. No major alluvial aquifers are present within the OOPD footprint and groundwater is not considered a primary rehabilitation constraint.
Soil types and productivity	Soils are shallow, cracking clays with brigalow associations. Topsoil will be stripped to depths of up to ~300 mm and reused as growth media for rehabilitation.
Land stability	The final OOPD will be designed to achieve a factor of safety of 1.3 – 1.5. Benching and contouring will be applied to manage runoff and erosion.
Vegetation and ecology	The Project Area is dominated by cleared or regrowth vegetation. Rehabilitation will establish a PMLU of cattle grazing.
Pre-mining land use	The site has been historically cleared and used for cattle grazing, consistent with the broader Daunia region.

4.3 Conceptual Final Landform

The conceptual final landform design for the Project is based on the LOM Plan and supporting studies undertaken for this EA Amendment Application and the revised PRCP. The design aims to ensure the OOPD achieves a stable, non-polluting and safe landform that can be rehabilitated to the nominated PMLU.

The main features of the Project's final landform will be:

- Reshaped and rehabilitated elevated spoil dumps constructed progressively in lifts (benches) during operations, and
- No residual voids will be created as part of the Project. The OOPD will remain as a permanent elevated landform.

The OOPD will be designed to:

- A maximum height of approximately 250 m AHD, and
- A maximum final slope angle of around 10% (≈6°) or flatter, with 10 m – 20 m benches to manage surface runoff,
- A factor of safety in the order of 1.3 – 1.5 to ensure geotechnical stability, and
- Final surfaces reshaped and prepared prior to growth media application and revegetation.

A conceptual final landform for the Project is presented in **Figure 3-14**.

Given the nature of the OOPD as a spoil dump, the final landform is capable of being rehabilitated to the PMLU. While this EA Amendment Application provides the conceptual design based on current information, the detailed landform parameters, milestones and completion criteria are provided in the PRCP.

4.4 Rehabilitated Landform Options Assessment

The proposed conceptual final landform for the OOPD is summarised in **Section 4.3** and detailed in the revised PRCP.

Future optimisation of the final landform may include consideration of:

- Regrading of outer slopes to achieve long-term stability and erosion control,
- Bench construction to break slope length and manage runoff,
- Reprofiling to integrate the OOPD with adjacent landforms and drainage patterns,
- Additional surface water drainage features to reduce erosion risk and prevent ponding, and
- Increased setbacks from drainage lines or boundaries to achieve required factor of safety.

The PRCP will further appraise viable, sustainable options to inform the final closure strategy for the Project.

4.4.1 Alternative Landform Treatments

Slope Reprofiling for Erosion Control

Options may include flattening selected external slopes or reducing bench spacing to improve erosion resistance. This would be assessed against material availability and haulage efficiency.

Surface Drainage Optimisation

Installation of contour drains, drop structures and stabilised channels may be evaluated to enhance surface water management and minimise erosion risks.

Growth Media and Revegetation Treatments

Alternative treatments for growth media placement and vegetation establishment (e.g. direct placement vs. stockpiled topsoil) may be considered to optimise rehabilitation outcomes.

4.4.2 Progressive Construction and Rehabilitation

The OOPD will be constructed in stages (lifts/benches) over the life of the Project. Progressive rehabilitation of completed batters and outer slopes will be implemented where practicable, including:

- Early placement of growth media and establishment of groundcover,
- Use of erosion protection such as mulching, geofabrics, or temporary seeding, and
- Monitoring and adaptive management to improve vegetation success rates.

This progressive approach reduces the extent of disturbed land at any one time and supports earlier rehabilitation outcomes, consistent with the requirements of the EP Act.

4.5 Proposed Land Outcomes

The proposed land outcomes for the Project are consistent with the broader closure vision for the DNM, which is to return disturbed land to safe, stable, non-polluting landforms that support sustainable post-mining land uses.

4.5.1 Post-Mining Land Use

Based on the disturbance type and surrounding landscape, the PMLU considered appropriate for the Project is:

- **Cattle grazing** - consistent with the predominant pre-mining land use in the region.

Figure 4-1 presents the PMLU for the disturbance area.

4.5.2 Non-Use Management Areas

The Project does not create any new NUMAs. The proposed OOPD will be a spoil dump that can be reshaped, stabilised, and rehabilitated to a nominated PMLU. Accordingly, no additional NUMAs are proposed.

4.6 Rehabilitation Activities

Below provides a summary of proposed rehabilitation activities. Refer to the revised PRCP for further detail.

4.6.1 Topsoil Management and Surface Preparation

Topsoil will be stripped ahead of disturbance, generally to depths of up to ~300 mm where available. Where practicable, topsoil will be directly placed on reshaped areas to minimise stockpiling and preserve seedbank and microbial viability. Surplus material will be stockpiled for later use in progressive rehabilitation.

Stockpiles will be kept low (≤2.5 m) and stabilised through temporary cover and drainage controls to reduce erosion and dust. Stockpile locations and volumes will be tracked to ensure availability for future use. OOPD slopes will be re-graded to 10% (≈6°) or flatter, ripped along contour, and covered with a nominal ~200 mm of topsoil prior to seeding.

Soils will be assessed for quality (pH, salinity, nutrients, organic matter) in line with the PRCP framework and ameliorated as per the PRCP. PMLU specific requirements are summarised in **Table 4-2**.

Table 4-2 Growth media, ameliorant options and surface treatments for Project PMLU

PMLU	Growth Media	Ameliorant Options	Surface Treatments
Cattle grazing	Topsoil minimum depth of 150 mm to store moisture and nutrients sufficient for pasture growth.	• Elemental sulphur • Manures • Urea • Diammonium phosphate • Superphosphate • Fertiliser • Gypsum • Incorporated organic matter • Surface mulching (e.g. hay mulch)	• Ameliorate growth media as recommended by a qualified person (if required) • Rip on contour • Direct seed as per cattle grazing revegetation mix

Note: Final topsoil depths, ameliorant applications and seeding specifications are detailed in the revised PRCP, supported by site-specific soil and rehabilitation studies.

4.6.2 Revegetation

Revegetation will be undertaken progressively across the OOPD and associated haul roads once reshaping, and topsoil placement are complete. The objective is to establish self-sustaining vegetation consistent with the nominated PMLU.

Direct seeding will be the primary method, supported by supplementary planting of key species where required. Early groundcover species may also be introduced to provide rapid erosion protection. Seed will be sourced from local provenance where possible, with preference for collections from within the Brigalow Belt North (BBN) bioregion to ensure ecological integrity and suitability to site conditions. The indicative revegetation approach the PMLU is summarised in **Table 4-3**.

Table 4-3 Revegetation approach for PMLUs

PMLU	Seeding/Planting Method	Species Mix	Establishment Support
Cattle grazing	Direct seeding of pasture species in warmer months (Sep–Mar).	Productive, palatable and persistent (3P) pasture grasses and legumes; final mix to be confirmed in PRCP Rev3.	Fertiliser application if required; maintenance reseeding; monitoring to ensure adequate cover.

Final species mixes, provenance requirements and establishment methods are detailed in the revised PRCP.

4.7 Rehabilitation Schedule

The life of the OOPD is approximately seven (7) years, including rehabilitation, with preparation for development expected to commence in FY2028.

The rate and extent of progressive rehabilitation will depend on operational factors such as:

- Dumping sequence - areas will only be rehabilitated once final lifts are placed and no further dumping is required in that location,
- Access ramps - some surfaces will remain unavailable until haulage ramps are decommissioned, and

- Geotechnical stability - lower benches must advance sufficiently before upper areas can be reshaped and rehabilitated.

As a result, rehabilitation will not proceed at a uniform rate. Larger areas are expected to become available towards the latter years of the schedule as the OOPD reaches its final extents.

Indicative sequencing is as follows:

- **Early years (1-3 years):** Limited rehabilitation as dumping advances. Scope for rehabilitation will not exist at this stage,
- **Middle years (3-5 years):** Continued dumping and shaping of OOPD; progressive rehabilitation of accessible slopes and benches should material become available, and
- **Final years (after year 7):** Completion of final lifts, regrading of surfaces, topsoil re-spread, and revegetation of remaining areas.

Refer to the revised PRCP schedule for further detail.

4.8 Rehabilitation Goals, Milestones and Completion Criteria

4.8.1 Rehabilitation Goals

Rehabilitation of the OOPD and associated haul roads will aim to:

- Establish safe, stable, non-polluting landforms,
- Return disturbed areas to nominated PMLUs,
- Re-establish ecological and/or grazing values consistent with the surrounding landscape, and
- Enable progressive rehabilitation throughout the OOPD lifecycle to minimise the area of active disturbance.

4.8.2 Rehabilitation Requirements

Table E1 of the EA EPML00561913 sets out rehabilitation goals, objectives, indicators and acceptance criteria for the DNM. The detailed domain milestones and completion criteria applicable to the Project is detailed in the revised PRCP. A summary of the rehabilitation milestones is provided below.

4.8.3 Rehabilitation Milestones

Indicative rehabilitation milestones for the Project include:

- **Landform shaping:** Completion of OOPD batters to final design slopes 10% (≈6°) or flatter) to achieve long-term geotechnical stability,
- **Topsoil placement:** Application of topsoil and ameliorants across reshaped areas to meet rehabilitation acceptance requirements,
- **Surface preparation:** Ripping or contouring to relieve compaction and promote infiltration,
- **Progressive revegetation:** Seeding and/or planting consistent with cattle grazing PMLUs,

- **Stability and cover:** Achievement of groundcover and erosion control consistent with acceptance criteria, and
- **Final verification:** Demonstration that rehabilitated areas are safe, stable, non-polluting and capable of sustaining the nominated PMLU, to the satisfaction of PRCP Rev3.

The specific hectares of rehabilitation areas and the timing of milestones is detailed in the revised PRCP Schedule and Plan, as supported by geotechnical, land suitability and ecological studies.

4.9 Monitoring, Maintenance and Reporting

Monitoring will be undertaken to demonstrate achievement of rehabilitation milestones for the OOPD and associated haul roads, consistent with the nominated PMLU.

Rehabilitation monitoring information will include, but not be limited to:

- Vegetation structure and cover (e.g. groundcover %, species richness, regeneration success),
- Soil and topsoil properties (e.g. depth, pH, nutrients, evidence of erosion),
- Photographic monitoring of representative sites, and
- Surface water and groundwater quality where relevant to assess non-polluting outcomes.

Monitoring data will be collected and analysed by appropriately qualified personnel and assessed against acceptance criteria. Monitoring will track the trajectory of rehabilitation to confirm whether areas are on a pathway to meeting the milestone criteria or whether corrective actions are required.

Maintenance will be implemented where monitoring identifies issues with rehabilitation performance (e.g. erosion, inadequate groundcover, poor species establishment). Maintenance measures may include erosion repairs, reseeding or supplementary planting, and weed or pest management to support establishment of the nominated PMLU.

Refer to the revised PRCP for the proposed monitoring and reporting program.

4.10 Exploration Areas

No exploration activities are proposed as part of the Project. Therefore, no exploration area rehabilitation requirements apply.

5.0 Project Justification and Alternatives

The following chapter outlines the justifications and considered alternatives to the Project, as well as assessing the Project against the Standard Criteria under Section 4 of the EP Act.

5.1 Justification

WHC has become one of Australia's largest seaborne exporters of metallurgical (steelmaking) coal from its operating mines in Queensland and New South Wales. WHC's operations in Queensland make a significant contribution to the Queensland and Australian economy. Assets in the Bowen Basin are being progressively developed by WHC to meet long-term global demand for high quality metallurgical coals with brownfield expansions and green field developments.

The DNM has been in operation since 2013 and has been subject to regular reviews overtime of its feasibility in consideration of market demand. The long-term access to DNM's resources assist to secure the future of WHC, its customers, workforce and the surrounding community. The Project facilitates an opportunity to further contribute to Australia's position as a primary global producer of high-quality coking coal products.

The Project consists of the construction and operation of an OOPD to accommodate the overburden material produced from the increase in the ROM tonnage rate to facilitate and support ongoing mining operations at DNM. Currently, there is insufficient short haul dump capacity at DNM to efficiently manage the volume of waste rock planned to be produced from the operations. ROM coal production from the DNM will be up to 6.5 Mtpa for the LOM.

The OOPD will be located to the west of, and adjacent to ML 1781 in EPC 27334 and EPC 1951. This location will provide shorter haulage distance from the mining areas compared to the previously proposed OOPD locations, as described further in **Section 5.2.1**. By minimising haulage distance, the consumption of diesel fuel, and subsequently the greenhouse gas (GHG) emissions from haul trucks, will be reduced. The shorter haul distance will also reduce the duration of trucking onsite, reducing the overall dust and noise emissions along the haul routes. A new MLA has been lodged (ML 700085) with the relevant administrating authority to accommodate for the OOPD.

The location of the OOPD was determined through assessments aimed at avoiding sensitive ecological areas, including koala and greater glider habitats as described further in **Section 5.2.1**. This location provides a reduction in impact to sensitive habitats when compared to alternative locations.

The Project will utilise existing infrastructure at DNM for activities such as coal processing, tailings management, train load-out of product coal and water management. The Project will continue to maximise metallurgical coal reserves and construct the OOPD in an area largely disturbed by existing land uses. The Project has been designed to avoid or minimise native vegetation clearance. Mitigation and management measures will be implemented to avoid or minimise impacts on environmental values.

The existing operations at DNM play a fundamental role in creating employment opportunities within the local and regional communities, which in turn, increases regional prosperity and domestic productivity. The local and regional community has established itself to service the existing mining complex, and is therefore accustomed to the benefits, costs and demands associated with the mining operations undertaken at DNM.

The Project will, as part of DNM operations, provide ongoing significant direct employment opportunities to regional communities, and long-term flow-on social and economic benefits primarily through local employment and business opportunities.

The benefits arising from ongoing operations facilitated by the Project will be the greatest in areas where direct activity will occur, such as the nearby major population and service centres, i.e., Moranbah and Mackay. In summary, the Project will continue to:

- Support economic activity in the region and Queensland through direct and flow-on activity, and thus contribute to local, regional and State economic growth,
- Provide local businesses with opportunities to continue to secure new contracts and increase sales to service the Project and workforce needs,
- Enable the local sourcing of goods and services as well as labour from the local region, preferentially to elsewhere in Queensland and Australia,
- Employ local, regional and State-based employees as an order of preference. Benefits may be further enhanced through skills transfer and on-the-job skills development. Over ~ 720 direct jobs are anticipated to be sustained due to the Project and the ongoing WHC operations, and
- Directly contribute to sustaining existing infrastructure in the region.

WHC is establishing itself as a major contributor to the Bowen Basin communities. Overall, the Project will contribute to economic growth of the region through sustained employment at the Local, Regional and State levels, primarily through employment, local business opportunities and taxation revenues.

5.2 Alternatives

Alternatives to the Project have been considered and include alternative mining and infrastructure footprints and a no Project option. These are described below.

5.2.1 Project Location

The Project location is defined by the location, nature and scale of the coal deposit. The Project is located in the Bowen Basin, and within EPC 27334 and EPC 1951 which are already held by Whitehaven Daunia. The MLA will also form part of the Project. The geological strata in the vicinity of the DNM is heavily influenced by the series of easterly dipping thrust faults. The major coal measures in the area of the Project are:

- Rangal Coal Measures,
- Fort Cooper Coal Measures, and
- Moranbah Coal Measures.

As discussed in **Section 3.1.3.2**, coal resources at DNM are contained within the 100 m thick Rangal Coal Measures, which is underlain by the Fort Cooper Coal Measures and overlain in places by the Rewan Group. The Late Permian Rangal Coal Measures comprise light grey, cross-bedded, fine to medium grained labile and well cemented sandstones, grey siltstones, mudstones, shale and coal seams. The Fort Cooper Coal Measures underlie the Rangal Coal Measures at DNM, and subcrop along the northwestern boundary of DNM. Regionally, the Fort Cooper Coal Measures have a maximum thickness of approximately 350 m. Drilling logs indicate the Fort Cooper Coal Measures comprise lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff and tuffaceous mudstone. The Moranbah Coal Measures are the lowermost coal-bearing sequence of the Blackwater Group. The Moranbah Coal Measures comprise volcanic lithic sandstones, with lesser siltstone, mudstone, conglomerate and coal.

The coal seams to be mined are within coal tenements held by Whitehaven Daunia, i.e., ML 1781. In addition, the mining of coal from the DNM is dictated by the geological formations that exist within the ML as described above. In addition, the location of the OOPD has been determined to reduce impacts to environmental values and increase efficiencies in waste material haulage distances.

5.2.2 Full Footprint Development

The coal reserves within ML 1781 at DNM extend further east than the Project Area. As described in **Chapter 1.0**, the DNM is currently scheduled to approach the western and eastern boundaries of ML 1781 over the LOM. To facilitate the continuation of mining at DNM it was considered appropriate to seek approval to increase the ROM rate for the DNM along with the OOPD to facilitate and support ongoing mining operations at DNM. Any progression of mining further than that proposed by the Project would be subject to future environmental assessments and applications.

5.2.3 Constrained Project Disturbance

The initial Project Area was designed to maximise resource recovery within ML 1781 and optimise location of the OOPD for operational purposes. The initial footprint extended west into EPC 1951 and south to border the Isaac River, beyond the boundary of EPC 27334. As found in recent terrestrial ecology surveys (discussed further in **Chapter 12.0**) a significant amount of remnant and riparian vegetation is present along the banks of the Isaac River, with numerous Of Concern REs present. These areas were found to contain habitat suitable for fauna including echidnas, koalas and greater gliders.

The Project Area has since been revised to avoid clearing these areas and to minimise disturbance as far as practicable. The Project footprint has been constrained to a smaller area adjacent to the existing DNM operations, and on land subject to prior and existing disturbance. The revised Project Area has been disturbed by prior vegetation clearing and agricultural activities (i.e., grazing) and contains some remnant vegetation, some of which consists of RE 11.3.3. The initial Project Area would have resulted in substantially greater impacts to remnant vegetation and fauna located immediately south of the revised Project Area.

The proposed haul road in the south of the Project Area is located adjacent to a ground-truthed area of RE 11.3.1. The haul road is unable to be located farther from the RE 11.3.1 as the proposed Project Area is limited by the perimeter of the tenure held by Whitehaven, that is, EPC 27334. However, the location of the haul road is sufficiently distanced as to avoid any vegetation clearing within this area of RE 11.3.1.

Figure 5-1 presents the comparison of the currently proposed Project Area and the initial Project Area.

The Project Area has been revised to minimise impacts to threatened species habitats as summarised below:

- Reduced impact to Koala habitat areas,
- No impact to Greater glider habitat areas,
- No impact to Brigalow threatened ecological community (TEC) or Category B environmentally sensitive areas (Endangered REs), and
- Ornamental snake and Squatter pigeon (southern) habitat impacts unavoidable however, mostly on marginal/suitable areas.

This revision has resulted in a balance between operational efficiencies and the protection of environmental values. For example, the final landform (including the OOPD) will result in similar final voids sizes but will significantly improve haulage demand due to the reduced cycle times based on the location of the OOPD.

5.2.4 No Project

The Project is constrained by the characteristics of the coal resource, local geographic features, the environmental setting, existing infrastructure, and economic and technical feasibility considerations. However, another alternative is to not proceed with the Project.

The direct consequences of not proceeding with the Project includes the loss of sustained positive economic opportunities for the locality and the region. The potential positive impact of not proceeding with the Project is avoiding the potential environmental impacts. In this case, potential impacts to land, water, noise and air (including carbon dioxide emissions [CO2-e]) (and associated physical, biological and social impacts) arising from the Project, would not occur.

Should the Project not proceed however, the following high-level impacts are highly likely to be realised:

- A reduction in the overall life of the DNM,
- Curtailment of production and potential for earlier mine closure,
- The full benefits of the State's mineral resources would not be realised,
- A reduction in State and Federal tax revenues from not receiving coal royalties,
- An earlier reduction in the workforce, with the earlier ramping down from the existing ~720 direct jobs provided by DNM, in regional Queensland, and
- Negative economic impacts on local businesses in regional centres such as Moranbah and Mackay.

5.3 Standard Criteria Assessment

The EP Act requires ERAs to be authorised by DETSI. When considering an application to amend an EA or when deciding on the conditions of an EA, DETSI must consider certain matters set out under the EP Act. One of those matters is the 'Standard Criteria'. The purpose of this assessment is to address each of these criteria to demonstrate how they will be met by Whitehaven Daunia for the Project.

Schedule 4 of the EP Act defines the 'Standard Criteria' as:

a. *the following principles of environmental policy as set out in the Intergovernmental Agreement on the Environment—*
   i. *the precautionary principle;*
   ii. *intergenerational equity;*
   iii. *conservation of biological diversity and ecological integrity; and*

b. *any Commonwealth or State government plans, standards, agreements or requirements about environmental protection or ecologically sustainable development; and*

d. *any relevant environmental impact study, assessment or report; and*

e. *the character, resilience and values of the receiving environment; and*

f. *all submissions made by the applicant and submitters; and*

g. *the best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows—*
   i. *an environmental authority;*
   ii. *a transitional environmental program;*
   iii. *an environmental protection order;*
   iv. *a disposal permit;*
   v. *a development approval; and*

h. *the financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument; and*

i. *the public interest; and*

j. *any relevant site management plan; and*

k. *any relevant integrated environmental management system or proposed integrated environmental management system; and*

l. *any other matter prescribed under a regulation.*

Note criterion (c) omitted from the list above, has been repealed.

5.3.1 Criterion (a) – Ecologically Sustainable Development

This section outlines the Project's compatibility with the objectives and principles defined in Australia's National Strategy for Ecologically Sustainable Development (Commonwealth of Australia, 1992). The key Ecologically Sustainable Development (ESD) objectives and principles defined in the National Strategy for ESD are:

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- To provide for equity within and between generations (the Intergenerational Equity Principle).
- To protect biological diversity and maintain essential ecological processes and life-support systems.

The National ESD Strategy also identifies three specific objectives for the mining sector:

- To ensure mine sites are rehabilitated to sound environmental and safety standards, and to a level at least consistent with the condition of surrounding land,
- To provide appropriate community returns for using mineral resources and achieve better environmental protection and management in the mining sector, and
- To improve community consultation and information, improve performance in occupational health and safety and achieve social equity objectives.

5.3.1.1 Individual and Community Well-being and Welfare

The Project will produce significant benefits, particularly to local and regional communities in terms of sustained contributions to household employment and income, training, business opportunities (Local and Regional) and increased government revenues and reinvestment.

WHC, as a company is focused on building local prosperity and community capacity, and helping regional towns thrive, and creating a legacy that will benefit future generations. The Project will continue to build stronger local communities through sustaining jobs, by supporting further employment pathways for locals, partnering with local suppliers, and investing directly in local community organisations.

In FY25, WHC invested more than $2 billion across Central Queensland regional communities and Northwest New South Wales and via procurement, salaries and wages, and community partnerships and donations.

Specifically, WHC is establishing itself as a major contributor within the Moranbah community and takes great pride in the delivery of social value for the community over recent years. Some examples of this include:

- Establishing strong working relationships with Isaac Regional Council and community groups to support regional advocacy on community projects,
- Since April 2025 Whitehaven has provided financial and in-kind support to more than 50 community groups, clubs and organisations, and
- Establishing major social impact partnerships with CQ Rescue, CapRescue, Queensland Minerals & Energy Academy and Mackay Whitsunday Voices Literary Festival.

WHC are equally committed to responsible environmental stewardship, and building strong relationships based on open and meaningful engagement to instil community trust and maintain continued community support for their operations. In FY25, WHC defined an approach to community support and engagement in Central Queensland, with a focus on local investment, procurement and engagement. This work will continue in FY26 to further embed WHC's brand and investment philosophy into the Central Queensland communities in which it operates. WHC also makes significant contributions to a variety of corporate community partnerships and donations. In summary WHC in FY25:

- Spent more than $450,000 in social investment funding to Queensland community organisations, events and projects,
- Spent $1.9 billion with suppliers in regional Queensland and Northwest NSW,
- Spent $365 million on wages and salaries in regional Queensland and Northwest NSW,
- Contributed $2.1 million to corporate community partnerships and donations comprising focus groups such as sporting clubs and associations, education, whole of community benefit schemes and health, and
- Paid $1.4 billion in taxes and royalties.

5.3.1.2 The Intergenerational Equity Principle

The Project addresses the welfare of future generations while realising economic benefits. The welfare of future generations has been considered through mine design and planning. The majority of mine infrastructure will be removed during closure and design of the mine will provide for the appropriate post-mining land use.

The Project has been designed to retain, where practicable, areas of ecological value and to minimise impacts on environmental values. The use of existing DNM infrastructure improves the overall efficiency and resource utilisation and minimises the Project footprint.

Building intergenerational equity requires that WHC consider the long-term use of the land and community impacts. The Project seeks to safeguard the welfare of future generations and achieve intergenerational equity by achieving a post-mining landform consistent with the former landscape, where practical, recognising that mining has been undertaken around DNM since the early 1960's.

This will continue to be achieved through the Project design, operational management, rehabilitation practices and environmental monitoring and reporting. A detailed PRCP will be prepared for the DNM incorporating the Project.

The principles of intergenerational equity have been addressed for the Project through assessment of its contribution to climate change and GHG emissions, assessment of the impacts on climate change to potential Project impacts, consideration of potential short-term, long-term and cumulative impacts on environmental values and the continued use of existing monitoring programs, avoidance actions, mitigation measures and biodiversity offsets to adequately address the potential impacts.

In summary, through the continued use of sound management practices (currently in practice) at DNM and monitoring of the impacts of the Project, the Project will not significantly reduce, or fail to maintain, the health, diversity and productivity of the regional environment or affect future generations.

5.3.1.3 Protection of Biological Diversity and Essential Ecological Processes

While the majority of the Project Area has been disturbed by previous and existing land uses (e.g., agriculture, exploration and mining-related activities), key decisions for the Project support the protection of biological diversity and ecological processes. Specifically, Whitehaven Daunia has limited the overall footprint of the Project (to the extent that is reasonable and practicable) by retaining areas of remnant vegetation and utilising existing

DNM infrastructure to avoid or minimise further vegetation clearing and impacts to sensitive areas. Disturbance areas will be progressively rehabilitated and monitored to measure the success of the rehabilitation in line with the post-mine land use strategy.

The terrestrial and aquatic ecology assessments conducted for the Project have assessed the ecological values of the Project Area. Despite the Project Area being within a highly modified environment with limited support for diverse wildlife species, habitat features, vegetation communities and habitat for threatened species and communities, avoidance, mitigation and management measures will be implemented. These include, but are not limited to:

- Clearing of vegetation to be avoided or minimised where practical,
- The implementation of weed management practices to prevent the introduction and / or spread of weeds, and
- Rehabilitation of mined land to include the use of native endemic species where appropriate to the proposed post-mining land use.

Further information on the assessment and protection of biological diversity is provided in the Terrestrial Ecology Assessment (**Appendix B**)**,** the Aquatic Ecology Assessment (**Appendix A**) and GDE Assessment (**Chapter 14.0**).

5.3.1.4 Mine Site Rehabilitation

WHC aims to maximise the positive outcomes and minimise the adverse impacts of its mining operations, providing lasting benefits for both communities and the environment in which they operate. WHC achieves this by:

- Integrating closure outcomes into all stages of mine planning, design and operation,
- Prioritising progressive rehabilitation as areas become available,
- Working with local, Indigenous and regional stakeholders to enhance closure-related opportunities,
- Transitioning sites to functional post-mining land landscapes that support beneficial re-use, while maintaining social and ecological integrity, and
- Relinquishing sites in a manner that meets regulatory obligations and commitments to stakeholders.

Rehabilitation at DNM is underpinned by industry good practices, aiming to re-establish structurally safe and stable, self-sustaining landforms that will support functional post-mining land uses. Rehabilitation is based on a geomorphic landform design which is visually appealing as it aims to mimic the shape and function of natural landscape features. This approach supports surface water routing and drainage, provides greater long-term erosional stability, improves establishment of self-sustaining ecosystems and requires less long-term care and maintenance. Proposed post-mining land uses at DNM include a mixture of grazing and native vegetation communities including grassy woodland, shrubby woodland, open forest, riparian forest, native forest and woodland habitats where appropriate.

The rehabilitation schedule and milestones for the Project are described in **Chapter 4.0** and will be defined in further detail in the PRCP. Where the rehabilitation milestones are being met or are on-track to being met (as indicated by monitoring results), this will demonstrate that the rehabilitated landscape has reached a stable and sustainable condition and is able to be certified and relinquished.

5.3.1.5 Provide Appropriate Returns for Mineral Resources and Achieve Better Environmental Protection and Management in the Mining Sector

The Project will facilitate the production of a product that is subject to international demand for the foreseeable future and will provide significant revenues to the Local, State and Commonwealth governments. The resource has been subject to detailed investigations to define the feasibility of its extraction and processing as reported in publicly available mineral resource and ore reserve statements, prepared in accordance with the JORC Code 2025.

The Project will not impact upon other resources, such as other mineral deposits and/or gas in the region.

5.3.1.6 ESD Guiding Principles

The guiding ESD principles, defined in the National Strategy for ESD, are:

- Decision-making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations,
- Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the Precautionary Principle),
- The global dimension of environmental impacts of actions and policies should be recognised and considered,
- The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised,
- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised,
- Cost-effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentives mechanisms, and
- Decisions and actions should provide for broad community involvement on issues which affect them.

Each of these ESD guiding principles are addressed below.

Decision-Making Based on Long and Short-Term Considerations

The Project will provide immediate and long-term benefits to the economic and social fabric of Queensland and in particular to the communities located in and around the Isaac Regional Council local government area, such as Moranbah and Mackay.

The Precautionary Principle

The EP Act does not define the ‘precautionary principle’ but rather requires DETSI to consider it in the decision-making process under Schedule 4 of the Standard Criteria definition. Hence, it is considered appropriate to refer to the definition of the ‘precautionary principle’ as stated in Section 391 (2) of the EPBC Act, that being:

> *The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.*

To address this principle, WHC has undertaken an assessment of the risk of unacceptable environmental harm consistent with the precautionary principle. These findings have been incorporated into the development of appropriate environmental control strategies/mitigation strategies as outlined in the Technical Assessments for each relevant environmental discipline. Further, WHC has the technical and financial support and resources to establish and maintain the proposed environmental protection controls/mitigation measures proposed for the Project.

Global Environmental Impact

WHC aims to play a practical and positive role in the shift to a lower-carbon future. WHC will achieve this by producing metallurgical coal, which is a key input to manufacture steel for renewable energy infrastructure; supporting global energy security and its customers' decarbonisation goals through investing in technologies and initiatives that can—or have the potential to—progressively decarbonise its operations. WHC support the aims of the Paris Agreement and recognises the importance of its ambition to hold the increase in the global average temperature to well below 2°C above pre-industrial levels. WHC acknowledge Australia's commitment to net-zero carbon emissions by 2050 and continue to align its decarbonisation ambition and business practices with the emissions reduction obligations set by the Australian Government, which support the national climate targets and align with the goals of the Paris Agreement. WHC's FY30 Scope 1 emissions intensity reduction target aligns with its obligations under the reformed Safeguard Mechanism which commenced on 1 July 2023.

The Paris Agreement requires national plans on climate change to consider the need for a just transition of the workforce and the creation of decent work and quality jobs. WHC's strategy supports global energy security and economic growth during the multi-decade transition to a lower-carbon economy. WHC's FY30 net Scope 1 emissions intensity reduction target is aligned with the emissions intensity reduction obligations set by the Safeguard Mechanism. Four of WHC's mines have obligations under the Safeguard Mechanism:

- Blackwater,
- Daunia,
- Narrabri, and
- Maules Creek.

DNM's Scope 1 emissions remained below its Safeguard site-specific emissions intensity baseline and accordingly generated 3,353 Safeguard Mechanism Credits (SMCs). The SMCs can be used to offset future emissions or traded with other Safeguard-covered sites.

In addition, the identification, evaluation and treatment of sustainability-related risks, including climate change risks, are integrated in WHC's risk management framework. WHC's framework establishes a standardised company-wide approach to risk management. Risks are assessed according to the magnitude of consequence and likelihood of occurrence, which are measured based on quantitative thresholds and qualitative factors. WHC's group risk profile is reviewed at least biannually, while material and emerging risks are proactively identified, monitored and assessed. Climate change is considered a standalone material risk in the framework, with constituent risks relating to operations, policy, reputation and strategy monitored and managed appropriately. WHC conduct regular climate-related scenario analysis on operating assets, as well as part of final investment decisions for new mining projects. This scenario analysis, which includes consideration of a less than 2°C Paris-aligned global warming scenario, supports its risk identification and assessment process.

Development of a Strong, Growing and Diversified Economy which can enhance the Capacity for Environmental Protection

The Project will contribute to life of the DNM (to FY2041) and therefore benefits to Local, Regional and State economies. There will also be flow-on effects to other areas of the Queensland economy because of the Project. WHC will continue to encourage the use of Local and Regional suppliers and contractors.

WHC sustainability reporting focuses on the sustainability topics considered to be most material to its performance, future strategy and potential external impacts.

WHC completed its most recent sustainability materiality assessment in FY24, with the prior formal assessment undertaken in FY21. WHC's materiality process considers its key sustainability impacts and most significant environmental, social and governance risks and opportunities. WHC's assessment process draws on research including peer reviews, sustainability standards, Group risks, community sentiment survey views, and relevant reports and policy perspectives. WHC monitors the external landscape and its internal priorities to inform an understanding of material topics. The 2024 material topics included:

- Health, safety and wellbeing,
- Talent attraction, development, management and retention,
- Tailings storage facilities,
- Environmental stewardship,
- Rehabilitation and closure,
- Climate,
- Communities,
- Indigenous people,
- Business conduct,
- Responsible supply chain, and
- Privacy and cybersecurity.

Enhancing International Competitiveness in an Environmentally Sound Manner

The Project will continue to enhance Australia's international competitiveness by adopting the latest technology in mining and processing, while minimising environmental impacts. The Project will continue to operate under an EA and manage environmental impacts in accordance with regulatory requirements. WHC's high quality metallurgical coal products are expected to remain in demand for longer than other producers with lower quality coal products, particularly as international decarbonisation plans progress.

Cost-Effective and Flexible Policy Instruments

The Project will be managed in accordance with relevant State and Commonwealth Government legislation, policies, and standards.

Community Involvement in Decisions and Actions

WHC will continue to consult with stakeholders including but not limited to the Commonwealth, State and Local government, local community, business associations, surrounding landholders, agistment licence holders and Traditional Owners. The Project will continue to utilise the existing formal complaint procedure in place at DNM.

5.3.2 Criterion (b) – Applicable Commonwealth, State or Local plans, Standards, Agreements or Requirements

Commonwealth, State and Local plans, agreements, standards, and requirements have been considered in the environmental assessments for the Project.

5.3.2.1 Plans/Schemes

It is expected that the operation of the Project will not be inconsistent with the Isaac Regional Council Planning Scheme, February 2021.

5.3.2.2 Agreements

The Commonwealth Government remains as a signatory to agreements on climate change, migratory birds, world heritage and biodiversity. There are four main principles of these conventions:

- The precautionary principle,
- Intergenerational equity,
- Conservation of biological diversity, and
- Improved valuation, pricing and incentive mechanisms.

These principles, in relation to the Project, have been discussed in **Section 5.3.1**.

5.3.2.3 Standards and Requirements

Relevant standards include those set out under the *National Environment Protection Council (Queensland) Act 1994* (NEPC Act). This reflects the Commonwealth legislation, which provides for standards that will have effect nationally. National Environment Protection Measures (NEPMs) outline national objectives for protecting and managing aspects of the environment.

The NEPMs relevant to the Project are:

- Ambient Air Quality,
- Diesel Vehicle Emissions,
- Movement of Controlled Waste, and
- National Pollutant Inventory.

These NEPMs have been considered during the environmental assessment stage for the Project.

5.3.2.4 Environmental Protection Policies

The following EPPs relevant to the Project provide a framework to manage development in an ecologically sustainable manner, in relation to air, acoustic, and water and wetlands environmental values:

- Environmental Protection (Water and Wetland Biodiversity) Policy 2019,
- Environmental Protection (Air) Policy 2019, and
- Environmental Protection (Noise) Policy 2019 (EPP[Noise]).

Environmental Protection (Water and Wetland Biodiversity) Policy 2019

Assessment of potential impacts on the environmental values of water in the Project Area and surrounds has been undertaken for the Project through the Surface Water Resources Assessment (**Appendix C**), Groundwater Resources Assessment (**Appendix D**) and Aquatic Ecology Impact Assessment (**Appendix A**).

WHC will update the existing DNM Water Management Plan, as required, to incorporate relevant aspects of the Project based on the existing practices. Mine affected water will be managed in accordance with the amended EA conditions for DNM. A comprehensive water balance model for the Project has been developed and is presented in **Appendix C**.

Environmental Protection (Air) Policy 2019

The EPP (Air) establishes guidelines for ambient air quality. Schedule 1 of the EPP (Air) provides air quality objectives for a range of airborne contaminants. The Project will generate GHG emissions and other air pollutants which have the potential to impact on the air quality in the vicinity of the Project. An air quality assessment along with GHG Assessment have been undertaken to assess the potential for impacts from the Project emission sources on air quality as informed by DNM's EA conditions. The results of the Air Quality Impact Assessment and GHG Assessment are presented in **Chapter 8.0** and **Appendix F,** and **Chapter 15.0** respectively. Dust management practices and controls will be implemented to mitigate air emissions from the Project.

Environmental Protection (Noise) Policy 2008

The EPP (Noise) covers environmental values and acoustic quality objectives. The Project will generate noise and contribute to the acoustic values in the surrounding area. Potential impacts from the Project and management of those impacts are described in **Chapter 9.0** and **Appendix I**.

5.3.3 Criterion (d) – Environmental Impact Study

WHC has prepared environmental assessments commensurate to a major EA Amendment Application (not requiring an EIS) subject to the provisions of the EP Act. These environmental assessments have focused on the critical matters of air quality, noise and vibration, surface water resources, groundwater resources, terrestrial ecology, aquatic ecology, groundwater dependent ecosystems and waste.

The environmental assessments conducted have considered the existing environmental values, the potential impacts of the Project, and the avoidance, management, mitigation, rehabilitation and offset measures to be implemented.

5.3.4 Criterion (e) – Character, Resilience and Values of Receiving Environment

The DNM is situated amongst a coal mining region in the central Bowen Basin in Queensland where resource extraction, agriculture and livestock grazing are the predominant, co-existent land uses. As a result, the landscape has been highly modified.

WHC recognises the vital role biodiversity plays in supporting healthy ecosystems and to protect them throughout the entire life cycle of its operations. WHC aims to avoid, minimise, offset or rehabilitate negative impacts from mining activities, aiming to achieve no net loss in biodiversity values.

The DNM has a variety of management plans in place, addressing risks to threatened, endangered and/or critically endangered species and ecological communities. These plans outline specific actions to prevent, mitigate or offset adverse biodiversity impacts. Where avoidance or mitigation is not possible, WHC implements biodiversity offsets and conservation agreements, in line with state and federal regulatory requirements. These biodiversity offsets ensure that biodiversity values—equal to or greater than those affected—are maintained and protected, including threatened species and ecological communities. To monitor its progress and maximise survival rates from tree planting activities, WHC regularly assesses flora and fauna survey data from monitoring programs and collects biodiversity management metrics. WHC's biodiversity-managed area totals 484 hectares for the DNM.

Baseline environmental studies have identified the existing environmental values within and around the Project Area, including air quality, acoustic environment, surface water and groundwater resources, terrestrial and aquatic ecology, and groundwater dependent ecosystems.

The resilience of the receiving environment is supported by progressive rehabilitation, water management systems, and established environmental controls currently applied at DNM. These measures will continue to minimise impacts and protect environmental values. The Project design also seeks to minimise disturbance by utilising existing disturbed areas and infrastructure wherever possible.

Chapters 6.0 to **Chapter 16.0** provide a description of the character, resilience and values of the receiving environment.

5.3.5 Criterion (f) – Submissions made by Applicant and Submitters

The EA Amendment and associated environmental studies will constitute WHCs submission in support of the EA Amendment Application. WHC will undertake an appropriate level of formal and non-formal key stakeholder consultation during the EA Amendment process. Further to any formal public notification process, WHC will respond to complaints and concerns from the public during all phases of the Project should they arise.

5.3.6 Criterion (g) – Best Environmental Management

Best practice environmental management is defined in the EP Act, Section 21 as: The management of the activity to achieve an ongoing minimisation of the activity's environmental harm through cost-effective measures assessed against the measures currently used nationally and internationally for the activity.

At every stage in the life cycle of its operated assets, WHC seeks to avoid, minimise, and mitigate adverse environmental impacts, supported by frameworks, policies, and processes to achieve environmental objectives. To support continual improvement in environmental performance, each of WHC's operated assets has an Environmental Management System (EMS) that aligns with ISO14001 standards. DNM's existing management plans will be updated to incorporate the Project.

WHC aim to drive improvement in its approach to environmental management. In FY25, the key environmental focus areas included the following actions:

Integration of environmental systems and processes across Queensland operations.

WHC continued the integration of the EMS, including emissions monitoring and reporting processes, into operational frameworks at DNM. This work provides consistency of environmental practices across all WHC sites and supports a coordinated approach to meeting our compliance objectives.

Embedding compliance requirements into operational processes

The integration of environmental compliance obligations was advanced into day-to-day operational activities at DNM, including the continuation of the program to streamline environmental management plans to provide clearer guidance for site teams and strengthen alignment with regulatory requirements.

Refreshing the environmental standards and assurance program

WHC recently completed a comprehensive review and update of its environmental standards to reflect current legislation and operational learnings. In addition, WHC's assurance programs were also strengthened to provide improved oversight and accountability.

Consolidation of disturbance and rehabilitation reporting

WHC recently aligned disturbance and rehabilitation reporting processes across all sites for consistency and to strengthen its ability to track progress against rehabilitation commitments.

Implementation of a compliance management system in our Queensland operations

A compliance management system was implemented to manage compliance obligations at its Queensland mines (i.e., DNM). The Queensland system is now in line with New South Wales operations, improving oversight, compliance tracking and reporting efficiency.

Compliance

WHC aims to deliver strong performance in complying with environmental legislation and regulations. For the third consecutive year, WHC has had no events across its operations that have led to an environmental enforcement action.

5.3.7 Criterion (h) – Financial Implications

The Project will financially benefit the local and regional communities directly, not only in value adding but also in providing the local community with sustained employment and opportunity. The Project has the technical and financial support from WHC to establish and maintain commitments associated with infrastructure requirements and environmental management controls.

5.3.8 Criterion (i) – Public Interest

The Project will provide sustained employment and wealth for the region. Issues of community interest and concern will be addressed during the EA Amendment process. WHC will continue to engage with the relevant key stakeholders in relation to the Project as an extension of its existing key stakeholder engagement program.

5.3.9 Criterion (j) – Site Management Plan

The existing environmental management plans will be updated accordingly stating the management strategies to prevent or minimise the potential for environmental harm from the Project and will also set out a framework to manage environmental obligations set out in the amended EA.

5.3.10 Criterion (k) – Integrated Environmental Management System

As discussed in **Section 5.3.6**, an Environmental Management Framework exists at DNM. Accordingly, the Project will operate under the EMS for the DNM. The EMS provides an integrated framework for planning, implementing, monitoring, and reviewing environmental management across all site activities. It incorporates the Environmental Management Framework and related management plans, ensuring compliance with the amended EA and supporting continual improvement in environmental performance. The EMS will be updated to include the Project.

5.3.11 Criterion (l) – Other matters

An EA under the EP Act is required for undertaking a resource activity, which includes a mining activity authorised under a ML. A single EA is required for all resource activities that are carried out as a single integrated operation. In this regard, an application to amend the EA has been prepared for the Project along with this Supporting Information Documentation. The amended EA will include authorisations for impacts to environmental values and management measures for these impacts.

6.0 Land Resources

6.1 Introduction

A Land Resources Assessment was conducted for the Project to assess the impacts to the soil and land resources within the Project Area (**Table 6-1**). The soil and land resource assessment was completed in line with the relevant standards and guidelines and the following tasks were completed:

- Identify relevant regulatory matters,
- Summarise the existing environmental values,
- Summarise previous investigations,
- Evaluate soil survey results, soil characteristics/descriptions & classifications and identification of soil map units,
- Description of soil resources, and
- Land resource impact assessment for land suitability, agricultural land classes and grazing suitability.

Table 6-1 Area of Investigation

Area of Investigation	Area (hectare)
Total Project Area (ML Application Area)	**500**
Undisturbed Footprint within Project Area	195
Disturbance Footprint within Project Area	**305**
OOPD within Project Area	282
Mine-Affected Water Dam	14
Sediment Dam	4
Haul Road	4
OOPD within existing ML1781	**39**
OOPD total area	**321**
Total area for rehabilitation	**344**

The following chapter summarises the findings from the assessment, with the full assessment provided in **Appendix G**.

6.2 Existing Environmental Values

6.2.1 Climate

The Bureau of Meteorology (BoM) operates the rainfall for the nearest meteorological station at Iffley Station (BoM Station 034100), located approximately 20 km south-east of the Project. The annual average rainfall (1998 – 2022) is 548.3 millimetres (mm), with most rain occurring between December and February. More recent information has been obtained from Moranbah Airport (BoM Station 034035), located approximately 23 km west of the Project for a period between February 2012 and May 2025, with the annual average rainfall being reported as 559.8 mm. Older information has been obtained from Moranbah Water

Treatment Plant (BoM Station 034038), located approximately 26 km north-west of the Project for a period between April 1972 and March 2012, with an annual average rainfall being reported as 613.0 mm.

The average maximum temperature ranges from 24°C in June/July to 35°C in December/January, whilst the average minimum temperature ranges from 9°C in July to 22°C in January/February.

The evaporation rate is highest in the summer months, with the mean daily rate of 8.5 mm in December and is typically lowest in the cooler months, with the mean daily rate of 3.5 mm in June. The annual average rate of evaporation is approximately 2,300 mm, which significantly exceeds the annual rainfall and is characteristic of semi-arid environments.

6.2.2 Topography

The topographic elevations in and around the Project range from approximately 180 m AHD (southern end of the Project Area) to 205 m AHD (at the northern end of the Project Area. Most of the Project is situated on gently undulating lowlands and plains with slopes of 0% to 6%.

The Project Area lies within the Fitzroy Basin and Issac River sub-basin. Watercourses are ephemeral and include the Isaac River to the south of the Project, with tributaries, and the New Chum Creek to the west of the Project, with tributaries. North Creek is seen further east and downstream of the Issac River.

6.2.3 Vegetation and Land Use

Based on an Isacc-Comet Area map produced originally by Division of Land Research (1967), the vegetation within the Project is predominately underlain by scrub or mixed scrub woodland, and savannah woodland with eastern mid-height grasses is present in the southern portion of Project. Most of the pastureland within the Project is described as Pastureland 10 – Scrub grasses, some eastern mid-height grasses on lowlands. To the south of the Project, the pastureland is described as Pastureland 7 – Eastern mid-height grasses, some downs on lowlands (Division of Land Research,1967).

Based on the ecology report (SLR, 2023), four (4) threatened ecological communities, as defined under the EPBC Act, were identified as potentially occurring within 20 km of the Project. These were:

- Brigalow (Acacia harpophylla dominant and co-dominant) (EPBC endangered),
- Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin (EPBC endangered),
- Poplar Box Grassy Woodland on Alluvial Plains (EPBC endangered), and
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (EPBC endangered).

Prior to mining, DNM had been largely cleared of native vegetation and was being utilised for cattle grazing pastures, resulting in extensive cover of buffel grass. Small areas of remnant vegetation in very poor condition remained as fragmented patches (SKM, 2008).

6.2.4 Land Systems

Three land systems occur within the Project Area; the Humboldt, Connors, and Girrah. The Humboldt land system (which is the majority of the Project Area) is dominated by plains and lowlands on acidic clay, frequently gravelly; texture-contrast soils with brigalow and blackbutt (Story *et. al,* 1967).

6.2.5 Soil Classification and Description

The dominant soil types within the Project Area are an Epipedal Black-Brown Vertosol and a Palic Brown Arenosol. One sub-dominant soil type was found within the Black-Brown Vertosol SMU, being a Sodic Eutrophic Black Chromosol with 24% clay content in the A horizon.

The topsoils range in thickness from 10 to 40 cm, and exhibit a neutral pH. Topsoils are non-sodic and non-saline. Topsoils are characterised by balanced to low calcium levels, with organic matter content generally being moderate and ranging from low to high. The phosphorus and nitrate concentrations are low to moderate.

The subsoils range in thickness from 40 to 100 cm and exhibit a pH range from neutral to mildly alkaline. Sodicity varies from non-sodic to strongly sodic, whilst salinity is generally non-saline in the upper profile, rising to moderate-high in the lower B2 horizons. Subsoils are characterised by low calcium to magnesium ratios, with the organic matter content varying between extremely low to moderate. The phosphorus and nitrate concentrations are low to moderate.

The topsoil are generally suitable for stripping and reuse using standard ESC. The subsoil generally exhibits neutral pH, marginal to high sodicity and moderate salinity. If the subsoil is exposed and not managed, in addition to severe agricultural productivity limitations, impacts may include:

- Erosion hazards including tunnel erosion,
- Impeded soil infiltration and permeability,
- Slumping failure of batters, and
- Soil dispersion leading to soil structure breakdown, increased run-off, and increased turbidity in run-off.

6.3 Potential Impacts to Land Resources

6.3.1 Cropping Land Suitability

The land suitability assessment for the Project was informed by desktop analysis and verified through field surveys and laboratory testing conducted in 2021 and 2023. The classification was applied using the *Regional Land Suitability Frameworks for Queensland* (DSITIA & DNRM, 2013) and the *Guidelines for Agricultural Land Evaluation in Queensland, 2nd Edition* (DSITIA & DNRM, 2015), specifically Section 10 for the Inland Fitzroy and Southern Burdekin Area.

This framework evaluates eight biophysical limitations—water erosion (E), subsoil erodibility (Es), soil water availability (M), narrow moisture range (Pm), surface condition (Ps), rockiness (R), microrelief (Tm), and wetness (W)—ranking each from 1 (most suitable) to 5 (least suitable). The overall land suitability is determined by the most severe limitation, with classifications ranging from Class 1 (highly suitable) to Class 5 (unsuitable). The framework is designed to assess cropping suitability but does not prescribe requirements for grazing or other land uses in the Bowen Basin region.

6.3.1.1 Pre-Mining

Based on the work undertaken by SLR in 2021 and 2023, the land suitability assessment for the proposed Project has rated each of the SMU's within the Project Area (SMU 1) as Class 4 for cropping, with the main limitations being soil water availability (M), soil wetness (W) and surface condition (Ps) and Class 5 (SMU 2), with the main limitations being soil water availability (M). The results for the pre-mining Land Suitability Assessment is summarised in **Table 6-2** and shown in **Figure 6-1** and the detailed land suitability assessment is presented in Appendix G of **Appendix G**.

6.3.1.2 Post-Mining

Land suitability classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. Land suitability classes for areas scheduled for the proposed mining activity disturbances should be managed and rehabilitated appropriately as per the conditions set in the PRCP Schedule. These inputs should result in successful rehabilitation such that these areas return to an appropriate land suitability class.

Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet the Rehabilitation Requirements as per the assigned PMLU. The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining land suitability classes except where rehabilitated slopes exceed 8% resulting in reduction of land suitability class from Class 4 to Class 5. A summary of the pre and post mining land suitability areas are provided in **Table 6-2**.

Table 6-2 Pre and Post Mining Cropping Land Suitability

Project Area	Land Suitability Class	Pre-mining		Post-mining		Difference
		ha	%	ha	%	ha
Project Area	4	413	83	271	54	-142
	5	87	17	229	46	142
Undisturbed and Disturbed Footprint within Project Area						
Undisturbed Footprint	4	112	22	195	39	83
	5	83	17	0	0	-83
Disturbance Footprint*	4	302	60	77	15	-225
	5	3	1	228	46	225
Project Area Total		**500**	**100**	**500**	**100**	

* Includes OOPD within ML1781, haul roads, Mine Affected Water Dam, Sediment Dam

6.3.2 Agricultural Land

The Agricultural Land Class (ALC) system identifies three agricultural land classes (A to C) and one non-agricultural class (D), based on the number of crop types suitable for each land unit using suitability classes 1, 2, or 3. Class A land supports four or more crop types with similar agronomic requirements grouped together; Class B supports three or fewer crops and remains important for agriculture; Class C is suitable only for pasture due to limitations preventing continuous cropping; and Class D includes land permanently alienated from agriculture due to extreme limitations. Complex areas may be classified as combinations (e.g., A/C, B/C), where the dominant class comprises more than 50% but less than 70% of the area.

6.3.2.1 Pre-Mining

The ALC assessment of the soils in the Project Area has identified SMU1 as ALC C1, pastureland suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils. SMU2 has been identified as ALC C2, which is suitable for grazing sown pastures requiring ground disturbance for establishment or native pastures on higher fertility soils. Results for the pre-mining Agricultural Land Assessment are summarised in **Table 6-3** and presented in **Figure 6-2**.

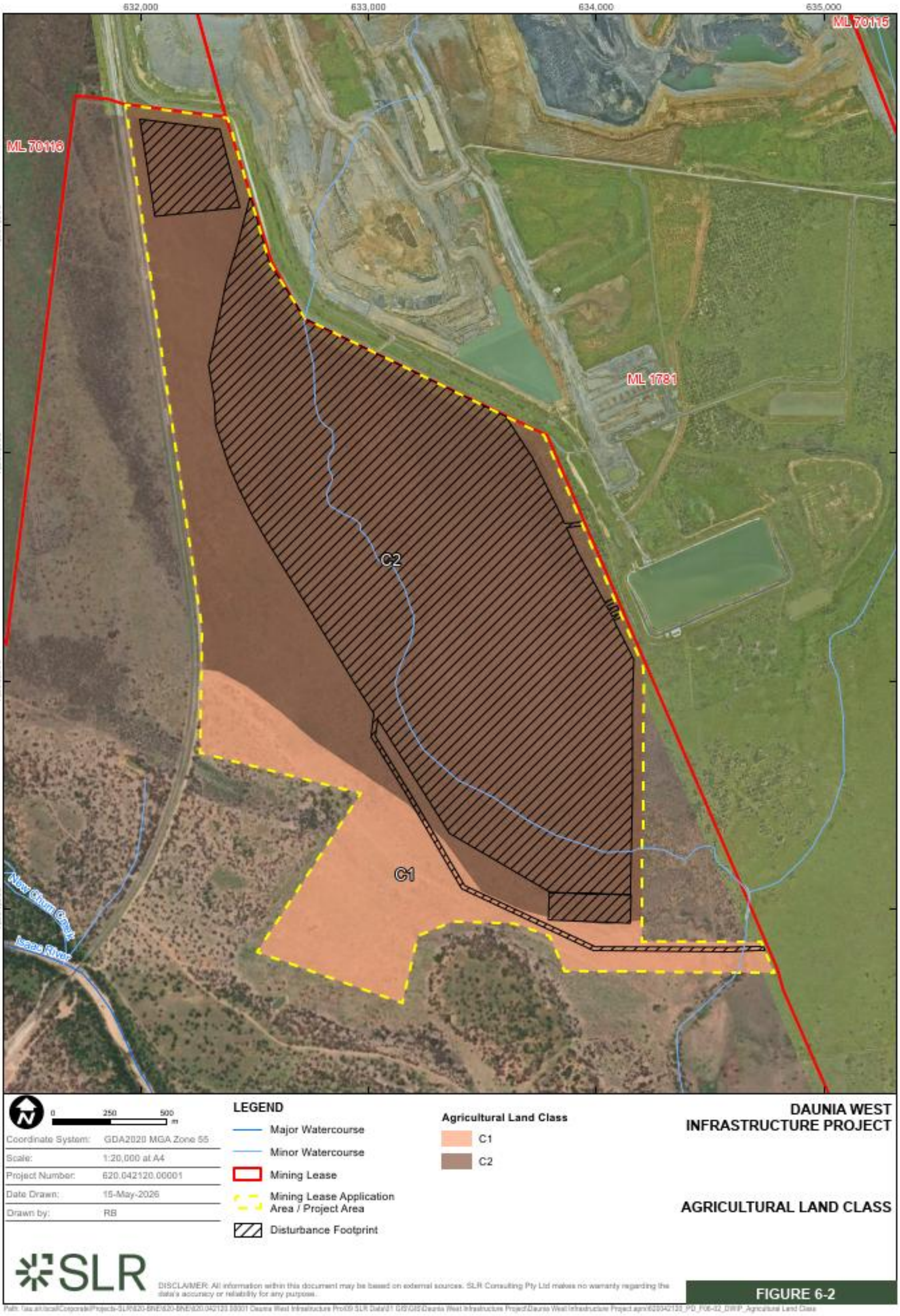


Figure 6-2 Pre- mining agricultural land class

6.3.2.2 Post-Mining

Agricultural land classes for areas not scheduled for the proposed mining activity disturbances should remain the same. Agricultural land classes for areas scheduled for the proposed mining activity disturbances should be managed and rehabilitated appropriately as per the conditions set in the PRCP Schedule, according to the assigned PMLU. These inputs should result in successful rehabilitation such that these areas return to an appropriate agricultural land class. The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining ALC except where rehabilitated slopes exceed 8% resulting in reduction of ALC from C1 to C2 (see **Table 6-3**).

Table 6-3 Pre and Post Mining Agricultural Land Class

Project Area Activity	Land Suitability Class	Pre-mining		Post-mining		Difference
		ha	%	ha	%	ha
Project Area	C1	413	83	271	54	-142
	C2	87	17	229	46	142
Undisturbed and Disturbed Footprint within Project Area						
Undisturbed Footprint	C1	112	22	195	39	83
	C2	83	17	0	0	-83
Disturbance Footprint*	C1	302	60	77	15	-225
	C2	3	1	228	46	225

* Includes OOPD within ML1781, haul roads, Mine Affected Water Dam, Sediment Dam

6.3.3 Grazing Land Suitability

A grazing suitability assessment was conducted using the framework outlined in *Rehabilitated mined land suitability for beef cattle grazing in the Bowen Basin: Technical Paper 1* (Short, 2023), which builds on earlier work by Short (2018) and the *Guidelines for Agricultural Land Evaluation in Queensland, 2nd Edition* (DSITI & DNRM, 2015). This framework identifies eight land use requirements and eleven limitations relevant to beef cattle grazing, including water availability, nutrient supply, soil physical factors, salinity, rockiness, topography, erosion, and acid-forming materials. Each hazard is ranked from 1 (most suitable) to 5 (unsuitable), with the overall land suitability determined by the most significant limitation. Suitability classes range from Class 1 (fattening/finishing) to Class 5 (never suitable), providing guidance on appropriate grazing systems for rehabilitated land in the Bowen Basin.

6.3.3.1 Pre-Mining

Prior to the commencement of mining activities, the Project Area formed part of the extensive grazing lands typical of the Bowen Basin. Historical land use comprised low-input pastoral systems supporting cow–calf operations and seasonal backgrounding, primarily on native pastures dominated by Dichanthium, Bothriochloa, and Astrebla species.

The information required for applying the Queensland land suitability classification for cattle grazing specifically to the assessment of open-cut coal mine rehabilitation in Queensland's Bowen Basin was collected during the desktop assessment and verified on the ground during the field survey and laboratory testing program. Data used to determine the land suitability classification is summarised in **Table 6-4** and presented in **Figure 6-3**. The complete laboratory results and chain of custody are shown in Appendix C of **Appendix G**.

The suitability framework criteria are shown in **Table 6-5** with the resulting class for each laboratory tested site assessed as part of the Project. The dominant limiting criteria in the pre-mining SMU1 and SMU2 was nutrient deficiency and soil water storage, with SMU1 rated as Class 5 and SMU2 as Class 4 based on the soil water storage criterion. All other plant production, land surface and degradation factors had parameters within Class 1 and Class 2. Results for the pre-mining Grazing Land Suitability Assessment are presented in **Figure 6-3**.

Table 6-4 Parameters Used to Determine Pre-mining Grazing Suitability Class

SMU	Observation Site	pH in 0-0.1m	Exchangeable Sodium Percentage in 0-0.1m soil depth	Saturated Electrical Conductivity in the Effective Rooting Depth (ERD)	Exchangeable Sodium Percentage at 0.5m depth	Available Phosphorus (Colwell-P)	Gravel Percentage	Calculated Plant Available Water	Surface Condition	Slope	Microrelief Vertical Interval
			%	dS/m	%	mg/kg	%	mm	-	%	m
1	HA01	6.9	1.9	2.8	10.7	1.5	1.1	120.0	Cracking	4	0
	HA02	7.2	2.0	3.5	11.9	2.6	2.1	120.0	Cracking	4	0
	HA03	6.7	1.4	2.7	9.1	4.7	2.9	116.0	Loose	4	0
2	HA13	6.8	0.2	2.0	1.1	13.3	0.0	36.0	Loose	4	0

Table 6-5 Pre-mining Grazing Suitability Class Based on SMU 1 and SMU 2 Chemical and Physical Properties

Limitation	Indicator	Suitable			Unsuitable		Grazing Suitability Class			
							SMU 1			SMU 2
		Class 1	Class 2	Class 3	Class 4	Class 5	H01	H02	H03	H13
Water availability (M)	Soil water storage (mm)	>75	75-60	<60-40	<40-30	<30	1	1	1	4
Nutrient deficiency (Nd)	Available-P (mg/kg) in 0-0.1 m depth increment	>20	20-14	<14-8	<8-4	<4	5	5	4	3
Nutrient availability and toxicity (Nr)	pH in 0-0.1 m depth increment	7.3-6.6	<6.6-6.0 >7.3-7.9	<6.0-5.6 >7.9-8.4	<5.6-5.0 >8.4-9.0	<5.0 >9.0	1	1	1	1
Surface condition (P)	Surface condition	Fine (peds <10mm)	Coarse (peds <10mm)	Surface crust	Very hard setting	Massive	1	1	1	1
Salinity (S)	ECe (dS/m) in ERD (0-0.6 m depth increment)	<2	2-4	>4-10	>10-16	>16	2	2	2	2
Rockiness (R)	Gravel, 20 – 60 mm (%) Cobble, 60 – 200 mm (%) Stone, 200 – 600 mm (%) Boulders, >600 mm (%)	<20 <10 <2 0	20-50 10-20 2-10 <2	>50-70 >20-50 >10-20 2-10	>70-85 >50-75 >20-50 >10-20	>85 >75 >50 >20	1	1	1	1
Slope (Ts)	Slope grade (%)	<5	5-10	>10-15	>15-20	>20	1	1	1	1
Microrelief (Tm)	Vertical interval (m)	0	<0.2	0.2-0.4	>0.4-0.6	>0.6	1	1	1	1
Water erosion (Ea)	Slope (%), ESP <6 (%) in 0-0.1 m soil depth Slope (%), ESP >6-14 (%) in 0-0.1 m soil depth Slope (%), ESP >14 (%) in 0-0.1 m soil depth	<5 <3 <1	5-10 3-6 1-2	>8-12 >6-10 >2-4	>12-18 >10-12 >4-6	>18 >12 >6	1	1	1	1
Subsoil erosion (Eb)	ESP (%) at 0.5 m depth	<6	6-14	>14-23	>23-34	>34	2	2	2	1
PAF materials (D)	Strongly acid conditions (pH <4.5) within (x) m depth	>3	3-2	<2-0.9	<0.9-0.6	<0.6	1	1	1	1
Grazing Suitability Class							**5**	**5**	**4**	**4**

6.3.3.2 Post-Mining

Grazing suitability for areas not scheduled for the proposed mining activity disturbances should remain the same. Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet the cattle grazing Rehabilitation Requirements. Increased slopes in the final landform will reduce the grazing suitability as it results in an increase in the water erosion limitation (Ea). The OOPD will be designed to a maximum final slope angle of around 10% (≈6°) or flatter to ensure long-term erosion control which would not decrease the land suitability based on the criteria presented in **Table 6-5**. Based on a slope assessment undertaken for the Project Area post mining landform, slopes associated with the proposed Disturbance Footprint will not exceed 10%. Therefore, water erosion which is dependent on the soil sodicity and slope is not the main limitation for post mining grazing suitability (see **Table 6-6**).

The predominant limitation to grazing suitability that will remain post mining is nutrient deficiency. Approximately 98% (**Table 6-6**) of the topsoil available to stockpile and reuse as growth medium have available-P concentrations associated with grazing suitability Class 5 (<4 mg/kg available-P). Based on the available information the post mining grazing land suitability has been assessed as Class 4 and Class 5 (**Figure 6-4**).

Soil nutrient deficiency is already recognised as a major constraint to pasture and cattle production in central Queensland (Shields and Williams 1991) and across northern Australia more broadly (Dixon, et al. 2020). Short (2025) indicates that nutrient deficiency does not preclude land to be rehabilitated to a suitable grazing land suitability (Class 3 or better). Where an evaluation decides an area of rehabilitation is Class 4 (Available-P <8-4mg/kg) or Class 5 (available-P <4 mg/kg) this could be adjusted by fertiliser application to make the rehabilitation suitable (i.e. Class 3 (available-P >14-8 mg/kg) or better) providing no other severe or extreme limitations are present which is the case for the soils evaluated in the Project Area.

Post mining Grazing Land Suitability values (**Table 6-6** and **Figure 6-4**) are based on the inherent soil properties without the application of ameliorants to enhance soil productivity. The application of ameliorants is further described in the PRCP.

Table 6-6 Pre and Post Mining Grazing Land Suitability

Project Area Activity	Land Suitability Class	Pre-mining		Post-mining		Difference
		ha	%	ha	%	ha
Project Area	4	413	83	413	83	0
	5	87	17	87	17	0
Undisturbed and Disturbed Footprint within Project Area						
Undisturbed Footprint	4	84	17	84	17	0
	5	112	22	112	22	0
Disturbance Footprint*	4	3	1	0	0	-3
	5	302	60	305	61	3

* Includes OOPD within ML1781, haul roads, Mine Affected Water Dam, Sediment Dam

6.4 Mitigation and Management Measures

6.4.1 Rehabilitation

The DNM PRCP (EPML00561913) was first submitted in July 2023 under the previous owners mine plan, and established the baseline domains, proposed PMLUs, and Non-Use Management Areas (NUMAs) for the DNM. Whitehaven Daunia has submitted an updated transitional PRCP to align with the updated LOM Plan. A subsequent PRCP amendment application for the Project has been submitted following the approval of the PRCP Schedule by DETSI, which will specifically incorporate the OOPD, into the rehabilitation domains.

Given this timing, the existing EA Amendment demonstrates that the OOPD can be returned to a safe, stable, non-polluting final landform and rehabilitated to a suitable PMLU. The detailed landform design criteria, milestones and completion requirements for the OOPD will be confirmed through the future PRCP amendment application.

6.4.2 Land Resources Mitigation Measures

Potential impacts to land resources and rehabilitation have been considered, and include the following:

- Impacts to land due to disturbance from mining activities (and changes to land use),
- Soil loss due to wind or water erosion,
- Reduction in soil quality and fertility including nutrient loss,
- Inability to achieve post-mine land uses, and
- Contamination of land due to leaks or spills from plant, storage facilities or infrastructure and/or transport of contaminated soil or water and introduction into previously uncontaminated areas.

The following general mitigation strategies are to be implemented by the Project to minimise the extent and severity of land disturbance and constraints on rehabilitation, thus mitigating risks that could result in environmental impacts:

- Clearing will occur within the area approved via the Permit to Disturb process,
- Appropriate storage and management of hydrocarbons and hazardous materials within the Project Area to prevent contamination of land e.g., bunding,
- Disturbance to be undertaken in consideration of water flows that could affect land resources during early mining activities,
- Amelioration to be applied as per PRCP to improve phosphorus availability and support long-term soil fertility.
- Topsoil will be stripped prior to mining and direct re-spread is the preferred method to minimise topsoil handling and reduce damage to soil structure and propagules (as per WHC Topsoil Management Plan as per DNM EA),
- Topsoil that is not directly re-spread will be stockpiled for re-use in rehabilitation.
- Appropriate surface water management measures are to be implemented including clean water diversions, and use of in-pit sumps and sediment dams to capture mine affected runoff and stormwater as outlined in an approved Water Management Plan,

- Establishment of engineered waste dumps, levees, and other landforms with appropriate non-dispersive materials design and features for erosion protection and location for optimal effectiveness, land suitability and efficiency, and
- Monitoring and maintenance of rehabilitation until post-mining land use criteria and relinquishment have been achieved.

7.0 Geochemistry

7.1 Introduction

The geochemical assessment for the Project was undertaken by Terrenus Pty Ltd (2025). It evaluates the geochemical nature of mineral waste expected to be disposed into the proposed OOPD and identifies relevant environmental issues and opportunities that may be associated with the OOPD to inform appropriate rehabilitation and management strategies. The complete *Geochemical Assessment of Potential Mineral Waste Report* (Terrenus Pty Ltd, 2025) is provided in **Appendix H**.

7.2 Material Types

The DNM has two main types of mineral waste:

- Spoil (overburden and interburden) comprises approximately 98.5% of all mineral waste at the DNM (BHP, 2023) and includes Tertiary- and Permian-age weathered waste and Permian-age fresh (unweathered) waste. About 91% of spoil from Pandora Pit is expected to be non-carbonaceous material. Carbonaceous spoil, of which almost all is fresh/unweathered, is expected to comprise up to nine per cent of the spoil reporting to the OOPD.
- Rejects (fine and coarse) are generated at the CHPP from processing ROM coal, and currently comprise less than 1.5 % of all mineral waste at the DNM. No rejects will be disposed into the new OOPD. The Project will not contain any rejects as all mineral waste from the CHPP will remain within the current approved ML at the DNM.

Coal is also included in the geochemical assessment; however, coal is generally not considered mineral waste, with the exception of small quantities of sub-economic seams that may report to the spoil dumps – including the proposed OOPD.

Based on the above, the OOPD is expected to be comprised almost entirely of spoil (overburden and interburden) – of which most will be non-carbonaceous; and with a conservative assumption that a minor proportion of waste coal may also be disposed into the OOPD. As such, the assessment has focused on the geochemical characteristics of spoil and waste coal likely to report to the OOPD.

7.3 Sample Collection (data sources)

Sampling and laboratory test-work has been undertaken by BMA (the previous owners of DNM) throughout the development and operation of the DNM. WHC acquired DNM from BMA in 2024. The DNM geochemical database contains all available geochemical data for mineral waste samples at DNM, and was provided to Terrenus Pty Ltd for this assessment.

Drillhole sampling was used to collect spoil and coal samples for geochemical assessment. Geochemical data of relevance to the Project is available for 633 spoil samples and 78 coal samples collected from 31 drill-holes located throughout the DNM – dating from 2008 to 2022.

7.4 AMD Potential of Spoil and Coal

Mineral waste samples have undergone environmental geochemical characterisation and assessment with regard to their potential to generate acid and metalliferous drainage (AMD), which comprises acid drainage (AD), neutral and metalliferous drainage (NMD) and/or saline drainage (SD) [salinity due to sulfate derived from sulfide oxidation]. Additionally, samples have been assessed with regard to their potential to generate salinity (non-oxidative) and, for spoil materials, their sodicity and dispersion potential.

7.4.1 AMD Potential of Spoil

Spoil, which is expected to comprise about 99% of the mineral waste within the proposed OOPD, is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage), which is typical for mine spoil in the Bowen Basin.

Based on the results of 633 samples, spoil has a very low potential to generate AMD as either AD and/or NMD and/or SD.

The total sulfur (S) concentration of spoil is very low, with a 95th percentile total S concentration of 0.19 %. As such, and combined with generally moderate to high acid neutralising capacity (ANC) values [median = 24 kilograms of sulfuric acid per tonne of rock (kg H_2SO_4/t)], which is significantly higher than the maximum potential acidity (MPA) [median 0.6 kg H_2SO_4/t], approximately 98 % of spoil samples tested were classified as non-acid forming (NAF) or UC(NAF) [uncertain, but expected to be NAF]. Less than two per cent of spoil samples were classified as potentially acid forming (PAF), PAF-LC [PAF, low capacity] or UC(PAF) [uncertain, but expected to be PAF or PAF-LC]. No spoil samples were classified as NAF-S [NAF, but with total S greater than one per cent]. Almost all of the 10 spoil samples classified as 'PAF' (of any type) were closely associated with coal seams and could potentially end up as coal reject if mined with ROM coal.

The test-work undertaken has demonstrated that the ANC for the non-carbonaceous spoil is generally expected to be about 35-95% available under field conditions (median 67 per cent), with iron-dolomite and dolomite being the main carbonate mineral contributing to the acid buffering potential of the spoil. Overall, spoil has excess acid neutralising capacity and is expected to be bulk acid consuming.

Total metal and metalloid concentrations from 107 spoil samples tested are very low compared to average element abundance in unmineralised soil/rock in the earth's crust, with only one sample being significantly enriched with regard to arsenic (As). About seven per cent of spoil samples showed minor enrichment with regard to one or more of As, barium (Ba), S and/or molybdenum (Mo).

Soluble multi-element results from 107 spoil samples indicate that leachate from spoil is expected to contain low concentrations of soluble metals and metalloids. Five samples produced leachate with low-moderate soluble metal concentrations, primarily due to low-moderate concentrations of aluminium (Al) and/or As. One extremely weathered spoil sample was weakly acidic (pH 5.8) with low soluble metals concentrations.

The assessment has demonstrated that spoil from Pandora Pit (based on 198 samples) has AMD characteristics that are comparable to spoil from outside Pandora Pit (based on 435 samples). For the key geochemical parameters assessed, the Pandora Pit spoil samples had concentrations/values within the same range as spoil samples from outside Pandora Pit. As such, the low AMD hazard posed by DNM spoil, generally, can be equally applied to spoil from Pandora Pit to be disposed with the OOPD at the Project.

7.4.2 AMD Potential of Coal

Coal is not regarded as waste and ROM coal remains on-site for a relatively short period of time. It is reasonably assumed that almost all coal mined from Pandora Pit will report as ROM coal. However, the assessment has conservatively assumed that some minor coal ply's from Pandora Pit may be mined with spoil (as waste coal) and will therefore be broadly disposed within the OOPD at the Project. The amount of waste coal that may be disposed into the OOPD is unknown, however we have conservatively assumed that waste coal will represent up to one percent of mineral waste in the OOPD.

Based on the results, and as a bulk material, coal is assessed as having a low-moderate potential to generate AMD as either AD, NMD and/or SD. Coal, as a bulk material, is expected to generate pH-neutral to alkaline contact water (run-off and seepage).

The total S concentration of coal is generally low with samples from Pandora Pit having generally similar total S concentration compared to coal samples from outside Pandora Pit. Approximately 29 % (median value) of the total S is present as sulfide (Scr), with the bulk of the total S likely present as organic S, which does not contribute to AMD. Coal samples have a wide range of ANC values; however, the median ANC, overall, is low. The Pandora coal samples have generally lower ANC values compared to other coal samples. As such, approximately 55 per cent of coal samples were classified as NAF or UC(NAF), with a much lower proportion of Pandora coal samples being classified as NAF or UC(NAF) (27 %) compared to other coal samples (73 %). The remaining samples were classified as PAF, PAF-LC or UC(PAF) – noting that the AMD classification is based on total S, which for coal samples likely leads to a highly conservative classification.

These results suggest that potentially un-economic coal seam material reporting to the OOPD as spoil (mixed with non-coal spoil) would conservatively pose a low-moderate AMD source hazard.

Assay data for 17 coal samples show that the total metal and metalloid concentrations are very low compared to average element abundance in soil in the earth’s crust. One Pandora coal sample was significantly enriched with regard to S and an additional Pandora coal sample was moderately enriched with regard to Mo.

Soluble multi-element results from 18 coal samples tested (with a range of NAF to PAF classifications) indicate that contact water (run-off and seepage) from coal is generally expected to contain low concentrations of soluble metals and metalloids. Two PAF Pandora coal samples have moderate metals concentrations associated with weakly acidic conditions; and one PAF Other coal sample had low soluble metals concentrations associated with weakly acidic conditions.

7.5 Salinity, Sodicity and Dispersion Potential of Spoil and Coal

7.5.1 Salinity, Sodicity and Dispersion Potential of Spoil

Spoil has low median and low 95th percentile electrical conductivity (EC)$_{1:5}$ values of 284 and 612 microSiemens per centimetre (µS/cm), respectively, and has very low total S concentrations. Similarly, saturated extract (ECse) data for 196 samples resulted in a 95th percentile ECse value of 1660 µS/cm. On this basis, contact water (run-off and seepage) from spoil is expected to be generally non-saline to slightly saline, as a result of dissolution of geogenic salts more so than from sulfide oxidation (sulfate salinity). Weathered spoil generally has higher $EC_{1:5}$ and ECse values compared to fresh spoil. The Pandora samples (n=219) had $EC_{1:5}$ and ECse values within the same range as the other spoil samples (n=600) – i.e. generally non-saline to slightly saline.

Spoil has moderate cation exchange capacity (CEC) values and generally high exchangeable sodium percentage (ESP) values, resulting about 90 % of samples being classified as ‘sodic’ to ‘strongly sodic’ and, therefore, with potential for dispersion. Based on Emerson aggregate class testing to directly measure dispersion, about 84 per cent of spoil samples displayed some degree of dispersion – consistent with the dispersion predictions from the ESP results. The Pandora spoil samples had a similar range and distribution of CEC and ESP values (results from 83 samples) compared to other spoil samples (results from 287 samples).

7.5.2 Salinity Potential of Coal

Coal has low median and 95th percentile $EC_{1:5}$ values of 119 and 378 µS/cm, respectively; and has generally low total S concentrations. On this basis, contact water (run-off and seepage) from coal, as a bulk material, is expected to be non-saline to slightly saline, either as a result of dissolution of geogenic salts and/or from sulfide oxidation (sulfate salinity).

7.6 Geochemical Source Hazard Assessment

A geochemical source hazard assessment was applied to the source material types within the proposed OOPD, which are expected to comprise: non-carbonaceous spoil, carbonaceous spoil, and coal. The AMD source hazard score takes into account the propensity to generate AMD, the AMD capacity (severity) and the quantity (volume/tonnage) of material that could produce AMD, as presented in **Table 7-1**. To support the assessment of the AMD closure risks, the landform AMD hazard score is assigned a likelihood score (**Table 7-2**), which is broadly aligned with ISO 31000.

The source hazard assessment used data from Pandora samples only (i.e. excluded data from outside Pandora Pit area). The AMD source hazard assessment has found that non-carbonaceous spoil poses a Low AMD source hazard, carbonaceous spoil poses a Low-Moderate AMD source hazard and coal also poses a Low-Moderate AMD source hazard.

When combined, and taking into account the proportion of each material that could generate AMD relative to the total proportion of all materials in the OOPD final landform, the proposed OOPD landform is expected to pose a Low AMD hazard, with AMD generation rated as Highly Unlikely.

The 'Low' AMD hazard for the OOPD is largely a result of the OOPD being comprised of 90 % non-carbonaceous spoil, of which approximately 1.2% (based on sample numbers) has been conservatively classified as PAF of some type. Although a significant proportion of coal samples were conservatively classified as PAF, coal will comprise a very minor proportion of the landform, with spoil comprising essentially all of the mineral waste within the landform.

Although the source hazard assessment used data from Pandora Pit, the assessment found no significant difference between the geochemical characteristics of spoil from Pandora Pit compared to the spoil from outside of Pandora Pit at DNM.

Table 7-1 AMD hazard scoring matrix for landforms

Component	Rating		Definition
Propensity for AMD generation Per material type: • non-carb. • carb. • rejects • tailings • coal	1	Implausible	Geochemical properties suggest that the vast majority of the source material has a negligible potential for AMD generation (less than 5% of the samples classified as 'PAF' or NAF-S)
	5	Plausible	Geochemical properties suggest that a significant proportion of the source material may have potential for AMD generation (5-40% of the samples classified as 'PAF' or NAF-S)
	7	Expected	Geochemical properties suggest that the source material has a high potential for AMD generation, but AMD has not yet been observed in the field (due to lag time) - (greater than 40% of the samples classified as 'PAF' or NAF-S)
	15	Certain	Evidence of AMD processes have been observed in the field from the source material
AMD Capacity Per material type: • non-carb. • carb • rejects • tailings • coal	1	Low	Source material has a negligible potential for AMD generation. 'PAF' and NAF-S samples have 75th percentile total S less than 0.1%
	3	Low-Moderate	Assumed to be bulk NAF but sulfide bearing, with NAF samples having 75th percentile total S greater than 1% (i.e. the material is predominantly NAF-S but has high readily available neutralising capacity). AMD generated will be NMD and/or SD (related to sulfide oxidation), not AD.
	5	Moderate	'PAF' and NAF-S samples have 75th percentile total S ranging from 0.1% to 1.0% and with potential to generate AD.

Component	Rating		Definition
	7	Moderate-High	'PAF' and NAF-S samples have 75th percentile total S ranging from 1.0% to 1.5% and with potential to generate AD.
	10	High	'PAF' and NAF-S samples have 75th percentile total S greater than 1.5% and with potential to generate AD.
AMD Quantity Per material type: • non-carb. • carb • rejects • tailings • coal	1	Low	Source material rated Low for AMD capacity; or less than 5% of source material reporting to a landform is rated Low-Moderate for AMD Capacity.
	3	Low-Moderate	Less than 5% of source material (in the landform) rated as Moderate for AMD capacity
	5	Moderate	Greater than 5% of source material (in the landform) rated as Low-Moderate or Moderate for AMD capacity
	7	Moderate-High	Less than 5% of source material (in the landform) rated as Moderate-High or High for AMD capacity
	10	High	Greater than 5% of source material (in the landform) rated as Moderate-High or High for AMD capacity

Table 7-2 AMD hazard ranking and landform AMD likelihood ranking

Landform AMD hazard scores	Landform AMD likelihood
0 - 5	Highly Unlikely: Highly unusual; may occur in extreme circumstances
>5 - 10	Unlikely: Known to occur, but only rarely
>10 - 15	Probable: May reasonably occur
>15 - 20	Likely: Could easily occur
>20	Highly Likely: Expected to occur

7.7 Management and Rehabilitation Measures

The OOPD is proposed to be constructed from spoil (overburden and interburden) mined from Pandora Pit. About 90% of the spoil is expected to be non-carbonaceous and the remainder carbonaceous. The Project conservatively assumes that a very small proportion (up to one %) of waste coal may also report to the OOPD, which is consistent with open-cut coal mining methods where minor waste coal reports as 'spoil', including current mining undertaken at the DNM. The assessment has found that there is no significant difference between the geochemical characteristics of spoil from Pandora Pit compared to the spoil from outside of Pandora Pit at DNM.

Spoil is overwhelmingly NAF with excess ANC and has a negligible risk of developing AMD, including AD, NMD and/or SD. Furthermore, surface water run-off and seepage from bulk spoil is expected to be non-saline to slightly saline with low soluble metal/metalloid concentrations. Taking into account material quantities (proportions) and the geochemical characteristics of the mineral wastes reporting to the proposed OOPD landform, the OOPD landform is expected to pose a Low AMD hazard, with AMD generation rated as Highly Unlikely. However, spoil is expected to be sodic to strongly sodic with potential for dispersion and erosion.

It is unlikely that sodic and potentially dispersive spoil will be able to be selectively handled and emplaced during operation of the OOPD, as is the case at the DNM. Therefore, in the absence of such selective handling, the OOPD will be designed to a maximum final slope angle of around 3H:1V (≈18°) or flatter to ensure long-term erosion control. Benches will be constructed at 10 - 20 m lifts to break slope length and manage run-off. Drainage and runoff will be managed through appropriately designed contour drains and drop structures. The final landform will be shaped to ensure long-term stability and compatibility with surrounding land uses.

Surface water run-off and seepage from the OOPD, including any rehabilitated areas, should be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, major anions, major cations and a broad suite of soluble metals/metalloids at high resolution analysis.

With the implementation of the proposed management and mitigation measures, the proposed OOPD is regarded as posing a low risk of environmental harm.

7.7.1 Validation of Spoil Characteristics

The AMD hazard posed by existing spoil at DNM is understood, and the geochemical characteristics (AMD hazard) of future spoil generated from Pandora Pit are expected to be very similar to the current spoil being produced at DNM. Nevertheless, Whitehaven Daunia will continue to undertake geochemical test-work of overburden and interburden throughout development of the Project. Test-work would likely focus on long-term (kinetic) processes associated with spoil seepage to validate the static geochemical data.

7.7.2 Coal Rejects Management Strategy

No coal rejects will be disposed into the proposed OOPD nor anywhere within the Project Area. Coal rejects generated at the DNM CHPP from processing ROM coal from DNM will continue to be disposed within spoil at DNM under the current approved disposal and management arrangements.

8.0 Air Quality

8.1 Introduction

An Air Quality Assessment was undertaken to assess the potential impacts of the Project on environmental values relating to air. The assessment focuses on the quantification of changes in operational risk due to the release of dust associated with the Project and its impacts on environmental values. The methodology and results of the air quality assessment are summarised in this Chapter. A comprehensive air quality assessment is presented in **Appendix F**.

8.2 Existing Environmental Values

8.2.1 Existing Receptors

The quantification of air quality throughout the local airshed depends on the assessment of a combination of natural and anthropogenic dust emission sources, the impacts on environmental values from which, are both temporally and spatially varying across the region. The DNM EA provides definitions for 'sensitive place' and 'commercial place' which define the predominate air quality environmental value for the Project.

Based on the EA definitions (and in consideration of other neighboring mining operations), the existing receptor locations for which the detailed Air Quality Assessment include are provided in **Table 8-1** and **Figure 8-1**.

It is important to note that whilst the Olive Downs Homestead (R1) is currently a sensitive receptor under the DNM EA, WHC are currently negotiating with the landowner to establish a non-residency agreement, which is anticipated to remove R1 as a 'sensitive place'.

Table 8-1 Receptor locations

ID	Easting (m) (1)	Northing (m) (1)	Description
R1	633,911	7,553,020	Olive Downs Homestead(2)
R2	639,658	7,558,572	Daunia Homestead
R3	639,052	7,563,796	Mavis Downs Homestead

Note:

(1) Based on GDA 2020 MGA Zone 55 coordinate reference.

(2) Impacts to the Olive Downs Homestead are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.

8.2.2 Existing Air Quality Environment

8.2.2.1 Meteorological Environment

The climate data from the Bureau of Meteorology's Moranbah Water Treatment Plant (1972 – 2012) suggest an average rainfall of c. 600 mm of which c. 50% is received between the months of November through March.

Numerically simulated wind speed and direction data for 2019 suggested that the winds were predominantly northeasterly through southeasterly in the vicinity of the Project, dependent on the time of year. Winds were predicted to be more easterly during the summer months, north easterly during the spring and southeasterly during the summer and fall quarters. Light winds occur more frequently overnight, particularly during the winter months of June, July and August.

8.2.2.2 Background Air Quality

The Air Quality Assessment estimated background air quality levels through the analysis of dust deposition data from R1 (**Figure 8-1**).

For the purposes of estimating background levels of PM_{10}, hourly averaged data from the DETSI Moranbah (Utah Drive) monitoring station has been used to generate a daily varying timeseries for the 24 hour average concentration of PM_{10} for 2019 (**Figure 8-2**) at which time the region was under significant drought conditions The hourly average data set was also used to generate an estimate for the annual average concentration of PM_{10}.

An estimate for the annual average concentration of total suspended particulates (TSP) has been developed based on an assumption that 50% of TSP is in the form of PM_{10}.

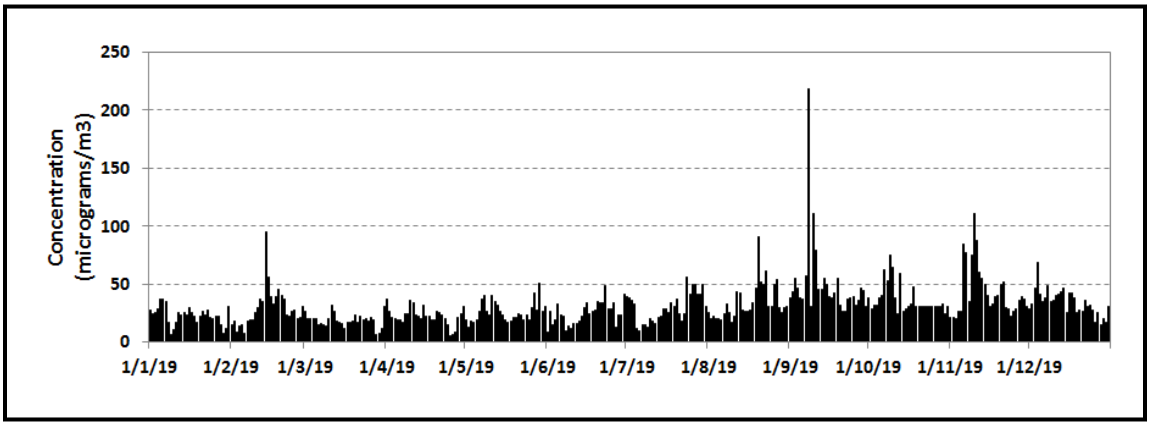


Figure 8-2 Daily varying 24 Hour Average Concentration of PM_{10} (DETSI Moranbah (Utah Drive), 2019)

Whilst $PM_{2.5}$ is not typically generated in significant amounts by open cut mining but rather instead associated with combustion processes, an assessment of $PM_{2.5}$ has been undertaken for completeness. Estimates of background levels of $PM_{2.5}$ were based on data from the DETSI Moranbah (Utah Drive) monitoring station. In the absence of a complete data set for 2019, the estimates of background levels of $PM_{2.5}$ are based on data from the period October 2019 through to September 2020. An estimate for the 24 hour average concentration of $PM_{2.5}$ is based on the 70th percentile of the data set. The average of the data set has been used as the estimate for the annual average concentration of $PM_{2.5}$.

The estimate developed for the background level of dust deposition is based on an average of data from the DNM dust deposition monitoring location situated in the vicinity of R1 (Figure 8-1) for the period march 2015 through February 2024.

Estimates of background levels are summarised in **Table 8-2**.

Table 8-2 Estimate of background levels

Pollutant	Averaging Period	Estimated Background Level	Percentage of Assessment Objectives	Source
Dust deposition	Monthly	38 mg/m2/day	c. 32%	DNM DDG Data(1)
TSP	annual	62.2 µg/m3	c. 69%	Inferred from DETSI Moranbah (Utah Drive)(3)
PM10	24 hour	Daily varying	n/a	DETSI Moranbah (Utah Drive)(2)
	annual	31.1 µg/m3	c. 125%(5)	DETSI Moranbah (Utah Drive)(2)
PM2.5	24 hour	7.2 µg/m3	c. 29%	DETSI Moranbah (Utah Drive)(4)
	annual	7.4 µg/m3	c. 106%	DETSI Moranbah (Utah Drive)(4)

Note: (1) Data collected over the period 03/2015 through 02/2024 has been used.
(2) Data collected over the period 01/2019 to 12/2019 has been used.
(3) Based on an assumption that 50% of TSP is in the form of PM_{10}.
(4) Data collected over the period 10/10/2019 to 30/09/2020 has been used.
(5) Values in bold font exceed the relevant Project assessment objective.

8.2.3 Assessment Criteria

Schedule B of the EA stipulates the conditions relating to air quality monitoring and management at the DNM. Specifically, Schedule B includes ambient air quality objectives for the monthly average of dust deposition (Condition B4(a)) and the 24 hour average concentration of PM_{10} (Condition B4(b)).

Additional pollutants and/or averaging periods of interest to DETSI that have been considered in this assessment include: the annual average of TSP, the annual average of PM_{10} as well as the 24 hour and annual average concentration of $PM_{2.5}$.

The requirement to demonstrate compliance with the air quality objectives specified in Schedule B is triggered by a request from DETSI (Condition A11). To date, it is understood that Condition A11 has not been triggered. A summary of the air quality assessment objectives is presented in **Table 8-3**.

Table 8-3 Air quality assessment objectives

Pollutant	Averaging Period	Assessment Objectives	Source
Dust deposition	Monthly	120 mg/m2/day	EA condition B4(a) (1)
TSP	Annual	90 µg/m3	QLD Environmental Protection (Air) Policy
PM10	24 hour	50 µg/m3	EA condition B4(b) (1)
	Annual	25 µg/m3	QLD EPP (Air)
PM2.5	24 hour	20 µg/m3	QLD EPP (Air)
	Annual	7 µg/m3	QLD EPP (Air)

Note: (1): *Monitoring required when triggered by EA Condition A11.*

8.3 Air Quality Assessment Methodology

8.3.1 Dust Emission Sources

To assess potential impacts to receptor locations from the emission of dust associated with the Project, a series of dust emissions sources were modelled. Dust emission sources that have been explicitly used in the dust dispersion modelling process include (and are limited to):

- Coal mining, hauling and dumping,
- Waste removal by Truck and Shovel fleets including the loading of trucks, hauling and truck dumping,
- Dozer operations in support of in-pit coal operations,
- Dozer operations in support of waste handling,
- CHPP activities (crushing, stacking, reclaiming),
- Wind erosion of exposed areas, and
- These modelled dust emission sources were considered to represent the majority of significant site-based dust generating emissions sources.

8.3.2 Dust Controls

Management measures to control dust are an important input into the dust dispersion modelling process. The DNM dust reduction measures that have been incorporated into the dust dispersion modelling for the Project included:

- The use of water sprays at the ROM dump,
- The use of water sprays whilst crushing, and
- The watering of haul roads at a rate of more than 2 litres/m^2/hour (i.e. level 2 watering).

8.3.3 Dust Emission Scenarios

Specifically, two mining scenarios were used for the Project based on Business as Usual (BAU) dust management practices as outlined below:

- Project Without (BAU) Case: The mining of DNM as permitted under current mining approvals,
- Project With (BAU) Case: The mining of DNM that includes the Project, and
- Dust impacts attributed to the Project are then calculated as the incremental change in results for the Project With (BAU) case minus those for the Project (BAU) Without case.

8.3.4 Dust Emissions Inventory

The National Pollutant Inventory (NPI) has produced a series of Emission Estimation Technique Manuals (EETM) that are intended to provide data on emissions of air pollutants from a wide variety of industries/activities. For this assessment, the NPI EETM for Mining V3.1 (NPI, 2012) has been used to develop estimates of the amount of TSP and PM_{10} emitted from the various dust generating activities and incorporating site-specific information where available.

Emission factors from the NPI EETM for Mining were supplemented with those from the US EPA's AP42 (USEPA, 1995) as required and/or considered appropriate. Additionally, it has been conservatively assumed that 20% of PM_{10} is in the form of $PM_{2.5}$.

Dust emissions associated with the Project are calculated as the difference between those for the Project With (BAU) case minus those for the Project Without (BAU) case. Results for two specific years of mining (FY28 and FY31) corresponding to high activity periods within the proposed OOPD, are summarised in **Table 8-4**.

Emission estimates presented in **Table 8-4** highlight the increase in emissions associated with the OOPD disturbance footprint as well as the decrease in emissions associated with the reduction in vehicle kilometres travelled associated with the short hauling of waste material to the OOPD.

Table 8-4 Emission inventory for the Project

Activity	TSP (t/year)		PM10 (t/year)		PM2.5 (t/year)	
	FY28	FY31	FY28	FY31	FY28	FY31
Coal handling	0	0	0	0	0	0
Waste handling by truck & shovel	-860	-390	-321	-145	-74	-29
Dozers	0	0	0	0	0	0
CHPP	0	0	0	0	0	0
Wind erosion (disturbance)	124	43	62	22	12	4
Total	**-736**	**-346**	**-258**	**-124**	**-51**	**-25**

8.3.5 Overview of Dispersion Modelling

Regional, three-dimensional wind fields used as input into the dispersion model were prepared using a combination of The Air Pollution Model (TAPM) developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Hurley, 2008), and CALMET, the meteorological pre-cursor for CALPUFF (Scirer, 2000). Aligning with worst-case background dust conditions, hourly varying meteorology was developed corresponding to 2019. Dust dispersion modelling was undertaken using CALPUFF.

8.4 Potential Impacts

Table 8-5 presents a summary of the changes to air quality outcomes attributable to the Project for each of the dust pollutants of interest at each of the three assessment locations.

Included in the table are the Project impacts for each of the following which are presented as an average over the LOM (i.e. as an average over the 15 years assessed):

- The change in the maximum monthly average dust deposition,
- The change in the annual average concentration of TSP,
- The change in the maximum 24 hour average concentration of PM_{10},
- The change in the annual average concentration of PM_{10},
- The change in the maximum 24 hour average concentration of $PM_{2.5}$, and
- The change in the annual average concentration of $PM_{2.5}$.

Table 8-6 provides a summary of the changes in the predicted number of exceedances that are attributed to the Project, for each of the pollutants and averaging periods assessed.

The results presented in **Table 8-5** and **Table 8-6** highlight the immateriality of the Project in terms of impacts to air quality outcomes. The air quality outcomes from the Project are predicted to be less than ±1 mg/m2/day or less than ±1 μg/m^3 at all locations for all pollutants and averaging periods assessed.

Table 8-5 Changes in predicted air quality outcomes attributed to the Project

Location	Dust Deposition Monthly Average (mg/m^2/day)	TSP Annual Average (μg/m^3)	PM_{10} 24hr Average (μg/m^3)	PM_{10} Annual Average (μg/m^3)	$PM_{2.5}$ 24hr Average (μg/m^3)	$PM_{2.5}$ Annual Average (μg/m^3)
	Change in Average of Maximum over LoM	Change in Annual Average over LoM	Change in Average of Maximum over LoM	Change in Annual Average over LoM	Change in Average of Maximum over LoM	Change in Annual Average over LoM
Mine years assessed	15	15	15	15	15	15
R1*	-0.3	-0.8	0.0	-0.1	-0.6	0.0
R2	0.0	-0.1	-0.3	0.0	-0.2	0.0
R3	0.0	0.0	-0.4	0.0	+0.1	0.0
Note *: Impacts to the Olive Downs Homestead are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.						

Table 8-6 Changes in predicted exceedances attributed to the Project

Location	Dust Deposition Exceedance Months	TSP Annual Average Exceedance years	PM_{10} 24hr Average Exceedance days	PM_{10} Annual Average Exceedance years	$PM_{2.5}$ 24hr Average Exceedance days	$PM_{2.5}$ Annual Average Exceedance years
	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM	Change in Average over LoM
Mine years assessed	15	15	15	15	15	15
R1*	0.0	0.0	-0.6	0.0	+0.1	0.0
R2	0.0	0.0	-0.2	0.0	0.0	0.0
R3	0.0	0.0	-0.3	0.0	-0.1	0.0
Note *: Impacts to the Olive Downs Homestead are expected to be managed through a non-residency agreement which WHC are currently negotiating with the landowner.						

In summary, a net overall reduction in dust emissions is estimated to be associated with the Project, with the advantages of short hauling outweighing the disadvantage of the larger disturbance footprint. Therefore, no changes to current EA conditions are suggested based on the scale of impacts associated with the Project.

8.5 Mitigation and Management Measures

The mitigation measures currently implemented at DNM are considered to be sufficient to manage dust associated with the Project, as demonstrated through a series of modelled mitigation scenarios. These scenarios focused on the mitigation of dust associated with material handling of waste, which was identified as the key driver of off-site dust impacts. Options for reducing dust included:

- Reducing haul distances where possible,
- Reducing vehicle speed and thus vehicle kilometres travelled per hour, and
- Reducing the number of operating trucks.

In general, results of the mitigation scenarios suggest that the range of mitigation measures available at DNM to inform day-to-day operations will in general be sufficient to adequately manage operational dust risk associated with the Project. Therefore, no changes to current dust management procedures are suggested based on the scale of impacts associated with the Project.

Note that additional, long term dust management strategies that are being utilised by WHC include the use of non-residency agreements as/if required to achieve acceptable air quality outcomes at potentially impacted off-site neighboring locations.

9.0 Noise and Vibration

9.1 Introduction

The Noise and Vibration Impact Assessment has been prepared for the Project and is included as **Appendix I**. The assessment involved modelling of operational noise emissions from DNM together with the Project operations associated with the proposed OOPD. An assessment of the potential for vibration impacts, excluding blasting noting this is not required for the Project, has also been completed. Notwithstanding this, blasting methods will continue at DNM (i.e. within the ML 1781) as currently employed with no change in intensity (i.e. frequency and/or size of blasts).

The Noise and Vibration Impact Assessment is summarised below.

9.2 Existing Environmental Values

9.2.1 Existing Receptors

As discussed in **Chapter 8.0**, the DNM EA provides the following definitions regarding sensitive places and not sensitive places:

a. *A sensitive place means any of the following:*

   i. *a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or*

   ii. *a motel, hotel or hostel; or*

   iii. *an educational institution; or*

   iv. *a medical centre or hospital; or*

   v. *a protected area; or*

   vi. *a public park or gardens.*

b. *Despite paragraph (a), the following places are not sensitive places:*

   i. *subject to paragraph (c), a place that is the subject of an alternative arrangement; or*

   ii. *a mining camp (i.e., accommodation and ancillary facilities for mine employees or contractors or both, associated with the mine the subject of the environmental authority), whether or not the mining camp is located within a mining tenement that is part of the mining project the subject of the environmental authority. For example, the mining camp might be located on neighbouring land owned or leased by the same company as one of the environmental authority holders for the mining project, or a related company; or*

   iii. *a property owned or leased by one or more of the environmental authority holders, or a related company, whether or not it is subject to an alternative arrangement.*

c. *A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a sensitive place for the purposes of that type(s) of environmental nuisance, however remains a sensitive place for the purpose of other types of environmental nuisances.*

The DNM EA also provides the following definitions regarding commercial places:

a. *A work place that is used as:*

   i. *an office; or*
   ii. *a place of business; or*
   iii. *a place used for commercial purposes.*

b. *Despite paragraph (a), the following places are not commercial places:*

   i. *subject to paragraph (c), a place that is the subject of an alternative arrangement; or*
   ii. *places that are part of the mining activity; or*
   iii. *employees accommodation or public roads; or*
   iv. *a property owned or leased by one or more of the environmental authority holders, or a related company, whether or not it is subject to an alternative arrangement.*

c. *A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a commercial place for the purposes of that type(s) of environmental nuisance, however remains a commercial place for the purpose of other types of environmental nuisances.*

Based on the above definitions, noise and vibration receptors (sensitive and not sensitive) surrounding and potentially impacted by the Project are listed in **Table 9-1** and identified on **Figure 9-1**.

Table 9-1 Noise and Vibration Receptors

ID	Easting (m) [1]	Northing (m) [1]	Description
R1	633,911	7,553,020	Olive Downs Homestead
R2	639,658	7,558,572	Daunia Homestead
R3	643,647	7,559,016	Devlin Creek Homestead
R4	639,052	7,563,796	Mavis Downs Homestead
R5	621,710	7,552,779	Winchester Downs Homestead
R6	633,556	7,571,559	Moorvale Works Accommodation
R7	633,548	7,572,351	Moorvale Residence
R8	633,354	7,573,162	Annadale Residence
R9	628,347	7,570,470	Tarkari Residence
R10	620,268	7,566,636	Wotonga Residence

Note 1: Based on GDA 2020 MGA Zone 55 coordinate reference.

Regarding the Olive Downs Homestead (R1), whilst this receptor is a sensitive receptor, WHC are currently negotiating with the landowner to establish a non-residency agreement (i.e. similar to the Winchester South Mine agreement) requiring the homestead to remain unoccupied for the period covering the life of the DNM. Therefore, this receptor is not considered “sensitive” for the purpose of this assessment but retained for information purposes.

9.2.2 Existing Acoustic Environment

To assist with defining the existing (pre-Project) acoustic environment, unattended and operator attended noise monitoring was completed at the closest receptor to the Project site between September and October 2021. The noise monitoring results are summarised in **Table 9-2**.

Table 9-2 Summary of (Unattended) Noise Logging Results

Monitoring Location	RBLs (dBA)			L_{Aeq} Noise Levels (dBA)		
	Day	Evening	Night	Day	Evening	Night
R1 Olive Downs Homestead	33	29	29	44	49 [1]	43

Note 1: Evening period LAeq noise level primarily attributed to insect noise.

It is important to note that the results presented in **Table 9-2** have not been filtered for insect noise because the evening and night-time period RBLs were below the former Department of Environment and Science's (now DETSI) Model Mining Conditions (MMC) guideline threshold background noise level of 30 dBA.

9.2.3 Assessment Criteria

In relation to noise and vibration, DNM's EA (EPML00561913) Conditions C1 and C5 (noise and vibration nuisance) requires DNM not to cause an environmental nuisance at any sensitive place or commercial place. Condition C4 requires noise monitoring when requested by the Administering Authority (EA Condition A14). Conditions C2, C6 and C8 specify the noise levels and vibration/airblast overpressure nuisance levels that are not to be exceeded when monitored in accordance with Condition A11.

Potential noise impacts from the Project have been assessed against the noise limits prescribed in the current DNM EA, which are outlined in **Table 9-3**.

Table 9-3 DNM EA Schedule C Table C1 (Noise Limits)

Noise Level (dBA)	Monday to Sunday (including public holidays)		
	Day 7 am – 6 pm	Evening 6 pm – 10 pm	Night 10 pm – 7 am
Sensitive Place			
$L_{Aeq, adj,10mins}$	38	35 [1]	33 [1]
$L_{A MAX, adj,10mins}$	43	40 [1]	38 [1]
Commercial Place			
$L_{Aeq, adj,10mins}$	43	40 [1]	35 [1]
$L_{A MAX, adj,10mins}$	48	45 [1]	40 [1]
Note 1: Based on the MMC threshold background noise level of 30 dBA.			

No resource extraction and therefore blasting will be undertaken within the proposed ML area. Other potential sources of vibration such as dumping of waste material and heavy vehicle movement on haul roads is not anticipated to result in vibration impacts to sensitive receptors. Nonetheless, a qualitative assessment of vibration has been provided in this study.

An assessment of the potential for cumulative noise impacts from DNM and other surrounding mines has been completed with regard to the Acoustic Quality Objectives (AQO) contained within the *Environmental Protection (Noise) Policy 2019* ((EPP(Noise)).

9.3 Noise and Vibration Assessment Methodology

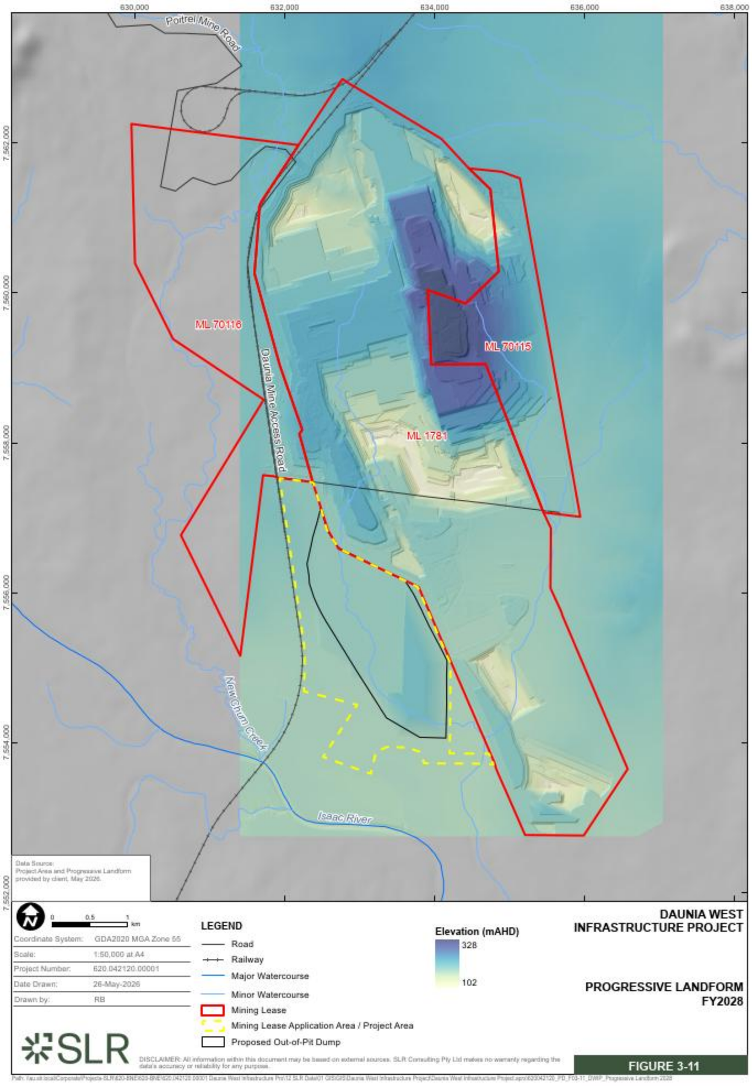
9.3.1 Noise and Vibrating Modelling Scenarios

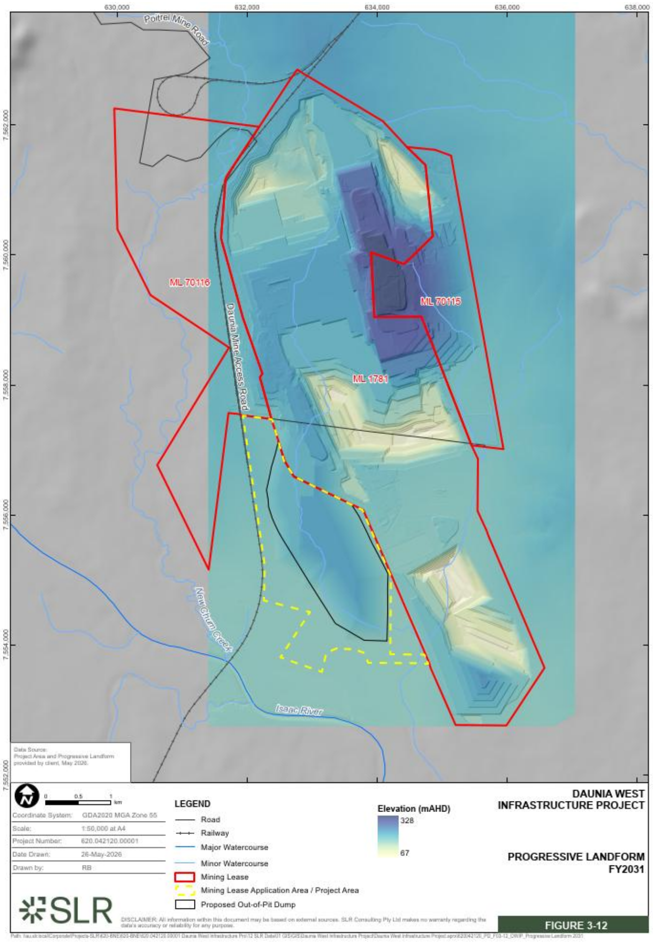
The selection of noise modelling/assessment scenarios for the Project, which included all DNM noise sources and not just activities occurring within the proposed ML area, was based on activities with the greatest potential to result in noise at the identified sensitive receptors. This included consideration of the commencement of activities within the proposed ML area as well as when plant and equipment (noise sources) would be at the closest proximity to receptors, and where there would be limited screening of noise from on-site structures or topography.

The assessment scenarios in **Table 9-4** were developed to assess potential 'typical worse case' noise levels with consideration of the following:

- The commencement of activities within the proposed ML area including development of the haul roads and OOPD, noting the life of the OOPD is approximately 7 years (up to and including rehabilitation). The preparation for development of the OOPD is estimated to commence in approximately FY2028,
- The most exposed areas of the ML OOPD relative to sensitive receptors,
- ML1781 extraction activities occurring close to the identified sensitive receptors, and
- Consideration of peak extraction years for both coal and waste (which occur at different times), and peak mobile mining equipment numbers.

Table 9-4 Assessed Operational Scenarios and Associated Mining Activities

Scenario	Scenario Justification	Mine Plan Diagram
FY2028	The FY2028 mine plan coincides with the commencement of OOPD activities in the proposed ML area. Mining activities in ML 1781 also align with the closest sensitive receptors to the east of DNM.	

Scenario	Scenario Justification	Mine Plan Diagram
FY2031	The FY2031 mine plan represents further development (in terms of height and extent) of the OOPD. DNM physicals in terms of ROM and production coal and waste movements are forecast to be maximised under the FY2031 mine plan.	

The noise assessment was based on the key assumptions and exclusions outlined below:

- New or relocation of existing infrastructure will be required for the Project, such as development of haul roads within the proposed ML area, however they are not considered acoustically significant sources of noise and therefore have not been included in this assessment. However, movement of mining equipment on the new haul roads, including waste haul and water trucks, has been included in the modelled scenarios.
- For both modelled scenarios, the noise assessment involved the modelling of noise sources associated with:
  - All acoustically significant mine equipment proposed to be operated at the DNM including within the proposed ML area.
  - Fixed plant operating at the mine industrial area (MIA), including the CHPP, conveyors, stacker reclaimers, train loadout facility (TLF) etc, as well as associated mobile mining equipment assigned to this area.
- 3-D mine plans for DNM were provided by Whitehaven Daunia for the FY2028 and FY2031 modelled scenarios.

With regard to mobile mining equipment, Whitehaven Daunia advised the type and quantity of equipment proposed to be operated at the DNM for the modelled scenarios (further details provided in **Appendix I**).

- Haul trucks (coal and waste), graders, water trucks have been modelled as line sources to reflect the mobile nature of these sources. Line sources contain all acoustic energy spread across the line source representing a path each source would travel over a representative 10 minute assessment period. To calculate the path travelled over the assessment period, the following average speeds have been assumed:
  - For haul trucks, approximately:
    - 35 to 40 km/hr for flat haul roads.
    - 10 km/hr for pit ramps (i.e. loaded ascents and unloaded descents).
  - Water trucks – 15 km/hr.
  - Graders – 5 km/hr.
- To account for the total number of waste and coal haulage trucks proposed for each pit/activity, an assumption has been made that one idle haul truck would be located next to the active loader (with relatively insignificant noise emission levels) and the remaining number of trucks are considered in calculating a total line source to simulate the haulage circuit,
- All remaining equipment (i.e. excavators, shovels, loaders, dozers, drills) have been modelled as point sources in a typically worst-case location for the pit/activity. For example, waste dozers were modelled towards the more exposed end of the push journey,
- All operations will be continuous 24-hours a day and seven days a week. As such, no allowance to the modelled noise emission was made for periods when plant would be temporarily idle or not in use,
- As per the definition in the EA, the $L_{Amax,adj,10mins}$ is the average maximum A-weighted sound pressure level (adjusted for character, such as tonality or impulsivity) measured over any 10 minute period. In SLR's experience with noise from mine operations, the average maximum noise level is typically equivalent to the LA10 noise descriptor (i.e. the noise level exceeded for 10% of the 10 minute measurement period), and therefore, to assess LAmax,adj,10mins noise levels, a +3 dB relationship between the L_{Aeq} and $L_{Amax,adj,10mins}$ has been applied where mobile mining equipment was identified as the dominant noise source,
- The Project would not require any material change to existing fixed plant operating at DNM. As such, modelling of these sources has been based on typical noise source data for the acoustically significant fixed plant items,
- Rail noise has been excluded from this assessment as rail operations are not proposed to change as a result of the Project. Further, given it's an existing noise source, sensitive receptors are unlikely to associate future rail noise as part of the Project, and
- Progressive rehabilitation activities are inherently assessed through the reported assessment of mining operations. Assessment of final rehabilitation activities (i.e. post mine closure) has not been considered. Noise emissions during this final rehabilitation would be minor in comparison to predicted noise levels from coal mining operations.

9.3.2 Noise Prediction Modelling

A SoundPLAN (version 8.2) computer noise model was developed to predict mine noise levels at the nominated noise sensitive receptors. SoundPLAN is a computer model software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The model can calculate noise levels taking into account such factors as the sound power levels and locations of noise sources, distance attenuation, ground absorption, air absorption and shielding attenuation, as well as meteorological conditions, including wind effects.

The Conservation of Clean Air and Water Europe (CONCAWE 1981) prediction methodology was utilised within SoundPLAN. The CONCAWE prediction method is specifically designed for large industrial facilities and incorporates the influence of wind effects and the stability of the atmosphere.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 – 1982). Marsh concluded that CONCAWE was accurate to ±2 dBA in any one octave band between 63 hertz (Hz) and 4 kHz and ± 1 dBA overall.

In relation to the modelling of atmospheric conditions, DETSI's Ecoaccess Guideline Planning for Noise Control provides guidance with respect to assessing the potential for noise enhancements due to prevailing atmospheric conditions.

9.3.3 Cumulative Noise Impact Assessment

As part of the assessment of cumulative noise impacts, the following mines in vicinity to the Project and nearest sensitive receptors have been identified:

- Millennium Mine/ Mavis Mine,
- Moorvale Mine,
- Moorvale South Mine,
- Poitrel Mine, and
- Winchester South Mine.

It is noteworthy that there are several other mines in the region (both existing and approved for development) such as Olive Downs Mine, Eagle Downs Mine, Isaac Downs Mine, Peak Downs Mine and Caval Ridge Mine, however these mines are located a significant distance from the sensitive receptors most exposed to DNM. Therefore, the potential for cumulative noise impacts, which has been assessed against the EPP(Noise) AQO, was limited to the mines listed above.

9.3.4 Blasting

Noting that blasting is not required within the proposed ML area, other potential sources of vibration such as dumping of waste material and heavy vehicle movement on haul roads is not anticipated to result in vibration impacts to sensitive receptors. Nonetheless, a qualitative assessment of vibration has been included.

9.4 Potential Impacts

9.4.1 Predicted Operational Noise Levels

The technical assessment has modelled DNM with the Project noise emission levels from two operational mining scenarios coinciding with FY2028 and FY2031. Through a review of the Project information supplied by Whitehaven Daunia as part of the assessment, these two (2) modelled scenarios were selected to represent various stages of the Project and operational intensity including the maximum fleet size, as well as targeting proximity of mining operations to noise sensitive receptors surrounding the Project.

Project noise emission levels predicted at the receptors surrounding DNM are presented in **Table 9-5**.

Table 9-5 Predicted DNM Operational Noise Levels – Neutral and Adverse Weather

ID	Description	Predicted DNM Noise Level (adj, 10 mins dBA)			
		FY2028		FY2031	
		LAeq	LAmax	LAeq	LAmax
***Neutral Weather**: 10 °C temperature, 70% humidity, 'D' Pasquill stability class, 0 m/s wind speed*					
EPML00561913 noise limits [1]		**33**	**38**	**33**	**38**
R1	Olive Downs Homestead [2]	45	48	41	44
R2	Daunia Homestead	25	28	25	28
R3	Devlin Creek Homestead	16	19	15	18
R4	Mavis Downs Homestead	21	24	20	23
R5	Winchester Downs Homestead	15	18	11	14
R6	Moorvale Works Accommodation	13	16	13	16
R7	Moorvale Residence	13	16	12	15
R8	Annadale Residence	12	15	11	14
R9	Tarkari Residence	15	18	15	18
R10	Wotonga Residence	13	16	10	13
***Adverse Weather**: 10 °C temperature, 90% humidity, 'F' Pasquill stability class, 0 m/s wind speed*					
R1	Olive Downs Homestead [2]	51	54	46	49
R2	Daunia Homestead	30	33	30	33
R3	Devlin Creek Homestead	21	24	19	22
R4	Mavis Downs Homestead	26	29	25	28
R5	Winchester Downs Homestead	19	22	15	18
R6	Moorvale Works Accommodation	18	21	17	20
R7	Moorvale Residence	16	19	16	19
R8	Annadale Residence	16	19	15	18
R9	Tarkari Residence	19	22	19	22
R10	Wotonga Residence	16	19	14	17

Note 1: Noting 24 hour operations at DNM, the limits are based on the most stringent noise limit corresponding to the night-time period
Note 2: Impacts to the Olive Downs Homestead is expected to be managed through a non-residency agreement (i.e. similar to the Winchester South Mine agreement) which WHC are currently negotiating with the landowner.

The assessment identified the following in relation to the potential for noise impacts from DNM with the Project:

- Under neutral weather conditions, the predicted noise levels for the FY2028 and FY2031 modelled scenarios comply with the EA noise limits at all sensitive receptors. The highest noise levels of 25 dBA $L_{Aeq,adj,10mins}$ and 28 dBA $L_{Amax,adj,10mins}$ were predicted at sensitive receptor R2 (Daunia Homestead),

- Likewise, under adverse weather conditions, the predicted noise levels for the FY2028 and FY2031 modelled scenarios comply with the EA noise limits at all sensitive receptors. The highest noise levels of 30 dBA $L_{Aeq,adj,10mins}$ and 33 dBA $L_{Amax,adj,10mins}$ were predicted at sensitive receptor R2 (Daunia Homestead),
- For sensitive receptors located east and north of DNM, predicted DNM noise levels are generally consistent between the two (2) assessed mine plans of FY2028 and FY2031. Further to this, DNM noise emission levels are dominated by mining activities associated with mobile equipment (i.e. haul trucks, dozers, water trucks etc.) occurring within the ML areas and not the proposed MLA area to the south-west of the mine, and
- Although DNM noise levels at the Olive Downs Homestead (R1) are predicted to exceed the EA noise limits, impacts to this receptor are expected to be managed through a non-residency agreement which is currently being negotiated between WHC and the landowner.

The technical assessment has also completed an analysis of the potential for low frequency noise impacts as defined in former and current Queensland guidelines. Neither the 48 dBC L_{eq} or 48 dBL L_{eq} predicted noise levels exceed the respective overall 60 dBC or 55 dBL L_{eq} external criteria at any sensitive receptor. Accordingly, low frequency noise is not predicted to be an issue for the Project.

9.4.2 Cumulative Noise Levels

The potential for cumulative noise impact is likely to be limited to the three (3) sensitive receptors to the east of DNM, namely R2 Daunia Homestead, R3 Devlin Creek Homestead and R4 Mavis Downs Homestead. As noted above, it is expected that noise impacting the Olive Downs Homestead (R1) will be managed through a non-residency agreement and therefore has been excluded from the cumulative noise assessment.

Sensitive receptors to the north and west of DNM are located at significant distances from DNM (i.e. as indicated by the predicted DNM noise levels in **Table 9-5**) and are all located closer to existing or approved mines that likely to be more dominant than DNM.

The cumulative noise impact assessment for noise sensitive receptors to the east of DNM is detailed in **Table 9-6**. It is noted that no publicly available noise assessment/predictions were sourced for Moorvale Mine, Moorvale South Mine and Poitrel Mine. Consequently, the assessment has been based on noise limits prescribed within the respective EAs or inferred from the DNM modelling where similarities in mining methods and noise emission was identified as part of this study.

It should also be noted that, the cumulative noise assessment has considered only adverse weather conditions, that is temperature inversion with negligible wind (i.e. the highest predicted noise level).

Table 9-6 Cumulative Mine Noise Under Adverse Weather Conditions

Receptor	Predicted LAeq,adj,10min (dBA) Noise Level from:						Predicted Cumulative Noise Level (LAeq dBA)
	DNM	Millennium	Moorvale	Moorvale South	Poitrel	Winchester South	
EPP(Noise) AQO = 37 dBA $L_{Aeq,adj}$							

Receptor	Predicted LAeq,adj,10min (dBA) Noise Level from:						Predicted Cumulative Noise Level (LAeq dBA)
	DNM	Millennium	Moorvale	Moorvale South	Poitrel	Winchester South	
R2 Daunia	30	<20 [1]	26 [2]	27 [3]	24 [4]	25 [5]	34
R3 Devlin	21	<20 [1]	27 [2]	21 [3]	18 [4]	20 [5]	30
R4 Mavis	26	21 [1]	33 [2]	<20 [3]	20 [4]	<20 [5]	34

Note 1: Predicted noise levels interpolated from the *Millennium Expansion Project Environmental Impact Statement Chapter 12: Noise and Vibration 2011* noise contour mapping.

Note 2: Based on achieving the night-time period noise limit from the existing EA EPML00802813 dated 8 August 2023 at the closest sensitive receptor (i.e. R4 Mavis Downs Homestead).

Note 3: Based on achieving the night-time period noise limit from the existing EA EPML00380113 dated 21 August 2023 at the closest sensitive receptor (i.e. R2 Daunia Homestead).

Note 4: Based on the DNM predicted noise levels in **Table 9-5**, noting that Poitrel Mine and DNM are similarly aligned (geographically) and similar in mining intensity, and the separation distance between Poitrel Mine and the sensitive receptors.

Note 5: Predicted noise levels extrapolated from the *Winchester South Project Environmental Impact Statement Attachment 14: Noise and Vibration Assessment 15 June 2022* noise contour mapping.

Based on the cumulative noise impact assessment detailed in **Table 9-6**, cumulative mine noise levels from DNM and surrounding mines are predicted to comply with the 37 dBA L_{Aeq} EPP(Noise) AQO. It is therefore anticipated that, with the introduction of the proposed ML area activities, cumulative noise impacts at surrounding sensitive receptors would be avoided.

9.4.3 Vibration

Vibration impacts resulting from activities proposed to occur within the MLA area are not expected to occur given the following:

- The nature of these works would be limited to heavy vehicle movements on maintained haul roads and dumping of waste material on the OOPD, and
- Excluding the Olive Downs Homestead (i.e. due to vibration amenity impacts being managed through the non-residency agreement), the closest sensitive receptor to the proposed MLA area is the Daunia Homestead (R2) which is approximately 6.4 km to north-east. At this distance, vibration from the proposed activities would be indiscernible, that is below the threshold of perception being typically in the range of 0.14 mm/s to 0.3 mm/s (British Standard BS 5228-2:2009) and expected to be below blasting vibration levels resulting from existing operations in ML 1781 and ML 70115.

9.5 Risk Assessment

A summary of the noise and vibration impact assessment findings and significance (i.e. qualitative risk assessment) is presented in **Table 9-7**. The likelihood and consequence criteria are consistent with the intent of AS ISO 31000:2018 Risk Management - Guidelines.

Table 9-7 Qualitative Risk Assessment of Potential Noise and Vibration Impacts

Potential impact	Aspect	Relevance factor	Sum of relevance factors	Impact significance	Comments and management measures
Increased noise and/or vibration levels at sensitive receptors during the construction phase of the Project	Probability of the impact	Low (1)	5	Low	Given the relatively minor nature of the construction works required for the Project and separation distance to sensitive receptors, noise and/or vibration impacts during the construction phase are not anticipated. Notwithstanding this, construction noise and/or vibration levels will be managed through measures routinely applied at DNM.
	Duration of the impact	Low (1)			
	Magnitude/intensity of the impact	Low (1)			
	Receiving environment sensitivity	Medium (2)			
Increased mine noise emission at sensitive receptors because of the operation of the Project	Probability of the impact	Low (1)	5	Low	Given the nature of the approved DNM operations (i.e. more intensive than activities occurring in the Project area), and separation distance to sensitive receptors, noise impacts are not anticipated. Notwithstanding this, mine noise levels will be managed through measures routinely applied at DNM.
	Duration of the impact	Low (1)			
	Magnitude/intensity of the impact	Low (1)			
	Receiving environment sensitivity	Medium (2)			
Increased or introduction of annoying noise characteristics (e.g. low frequency noise, tonality, impulsive noise etc) at sensitive receptors	Probability of the impact	Low (1)	5	Low	Given the nature of the mining activities associated with the Project and separation distance to sensitive receptors, noise characteristics such as low frequency noise, tonality or impulsive noise are not anticipated. Notwithstanding this, Project noise will be managed through measures routinely applied at DNM such as ensuring all equipment is in good working order and fit for purpose.
	Duration of the impact	Low (1)			
	Magnitude/intensity of the impact	Low (1)			
	Receiving environment sensitivity	Medium (2)			
Increased cumulative noise at sensitive receptors because of the introduction of the Project	Probability of the impact	Low (1)	5	Low	Given the nature of the approved DNM operations (i.e. more intensive than activities occurring in the Project area), and separation distance to sensitive receptors, cumulative noise impacts because of the Project are not anticipated. Notwithstanding this, mine noise levels will be managed through measures routinely applied at DNM.
	Duration of the impact	Low (1)			
	Magnitude/intensity of the impact	Low (1)			
	Receiving environment sensitivity	Medium (2)			
Increased vibration levels at sensitive receptors because of the Project	Probability of the impact	Low (1)	5	Low	Noting that blasting is not required within the Project area and other potential sources of vibration are anticipated to be insignificant at sensitive receptors, vibration impacts would be avoided.
	Duration of the impact	Low (1)			
	Magnitude/intensity of the impact	Low (1)			
	Receiving environment sensitivity	Medium (2)			

9.6 Mitigation and Management Measures

The assessment of predicted noise levels indicates that the DNM with the introduction of the proposed MLA area will comply with the noise limits prescribed in the existing EA. On this basis, specific noise mitigation measures beyond the measures routinely applied at DNM are not warranted. Notwithstanding this, the following proven noise management advice is outlined for consideration during mine planning and operations over the life of the Project to minimise off-site noise emission levels:

- All equipment should be operated in accordance with the manufacturer's instruction and regularly maintained to minimise noise emission levels,
- Avoid clustering of mobile equipment on haul roads, OOPD areas and other exposed/elevated areas, such as during shift changeovers. Haul truck arrival and departures from go lines should be staggered where possible,
- Dumping of material can include engineering controls to minimise the distance the material falls and lining bins and chutes with rubber to dampen the impact,
- Equipment should be shut down when not in use,
- Broadband "buzzer", not tonal "beeper", reversing alarms should be utilised on all mobile plant, and
- To eliminate potentially impulsive noise, dozer track slap can be minimised through idle wheel modification, use of track slides and grousers, and management controls such as gear limitation.

It should be noted that the noise management options discussed above are preliminary in nature. Any actual noise mitigation measures implemented on site, if required based on actual mine noise emissions, will be subject to further detailed analysis in the future in accordance with the DNM Noise and Vibration Management Plan.

No additional mitigation measures with respect to cumulative noise and vibration for the proposed operations in the ML area are warranted for the reasons outlined in the assessment.

10.0 Surface Water

10.1 Introduction

A Surface Water Assessment (WRM, 2025) has been completed for the Project and is provided in **Appendix C**. The key elements of the Surface Water Assessment include:

- Describes the existing surface water environment, climate and site characteristics of the Project,
- Describes the sediment management system for the Project, including the sediment dam (PW Sed Dam) for capturing sediment from the OOPD,
- Describes the surface water management system and updated site water balance model and assessment for the Project and the larger DNM, and
- Assesses potential impacts of mining voids located within floodplains, identifies associated risks, and proposes mitigation strategies to protect hydrological and ecological systems.

10.2 Existing Surface Water Environment

10.2.1 Drainage Network

The Project is located within the Isaac sub-catchment of the greater Fitzroy Basin (**Figure 10-1**). The Isaac River is the main watercourse in the vicinity of the Project Area and flows in a south easterly direction to the southwest of the Project. The regional drainage features surrounding the Project Area is shown in **Figure 10-2**.

Key waterways include Isaac River, New Chum Creek, and North Creek. The Project Area drainage characteristics is illustrated in **Figure 10-3**. Waterways have been defined from the Ordered Drainage 100K mapping layer from the Queensland Government Qspatial website, which identifies riverine systems, watercourses, waterways or drainage lines (here referred to collectively as waterways) for the Project Area. The drainage layer classifies the hierarchy of streams using the Strahler (1957) stream ordering system.

There are three watercourses in the vicinity of the Project Area:

- The Isaac River located southwest (Strahler stream order six (6)),
- North Creek located northeast (Strahler stream order four (4)), and
- New Chum Creek located west (Strahler stream order three (3)).

The Project Area is confined to the catchment of an unnamed first order drainage features, this is shown in **Figure 10-3**. These features generally show no characteristics of being a watercourse as they are ill-defined and do not have sufficient continuing flow to create a riverine environment. Neither feature has riparian vegetation of significance.

No part of the Project drains to New Chum Creek. Existing mine infrastructure and releases associated with the New Chum Creek catchment are outside the DWIP footprint and are not affected by the Project. The Project disturbance footprint represents a negligible proportion of the Isaac River catchment and does not materially alter regional drainage patterns.

10.2.2 Streamflow

The Isaac River is highly ephemeral, with flows mostly occurring during summer months. Data from the Deverill station shows that flows are most likely to occur during the summer months (**Figure 10-4**). Stream flows are highly variable, with the river drying out during winter and early spring. Some pools are expected to hold water for extended periods. Refer to **Appendix C** for further details.

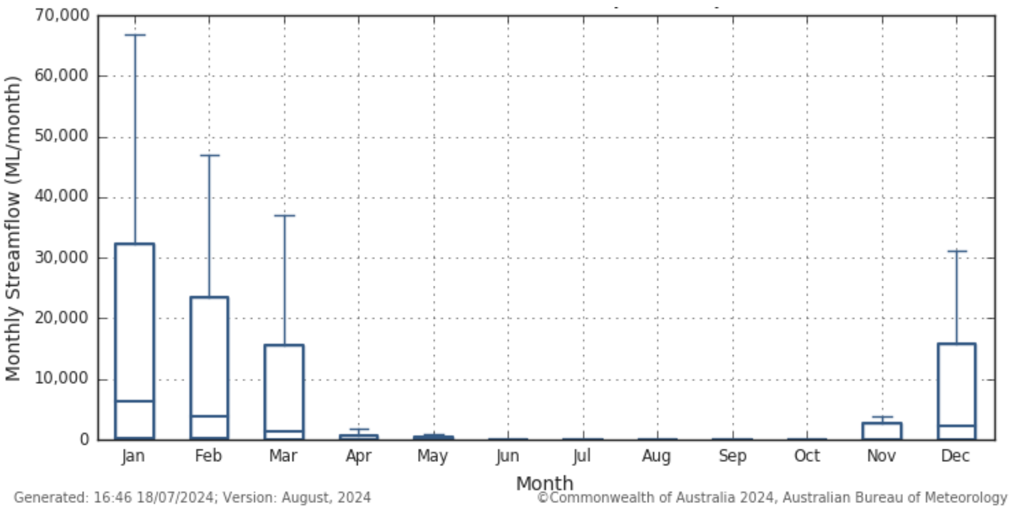


Figure 10-4 Monthly box and whisker plot of flow volume for the Isaac River at Deverill (DNRME station 130410A)

10.2.3 Environmental Values

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water), subordinate to the EP Act, establishes a comprehensive framework for protecting Queensland's waterways and wetlands. The policy outlines processes for identifying environmental values (EVs)—such as aquatic ecosystem health, recreational use, and agricultural needs—and setting water quality objectives (WQOs) to maintain or enhance these values. These objectives are derived using national standards like the ANZG (2018) and the Queensland Water Quality Guidelines and are tailored to the ecological condition of each water body (DES, 2019).

The EVs and WQOs for the Project are defined in *the Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Isaac River Sub-basin (including Connors River) September 2011*, which is made pursuant to the provisions of EPP Water. The Project is located within two subcatchments defined within the EPP Water:

- The Isaac River channel is located within the Isaac and lower Connors River subcatchment, and
- The minor tributaries and nearby watercourses are located with the Isaac River northern tributaries subcatchment.

The EVs defined for both areas are the same. An overview of the EVs for the receiving waters for the Project, emphasising the protection of water quality to support ecological health, human uses, and cultural significance is provided in **Table 10-1**.

Table 10-1 Receiving water environmental values

Environmental Value	Description
Aquatic Ecosystems	Protection of water quality to sustain aquatic life and biodiversity.
Primary Industries	Support for agricultural activities, including irrigation, farm use and stock watering.
Recreational Use	Maintenance of water quality for safe recreational activities.
Drinking Water	Ensuring water quality meets standards for human consumption.
Industrial Use	Water quality suitable for industrial processes and mining operations.
Cultural and Spiritual Values	Recognition of water bodies' significance to local communities.

10.2.4 Surface Water Quality

The DNM is part of the Fitzroy Regional Receiving Environment Monitoring Program (FRREMP), which monitors water quality in the Upper Isaac sub-basin.

The surface water monitoring locations for the DNM is shown in **Figure 10-5**. Key Isaac River monitoring locations include the Deverill gauging station, located near the downstream boundary of the Project, and the upstream sites MP3 and MP4. These datasets provide comparative statistics to assess water quality trends and potential influences from mining and natural processes throughout the catchment.

A comparison of water quality data from monitoring sites MP3 and MP4 with the Deverill gauge on the Isaac River shows several exceedances of aquatic ecosystem protection guideline values. Water quality monitoring conducted between 2015 and 2025 indicates that seasonal changes, upstream land use, and mining activities influence variability in results.

Key observations include:

1 Near the Project Area, median concentrations of sulphate and sodium exceed their respective guideline values, while 80th percentile concentrations for dissolved aluminium, copper, sulphate, zinc, and turbidity (sampled at Deverill) also exceed the relevant WQOs.

2 Sulphate concentrations upstream of the site are close to the WQO of 25 mg/L. At MP4, the median sulphate concentration is 26 mg/L, slightly above the guideline, and the 80th percentile reaches 40.6 mg/L.

3 Dissolved aluminium exceeds the WQO of 0.055 mg/L, with a median concentration of 0.15 mg/L at Deverill and elevated 80th percentile values at MP3 and MP4.

4 Copper shows exceedances, with 80th percentile concentrations above the guideline at Deverill, MP3, and MP4.

5 Zinc shows exceedances at MP3, with 80th percentile concentrations reflecting those at Deverill, where the median and 80th percentile values are 0.06 mg/L and 0.2 mg/L, respectively above the relevant WQO.

6 Occasional exceedances of ecosystem protection guidelines have also been recorded for pH, electrical conductivity (EC), aluminium, and copper (Gauge, 2020).

7 Other metals, including cadmium, cobalt, lead, selenium, silver, mercury, and uranium, generally remained below detection limits (Gauge, 2023).

Appendix C provides further detail.

10.2.1 Release Water Quality

Mine-affected water releases from Daunia Mine are regulated under Schedule F of the Environmental Authority (EA) and permitted only from the approved release point (RP1) where compliance with specified water-quality limits and monitoring requirements can be demonstrated. Key parameters, including electrical conductivity (EC) and pH, are monitored using real-time telemetry, supported by grab sampling at release commencement and during releases, with any exceedances managed in accordance with EA investigation and reporting requirements.

The controlled release from RP1 (Dam 2) between 31 March and 9 April 2025 demonstrates the effectiveness of the existing release framework. Although mine-affected water at the release point exhibited elevated EC and sulphate concentrations, monitoring confirmed that downstream water quality in the Isaac River remained within applicable water quality objectives. Elevated wet-season flows and hydrological mixing at the New Chum Creek confluence provided substantial dilution capacity, resulting in rapid attenuation of salinity and stable pH and sulphate concentrations downstream.

Electrical conductivity, the primary parameter of concern for coal-mine releases in the Fitzroy Basin, showed no increasing downstream trend during the release period. These results confirm that the Isaac River has sufficient assimilation capacity under event-flow conditions and that releases undertaken in accordance with the EA did not result in measurable downstream water-quality impacts.

Appendix C provides further information.

10.2.2 Sodium Release Trigger Level

A sodium trigger level assessment was undertaken to address the Environmental Authority requirement to establish a sodium trigger value to support routine release monitoring. In the absence of a defined value in the EA and given limited baseline sodium data, the assessment establishes an evidence-based, regionally appropriate framework for evaluating sodium in mine-affected water releases.

Consistent with ANZG guidance, sodium has been assessed as a component of overall salinity, with electrical conductivity retained as the primary compliance indicator for salinity-related stress. Sodium-specific human health guideline values under the Australian Drinking Water Guidelines were considered for context only and are not applied to ecological assessments or receiving waters.

Given the lack of suitable upstream reference data, an interim regional benchmark of approximately 350 mg/L for sodium was adopted, representing the 80th-percentile concentration for highly saline inland systems within the Isaac River sub-basin. This value provides a conservative, contextual reference for interpreting sodium behaviour in mining-influenced surface waters rather than a toxicity threshold.

Ongoing monitoring is recommended to progressively refine baseline conditions, with sodium assessed as a supporting parameter alongside electrical conductivity across a range of flow conditions. This approach supports statutory compliance, protects downstream environmental values, and aligns with a weight-of-evidence assessment framework.

Table 10-2 Comparison between EA trigger and analyte concentrations

Parameter	Unit	Deverill				MP3				MP4				Water Quality Objective
		No.	20%ile	Median	80%ile	No.	20%ile	Median	80%ile	No.	20%ile	Median	80%ile	
Electrical Conductivity	µS/cm	49	120	261	398	32	120	234	454	38	164	320	456	< 720 (baseflow) < 250 (high flow)
pH	-	12	7.19	7.6	8.0	32	7.58	8.00	8.43	38	7.55	8.07	8.32	6.5–8.5 (aquatic)
Sulphate (total)	mg/L	42	6.92	10	18.8	25	4.0	9.0	30.3	31	7.0	26.0	40.6	< 25 (aquatic)
Nitrate (total)	mg/L	13	0.001	0.01	0.01	31	0.02	0.16	0.30	34	0.01	0.19	0.28	< 1.1 (stock)
Fluoride (total)	mg/L	46	0.10	0.14	0.20	29	0.09	0.10	0.20	34	0.10	0.20	0.20	< 2 (irrigation)
Aluminium (dissolved)	mg/L	14	0.03	0.05	0.15	33	0.010	0.050	0.216	38	0.01	0.02	0.284	< 0.055 (aquatic)
Boron (total)	mg/L	21	0.04	0.06	0.10	17	0.05	0.05	0.06	28	0.05	0.05	0.06	< 5 (stock)
Copper (dissolved)	mg/L	16	0.006	0.03	0.036	33	0.0010	0.0010	0.0020	37	0.0010	0.0010	0.0020	< 0.0014 (aquatic)
Iron (dissolved)	mg/L	17	0.02	0.06	0.34	27	0.05	0.05	0.26	35	0.05	0.08	0.39	< 0.70 (aquatic)
Manganese (dissolved)	mg/L	16	0.006	0.030	0.036	28	0.001	0.002	0.008	31	0.001	0.005	0.013	< 1.9 (aquatic)
Zinc (dissolved)	mg/L	14	0.01	0.02	0.06	28	0.004	0.005	0.010	30	0.005	0.005	0.007	< 0.008 (aquatic)
Sodium (total)	mg/L	49	12	22	40	8	15	24	44	5	26	37	47	< 350
Turbidity	NTU	19	11	50	910	-	-	-	-	-	-	-	-	< 50 (aquatic)
Total Dissolved Solids		47	81	155	224	-	-	-	-	-	-	-	-	< 2,000 (stock)
Total Suspended Solids		41	10	135	1340	-	-	-	-	-	-	-	-	< 55 (aquatic)

NOTE: values that were recorded as below the limit of reporting have been assumed to be equal to the limit of reporting for this statistical analysis.

10.3 Climate

10.3.1 Rainfall

Climate data for the Project Area (latitude 22.05°S, longitude 148.30°E) was sourced from the Department of Science, Information Technology and Innovation’s SILO Data Drill (SILO). This dataset provides continuous, gap-free daily records interpolated from Bureau of Meteorology (BoM) observations.

The historic average annual rainfall from 1957 to 2024 is 584 mm. The minimum recorded rainfall during this period was 262 mm in 1982, while the maximum reached 1,082 mm in 2010. The distribution of monthly SILO rainfall is shown in **Figure 10-6**. Rainfalls predominantly fall during the warmer months from November to March with significantly lower rainfalls recorded during the cooler months this is shown in **Figure 10-6**.

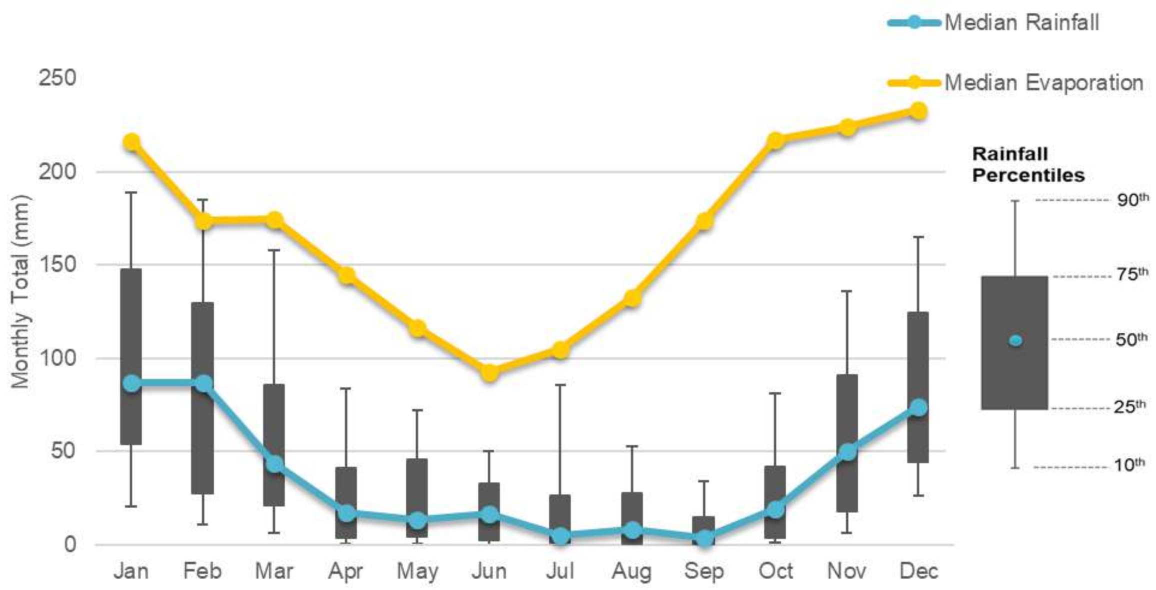


Figure 10-6 Monthly SILO rainfall and evaporation distributions summary

10.3.2 Evaporation

The median monthly Class A pan evaporation and rainfall based on SILO data between 1957 and 2024 is shown in **Figure 10-6**. Evaporation data for the site has been compiled using a combination of synthetic estimates before 1970 and Class A pan evaporation measurements from 1970 onwards. The SILO evaporation estimates were derived using climatological modelling techniques to fill gaps in historical records. Of note:

- Average annual pan evaporation is 2,014 mm,
- Evaporation peaks between October and January, aligning with the warmer months, and
- Median monthly evaporation exceeds median monthly rainfall for all months.

10.4 Site Characteristics

10.4.1 Existing Operations

Existing surface water characteristics at DNM includes regulated dams and contingency storage for mine-affected water (MAW). Key storages include Dam 2 (release point) and inactive pits, such as Calypso Central, that can be used for water storage during wet weather.

A summary of the mine water storage inventory and capacity is shown in **Table 10-3,** and the existing MAW storages is shown in **Figure 10-7**.

Table 10-3 Mine water storage inventory and capacity

Storage Name	Storage Capacity (ML)	Maximum Operating Level (MOL)	Function
Dam 1	118	47	Non-regulated, mine-affected water dam
Dam 2	172	104	Non-regulated, mine-affected water dam, mine water release
Dam 3	670	335	Regulated mine-affected water dam
Dam 5	855	515	Non-regulated, mine-affected water dam
Dam 8	677	610	Regulated mine-affected water dam
Dam 10	118	-	Regulated mine-affected water dam
Calypso Central	2,560	2,175	Inactive Pit, contingency storage
Titan North	6,000		Inactive Pit, contingency storage
Titan East	15,000		Inactive Pit, contingency storage

10.4.2 Final landform

Residual voids are designated as Non-Use Management Areas (NUMAs). Indicative dimensions of the proposed voids are provided in **Table 10-4**. The final landform and residual voids are shown in **Figure 10-8**.

Table 10-4 Indicative dimensions of the proposed voids and Non-Use Management Areas (NUMAs)

<table>
<tr><th>Proposed Void</th><th>Indicative Maximum Width (m)</th><th>Indicative Maximum Length (m)</th><th>Indicative Maximum Depth (m)</th><th>NUMA (ha)</th></tr>
<tr><td>Titan North</td><td>1276</td><td>1048</td><td>76</td><td>112</td></tr>
<tr><td>Titan Central</td><td>165</td><td>395</td><td>18</td><td rowspan="2">64*</td></tr>
<tr><td>Titan East</td><td>330</td><td>1085</td><td>104</td></tr>
<tr><td>Pandora</td><td>1550</td><td>1680</td><td>134</td><td>256</td></tr>
</table>

*Titan Central is combined with Titan East, as overflow from Titan Central void discharges into Titan East void

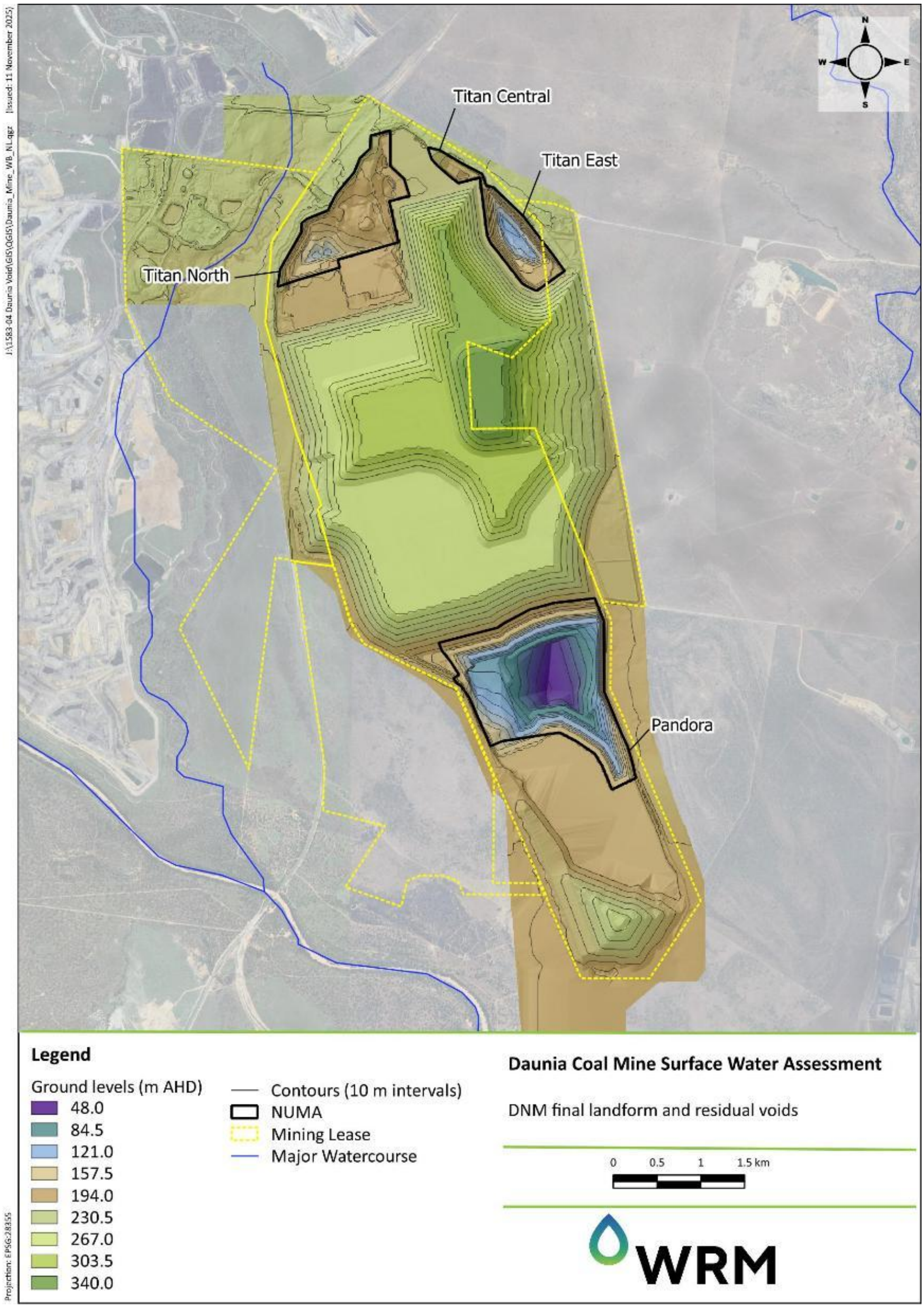


Figure 10-8 DNM final landform and residual voids

10.4.3 Water Types and Contamination Sources

Water is categorized into MAW, sediment water, clean catchment water, raw water, contaminated water, and potable water. The types of water generated on-site is defined in **Table 10-5**.

Table 10-5 Types of water generated on site

Water type	Definition
Mine-affected water (MAW)	In accordance with the DNMs EA definition for mine-affected water means the following types of water: • Pit water, tailings dam water, processing plant water, • Water contaminated by a mining activity which would have been an environmentally relevant activity *under Schedule 2 of the Environmental Protection Regulation 2008* if it had not formed part of the mining activity, • Rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water, • Groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, • Groundwater from the mine dewatering activities, and • A mix of mine-affected water (under any of paragraphs I to v) and other water.
Sediment water	Surface water runoff from areas that are disturbed by mining operations (including out-of-pit waste rock emplacements). This runoff does not come into contact with coal or other carbonaceous material and may contain high sediment loads but does not contain elevated level of other water quality parameters (e.g. EC, pH, metals, metalloids, non-metals). This runoff must be managed to ensure adequate sediment removal prior to release to receiving waters.
Clean catchment water	Surface runoff from areas unaffected by mining operations. Clean catchment water includes runoff from undisturbed areas and fully rehabilitated areas.
Raw water	Untreated water, generally from an external water supply, particularly the Burdekin pipeline.
Contaminated water	Contaminated water includes runoff from areas containing explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods, as well as flammable and combustible liquids (including petroleum products).
Potable water	Treated water suitable for human consumption.

10.4.4 Stored Water Quality

Improvements in electrical conductivity (EC) values were observed in most storages from 2024 to 2025. The DNM storage water quality data is provided in **Table 10-6**.

Table 10-6 DNM storage water quality data

Storage Name	Type of Storage - Current Use	pH 30 June 2024	pH 30 June 2025	EC 30 June 2024 (µs/cm)	EC 30 June 2025 (µs/cm)
Dam 1	Dam	8.98	8.50	5,930	4,390
Dam 2	Dam	7.37	8.48	608	5,110

Storage Name	Type of Storage - Current Use	pH 30 June 2024	pH 30 June 2025	EC 30 June 2024 (µs/cm)	EC 30 June 2025 (µs/cm)
Dam 3	Dam	9.61	8.76	5,160	3,050
Dam 5	Dam	9.56	8.80	3,440	2,550
Dam 8	Dam	9.41	9.07	4,560	3,380
Calypso Central	Inactive Pit	8.70	8.52	5,820	2,510

Dam 2 EC is closely monitored due to its role in the release (RP1) and management of mine water inventory particularly in preparation for the wet season. Salinity may vary significantly throughout the year due to dilution from rainfall runoff and may be altered through mine water transfers. Dam 2 receives water from the integrated mine water system (which includes Dam 1, the Eastern backbone pipeline, and the Western backbone pipeline).

10.5 Surface Water Management System

10.5.1 Overview

Surface water at DNM is managed in accordance with the following documents:

- DNM Mining Waste Management Plan (WHC, 2025a),
- DNM Water Management Plan (WHC, 2025b), and
- Erosion and Sediment Control Plan (WHC, 2025c).

These documents will be updated for the water management requirements introduced by the Project.

The Project formalises and supplements existing water management infrastructure without expanding the mine water release footprint or altering authorised release conditions.

10.5.2 Surface water management objectives

The water management system at DNM, including the Project, is designed to support operational efficiency while protecting environmental values. The key objectives, as outlined in the WMP (WHC, 2025), are as follows:

- Prevent the release of contaminants into the receiving environment,
- Ensure water resource use does not negatively affect the local and regional environment,
- Separate clean and contaminated waters,
- Capture and treat runoff from disturbed areas in sediment dams for reuse in dust suppression or coal processing,
- Divert runoff from undisturbed areas away from disturbed areas using diversion drains and bunds,
- Establish and maintain a long-term sustainable water balance to minimise risks to the environment and operational activities,
- Maximise water reuse on-site to reduce reliance on external water supplies,
- Fulfil the requirements of the EA EPML00561913, including monitoring and reporting obligations,
- Implement contingency procedures for emergencies,

- Transfer water between dams to optimise usage and reduce the risk of uncontrolled discharges, and
- Use mine-affected water for operational purposes such as dust suppression and coal handling.

10.5.3 Mine water management infrastructure

The proposed and existing MAW storages within the Project Area and DNM is shown in **Figure 10-9**. The mine water management system configuration is summarised in **Table 10-7**.

Inactive in-pit areas will be used for excess mine water storage over the life of mine (LOM) as follows:

- Calypso Central: available between 2025 and 2026.
- Titan North: available between 2027 and 2044.
- Titan East: available between 2030 and 2044.

The following is of note:

- Dam 2 remains the only designated release point, with an outlet pipe facilitating controlled discharge.
- The Project will continue to operate under the current WMS and requires construction of the PW Sed Dam for capturing sediment-laden runoff from the OOPD.
- The construction of the PW MAW Dam is necessitated by the Pandora Pit expansion intersecting with Dam 5 and is required regardless of the OOPD proposal as part of the Project. The PW MAW Dam will intercept MAW from the catchment currently draining to Dam 5. Dam 5 is scheduled for decommissioning in 2031 due to the expansion of Pandora Pit.
- Mining in Pandora Pit is scheduled to commence in 2026.
- Dam 3 and Dam 8 will be continuously dewatered and operated empty between 2025 and 2028, due to mining activities adjacent to these storages. Both dams will be decommissioned in 2028 to allow for the Pandora Pit expansion.
- Dam 5 will be decommissioned in 2031, also due to Pandora Pit expansion.
- Dam 10 is planned for decommissioning in 2041.

Table 10-7 Mine water management system configuration

Storage Name	Storage Capacity (ML)	Maximum Operating Level (MOL)	Online for storage	Offline for storage
Dam 1	118	47	Current	2042
Dam 2	172	104	Current	2042
Dam 3	670	335	Current	2028
Dam 5	855	515	Current	2031
Dam 8	677	610	Current	2028
Dam 10	118	-	Current	2031
Calypso Central	2,560	2175	Current	2027

Storage Name	Storage Capacity (ML)	Maximum Operating Level (MOL)	Online for storage	Offline for storage
Titan North (TNN)	6,000	-	2027	2042
Titan East (TNE)	15,000	-	2030	2042
P Sed Dam	38	-	2026	2042
P MAW Dam	138	100	2027	2042
PW Sed Dam	144	100	2028	2042
PW MAW Dam	513	100	2028	2042

10.5.4 Controlled releases

Controlled releases are permitted under the current EA from Dam 2 (RP1). Dam 2 receives water from the integrated water system (which includes Dam 1, the Eastern backbone pipeline, and the Western backbone pipeline). No changes are proposed to the controlled release conditions as part of the Project.

The Project does not introduce any new mine water release locations and does not alter the existing controlled release framework under Environmental Authority (EA) EPML00561913. Controlled releases will continue to occur solely from Dam 2 (RP1) in accordance with Schedule F of the EA. The PW MAW Dam replaces Dam 5, which is scheduled for decommissioning due to the Pandora Pit expansion, and is required regardless of the OOPD.

10.6 Site Water Balance Assessment

10.6.1 Water Balance Model

A dynamic simulation model (GoldSim) assesses water inventory under varying climatic conditions. The site has sufficient storage capacity to manage water during wet and dry conditions. The forecast WMS inventory is shown in **Figure 10-10**.

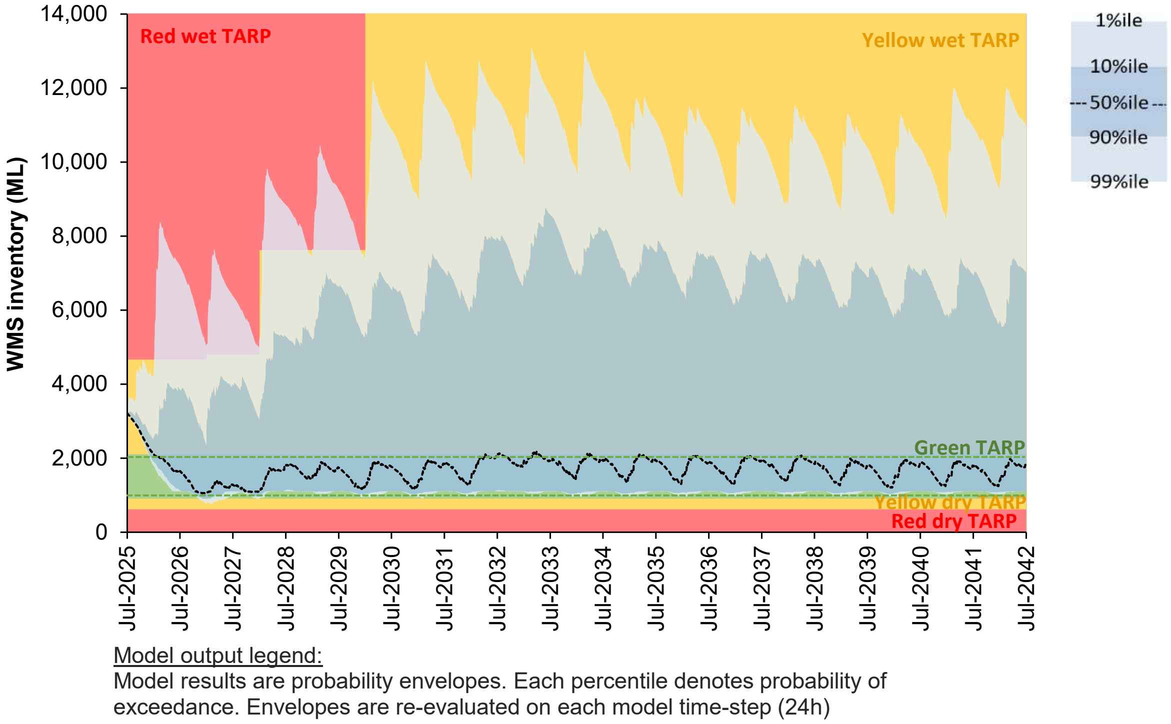


Figure 10-10 Forecast WMS inventory (source: HydroBalance, 2025)

10.6.2 Controlled releases

Releases occur under specific conditions, such as high site inventory and compliance with water quality criteria.

The forecast annual controlled release volumes are shown in **Figure 10-11**. The modelling demonstrates that the implementation of the water management system would mitigate potential impacts of the Project on downstream water quality and the environmental values of the downstream waterway.

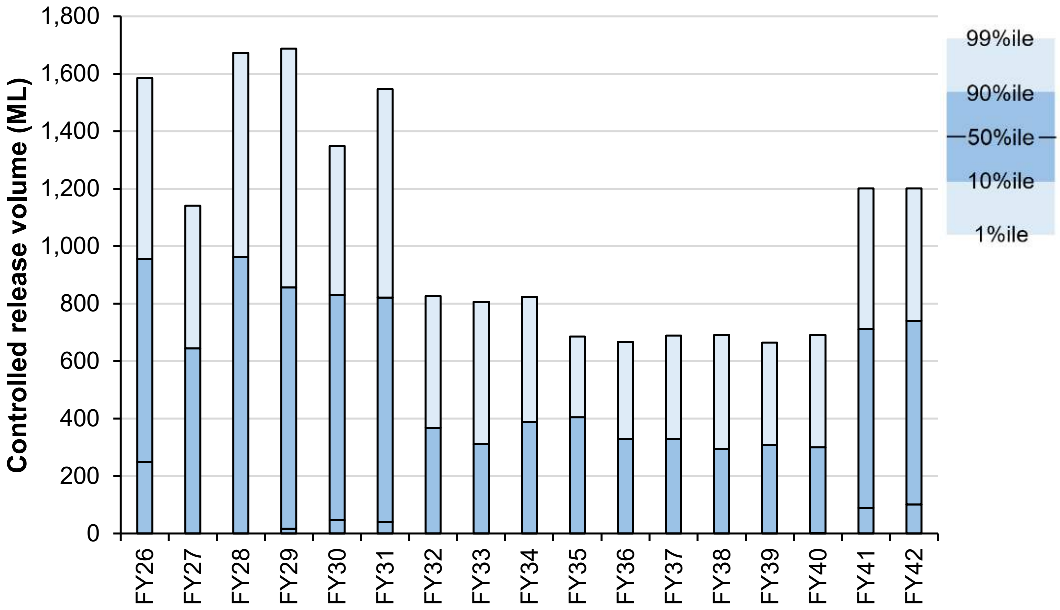


Figure 10-11 Forecast controlled release volumes for the Project (source: HydroBalance, 2025)

10.6.3 Uncontrolled discharges

Water balance modelling indicates that the Project presents a similar risk of uncontrolled discharges to the currently approved Environmental Authority scenario. Replacement of Dam 10 and Dam 5 with the PW Sed Dam and PW MAW Dam forms part of the ongoing reconfiguration of the Water Management System and does not materially increase spill risk. Modelled uncontrolled overflows are limited to wet (10% AEP) and very wet (1% AEP) climatic conditions, with most MAW dams predicted to avoid overtopping entirely, or to overflow only during rare, extreme rainfall events.

High-risk sediment dams are designed to perform to the 10% AEP standard, while MAW dams are designed to the 1% AEP standard. Predicted overflow volumes, where they occur, are episodic and associated with rare climatic extremes. Operational modelling confirms that mine-affected water is prioritised for on-site reuse, that in-pit and out-of-pit storages provide sufficient capacity to manage water inventories under most conditions, and that uncontrolled MAW discharges are only possible during very wet years, with an overall probability of less than 1% AEP.

Overall, the Project water management system provides adequate capacity and operational flexibility to support mining activities while maintaining a low and acceptable risk profile for uncontrolled discharges, consistent with the approved EA and accepted design standards.

10.7 Final Void Water Balance Assessment

10.7.1 Overview

The DNM final landform water balance model (the model), developed using GoldSim software. GoldSim has been extensively used to develop graphically oriented models with developed network logic, including water balances.

The model operates at a daily time step, predicting the water level and the salinity of the water in the void. The probability of these outcomes is driven by probabilistically generated rainfall and evaporation to assess the potential impact on the water and salt balance.

The topographic data used for the assessment included the proposed final landform topographic data (Rev3.1), which incorporates Project infrastructure changes (see **Figure 10-12**).

10.7.2 Climate change

Climate change adjusted rainfall, evaporation and temperature sequences were sourced for the DNM from the Government SILO Consistent Climate Scenarios (CCS) project, which transformed historical climate data from the period of 1960 to 2023. The climatic sequences produced by the Q5 v.3 Quantile Matching method were selected. These climatic sequences were processed in the Stochastic Climate Library to produce 250 iterations (realisations) of daily data over 500 years.

The model applies climate change projection SSP2-4.5 as the base scenario, with sensitivity analyses for SSP1-2.6 and SSP5-8.5.

10.7.3 Void water levels

- Residual voids will act as groundwater sinks, with water levels stabilising below overflow levels as follows:
- Titan North: Median water levels range from 138.8 m AHD to 139.4 m AHD over 500 years (**Figure 10-12**),
- Titan Central: Water level remains constant at approximately 192.2 m AHD (**Figure 10-12**),
- Titan East: Water level slightly increases from 118.8 m AHD to 121.1 m AHD (**Figure 10-12**), and
- Pandora Void: Water level rises from 70.6 m AHD to 94.8 m AHD, with a mean increase of 2.8 m compared to the approved EA (**Figure 10-12**).

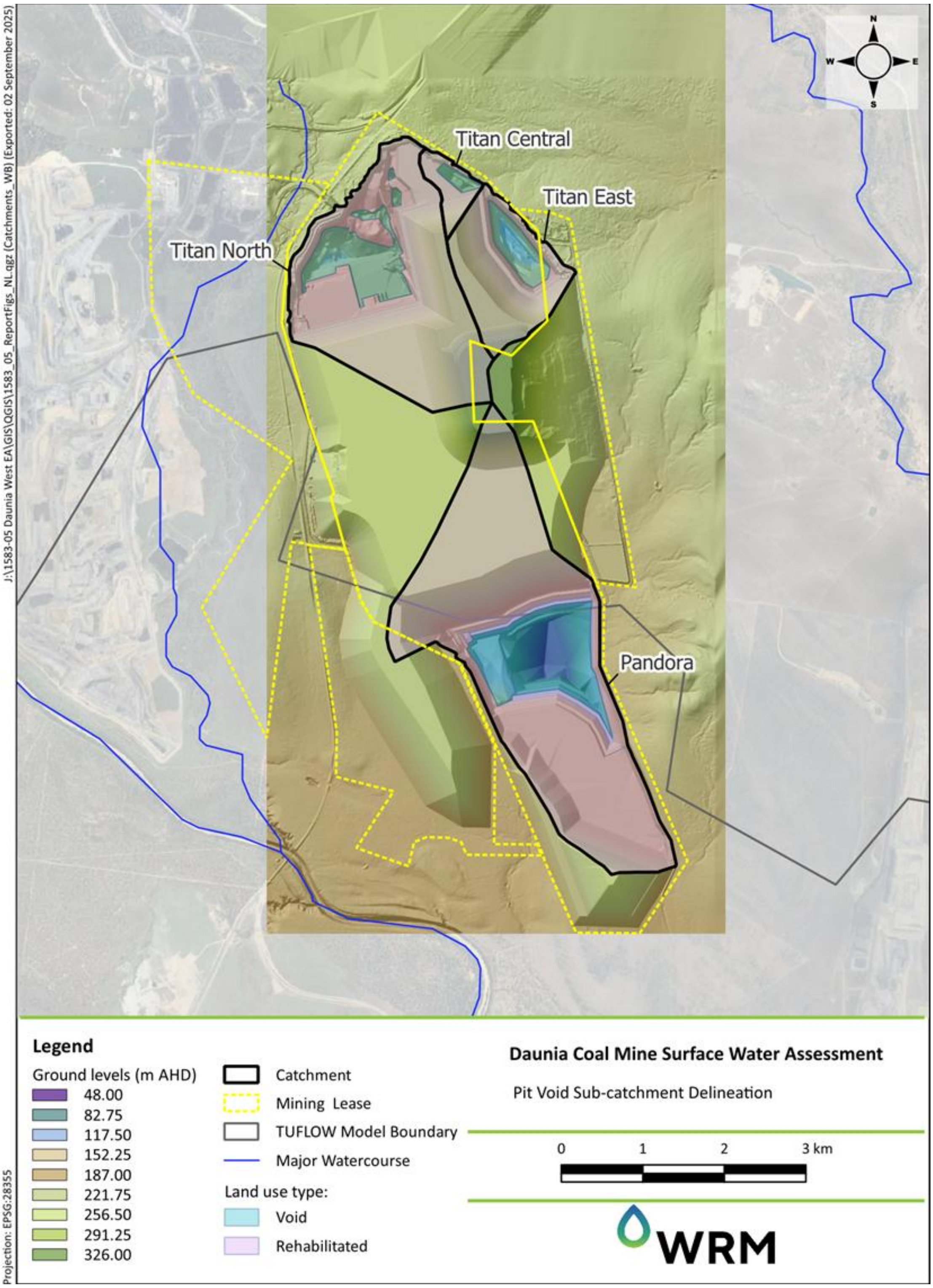


Figure 10-12 Project final landform and pit void sub catchment delineation

10.7.4 Final void average inflows/outflows

Results show that the void water levels will eventually reach an approximate equilibrium, acting as an evaporative sink, with all dissolved salts concentrating over time. The base climate change projection (SSP2-4.5) was run for 250 realisations and 500 years, from 2045 to 2545.

DNM final landform voids capture seepage originating from groundwater recharge into spoil emplacements surrounding open voids. Stored water within the northern voids (Titan North, Titan Central, and Titan East) typically seeps into the surrounding spoil material, which ultimately seeps toward the lower-lying Pandora void. Pandora void acts as a groundwater sink, collecting this seepage and losing water through evaporation.

Groundwater modelling confirms that lake levels within these voids will remain well below shallow aquifers, with sufficient freeboard to prevent external discharge. The regional groundwater levels in the vicinity of the DNM show a general northwest to southeast decline in elevation, with local drawdown in the immediate vicinity of active mine pit voids. Regional groundwater flow is predominantly towards the southeast, consistent with the direction of the Isaac River.

Further details relating to the modelled inflows, outflows, evaporation and final void water levels and salinity concentrations are provided in **Appendix C**.

10.8 Flood Impact Assessment

10.8.1 Hydrologic and hydraulic modelling

Design discharges and flood behaviour were assessed under existing, approved EA, and proposed Project conditions, incorporating climate change factors. TUFLOW model configuration shows the current state of the site and surrounding floodplain (**Figure 10-13**).

The configuration under the approved EA conditions, which includes the approved final landform and levees for adjacent mine sites is presented in **Figure 10-14**. The configuration under the proposed Project conditions, which incorporates the Project's final landform design is presented in **Figure 10-15**.

10.8.2 Flood risk assessment

The proposed final landform provides sufficient freeboard to prevent flooding of residual voids and infrastructure during extreme events as follows:

- **Figure 10-16** and **Figure 10-17** show the predicted peak flood extents, depths, and velocities for the 0.1% AEP event for the existing conditions,
- **Figure 10-18** and **Figure 10-19** show the predicted peak flood extents, depths, and velocities for the 0.1% AEP event for the approved EA,
- **Figure 10-20** and **Figure 10-21** show the predicted peak flood extents, depths, and velocities for the 0.1% AEP event for the proposed Project post-mining conditions, and
- **Figure 10-22** and **Figure 10-23** show the predicted change in peak flood levels and velocities, respectively, under proposed Project conditions compared to approved EA conditions, for the 0.1% AEP event.

The model results show that, with consideration for predicted future (year 2100 climatic conditions):

- Localised flooding around the southern end of the OOPD for events up to 5% AEP include changes in peak flood levels less than +0.1m and changes in peak flow velocities less than +0.1 m/s. These changes do not materially change the extent or characteristics of flooding, the geomorphic characteristics of New Chum Creek or the Isaac River, nor materially adverse effect on adjacent landholders (Poitrel or Winchester mines) or nearby infrastructure (the railway line),
- Predicted flooding impacts for events from 0.1% AEP (inclusive) extend upstream to the New Chum Creek confluence and the Poitrel Mine site, including at the railway. However, predicted changes in peak levels are minor (up to about +0.2 m at Poitrel, and between +0.02 m to +0.07 m along the already overtopped railway). Changes in peak velocities are confined to the area downstream of the railway, between the Project site and the adjacent Winchester mine, and are generally less than +0.1m/s. Impacts such as these would not have a materially adverse impact on adjacent landholders (Poitrel or Winchester mines) or nearby infrastructure (the railway line). Neither would these impacts materially change the flooding or geomorphic characteristics of New Chum Creek or the Isaac River, and
- The proposed OOPD configuration does not increase the risk of pit inundation for the approved EA conditions final void, with the proposed final void configuration remaining flood free for events up to and including the PMF.

10.9 Water Management Risk Mitigation

The Project introduces minor changes to the hydrologic and hydraulic characteristics of the DNM site. Potential surface water management risk and mitigation are summarised below and further detail is provided in **Appendix C**.

10.9.1 Local catchment flows

The Project would result in minor changes to local catchment flows due to adjustments in drainage patterns associated with the OOPD. These changes are confined to an unnamed second-order drainage feature within the Isaac River floodplain that functions as an active flood channel and discharges to the Isaac River approximately 6 km downstream of the Project site.

Rainfall–runoff modelling indicates that the Project would reduce mean annual flow volumes within this drainage feature from approximately 394 ML/a to 275 ML/a, consistent with a reduction in contributing catchment area from 23.8 km² to 16.6 km². Flow frequency and duration are not materially altered, with flow events continuing to occur approximately 6 to 7 times per year, and an average event duration of around 13 days.

Overall, the Project is expected to reduce total runoff volumes while maintaining existing flow frequency and duration characteristics. These changes are localised, hydrologically minor, and would not result in adverse impacts to downstream waterways or the hydrologic behaviour of the Isaac River.

10.9.2 OOPD Flood Risk and Mitigation

Flood risk to the OOPD was assessed under extreme events, including the 0.1% AEP and Probable Maximum Flood (PMF), considering flood depths, inundation extent, flow velocities and erosion potential to determine the stability of the rehabilitated final landform at closure.

Hydraulic modelling indicates that, during the 0.1% AEP event, inundation is largely confined to the Isaac River floodplain, with interaction limited to the lower toe of the rehabilitated landform. Under PMF conditions, flood extents increase across the floodplain; however, interaction with the landform remains localised at the toe, with no widespread inundation of upper landform surfaces.

Modelled flood velocities adjacent to the rehabilitated landform are consistently lower than those in the centre of the floodplain. Higher velocities are restricted to established flood flow paths that do not directly interact with rehabilitated surfaces. Comparison with IECA (2008) maximum allowable velocity criteria shows that velocities at the landform interface remain below 2.1 m/s for grassed, vegetated surfaces for all events up to and including the 0.1% AEP.

Erosion risk assessment confirms that the proposed landform is expected to remain stable under extreme flood conditions, with design measures to support long-term erosion resistance and minimal maintenance at closure.

10.9.3 Proposed Erosion and Sediment Control Measures

The Project represents a minor modification to existing operations through the formalisation and inclusion of additional erosion and sediment control (ESC) and mine-affected water (MAW) management infrastructure required to support the OOPD and ongoing mine development. Key components include the Pandora Sediment Dam (P Sed Dam) and the Pandora West Sediment Dam (PW Sed Dam) for the passive capture of sediment-laden runoff, together with the Pandora MAW Dam (P MAW Dam) and the Pandora West MAW Dam (PW MAW Dam) to maintain mine water storage capacity.

The Project does not introduce new external release points and does not expand the overall MAW footprint beyond what would otherwise occur under approved operational requirements. Instead, it formalises the location, function and management of ESC and MAW infrastructure that would be required to support ongoing mining activities.

Mine-affected water used for dust suppression is managed within the existing Water Management System and Erosion and Sediment Control Plan. MAW is sourced from authorised storages and applied only in designated areas such as haul roads and stockpiles, where runoff can be effectively intercepted and contained. Engineered controls, including berms, diversion drains and containment bunds, prevent runoff from MAW application areas from entering natural drainage lines or ESC structures not designed to receive MAW. Application rates are managed to minimise ponding and off-site runoff.

Routine inspection and maintenance of sediment controls, MAW storages and associated infrastructure are undertaken to ensure ongoing performance, with inspections prioritised before and after wet-season rainfall events.

10.9.4 Preliminary Consequence Category Assessment

A preliminary consequence category assessment (CCA) (the assessment) has been completed for the following proposed sediment and MAW dams:

- P Sediment Dam;
- PW Sediment Dam;
- P MAW Dam; and
- PW MAW Dam.

The assessment evaluated failure scenarios for these dams based on seepage, overtopping, and dam break scenarios, and assigned a preliminary consequence category for each dam in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (the DETSI Manual) (DETSI, 2025). Active water management strategies are recommended to minimise environmental harm and manage contaminated water.

The mining lease application area is north of the Isaac River, downstream of New Chum Creek (see **Figure 10-24**). **Figure 10-24** shows the locations and catchment areas for the proposed dams and runout paths considered for dam-break or operational overflow scenarios.

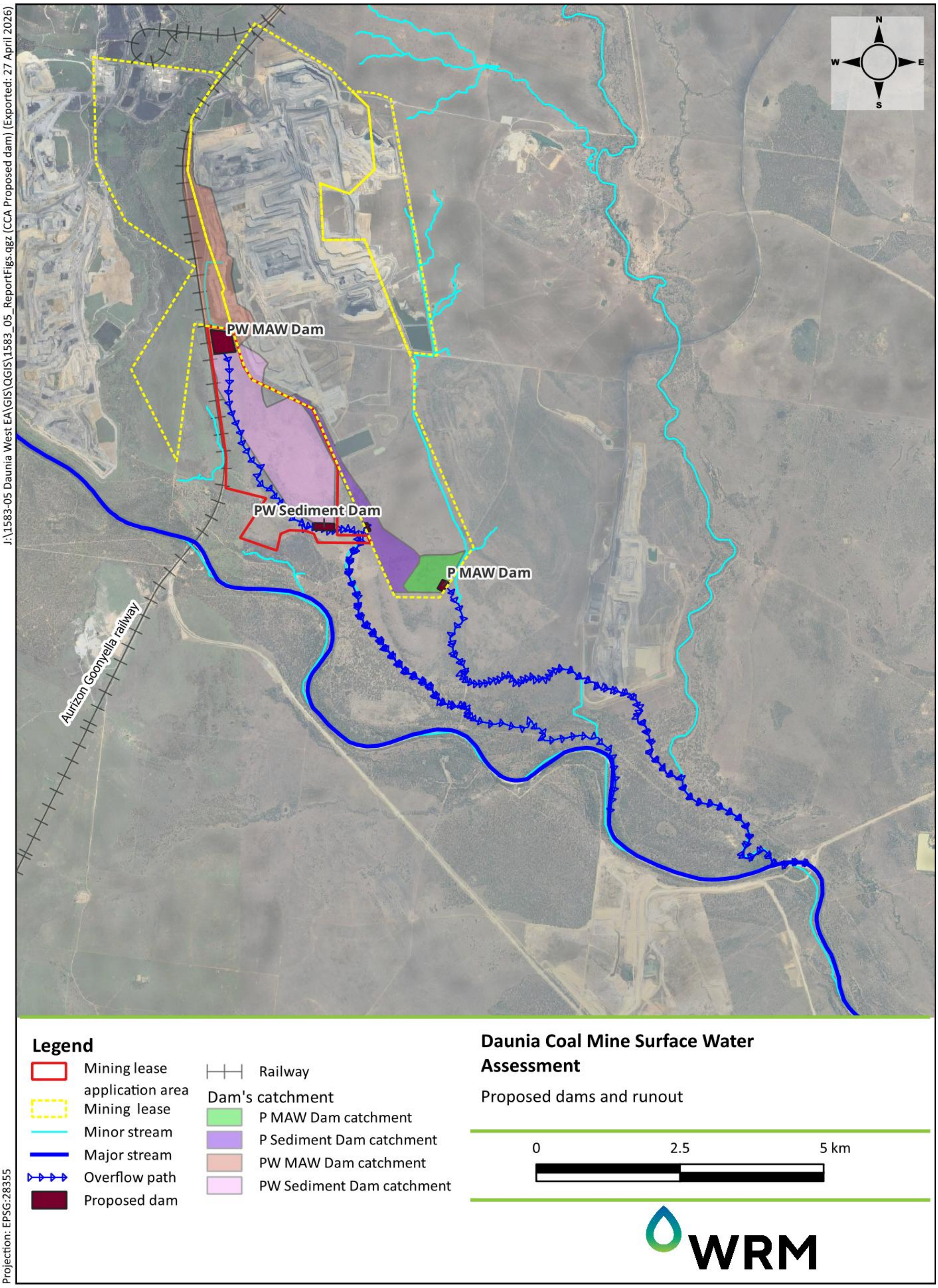


Figure 10-24 Proposed dams and runout

Table 10-8 presents the assessment outcomes, identifying the preliminary consequence category determined for each assessed dam and the likely regulated status. The assessment results are based on the concept design, the intended operational strategy and expected contaminant concentrations for the proposed dams.

Table 10-8 Summary of the preliminary consequence category assessment

Dam / Structure	Harm to Humans	General Environmental Harm	General Economic Loss or Property Damage	Overall Consequence Category	Regulated Structure
PW Sediment Dam	Low	Low	Low	Low	No
P Sediment Dam	Low	Low	Low	Low	No
P MAW Dam	Low	Low	Low	Low	No
PW MAW Dam	Low	Low	Low	Low	No

Detailed engineering design and construction documentation will be prepared during the next design phase, defining hydrologic, hydraulic and geotechnical criteria, freeboard, erosion protection and operational performance requirements in accordance with Queensland regulatory guidance and contemporary dam engineering practice. Design hydrology will be undertaken in accordance with Australian Rainfall and Runoff and sediment dams will be designed using risk-based erosion and sediment control principles appropriate to their catchment classifications.

Construction methods, quality assurance procedures and scheduling will be developed to suit site conditions and mine sequencing, with consideration of wet-season risk management. All designs will be reviewed and certified by suitably qualified Registered Professional Engineers of Queensland prior to construction. A full CCA will be completed at detailed design, once final storage configurations and spillway arrangements are confirmed.

10.9.5 Controlled release strategy

Controlled release of MAW is currently authorised under the EA. Releases shall only occur in compliance with the EA release conditions to ensure no environmental impacts from MAW to the receiving environment. Within the New Chum Creek catchment, controlled release of MAW can occur (in compliance with the EA release conditions) at “Licensed Discharge Points” RP1 (Dam 1), as shown in **Figure 10-5**.

The Project would not change the controlled release strategy; as such, controlled releases would continue to be undertaken in accordance with the EA release conditions.

10.9.6 Uncontrolled release risk and mitigation

Water balance modelling indicates that the Project presents a similar risk of uncontrolled releases to the currently approved Environmental Authority scenario, with operations continuing under the existing Water Management System. Predicted overflow likelihoods for sediment and MAW dams are expressed in terms of Annual Exceedance Probability (AEP) and are confined to extreme wet conditions.

A comprehensive suite of mitigation measures has been adopted to minimise the likelihood and consequences of uncontrolled releases and to protect downstream environmental values. These measures integrate engineering design controls, active operational water management, routine monitoring and inspection, and provision of contingency storage, ensuring compliance with Environmental Authority conditions and dam safety requirements.

Mine-affected water is fully contained within the site water management system, with runoff directed to approved MAW storages or pit voids and no planned releases unless EA criteria are met. Temporary or sacrificial pit storage may be utilised during extreme rainfall periods to maintain freeboard, supported by automated pumping systems and real-time monitoring. MAW dams are conservatively sized and designed to limit overtopping to rare events, with controlled overflow pathways, defined Mandatory Reporting Levels and emergency response procedures in place.

In the unlikely event of an uncontrolled release during extreme rainfall, impacts are expected to be short-term and localised, with dilution provided by large downstream catchments. Overall, the adopted controls demonstrate that uncontrolled release risks are low, appropriately managed, and consistent with accepted engineering practice and regulatory requirements.

10.9.7 Project Water Quality

The Project is unlikely to substantially affect the quality of surface waters in receiving environments. Key findings comprise:

- The additional disturbance footprint associated with the Project Area will increase the volume of sediment water that needs to be contained and managed at DNM. It is unlikely that overflows from sediment dams will have a measurable impact on the quality of the receiving waters,
- Analysis of water quality data from the Isaac River indicates that several parameters consistently exceed regional default guideline values (DGVs). These include dissolved aluminium, copper (total and dissolved), iron (total and dissolved), zinc (dissolved), filterable reactive phosphorus, turbidity, and total suspended solids (TSS), and
- Variability in water quality parameters is primarily influenced by natural enrichment and seasonal changes, rather than mining activities (Gauge, 2023).

Existing water quality monitoring programmes demonstrate compliance with regulatory standards and facilitate early detection of potential issues, which was assessed adequate for the Project.

Existing water quality monitoring programs demonstrate compliance with relevant regulatory standards, provide early detection of potential water quality issues and are therefore considered adequate for the Project. Identified data gaps will be addressed through ongoing monitoring, with future programs focusing on the systematic collection of sodium and salinity data across a range of flow conditions. This approach will support progressive refinement of baseline conditions and long-term trend assessment in accordance with ANZG (2018).

10.9.8 Great Barrier Reef Water Quality

A Great Barrier Reef (GBR) water quality assessment was undertaken to address the requirements of Section 41AA of the Environmental Protection Regulation 2019 and the Reef discharge standards for industrial activities. The Project is located within the Fitzroy Basin, approximately 600 km upstream of the GBR, as shown in **Figure 10-25**. The assessment focused on potential indirect impacts associated with fine sediment (FS) and dissolved inorganic nitrogen (DIN) transported via surface water runoff and releases.

Figure 10-25 Map of the Great Barrier Reef Region, Marine Park and World Heritage Area (Commonwealth of Australia, 2024)

Surface water from the Project drains to the Isaac River, a tributary of the Fitzroy River system. The Project would permanently excise approximately 15.6 km² of the contributing catchment through by the development of the residual voids, representing around 0.4% of the Isaac River catchment upstream of the site. This change is small and is not expected to materially alter downstream flow volumes or hydrologic behaviour.

Water quality monitoring indicates that nitrate concentrations in the Isaac River downstream of the Project remain below Environmental Authority trigger values, while suspended sediment concentrations display high natural variability associated with flow conditions in the Isaac River. A simplified load assessment indicates that the reduction in contributing catchment area would result in a small decrease, rather than an increase, in annual sediment and nutrient loads exported from the catchment.

The Project does not introduce new release locations, does not increase authorised discharge volumes, and does not increase the frequency, duration, or contaminant concentrations of releases. Existing surface water management measures, including capture and reuse of mine-affected water and controlled releases in accordance with Environmental Authority conditions, would continue unchanged. Post-mining, internal drainage of residual voids further limits the potential export of FS and DIN.

Accordingly, the Project is not expected to result in a residual impact to GBR catchment waters as defined under Section 41AA of the Environmental Protection Regulation 2019 and is consistent with the Reef discharge standards and the objective of no net decline in GBR water quality.

10.9.9 Final Void Management

The Project final landform will include residual voids that function as groundwater sinks. Key considerations include:

- The expansion of the Pandora catchment area from 715.4 ha to 827.4 ha will result in increased surface water runoff into the final void. This adjustment, coupled with catchment excision and the final landform design, is projected to raise the mean water level in Pandora Pit void by approximately 2.8 m, reaching 94.8 m AHD,
- Void water levels will be influenced by groundwater inflow, rainfall, runoff, and evaporation, with equilibrium levels expected below overflow levels,
- Salinity will increase over time due to evapoconcentration,
- Disturbed areas will be rehabilitated to stabilise landforms and improve water quality, and
- Potentially reduce void catchment area through rehabilitation and runoff diversion away from the void.

10.9.10 Monitoring

A comprehensive management and monitoring program was developed to ensure the long-term sustainability under varying hydrologic conditions at DNM:

- Flood monitoring: regular monitoring of flood behaviour and infrastructure performance during extreme events,
- Water quality monitoring: Routine sampling and analysis of surface water to ensure compliance with the DNM EA,
- Infrastructure maintenance: Periodic inspections and maintenance of drainage systems, levees, and sediment basins, and
- Climate change adaptation: Continuous evaluation of climate change impacts and implementation of adaptive measures as needed.

The existing water management and monitoring regime for the approved EA would be continued for the Project with ESC as appropriate. Key elements of surface water management and monitoring include:

- The Water Management Plan (WMP) will be reviewed and updated in accordance with DNM EA,
- Management of erosion and sediment control through implementation of the ESC Plan,
- Surface water monitoring would continue in accordance with the WMP. Current monitoring locations are sufficient to cover Project disturbance,
- Regular inspections and maintenance of dams, pipelines, and sediment control structures, and
- Real-time monitoring of controlled release volumes.

10.9.11 Water Management Plan

An updated WMP will be prepared for the Project, subject to the conditions of the EA.

The WMP will be updated to describe the operational water management system and include provisions for review of the site water balance, erosion and sediment controls, surface water (and groundwater) monitoring and management. The updated WMP will describe the water management protocols and response procedures for the water management system that would be adhered to throughout the operation of the Project.

The existing WMP for DNM outlines several policy recommendations to mitigate water quality impacts as follows:

a) Risk Management:
   i. Conduct risk assessments to identify potential environmental risks, including impacts from salts, metals, aquifer contamination, and water management associated with mining activities, and
   ii. Implement controls to mitigate risks, documented in the DNM risk register and tested during the Critical Control Monitoring (CCM) process.

b) Water Management System:
   i. Separate clean and contaminated water using diversion drains and sediment dams,
   ii. Maximize water reuse on-site to minimise releases and reliance on external water sources,
   iii. Use sediment dams to settle suspended solids and ensure water quality before discharge, and
   iv. Install coalescent plate oil-water separators to manage hydrocarbon contamination.

c) Saline and Acid Rock Drainage Management:
   i. Encapsulate hostile materials with benign spoil during rehabilitation,
   ii. Direct drainage to retention dams for reuse in mine activities, and
   iii. Conduct ongoing water quality monitoring of storages and pits.

d) Monitoring and Measurement:

i. Implement a comprehensive water monitoring program, including dam safety inspections, groundwater and surface water quality monitoring, and weather tracking,

ii. Use automated telemetry, in situ probes, and lab analysis for water quality monitoring, and

iii. Regularly review monitoring data to ensure compliance with legal conditions and environmental standards.

e) Water Balance Model:

i. Maintain and update a water balance model to assess storage capacity and water movements on-site, and

ii. Use the model to identify risks and optimise water management strategies.

f) Training and Awareness:

i. Provide environmental awareness training to employees, contractors, and visitors, and

ii. Ensure personnel understand their roles, responsibilities, and the consequences of poor environmental performance.

g) Reporting:

i. Notify regulators within 24 hours of environmental incidents or emergencies, and

ii. Report performance against monitoring programs and compliance requirements.

h) Contaminant Management:

i. Conduct leachate testing of overburden, ore, and waste materials to predict potential water contamination, and

ii. Implement measures to manage saline drainage, acid rock drainage, and bio-accumulative contaminants.

The implementation of these recommendations is considered sufficient to manage and mitigate risks to surface water as a result of the Project.

11.0 Groundwater

11.1 Introduction

A groundwater impact assessment has been undertaken to assess the potential impacts of the Project on groundwater resources. This assessment has included development of a conceptual hydrogeological model (CHM); numerical groundwater modelling; and an assessment of the potential risks posed by the OOPD to the groundwater environment and associated receptors.

The full Groundwater Impact Assessment and Technical Modelling Report are provided in **Appendix D** and **Appendix E**, respectively. For references included in this chapter refer to the relevant appendix.

11.1.1 Scope and Objectives

To assess the potential impacts on groundwater the following tasks have been completed:

- Development of a hydrogeological conceptual model focusing on the area of the proposed OOPD and its immediate surrounds including:
  - A review of the geological, hydrogeological, and hydrological setting, groundwater levels and groundwater chemistry.
  - A review and appraisal of local groundwater values (groundwater users, potential groundwater dependent ecosystems (GDEs)).
  - A description of the location, extent, form, and likely properties (hydraulic and geochemical) of the OOPD.
  - A review of previous hydrogeological studies for DNM.
- A predictive numerical modelling exercise assessing the potential risks to the local groundwater environment from the OOPD including an assessment of hydraulic gradients and potential contaminant migration pathways, in the context of the surrounding mining activity.
- An assessment of predicted impacts from the OOPD to potential groundwater receptors.

Development of the (CHM and assessment of baseline conditions was undertaken in accordance with the Queensland government requirements and the EPBC Act "Water Trigger".

Groundwater modelling was undertaken in accordance with the Australian Groundwater Modelling Guidelines (Barnett et al., 2012) and Murray Darling Basin Commission guidelines (Middlemis et al., 2001). The numerical model used is an existing, detailed, regional model previously developed for DNM and other nearby operations, and which includes current details of all the mining operations surrounding Pandora Pit and the proposed OOPD.

11.2 Underground Water Rights

Section 227AA of the EP Act stipulates that an applicant must provide the information required by Section 126A of the EP Act where the application is for a resource activity or project and the amendment involves changes to the exercise of underground water rights.

As the Project involves the addition of a new tenure and Whitehaven Daunia propose to exercise underground water rights, this EA Amendment Application must provide the information required under Section 126A of the EP Act.

The relevant information is provided in the following sections of this Chapter, as well as in **Appendix D** and **Appendix E**.

Table 11-1 identifies the location of the required information, consistent with Table 1.1 of the Queensland Government guideline *Requirements for site-specific and amendment applications—underground water rights* (ESR/2016/3275).

Table 11-1 Underground water rights information required under Section 126A of the EP Act

Application Requirement	*Environmental Protection Act 1994*	Summary Response	Location of Further Information
A statement that the applicant proposes to exercise underground water rights	Section 126A(2)(a)	Whitehaven Daunia proposes to exercise underground water rights in association with the Project.	**Section 11.2**
A description of the area/s in which underground water rights are proposed to be exercised	Section 126A(2)(b)	The area in which underground water rights are to be exercised occurs within the Isaac River sub-basin and comprises predominantly shallow, low-yield groundwater systems in Quaternary alluvium and underlying regolith, overlying deeper confined coal seam aquifers of the Permian coal measures. Groundwater occurrence is generally limited or absent in the alluvium and tertiary sediments, with groundwater in the underlying Permian strata being compartmentalised by faulting and moving via coal seams. Recharge is primarily derived from rainfall infiltration with occasional Isaac River flows / flooding recharging the alluvium. Regional groundwater flow is toward the south-east.	**Section 3.2** **Section 11.4** **Appendix D:** • **Section 2.2;** • **Section 4.2**
A description of the aquifer/s affected or likely to be affected	Section 126A(2)(c)(i)	**Appendix D** identifies three principal hydrogeological units that may be impacted by the Project. These are summarised as follows: • Shallow Isaac River Alluvium (Unconfined Aquifer): Occurs directly southwest of the Project where it is thin and dry and extends along the NW-SE orientated Isaac River. It comprises heterogeneous sands, silts, clays and gravels and supports local receptors including groundwater-dependent ecosystems and nearby water supply bores.	**Section 11.4** **Appendix D:** • **Section 4.2** • **Section 5.1**

Application Requirement	*Environmental Protection Act 1994*	Summary Response	Location of Further Information
		• Tertiary–Quaternary Sediments / Regolith (Shallow Unconfined Unit): This unit underlies the Project Area and consists of weathered bedrock, colluvium and older alluvial deposits. It is generally of low permeability and often only partially saturated. • Permian Coal Measures (semi-confined): The deeper groundwater system includes the Rangal Coal Measures (notably the Leichhardt and Vermont seams) and underlying Fort Cooper Coal Measures. The more permeable coal seams are confined and compartmentalized due to low permeability interburden and structural faulting.	
An analysis of the movement of underground water to and from the affected or potentially affected aquifer/s	Section 126A(2)(c)(ii)	**Section 11.4.6** of this document and **Sections 5.3** and **5.4** of **Appendix D** analyse the groundwater flow, recharge and discharge of relevant aquifers.	**Section 11.4.6** **Appendix D:** • **Section 5.3** • **Section 5.4**
A description of the area of the aquifer where the water level is predicted to decline because of the exercise of underground water rights	Section 126A(2)(c)(iii)	Water level is not predicted to decline because of the exercise of underground water rights associated with the Project.	**Section 11.9** **Appendix D:** • **Section 8.0**

Application Requirement	*Environmental Protection Act 1994*	Summary Response	Location of Further Information
The predicted quantities of water to be taken or interfered with because of the exercise of underground water rights	Section 126A(2)(c)(iv), noting that EP Act requires take for life of the project is required.	The Project does not propose to take underground water. The predicted changes in groundwater fluxes due to the exercise of underground water rights are summarised as follows: • Increase by 0.09 megaliters per day (~1 L/s) of flux to alluvium along the affected reach of the Isaac River. • Groundwater mounding is predicted to increase groundwater levels by around 16 m within the regolith beneath the OOPD, and up to 5 m in the Isaac River alluvium southwest of the Project Area. • Groundwater mounding extends up to approximately 6 km downstream and 4 km upstream in the alluvium. • Predicted increase of up to approximately 0.03L/s in baseflow to the Isaac River, following flood events which recharge the alluvium. • Changes in Permian coal seam aquifers are minimal, with low hydraulic conductivity (<10^{-4}m per day in interburden) limiting vertical and lateral movement.	**Section 11.9** **Appendix D:** • **Section 8.0**
Information on predicted impacts to the quality of groundwater that will, or may, happen because of the exercise of underground water rights	Section 126A(2)(e)	Groundwater quality impacts are predicted to be low, localised and not significant at receptors, and can be summarised as follows: • Seepage from the OOPD is expected to be alkaline with low acid-generating potential, with some elevated metals indicated in testing. • Substantial dilution occurs during groundwater transport, with concentrations reduced by	**Section 11.9.4** **Appendix D:** • **Section 8.4**

Application Requirement	*Environmental Protection Act 1994*	Summary Response	Location of Further Information
		approximately 33 to100 times at nearby bores and 200 to 650 times by the time groundwater reaches the Isaac River. • In shallow aquifers (alluvium and regolith), only minor and localised changes in parameters such as salinity and alkalinity are expected. • Deep coal seam aquifers are unlikely to be affected, due to low permeability layers and limited hydraulic connectivity. • Overall, predicted groundwater quality changes are minor, would only occur over the very long term, and are below relevant guideline values at identified receptors.	
Information on the environmental values that will, or may, be affected by the exercise of underground water rights	Section 126A(2)(d)	The EVs relevant to the Project are defined under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* for Isaac Groundwaters within the Fitzroy Basin. These values reflect the beneficial uses and ecological functions of groundwater in the Project Area and can be summarised as follows: • Ecological values: o Maintenance of the biological integrity of aquatic ecosystems, including groundwater-dependent ecosystems (e.g. riparian vegetation and intermittent waterholes associated with the Isaac River). • Human use values: o Irrigation and agricultural use	**Section 11.4** **Appendix D:** • **Section 2.2.2** • **Section 5.5.2**

Application Requirement	*Environmental Protection Act 1994*	Summary Response	Location of Further Information
		○ Farm water supply and stock watering ○ Primary recreation (where relevant) ○ Drinking water supply (noting local groundwater is generally unsuitable without treatment) ○ Cultural and spiritual values associated with water resources.	
Information on strategies for avoiding, mitigating or managing the predicted impacts on the environmental values or predicted impacts on the quality of groundwater	Section 126A(2)(f)	**Section 11.10** presents a monitoring and management strategy that is commensurate to the assessed potential impacts to groundwater EVs.	**Section 11.10** **Appendix D:** • **Section 9.0**

11.3 Geology

11.3.1 Regional Geology

DNM is located in the northern part of the Bowen Basin, a foreland sedimentary basin of approximately 200,000 km^2 referred to as the Collinsville Shelf (**Figure 11-1**). The Bowen Basin is orientated north-northwest to south-southeast and contains the largest coal reserves in Australia. The southern half of the Bowen Basin is covered by the Surat Basin, and the Galilee Basin is present to the west (Geoscience Australia, 2017).

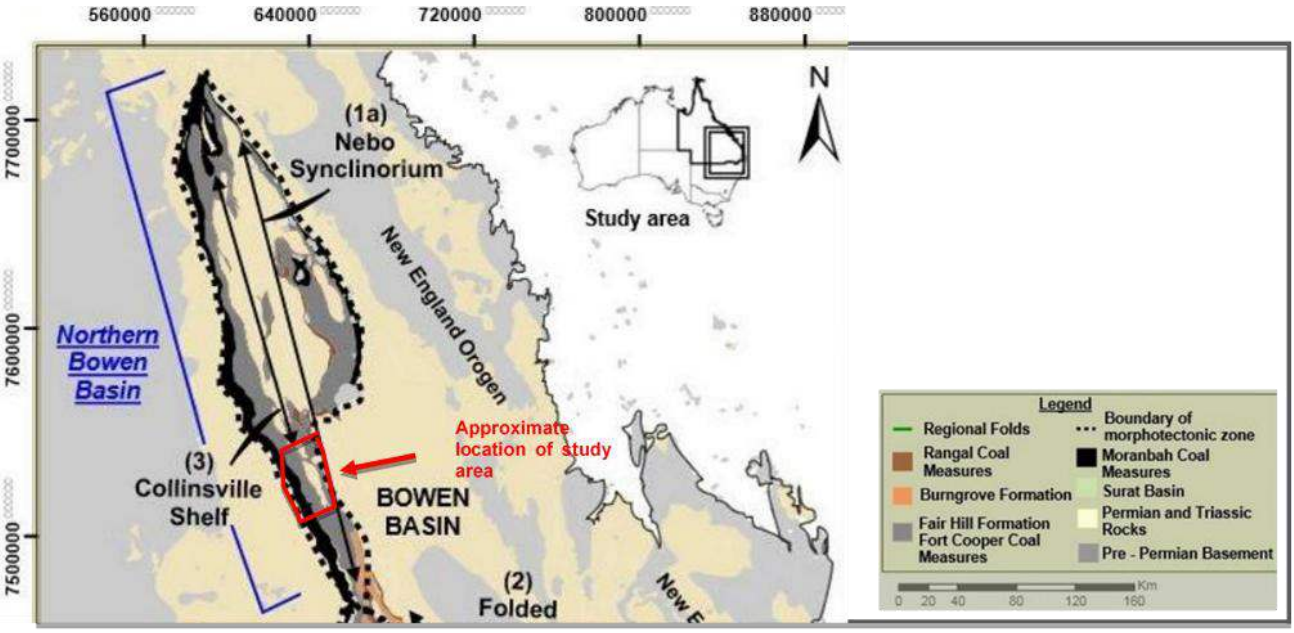


Figure 11-1 Structural Setting of the Bowen Basin (after Dickins and Malone, 1973

Basin geology within the Collinsville Shelf includes the basal Permian aged Back Creek Group, which typically comprises fine-grained clastic sedimentary rocks. The Back Creek Group is conformably overlain by the Blackwater Group, which includes the Moranbah Coal Measures, Fort Cooper Coal Measures and Rangal Coal Measures. The economic seams at DNM are contained in the Late Permian Rangal Coal Measures. The Permian strata outcrop on the eastern and western edges of the Basin and are unconformably overlain by Triassic sedimentary rocks of the Rewan Group.

The Permian and Triassic units are covered by a thin veneer of unconsolidated to semi-consolidated Cenozoic sediments (Tertiary to Quaternary alluvium and colluvium). The alluvial sediments are localised along rivers and creeks. Volcanic intrusions and extrusions are also present within the region.

The generalised regional stratigraphy is summarised in **Table 11-2**. The surface geology is shown in **Figure 11-2**, and geology **Figure 11-3**.

Table 11-2 Regional Stratigraphy

Period		Stratigraphic Unit		Description	Distribution	Max Thickness (m)
Cenozoic		Isaac River Quaternary alluvium (Qa)		Flood plain alluvium comprising clay, silt, sand, and gravel.	Surficial cover localised along Isaac River and North Creek.	~ 50 m
Cenozoic		Regolith - alluvium, colluvium and other sediments in floodplains, alluvial fans, and high terraces (Qr, Qr\b and TQa)		Colluvial and residual deposits comprising poorly sorted clay, silt, sand, gravel and black soils, silts and muds derived from weathered basalts.	Surficial cover throughout the Project.	~ 20 m
Cenozoic		Suttor Formation (Tu)		Mudstone, sandstone, conglomerate, siltstone, oil shale, lignite, and basalt.	Present to south and east of Study Area.	~100 m
Triassic		Mimosa Group	Clematis Group (Re)	Cross-bedded quartz sandstone, some quartz conglomerate and minor red-brown mudstone.	Isolated outcrop to the south-east of the Project.	~100 m
Triassic		Mimosa Group	Rewan Group (Rr) (Rewan Formation and Sagittarius Sandstone)	Rewan Formation: green lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerate (at base). Sagittarius Sandstone: lithic sandstone interbedded with mudstones and siltstones with scattered carbonaceous plant material.	Outcrops or subcrops within the Study Area, and central and northern zones of the Project.	~840
Permian	Late	Blackwater Group	Rangal Coal Measures (Pwj)	Coal seams, carbonaceous shale and mudstone, tuff, siltstone, and mudstone.	Within Project Area; isolated Outcrops in the central and northern zones of the Project.	~200
Permian	Late	Blackwater Group	Fort Cooper Coal Measures (Pwt) (Fair Hill Formation)	Coal, brown and green sandstone, conglomerate, carbonaceous shale, tuff.	Within Project Area; Outcrops or subcrops in central and northern zones of the Project.	~350
Permian	Late	Blackwater Group	Moranbah Coal Measures (Pwb)	Quartzose to sublabile locally argillaceous sandstone, siltstone, mudstone, carbonaceous mudstone, and coal.	Within/underlies the Project; Outcrops or subcrops in the west of the Study Area.	~ 400
Permian	Early to	Back Creek Group (Pb)		Quartzose to lithic sandstone, siltstone, carbonaceous shale, minor coal and sandy coquinite.	Within/underlies Project; Outcrops in the west of the Study Area.	~400

11.3.2 Local Geology

11.3.2.1 Cenozoic Sediments

Surface geology mapping shown in **Figure 11-2**, indicates that Tertiary to Quaternary aged sediments are present across the area of Pandora Pit, the OOPD and along the flood plain of the Isaac River. These deposits typically comprise a heterogeneous distribution of unconsolidated clay, silt, sand, and gravel and are generally less than 20 m thick. The transition from Tertiary to Quaternary sediments is often difficult to define such that the Quaternary and Tertiary units is often taken to form a single unconsolidated sedimentary unit.

Isaac River Alluvium (Quaternary)

Quaternary alluvium is present along the course of the Isaac River in a broad tract between 1.5 km to 2 km wide to the south-west of DNM, becoming wider downstream. The flood-plain alluvium typically comprises clay, silt, sand and gravel (**Figure 11-2** symbolised as Qa), and is typically less than 20 m thick (AGE, 2013).

Figure 11-2 indicates that the mapped extent of the Isaac River Alluvium extends just beneath part of the southwestern margin of the OOPD footprint. There is limited data for monitoring bores within the Isaac River Alluvium in the vicinity of the Project. Poitrel Mine monitoring bore OBS8 shown in **Figure 11-5**, is located approximately 2 km south-west of the proposed OOPD and directly adjacent to the Isaac River (east bank), recorded 8m of alluvium comprising clay and sandy clay.

The heterogeneous distribution of alluvial sediments associated with the Isaac River was also characterised by AGE (2020) for the Isaac Downs project (located 10 km upstream from Daunia on the north side of the Isaac River) in the same geological setting. AGE (2020) describe a highly heterogenous alluvial system, with deeper paleochannel systems incised into the bedrock. Towards the edge of the alluvial plain, away from the current main channel the sediments mainly comprise clay and silt associated with floodplain deposits.

Other Quaternary and Tertiary Sediments

Surface geology mapping shown in **Figure 11-2** indicates that the surficial material covering the area of Pandora Pit and the OOPD comprises older higher level Tertiary-Quaternary alluvium (TQa). Beyond the higher level alluvial deposits, areas of Quaternary colluvium and are present.

Beneath the Tertiary-Quaternary alluvial and colluvial deposits weathered Permian strata make up the lower portion of the regolith above unweathered bedrock. In the vicinity of DNM, the Permian units are highly weathered to an average depth of 25 m BGL. In recent groundwater studies (e.g. HydroSimulations 2018, SLR 2019, 2020 & 2021b) the Quaternary sediments are grouped with the unconsolidated Tertiary units and the weathered bedrock and collectively termed “regolith”, as they are essentially regarded as functioning as a single hydrogeological unit, and there is limited data to accurately spatially separate these units into separate layers within the numerical model.

11.3.2.2 Triassic Strata

The Triassic aged strata include the Rewan Group (Rr), which unconformably overlies the Permian coal measures sub cropping on the northeastern boundary of the DNM mining lease. It also subcrops to the west of DNM as a result of faulting and deformation of the Permo-Triassic strata. The Rewan Group comprises Late Permian to Early Triassic strata with pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerates.

11.3.2.3 Permian Coal Measures (Blackwater Group)

Permian coal-bearing sedimentary rocks of the Blackwater Group form the main economic resource of the numerous mines in the Study Area. In order of increasing age (top to bottom), the major coal measures in the area of the Project are:

- Rangal Coal Measures (Pwj);
- Fort Cooper Coal Measures (Pwt); and
- Moranbah Coal Measures (Pwb).

Rangal Coal Measures (RCM)

The economic coal resources at DNM (as well as at the adjacent Poitrel Mine, Moorvale South Mine, Olive Downs Mine and Winchester South Project) are contained within the ~100 m thick Rangal Coal Measures (Pwj), which is underlain by the Fort Cooper Coal Measures and overlain to the north-east by the Rewan Group. The Late Permian RCM comprise light grey, cross-bedded, fine to medium grained labile and well cemented sandstones, grey siltstones, mudstones, shale and coal seams.

The Leichhardt and Upper Vermont Seams are the target seams within the RCM at DNM. The Leichhardt Seam (DL1) is typically 5 m thick and the Upper Vermont Seam (DV4) typically 3.5 m thick at DNM. These two seams are separated by approximately 10 m to 35 m of siltstone and sandstone interburden. In the north of DNM, the Upper Vermont Seam splits into upper and lower plies (DV2 and DV1 respectively).

Across Pandora Pit, directly east of the Project Area, the Permian coal measures form a syncline with a north-west south-east axis. Within this syncline the Leichhardt and Vermont seams reach maximum depths of approximately 115m and 140m respectively below natural surface. A schematic geological cross section is presented in **Figure 11-4** and the section line is shown on **Figure 11-3**.

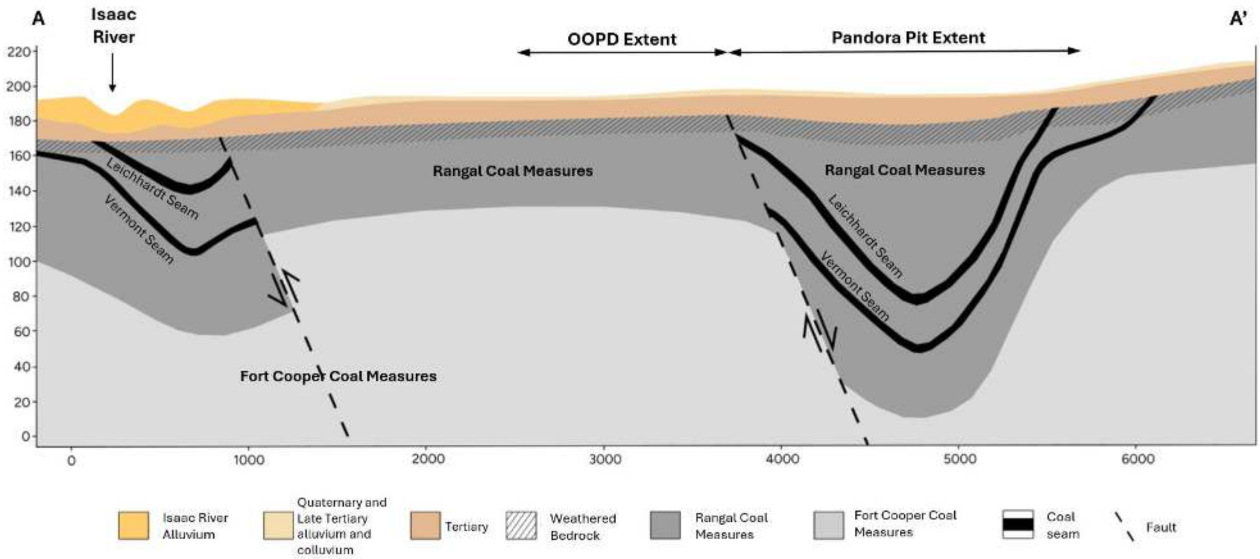


Figure 11-4 Schematic geological cross section through the DNM South

Fort Cooper Coal Measures (FCCM)

The FCCM (Pwt) underlie the RCM at DNM, and subcrop along the northwestern boundary of DNM. Regionally, the FCCM have a maximum thickness of approximately 350m. The FCCM comprise lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff and tuffaceous mudstone.

The transition between the RCM and the FCCM is marked by the Yarrabee Tuff, which immediately overlies the Lower Vermont Seam (**Figure 11-4**). The Yarrabee Tuff is a basin-wide marker bed comprised of weak, brown tuffaceous claystone, with a thickness ranging from 0.5 m - 1.5 m at DNM.

Moranbah Coal Measures

The Moranbah Coal Measures (Pwb) are the lowermost coal-bearing sequence of the Blackwater Group. They subcrop on the western limb of the Bowen Basin, and are mined at Caval Ridge Mine, Peak Downs Mine and Saraji Mine located to the far west of DNM. The Moranbah Coal Measures comprise volcanic lithic sandstones, with lesser siltstone, mudstone, conglomerate and coal. Their depth in relation to DNM mining activities means the Moranbah Coal Measures are not relevant to this groundwater assessment.

11.3.3 Structural Geology

The Bowen Basin was subject to significant tectonic compression from the east at the end of coal deposition in the late Triassic. This compression caused major thrust faulting, which resulted in the commercial viability of mining the coal deposits across the region. DNM is located within the regional Western Foreland structural domain of the Bowen Basin, located approximately 20 km west of the Jellinbah Fault Zone. Fault throws up to and exceeding 100 m are associated with these regional scale structural features.

The Permian coal measures at DNM have been subject to significant regional deformation and faulting. DNM is affected by numerous normal and reverse faults (BHP, 2019), with some major northwest-southeast trending faults (i.e. New Chum Fault and Eastern Fault Alignment), and minor southwest-northeast trending faults (SLR, 2017). These major faults result in the FCCM / RCM / Rewan sequence repeating at surface (or subsurface), from west to east in the vicinity of DNM.

Igneous intrusions have also been mapped within the region, with a large granite intrusion located approximately 1.7 km east of the northern DNM Area. Drilling in the DNM Area has also identified intrusive igneous rock present at the southern end of ML 1781, not identified in Queensland Government geological mapping.

11.4 Hydrogeology

11.4.1 Introduction

The key hydrogeological units at DNM relevant to the Project are:

- Cainozoic sediments and weathered strata:
    - Quaternary alluvium – unconfined aquifer where saturated (water-bearing strata of permeable unconsolidated sand or gravel with interlayered clays and silts) localised along Isaac River, and
    - Quaternary to Tertiary colluvium and weathered Permian coal measures (collectively ‘regolith’) – unconfined and largely unsaturated unit extending beneath the alluvium (where present) and across the OOPD footprint and Pandora Pit.
- Permian coal measures (unweathered) with:
    - Low permeability interburden (mudstone, siltstone) with aquitard properties, and
    - Coal seams with higher permeability due to secondary porosity (cleats and fissures).

The coal seams within the RCM can be characterised as confined fractured rock aquifers, with the Leichhardt Seam and combined Vermont Seams being the main aquifer units within the Project Area. The overburden above the Leichhardt Seam, including the Triassic-aged Rewan Group where present, generally acts as an aquitard.

Significant structural faulting associated with the Jellinbah Thrust System occurs at DNM and within the surrounding area and has a significant influence on the regional groundwater system. Field investigations have found that the major structural features are effectively barriers to groundwater flow perpendicular to the faults. The major faults that repeatedly truncate the lateral east-west extent of the Permian units to both the west and east of DNM result in hydrogeological compartmentalisation of the Permian groundwater system.

11.4.2 Local Groundwater Monitoring Network

The current and historic groundwater monitoring network at DNM comprises a total of 35 monitoring bores (13 active, 22 inactive or decommissioned).

The DNM monitoring network was first established in 2009 following the submission of the DNM EIS in 2008 (BMA, 2008). Groundwater level monitoring and water quality sampling is currently undertaken on a quarterly basis at 13 monitoring bores:

- RCM coal seams – 4 bores; 3 in the Vermont seam and 1 in the Leichhardt seam,
- RCM interburden – 5 bores including 1 landholder bore (BMB),
- FCCM coal seams – 1 bore,
- FCCM interburden – 2 bores, and
- Tertiary sediments – 1 bore.

Current and historic monitoring bores at DNM are shown in **Figure 11-5**.

Fifteen monitoring bores (MB01 to MB18) were installed in 2012 as part of hydrogeological studies undertaken to support future mining in the south of the DNM Area. These bores were monitored for groundwater levels between September 2012 and August 2013 (AGE, 2013) to support the early development of the mine but were not used at long term monitoring bores.

11.4.3 Other Projects

Groundwater monitoring data from two bores (OBS2, OBS8) located to the west of DNM on the eastern margin of the Poitrel mine monitoring bore network have been included in the numerical model calibration dataset for DNM which sits within a large regional groundwater model incorporating surrounding mines. Monitoring data from mines across the whole model domain including those neighbouring DNM (Poitrel, Winchester South, Olive Downs, and Moorvale South), are included in the regional model calibration.

11.4.4 Hydraulic Properties

DNM hydraulic testing of strata includes slug (rising and falling head) tests performed on DNM monitoring network bores completed in 2008 (BMA, 2008), in 2012 (AGE, 2013) and in 2021 (BHP, 2021). In addition, an extensive database of hydraulic testing data for the wider region is also available from neighbouring mine sites through WHC's regional data sharing agreement.

11.4.4.1 Hydraulic Conductivity Ranges

A histogram of horizontal hydraulic conductivity data (Kh) derived from field testing at DNM, as well as at other nearby Bowen Basin coal mines in the same geological setting, is presented in **Figure 11-6**. The results are compared to the range of values for each unit as presented within a literature review previously completed by HydroSimulations (2018) based on a number of other studies within the Bowen Basin.

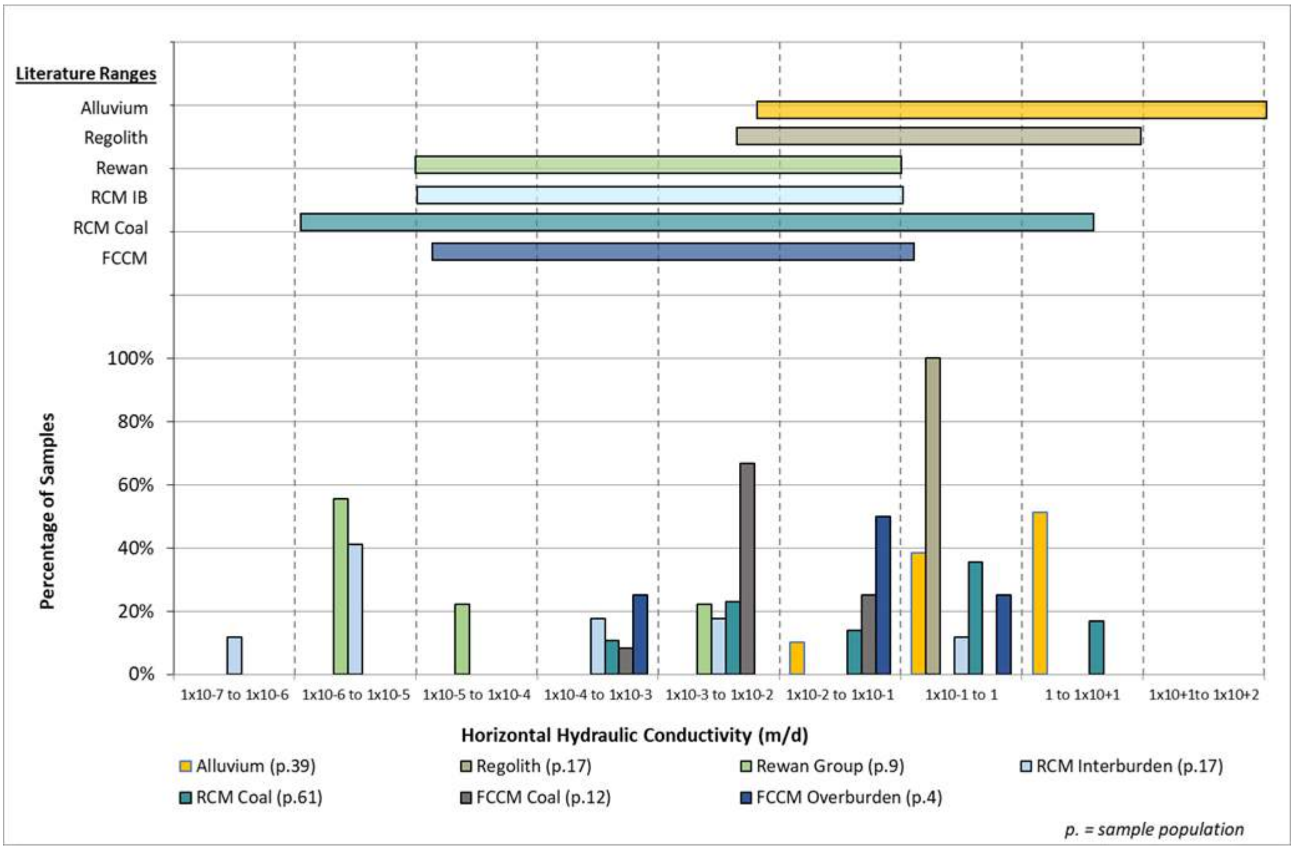


Figure 11-6 Histogram of Horizontal Hydraulic Conductivity Distribution

The comparison shows that field testing values for alluvium, regolith, Rewan Group, RCM, FCCM and MCM at the DNM and the surrounding area fall within the range of field data collected through other studies across the Bowen Basin.

11.4.5 Faulting

There are numerous faults trending northwest-southeast within Permian strata across DNM and surrounding area.

As identified by Jourde et al. (2002), faulting can result in higher permeabilities within strata parallel with the fault plane, and lower permeabilities within strata perpendicular to the fault plane. However, this can also be dependent on whether faults are currently active (Paul et al., 2009). Faulting has been inactive within the Bowen Basin for over 140 million years (Clark et al., 2011), indicating that the fault zones are less likely to act as conduits to flow; this is due to filling of the fractured pore spaces over time through hydrothermal alteration and mineralisation (Uysal et al., 2000).

Hydrogeological field studies completed in the south of the DNM Area found variable groundwater flows indicating groundwater compartmentalisation across the site. AGE (2013) concluded that displacement of Permian strata by faulting has formed hydraulic barriers due to the vertical offset of the more permeable horizons, rather than enhanced groundwater movement. The barrier effect is most evident in an east-west direction i.e., perpendicular to the dominant fault strike directions.

11.4.6 Groundwater Flow, Recharge and Discharge

11.4.6.1 Quaternary and Tertiary Sediments

The Quaternary-aged Isaac River Alluvium comprises unconsolidated clay, silt, sand, and gravel generally less than 20 m in thickness (AGE, 2013) and is present to the southwest of the proposed OOPD. Older Quaternary and Late Tertiary sediments extend across the footprint of the OOPD and Pandora Pit.

There are no groundwater monitoring bores within the Isaac River Alluvium to the south-west of the proposed OOPD and Pandora Pit. However, a Poitrel Mine groundwater monitoring bore (OBS8) screened in the alluvium is located approximately 3 km west-northwest (i.e. up hydraulic gradient) of the OOPD on the north bank of the Isaac River. Groundwater monitoring at OBS8 was limited (due to it often being recorded as dry) and ceased in 2017. Similarly, DNM bores MB20DNM05A_R01 and MB02A, installed within unconsolidated Quaternary-Tertiary sediments, were both recorded as ‘dry’ during the limited period when they were monitored in 2021. This information suggests limited or sporadic saturation of the shallow unconsolidated sediments.

Data is available from three Winchester South shallow monitoring bores (Knob Hill 1 & 2, and Winnet bore – **Figure 11-5**). These bores are situated on the southern bank of the Isaac River and show groundwater level ranges between 0.5 m and 5 m below the adjacent Isaac channel invert level. Early data for Knob Hill 2 from 2012 shows levels typically 1m higher than the rest of the record just in excess of the adjacent channel invert level. Groundwater levels in these bores range between approximately 14 mbgl to 15 mbgl. Given the general interpreted thickness of the unconsolidated sediments not exceeding 20 m in proximity to DNM, these results suggest very limited saturation of the alluvium.

The DNM alluvial bores MB20DNM05A and MB02A located on the south-west side of Pandora Pit (**Figure 11-5**) have always been recorded as dry and the Poitrel monitoring bore OBS8 is understood to be monitored irregularly after being found to be dry following installation. Therefore, it is possible that the Isaac River Alluvium (and potentially also the underlying older Tertiary sediments) is largely dry in the immediate vicinity of DNM and the Project Area.

Recharge and Discharge

Recent groundwater modelling for DNM PRCP (SLR, 2025a), indicates that the Isaac River acts as a recharge source generating a low hydraulic gradient away from the river to the east towards the proposed OOPD and Pandora Pit. Recharge will occur mostly via leakage of flow into the underlying / adjacent alluvium during river flow events and occasional inundation of the flood plain. Direct infiltration of rainfall to the alluvium will also occur where there are no substantial barriers (clay layers) in the shallow subsurface.

Recharge rates to the Tertiary-Quaternary sediments were estimated using chloride mass balance (CMB) calculations (SLR, 2021) based on available groundwater quality data collected from monitoring bores within the area of DNM. CMB recharge rates ranged from 3 mm to 0.1 mm a year.

Calibrated recharge values used in the numerical model are generally lower for the alluvium (0.2 mm/yr – 0.4 mm/yr for the Isaac River Alluvium) and were derived using the AWRA-L climate model's simulated deep drainage values with multipliers.

Groundwater within the Isaac River alluvium discharges as evapotranspiration from riparian vegetation along the Isaac River, as well as potential short term baseflow contributions after major recharge / flood events. There will also be a general downstream (east-southeast) movement of groundwater along the alluvium at times when there are longer reaches of saturated alluvium. Alluvial groundwater will also leak to the underlying strata although this will be limited by the low hydraulic conductivity of these formations (i.e., claystone, siltstone, fine sandstone).

11.4.6.2 Permian Coal Measures

Groundwater within the Permian coal measures is confined and sub-artesian. Groundwater level trends for DNM monitoring bores screened in the Permian Coal Measures are presented in **Figure 11-8** and **Figure 11-9**. For context, the DNM mining progression is presented in **Figure 11-7**.

Leichhardt and Vermont Seams

Groundwater levels are presented in **Figure 11-8** the Vermont Seam monitored in the north of DNM (PZ06 and PZ08) show responses that do not appear to be obviously linked directly to mining or recharge. PZ06 shows large responses possibly linked to recharge / high rainfall in early 2017 and through 2022 followed by short term recessions, however groundwater level increases are also observed in this bore through the long period of lower than average rainfall from 2018 to 2021.

PZ08 in the north-east of DNM shows steady groundwater level for the first 4 years of monitoring followed by an increase in levels of 5m in early 2023. This increase through a period of average rainfall may be due to a combination of pressure loading from the waste rock placement immediately to the west and higher recharge through the waste rock compared to the pre-mining surface.

MB19DNM01P and MB19DNM02P are paired bores screened in the Leichhardt and Vermont seams respectively, in the south of DNM away from mining activity in the north. The relatively short monitoring record for these bores shows a small and consistent downward vertical gradient from the Leichhardt to the Vermont seams.

Permian Interburden

Hydrographs for Permian coal measures interburden/overburden are presented in **Figure 11-9**.

PZ01, PZ05 and MB20DNM01P_R01 are located in the north of the DNM Area, in close or relatively close proximity to the currently active mining voids. PZ05 and MB20DNM01P_R01 show decreasing trends which are likely related to a combination of mining activity and possibly also recession from higher levels associated with periods of higher rainfall / recharge. The record for PZ01 mostly spans a period of significantly increased rainfall which may explain the increasing trend in this bore

BMB is a landholder supply bore located 4km east of the DNM mining lease that is monitored as part of DNM's EA. Recorded groundwater levels in this bore are heavily influenced by landholder extraction. The maximum recorded levels appear to show a declining trend in the order of 6-7 m over the 11 year monitoring record. However, given the distance of this bore from the site it is not considered to be impacted by mining activity at DNM.

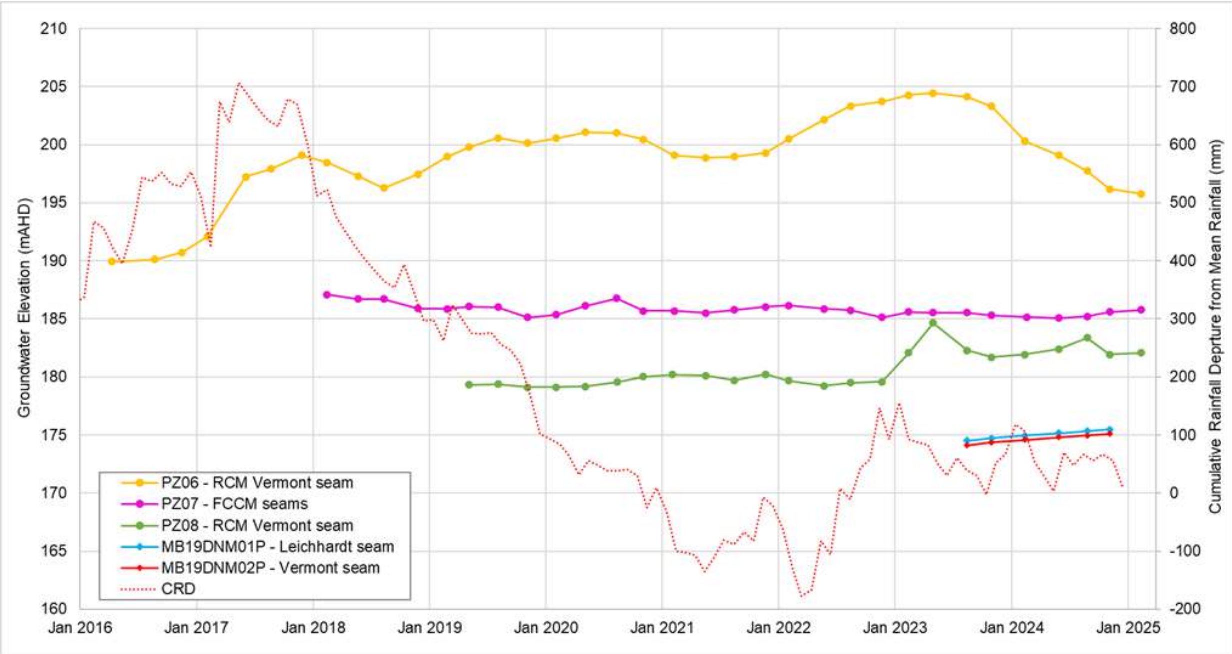


Figure 11-8 Leichhardt and Vermont Seams - Monitoring Bore Hydrographs

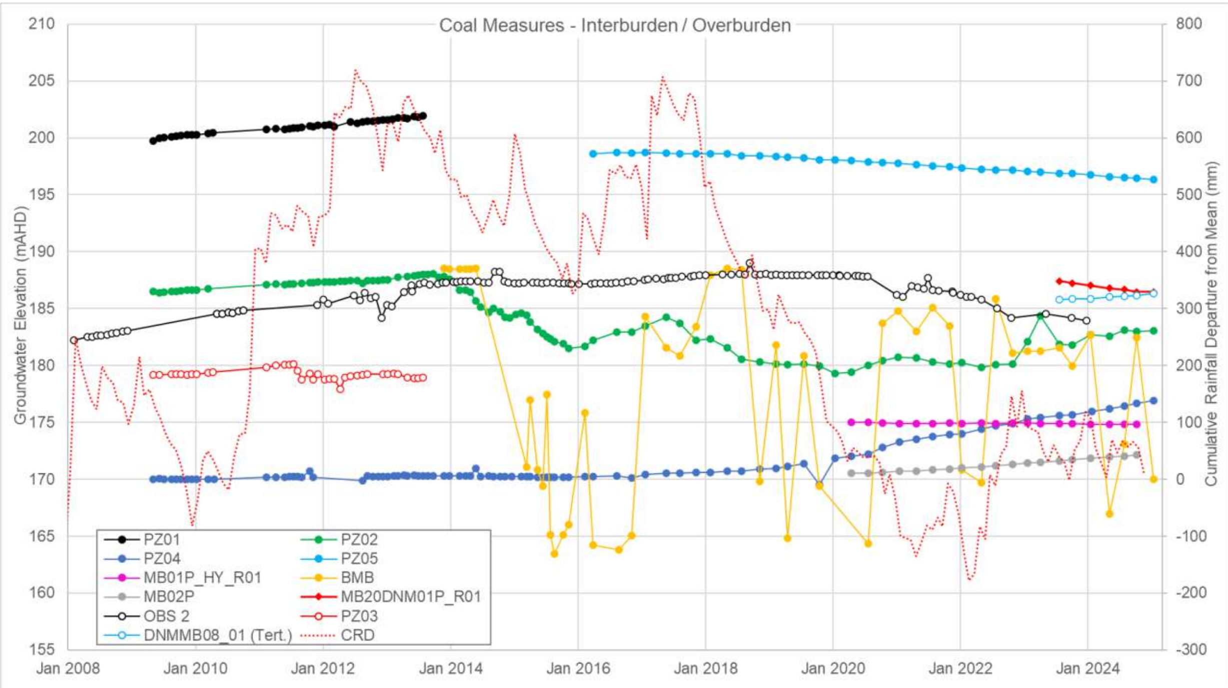


Figure 11-9 Permian Coal Measures (non coal) Monitoring Bore Hydrographs

The general lack of obvious / significant groundwater level drawdown response to mining activity within most Permian coal measures monitoring bores at DNM is indicative of very low hydraulic conductivity, and/or compartmentalisation of the groundwater system by faulting. Some indication of groundwater level increases in response to mining and surface activity (restoration and waste rock placement) may be evident. Possible, and generally limited mining impacts are observable in PZ06, PZ05, OBS2 and MB20DNM01P_R01.

Groundwater levels in the Permian Coal Measures show a general northwest to southeast decline in elevation (**Figure 11-10**), with local drawdown in immediate vicinity of the active mine pit voids as expected, whilst regional flow remains towards the southeast.

11.4.7 Groundwater Quality

11.4.7.1 Water Type

Groundwater quality at DNM is dominated by Na and Cl within both the coal seams and the coal measures interburden. Higher relative proportions of Ca and Mg are seen in some bores, but Na is the dominant cation.

There are no alluvium monitoring bores at DNM, however samples from the Isaac River Alluvium collected from Moorvale South mine monitoring bores located to the southeast of DNM reflect fresher Na-HCO_3 type groundwaters due to sporadic river flows recharging the alluvium with fresher water.

11.4.7.2 Groundwater Use (Environmental Values)

Groundwater resources in the DNM area are scheduled under the EPP Water and Wetland Biodiversity as Isaac Groundwaters of the Isaac River Sub-basin of the Fitzroy Basin water plan (WQ1310). The legislated environmental values (EVs) for these groundwaters are:

- Biological integrity of aquatic ecosystems,
- Human use EVs:
  - Suitability of water supply for irrigation,
  - Farm water supply/use,
  - Stock watering,
  - Primary recreation,
  - Drinking water supply, and
  - Cultural and spiritual values.

The EPP Water and Wetland Biodiversity provides water quality objectives (WQOs) for the scheduled EVs in WQ1310. WQOs are long-term goals for water quality management and the purpose of the WQOs is to support and protect EVs. They are 20th, 50th and 80th percentile concentrations for a range of metals and non-metal parameters. Where groundwater quality exceeds a WQO for a particular EV, it is considered indicative that the groundwater may be unsuitable for that EV.

To understand groundwater quality with respect to the scheduled EVs in the vicinity of the Project, available groundwater quality data from DNM have been compared to the following EV guidelines:

- **Groundwater Quality Objectives for Isaac Groundwaters (Zone 34) (DEHP 2011)** – long-term goals for water quality management within the Isaac River Sub-basin of the Fitzroy Basin to support and protect EVs, for both “shallow” and “deep” groundwater,
- **Livestock drinking water guidelines (ANZECC, 2000)** – the high salinity of local groundwater in the Permian makes it generally unsuitable for potable supply, but it may be suitable for livestock watering,
- **Australian Drinking Water Guidelines (NHMRC, NRMMC 2011)** – it is unlikely that the local groundwater in the Permian strata would be regarded as suitable for drinking without treatment (based on salinity alone), but the drinking water guidelines provide a useful benchmark for the evaluation of background groundwater quality in the Project Area, and
- **Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)** – these guidelines provide for the protection of fresh and marine water habitats. The guideline value selected from this guidance is for slightly to moderately disturbed freshwater systems

and the 95% species protection value (99% species protection for Se and Hg). These guideline values may be considered relevant to the protection of the Isaac River.

The WQ1310 WQOs for groundwater at DNM and the guidelines referenced above have been used to evaluate groundwater quality data for the bores currently monitored at DNM (screened within coal seams or coal measures interburden). In addition, water quality statistics for leachability tests undertaken on coal measures waste rock samples collected from DNM between 2008 and 2022 (Terrenus, 2025), were reviewed as a very approximate guide to potential water quality within the OOPD. However, it should be noted that spoil leachability tests are a poor proxy for understanding the potential quality of water within the OOPD as these tests are likely to overestimate the leachable concentrations of substances from the waste rock.

11.4.7.3 Salinity / Total Dissolved Solids

Salinity is a key constraint to water management and groundwater use and can be described by total dissolved solids (TDS) and electrical conductivity (EC).

DNM monitoring bores screened within the Quaternary-Tertiary unconsolidated sediments have been dry since installation and therefore representative alluvium groundwater samples have not been collected at DNM. However, data for the wider area shows that water within the alluvium is typically fresh to saline with an average TDS of 556 mg/L, but ranging up to 5,620 mg/L. These concentrations of TDS indicate that alluvial groundwater, where it is present, would typically be suitable for watering livestock. Groundwater within the deeper regolith, where present, is generally highly saline but can be brackish to moderately saline with an average TDS of 7,101 mg/L and ranging between 1,110 mg/L and 18,600 mg/L.

TDS in the coal seams is high with the median value for the coal seam samples significantly exceeding the mid-range guideline for most stock with the exception of sheep. The median coal seam TDS also exceeds or equals the upper range guideline for all but sheep, the most salinity tolerant livestock.

The median TDS for coal measures interburden samples is significantly lower that for the coal seams but exceeds the upper end of the mid-range guideline for stock with the exception of sheep, and sits within the upper guideline range, for all but the most salinity sensitive livestock (poultry).

11.4.7.4 Comparison to Guideline Values

Livestock drinking water guidelines – excluding salinity, none of the guideline values for stock watering are exceeded by the DNM groundwater samples from the RCM coal or interburden bores.

Australian Drinking Water Guidelines – groundwater in the Permian coal measures at DNM is unsuitable for drinking water supply primarily based on salinity/TDS, but there are several other occasional exceedances of the guideline values for iron and SO_4.

Water Quality Objectives – Isaac Groundwaters (Zone 34) - Permian groundwater samples exceed the WQOs for EC, calcium, chloride, iron, magnesium, sodium, and HCO_3 for shallow and deep aquifers, suggesting that broadly that groundwater quality in the Permian coal measures at DNM does not support the identified EVs for this region.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018) – 95% species protection – there were no exceedances of these guidelines by median DNM groundwater quality where the analytical suite included the parameters for this guideline.

11.4.7.5 Leachability Tests (Terrenus, 2025)

Leachability tests undertaken on coal measures samples from DNM provide a very approximate guide for the quality of water seeping through the OOPD. The test data comprised leachate from 125 samples of predominantly coal measures interburden with 14 samples containing >10% coal.

The 1:5 w:v (solid:water) deionised water leach procedure was used to measure soluble metals/metalloids on fine pulps of these samples. The use of fine pulped materials (very high surface area) in water extract tests enables a high level of dissolution and therefore may overestimate the potential for dissolution of elements into water seeping through the proposed OOPD. However, many analytes were below detection limits for most samples:

Livestock drinking water guidelines – the RCM leachate samples were significantly below these guideline values with the exception of selenium.

Australian Drinking Water Guidelines – the RCM leachate samples exceed pH at the 50th and 80th percentile; arsenic at the 50th and 80th percentiles, and molybdenum and selenium at the 80th percentile.

Water Quality Objectives for Isaac Groundwaters (Zone 34) - The leachate samples exceed pH, but no other parameters.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018) – 95% species protection. The leachate test samples exceeded aluminium, molybdenum, selenium and zinc at the 80th percentile, and arsenic at the 50th and 80th percentiles.

With regard to a comparison of the RCM leachate samples to the Permian groundwater samples, the concentrations of analytes in the leachate samples exceeded those in the Permian groundwater samples as follows, but were otherwise significantly lower:

- pH at 20th, 50th and 80th percentiles,
- Aluminium, arsenic and molybdenum at the 50th and 80th percentiles, and
- Selenium at the 80th percentile.

In addition to the leachability data presented above the Terrenus geochemical assessment for the Project (Terrenus, 2025) presents a number of key findings in relation to the geochemical hazard assessment for the proposed OOPD:

- DNM spoil is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage), which is typical for mine spoil in the Bowen Basin,
- DNM spoil has a very low potential to generate acid and metalliferous drainage (AMD),
- The expected proportions of non carbonaceous, carbonaceous and coal materials in the OOPD are 90%, 9% and 1% respectively,
- DNM non-carbonaceous spoil poses a “Low” AMD source hazard, with the small proportions of carbonaceous spoil and coal posing a “Low-Moderate” AMD source hazard,
- Spoil is overwhelmingly non acid forming (NAF) with excess acid neutralising capacity (ANC) and has a negligible risk of developing AMD, including acid drainage (AD), neutral metalliferous drainage (NMD) and/or saline drainage (SD), and
- Taking into account the proportion of each material that could generate AMD relative to the total proportion of all materials in the OOPD final landform, the proposed OOPD is expected to pose a “Low” AMD hazard”, with AMD generation rated as “Highly Unlikely”.

11.4.8 Groundwater Receptors

11.4.8.1 Local Groundwater Supply Bores

A search of the Queensland Government’s Groundwater Bore Database (GWBD) for a 5km of DNM indicated that of the 70 registered bores identified 57 are for groundwater monitoring, and only 4 are recorded as being used for water supply. The other 9 do not have an identified use recorded in the GWBD.

The 2023 PRCP groundwater assessment for DNM (SLR, 2023) included a review of landholder bore surveys for surrounding mining projects (Olive Downs, Moorvale South, and Winchester South). The identified groundwater supply bores from these surveys and the GWBD is presented in Figure 11-11. Four alluvium / Tertiary bores were identified directly south of the OOPD, the nearest being an apparently "active" domestic supply bore (Bore 9 / House Bore) adjacent to the Isaac River approximately 1 km directly south of the southern end of the OOPD. Available details for the four landholder bores identified to the south of the OOPD are summarised in **Table 11-3**.

Table 11-3 Groundwater Bores South and South-West of the OOPD

RN	Bore Name	Easting[1]	Northing[1]	Depth (m)	Purpose	Geology	In use?	Survey
Unregistered	Knob Hill 1	631005	7553874	-	Unknown	Tertiary	Yes	Winchester South Bore Census/Monitoring (2020)
Unregistered	Knob Hill 2	630431	7554061	-	Unknown	Tertiary	Back-up	Winchester South Bore Census/Monitoring (2020)
Unregistered	Winnet Bore	634791	7550023	-	Unknown	Alluvium	-	Winchester South (2020), Olive Downs (2018)
162826	Bore 9 / House Bore	633886	7553064	30*	Domestic	Alluvium	Yes	Olive Downs Bore Census 2017

1 GDA94z55
* Anecdotal depth provided by landowner

11.4.8.2 Groundwater Dependent Ecosystems

A groundwater dependent ecosystem (GDE) is one in which the plant and/or animal community is dependent on the availability of groundwater, either permanently or periodically, to maintain its structure and function.

National Atlas of Groundwater Dependent Ecosystems

The BoM National Atlas of Groundwater Dependent Ecosystems (GDE Atlas) is a high level national scale mapping tool that classifies ecosystems based on the potential for dependence on groundwater through various lines of evidence using regional datasets. It is regarded as a high level “first pass” guide to the potential presence of GDEs within a given area rather than confirmation of their presence.

The GDE Atlas indicates that areas with possible high, moderate and low potential for groundwater interaction occur in the vicinity of DNM (BoM, 2017; **Figure 11-12**), with moderate to high potential GDE’s identified predominantly to the southwest of DNM in alignment with the Isaac River:

- Terrestrial vegetation associated with the riparian zones of the Isaac River and tributaries is mapped as having a high potential to be dependent on groundwater,
- Broader areas of the Isaac River floodplain are mapped as hosting terrestrial ecosystems with a moderate to low potential to be dependent on groundwater, and
- The channel of the ephemeral Isaac River channel and an adjacent unnamed minor drainage line is designated as having a high potential to be dependent on the surface expression of groundwater.

The Isaac River is ephemeral flowing (>0.001 m^3/s) only 26% of the time, i.e. there is no perennial groundwater supported flow (baseflow). The surface expression of groundwater in the creeks and the associated aquatic habitat be limited to isolated occasions following significant rainfall where partial saturation of the alluvium may result in some short term baseflow to the Isaac and other watercourses. Alluvial groundwater may also support aquatic GDEs in the form of water holes within the Isaac River channel hosting aquatic species through no-flow periods, depending on their permanence.

11.4.9 Local GDE Studies

Ground truthing GDE studies have been completed for the Isaac Downs Project 9 km to the west of DNM (3D Environmental, 2019) and for Poitrel Mine immediately adjacent to the west of DNM (3D Environmental, 2024). These studies focussed on the Isaac River and associated floodplain environment and the results are considered directly relevant to DNM given the same hydrogeological setting. The results from both studies indicated:

- There is no evidence that terrestrial vegetation is utilising groundwater from deeper confined aquifers associated with Permian coal seams;
- Areas were identified where terrestrial vegetation is likely interacting with shallow alluvial groundwater, both associated with riparian ecosystem analogous to RE11.3.25 (Eucalyptus tereticornis or E. camaldulensis [red gum] woodland fringing drainage lines).
- Vegetation on the riparian fringe was found to be variably interacting with groundwater depending on riverbank position, with trees fringing the river channel generally demonstrating a greater degree of groundwater interaction than those higher up the bank. There is also likely to be a significant proportion of trees that have no, or limited dependence on groundwater;

- The dependence of vegetation on groundwater decreases significantly moving up the bank onto higher river terraces to the point that there is no interaction between trees and groundwater on the higher, older alluvial terraces; and
- Providing volumetric changes to the alluvial aquifer are not rapid and otherwise normal hydrological function of the river system is maintained, the studies found that mining related impacts to the identified GDEs are likely to be minor.

Overall, the GDE ground truthing studies at nearby Isaac Downs and Poitrel mines indicate that GDEs associated with the Isaac River are limited to mature deeper rooted red gum tree species immediately fringing the modern river channel.

11.4.10 Watermark Ecohydrology 2025 Study

Watermark Ecohydrology (refer to **Chapter 14.0**) undertook a desktop GDE risk assessment for the Project. With regard to terrestrial groundwater GDEs, the study found that:

- Groundwater within and adjacent to the OOPD areas is typically too deep (>10 mbgl) to support most woody vegetation species in the Project Area and surrounds, meaning that most woody vegetation is reliant on soil moisture to support transpiration, and
- Facultative groundwater dependence for riparian vegetation fringing the Isaac River is likely where deep-rooted vegetation accesses alluvial groundwater resources on a permanent or seasonal basis, depending on its position relative to the channel and distance from the watercourse.

The study concluded that the development of the OOPD will not significantly impact the ecohydrological function of groundwater-dependent vegetation within and surrounding the Project.

11.5 Summary Conceptual Hydrogeological Model

A conceptual hydrogeological cross-section orientated north-east south-west through Pandora Pit and the proposed OOPD is presented in **Figure 11-13** showing an interpreted pre-mining and post-mining groundwater profile. The pre-mining water table shows a local hydraulic gradient away from the Isaac River due to higher recharge across the alluvium and additional recharge from occasional flow events via river leakage. Across DNM, groundwater flows south turning south-east at the southern end of the site aligning with the drainage direction of the Isaac River.

When mining below the water table commences at the southern end of Pandora Pit, there will be a local reversal of the hydraulic gradient south of Pandora Pit with groundwater flowing back towards the mine void. The active Pandora Pit mine void will form a local groundwater sink during mining operations. When mining has ceased and groundwater levels partially recover, a lake will form in the residual void as a result of both surface water and groundwater inflow. A low lake level will be maintained by higher rates of evaporation from the void lake compared to the rate of surface and groundwater inflow, which will result in the void continuing to act as a groundwater sink.

There will be a higher rate of rainfall recharge over the area of the OOPD due to the more permeable and unstructured nature of waste rock. The rainfall infiltrating the OOPD will exit the OOPD in the following ways:

- Evaporation and transpiration from the OOPD as it is profiled to its final form and vegetated,
- Possible localised seepage from the toe of the OOPD where the underlying soil permeability does not permit infiltration at the rate water is percolating through the OOPD. This seepage may be captured in a toe drain around the OOPD, and
- Seepage through the base of the OOPD to the underlying Tertiary/Quaternary sediments and weathered Permian coal measures.

It is anticipated that the higher rate of recharge to the OOPD will result in seepage / recharge to the underlying strata at a rate higher rate than would occur in the absence of the OOPD, due to a greater volume of water infiltrating and being retained by the spoil. The higher rate of recharge to the underlying strata will result in a local mounding of groundwater beneath the OOPD and outward migration towards the Pandora Pit void acting as a strong groundwater sink, and potentially off site to the west and south. The groundwater mounding beneath the OOPD create a groundwater divide with groundwater west of the divide migrating west together with seepage from the OOPD. The higher the infiltration rate to the OOPD the higher the hydraulic gradient west of the divide and the greater the potential for off site migration of groundwater from below the OOPD. The Project's numerical groundwater model uses a range of recharge for spoil of 1-5.5% total rainfall based on a widely accepted study (Mackie, 2009). Placement and compaction of out of pit spoil to form a designed landform with profiling to promote runoff, together with spoil consolidation over time and increasing EVT as vegetation becomes established and matures is considered likely to result in infiltration rates towards the lower end of the range used for spoil within the numerical model.

Rainfall infiltration through the OOPD may leach substances from the waste rock, although leachability data indicates that the waste rock which will comprise the OOPD is overwhelmingly non acid forming with excess acid neutralising capacity, and has a negligible risk of developing acid metalliferous drainage, including acid drainage, neutral metalliferous drainage and/or saline drainage. The waste rock leachability test data is a poor proxy for a "source term" in that is likely to overestimate the concentrations of substances that may leach from the OOPD. Leachate quality from DNM spoil leachability tests does not exceed any of the local Water Quality Objectives for Isaac Groundwaters (Zone 34) with the exception of a slight exceedance for pH. Consequently, the potential risk posed by off-site migration of seepage from the OOPD is considered low.

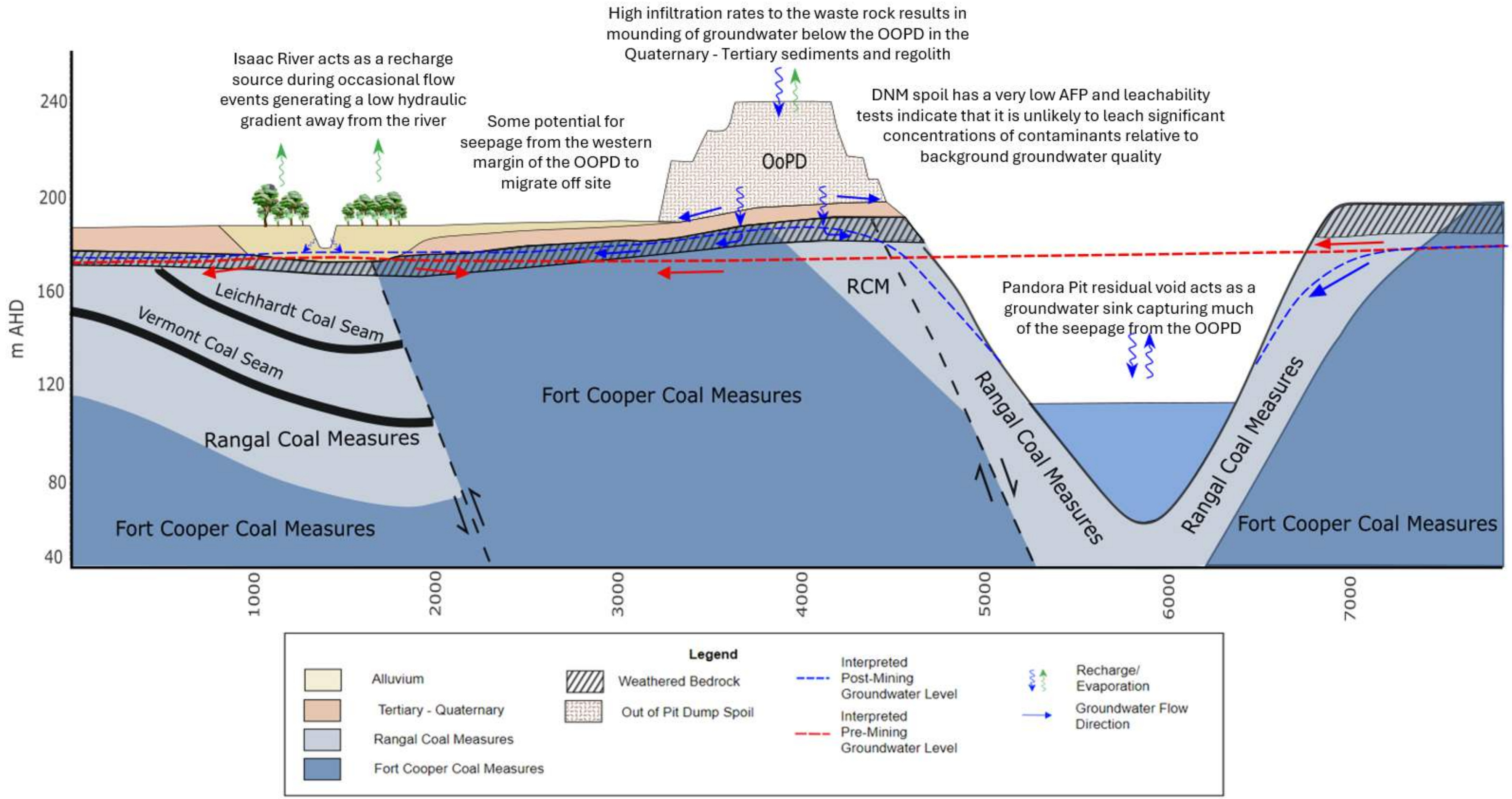


Figure 11-13 Conceptual Hydrogeological Cross Section

11.6 Numerical Modelling

11.6.1 Modelling Objectives

The objective of the numerical groundwater modelling exercise was to simulate the presence of the OOPD and its effect on the groundwater regime against the base case of there being no OOPD. The key quantities of interest in terms of model predictions are:

- Shallow groundwater levels and hydraulic gradients in the vicinity of the OOPD: The increased recharge over the OOPD footprint will result in local mounding of the water table beneath the OOPD which will locally change the direction of groundwater flow,
- Potential contaminant concentrations in groundwater: Particle tracking and simple solute transport modelling has been undertaken to determine the migration pathways, and potential concentrations of selected contaminants in groundwater arising from seepage from the OOPD to groundwater,
- Groundwater flux to the Isaac River Alluvium / baseflow: The increased groundwater levels in the vicinity of the OOPD have the potential to change the groundwater levels in the Isaac River Alluvium and episodic baseflows to the Isaac River on the isolated occasions where, immediately following significant rainfall / runoff events, simulated groundwater levels in the alluvium may be sufficiently high to generate very short-term periods of baseflow to the Isaac River, and
- Pandora Pit residual void lake levels: The increased recharge to the OOPD and locally increased groundwater levels in the vicinity of the OOPD will increase the hydraulic gradient into the adjacent Pandora Pit final void and increase the post-mining equilibrium void lake level through an increase in groundwater inflow.

DNM sits within the Central Bowen Basin regional groundwater model domain, a regional scale model using MODFLOW-USG code developed by SLR. Full details of the model and the numerical modelling details for this assessment are presented in the Technical Modelling Report (**Appendix E**).

11.6.2 Predictive Scenarios and Representation of the OOPD

Two predictive scenarios were setup to assess the effect of the OOPD on the local hydrogeological regime:

- **Approved case**: Currently approved DNM mine extent and progression and includes all approved mining at neighbouring mining operations. It uses the currently proposed final landform for DNM as per the recently prepared DNM PRCP and available final landforms for neighbouring mines, and
- **Proposed case**: This model setup includes a representation of the OOPD as the only difference compared to the approved case model setup.

11.6.2.1 Recharge Rate Applied to the OOPD

The calibrated model for the Project i.e. the model realisation that best matches the observed groundwater levels around DNM includes a spoil recharge rate of 3.7%. However, as there are no observation bores in the spoil at DNM the calibration will not be sensitive to this recharge rate. As such the spoil recharge rate is not considered to be a calibrated value. However, the recharge rate applied to the spoil of the OOPD in the predictive modelling will report directly to the highest saturated layer of the model resulting in mounding of the simulated water table below the OOPD. The degree of groundwater mounding will partly determine the simulated destination of seepage from the OOPD. The higher the recharge rate, the greater the groundwater mounding beneath the OOPD and the more likely it is that seepage from the OOPD will migrate off-site.

As there are no spoil monitoring bores to allow accurate calibration of spoil recharge rates and appropriate value based on literature has been used. The selected spoil recharge rate of 3.7% total rainfall sits approximately in the middle of the widely accepted range of 1% to 5.5% (proposed by Mackie, 2009). However, it is considered likely that rainwater infiltration to the OOPD, and more importantly recharge to the underlying natural ground, will be lower than this value for a number of reasons:

- Placement / compaction of spoil to form a designed landform with profiling, which will promote runoff,
- Spoil consolidation and compaction under loading will decrease the permeability of the spoil in the OOPD over time,
- Increasing EVT intercepting soil moisture as vegetation becomes established and matures, and
- Possible seepage from the toe of the OOPD where the underlying soil permeability does not permit infiltration at the rate water is percolating through the OOPD. This seepage may be captured by perimeter toe drains.

Consequently, the spoil recharge rate of 3.7% total rainfall is considered highly conservative and will generate greater mounding beneath the OOPD and outward migration of groundwater within the model simulations than is likely.

11.6.2.2 Model Timing

The model has been set up to simulate mining at DNM as per the historic mine progression, and the future progression sequence provided through to the end of 2041 (**Figure 11-7**), after which the post mining period starts. The post-mining recovery period runs for approximately 1,000 years from the end of mining at DNM and incorporates recovery at neighbouring mine sites. This long post mining period allows for full stabilisation of residual void lake levels and allows a long run time for particle tracking and solute transport modelling.

Construction of the OOPD would start in FY2028 and enhanced recharge over the area of the OOPD has been applied from this time.

11.6.3 Post Mining Recovery

Recovering groundwater levels, rainfall, runoff and drainage of rainfall infiltration through the spoil can result in the accumulation of water in the residual voids and the formation of void water bodies. Final void equilibrium water body levels were derived through an iterative process using both the groundwater model and a surface water model (WRM, 2025). The surface water balance model simulates the processes of direct rainfall, rainfall runoff from the void catchment and evaporative loss from the void water body to estimate void water body levels and uses estimates of groundwater inflow to the final voids from the SLR groundwater model.

This iterative process was completed for the DNM PRCP groundwater assessment using the approved case version of the groundwater model. Two further iterations were undertaken using the groundwater inflows to the voids generated by the proposed case model for the Project i.e. including the OOPD. As anticipated the higher recharge applied to the OOPD (3.7% total rainfall) resulted in slightly higher predicted groundwater inflows to the Pandora Pit void and a slightly higher equilibrium void lake level, although it is still far below the crest level of the void and the elevation of Quaternary and Tertiary sediments.

Details of the equilibrium conditions for the DNM residual voids (both with and without the OOPD) are presented in **Table 11-4**.

Table 11-4 Approximate Equilibrium Conditions for Residual Voids at DNM With and Without the OOPD

Component	Residual Void					
	Titan North		Titan East		Pandora	
	Without OOPD	With OOPD	Without OOPD	With OOPD	Without OOPD	With OOPD
Fill Time to Equilibrium Level (years)	100		150		200	
Equilibrium Void Water Level (mAHD)	140	140	120	121	92	95
Spill Elevation (mAHD)	210		220		190	
Freeboard1 (m)	70	70	100	99	98	95
Approximate Pre-mining Groundwater Level (mAHD)	198		192		180	
Net groundwater inflow at equilibrium (ML/d)	-0.08	-0.08	0.20	0.20	0.83	0.93

1 Freeboard is the remaining depth of void between the predicted equilibrium water body level and the void spill level

11.6.4 Predicted Effect of the OOPD on Shallow Groundwater Levels

The predicted effect on shallow groundwater in the vicinity of DNM and the OOPD in the form of outputs from the numerical modelling for the 3.7% spoil recharge rate is presented below.

11.6.4.1 Quaternary Alluvium, Tertiary and Regolith (Layers 1 and 2)

The predicted increase in groundwater levels within the Quaternary Alluvium (model Layer 1) as a result of the OOPD, as compared to the approved case simulation without the OOPD, at post mining equilibrium is presented in **Figure 11-14**. Between the Isaac River and the OOPD the Quaternary alluvium becomes thinner and elevated well above the saturated water table and so no mounding of groundwater is predicted in this area in Layer 1. South-west of the OOPD in the area of saturated Quaternary Alluvium groundwater levels are predicted to increase by as much as 5 m in isolated areas, with the effect of the increased recharge through the OOPD extending up to 6 km downstream and 4 km upstream.

Figure 11-15 shows the predicted groundwater elevation in model layer 2 (Tertiary-Quarternary alluvium, regolith), which is the highest partly saturated model layer beneath the OOPD and its immediate surroundings to the west and south.

The increased recharge applied across the area of the OOPD results in mounding of groundwater in the underlying layer 2, extending out into the surrounding area. The position of the groundwater divide through the western margin of the OOPD is clear with the mounded water table in Layer 2 below the OOPD inclined mostly toward the east and the deep residual void in Pandora Pit. The groundwater mounding in layer 2 beneath the OOPD is up to 16 m. Mounding of 1m or more in layer 2 extends up to 7.5 km down the Isaac River floodplain from the OOPD and approximately 5 km west of the OOPD. Mounding in the vicinity of the Isaac River is below 5 m.

Despite this mounding of groundwater in layer 1 and layer 2, groundwater levels along the Isaac River remain >2 m below the channel elevation in the vicinity of DNM at post-mining equilibrium reflecting the long term average climate condition resulting in no baseflow from the alluvium to the Isaac.

11.6.5 Predicted Change in Fluxes to the Isaac River Alluvium

11.6.5.1 Isaac River Alluvium

Fluxes to the Isaac River Alluvium includes direct recharge to alluvium plus any lateral and vertical groundwater flow into this layer. Increased groundwater levels in the alluvium and regolith adjacent to the Isaac River arising from the high model infiltration/recharge rate across the OOPD is shown in **Figure 11-14** and **Figure 11-15**. As a result of groundwater mounding below the OOPD the lateral groundwater flux westward into the Isaac River Alluvium is predicted to increase by around 0.09 ML per day (~1 L/s) at post mining equilibrium due to the presence of the OOPD (**Figure 11-16**).

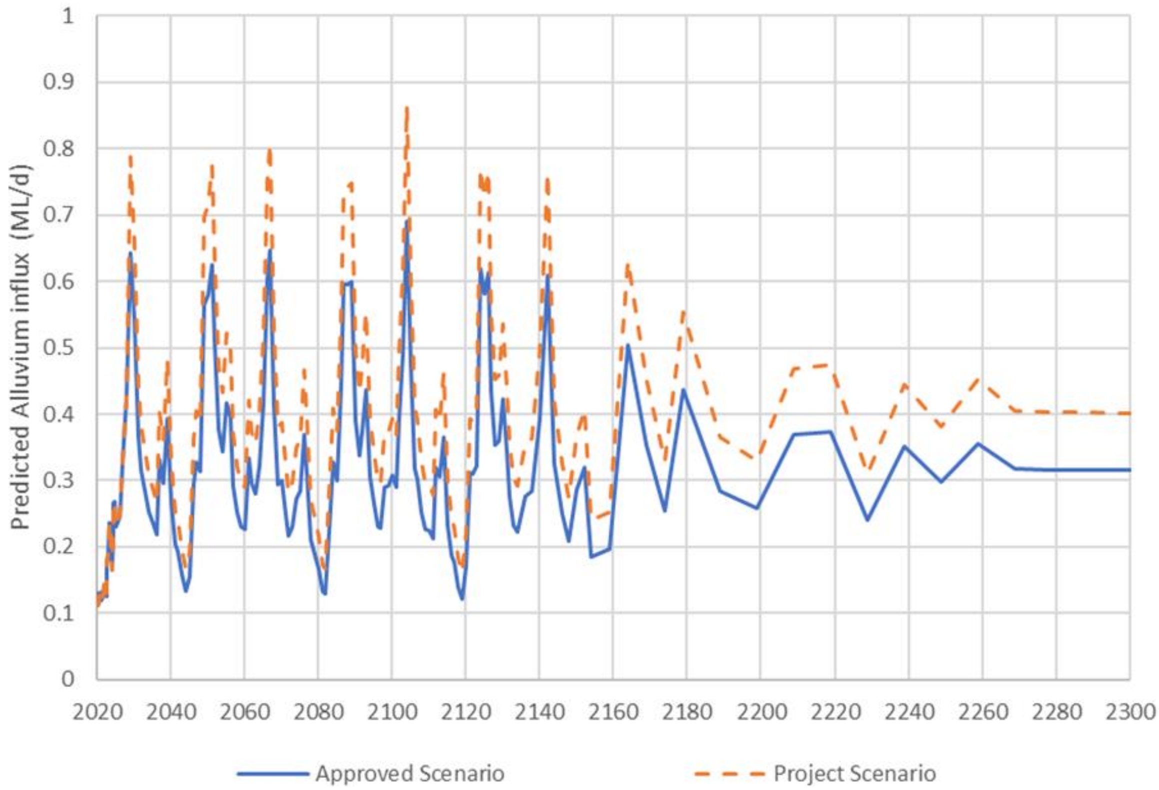


Figure 11-16 Predicted Inflows to the Isaac River Alluvium Inflow

11.6.6 Isaac River

The model simulates the Isaac River as an ephemeral watercourse with a river stage above zero provided for very short durations through the calibration to match observed river flow events. Through the predictive mining period (for all mining within the model, which ends in 2113) synthetic episodic flows are simulated in the Isaac River to match the historic flow record with the last flow period occurring in 2104. For the recovery period from 2113 onwards, the stress period lengths increases up to 50-years and reflects long term average conditions. Episodic Isaac River flows cannot be not simulated through the very long post-mining stress periods. However, the simulation of occasional flows in the Isaac through the long post-mining period is considered unlikely to significantly affect the migration of seepage from the OOPD into groundwater which is driven by the higher recharge rate over the area of the OOPD and the resulting mounding of groundwater beneath the OOPD. Occasional additional recharge to the Isaac River Alluvium from the simulated Isaac flow events might locally increase groundwater levels in the alluvium close to the river channel and possibly slightly inhibit the westward migration of any spoil affected groundwater arising from the OOPD.

Due to the higher groundwater levels in the surficial geology as a result of higher recharge over the OOPD there is a predicted increase in the occasional groundwater discharges to the Isaac River. Following periods of simulated Isaac River flow there is an increase in groundwater levels in the Quaternary Alluvium along the course of the Isaac River due to leakage from the river. In the following stress periods, a small amount of water is simulated leaving model via the river (baseflow) from layer 1 where the water level in layer 1 is greater than the riverbed elevation. Figure 11 17 shows that the short term baseflow following periods of simulated river flow along the Isaac is slightly higher for the simulation including the OOPD, by up to 0.03 L/s at peak baseflow.

Post recovery, the river stage is always zero reflecting the average condition of the longer stress periods and groundwater levels never exceed the riverbed elevation. Consequently, there is no short term discharge from the alluvium to the river

The model simulates the Isaac River as an ephemeral watercourse with a river stage above zero provided for very short durations through the calibration and predictive mining period to match observed river flow events. For the recovery period, the average river condition is that the river is dry and therefore no river flow is simulated.

Due to the higher recharge over the OOPD there is a predicted increase in fluxes to the Isaac River. Following periods of simulated Isaac River flow there is an increase in groundwater levels in the Quaternary Alluvium along the course of the Isaac River due to leakage from the river. In the following stress periods, a small amount of water is simulated leaving model via the river (baseflow) from layer 1 where the water level in layer 1 is greater than the riverbed elevation. The short term baseflow following periods of simulated river flow along the Isaac River is slightly higher for the simulation including the OOPD, by up to 0.03 L/s at peak baseflow is presented in **Figure 11-17**.

Post recovery, the river stage is always zero reflecting the average condition of the longer stress periods and groundwater levels never exceed the riverbed elevation. Consequently, there is no short term discharge from the alluvium to the Isaac River.

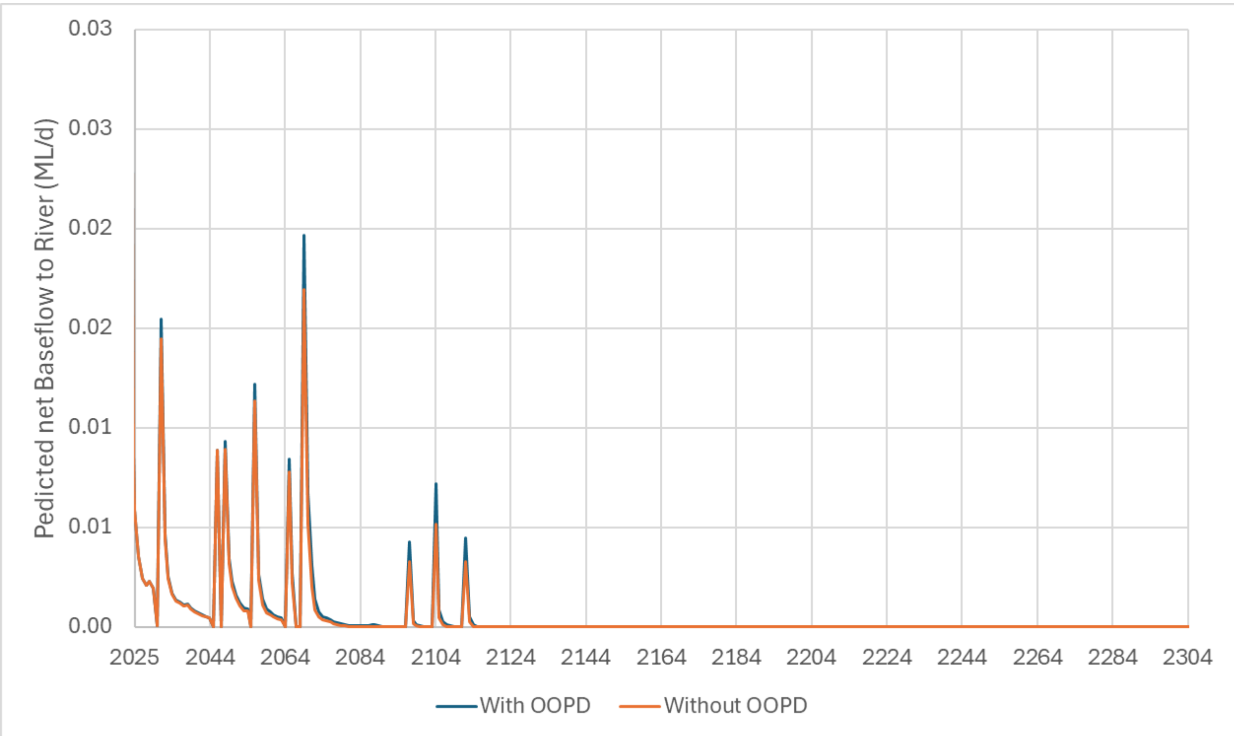


Figure 11-17 Predicted Groundwater Outflow to the Isaac River With and Without the OOPD

11.7 Post Mining Groundwater Flow Path Simulation (Particle Tracking)

Particle tracking was undertaken as a first pass assessment of the movement and fate of water particles from the area of the OOPD through the surrounding groundwater system. Particle tracking simulates the advection component of solute transport and is therefore indicative of groundwater flow paths. A number of particles were placed across the OOPD and released at the end of mining / start of groundwater recovery to understand the groundwater flow pathways away from the OOPD under the altered hydrogeological conditions generated by its presence.

The mod-PATH3DU code (S.S.Papadopulos & Associates, Inc., 2018) was used to simulate particle pathways through the groundwater flow field from the end of mining / start of recovery, with a model run time of 977 years from release at the end of mining at DNM in 2042 to the end of the model simulation in 3019. The transient head outputs from the groundwater flow model were used by mod-PATH3DU to simulate particle flowpaths.

The recharge rate applied to the OOPD is 3.7% of total rainfall which sits approximately in the middle of the widely accepted range of 1% to 5.5% proposed by Mackie (2009). The recharge rate across the OOPD of 3.7% total rainfall is the same as that applied to the in-pit spoil across the rest of the model.

A key parameter affecting the distance travelled by the particles is the effective porosity allocated to the formations through which the particles travel. Lower effective porosity will tend to produce greater velocity within the model and increase the distance travelled within a given time frame i.e. lower porosity increases the potential area affected by solute migration.

The following effective porosity values were used for in the model for the particle tracking simulation:

- Layer 1 – Isaac River Alluvium: 10% effective porosity - a mixed sequence of fine to coarse material. The effective porosity of sand layers within this layer could be significantly higher
- Layer 2 – Older Quaternary to Tertiary alluvium and regolith: 10% effective porosity was also used to for the older more extensive alluvium and regolith which is considered likely to have a more open permeable texture
- Layer 9 – Fort Cooper Overburden: this is the geology which underlies Layer 2 in the vicinity of the OOPD and the area to the west and south. An effective porosity of 1% was applied to this layer which is considered a low value for mixed fine sandstone, siltstone and mudstone.
- All other layers: 1% effective porosity was applied to all other consolidated formations – mostly coal measures formations and the Rewan Formation. These layers do not affect the area of interest to the west and south of the OOPD.

Figure 11-18 shows the pathlines for the particle tracking after 977 years, as well as the starting location of particles placed across the OOPD. The pathlines are colour coded according to the model layer they are moving through. The mod-PATH3DU code automatically moves the particle to the shallowest saturated layer at the commencement of the simulation. The shallowest saturated layer beneath the OOPD is layer 2 (Quaternary-Tertiary alluvium and regolith), and this is the layer in which all particles released over the OOPD start.

The movement of particles within Layer 2 aligns with the flow directions illustrated by the groundwater level contours for Layer 2 (Figure 11-15). The particle movements clearly demonstrate the presence of the groundwater divide beneath the OPD with approximately 65% of the particles moving eastward into the Pandora Pit void. Below the western margin of the OOPD there is some outward movement of particles away from the OOPD to the north, west and south, through Layer 2. Beneath the OOPD groundwater levels are significantly higher in Layer 2 than in the underlying Fort Cooper overburden (Layer 9) which drives a downward vertical hydraulic gradient. The particles enter the underlying Fort Cooper overburden (Layer 9) and there is a change in direction of most particles in line with the groundwater flow direction in this layer. Some of the particles on the western part of the OOPD that migrate west through Layer 2 turn back to the east towards the Pandora Pit void as they enter Layer 9, and particles on the western edge of the OOPD footprint take a sharp turn to the south on entering Layer 9.

Only 3 particles on the very western margin of the OOPD continue to move south to south-east away from DNM and along the general direction of deeper groundwater flow in this area. These particles remain in the Fort Cooper Coal Measures overburden (Layer 9) for the full simulation, i.e. they do not migrate to shallow depths as they move towards the Isaac River.

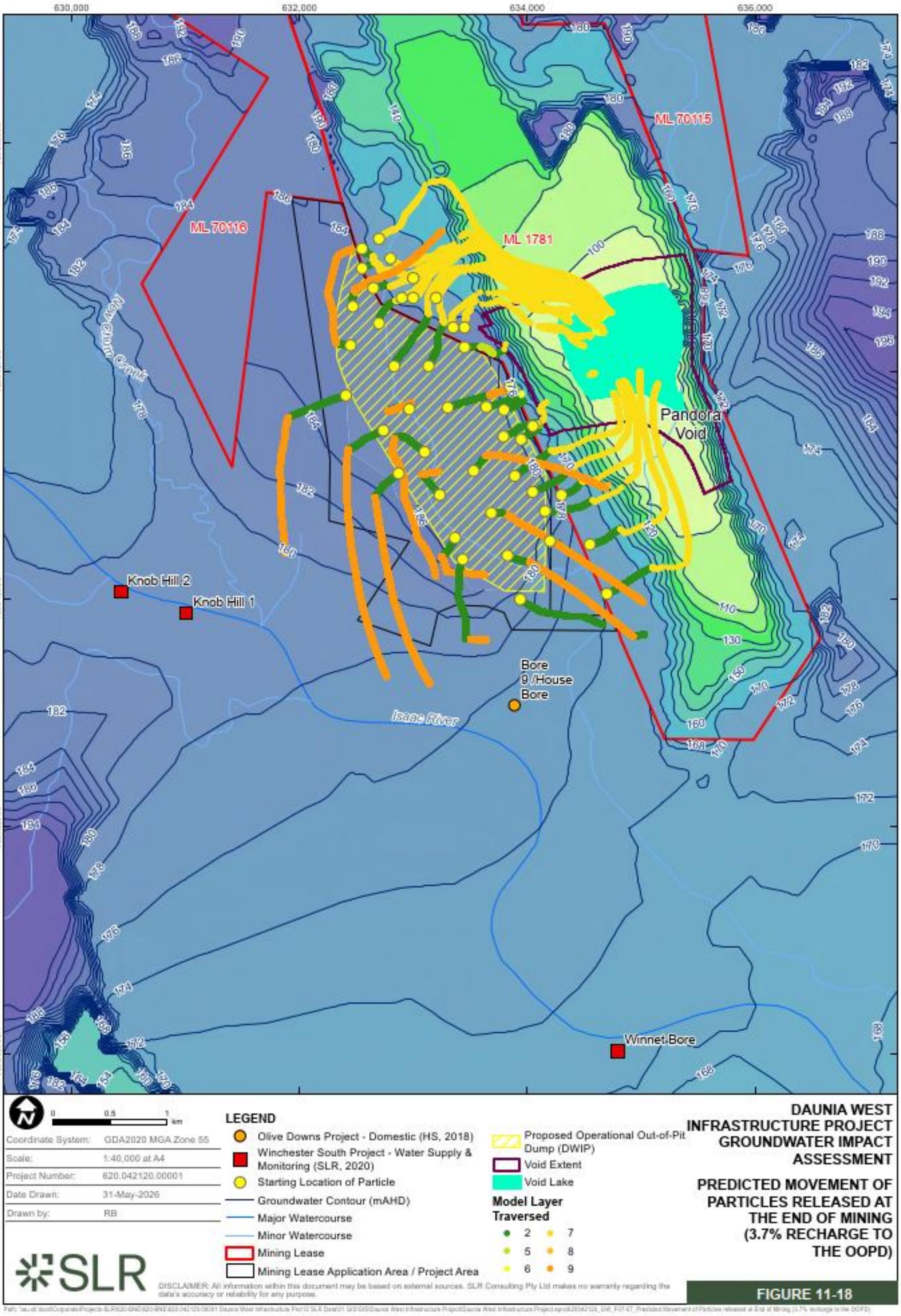


Figure 11-18 Predicted movement of Particles released at the end of mining

11.8 Groundwater Solute Transport Modelling

Particle tracking provides a high level assessment of groundwater movement and migration pathways. Given that this has indicated the potential for off site migration of seepage from the OOPD a groundwater solute transport assessment was completed.

11.8.1 Solute model setup

Full details of the set up of this simulation are presented in the Modelling Technical Report (Appendix E, SLR, 2026). The solute transport model packages are added to the numerical flow model simulation from which the other modelling output presented in this report has been derived.

The solute is released via the recharge (RCH) package over the entire footprint of the OOPD. A constant nominal concentration of 1 mg/L was applied and the reduction of this nominal concentration with distance from the source provides a “dilution factor” that can be applied to actual source concentrations for any substances of interest. The model uses advection and dispersion transport only. No retardation parameters have been applied making this approach very conservative.

11.8.2 Solute migration from the OOPD and dilution

The output from the solute transport modelling is presented in Figure 6-1 to Figure 6-3 of the groundwater modelling report (**Appendix E**) which show the extent of seepage migration from the OOPD within each of the model layers to the west and south (Layer1, 2 and 9). The figures show concentration contours after 977 years for a solute seeping from the OOPD which has a nominal starting concentration of 1 mg/l at the source (the recharge applied to the OOPD).

Figure 6-1 presents the extent and concentration contours for Layer 1 (Isaac River Alluvium). This layer is only present / partly saturated close to the Isaac River. Whilst there is a constant downward vertical hydraulic gradient between the OOPD and the Isaac River, with particle tracking indicating that seepage from the OOPD migrates downward from Layer 2 into Layer 9, the solute transport modelling indicates migration and dispersion through Layer 2 and into Layer 1 where it contains groundwater close to the Issac River. After 977 years solute concentrations at the House Bore (likely screened in Layer1 / Layer 2) would be diluted by 100 times i.e. a solute concentration of 1 mg/l seeping from the OOPD would be 0.01 mg/l in Layer 1 at the location of the House bore. Over this timescale (and with no retardation), solutes seeping from the OOPD and entering groundwater would not reach any other private bores at measurable concentrations. At the Isaac River over a short reach southwest of the House Bore seepage from the OOPD has been diluted by a factor of approximately 650. However, the Isaac River receives minimal sporadic baseflow discharge and any small volumes of baseflow from the alluvium would be further diluted in the river under flowing conditions.

Figure 6-2 of **Appendix E** presents the solute concentration contours for Layer 2 (Tertiary-Quaternary alluvium and regolith). After 977 years solute concentrations at the House Bore would be diluted by a factor of approximately 33 i.e. a solute concentration of 1 mg/l seeping from the OOPD would be 0.03 mg/l in Layer 2 at the location of the House bore. At the Isaac River southwest of the House Bore the dilution factor in Layer 1 increases to 200 reducing a source concentration of 1 mg/l to 0.005 mg/l. Over this timescale seepage from the OOPD migrating through Layer 2 would not reach any other private bores at measurable concentrations.

Figure 6-3 of Appendix E presents the solute concentration contours for Layer 9 (Fort Cooper overburden), the formation which directly underlies the alluvium / regolith across the OOPD and the area to the south and southwest. It is unlikely that this is the source aquifer for the House Bore, however after 977 years solute concentrations in Layer 9 at this location would be diluted by a factor of approximately 50 i.e. 1 mg/l at the source reducing to 0.02 mg/l. At the Isaac River west of the House Bore the minimum dilution factor is 10 with However, the Fort Cooper overburden would not be providing baseflow to the Isaac River at this location.

11.8.3 Potential impacts of OOPD seepage on groundwater quality

To understand the potential concentrations of solutes that may seep from the OOPD and reach receptors, the dilution factors from the solute transport modelling have been applied to the DNM waste rock leachate for substances which exceed relevant guideline values (Al, As, Mo, Se, Zn). It should be noted that the waste rock leachability data is a very conservative proxy for the likely quality of seepage from the OOPD because the testing method results in higher concentrations of solutes than would naturally seep from the spoil. However, using the dilution factors from the solute transport modelling the concentrations of substances in the spoil leachate data can be reduced to their potential concentration at a receptor (e.g. the House Bore and the Isaac River). This diluted leachate concentration is added to the background concentration in groundwater to derive a conservative total concentration at the point of interest.

The Groundwater Impact Assessment (Appendix D, Table 7-3) presents the concentrations for Al, As, Mo, Se, Zn from the DNM spoil leachanility data which exceed one or more relevant guideline value at either the 80th of 50th percentile concentration. The table also presents background groundwater quality for the RCM derived from the DNM groundwater monitoring network, and background groundwater quality data for the Isaac River Alluvium based on groundwater samples collected from the Knob Hill bores and the Winnet bore located close to the Isaac River upstream and downstream of the OOPD (no groundwater quality data is available for the House Bore).

Using the dilution factors for the OOPD seepage quality for relevant model layers at the receptor locations, and background concentrations for the substances of interest, total concentrations have were calculated at the location of the House Bore and the Isaac River. These represent the total concentrations predicted 977 years after mining at DNM ceases with no depletion of the OOPD source concentration and no retardation. The results are detailed the Groundwater Impact Assessment (Appendix D, Table 7-4 (L1), Table 7-5 (L2) and Table 7-6 (L3)) and sumarised below.

The predicted total concentrations in Layer 1 and 2 at the House Bore are all below the guideline values for drinking water quality and stock watering, with most total concentrations falling below detection limits. The predicted total concentrations in Layer 1 and 2 (alluvium) at the Isaac River are also generally below detection limits with the exception of zinc which exceeds the freshwater guideline for 95% species protection at the 80th percentile. However, this exceedance is due to the background concentration and not the diluted concentration in seepage from the OOPD which is below detection limits.

Predicted total concentrations in Layer 9 (Fort Cooper overburden) are less relevant as this is not considered to be the source formation for the House Bore and it will not discharge baseflow to the Isaac River at this location. However, the predicted total concentration of arsenic at the 80th percentile slightly exceeds the freshwater guideline for 95% species protection.

The solute transport modelling indicates that even with conservative assumptions (constant source concentration and no retardation), and after approximately 1000 years, seepage from the OOPD is unlikely to pose a significant risk to private water supplies or alluvial groundwater at the Isaac River.

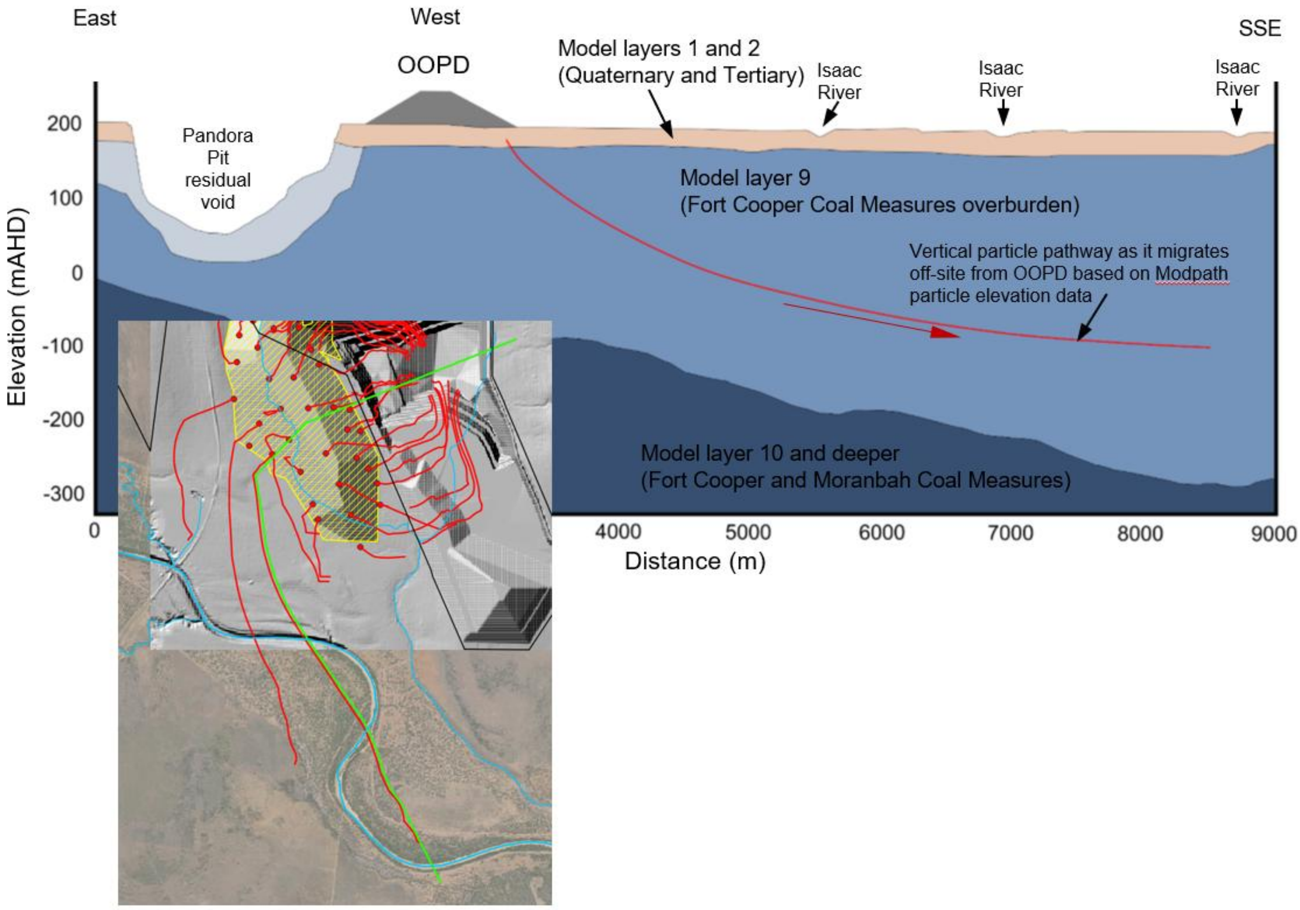


Figure 11-19 Predicted Vertical Movement of Particle Moving Off-Site from the Western Margin of the OOPD (3.7% recharge to the OOPD)

The 1000 year path line for one of the particles which migrates west and then south-east from below the western edge of the OOPD is shown in **Figure 11-19**. The section line (green) is shown on the inset adjacent to the particle path line (red). The section reproduces the numerical model layer boundary elevations and the vertical descent of the particle uses the particle elevation data extracted from Modpath (3.7% OOPD recharge scenario). The particle migrates just over 5km horizontally down hydraulic gradient during the 1000 year run time and quickly descends from model layer 2 into the Fort Cooper Coal Measures overburden (model layer 9) to a final elevation of approximately -85 m AHD. The particle descends approximately 260 m below it’s starting elevation and remains well below the overlying Quaternary and Tertiary sediments once it has moved into model layer 9. The Isaac River is a recharge source which will partly be driving a downward vertical gradient along the path line.

The vertical descent of other particles migrating west and south from the eastern margin of the OOPD was reviewed and they show a similar vertical trajectory.

11.9 Potential Impacts on Groundwater Resources

11.9.1 Influence on Shallow Groundwater

It is anticipated that the proposed OOPD will increase recharge to the underlying Quaternary-Tertiary deposits and regolith. Conservative modelling of increased recharge (3.7% of total rainfall) shows that groundwater mounding beneath the OOPD could be in the order of 16 m, and up to 5 m to the south-west within the nearby Isaac River Alluvium. Increased groundwater levels in the alluvium and regolith of up to 1m could extend up to 6 km downstream and 4 km upstream along the Isaac River floodplain from the OOPD. The change (increase) in flux to the alluvium along the affected reach of the Isaac River has been estimated at approximately 0.09 ML/day (~1 L/s).

11.9.2 Potential Impacts on Groundwater Users

11.9.2.1 Private Water Supply Bores

Predicted increases in the standing water levels at the location of these bores are presented in **Table 11-5**.

Table 11-5 Increase in Standing Water Levels at Local Water Supply Bores

RN	Bore Name	Easting1	Northing 1	Depth (m)	Purpose	Geology	In use?	Predicted change in water table at location (3.7% recharge to OOPD)
Unregistered	Knob Hill 1	631005	7553874	-	Unknown	Tertiary	Yes	+2.8m
Unregistered	Knob Hill 2	630431	7554061	-	Unknown	Tertiary	Back-up	+2.0m
Unregistered	Winnet Bore	634791	7550023	-	Unknown	Alluvium	-	+2.2m
162826	Bore 9 / House Bore	633886	7553064	30*	Domestic	Alluvium	Yes	+4.2m

1 GDA94z55

*Anecdotal depth provided by landowner

The status of these bores is uncertain and the information regarding their use and status is based on previous studies. The predicted increases in standing water levels at the location of these bores assumes that 100% of the recharge rate applied across the area of the OOPD reaches the water table. This is a conservative assumption and consequently increases in shallow groundwater levels may be lower.

11.9.2.2 Ecological Sites

A desktop GDE risk assessment for the Project (Watermark, 2025) concludes that several factors indicate that the development of the OOPD will not significantly impact the ecohydrological function of groundwater-dependent vegetation within and surrounding the Project.

The higher infiltration rates to the spoil and retention of water within the spoil will result in groundwater mounding below the OOPD extending out to the south-west towards the Isaac River.

Shallower groundwater levels will result in an increase in groundwater availability within the tree root zone, as well as an extended period of potential groundwater availability.

11.9.3 Potential Impacts on Surface Water

The Isaac River is simulated as an ephemeral watercourse with occasional short duration flows to match observed river flow events and simulates these events through the predictive mining period for all mining operations in the model. For the recovery period, where stress periods increase in length to 50 years, episodic flow events cannot be simulated. However, the simulation of occasional flows in the Isaac through the long post-mining period is considered unlikely to significantly affect the migration of seepage from the OOPD into groundwater which is driven by the higher recharge rate over the area of the OOPD and the resulting mounding of groundwater beneath the OOPD.

Following periods of simulated Isaac River flow there is an increase in groundwater level in the Quaternary Alluvium due to leakage from the river. In the following stress periods, a small amount of water (up to 7 ML per year or 0.2 L/s) is simulated leaving the model via the river (baseflow) where the water table is greater than the riverbed elevation.

The short-term periods of baseflow following simulated river flow along the Isaac is slightly higher for the simulation including the OOPD, by up to 0.03 L/s (16% higher) for the maximum simulated short-term period of baseflow.

11.9.4 Potential Impacts on Groundwater Quality

Modelling conducted assumes that rainfall infiltration passes through the OOPD and reaches the groundwater table. There is the potential for water infiltrating through the OOPD to leach substances from the waste rock, which may result in changes in groundwater quality beneath the OOPD.

A geochemical assessment (Terrenus, 2025; **Appendix H**) including leachability data for coal measures waste rock samples from DNM that will form the OOPD presents key findings:

- DNM spoil is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage), which is typical for mine spoil in the Bowen Basin,
- DNM spoil has a low potential to generate acid and metalliferous drainage (AMD),
- Spoil is overwhelmingly non acid forming (NAF) with excess acid neutralising capacity (ANC) and has a negligible risk of developing AMD, including acid drainage (AD), neutral metalliferous drainage (NMD) and/or saline drainage (SD), and
- The proposed OOPD is expected to pose a “Low” AMD hazard”, with AMD generation rated as “Highly Unlikely”.

It should be noted that the leachability tests use fine pulped materials (very high surface area) enabling a high level of reaction and dissolution and therefore may overestimate concentrations of substances leaching from the OOPD. Regardless of this, many analytes were below detection limits for the majority of leachate samples. The WQOs for aquatic ecosystem protection in Isaac Groundwaters (Zone 34), the leachate test samples exceed the guideline for pH but did not exceed any other parameters.

The RCM leachate quality is significantly below livestock drinking water guideline values with the exception of selenium which matched the guideline of 0.02 mg/L at the 80th percentile. The RCM leachate samples exceed the Australian Drinking Water Guidelines guideline values for pH, arsenic, molybdenum and selenium. The RCM leachate quality exceeds the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018) – 95% species protection for aluminium, molybdenum, selenium, zinc and arsenic.

Compared to Permian groundwater quality, the leachate concentrations exceeded the Permian groundwater samples for pH, aluminium, arsenic, molybdenum and selenium, but were otherwise significantly lower. Whilst the leachate data exceeds groundwater quality in the RCM for some parameters it is well below the WQOs for aquatic ecosystem protection in Isaac Groundwaters (Zone 34). In addition, it is considered likely that the actual quality of water seeping from the OOPD will contain leached substances at concentrations well below the leachate test results due to the nature of the test methodology vs actual water – waste rock interactions in the OOPD.

Particle tracking indicates that the majority of seepage from the OOPD is likely to migrate back towards the Pandora Pit void where it will be captured. Only seepage from the very western margin of the OOPD is likely to migrate away from DNM and the Pandora Pit, to the west and south.

Solute transport modelling was undertaken which considered advection and dispersion of seepage entering groundwater beneath the OOPD and migrating to the west and south. The modelling provided dilution factors at the location of receptors for the alluvium and underlying Fort Cooper coal measures which were applied to the concentration of those substances in the waste rock leachate above guideline values. The modelling indicated that over a 977 year post mining timescale the extent of leachate seepage from the OOPD within groundwater had only reached the House Bore (~1 km south of the OOPD), and a short section of the Isaac River to the southwest of the House Bore. The diluted concentrations of the substances identified in the waste rock leachate above guideline values (Al, As, Mo, Se, Zn), at receptors, were combined with background concentrations in groundwater to give a prediction of the total concentration of these substances at the receptors.

The predicted total concentrations in Layer 1 and 2 at the House Bore are all below the guideline values for drinking water quality and stock watering, with most total concentrations falling below detection limits. The predicted total concentrations in Layer 1 and 2 at the Isaac River are also generally below detection limits with the exception of zinc which exceeds the freshwater guideline for 95% species protection at the 80th percentile. However, this exceedance is due to the background concentration and not the diluted concentration of seepage from the OOPD which is below detection limits.

Predicted total concentrations in Layer 9 (Fort Cooper overburden) are less relevant as this is not considered to be the source formation for the House Bore and it will not discharge baseflow to the Isaac River. However, the predicted total concentration of arsenic at the 80th percentile exceeds the freshwater guideline for 95% species protection

The solute transport modelling indicates that even with conservative assumptions (constant source concentration and no retardation), and after approximately 1000 years, seepage from the OOPD is unlikely to pose a significant risk to private water supplies or the Isaac River.

11.9.5 Potential Impacts on Final Void Lakes

The higher recharge applied to the OOPD is predicted to result in slightly higher groundwater inflows to the Pandora Pit void and a slightly higher equilibrium void lake level. However, predicted void lake levels remain far below the crest level of the void, and the elevation of Quaternary and Tertiary sediments.

11.9.6 Risk Assessment

A risk assessment informed by the numerical modelling outcomes has been used to summarise the potential impacts on groundwater related receptors arising from the proposed OOPD based on the source > pathway > receptor approach and consideration of likelihood and consequence of potential risks being realised. For the two primary potential risks (impacts on groundwater levels and groundwater quality) the following were considered and recorded as part of the risk assessment:

- Brief description of the potential issue in terms of source > pathway > receptor,
- Description of the potential impact,
- Potential likelihood of the impact being realised,

- Potential consequence of the impact, and
- Risk rating derived from likelihood vs consequence.

Descriptions of the categories that were used to rank the likelihood and consequence of potential risks being realised are provided in **Table 11-6** and **Table 11-7**, respectively. The risk category is based a matrix of the combined consequence and likelihood of a risk being realised (**Table 11-8**), and the risk assessment is presented in **Table 11-9**.

Table 11-6 Likelihood Categories

Likelihood	Basis of Rating
Highly Likely	Expected to occur
Likely	More likely to occur than not to occur
Possible	As likely to occur as not to occur
Unlikely	More likely to not occur than to occur
Highly Unlikely	Very unlikely to occur even in the long term

Table 11-7 Consequence Categories

Rating		Environmental	Reputational / Legal & Compliance
5	Severe	Serious widespread environmental damage or harm that is permanent) or irreversible and cannot be adequately remediated • Permanent loss of declared environmental values • Irreversible contamination groundwater, or surface water • Long-term failure to meet environmental objectives or environmental protection policies • Likely to constitute serious environmental harm under the EP Act • Prohibitive remediation cost or technically unfeasible	• Formal expression of significant dissatisfaction by government • Sustained campaign by one or more international NGOs resulting in physical impact on the assets or loss of ability to operate • Major litigation / prosecution at corporate level
4	High	Material environmental harm with long-term or widespread effects. Recovery possible only through significant intervention over extended timeframe. • Significant degradation of environmental values beyond the site boundary • Long-term contamination requiring active remediation • Measurable impacts on groundwater-dependent ecosystems or beneficial uses • Likely enforcement, regulatory intervention, or EA non-compliance • Recovery timeframe typically years to decades	• Broad societal concern and criticism • Negative media coverage at international level resulting in a Corporate statement within 24 hours • Investigation from government and/ or international (or high-profile) NGOs • Negative impact on share price • Major litigation / prosecution at Department level
3	Moderate	Impact causes measurable but localised harm to environmental values. Temporary to medium-term and largely reversible through mitigation and management.	• Negative media coverage at national level over more than one day • Local Stakeholder action resulting in national societal scrutiny

Rating		Environmental	Reputational / Legal & Compliance
		• Short- to medium-term exceedance of environmental quality objectives • Localised impacts confined to the site or immediate surrounds • Temporary impacts to ecosystems or environmental values with recovery expected • Generally below the threshold of environmental harm, but operationally relevant	• Major litigation / prosecution at Operation level
2	Low	Impact results in minor, short-term disturbance to environmental values. Natural short term recovery and no lasting or measurable effect on environmental objectives. • Minimal harm or low-level contamination • Natural recovery or routine low cost remediation sufficient • No breach of statutory criteria or environmental protection policies	• Negative local/ regional media coverage • Complaint received from an internal or external stakeholder • Regulation breaches resulting in fine or litigation
1	Negligible	No change to environmental values and no environmental harm. • Impacts within licensed limits and EA conditions • No interaction with sensitive receptors or environmental values • No management or mitigation required beyond standard procedures	• Negligible media interest • Regulation breaches without fine or litigation

The risk rating for each potential impact was determined by combining the likelihood and consequence of a risk being realised. The numerical modelling predictions allows quantification of the likelihood of a particular drawdown impact occurring. The likelihood vs consequence risk assessment matrix is presented in **Table 11-8.**

Table 11-8 Risk Ranking Matrix

		Likelihood				
		Highly Unlikely	Unlikely	Possible	Likely	Highly Likely
Consequence	5	Moderate	Moderate	High	High	High
	4	Low	Moderate	Moderate	High	High
	3	Low	Low	Moderate	Moderate	High
	2	Negligible	Low	Low	Moderate	Moderate
	1	Negligible	Negligible	Low	Low	Low

Table 11-9 Risk Assessment for the Proposed DNM OOPD

Source	Pathway	Receptor	Potential Impact	Likelihood	Consequence	Risk
Increased recharge through the OOPD resulting in locally elevated shallow groundwater levels	Outward migration of shallow groundwater mounding beneath the OOPD into Quaternary and Tertiary sediments to the west and south	Isaac River Alluvium and Isaac River	Increased groundwater levels in the alluvium and increased episodic baseflow to the Isaac River	**Possible**: The relatively high recharge rate applied to the OOPD, and the assumption that all recharge applied to the OOPD will reach the water table is conservative. Even with these conservative assumptions the change (increase) in episodic baseflow to the Isaac River is very small.	**Negligible**: The predicted increase in episodic baseflow is very low and probably undetectable. Slightly increased baseflow following episodic flows would not impact environmental values	**Low**
		Landholder bores	Increased standing water levels in a number of local private bores (current status of bores unverified)	**Possible**: The relatively high recharge rate applied to the OOPD, and the assumption that all recharge applied to the OOPD will reach the water table is conservative, and it is considered unlikely that the predicted increases in standing water levels at these bores would be fully realised. Small increases may not be easily observable in active bores with large fluctuations in water levels. Water level increases may not occur within the operational life of the potentially affected bores.	**Negligible**: standing water level increases at these bores (if still in use) may be considered a benefit. Small increases may not be easily observable in active bores with large fluctuations in water levels.	**Low**
		Terrestrial GDEs along Isaac River	Groundwater availability	**Highly Unlikely**: Groundwater levels in the vicinity of the OOPD are predicted to increase as a result of increased infiltration to the waste rock compared to the natural in-situ ground.	**Negligible**: No negative consequence to TGDEs resulting from slightly elevated groundwater levels in the alluvium occurring over a long period.	**Negligible**

Source	Pathway	Receptor	Potential Impact	Likelihood	Consequence	Risk
		DNM final voids	Increased final void lake levels	**Likely**: The relatively high recharge rate applied to the OOPD, and the assumption that all recharge applied to the OOPD will reach the water table is conservative, but it is likely that there will be some increased inflow form the OOPD to the adjacent Pandora Pit void that will influence the final void lake level to some degree.	**Negligible**: The predicted increase in the Pandora Pit equilibrium lake level is 3 m, but this is still far below the spill level of the void and the base of superficial sediments.	**Low**
Seepage from the OOPD potentially containing elevated concentrations of contaminants.	Seepage to shallow groundwater below the OOPD and down hydraulic gradient ration to the west and south.	Isaac River Alluvium and Isaac River	Changes in groundwater quality in the alluvium and the episodic baseflow to the Isaac River	**Possible**: Particle tracking and conservative solute transport modelling indicates that substances seeping from the OOPD could reach the Isaac River Alluvium and a short section of the Isaac River over the very long term. However, this assessment involved conservative assumptions including: • The higher recharge applied to the OOPD all reaches the water table beneath the OOPD • The source term used for seepage from the OOPD is based on leachability tests that are likely to overestimate actual solute concentrations in seepage, certainly over the long term. • The solute transport modelling assumes a	**Negligible**: The predicted water quality impacts in the alluvium along a short reach of the Isaac River due to seepage from the OOPD are below detection limits.	**Low**

Source	Pathway	Receptor	Potential Impact	Likelihood	Consequence	Risk
				constant source and no retardation (advection and dispersion only)		
		Landholder bores	Changes in groundwater quality at private bores located down hydraulic gradient (south) of the OOPD (status of bores unverified)	**Possible**: Particle tracking and conservative solute transport modelling indicates that substances seeping from the OOPD could reach one private bore (House Bore) located 1 km south of the OOPD over the long term (likely well beyond the operation life of the bore). The solute transport assessment included several conservative assumptions (outlined above) such that it is uncertain whether solutes in seepage from the OOPD could reach this bore even in the long term.	**Low**: The predicted water quality impacts at the House Bore due to seepage from the OOPD are generally below detection limits and do not result in exceedances of drinking water or stock water guidelines.	**Low**
		Terrestrial GDEs along Isaac River	Changes in groundwater quality	**Possible**: The likely seepage quality from the OOPD will be below WQOs. Conservative solute transport modelling indicates that substances seeping from the OOPD could reach the Isaac River Alluvium and a short section of the Isaac River hosting TGDEs over the very long term. However, this assessment involved several	**Negligible**: The predicted water quality impacts occurring over the very long term in the alluvium at the Isaac River are below detection limits.	**Low**

Source	Pathway	Receptor	Potential Impact	Likelihood	Consequence	Risk
				conservative assumptions (outlined above). TGDEs along the Isaac River may access shallow groundwater in the Quaternary and Tertiary sediments facultatively.		
		DNM final voids	Changes to Pandora final void water quality	**Possible:** Seepage from the OOPD is likely to enter the Pandora Pit void and may have some effect on water quality.	**Negligible**: The void water quality will reduce over time regardless of the OOPD due to evapo-concentration of dissolved substances. Changes to void water quality resulting from the presence of the OOPD are considered unlikely to be detectable.	**Low**

11.10 Recommendations

Whilst the groundwater impact assessment indicates that the risk of significant contamination of groundwater as a result of the OOPD is low, it is recognised that there is the potential for seepage from the OOPD to enter groundwater and migrate to the west and south. There is currently no groundwater monitoring between the OOPD and the Isaac River to the southwest of the OOPD. Given the potential for migration of seepage affected groundwater to the west and south of the OOPD, and to inform the general hydrogeological understanding of the alluvium / Tertiary / regolith to the southwest of DNM we propose the installation of three monitoring bores at the provisional locations in **Figure 11-20**.

The three locations proposed have been selected based on the solute transport modelling and the location of groundwater receptors (private bores and the Isaac River), and the Mining Lease extent. Locations 2 and 3 have been positioned inside the mining lease in order to facilitate installing them more quickly (i.e. without the need for land access negotiations), and so that they remain under the control of DNM. Location 1 positioned between the OOPD and the House Bore is outside the Mining Lease the final position will be subject to negotiation with the landholder.

The bores would target the saturated water table either in the alluvium or the regolith if the alluvium was found to be thin and dry (or absent). As the geological and hydrogeological conditions are uncertain at these locations bore depths and screened intervals would be confirmed during the drilling process. It is also recommended that allowance be made for installing two bores at one or more of these locations in the event that the alluvium is dry at the time of drilling, with a shallower bore installed to the base of the alluvium and a deeper bore screened across the saturated water table.

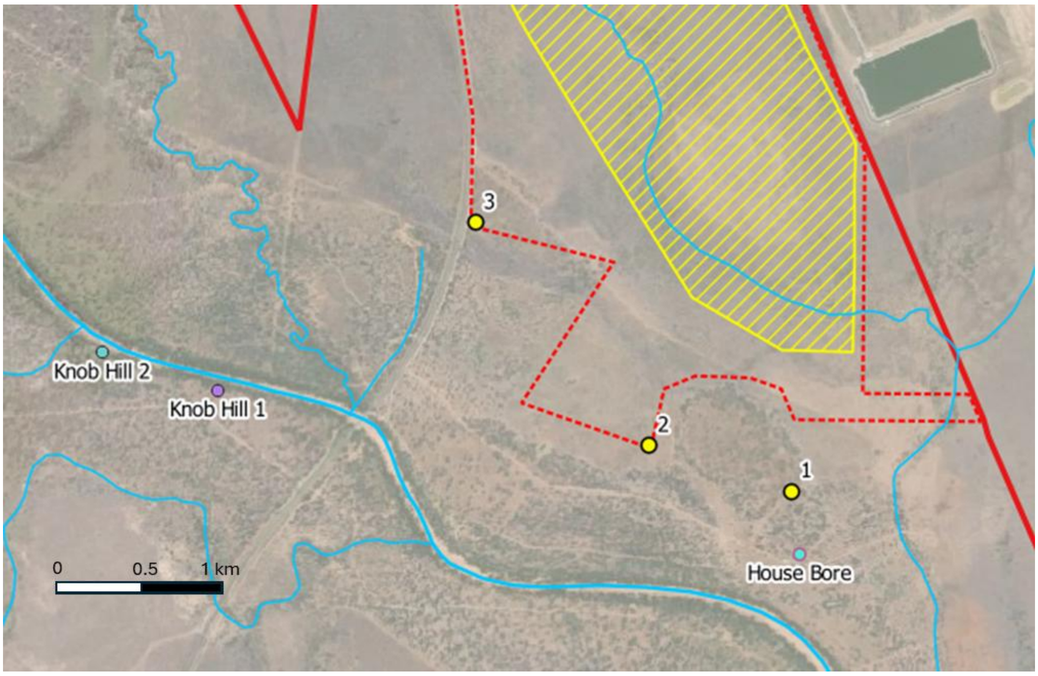


Figure 11-20 Proposed location of groundwater monitoring bores to the south and west of OOPD

The coordinates of the proposed bores are provided in **Table 11-10**.

Table 11-10 Coordinates of proposed groundwater monitoring bores

Monitoring Bore ID	Easting (GDA2020Z55)	Northing (GDA2020Z55)
1	633815.6082	7553370.386
2	633148.5768	7553586.872
3	632259.2258	7554685.409

It is also recommended that bore assessments are undertaken for the three private bores in closest proximity to the proposed OOPD (Knob Hill Bores 1 and 2, House Bore). This would involve assessing the current condition of the bore with landowner interviews to obtain any available details about the bore and how it’s used, including:

- Depth and construction details, age of bore, condition, servicing
- Rest water level
- Bore yield (seasonal variations, reduced yield over time)
- Water use (livestock watering, potable supply etc)
- Water consumption (how many livestock it supports, seasonal variation in use etc)
- Water quality issues
- Collection of a sample for laboratory analysis

This information can be used as a baseline for future reference against which potential impacts from mining activity can be assessed. A more detailed understanding of the construction of these bores may also be used to inform the construction / screen depths of the proposed monitoring bores.

There are a number of ways in which it might be possible to reduce seepage from the OOPD to groundwater, reduce infiltration into the OOPD and promote the drainage or removal of water from the OOPD that may help reduce the potential for impacts on groundwater:

- Compaction of the natural ground across the footprint of the OOPD towards Pandora Pit to reduce infiltration to the natural ground promote drainage of water from the base of the waste rock.
- Water seeping from the toe of OOPD could be collected by a perimeter toe drain, with sumps where water can be removed to an appropriate storage dam or for treatment.
- To facilitate the flow of water from the base of the OOPD to a perimeter toe drain, the following could be considered:
    - The selection of coarser material for the base layer of the OOPD
    - The placement of an engineered drainage layer across the base of the OOPD
    - The installation of drains across the OOPD footprint beneath the waste rock.

- Compaction of the waste rock as each lift is placed. This would reduce the permeability of the waste rock material and therefore, reduce infiltration to the OOPD.
- Appropriate selection of the topsoil layer and profiling of the OOPD may also promote runoff rather than infiltration to the waste rock.

It is acknowledged that there will be overriding engineering, geotechnical and stability considerations that take precedence in the design of the OOPD.

11.11 Conclusions

The groundwater impact assessment for the proposed DWIP OOPD concludes that the potential risk to groundwater environmental values is low.

Due to the more permeable and unstructured nature of waste rock that will form the OOPD, the anticipated higher infiltration rate may result in greater recharge to the underlying strata. Numerical modelling of higher recharge over the OOPD results in groundwater mounding beneath the OOPD. Whilst much of the additional recharge to the OOPD will be captured by the adjacent Pandora Pit residual void, which acts as a strong groundwater sink, particle tracking and solute transport modelling indicates the potential for some off-site migration of seepage from the OOPD to the west and south through the shallow unconsolidated sediments and the underlying Fort Cooper coal measures.

An assessment of the potential extent and concentration of solutes in groundwater arising from the OOPD determined that over the long term (977 years) seepage from the OOPD may reach one private bore (House Bore), and a short reach of the Isaac River. However, the diluted concentrations of solutes in seepage from the OOPD at these locations would not be significant nor would it exceed the relevant water quality guidelines for these receptors.

In addition, the assessment of seepage migration from the OOPD includes several conservative assumptions:

- The assessment assumes that the high recharge rate applied to the OOPD will all reach the water table below the OOPD. In reality, whilst recharge to the sediments below the OOPD may be increased it is likely that some or a significant portion of the infiltration to the spoil may seep from the toe of the OOPD where it can be captured in drains.
- Waste rock leachability data for DNM (Terrenus, 2025) was adopted as the quality of water seeping from the OOPD to groundwater. However, the spoil leachability test method provides a poor proxy for water rock interactions within the OOPD and is considered to overestimate the concentrations of substances that may be present within seepage from the OOPD, certainly over the long term.
- The solute transport model assumes that the “source term” is constant i.e. that the concentrations of solutes seeping from the OOPD do not decline, even over the very long term but remain at the concentrations adopted from the waste rock leachability tests.
- The solute transport model considers advection and dispersion only, no retardation of contaminants was considered that might reduce concentrations or retard their rate of migration.

Even with these conservative assumptions, after 977 years the extent of seepage migration to the west and south of the OOPD was limited with dilution of solutes generally reducing concentrations below detection limits at groundwater receptors.

The post mining equilibrium lake level in the Pandora Pit residual void is anticipated to be in the order of 95 m AHD, some 85 m below the pre-mining groundwater level, and therefore represents a strong groundwater sink in the DNM final landform that will capture the majority of seepage entering groundwater below the OOPD as well as groundwater draining from the surrounding in-pit spoil. In the north of DNM the Titan East final void also acts as a sink for groundwater with a predicted final void lake level of 121 m AHD, approximately 70 m below the pre-mining groundwater level.

12.0 Terrestrial Ecology

12.1 Introduction

A Terrestrial Ecological Assessment has been prepared for the Project and is provided in **Appendix B**. The assessment comprised a desktop review and field surveys of terrestrial ecological values within and adjacent to the Project Area.

The assessment of terrestrial ecology values covered MNES, MSES and other terrestrial matters such as habitat quality assessment, regulated vegetation and REs. The assessment also considered biosecurity obligations under the *Biosecurity Act 2014*, incorporating Weeds of National Significance (WoNS) and locally significant weed species.

Significant impact assessments (SIA) and significant residual impact assessments (SRIA) were undertaken to evaluate potential impacts of the Project on terrestrial ecological values.

12.2 Regional and Local Setting

The DNM is located adjacent to the Isaac River in the Upper Fitzroy River Basin (**Figure 12-1**) and within the Brigalow Belt North bioregion. The region is characterised by high seasonal variability in rainfall, with many waterways of the region, including the Isaac River, being ephemeral and reliant on large summer rainfall events to initiate stream flow. The region is described as mostly semi-arid (Abbas et al 2016).

Spanning from 2015-2025, mean maximum monthly temperatures ranged between 22.9ºC and 28.1ºC in June, and 31.9ºC and 37.9ºC in December (BoM, Moranbah Airport weather station 034035), and mean minimum monthly temperatures range between 8.3ºC and 12.2ºC in June, and 19.1ºC and 21.8ºC in December (BoM, 2025).

Land use within the Brigalow Belt North bioregion is predominately beef cattle grazing on pastoral leases; however, coal mining is also a major economic driver for the region. No watercourses regulated under the *Water Act 2000* are mapped within the Project Area, however the Isaac River runs to the south-west of the Project Area. The waterways of the Project Area and surrounds consist of several ephemeral unnamed tributaries of the Isaac River, that are mapped as having low (green) or moderate (amber) risk of impact to fish passage under the *Fisheries Act 1994*.

The topographic elevations in and around the Project Area range from approximately 180 m AHD (southern end of the disturbance footprint) to 205 m AHD (at the northern end of the Project Area). Most of the Project is situated on gently undulating lowlands and plains with slopes of 0% to 6%.

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12.3 Methodology

12.3.1 Assessment conventions

The assessment conventions are outlined below:

- Project Area – the MLA area to the west of, and adjacent to, ML 1781, off-lease from DNM,
- Disturbance footprint – the disturbance area within the Project Area including the proposed OOPD, haul roads and dams, and
- Study area – the disturbance footprint plus a 20 km buffer.

The Project Area and disturbance footprint differ as there are portions of the Project Area that will not be disturbed. The disturbance footprint is the area proposed to be directly disturbed within the Project Area.

12.3.2 Terminology and nomenclature

Conservation significant species include flora and fauna species that are listed as:

- Threatened (critically endangered, endangered or vulnerable) and/or migratory under the EPBC Act, and
- Threatened, near threatened or special least concern (SLC) species under the *Nature Conservation Act 1992* (NC Act).

12.3.3 Desktop assessment

A desktop assessment was completed to identify any mapped or previously recorded terrestrial ecological values known to occur within the Project Area and Study area. The desktop assessment considered the outcomes of the previous ecological surveys completed to date for the Project Area and disturbance footprint.

12.3.4 Likelihood of occurrence

The information obtained through the desktop assessment was used to characterise the existing ecological values of the Project Area. For conservation significant species, a likelihood of occurrence assessment was undertaken. This assessment considered information relating to species habitat preferences, known or suspected distribution, database records from the Study area, the occurrence of suitable habitat based on desktop information and field assessments, or confirmed presence of species within the Study area (i.e., known records).

If the likelihood of occurrence assessment identified threatened flora and/or fauna species with a moderate, high or known likelihood of occurrence within the Project Area, potential habitat and animal breeding places for those species were targeted during field surveys. Field surveys were conducted within and immediately adjacent to the Project Area to gain an improved understanding of the flora and fauna values that may occur.

12.3.5 Field survey

12.3.5.1 Flora survey methods

Flora surveys followed standard Queensland Herbarium methods (Neldner et al., 2022). To assess the occurrence of vegetation communities and flora species, SLR completed the following at sites across the Project Area and adjacent areas (**Figure 12-2**):

- Quaternary and tertiary assessments in representative vegetation communities to ground-truth REs, identify remnant, regrowth and non-remnant areas, and record vegetation boundaries,
- Identified and recorded the location of MNES or MSES flora species and ecological communities,
- Identified and recorded the location of potential habitat features,
- Identified the presence of invasive flora and fauna species listed under the *Biosecurity Act 2014*,
- Collection of GPS points for any conservation significant flora species, and
- BioCondition assessment.

BioCondition assessment

Methods followed *BioCondition: a condition assessment framework for terrestrial biodiversity in Queensland* (Eyre et al., 2015). BioCondition assessments include a landscape component that uses GIS mapping and a field survey component that measures site-based attributes within a 50 m by 100 m plot. The BioCondition method calculates a condition score (out of 10) for each site by comparing the site-based data to benchmark data developed by the Queensland Herbarium for each RE type (Eyre et al., 2015, Neldner et al., 2022). The benchmark condition for an RE represents that RE in an undisturbed, reference condition. Plots were orientated to minimise any environment gradients (e.g., long axis following altitudinal contour, ridge line, riparian zone). Where no gradient was evident, the long axis of the plot was aligned in a north-south or east-west direction. GPS coordinates were recorded at the 0 m, 50 m and 100 m points of all plots. A summary of methods that were used to assess the site-based BioCondition attributes for REs that have BioCondition benchmarks has been provided in **Table 12-1**.

Table 12-1 Methods used to measure site-based BioCondition attributes

Attribute	Scale	Assessment method
Large trees	100 m x 5 m plot	The large trees attribute records the number of trees within the 100 m x 50 m plot area (i.e., 0.5 ha) over a certain diameter at breast height (DBH) size threshold. The DBH threshold is provided in the benchmark document for the RE being assessed. The count is multiplied by 2 to give a count per ha (for comparison with the benchmark value).
Tree canopy height	100 m x 50 m plot	Tree canopy height (measured to the top of the highest leaves) is the median canopy height (m), estimated for the trees in the ecologically dominant layer (i.e., canopy or T1 layer) within the 100 m x 50 m plot area.
Recruitment of dominant canopy species	100 m x 50 m plot	The recruitment attribute assesses the presence of regeneration of the dominant/abundant canopy species within the 100 m x 50 m plot area.

Attribute	Scale	Assessment method
Tree canopy cover	100 m transect	The vertically projected crown cover of the native tree canopy layer is measured along the 100 m transect, using the line intercept method. If the community includes the presence of a distinct emergent or subcanopy layer, these layers are assessed separately. In BioCondition, a tree is defined as a single-stemmed woody plant more than 2 m tall (or a multi-stemmed mallee eucalypt over 8 m tall and with at least three stems over 10 cm DBH).
Shrub layer cover	100 m transect	The vertically projected crown cover of native shrubs is measured along the 100 m transect, using the line intercept method. In BioCondition, a shrub is defined as a woody plant that is multi-stemmed from the base (or within 200 mm from ground level) or if single stemmed, less than 2 m tall.
Coarse woody debris	50 m x 20 m sub-plot	Coarse woody debris measures logs or dead timber on the ground that are >10 cm in diameter and >0.5 m in length and >80% in contact with the ground. Assessment is conducted by measuring the length of all coarse woody debris within the 50 m x 20 m sub-plot (i.e., 0.1 ha). The total length is multiplied by 10 to give a length per ha.
Native plant species richness by lifeform	100 m x 50 m plot (trees) 50 m x 10 m sub-plot (other life forms)	Assessment is based on the number of native tree, shrub, grass and forb/other species. Tree species richness is assessed within the 100 m x 50 m plot, while other life forms are assessed within the 50 m x 10 m sub-plot. Appendix 7 and 8 of the BioCondition manual (Eyre et al., 2015) define these life form groups. A tree species is also included in the shrub species count if an individual <2 m tall is present in the 50 m x 10 m sub-plot.
Non-native plant cover	50 m x 10 m sub-plot	Non-native plant cover is the vertically projected crown cover of exotic and non-indigenous species, assessed within the 50 m x 10 m sub-plot. Cover is assessed across all vegetation layers by a vertical projection downwards from the canopy and cannot be greater than 100% (e.g., cover of non-native shrubs is excluded where it is directly below the vertically projected cover of non-native trees).
Native perennial grass cover	5 x 1 m quadrats	Perennial grass cover is the foliage projective cover of native perennial grasses, including living and attached plant material. Cover is assessed within each of the five 1 m x 1 m quadrats and averaged to give a value for the site.
Organic litter cover	5 x 1 m quadrats	Organic litter includes both fine and coarse organic material such as fallen leaves, twigs and branches <10 cm in diameter, and dead unattached plant material including dead grass. Organic litter cover is assessed as foliage projective cover within each of the five 1 m x 1 m quadrats and averaged to give a value for the site.

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12.3.5.2 Fauna survey methods

The fauna survey generally incorporated survey timing and effort recommendations outlined in the Terrestrial Vertebrate Survey Guidelines for Queensland (Eyre et al., 2022a). The assessment methodology completed across the Project Area (**Figure 12-3**) included:

- Identification and verification of fauna habitats within the Project Area (including one site adjacent to the Project Area boundary),
- Assessment of habitat value for conservation significant fauna species including identifying critical elements for species usage such as feed trees, hollowing bearing trees, waterway and riparian habitat and other micro-habitat features, and
- Targeted searches for conservation significant fauna species considered likely to occur.

Fauna habitat assessments included recording the following parameters within and adjacent the Project Area:

- Rocks and rocky outcrops, gravel areas, exfoliating rocks with cervices,
- Sandy or cracking soils,
- Trees and logs with hollows, presence of senescent (old) or dead trees (stags) and trees or logs with peeling or loose bark,
- Vegetation cover: canopy, shrub, ground cover and leaf litter,
- Habitat features and or food resources, such as termite mounds, mistletoe (abundance), flowering trees,
- Standing water or ephemeral waterways including wetland, riverine and groundwater springs (presence / absence), and
- Scats, tracks and other traces of fauna utilisation.

These assessments assisted in determining the likelihood of occurrence for conservation significant species within the Project Area. Opportunistic fauna sightings of all species were also recorded.

Habitat quality assessments

Habitat quality assessments for conservation significant species were conducted in accordance with the Guide to determining terrestrial habitat quality: A toolkit for assessing land based offsets under the *Queensland Environmental Offsets Policy*, version 1.3 (GTDTHQ) (DES, 2020). This approach incorporates a range of indicators to measure the overall viability of a site and its capacity to support a prescribed environmental matter (DES, 2020).

For each species, specific habitat quality indicators were developed for conservation significant species considered highly likely to occur at the desktop stage. These indicators were developed to determine the:

- Quality and availability of food and habitat required for foraging,
- Quality and availability of habitat required for shelter and breeding,
- Quality and availability of habitat required for mobility, and
- Absence of threats.

Indicators are scored from zero to five in the field, with the exception of threat indicators being scored zero to five. Each score (excluding threat indicators) is multiplied by five to convert to a score between 0 and 25. The species habitat attribute score is calculated by averaging each indicator score (excluding absence of threats) to obtain an overall score out of 25.

Scoring for absence of threats requires identifying all known and potential threat factors, assigning each a rating for scope and severity (out of 25) and using the threat matrix provided in GTDTHQ (DES, 2020). A threat factor rating of 1 poses a very high threat and a rating of 25 poses a very low threat to the species. The final score for absence of threats is the highest scoring threat factor. The overall species habitat score is calculated by summing all attribute scores and dividing by 10 to provide a final score.

Targeted surveys

The targeted survey effort that has been undertaken within the Project Area (including surveys adjacent to the Project Area) in 2021, 2023 and 2025 is detailed in **Table 12-2**. The findings in the assessment have been informed by the results from these surveys. Targeted survey methods followed State and/or Commonwealth survey guidelines for fauna considered likely to occur within the Project Area, however, survey effort for some species (e.g. cryptic species such as ornamental snake (*Denisonia maculata*) focused on habitat suitability and applying the precautionary principle to assume presence rather than meeting the extensive required survey effort for the species.

Table 12-2 Targeted fauna survey methods

Survey method	Description	Total survey effort from 2021 to 2025 within and adjacent to the Project Area
Elliott traps	At each trapping site, type-A Elliott traps were placed on the ground approximately 5 to 10 m apart in a straight line. Twenty traps were employed at each site. All traps were baited with a mixture of rolled oats, peanut butter and honey.	20 traps x 4 nights x 5 sites = 400 trap nights
Bat detectors	An Anabat or SM4 bat call detector was deployed for one night to identify the presence/absence of microbat species.	4 sites x 1 night = 4 nights
Active diurnal searches	Active diurnal searches were undertaken concurrently with vegetation assessments throughout the disturbance footprint. This technique involved intensive investigation of ground layer habitat features (such as under logs, rocks and leaf litter), low vegetation (under bark and tree stumps) for cryptic fauna, particularly reptiles. Searches were focused during the hotter times of the day when reptile activity was likely to be at its peak.	105 person minutes x 2 persons x 10 days = 35 person-hours
Diurnal bird surveys	Birds were surveyed in each vegetation community for a total of at least one hour at multiple periods throughout the day, but with a particular focus during peak activity in the morning. Incidental observations made whilst conducting other survey techniques were also recorded. Birds were identified from either direct observation or by their calls. Targeted survey effort included flushing surveys for squatter pigeon (southern) (*Geophaps scripta scripta*) and early- morning watches of standing water for more cryptic bird species.	54 person minutes x 2 persons x 10 sites = 18 person-hours

Survey method	Description	Total survey effort from 2021 to 2025 within and adjacent to the Project Area
Nocturnal surveys	High-powered spotlights were used to survey nocturnal mammals (flying, arboreal and terrestrial), birds (active nocturnal species, and roosting diurnal species), reptiles and frogs. Focus was placed on searches for ornamental snake (*Denisonia maculata*) in remnant, regrowth and non- remnant Brigalow communities on Cainozoic cracking clays, and searches for greater glider (central and southern) (*Petauroides volans*) in remnant eucalypt-dominated riparian woodland with high density of tree hollows.	100 person minutes x 2 persons x 5 nights = 16 person-hours
Infrared motion-sensitive trail cameras	Camera traps (motion-sensing infrared cameras) were utilised at multiple locations within the Project Area and adjacent area to target cryptic species. Camera traps were baited with the peanut-butter rolled oat mixture and sardines.	5 cameras x 4 nights = 20 camera nights
Koala spot assessment technique (SAT)	For each SAT, 30 suitable koala trees (e.g. *Eucalyptus tereticornis* present within the Project Area) were examined for koala scratches, urine stains and the ground up to 1 m from the base of each tree examined for scats (Phillips and Callaghan, 2011). This survey aims to detect the presence and activity level of koala in a specified area. Activity level is determined by the number of trees recording evidence of koala divided by the total number of trees searched multiplied by 100.	2 person-hours x 2 persons x 2 sites = 8 person-hours
Incidental sightings	Observations for scats, scratches, cone chewings “orts”, burrows and dreys, or other signs of fauna activity.	Opportunistically

12.3.5.3 Survey effort and limitations

Five field survey periods were completed in three separate years (2021, 2023 and 2025), those being:

- 19 to 23 April 2021,
- 25 to 28 May 2021,
- 6 to 9 November 2021,
- 6 to 11 November 2023, and
- 1 to 3 September 2025.

The 2021 April and November survey periods were both truncated due to heavy rainfall throughout the Project Area and adjacent area. As many portions of the Project Area and adjacent area and most access tracks are dominated by black alluvial soils, even a small amount of precipitation impeded access to site. The digging of pitfall traps was not permitted on site as per client and cultural heritage request.

No fauna trapping was undertaken during the November 2021 and 2023 surveys due to high day-time temperatures and a high chance of rain, which would impede access to trap sites resulting in the potential for fauna mortalities and contravene SLR's animal ethics permit requirements.

Significant vegetation management had been undertaken by the landowner just prior to the September 2025 survey. Vegetation management resulted in heavily disturbing the existing environment and made it difficult to assess certain habitat attributes including suitability of cracking clays for ornamental snake habitat.

As a general note, field surveys may confirm the presence of a species, but not the absence. Species not recorded during the field surveys may still occur in the Project Area but would require further investigation to confirm their presence. The likelihood of occurrence has been used to assess the presence of species and aid in overcoming this limitation.

Survey results only present a snapshot in time, and may not detect those species that are nomadic, migratory or are more active (and detectable) at particular times of the year. Factors such as seasonal variation, weather conditions, species detectability, and survey timing can influence the likelihood of recording certain flora and fauna. Some species may only be present intermittently, occur in low densities, or utilise the site during particular life stages or seasonal movements. As such, the absence of records during surveys does not necessarily indicate true absence, and results should be interpreted with consideration of these constraints.

12.3.5.4 Threatened species habitat mapping

Habitat values and quality were assessed for each species within or adjacent to the Project Area. Where conservation significant species were identified as highly likely to occur within the Project Area based on the likelihood of occurrence assessment and field survey, species specific habitat mapping was developed. This included a detailed literature review of individual species habitat requirements from the following sources:

- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Species profile and threats (SPRAT) database (DCCEEW, 2025b),
- Conservation advice and listing advice documents, and
- DETSI Species Profiles (DETSI, 2025a).

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12.4 Environmental Values

12.4.1 Desktop assessment results

The MNES and MSES identified within or adjacent to the Project Area by the desktop assessment has been summarised in **Table 12-3**. The key environmental values mapped within the Project Area and / or Study area are presented in **Figure 12-4**.

Table 12-3 MNES and MSES summary

Ecological value	Description/Status/Presence of likely absence
MNES	
World Heritage Places	None within the Study area
National Heritage Places	None within the Study area
Wetlands of International Importance	None within the Study area
Great Barrier Reef Marine Park	None within the Study area
Commonwealth Marine Area	None within the Study area
Threatened Ecological Communities (TECs)	Four TECs were returned within the Study area, including: • Brigalow (*Acacia harpophylla* dominant and codominant) (endangered), • Poplar Box Grassy Woodland on Alluvial Plains (endangered), • Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin (endangered), and • Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (endangered).
Threatened Species*^	30 threatened species have potential to occur including: • 12 birds, • Six plants, • Five mammals, and • Seven reptiles.
Migratory Species*^	10 migratory bird species have potential to occur
MSES	
Protected areas	No protected areas are mapped within the Project Area or Study area. The closest protected area is the Dipperu National Park, located approximately 42 km to the northeast of the Project Area.
Regulated Vegetation	The Project Area is mapped as Category X non-remnant vegetation. The following regulated vegetation is mapped within 1 km of the Project Area: Category B (endangered), Category B (least concern), and Category C (least concern).

Ecological value	Description/Status/Presence of likely absence
Regional Ecosystem	The Project Area occurs within the Brigalow Belt Bioregion (Bioregion 11) and is mapped as non-remnant (**Figure 12-5**). Pre-clear mapping for the disturbance footprint identifies the pre-clear RE as 11.9.2, 11.9.2/11.9.5 and 11.4.9. The following REs are mapped as occurring within 500 m of the disturbance footprint: • 11.3.2/11.3.7/11.3.1, • 11.4.9, and • 11.5.3/11.4.9.
Vegetation management wetlands and watercourses (Queensland Government, 2025)	No wetlands of high ecological significance are mapped to occur within the Project Area or Study area. The following wetlands and watercourses are mapped within the Project Area and disturbance footprint (**Figure 12-4**): • Regulated vegetation watercourse; • Lacustrine wetland; and • Regulated vegetation (100 m from wetland).
Essential habitat	No essential habitat is mapped within the Project Area. Essential habitat for squatter pigeon (southern), ornamental snake and koala (*Phascolarctos cinereus*) is mapped within 13 m of the disturbance footprint (**Figure 12-4**).
Wildlife habitat	Not mapped within the Project Area or Study area.
Environmentally Sensitive Area (ESA)	No ESA is mapped within the disturbance footprint. Category B ESA – Endangered RE (biodiversity status) is mapped within 200 m of the disturbance footprint.
DETSI Protected Plants Flora Trigger map	No protected plant flora survey trigger areas are mapped within the Project Area or Study area.
Waterways (Fisheries Act 1994)	One green (low impact) waterway and one amber (moderate impact) waterway runs through the Project Area and disturbance footprint.
WildNet species	A total of 19 conservation significant species (16 threatened and near-threatened, and 3 SLC) were returned from database searches including: • Four birds, • Five mammals, • Two reptiles, and • Eight plants.
Legally secured offset areas	Not mapped within the Project Area of Study area.
Biodiversity Significance	Areas of biodiversity significance are mapped withing the Project Area and disturbance footprint (**Figure 12-6**): • State; • State habitat for conservation significant species; and • Local of other value.

* PMST and WildNet searches include a 20 km buffer on the Project Area.
^ PMST results for marine species have been excluded.
# MSES searches include a 2 km buffer on the Project Area.

The four TECs returned in the PMST search, and their component or corresponding REs are summarised in **Table 12-4**.

Table 12-4 Desktop likelihood of occurrence assessment for TECs

TEC	Likelihood of occurrence
Brigalow (*Acacia harpophylla dominant* and *codominant*) (endangered)	**Unlikely** Conservation advice lists the following REs as corresponding to this ecological community within the Queensland Brigalow Belt Bioregion: 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21. None of these REs are mapped by the State within the Project Area or disturbance footprint.
Popular Box Grassy Woodland on Alluvial Plains (endangered)	**Unlikely** Conservation advice lists the following REs as corresponding to this ecological community: 11.3.2, 11.3.17, 11.4.7, 11.4.12, 12.3.10. None of these REs are mapped by the State within the Project Area or disturbance footprint.
Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin (endangered)	**Unlikely** Conservation advice lists the following REs as corresponding to this ecological community: 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.3, 11.9.12, 11.11.17. None of these REs are mapped by the State within the Project Area or disturbance footprint.
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (endangered)	**Unlikely** Conservation advice lists the following REs as corresponding to this ecological community: 11.3.11, 11.4.1, 11.8.13, 11.11.18, 11.2.23, 11.9.4. None of these REs are mapped by the State within the Project Area or disturbance footprint.

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12.4.2 Field results

12.4.2.1 Weather conditions

Weather data relevant to the fauna survey periods was obtained from the Bureau of Meteorology (BoM, 2025) Moranbah Airport Weather Station (station number: 034035), located approximately 23 km to the northwest of the Project Area. Weather conditions during the surveys were considered favourable for detecting most vertebrate faunal groups. However, rainfall over the April and November 2021 and November 2023 surveys resulted in access limitations to the Project Area and adjacent area.

Monthly rainfall data up to and including a six-month period prior to field assessments is shown in **Figure 12-7** and compared to the historical monthly average (available for the 2012 to 2023 period). Above average rainfall prior to surveys in 2021 resulted in favourable conditions for the growth and vigour of flora species and the assessment of vegetation communities. Conversely, monthly rainfall was well below the historical average over August, September and October 2023, leading to very dry conditions, which impacted groundcover species in flora assessment sites.

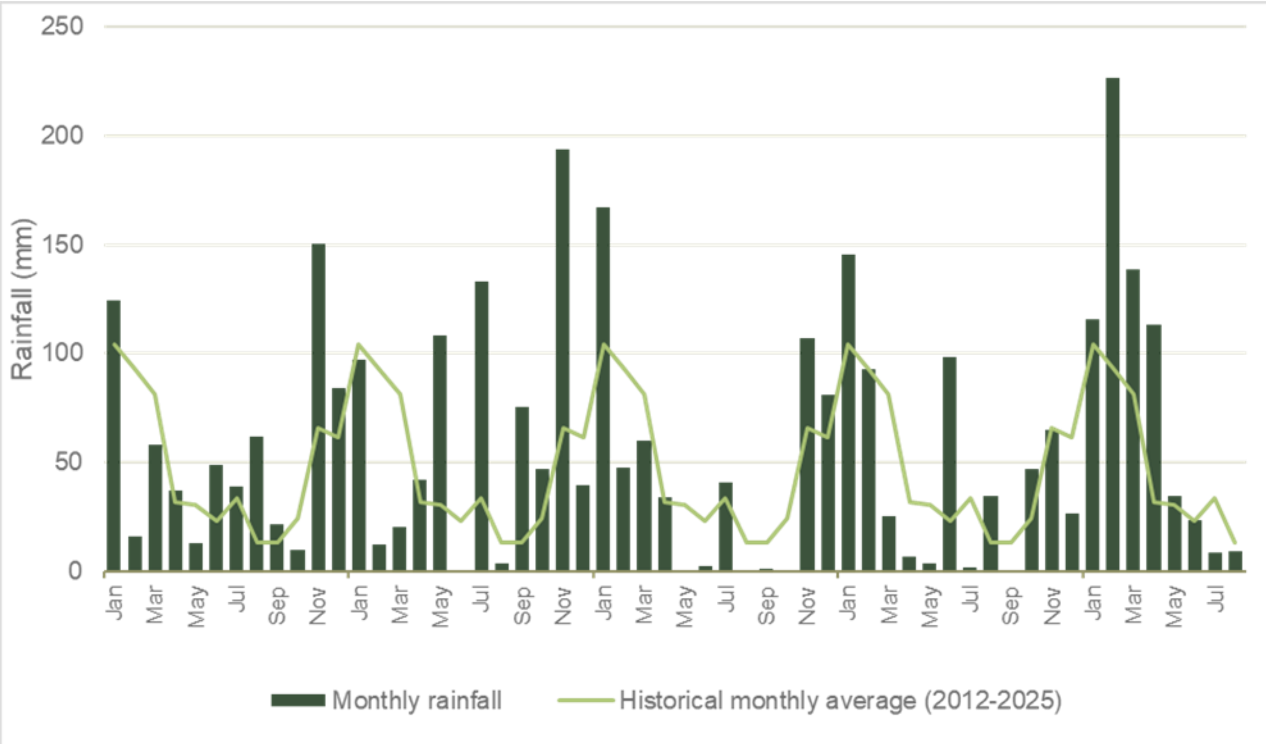

Figure 12-7 Monthly rainfall data from 2021 to 2025 compared to the historical monthly average

12.4.2.2 Terrestrial flora

Flora species

No conservation significant flora species listed under the EPBC Act or NC Act were recorded within the Project Area. A total of 156 flora species were recorded within the Project Are and area immediately adjacent, of which, a total of 22 species are considered non-native naturalised species. Four of these species *(Lantana camara, Parthenium hysterophorus, Harrisia martinii* and *Opuntia tomentosa*) are listed as Category 3 restricted invasive flora under the Biosecurity Act 2014. Three species, L. camara, P. hysterophorus, and O. tomentosa are also listed as WoNS. Four NC Act listed SLC flora species were identified outside the Project Area but immediately adjacent. All species recorded are considered common and widespread within similar habitats throughout the Brigalow Belt Bioregion.

REs

Previous field-verification surveys (2021 - 2023) ground-truthed the State-mapped REs across the Project Area and immediate vicinity. The 2025 September survey included two additional quaternary surveys and nine BioCondition assessments to ground-truth the State-mapped vegetation within the Disturbance footprint. These assessments verified the non-remnant status of 308.1 ha of vegetation within the disturbance footprint and 16.26 ha of remnant Of Concern RE 11.3.3 (**Figure 12-8**).

Non-remnant vegetation within the disturbance footprint could be broadly grouped into three categories:

- Recently cleared *Acacia harpophylla* (Brigalow) regrowth (was likely to be approximately ten years old prior to clearing in 2025, based on review of aerial imagery),
- Historically cleared paddock, and
- Isolated small stands of Brigalow too small to accurately map.

TECs

The desktop assessment returned four TECs as potentially occurring within the Project Area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin
- Poplar Box Grassy Woodland an Alluvial Plains
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions.

Nine vegetation assessments were previously conducted in the Project Area and disturbance footprint and an additional twelve were conducted in the September 2025 survey. Surveys confirmed non-remnant vegetation and remnant RE 11.5.3 and 11.3.1 within the Project Area, and remnant RE 11.3.3 within the Project Area and disturbance footprint.

Furthermore, clearing has occurred regularly within the last 15 years in the disturbance footprint and the disturbance footprint was extensively cleared prior to the 2025 September surveys. In accordance with Brigalow (*Acacia harpophylla* dominant and co-dominant) conservation advice (DCCEEW, 2001), areas of regrowth that have been cleared in the previous 15 years are unlikely to be considered to meet the key diagnostic criteria for the EPBC Act listed Brigalow TEC. Furthermore, extensive areas of exotic perennial grasses (e.g., buffel grass, or Indian bluegrass) are present across the Disturbance footprint and likely comprises in excess of 50% of the vegetation cover at the ground layer, meaning any Brigalow patch present is also unlikely to meet the TEC condition thresholds on this basis.

Previous studies confirmed the presence of two TECs within and adjacent to the Project Area (survey site H9 and H13, Brigalow (A. harpophylla) dominant and co-dominant and Poplar Box Grassy Woodland on Alluvial Plains (SLR, 2023, **Figure 12-9**). The Brigalow TEC occurs within the Project Area approximately 13 m to the south of the disturbance footprint's haul road and the Poplar Box TEC occurs approximately 450 m to the southwest of the disturbance footprint, outside of the Project Area. This distance would provide an appropriate buffer from the disturbance footprint to the Poplar Box TEC, however not to the Brigalow TEC. There will be no direct impacts to the Brigalow TEC, and as long as suitable management is implemented (e.g. sediment control), the Project is unlikely to result in indirect impacts to either of these TECs.

Environmentally Sensitive Areas (ESA)

The previous field assessments (SLR, 2023) identified one endangered RE within the Project Area approximately 480 m southeast of the disturbance footprint (RE 11.3.1) and one endangered RE approximately 500 m southwest of the disturbance footprint (RE 11.4.9). Both REs are classified as Category B ESAs. As per the *Standard Conditions for mining lease activities* (ESR/2016/2241 version 2.00, (DEHP 2016)), a 1 km buffer should be applied to the ground-truthed RE 11.3.1 (approximately 45 ha of ESA buffer for all patches of RE 11.3.1) and RE 11.4.9 (56.4 ha of RE 11.4.9 buffer) for protection. This site-specific EA application is submitted for the new MLA, and therefore, standard conditions and associated buffers are not applicable to the Project. Management measures to protect the patch of RE 11.3.1 immediately adjacent to the haul road (southern portion of disturbance footprint) are discussed in **Section 12.6**.

Weeds

A total of 22 non-native flora species were identified within or adjacent to the Project Area. The majority of these species are considered environmental weeds or flora introduced for the purpose of pasture improvement. However, four of these species are listed as Category 3 restricted invasive flora under the *Biosecurity Act 2014*.Three of these species are also listed as WoNS:

- Llantana (*Lantana camara*), Category 3 restricted, WoNS,
- Parthenium (*Parthenium hysterophorus*), Category 3 restricted, WoNS,
- Harrisia cactus (*Harrisia martinii*), Category 3 restricted, and
- Velvety tree pear (*Opuntia tomentosa*), Category 3 restricted, WoNS.

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BioCondition assessment

The Project Area is comprised of non-remnant vegetation and remnant RE 11.3.3. BioCondition assessments were conducted at nine sites during the September 2025 survey, including one site within remnant RE 11.3.3 and eight sites within non-remnant vegetation. Remnant REs 11.3.1 and 11.5.3 were previously surveyed (SLR, 2023). A summary of key BioCondition assessment results are provided in **Table 12-5**. As most of the site was non-remnant, pre-clear RE mapping was used for benchmarks.

Table 12-5 Summary of key BioCondition assessment results

RE used for benchmark	VM Act class	Biodiversity status	REDD short description	BioCondition sites			Location
				2021	2023	2025	
11.4.9 (pre-clear)	Endangered	Endangered	*A. harpophylla* shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains.			BC1, BC2	Within Project Area
11.3.1 (remnant)	Endangered	Endangered	*A. harpophylla* and/or *C. cristata* open forest on alluvial plains.	H9			Within Project Area
11.9.4 (pre-clear)	Of concern	Endangered	Semi-evergreen vine thicket or *A. harpophylla* with a semi-evergreen vine thicket understorey on fine-grained sedimentary rocks.			BC3, BC4	Within Project Area
11.3.3 (remnant)	Of concern	Of concern	*E. coolabah* woodland on alluvial plains.			BC9	Within disturbance footprint
11.5.3 (remnant)	Least concern	No concern at present	*E. populnea* +/- *E. melanophloia* +/- *C. clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces.		BC3		Within Project Area
11.9.2 (pre-clear)	Least concern	No concern at present	*E. melanophloia* +/- *E. orgadophila* woodland to open woodland on fine-grained sedimentary rocks.			BC5*, BC6*, BC7*, BC8*	Within Project Area
*RE 11.9.2 benchmarks were used for these sites which had a mosaic pre-clear RE of 11.9.2/11.9.5							

12.4.2.3 Terrestrial fauna

Habitat features

Habitat types within the Project Area and disturbance footprint fall into six broad categories:

- Non-remnant cleared areas with very sparse shrub cover,
- Isolated small stands of Brigalow (too small to be mapped),
- Sparse *Eucalyptus coolabah* woodland (RE 11.3.3) fringing an ephemeral watercourse,
- Open forest to open woodland of Poplar Box (RE 11.5.3) on crests of low slopes on red- brown sandy loam,
- Low open forest to woodland of Brigalow on ephemeral drainage channels, and
- Ephemeral cracking clay soil watercourse.

Within each habitat type, habitat values and features providing suitable shelter, nesting and food resources were recorded. Very sparse *Eucalyptus coolabah* woodland along the ephemeral watercourse that runs through the disturbance footprint (RE 11.3.3) contained the most substantial fauna habitat across the disturbance footprint, including hollows, cracking clay soils, leaf litter, ephemeral watercourse (which would maintain small shallow pools for short periods after rainfall), and Brigalow Belt locally important koala trees (E. coolabah) and ancillary habitat trees (*Acacia salicina*) (Youngentob et al., 2021). This habitat recorded the highest faunal diversity within the disturbance footprint during 2025 September surveys.

No permanent standing water occurs within the disturbance footprint. The Isaac River is located approximately 1.5 km south of the disturbance footprint. It is the largest watercourse in the local area and retains water in some isolated pools into the dry season. The Isaac River along with adjacent RE 11.3.25, provides a valuable resource to multiple faunal groups that occupy vegetation in the land adjacent (500 m to the south) to the disturbance footprint. This vegetation contains larger tree species with increased amounts of hollows, woody debris, seasonally inundated areas and semi-permanent pools, all of which provide foraging and sheltering opportunities. These established habitats adjacent to the Disturbance footprint supported flowering trees providing foraging opportunities for arboreal mammals and nectivorous birds.

Previous surveys (SLR, 2023) recorded the highest diversity of fauna in heavily wooded areas in land to the south of the disturbance footprint, where the presence of woody debris, moderate groundcover and leaf litter was recorded providing micro habitats for small mammal, reptile and amphibians. Within these areas, REs 11.3.1, 11.3.3 and 11.4.9 contained additional habitat values in the form of cracking clay soils.

Fauna detected

No conservation significant fauna species were recorded within the disturbance footprint. However, some species were detected adjacent (1 km - 2 km) to the Project Area, these include koala (*Phascolarctos cinereus*), greater glider (central and southern) (*Petauroides volans*), and squatter pigeon (southern) (**Figure 12-10**). Few habitat features for conservation significant species occur in the disturbance footprint, the following sections provide a brief discussion of the species observed for each taxonomic group.

Native birds

The 2025 September survey recorded 63 bird species within and adjacent to the Project Area. Previous field surveys recorded additional species within the Project Area and surrounding 1 km to 2 km, bringing the total to 82 native bird species.

One conservation significant species, squatter pigeon (southern) has been recorded outside the Project Area on multiple occasions during field surveys. The squatter pigeons were recorded in non-remnant vegetation, within and adjacent to remnant RE 11.3.1, adjacent to the rail corridor, cattle dams, cattle yards, and along the roadside on various occasions between 2021 and 2025.

The entire Project Area is within 1.7 km of various permanent water sources, including a large pond associated with the existing mine. Areas within 300 m of woodland or scattered trees within the Project Area, particularly on sandy, gravelly or loamy soil, provide foraging habitat for squatter pigeon. (Lloyd et al. 2025). Some of these areas within the Project Area are located within 1 km of a permanent water source and thus provide both breeding and foraging habitat. Areas within 300 m of scattered trees or woodland on clay plains within the Project Area provide dispersal habitat for the squatter pigeon. As there is habitat suitable for the species, this was assessed further through habitat quality assessment (see **Section 12.4.2.4** for more detail) and assessment of significant impacts completed against Commonwealth and State guidelines. All other bird species observed within the Project Area and immediately adjacent are not of conservation significance.

Native mammals

The 2025 September survey recorded four native mammal species within the Project Area with a total of 21 native mammal species recorded across all surveys within the Project Area and immediately adjacent during field assessments. Two conservation significant species were recorded, including koala within the Project Area and greater glider (central and southern) (*Petauroides volans*) outside the Project Area; both are listed as Endangered under the NC Act and EPBC Act. The 2025 September survey detected koala scratches on a stand of trees approximately 260 m southwest of the disturbance footprint within a patch of vegetation that is spatially separated from eucalypt woodland within the disturbance footprint by approximately 400 m of cleared paddock. The 2025 September survey also incidentally recorded three greater gliders located in riparian vegetation along the Isaac River outside of the Project Area.

The Project Area does not contain suitable habitat to support foraging or breeding for greater glider, as they require denning trees with hollows greater than 50 cm (Eyre et al 2022b), attributes which are not found within the Project Area. The highly fragmented remaining eucalypt woodland within the v is also unlikely to be suitable for dispersal habitat due to the large, cleared areas between suitable refuge vegetation. Furthermore, the vegetation within the site does not connect two larger patches of habitat together, thus supporting that it is unlikely to be used as dispersal habitat.

The remnant RE 11.3.3, 11.5.3 and 11.3.1 open woodland patches within the Project Area provides breeding and foraging habitat for koala. These REs contain important ancillary habit elements and locally important koala trees that may be essential for koala survival (Youngentob et al. 2021). A small stretch of isolated trees connecting two patches of RE 11.3.3 provides dispersal habitat for koala within the disturbance footprint, as isolated trees can act as stepping stone between larger habitat patches (Youngentob et al. 2021). This habitat is fragmented from adjacent habitat by approximately 400 m of cleared paddock.

Evidence of short-beaked echidna (*Tachyglossus aculeatus*) was also observed adjacent to, but not within the disturbance footprint (in RE 11.3.2), in the form of excavated termite mounds, a known habitat feature used by this species. Whilst no individuals were recorded within Project Area or disturbance footprint, the disturbance footprint is also likely to support foraging habitat for the species as they occur in almost all terrestrial habitats (Nicol and Andersen, 2007).

Native reptiles

The 2025 September survey recorded eight reptile species within the Project Area with a total of 16 reptile species recorded across all surveys within the Project Area and immediately adjacent during field assessments. None of these are conservation significant species, and all are generally common within similar habitats throughout the region.

Some habitat features for ornamental snake were recorded in the Project Area (see **Section 12.4.2.4** for more detail), namely areas of alluvial soils that contained some cracking features.

Native amphibians

The 2025 September survey recorded two native amphibian species within the Project Area with a total of four native reptile species recorded across all surveys within the Project Area and immediately adjacent. None of these are conservation significance species, and all are generally common in similar habitats throughout the region. Marginal features for amphibians, such as the ephemeral watercourse and cracking clays occur within the Project Area. The watercourse and low-lying areas within the disturbance footprint may seasonally maintain water during and shortly after rainfall.

Introduced fauna

Seven introduced fauna species were detected across all surveys within the Project Area and immediately adjacent. Three of these species are restricted invasive fauna under the *Biosecurity Act 2014*. The introduced species detected included:

- Cane toad (*Rhinella marina*),
- Common myna (*Acridotheres tristis*),
- European cattle (*Bos taurus*),
- European brown hare (*Lepus europaeus*),
- Dingo[1] (*Canis lupus dingo*) restricted,
- Feral pig (*Sus scrofa*) restricted, and
- Red fox (*Vulpes vulpes*), restricted.

[1] Dingoes are a protected native species under the NC Act within a protected area. However, this species is a restricted invasive fauna species under the *Biosecurity Act 2014* outside of protected areas.

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12.4.2.4 Areas of biodiversity significance

The disturbance footprint is mapped as containing areas of state and local biodiversity significance on the Biodiversity Plan Assessment mapping for the Brigalow Belt Region.

Areas of state significance are mapped within the southern portion of the disturbance footprint. These areas are recognised for their state significance due to the presence of remnant vegetation that forms part of a bioregional corridor and provides habitat for conservation-significant species. One area of local significance was also identified, which contains important wildlife refugia.

12.4.2.5 Habitat quality assessment results

Squatter pigeon (southern)

Squatter pigeon (southern) habitat was determined by a combination of habitat suitability and distance from water, as this species relies on regular access to a water source (TSSC, 2015). Habitat attributes were informed by the Conservation Advice (TSSC, 2015), Squatter Pigeon (southern) workshop outcomes summary (DEHP, DERM and Queensland Parks and Wildlife Service, 2011) and published literature.

There have been no confirmed records of squatter pigeon (southern) within the disturbance footprint. The nearest record during previous surveys was recorded near a cattle dam approximately 1 km southeast of the Project Area (Latitude: - 22°7'3.93"S Longitude: 148°17'8.25"E). The 2025 September survey recorded six squatter pigeons (southern) foraging adjacent to a gravel track and cattle yards, approximately 12 km from the disturbance footprint. Within the Study area, 26 records were returned from the desktop assessment (ALA) and approximately 22 were recorded during field surveys adjacent to the Project Area.

For the purposes of this assessment, squatter pigeon (southern) suitable breeding habitat is described as eucalypt woodlands or scattered trees within a 300 m buffer on any landzone excluding landzone 4 that are within 1 km of a perennial water source. Suitable foraging habitat is described as eucalypt woodlands or scattered trees within a 300 m buffer on any landzone excluding landzone 4 that are within 1.7 km of a perennial water source. Squatter pigeon (southern) dispersal habitat includes eucalypt woodland or scattered trees within a 300 m buffer occurring on landzone 4.

Squatter pigeon habitat is depicted in **Figure 12-11**. The Project Area contains 326.96 ha of suitable squatter pigeon habitat including 141.44 ha of breeding habitat, 51.72 ha of foraging habitat and 133.79 ha of dispersal habitat. The disturbance footprint contains 198.26 ha of suitable squatter pigeon (southern) habitat comprised of 90.42 ha of suitable breeding habitat, 49.77 ha of suitable foraging habitat and 58.06 ha of dispersal habitat.

Ornamental snake

Ornamental snake habitat is defined as Brigalow-dominated and Coolabah-dominated vegetation communities on appropriate cracking clay soils or with sufficient quantities of shelter. Other important habitat features include:

- Evidence of seasonal inundation with the potential to support frog communities as a source of food, and
- Areas with deep soil cracks providing potential breeding and sheltering areas.

No ornamental snakes were recorded within the disturbance footprint, however, suitable habitat in the form of some cracking soils and areas of seasonal inundation is present within the disturbance footprint and broader Project Area, in deeply alluvial soils along the watercourse. Ornamental snake habitat is depicted in **Figure 12-12.** The Project Area contains 113.13 ha of suitable ornamental snake habitat including 24.43 ha of breeding and foraging habitat and 88.7 ha of dispersal habitat. The extent of habitat within the disturbance footprint is approximately 23.66 ha of breeding and foraging habitat and 48.70 ha of dispersal habitat.

Koala

The koala is predominantly associated with eucalypt forests containing locally important koala trees and ancillary tree species. Non-eucalypt trees, even when not favoured for food, may be used for shelter and thermoregulation. Both remnant and non-remnant vegetation can be high quality koala habitat, and koalas are just as likely to occur in “lower quality” regrowth habitats as they are in “higher quality” habitats (Youngentob et al. 2021).

No koalas were recorded within the disturbance footprint, however, during the September 2025 survey, one individual was recorded within the Project Area. Several *Eucalyptus tereticornis* trees located in a patch of vegetation approximately 460 m to the southwest of the disturbance footprint showed evidence of koala scratch marks.

There are three koala habitat types mapped within the disturbance footprint, these include:

- Potential breeding and foraging habitat: ground-truthed remnant vegetation containing locally important koala habitat trees.
- Dispersal habitat: non-remnant areas that do not provide potential breeding or foraging habitat, located adjacent to remnant vegetation containing scattered trees in sufficient densities to allow safe movement through the landscape.
- Unsuitable habitat: non-remnant areas containing limited to no suitable habitat trees. Koala habitat quality was informed using data collected for RE verification. Within the disturbance footprint, suitable habitat for this species is limited to three ground-truthed patches of RE 11.3,3, 11.5.3, 11.3.1 and an interconnecting strip of non-remnant vegetation between two patches of RE 11.3.3. Remnant vegetation provides suitable foraging and breeding habitat, while the non-remnant interconnecting strip of vegetation provides dispersal opportunities between the two patches of RE 11.3.3.

Suitable habitat for this species within the disturbance footprint is separated from adjacent areas of suitable habitat approximately 400 m to the south within the Project Area. Isolation has resulted from historical mechanical clearing of regenerating vegetation, which has created extensive open areas largely lacking tree and shrub cover. Recent vegetation management had been undertaken by the landowner just prior to the September 2025 survey, further reinforcing the ongoing isolation and fragmentation of suitable habitat within the disturbance footprint.

Koala habitat is depicted in **Figure 12-13**. The Project Area contains 33.84 ha of suitable koala habitat including 28.84 ha of breeding and foraging habitat and 4.99 ha of dispersal habitat. The disturbance area contains 16.26 ha of breeding and foraging habitat and 2.70 ha of dispersal habitat.

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12.5 Potential Impacts

Potential direct impacts in the absence of appropriate mitigation measures include:

- Removal of up to 16.26 ha of remnant RE 11.3.3,
- Loss of breeding, foraging and dispersal habitat for squatter pigeon (southern), ornamental snake, koala and short-beaked echidna, and
- Unintentional fauna mortality or injury resulting from vegetation clearing and other construction works.
- Potential indirect impacts in the absence of appropriate mitigation measures include:
- Increased fauna mortality or injury via vehicle strike (vehicle movement is likely to increase, leading to an increased risk of animal collisions and increased mortality per collision),
- Changes to land-based hydrology may impact the presence or persistence of frog species,
- Facilitating pest animal movement into new areas,
- Introduction and spread of disease and pathogens,
- Increased noise, light, vibration and dust,
- Edge effects and disturbance to adjacent habitats,
- Sedimentation of adjacent habitats (including potential TECs), and
- Introduction of new weed species or spread of existing weeds limiting fauna movement.

12.6 Mitigation and Management Measures

Measures to mitigate potential impacts to ecological values include:

- Clearing carried out in a sequential manner that allows fauna to escape to natural areas away from construction works. In particular, clearing from the northern, and eastern fringes of the disturbance footprint, before moving south. This will support the natural self-relocation of fauna to the retained, remnant vegetation communities south of the disturbance footprint,
- Demarcate clearing areas before works commence to prevent unnecessary clearing of vegetation and minimise accidental damage,
- Engage a suitably qualified person (e.g., ecologist, fauna spotter-catcher) to undertake pre-clearance surveys in areas where habitat removal is required to identify new fauna habitat values and potential breeding sites. The final pre-clearance survey should be undertaken by a suitably qualified person no later than 48 hours prior to clearing,
- Salvage of large woody debris (e.g., logs) within clearing areas and placed in adjacent vegetation, so they can be used for habitat,
- Reduce unnecessary noise and disturbance (e.g., turning off equipment/plant when not in use, use of acoustic barriers around equipment, use of equipment with lower sound power levels where feasible),

- Where possible works should be undertaken outside of the squatter pigeon (southern) breeding season (November-March),
- If a breeding place for a protected animal (other than koala) is likely to be disturbed by construction activities, a Species Management Program (SMP) is required to be prepared and approved by DETSI prior to commencement of clearing. If active breeding places for least-concern species are found during pre-clearance surveys and will be disturbed, the Project will require a low-risk of impacts SMP. A high risk of impacts SMP is required to be implemented if active breeding places of conservation significant species (including least concern species that are colonial breeders) are found during pre-clearance surveys and will be disturbed. The SMP would aim to provide an avoidance/prevention framework detailing a hierarchical range of measures to firstly avoid impacts, then mitigate unavoidable impacts. Note the September 2025 surveys did not find any breeding places for conservation significant species. A precautionary high risk SMP for conservation significant species is recommended based on the suitable breeding habitat identified within the disturbance footprint for squatter pigeon (southern), ornamental snake and short-beaked echidna. Koala are not subject to an SMP as there is no defined breeding place for the species,
- Follow the approved *WHC Weed and Feral Animal Management Plan* (WHC, 2022) which outlines treatment methods and regimes for significant weed species. Treat significant weed species prior to, during and post construction at designated intervals (treatment intervals to be determined by proposed activities, and size and invasiveness of weed infestations) with waterway friendly herbicides and in accordance with relevant site-specific management plans,
- Specific mitigation measures to reduce impacts to mapped ESAs immediately adjacent to the Disturbance footprint include:
    - Washdown of equipment for weed and seed prior to entering DNM to prevent additional weeds from impacting the ESA.
    - Disturbance areas are to be clearly demarcated ahead of clearing to ensure no unauthorised clearing is undertaken.
    - Rehabilitation will be undertaken in accordance with the PRCP.
- Design and implement Erosion Sediment Control (ESC) measures for the Project will be implemented in accordance with DNM ESC Plan (*WHC-DNM-PLN-Erosion and Sediment Control*), which has been developed in accordance with condition F33 of DNMs EA. Examples of ESC outlined in DNM ESC Plan are as follows:
    - Minimise the area of disturbance, where possible, and schedule the disturbance such that it is not exposed for longer than is necessary. DNM pit protection models should be used to plan drainage away from the excavation.
    - Where the surface is to be disturbed, topsoil should be stripped and stockpiled in line with the *WHC-QLD-PRO-Topsoil Management*. Placing any stockpile material in a channel or flow path should be avoided. Consideration should also be given for revegetating or rip the materials surface to promote surface cover or infiltration, respectively thus reducing surface runoff and erosion.
    - Clean water is to be diverted around the disturbed and/or sensitive areas where possible.
    - Exposed surfaces should then be protected with surface cover as soon as practical after works to assist in reducing surface erosion.

  - Rehabilitation should be undertaken to provide a stable and vegetated landform.
  - Surface treatment must consider the type of material/rock suitable for the required slope and velocity to ensure the selected material is fit for purpose.
  - Where disturbance has occurred within a waterway, the area should be revegetated as soon as practical. Consideration should be given to the use of a soil binder, coir mesh or rock/topsoil matrix, depending on the significance of the waterway, to stabilise the surface during vegetation establishment.
  - Stabilise the surface of slopes using appropriate slope protection measures.
  - Implementation of erosion protection measures such as revegetation, excavated rock traps, rock checks and sediment fencing/bunds.
  - A risk rating guide's the selection of sediment control requirements, based on the disturbance catchment size, soil category, duration of disturbance and average catchment slope.
- Site inductions or toolbox meetings should include information about sensitive aspects of the environment in which personnel are working, including the risk of injury or death to squatter pigeons or ornamental snakes from machinery,
- Due to the ground dwelling nature of the squatter pigeon, all vehicles should remain on existing access tracks and roads wherever possible,
- Speed limits should be implemented where appropriate to reduce the risk of fauna strike, and
- While it is unlikely that dust will significantly impact plant function, advisable dust suppression techniques include:
  - Application of water on trafficable surfaces,
  - Limiting activities in high wind conditions, and
  - Application of water/binding agent to construction sites during construction.

12.7 Significant Impact Assessments

This section provides a summary of the SIAs s for MNES and MSES considered to have a high likelihood of occurrence within the Disturbance footprint, squatter pigeon (southern), ornamental snake and echidna. Although only a moderate likelihood of occurrence within the disturbance footprint based on the presence of breeding and foraging and dispersal habitat, a precautionary impact assessment has also been completed for koala. An impact assessment has been undertaken for the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC as the disturbance footprint is approximately 13 m from the ground-truthed boundary.

This section also outlines the management and mitigation measures for each matter of environmental significance. The total disturbance footprint considered for these impact assessments is approximately 305 ha within the Project Area, which is a total 500 ha.

Matters of State and National Environmental Significance known to the disturbance footprint or considered likely to occur have been summarised in **Table 12-6** and detailed in the subsections below.

Table 12-6 MNES and MSES subject to impact assessment

Scientific name	Common name	MNES EPBC Act	MSES NC Act VM Act	Basis for assessment	Nature of impact
N/A	Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC	E	-	Known to occur adjacent to disturbance footprint	Indirect effects
N/A	Regulated vegetation		Vegetation management category	Known to occur within disturbance footprint	Cumulative direct effects: 16.26 ha Indirect effects
Denisonia maculata	Ornamental snake	V	V	High likelihood of occurrence	Direct effects:64.77 ha Indirect effects
Geophaps scripta scripta	Squatter pigeon (southern)	V	V	High likelihood of occurrence	Direct effects: 189.68 ha Indirect effects
Phascolarctos cinereus	Koala	E	E	Moderate likelihood of occurrence	Direct effects: 18.96 ha Indirect effects
Tachyglossus aculeatus	Short-beaked echidna	-	SLC	High likelihood of occurrence	Direct effects: 304.75 ha

12.7.1 Matters of National Environmental Significance

12.7.1.1 Squatter pigeon (southern)

Important populations

The southern boundary of the known distribution of the squatter pigeon (southern) is contracting northwards. Therefore, all of the relatively small, isolated and sparsely distributed sub-populations occurring south of the Carnarvon Ranges in Central Queensland are considered to be important sub-populations of the subspecies (DEHP, DERM and Queensland Parks and Wildlife Service, 2011). This includes, but is not limited to (DEHP, DERM and Queensland Parks and Wildlife Service, 2011):

- Populations occurring in the Condamine River catchment and Darling Downs of southern Queensland,
- The populations known to occur in the Warwick-Inglewood-Texas region of southern Queensland, and

- Any populations potentially occurring in northern NSW.

For the purpose of this assessment, the population which may utilise the disturbance footprint is not considered an important population as the Moranbah region occurs well north of the above definitions.

Occurrence within disturbance footprint

No confirmed records of squatter pigeon (southern) have been identified within the disturbance footprint or Project Area. The nearest squatter pigeon (southern) individual was observed during previous surveys near a cattle dam approximately 1 km southeast of the disturbance footprint (Latitude: 22° 7'3.93"S Longitude: 148°17'8.25"E). The 2025 survey recorded six squatter pigeons (southern) foraging adjacent to a gravel track and cattle yards, approximately 12 km from the disturbance footprint. Within the Study Area, the desktop assessment (Atlas of Living Australia [ALA]) returned 26 records, with approximately 22 observed during field surveys adjacent to the disturbance footprint.

Suitability of habitat and habitat mapping

There are four squatter pigeon (southern) habitat types mapped within the disturbance footprint, these include:

- *Breeding and foraging habitat*: grassy eucalypt woodlands and open forests, or scattered trees within 300 m of woodlands and open forest, within 1 km of a permanent water source,
- *Foraging habitat:* grassy eucalypt woodlands and open forests, or scattered trees within 300 m of woodlands and open forest, >1 km and <1.7 km from a permanent water source,
- *Dispersal habitat*: grassy eucalypt woodlands and open forests, or scattered trees within 300 m of woodlands and open forest, with sparse, patchy native grasses on clay plains (landzone 4), and
- *Unsuitable habitat:* grassland >300 m from woodlands, open forests or scattered trees, or impervious surfaces (e.g. mine pit).

The disturbance footprint contains squatter pigeon (southern) habitat along the two patches of remnant RE 11.3.3, adjacent non-remnant areas containing scattered trees and a 300 m buffer around these areas. The breeding and foraging habitat within the disturbance footprint is predominantly on the western side of the ephemeral watercourse and associated with the large pond to the west of the disturbance footprint. Small patches of breeding and foraging habitat within proximity to trees and permanent water are also located in the south and the south-east of the disturbance footprint. Adjacent to the breeding and foraging habitat, is foraging habitat. This area contains reduced ground cover on suitable soils and a variety of grass species. Foraging habitat is located within 300 m of woodland or scattered trees and up to 1.7 km from a permanent water source. Breeding and foraging habitat and foraging habitat is connected by dispersal habitat containing sparse, patchy grasses within 300 m of woodland or scattered trees on clay plains (landzone 4). The remainder of the disturbance footprint contains unsuitable habitat.

The disturbance footprint contains 88.47 ha of breeding and foraging habitat, 47.77 ha of foraging habitat, 53.44 ha of dispersal habitat and 115.07 ha of unsuitable habitat for the squatter pigeon (southern).

Project related impacts

The Project seeks to construct and operate an OOPD. The primary impact pathway during the construction phase will be vegetation clearing, increased risk of predation and vehicle strike. It is anticipated that 88.47 ha of breeding and foraging habitat, 47.77 ha of foraging habitat and 53.44 ha of dispersal habitat will be removed. Indirect impacts that may occur during the construction phase include noise pollution, light pollution and dust deposition on nearby habitats and vegetation communities.

Assessment of significance

The criteria outlined for species listed as vulnerable in the MNES Significant impact guidelines 1.1 (DEWHA, 2021) were used to assess the proposed activity's impact on the squatter pigeon (**Table 12-7**). In summary, the population of squatter pigeon (southern) in the Moranbah region is not considered to be an important population and although the proposed Project will result in a loss of breeding and foraging habitat for the squatter pigeon, the activity is unlikely to significantly impact an important population or impact connectivity within the region. Provided the recommended mitigation measures are successfully implemented, the proposed Project is considered unlikely to have a significant impact on squatter pigeon (southern) subspecies.

Table 12-7 EPBC Act significant impact assessment for the vulnerable squatter pigeon (southern)

Significant impact criteria	Assessment of the disturbance footprint
Lead to a long-term decrease in the size of an important population of a species	**Unlikely** As detailed above, any individuals which may utilise the disturbance footprint do not meet the criteria of an important population. There are currently 42 known records of the species within 20 km of the disturbance footprint. No individuals have been recorded in the disturbance footprint, with the closest record being 1 km to the southeast. The proposed Project will not impact areas (directly or indirectly) where the species have been recorded, or areas where there is a mosaic of breeding, foraging and dispersal habitat. The population size of the squatter pigeon (southern) was estimated at >40,000 breeding birds in 2000 (DCCEEW 2025). The estimated number within the Study area (42 birds) accounts for 0.1% of the total estimated population size. With the retention of suitable habitat adjacent to the disturbance footprint, and where the species have been recorded, it is considered likely that the individuals recorded within Study area will persist during the construction and operational phases of the project. The 22 individuals recorded adjacent to the disturbance footprint, and additional 26 records within the Study area, do not constitute an important population and therefore, the Project is unlikely to lead to a long-term decrease in the size of an important population.
Reduce the area of occupancy of an important population	**Unlikely** As detailed above, any individuals which may utilise the disturbance footprint do not meet the criteria of an important population. The national area of occupancy of the subspecies was estimated in 2000 to be 10,000 km², or 1,000,000 ha (DCCEEW 2025). The Project proposes to remove 189.68 ha of suitable critical habitat (88.47 ha of breeding and foraging habitat, 47.77 ha of foraging habitat and 53.44 ha of dispersal

Significant impact criteria	Assessment of the disturbance footprint
	habitat). This will result in a 0.01% decrease in the species national area of occupancy. The disturbance footprint is also well within the natural distribution for the subspecies, as such there are not additional pressures from being on the edge of the subspecies known range. On a landscape scale, the adjacent habitat is known to support the species, with 22 records during field survey adjacent to the disturbance footprint, and 26 known records within the Study area. Whilst the Project will clear 189.68 ha of suitable habitat, significant areas of land will be retained adjacent to the impact area which will continue to provide a higher-quality mosaic habitat comprising foraging, breeding and dispersal, for squatter pigeon (southern). As the decrease in area of occupancy on a national scale is only 0.01% and the population within the disturbance footprint (and Study area) do not constitute an important population, the Project is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**Unlikely** As detailed above, any individuals which may utilise the disturbance footprint do not meet the criteria of an important population. Whilst the proposed Project will result in the loss of 189.68 ha of suitable critical habitat (88.47 ha of breeding and foraging habitat, 47.77 ha of foraging habitat and 53.44 ha of dispersal habitat), ongoing clearing and land development have already led to degradation of habitat with the disturbance footprint as shown by the absence of canopy across most of the disturbance footprint and stockpiles of dead mature trees. The historical impacts adjacent to the disturbance footprint (active mine operations) has created a landscape which requires the species to fly across. Even with the changing landscape, the species persists in the wider region, which suggests the species is adaptable to flying between habitat types. Adjacent to the disturbance footprint existing remnant vegetation, some of which are MNES TECs, will be retained, and will continue to provide the local population of squatter pigeon (southern) ongoing breeding, foraging and dispersal habitat. The species is naturally highly mobile and responds to food abundance and climatic conditions, thereby, individuals during construction and operation would be considered able to fly over the disturbance footprint to reach appropriate habitat. As the population within the Study area do not constitute an important population, and the proposed Project will not increase the fragmentation, which is present in the broader landscape, the Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** Habitat critical to the survival of the species has not yet been defined. Whilst the term is referenced in the SPRAT Database, there is no definition of what is considered habitat critical to the survival of the species. For this assessment critical habitat is considered to be areas which have become heavily fragmented, and which support foraging or breeding for the subspecies. As such, the removal of these smaller fragmented habitats will lead to an increased pressure on existing resources, and the retention of these small, fragmented parcels are critical to the species persistence within the landscape.

Significant impact criteria	Assessment of the disturbance footprint
	Whilst the disturbance footprint does provide some suitable habitat for breeding and foraging, on a landscape scale, the disturbance footprint is surrounded by extensive areas of suitable habitat which will not be impacted by the Project, resulting in only a small loss of suitable habitat for the species. Although up to 189.68 ha of suitable critical habitat (88.47 ha of breeding and foraging habitat, 47.77 ha of foraging habitat and 53.44 ha of dispersal habitat) will be impacted, it is considered sufficient habitat will remain in the broader region to support local population minimising adverse impacts to the overall availability of critical habitat for this species.
Disrupt the breeding cycle of an important population	**Unlikely** As detailed above, any individuals which may utilise the disturbance footprint do not meet the criteria of an important population. Surveys completed across the site, occurred between April and October, although site conditions (availability of seeding grasses) were variable between these seasons. No evidence of breeding individuals were observed within or adjacent to the disturbance footprint during field surveys. Additional pre-clearance surveys will be undertaken prior to the removal of vegetation to assess for the presence of potentially breeding squatter pigeon (southern). Particular focus will be provided seasonally in the 88.47 ha of habitat within the disturbance footprint considered suitable for breeding. Given the number of records within the Study area (26) compared to the lack of records within the disturbance footprint, the risk of breeding birds being present is considered low, as it is likely the species appears to favour areas away from the disturbance footprint, such as the habitat along the Issac River. Given the population doesn't meet the definition of an important population, and the lack of records within the disturbance footprint, the Project is unlikely disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Whilst the Project will result in the loss of 88.47 ha of breeding and foraging habitat, 47.77 ha of foraging habitat and 53.44 ha of dispersal habitat suitable for the squatter pigeon (southern) the Project will occur in areas which have been subject to historical clearing and soil disturbance for grazing activities and therefore, has been subjected to long-term degradation and modification from the establishment of exotic perennial grasses. Given the highly modified habitat, which is currently present, the Project will not modify, destroy, remove or isolate, or decrease the quality of remaining habitat. Whilst there may be a small percentage of loss in the area of suitable habitat available for the species, the retention of existing remnant vegetation approximately 500 m south of the disturbance footprint will continue to provide extensive areas of higher quality suitable habitat and ensure the species is unlikely to decline. The implementation of mitigation measures (refer to Section 12.6), including weed management and weed hygiene protocols, along with dust and sediment control, will assist in reducing any potential introduction or spread of exotic species or sedimentation of retained habitat within the disturbance footprint.
Result in invasive species that are harmful to a vulnerable species becoming	**Unlikely** The proposed Project is unlikely to increase the abundance of invasive species (i.e., feral dogs, cats and foxes) above their current levels or result in the introduction of new invasive species. The disturbance footprint is also extensively cultivated with exotic perennial grasses which are used as cattle

Significant impact criteria	Assessment of the disturbance footprint
established in the vulnerable species' habitat	fodder and 19 species of weeds were recorded. Four of these weed species (*Lantana camera*, *Parthenium hysterophorus*, *Harrisia martinii* and *Opuntia tomentosa*) are listed as Category 3 restricted invasive flora under the Biosecurity Act 2014. Lantana camera, Parthenium hysterophorus, and Opuntia tomentosa are also listed as WoNS. Exotic and non-native weed species can quickly outcompete native grasslands, which can lead to a reduction in foraging availability for the species. Therefore, the implementation of mitigation measures (refer to Section 12.6), including weed management and weed hygiene protocols, will assist in reducing any potential introduction or spread of exotic species in retained habitat within the disturbance footprint.
Introduce disease that may cause the species to decline	**Unlikely** The proposed Project is unlikely to introduce a disease that may cause the species to decline, given there are no known diseases that impact this species.
Interfere substantially with the recovery of the species	**Unlikely** The SPRAT database for the squatter pigeon (southern) identifies a number of Actions and priorities for recovery for the species (DCCEEW 2025). • The protection of habitat critical to the survival of the subspecies throughout its range, • The restoration of habitat which is potentially critical to the survival of the subspecies, especially in northern NSW and southern Queensland where there is a greater threat of a further contraction in the subspecies' range, • The alleviation of mortality caused by predators, particularly cats and foxes, and • The development of a greater understanding of the subspecies' ecology and use of modified landscapes for foraging, breeding and dispersal. The land proposed for the Project is regularly subject to clearing and soil disturbance and is not in an area identified for conservation of the species. The project would therefore not interfere with any of the defined strategies and therefore, is unlikely to interfere with the recovery of this species.
Overall impact assessment	**Unlikely** The proposed Project is unlikely to have a significant impact on squatter pigeon (southern).

Squatter pigeon (southern) specific mitigation measures

Mitigation measures for the squatter pigeon (southern), in addition to mitigation and management measures identified in **Section 12.6**, should include at a minimum:

- Minimising works and clearing areas within potential habitat, and
- Preparation and implementation of a high risk of impacts SMP if breeding places are found during pre-clearance surveys.

12.7.1.2 Ornamental snake

Important population

The occurrence of important habitat for this species is considered a surrogate for an 'important population' of the species (DCCEEW, 2025b). Specifically for ornamental snake known important habitat is determined to be gilgai depressions and mounds, along with habitat connectivity between gilgais and other suitable habitats. As there is State-mapped essential habitat for this species within the Study area (Queensland Government, 2025), which is considered to represent important habitat, it is considered this is sufficient basis for the Study area to comprise an important population of this species.

Suitable habitat for the ornamental snake is considered important if it is (DCCEEW, 2023):

- Habitat where the species has been identified during a survey, or a habitat type where the species is identified during a survey, but which was previously thought not to support the species,
- Near the limit of the species' known range, or
- Large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations).

The species has not been recorded during field assessments to date, and the disturbance footprint is well within the normal distribution for the species. The disturbance footprint includes areas of potential breeding and foraging habitat and dispersal habitat, which provides valuable resources (some cracking soils, woody debris and some minor gilgai). The habitat within the disturbance footprint forms part of a larger contiguous patch that connects with habitat along the Issac River and forms a viable landscape corridor for breeding and dispersal. Therefore, the suitable habitat within the disturbance footprint is considered important and is to be used as a surrogate for an important population. If a population were to persist within the Study area, the presence of essential habitat and suitable foraging and breeding habitat would result in the species meeting the definition of an important population.

Occurrence within study area

WildNet searches identified 27 records (since 1980) of ornamental snake within the Study area (DETSI, 2025b). However, this species was not observed within the disturbance footprint or adjacent areas during field surveys.

Suitability of habitat and habitat mapping

There are three ornamental snake habitat types mapped within the disturbance footprint, these include:

- *Breeding and foraging habitat:* brigalow woodlands, open forests and non-remnant areas with deep cracking clay soils adjoining watercourses,
- *Dispersal habitat:* non-remnant areas on landzone 3 and 4 with cracking clay soils, and
- *Unsuitable habitat*: areas that do not contain brigalow, have been disturbed/subject to extensive clearing, or are lacking clay soils.

Some cracking soils in alluvial soils representing breeding and foraging habitat (23.66 ha) were recorded along the watercourse that traverses the disturbance footprint. The remainder of the disturbance footprint was degraded and has been subject to extensive clearing, soil disturbance and generally has less consistent in-soil cracks and consists of areas of 41.11 ha of dispersal habitat and 240 ha of unsuitable habitat for ornamental snake. The disturbance footprint contains 23.66 ha of breeding and foraging habitat, 41.11 ha of dispersal habitat and 240 ha of unsuitable habitat for the ornamental snake.

Project related impacts

The Project seeks to construct and operate an OOPD. The primary impact pathway during the construction phase will be vegetation clearing and vehicle strike. The Project will clear 23.66 ha of ornamental snake breeding and foraging habitat, and 41.11 ha of dispersal habitat. Indirect impacts may arise during the construction phase, and may include noise pollution, vibration impacts and dust deposition on nearby habitats and vegetation communities. During the operational phase indirect impacts such as noise, vibration, light and dust pollution may occur. Changes to land-based hydrology may also indirectly impact the presence or persistence of frog species.

Assessment of significance

The criteria for vulnerable species outlined in the *MNES Significant Impact Guidelines 1.1* (DEWHA, 2021) were used to assess the proposed Project's impact on the ornamental snake (**Table 12-8**). In summary, the disturbance footprint potentially contains an important population and the proposed Project will result in a loss of important habitat for the ornamental snake. Clearing ≥2 ha of important ornamental snake habitat is listed as having a high risk of significant impact (DCCEEW 2023). The disturbance footprint contains habitat that forms part of a larger contiguous patch of vegetation connecting to habitat along the Issac River. The project is unlikely to fragment an existing important population into two or more populations. Existing remnant vegetation to the south of the disturbance footprint, which holds a higher number of key habitat values (woody debris, gilgai and permanent waterbodies), will not be impacted by the Project.

Applying the precautionary principal in the absence of records within the disturbance footprint, and noting the presence of important habitat within the disturbance footprint and records within the Study area, the Project is likely to reduce the area of occupancy of an important population and adversely affect habitat critical to the survival the species. This is likely to result in a significantly impact on ornamental snake.

Table 12-8 EPBC Act significant impact assessment for vulnerable ornamental snake

Significant impact criteria	Assessment of the disturbance footprint
Lead to a long-term decrease in the size of an important population of a species	**Unlikely** As detailed above, any individuals which may utilise the disturbance footprint would meet the criteria of an important population. No individuals have been recorded within the disturbance footprint during field surveys. The most recent record within 10 km of the disturbance footprint was in 2012. This species is highly cryptic and as a result extremely difficult to survey, with survey guidelines recommending lengthy periods of survey effort (DCCEEW 2023). Suitable yet modified habitat for breeding, foraging and dispersal is known to occur within the disturbance footprint, with some cracking soil and woody debris that may provide suitable habitat for a local population of this species. However, the disturbance footprint has historically been subject to continual clearing and soil disturbance degrading the quality of the available habitat within the disturbance footprint for the species. Improved quality habitat for the species occurs to the south of the disturbance footprint, along the Issac River. The proposed Project may impact individuals during clearing and result in mortality of individuals (if present). Provided management and mitigation measures such as the use of fauna spotter catchers during clearing activities,

Significant impact criteria	Assessment of the disturbance footprint
	and sequential clearing of vegetation are implemented, the risk to individuals will be reduced. During construction operations, it is expected that any individuals present will self-relocate to remnant vegetation to the south of the disturbance footprint and as such, it is considered unlikely that the Project will contribute to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**Likely** As detailed above, any individuals which may utilise the disturbance footprint would meet the criteria of an important population. There is no publicly available information on the national area of occupancy of the species via Commonwealth and State regulators. For this assessment, the ALA online database tool of known records was used to develop an area of national occupancy of 54,400 ha. The Project proposes to remove 23.66 ha of breeding and foraging habitat and 41.11 ha of dispersal habitat for the species. This will result in a 0.13% decrease in the species national area of occupancy. The disturbance footprint is well within the natural distribution for the species, and as such the species is not at the limits of its known range. There are significant areas of land to the south of the disturbance footprint that will not be impacted by the Project and will continue to provide a suitable habitat comprising foraging, breeding and dispersal, for ornamental snake. However, clearing of ≥2 ha of important ornamental snake habitat is considered to pose a high risk of significant impact to an important population (DCCEEW 2023). The Project will likely reduce the area of occupancy of an important population by 0.13% at a national scale (although noting no individuals were recorded).
Fragment an existing important population into two or more populations	**Unlikely** As detailed above, any individuals which may utilise use the disturbance footprint would meet the criteria of an important population. Whilst the proposed Project will result in the loss of 23.66 ha of breeding and foraging habitat and 41.11 ha of dispersal habitat, ongoing clearing, grazing and land development has already led to fragmentation and degradation of habitat within the disturbance footprint. Additionally, the disturbance footprint is extensively covered in exotic perennial grasses, used as cattle fodder, with cattle further impacting the quality of the available soils and habitat. Adjacent to the disturbance footprint, existing remnant vegetation contains higher quality habitat features such as increased amounts of woody debris, cracking soils and gilgai. Provided the management and mitigation measures are implemented, the Project will not directly, or indirectly, impact these habitats. The proposed Project will not increase the fragmentation of the available habitat, the Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** Habitat critical to the survival of the species has not yet been defined. As there is no definition on what is considered habitat critical to the survival of the species, for the purpose of this assessment it has been assumed that critical habitat is likely to be: • Areas located within the lowest part of the catchment,

Significant impact criteria	Assessment of the disturbance footprint
	• A diversity of gilgai size and depth, • Soils of high clay content and deep-cracking characteristics, • Areas with an abundance of woody debris, • Presence of an abundant population of burrowing frogs (*Cyclorana species*), • Habitat patches that are typically greater than 10 ha in area and are within, or connected, to larger areas of remnant vegetation, and • Habitat patches that are less than 1 km apart and connected by suitable dispersal habitat. The disturbance footprint is not located within the lowest part of the Issac River catchment. Field-verification surveys found the presence of cracking clay soils, however, limited gilgai were observed. The disturbance footprint had low abundance of woody debris (when compared to remnant vegetation communities approximately 500 m south of the disturbance footprint); likely due to the ongoing clearing/grazing operations within the site. However, field surveys confirmed the presence of foraging habitat and dispersal habitat, and recorded five species of amphibians, including green tree frog, which is listed as a preferred prey species for ornamental snake, within the disturbance footprint. The foraging habitat is connected to the remnant vegetation to the south of the disturbance footprint allowing for localised movement through the landscape. The Project will clear 23.66 ha of breeding and foraging habitat and 41.11 ha of dispersal habitat that is likely to be considered habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	**Unlikely** As detailed above, any individuals which may utilise the disturbance footprint would meet the criteria of an important population. The disturbance footprint contains minor soils cracks and very limited amounts of woody debris that this species can use for shelter however, no permanent or semi-permanent water is available within the disturbance footprint limiting the foraging availability for this species. Whilst there is suitable habitat within the disturbance footprint, the lack of many key habitat attributes (as previously mentioned) will reduce the likelihood of species using the area, therefore it is anticipated that breeding habitat for this species is unlikely to occur in the disturbance footprint. Pre-clearance surveys will be undertaken prior to the removal of vegetation and commencement of the Project. A fauna spotter catcher will be present when clearing any mapped ornamental snake habitat. With suitable mitigation measures in place, the Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** Whilst the Project will result in the loss of 23.66 ha of breeding and foraging habitat, this clearing will occur in areas subject to long-term, regular clearing for grazing activities and therefore has been subject to long-term degradation and modification (i.e., significant increase in exotic perennial grasses and soil compaction from grazing and clearing practices). Given the highly modified habitat, which is currently present, the Project will not modify, destroy, remove or isolate, or decrease the quality of habitat. Whilst there may be a small percentage of loss in foraging and breeding

Significant impact criteria	Assessment of the disturbance footprint
	habitat available for the species, the retention of existing remnant vegetation within the wider locality and the implementation of construction and operational management measures (e.g., sediment and dust control), will continue to provide extensive areas of higher quality suitable habitat and is unlikely to modify, destroy, remove or isolate, or decrease the adjacent habitats to the extent the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** The disturbance footprint is in a modified rural landscape, and invasive species that may be harmful to the ornamental snake exist in the broader region (i.e., cane toads and feral pigs). The Project is unlikely to result in the new introduction and establishment of any new invasive species that may predate on the ornamental snake in the habitat present within the disturbance footprint. Monitoring and management of pests, including corrective actions, will be implemented in accordance with the *WHC QLD Procedure Weed and Feral Animal Management Plan* (WHC 2022). The Project is unlikely to result in the increase of invasive species that are harmful to ornamental snake being established.
Introduce disease that may cause the species to decline	**Unlikely** There are no diseases listed as a threat to the ornamental snake. Chytrid fungus has potential to impact amphibian species, the main prey item of the ornamental snake. The *WHC Weed and Feral Animal Management Plan* (WHC, 2022), with a section specifically addressing pathogens will be implemented for the Project to ensure the movement of vehicles onto the site will not result in the introduction or spread of Chytrid fungus.
Interfere substantially with the recovery of the species.	**Unlikely** There is no adopted or made Recovery Plan for this species. Priority recovery actions identified by the DAWE (2014) include the identification of populations of high conservation priority, the use of conservation arrangements or management agreements on private land, inclusion in reserve tenure, minimisation of adverse impacts and controlling of introduced pests. The land proposed for the Project is regularly subject to clearing and soil disturbance and is not in an area identified for conservation of the species. The project therefore is unlikely to substantially interfere with the recovery of the species.
Overall impact assessment	**Likely** No individuals have been recorded within the disturbance footprint during field surveys. The most recent record within 10 km of the disturbance footprint was in 2012. The species is highly cryptic, and detectability is low, therefore it is likely that the species may be present in the landscape. Although the species have no clear definition of habitat critical to their survival, the presence of some key values within the disturbance footprint would likely align with attributes and may be considered as critical for the species, and its survival. As such, a precautionary approach has been adopted. The disturbance footprint is adjoined on the southern extent by larger, contiguous, remnant vegetation communities which have an increased density of gilgai, woody debris and permanent waterbodies which could support amphibians. These areas of habitat will not be impacted by the Project. The Project will clear 23.66 ha of breeding and foraging habitat, and 41.11 ha of dispersal habitat for the species. If present, the species would continue to persist in the suitable foraging and breeding habitat within Study area and

Significant impact criteria	Assessment of the disturbance footprint
	wider landscape. Despite this, the Project is likely to reduce the area of occupancy of an important population of ornamental snake and impact habitat critical to their survival and therefore the Project is likely to have a significant impact.

Ornamental snake specific mitigation measures

Mitigation measures for the ornamental snake, in addition to Mitigation and management measures identified in **Section 12.6**, should include at a minimum:

- Designing the Project to only clear potential habitat that is critical for construction and operation and retaining non-critical areas,
- Where possible works should be undertaken outside of the breeding season,
- Where possible, any ponding should be drained at least one month prior to vegetation clearing, and be maintained as dry, and
- Preparation and implementation of a high-risk of impacts SMP.

12.7.1.3 Koala

Habitat critical to the survival

- Habitat critical to the survival of this species is described in DAWE (2022b) as the areas that the species relies on to avoid or halt decline and promote the recovery of the species. Under the EPBC Act, the following factors and any other relevant factors may be considered when identifying habitat that is critical to the survival of the species:
- Whether the habitat is used during periods of stress (e.g., flood, drought or fire),
- Whether the habitat is used to meet essential life cycle requirements e.g., foraging, breeding, or social behaviour patterns),
- The extent to which the habitat is used by important populations,
- Whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development,
- Whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements,
- Whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation, or
- Any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community.

The regional differences in koala habitat and nutritional requirements, and the varying importance of non-remnant habitat features (e.g. roadside vegetation, paddock trees) depending on landscape context means that habitat critical to the survival of the species will be location-dependent (DAWE, 2022c). This can include forests, woodlands, road-side or rail vegetation, paddock trees and safe intervening ground matrix for travelling between trees and habitat patches. Nonetheless, the national recovery plan for the species advises that the following should be avoided to avoid impacts to koala:

- Clearing of habitat used by koalas for feeding and resting,
- Reducing connectivity between patches of habitat used by koalas for feeding, resting, commuting and dispersing (either by clearing of vegetation or by the erection of barriers to passage),
- Clearing of habitat used by koalas during extreme events (heat waves, drought, and fire), and
- Avoiding activities that will expose koalas to additional threats (e.g. dogs, cars) in places where koalas must use the ground to move between resting and feeding trees.

Occurrence within the disturbance footprint

During the September 2025 survey, several *Eucalyptus tereticornis* trees located in a patch of vegetation approximately 260 m to the southwest of the disturbance footprint showed evidence of koala scratch marks. No evidence of this species has been recorded within the disturbance footprint. Previous surveys recorded koala scratches and scat approximately 1.3 km south of the disturbance footprint along the Issac River.

Suitability of habitat and habitat mapping

There are two koala habitat types mapped within the disturbance footprint, these include:

- *Potential breeding and foraging habitat:* ground-truthed remnant vegetation containing locally important koala habitat trees,
- *Dispersal habitat*: non-remnant areas that do not provide potential breeding or foraging habitat, located adjacent to remnant vegetation containing scattered trees in sufficient densities to allow safe movement through the landscape, and
- *Unsuitable habitat*: non-remnant areas containing limited to no suitable habitat trees.

Within the disturbance footprint, suitable habitat for this species is limited to two ground-truthed patches of RE 11.3.3 and an interconnecting strip of non-remnant vegetation. RE 11.3.3 provides suitable foraging and breeding habitat, while the non-remnant interconnecting strip of vegetation provides dispersal opportunities between the two patches of RE 11.3.3.

Suitable habitat for this species is separated from adjacent areas of suitable habitat to the south of the disturbance footprint by approximately 400 m. Isolation has resulted from historical mechanical clearing of regenerating vegetation, which has created extensive open areas largely lacking tree and shrub cover. Evidence of recent mechanical vegetation management observed during the September 2025 survey further supports the ongoing isolation and fragmentation of suitable habitat within the disturbance footprint. There are no mapped ecological values for this species within 1 km to the north, east or west of the disturbance footprint, meaning that potentially suitable habitat is confined to the outer margin of known habitat to the south, generally associated with, or located near, the Isaac River.

Evidence of dingoes or wild dogs were detected within the disturbance footprint during the September 2025 survey, indicating that a predation threat already exists. Recent clearing of large vegetation areas has reduced available shelter, limiting opportunities for this species to avoid predators. As large areas of vegetation have recently been cleared within the disturbance footprint there are limited shelter opportunities for this species to escape predation. Consequently, individuals moving across open ground between isolated patches of potentially suitable habitat are vulnerable to predation and may become further disconnected from known habitat areas to the south.

The disturbance footprint is isolated from larger patches of known habitat for this species and does not provide a clear connectivity corridor to surrounding habitats. Additionally, this species has not been recorded within the disturbance footprint. The disturbance footprint contains 16.26 ha of potential breeding and foraging habitat, 2.70 ha of dispersal habitat and 285.5 ha of unsuitable habitat for koala.

Project related impacts

The Project seeks to construct and operate an OOPD, haul road and two dams within the Project Area. The primary impact pathway during the construction phase will be vegetation clearing, increased risk of predation and vehicle strike. It is anticipated that 16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat will be removed. Indirect impacts that may occur during the construction phase include noise pollution, vibration impacts and dust deposition on nearby habitats and vegetation communities.

Assessment of significance

The criteria for endangered species outlined in the *MNES Significant Impact Guidelines 1.1* (DEWHA, 2021) were used to assess the Project’s impact on the koala (**Table 12-9**). In summary, while the Project will result in a net loss of suitable koala habitat, it is unlikely to have a significantly impact on the local population or disrupt regional habitat connectivity. Existing, habitat to the south of the disturbance footprint will remain intact and will not be directly impacted by development of the disturbance footprint. Therefore, the Project is unlikely to have a significant impact on the koala.

Table 12-9 EPBC Act significant impact assessment for the endangered koala

Significant impact criteria	Assessment of the disturbance footprint
Lead to a long-term decrease in the size of a population of a species	**Unlikely** No koalas were observed within the disturbance footprint. The closest evidence of koala, scratch marks, were observed on *Eucalyptus tereticornis* trees located in a patch of vegetation approximately 460 m to the southwest of the disturbance footprint, but still within the Project Area, The Project will clear 16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat. Based on an average estimated abundance/density of ~0.0005 koalas/ha in QLD ~0.009 koalas will be impacted based on the removal of 16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat for this species. This is ~0.00006% of the estimated population of this species within the Brigalow Belt (north) Bioregion (15,179 individuals (DAWE, 2022b)). Measures to minimise injury/mortality will include pre-clear surveys, sequential clearing and use of fauna spotter catchers to identify and allow koalas to self-relocate during construction and traffic management to minimise collisions. The Project is unlikely to permanently increase levels of introduced predators. However, predator control may be implemented if signs of koala predation or increased predator numbers are observed during construction. Provided these measures are successfully implemented, the Project is unlikely to lead to a long-term decrease in the size of a population.

Significant impact criteria	Assessment of the disturbance footprint
Reduce the area of occupancy of the species	**Unlikely** The Project will clear 16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat. The nearest suitable habitat is located approximately 400 m to the south of the disturbance footprint. The disturbance footprint has historically been cleared resulting in large, open and isolated areas lacking in tree and shrub cover. Within the Study area, preliminary estimates of koala habitat suggest that the species occupies 52,221.20 ha (mapped remnant and high value regrowth vegetation). Within the Study area, the Project will reduce the area of occupancy by 0.04% and is therefore unlikely to significantly reduce the area of occupancy for the koala as a species.
Fragment an existing population into two or more populations	**Unlikely** Potential breeding and foraging habitat and dispersal habitat for koala within the disturbance footprint has previously been isolated from habitat to the south of the disturbance footprint by approximately 400 m. Isolation has resulted from a history of mechanical vegetation management, with evidence of the most recent clearing occurring immediately prior to the September 2025 survey. No suitable habitat for koala occurs to the north, east, or west of the disturbance footprint. Given the already fragmented nature of the disturbance footprint and the small amount of potential suitable breeding and foraging habitat to be cleared, it is unlikely that the Project will fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Likely** The current koala guidelines do not specify areas of critical koala habitat. The Project will clear 16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat. Habitat critical to the survival of the koala is considered to occur within foraging and breeding habitat. The dispersal habitat within the site connects two relatively small, isolated patches of remnant vegetation and does not form a corridor to a larger contiguous patch of vegetation. The dispersal habitat therefore does not form an important corridor for maintaining genetic diversity or to meet other essential life cycle requirements and is not considered habitat critical to the survival of the species (DAWE 2022b). The management and mitigation measures will reduce the direct and indirect impacts on habitat however, the Project is likely to adversely affect critical koala habitat (foraging and breeding).
Disrupt the breeding cycle of a population	**Unlikely** As this species is a pouch-bearing marsupial that will feed, rest and breed throughout a large home range area, clearing of the disturbance footprint is unlikely to disrupt the breeding cycle of this species. Additionally, clearing works will be undertaken outside of breeding season where possible.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely** The Project will clear 16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat. The disturbance footprint contains habitat critical to the survival of koalas (foraging and breeding) however, this habitat has been previously disconnected from existing, known habitat for this species. No suitable habitat or dispersal habitat for the koala occurs to the north, east, or west of the disturbance footprint. Reduction in areas of koala habitat containing food tree species may reduce the availability of food resources for

Significant impact criteria	Assessment of the disturbance footprint
	koalas and may lead to trees being unsustainably over-browsed or koalas leaving the area in search of new and higher quality food resources. These impacts, while possible on a local level, will not occur on a scale that will likely cause the species to decline. Measures to minimise impacts to habitat quality will include weed and pest animal management, erosion and sediment control and dust suppression. The Project will lead to clearing of koala habitat however, given the already isolated nature of the site the Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** Koalas are threatened by dogs (domestic and wild) when traversing between habitat patches. During 2025 surveys, evidence of dingoes were observed indicating a predation threat already exists. The Project is unlikely to result in dogs becoming more prevalent The Project does not propose to introduce domestic dogs to habitat for this species. Therefore, development of the Project will not result in an invasive species that is harmful to the species becoming established in the species habitat.
Introduce disease that may cause the species to decline	**Unlikely** KoRV and *Chlamydia* are diseases that are known to be a severe threat to koala. Disease can be a major contributor to population decline and reduces population viability. Chlamydia causes infertility, blindness and death. The prevalence of disease has been found to increase following extreme stress from hot weather, drought habitat loss and fragmentation. The Project will clear 16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat that could increase stress levels in the short term but is unlikely to cause a long term increase in stress-induced disease. Additionally, the Project has limited capacity to introduce disease as koala translocations are not proposed. Stress will be reduced by sequential clearing and staged clearing of trees to allow koalas to self-relocate without human intervention. Therefore, development of the disturbance footprint is unlikely to contribute to habitat loss or fragmentation to the extent that it will result in extreme stress or introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**Unlikely** DAWE (2022c) describes the national recovery plan key objectives for this species as: • 1A: the area of occupancy and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised then increased, and • 1B: The area of occupancy and estimated size of populations that are suspected and predicted to be stable are maintained or increased. On-ground strategies to achieve these objectives are to strategically restore listed koala habitat and actively manage listed koala metapopulations. The Project will clear 16.26 ha of suitable potential breeding and foraging habitat and 2.70 ha of dispersal habitat leading to a reduction in available habitat. Provided recommended management and mitigation measures are implemented, the Project is unlikely to interfere with the recovery of the species at a regional or national level.

Significant impact criteria	Assessment of the disturbance footprint
Overall impact assessment	**Unlikely** No koalas were observed within the disturbance footprint. 16.26 ha of potential breeding and foraging habitat that is considered habitat critical to the survival of the species will be cleared. Provided recommended management and mitigation measures are implemented, the Project is unlikely to have a significant impact on koala.

Koala specific mitigation measures

Mitigation measures for the koala should include at a minimum:

- Minimising works and clearing areas within potential habitat,
- A preclear survey is to be carried out prior to works commencing,
- Construction works to be undertaken with a fauna spotter catcher present,
- Where possible works should be undertaken outside of the breeding season, and
- Clearly delineate the disturbance footprint and associated infrastructure to ensure habitat outside of these areas is not impacted and clearing limits are not exceeded.

12.7.1.4 Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC

Distribution and habitat requirements

Brigalow (*Acacia harpophylla* dominant and co-dominant) is restricted to the inland and coastal plains and low slopes of central and eastern Australia, occurring primarily across central and southern Queensland and extending into northern New South Wales.

Historically it occupied an extensive band (the Brigalow Belt) across these regions, but has been reduced to roughly 10% of its original extent by broadscale clearing for agriculture and grazing (DEWHA, 2008).

Brigalow vegetation typically forms open forests or woodlands (canopy commonly ~9 m – 25 m tall) where *Acacia harpophylla* is one of the most abundant trees and often occurs either as the dominant canopy species or co-dominant with certain eucalypts, Casuarina species and other Acacias (DEWHA, 2008). It is strongly associated with heavy, often cracking or self-mulching clay soils (black and brown vertosols) on alluvial plains, low slopes and basins in semi-arid to sub-humid climates; these soil and topographic affinities explain its patchy, but once broad, distribution across the Brigalow Belt regional ecosystems (DEWHA, 2008).

Occurrence within the Study area and disturbance footprint

The PMST identified Brigalow (*Acacia harpophylla* dominant and co-dominant) as potentially occurring within the Study area. Previous studies confirmed the presence of this TEC within the Project Area but not within the disturbance footprint. The Brigalow TEC occurs within the Project Area approximately 13 m to the south of the disturbance footprint's haul road. A 100 m buffer zone to reduce indirect impacts is recommended for this TEC. No other corresponding remnant or regrowth REs were present across the entire disturbance footprint.

Project related impacts

The Project seeks to construct and operate an OOPD, haul road and two dams within the Project Area. There will be no direct impacts to the Brigalow TEC, and as long as suitable management is implemented (e.g., sediment control) the Project is unlikely to result in indirect impacts to this TEC.

Assessment of significance

The criteria for endangered TECs outlined in the *MNES significant impact guidelines 1.1* (DEWHA 2021) were used to assess the Project's impact on the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC (**Table 12-10**).

Table 12-10 EPBC Act significant impact assessment for the endangered Brigalow (Acacia harpophylla dominant and co-dominant)

Significant impact criteria	Assessment of the disturbance footprint
Reduce the extent of an ecological community	**Unlikely** Current designs will not result in the removal of any vegetation associated with the TEC. Some disturbance of soil will occur within the TEC buffer area, however strict management measures during construction including implementation of no-go zones, along with erosion and sediment control, and rehabilitation of non-permanent disturbance areas will ensure indirect impacts to the potential TEC would be minimised and the works would not result in a reduction of the extent of the potential TEC.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	**Unlikely** No vegetation clearing will occur outside the disturbance footprint, as such, clearing will not remove any of the TEC and therefore will not fragment the TEC any further by creating two distinct patches of vegetation. Strict management measures during works including implementation of no-go zones, along with erosion and sediment control, and rehabilitation of non-permanent disturbance areas will ensure indirect impacts to the potential TEC would be minimised.
Adversely affect habitat critical to the survival of an ecological community	**Unlikely** The buffer of the TEC occurs within the disturbance footprint. These works have a limited spatial extent and no vegetation clearing will occur outside the disturbance footprint. Therefore, the Project will not adversely affect habitat critical to the survival of this TEC.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	**Unlikely** The Project will be completed in accordance with a project specific sediment and erosion control, and strict weed management controls to ensure all impacts to the TEC are minimised. No waterways or drainage lines adjacent will be altered as a result of the Project. It is unlikely the Project will interact with the groundwater and as such the Project is considered to not have an impact on groundwater systems. If the appropriate water quality and sedimentation controls are in place the Project is unlikely to modify or destroy the abiotic factors necessary for the TEC's survival.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing	**Unlikely** The TEC does not occur within the disturbance footprint and there will be no direct impact to the TEC. The TEC buffer area may be impacted, however through the implementation of management and

Significant impact criteria	Assessment of the disturbance footprint
a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	mitigation controls the Project is unlikely to cause a substantial change in the species composition of the patch of TEC within the Project Area.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • Assisting invasive species, that are harmful to the listed ecological community, to become established • Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community	**Unlikely** The Project will be completed in accordance with a project specific sediment and erosion control, and strict weed management controls to ensure all impacts to the TEC are minimised. Regular monitoring of the sensitive areas (such as the TEC) and of the disturbance footprint by environmental staff during the life of the Project will be completed. Additionally, the proposed works have a limited spatial extent and no vegetation clearing will occur outside the disturbance footprint. Assuming appropriate controls are implemented the Project is unlikely to cause a substantial reduction in the quality or integrity of the TEC.
Interfere with the recovery of an ecological community	**Unlikely** There is no recovery plan for this TEC, however, the conservation advice identifies the following as key recovery actions for the TEC: • Protect community and conserve remaining patches, • Manage actions to minimise impacts, • Apply buffer zones (100 m for this TEC), • Prevent the introduction and spread of exotic species, • Restore and manage the TEC, • Manage threats - weeds, pests and disease, activities causing degradation, trampling, browsing and grazing, and fire regimes, and • Undertake restoration of the TEC. No permanent infrastructure will be placed in the buffer zone. Management measures and regular monitoring of the ongoing works by environmental staff will be undertaken. Additionally, the proposed works have a limited spatial extent and no vegetation clearing will occur outside the disturbance footprint. The Project is therefore considered unlikely to interfere with the recovery of the TEC.
Overall impact assessment	**Unlikely** No vegetation clearing will occur outside the disturbance footprint. Provided recommended management and mitigation measures are implemented, the Project is unlikely to have a significant impact on the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC.

Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC specific mitigation measures

Mitigation measures for the Brigalow (*Acacia harpophylla* dominant and co-dominant) TEC should include at a minimum:

- Designing the Project to only clear potential habitat that is critical for construction and operation and retaining non-critical areas,
- Preparation and implementation of a project specific erosion and sediment control plan,
- The boundary of areas to be cleared should be clearly marked, to ensure the disturbance footprint is minimised,
- Excavation within the 100 m TEC buffer should be limited to shallow earthworks (<3 m), within 50 m from the boundary of the remnant vegetation,
- Excavation and vehicle movements may produce increased levels of dust, which can have a cumulative impact on plant function. Advisable dust suppression techniques include:
    - Application of water on trafficable surfaces,
    - Limiting activities in high wind conditions, and
    - Application of water/ binding agent to construction sites during construction.

12.7.2 Matters of State Environmental Significance

12.7.2.1 Regulated vegetation

One *Vegetation Management Act 1999* (VM Act) ‘of concern’ RE was ground-truthed within the disturbance footprint during the September 2025 survey; RE 11.3.3, which has a ‘sparse’ structural category (Queensland Herbarium, 2024). Areas in which this RE has been ground-truthed to occur are located across State-mapped non-remnant vegetation. However, results from remnant status assessments within this vegetation type during the September 2025 survey identify that on-ground structural characteristics of this vegetation meet the cover and height requirements to be considered a remnant community. As RE 11.3.3 has a VM Act ‘of concern’ status and on-ground occurrences of this community intersect a VM Act watercourse, impacts to this community have the potential to result in an impact to the following MSES regulated vegetation classes:

- ‘Endangered’ and ‘of concern’ REs,
- Regulated vegetation within the defined distance of a watercourse,
- VM Act wetland, and
- Regulated vegetation 100 m from a wetland.

‘Endangered’ and ‘of concern’ REs

Significant residual impacts to this prescribed environmental matter are determined by the following criteria:

- Clearing for other than linear infrastructure within a sparse structural category RE is greater than 2 ha.

A total of 16.26 ha of RE 11.3.3 is proposed to be cleared by the Project. The provision of offsets under the Queensland Environmental Offsets Policy may be required due to this MSES being significantly impacted by proposed development of the disturbance footprint.

Regulated vegetation within the defined distance of a watercourse

There is one VM Act first order watercourse that intersects the disturbance footprint (Queensland Government, 2025). The defined distance (or extent to which the remnant vegetation associated with the watercourse is considered a prescribed environmental matter) is determined by the bioregional context and the stream order of the watercourse or drainage feature.

The ground-truthed extent of RE 11.3.3 that is located within the defined distance from the defining banks of this first order VM Act watercourse is a MSES. The disturbance footprint is located within a non-coastal bioregion and the relevant defining distances for REs associated with a watercourse is shown in **Table 12-11**.

Significant residual impacts to this prescribed environmental matter are determined by the following criteria:

- Clearing occurs within 5 m of the defining bank of the feature, and
- The following area thresholds are exceeded:
  - Clearing for linear infrastructure within a sparse structural category RE is greater than 20 m wide, or
  - Clearing for other than linear infrastructure within a sparse structural category RE is greater than 2 ha.

Development of the disturbance footprint proposes to impact vegetation within 5 m of the defining bank of the VM Act watercourse. A total of 5.94 ha of RE 11.3.3 within the defining distance of a VM Act watercourse for non-linear infrastructure is proposed to be cleared by development of the disturbance footprint. The provision of offsets under the Queensland Environmental Offsets Policy may be required due to this MSES being significantly impacted by proposed development of the disturbance footprint.

Table 12-11 Defined distance for REs associated with a watercourse (non-coastal bioregions) as shown in the Queensland Environmental Offsets Policy (v1.17)

Stream order	Defined distance (m)
1 or 2	25
2 or 4	50

12.7.2.2 VM Act Wetland

There is one VM Act wetland that intersects with the disturbance footprint (Queensland Government, 2025). Significant residual impacts to this prescribed environmental matter are determined in accordance with the following criteria:

- Clearing occurs within 50 m of the defining bank of the feature, and
- The following area thresholds are exceeded:
  - Clearing for linear infrastructure within a sparse structural category RE is greater than 20 m wide; or

- Clearing for other than linear infrastructure within a sparse structural category RE is greater than 2.2 ha.

A total of 0.01 ha of mapped wetland is proposed to be cleared by the Project. Significant impacts to the wetland are unlikely, as the area of impact is limited and proposed mitigation measures are expected to effectively manage and reduce potential adverse effects

12.7.2.3 Regulated vegetation within 100 m of a VM Act Wetland

State vegetation mapping indicates the potential presence of regulated vegetation within 100 m of a Vegetation Management Wetland within the disturbance footprint. However, detailed ground-truthed vegetation mapping has been undertaken across the disturbance footprint and used to inform this assessment. The field-verified mapping has been submitted to the Queensland Herbarium for a formal mapping amendment.

The validated field-based mapping differs from the current State mapping and does not identify regulated vegetation within 100 m of a Vegetation Management Wetland within the disturbance footprint. This assessment therefore relies on the verified ground-truthed data, which provides a more accurate representation of on-ground conditions. On this basis impacts associated with regulated vegetation in proximity to mapped wetlands are not present within the disturbance footprint. Accordingly, regulated vegetation within 100 m of a Vegetation Management Wetland will not be significantly impacted by the Project.

12.7.2.4 Landscape Fragmentation and Connectivity Tool

The Landscape Fragmentation and Connectivity (LFC) tool was applied to assess potential changes in habitat connectivity and landscape configuration associated with the Project. The analysis compared pre- and post-development conditions to quantify any changes in fragmentation metrics.

The tool operates by classifying vegetation into habitat patches and non-habitat areas based on mapped REs or vegetation communities. It then calculates a range of landscape metrics that describe fragmentation and connectivity, which may include patch size distribution, edge effects, inter-patch distances, and overall connectivity indices. These metrics are derived for both the existing (pre-development) scenario and the proposed (post-development) scenario, allowing a direct comparison of landscape structure before and after the Disturbance footprint is applied.

For this assessment, the LFC tool was run using the disturbance footprint overlaid against the existing vegetation mapping to determine whether any habitat patches would be removed, reduced, or functionally disconnected. The outputs were then compared to quantify the percentage change in fragmentation and connectivity values.

Results from the LFC tool indicate a 0% change in landscape fragmentation and connectivity values as a result of the proposed works. This outcome demonstrates that the Project will not alter the existing spatial arrangement, patch size, or connectivity of vegetation within the assessed area.

Accordingly, the Project is not expected to result in any measurable or meaningful impact to landscape connectivity or fragmentation, and the effect is therefore considered not significant.

12.7.2.5 Squatter pigeon

Habitat for the squatter pigeon (southern) within the disturbance footprint is mapped in **Figure 12-14**. The disturbance footprint contains 88.47 ha of breeding and foraging habitat, 47.77 ha of foraging habitat, and 53.44 ha of dispersal habitat for the squatter pigeon (southern).

A formal significant residual impact assessment (DEHP, 2014b) for squatter pigeon (southern) in accordance with NC Act assessment guidelines is presented in **Table 12-12**.

Table 12-12 Squatter pigeon significant residual impact assessment

Significant residual impact criteria	Assessment of the disturbance footprint
Result in a long-term decrease in the size of a local population	**Unlikely** – refer to “Lead to a long-term decrease in the size of an important population of a species” in **Table 12-7**.
Reduce the extent of occurrence of the species	**Unlikely** – refer to “Reduce the area of occupancy of an important population” in **Table 12-7**.
Fragment an existing population	**Unlikely** - refer to “Fragment an existing important population into two or more populations” in **Table 12-7**.
Result in genetically distinct populations forming as a result of habitat isolation	
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat	**Unlikely** – refer to “Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat” in **Table 12-7**.
Introduce disease that may cause the population to decline	**Unlikely** – refer to “Introduce disease that may cause the species to decline” in **Table 12-7**.
Interfere with the recovery of the species	**Unlikely** – refer to “Interfere substantially with the recovery of the species” in **Table 12-7**.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**Unlikely** Suitable squatter pigeon (southern) habitat within 1 km of a perennial water source is important for breeding). (Lloyd et al., 2025). Permanent water sources (i.e., farm dams) do not occur within the disturbance footprint but they do occur within 1 km of some of the suitable southern squatter pigeon habitat within the disturbance footprint. The Project will clear 88.47 ha of breeding and foraging habitat. Suitable squatter pigeon (southern) habitat within 1.7 km of a perennial water source is important for foraging (Lloyd et al., 2025). The Project will clear 47.77 ha of foraging habitat (additional to the 88.47 ha of breeding and foraging habitat). No breeding places were observed during field surveys, however reinspection will be required prior to clearing to reduce any potential disturbance to the species during foraging or nesting. Whilst the disturbance footprint does provide some suitable habitat for breeding and foraging, on a landscape scale, the disturbance footprint is surrounded by extensive areas of habitat which will not be impacted by the Project, resulting in only a small loss of habitat for the species. Although up to 88.47 ha of breeding and foraging and 47.77 ha of foraging habitat will be impacted, sufficient habitat will remain in the

Significant residual impact criteria	Assessment of the disturbance footprint
	broader region to support ecologically significant locations for the species. The Project is unlikely to cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.
Overall impact assessment	**Unlikely** The Project will clear 88.47 ha of squatter pigeon (southern) breeding and foraging habitat, 47.77 ha of foraging habitat and 53.44 ha of dispersal habitat and is unlikely to have a significant impact on squatter pigeon, assuming all practical mitigation measures outlined in **Section 12.7.1.1** are implemented.

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12.7.2.6 Ornamental snake

Habitat for the ornamental snake within the Disturbance footprint is mapped in **Figure 12-15.** The Project will clear 23.66 ha of ornamental snake breeding and foraging habitat, and 41.11 ha of dispersal habitat, primarily within the outer pit dump, haul road and southern dam location.

A formal significant residual impact assessment (DEHP, 2014b) for ornamental snake in accordance with NC Act assessment guidelines is presented in **Table 12-13**.

Table 12-13 Ornamental snake significant residual impact assessment

Significant residual impact criteria	Assessment of the disturbance footprint
Result in a long-term decrease in the size of a local population	**Unlikely –** refer to **"**Lead to a long-term decrease in the size of an important population of a species**"** in **Table 12-8**.
Reduce the extent of occurrence of the species	**Likely –** refer to **"**Reduce the area of occupancy of an important population" in **Table 12-8**.
Fragment an existing population Result in genetically distinct populations forming as a result of habitat isolation.	**Unlikely –** refer to "Fragment an existing important population into two or more populations" in **Table 12-8**.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely** – refer to "Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat" in **Table 12-8**.
Introduce disease that may cause the population to decline	**Unlikely** – refer to "Introduce disease that may cause the species to decline" in **Table 12-8**.
Interfere with the recovery of the species	**Unlikely** – refer to "Interfere substantially with the recovery of the species" in **Table 12-8**.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**Likely** Ecologically significant locations for ornamental snake are likely to include: • Areas located within the lowest part of the catchment, • A diversity of gilgai size and depth, • Soils of high clay content and deep-cracking characteristics, • Areas of an abundance of woody debris, • Presence of an abundant population of burrowing frogs (*Cyclorana species*), • Habitat patches that are typically greater than 10 ha in area and are within or connected to larger areas of remnant vegetation, and • Habitat patches that are less than 1 km apart and connected by suitable dispersal habitat. The disturbance footprint is in a modified rural landscape, and invasive species that may be harmful to the ornamental snake, including cane toads exist within the disturbance footprint and in the broader region. The disturbance footprint is not located within

Significant residual impact criteria	Assessment of the disturbance footprint
	the lowest part of the Issac River catchment. There was low abundance of woody debris (when compared to remnant vegetation communities approximately 500 m south of the disturbance footprint), likely due to ongoing clearing/grazing operations within the area. Surveys detected cracking clay soils, but limited gilgai, and five species of amphibians, including green tree frog (a preferred prey species) within the disturbance footprint. Implementation of construction and operational management measures (e.g., sediment and dust control), will ensure the remnant vegetation approximately 500 m south of the disturbance footprint will continue to provide extensive areas of higher quality suitable habitat for ornamental snake. However, the Project will clear 23.66 ha of breeding and foraging habitat which would be considered ecologically significant locations. Pre-clearance surveys will be undertaken prior to the removal of vegetation and commencement of the Project. A fauna spotter/catcher will be present when clearing any mapped ornamental snake habitat. The Project is likely to cause disruption to ecologically significant locations (23.66 ha of breeding and foraging habitat) of the ornamental snake.
Overall impact assessment	**Likely** The proposed Project is likely to reduce the extent of occurrence of ornamental snake and cause disruption to ecologically significant locations including 23.66 ha of breeding and foraging habitat. Assuming all practical mitigation measures outlined in **Section 12.7.1.2** are implemented, the Project is likely to have a significant residual impact on ornamental snake.

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12.7.2.7 Koala

Habitat for the koala within the disturbance footprint is mapped in **Figure 12-16**. The disturbance footprint contains 16.26 ha of potential breeding and foraging habitat, and 2.70 ha of dispersal habitat for koala.

The koala is listed as endangered under both the NC and EPBC Acts. A formal significant residual impact assessment (DEHP, 2014b) for the koala in accordance with the NC Act assessment guidelines is presented in **Table 12-14**.

Table 12-14 Koala significant residual impact assessment

<table>
<tr><th>Significant residual impact criteria</th><th>Assessment of the disturbance footprint</th></tr>
<tr><td>Result in a long-term decrease in the size of a local population</td><td>Unlikely – refer to “Lead to a long-term decrease in the size of an important population of a species” in Table 12-9.</td></tr>
<tr><td>Reduce the extent of occurrence of the species</td><td>Unlikely – refer to “Reduce the area of occupancy of an important population” in Table 12-9.</td></tr>
<tr><td>Fragment an existing population</td><td rowspan="2">Unlikely – refer to “Fragment an existing important population into two or more populations” in Table 12-9.</td></tr>
<tr><td>Result in genetically distinct populations forming as a result of habitat isolation</td></tr>
<tr><td>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat</td><td>Unlikely – refer to “Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat” in Table 12-9.</td></tr>
<tr><td>Introduce disease that may cause the population to decline</td><td>Unlikely – refer to “Introduce disease that may cause the species to decline” in Table 12-9.</td></tr>
<tr><td>Interfere with the recovery of the species</td><td>Unlikely – refer to “Interfere substantially with the recovery of the species” in Table 12-9.</td></tr>
<tr><td>Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species</td><td>Unlikely
Suitable habitat for this species within the disturbance footprint is limited to two patches of ground-truthed remnant RE 11.3.3 and an interconnecting strip of non-remnant vegetation. The remnant vegetation forms potential breeding and foraging habitat for this species and the interconnecting strip of non-remnant vegetation forms dispersal habitat.
Koala habitat within the disturbance footprint is isolated from surrounding areas of suitable habitat to the south of the disturbance footprint by a distance of approximately 400 m. Habitat isolation occurs due to a history of mechanical clearing of regenerating vegetation within the disturbance footprint, creating expansive bare areas, largely void of tree and shrub cover. Evidence of recent mechanical clearing was observed during the September 2025 survey, supporting the isolation and disconnection of potentially suitable habitat for this species within the disturbance footprint.
No suitable habitat for this species occurs to the north, east, or west of the disturbance footprint for this species to disperse into. Additionally, development of the disturbance footprint does not propose to directly impact upon existing, known habitat for this species to the south of the disturbance footprint.</td></tr>
</table>

Significant residual impact criteria	Assessment of the disturbance footprint
	The Project will result in the loss of 18.96 ha of koala habitat (16.26 ha of potential breeding and foraging habitat and 2.70 ha of dispersal habitat). The disturbance footprint has been subject to long-term, regular clearing for grazing activities and as such, subject to long-term degradation, modification and isolation from known koala habitat areas. Implementation of construction and operational management measures (e.g. sediment and dust control) will ensure existing remnant vegetation to the south of the disturbance footprint will not be impacted by the Project and will continue to provide extensive area of higher quality habitat. Pre-clearance surveys will be undertaken prior to the removal of vegetation and commencement of the proposed Project. A fauna spotter/catcher will be present when clearing any mapped koala habitat. Due to the fragmentation from existing habitat and the highly degraded site-context, and assuming implementation of all mitigation measures outlined in Section 12.7.1.3 the Project will not cause disruption to ecologically significant locations of the koala.
Overall impact assessment	**Unlikely** No koalas were observed within the disturbance footprint, although 16.26 ha of suitable breeding and foraging habitat will be cleared. Provided recommended management and mitigation measures are implemented, the Project is unlikely to have a significant residual impact on koala.

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12.7.2.8 Short-beaked echidna

The disturbance footprint contains 305 ha of suitable breeding and foraging habitat for echidna.

The short-beaked echidna is listed as SLC under the NC Act. The 2025 September survey did not detect evidence of this species, but previous surveys observed excavated termite mounds outside but immediately adjacent to the disturbance footprint (RE 11.3.2) in an area likely used as foraging habitat. Previous surveys also recorded a deceased individual outside the disturbance footprint within RE 11.3.7 Evidence from the carcass indicates that it was likely predated upon by a wild dog or dingo (SLR, 2023). September 2025 surveys did not detect termite mounds within the disturbance footprint.

This well-known species occurs throughout Australia in almost all terrestrial habitats except intensively managed farmland (Nicol and Andersen, 2007). This species has a sparse distribution in some parts of its wide range, especially the arid regions, but overall, it is considered ubiquitous and common. This species does not have any particular habitat requirements but prefers to have access to vegetative cover and access to refuges (Nicol and Andersen, 2007). Ants, termites and beetle larvae make up the majority of the echidna diet. Large ant and termite nests may be breached with the broad front claws, while other invertebrates and ants in small colonies may be extracted by the echidna probing the soil with its beak, leaving distinctive ‘nose-pokes’ (Nicol and Andersen, 2007). The home range of females is approximately 10 to 80 ha, with males being much larger and overlap with several other males and females. However, the home range of individuals is strongly dependent on the availability of shelters, such as thick bushes, grass tussocks and hollow logs. Throughout Australia, the breeding season for this species occurs at approximately the same time; June to September. After pregnancy, the female constructs a short, unlined burrow to mature over a 4 to 5 month period (Nicol and Andersen, 2007).

A formal significant residual impact assessment (DEHP, 2014b) for the short-beaked echidna in accordance with NC Act assessment guidelines is presented in **Table 12-15.**

Table 12-15 Short-beaked echidna significant residual impact assessment

Significant residual impact criteria	Assessment of the disturbance footprint
Result in a long-term decrease in the size of a local population	**Unlikely** WildNet has 15 records within the disturbance footprint and immediate vicinity. Echidnas utilise a wide range of habitats, including remnant forest, woodlands, shrublands and grasslands, as well as grazing lands and other disturbed habitats. The Project will remove 305 ha of suitable habitat from the disturbance footprint. However, given the large amount of preferred habitat available within the vegetation surrounding the disturbance footprint, sufficient habitat is likely to remain to support the existing population of short-beaked echidna.
Reduce the extent of occurrence of the species	**Unlikely** As echidnas can utilise a wide range of remnant and non-remnant vegetation communities, the proposed level of clearing for the Project is unlikely to reduce the extent of occurrence of this species.

Significant residual impact criteria	Assessment of the disturbance footprint
Fragment an existing population	**Unlikely** The Project will remove 305 ha of suitable habitat from the disturbance footprint. The proposed clearing is immediately adjacent to the active DNM, therefore the Project will not increase fragmentation of the surrounding landscape. Given the large amount of preferred habitat within the Study area, sufficient habitat is likely to remain to support the existing population of short-beaked echidnas.
Result in genetically distinct populations forming as a result of habitat isolation	**Unlikely** Short-beaked echidna are widespread and the Project will not result in limiting movement of the species within a broader regional landscape, as such it is unlikely result in habitat isolation or cause the formation of genetically distinct populations.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**Unlikely** Proposed clearing may result in the loss of a small area of feeding habitat and removal of some ecologically significant resting sites (e.g., logs, protective understorey vegetation). Fallen timber or large logs will be retained and placed in adjacent habitat either within or adjacent to the disturbance footprint prior to vegetation clearing. While some habitat may be removed during clearing works, the Project is unlikely to cause disruption to breeding sites that would impact significantly on local populations. No breeding places were observed during field surveys, however reinspection will be required prior to clearing and if any breeding locations detected a high-risk of impacts SMP is required to be developed and implemented prior to clearing.
Overall impact assessment	**Unlikely** The Project is unlikely to have a significant impact on short-beaked echidna, assuming all practical mitigation measures are implemented.

Short-beaked echidna specific mitigation measures

Mitigation measures for the short-beaked echidna should include at a minimum:

- A high risk of impacts SMP ‘will be required for this species to outline the management and mitigation measures to protect breeding places during construction,
- A preclear survey is to be carried out two weeks prior to and again within 24 hours prior to clearing works commencing,
- A fauna spotter catcher present during clearing and preliminary earthworks,
- Although trenches are not expected, should they be required during the Project temporary fencing should also be placed around open trenches to prevent fauna from falling in and minimise the time trenches are left open where trenches. Where trenches are left open for long periods of time escape ramps and/or ropes should be installed and spaced no more than 10 m - 15 m apart,

- Where possible works should be undertaken outside of the breeding season (June – September) in areas identified during the pre-clearing survey to potentially contain burrows,
- Reduce vibrations caused by works, where known burrows exist as vibrations may cause damage to adjacent burrows, and
- Reduce unnecessary noise and disturbance (e.g., turning off equipment/plant when not in use, use of acoustic barriers around equipment, use of equipment with lower sound power levels where feasible).

12.8 Conclusions

Based on the results of the ecological assessment and previous local studies, the following conclusions and associated recommendations can be made regarding the disturbance footprint:

- A site-specific EA application will be submitted for the new ML, therefore standard conditions and associated buffers are not applicable,
- No conservation significant flora or fauna species listed under the EPBC Act or NC Act were recorded within the disturbance footprint,
- A significant impact assessment under the EPBC Act for the squatter pigeon and koala concluded that although works will result in a loss of breeding, foraging and dispersal habitat for these species, the Project is unlikely to lead to significant impacts on squatter pigeon and koala,
- The Project is not likely to have a significant residual impact on connectivity.
- A significant impact assessment under the EPBC Act for ornamental snake, applying the precautionary principle, concluded that the loss of potential breeding and foraging habitat and dispersal habitat from the Project is likely to lead to significant impacts on ornamental snake,
- A significant residual impact assessment under the NC Act identified that development of the disturbance footprint will result in the following significant residual impacts to MSES regulated vegetation:
  - 16.26 ha of impact to ‘endangered’ or ‘of concern’ REs via impacts to ground-truthed areas of RE 11.3.3, which is an ‘of concern’ RE, and
  - 5.94 ha of impact to prescribed REs (RE 11.3.3) located within the defined distance from the defining banks of a watercourse identified on the vegetation management watercourse map, as defined under the VM Act.
- A significant residual impact assessment under the NC Act for the squatter pigeon, ornamental snake, koala and short-beaked echidna concluded that, although works will result in a loss of suitable habitat for these four species, the Project is unlikely to significantly impact squatter pigeon, koala or short-beaked echidna, provided mitigation measures are implemented. The Project is likely to significantly impact ornamental snake despite implementation of all mitigation measures,
- Pre-clearance surveys will be completed prior to clearing works to detect fauna or fauna habitat present in the clearing area. During clearing a suitably qualified fauna spotter catcher will be present onsite to ensure protection of all fauna, and

- A SMP 'high risk of impacts' will be prepared for impacts to the breeding places of conservation significant species (squatter pigeon, ornamental snake and short-beaked echidna). **Appendix B** provides the Terrestrial Ecology Assessment Report which contains further details.

13.0 Aquatic Ecology and Stygofauna

13.1 Introduction

Separate Aquatic Ecology and Stygofauna Technical Reports have been prepared for the Project and are included in **Appendix A** and **Appendix J**, respectively. These studies comprised desktop assessment of aquatic ecology and stygofauna values of the Project Area and dedicated survey of aquatic ecology and stygofauna in and surrounding the Project Area.

The aquatic ecology values assessed were aquatic MNES, aquatic MSES and other aquatic matters (e.g. aquatic habitat, surface expression groundwater dependent ecosystems, aquatic biota), with aquatic ecological values summarised using High Ecological Value Aquatic Ecosystem (HEVAE) criteria (DAWE 2012). Stygofauna values were assessed using conservation listing and degree of groundwater dependence (i.e. obligate (stygobites) versus facultative (stygoxenes)) of the recorded stygofauna.

Impact assessment comprised a conventional risk matrix for the identified sources of potential impact, significant impact guidelines for aquatic MNES, and significant residual impact guidelines for aquatic MSES.

13.2 Regional and Local Setting

The DNM is located adjacent to the Isaac River in the Upper Fitzroy River Basin. The region is characterised by high seasonal variability in rainfall, with many waterways of the region, including the Isaac River, being ephemeral and reliant on large summer rainfall events to initiate stream flow. The waterways of the Project Area and surrounds consist of several ephemeral unnamed tributaries of the Isaac River, that are mapped as having low (green) or moderate (amber) risk of impact to fish passage.

13.3 Methodology

13.3.1 Desktop Assessment

13.3.1.1 Matters of National Environmental Significance

A Protected Matters Search was completed on 29 May 2025. The MNES identified by the searches were reviewed, with only those matters relating to aquatic ecology (e.g. protected wetlands, threatened aquatic species) considered in this study, and terrestrial MNES assumed to be assessed in the terrestrial ecology study or not relevant for the assessment.

For the assessed aquatic MNES, the likelihood of occurrence in the Project study area was assessed by suitably qualified aquatic ecologists, and review of habitat and hydrological characteristics of the waterways and biological traits of the species. For aquatic species that are listed as vulnerable under the EPBC Act it was also determined if an ‘important population’, as defined in the Significant Impact Guidelines (DotE 2013), likely occurs in the major waterways traversed by the Project.

13.3.1.2 Matters of State Environmental Significance

Searches of Queensland Globe and Queensland Government Environmental Reports were completed on 6 July 2025. The indicated MSES were reviewed, and those that relate to aquatic ecology were assessed further with respect to likelihood of occurrence and proximity to the Project disturbance footprint.

13.3.1.3 Flow Regime

Stream flow data was sourced from the Queensland Government gauging station at Deverill (130410A), and mean daily flow and percentage of time flow was recorded were calculated, and a flow duration curve graphed.

13.3.1.4 Water Quality

Historical water quality data was collected from the Isaac River and was collated and analysed, with the survey sites from the Project Area and surrounds. Summary statistics were calculated for data collected from 2015 to 2023 and the median value was compared to applicable Water Quality Objectives (WQOs) scheduled under the EPP (Water and Wetland) for moderately disturbed waters for Upper Isaac River catchment waters (DEHP 2013), or Australian and New Zealand Guidelines (ANZG) toxicant default guideline values (DGVs) (ANZG 2018).

13.3.1.5 Aquatic Habitat

The aquatic biota likely to occur in waterways and wetlands within and surrounding the Project Area was indicated by searches of Atlas of Living Australia (ALA) (ALA 2024), Wetland Info (DESI 2024) and Wildlife Online (DESI 2024) completed on 8 July 2025. Further assessment of aquatic species identified by the searches was then completed for likelihood of occurrence. The aquatic biota assessed comprised turtles, platypus, fish, aquatic macroinvertebrates, and aquatic plants (i.e. wetland indicator plants excluding trees and shrubs). Field survey data from 2015-2023 surveys was summarised as part of the desktop assessment.

13.3.1.6 Stygofauna

A desktop review was used to describe stygofauna of the region and determine the suitability of groundwater ecosystems of the Project Area to provide habitat for stygofauna on the basis of geological, hydrological and water quality characteristics of local groundwater ecosystems. The desktop review included:

- Review of stygofauna using published available information (e.g. Glanville et al. 2016; Hancock & Boulton 2008; Hose et al. 2015; Saccò et al. 2022) to determine the recorded presence and distribution of stygofauna in the region,
- Review of hydrogeological data for the Project Area, and
- Review of groundwater pH, electrical conductivity (EC) and total dissolved solids (TDS) data within and surrounding the Project Area.

13.3.2 Baseline Surveys

13.3.2.1 Survey Design

Aquatic ecology field surveys were conducted at 9 sites between the 27 July 2024 to 29 July 2024, and at 10 sites between the 12 May 2025 to 16 May 2025 (**Table 13-1, Figure 13-1**). Field survey included in situ and laboratory water quality measurements, aquatic habitat, aquatic plant, macroinvertebrate, fish, and turtle assessments, as well as stygofauna assessment at 10 groundwater bores.

Table 13-1 Aquatic ecology sites surveyed in July 2024 and May 2025.

Site	Waterway	Site Description	Latitude*	Longitude*
Upstream Sites				
IRUS	Isaac River	Isaac River at Goonyella railway crossing	-22.116360	148.277030
NCCUS	New Chum Creek	New Chum Creek upstream of confluence with Isaac River	-22.111038	148.273222
UCUS	Unnamed Creek	Unnamed Creek downstream of DNM	-22.097010	148.312050
UCUS2a	Unnamed Creek	Unnamed Creek downstream of DNM and within the Project Area	- 22.100278	148.290278
Downstream Sites				
IRDS1	Isaac River	Isaac River at Moorvale homestead	-22.129550	148.300517
IRDS2	Isaac River	Isaac River upstream of confluence with Unnamed Creek	-22.145811	148.317692
UCDS1	Unnamed Creek	Unnamed Creek downstream of DNM and the Project Area at Moorvale homestead	-22.121690	148.303150
UCDS2	Unnamed Creek	Unnamed Creek upstream of confluence with Isaac River	-22.142093	148.322348
Farm dams and wetlands				
Farm Dam 1 (FD1)	Unnamed Creek	FD1 is a dam for watering cattle that has been built in the channel of the Unnamed Creek downstream of the DNM	-22.117789	148.301764
Wetland site 2 (WS2)		WS2 is a wetland approximately 50 m southeast of FD1. It held very shallow pools at the time of survey (approximately 10cm deep) from a recent rainfall event, and would likely not hold water for most of the year	-22.117956	148.303439

[a] Site was not sampled in July 2024 as it was inaccessible *GDA2020 MGA Zone 55

13.3.2.2 Environmental Conditions

Rainfall in the 12 months leading up to the July 2024 survey recorded at weather station 034035 (Moranbah Airport) indicated that rainfall was equal to or higher than the long-term monthly average in November and December 2023, and January, February and June 2024 (**Figure 13-2**). In all other months, including in July 2024 when the survey was conducted, monthly rainfall was below the long-term average.

Rainfall in the 12 months leading up to the May 2025 survey recorded at weather station 034035 (Moranbah Airport) indicated that rainfall was equal to or higher than the long-term monthly average in June, August and September 2024, and January, February, March and April 2025. In all other months including May 2025 when the survey was conducted, monthly rainfall was below the long-term average.

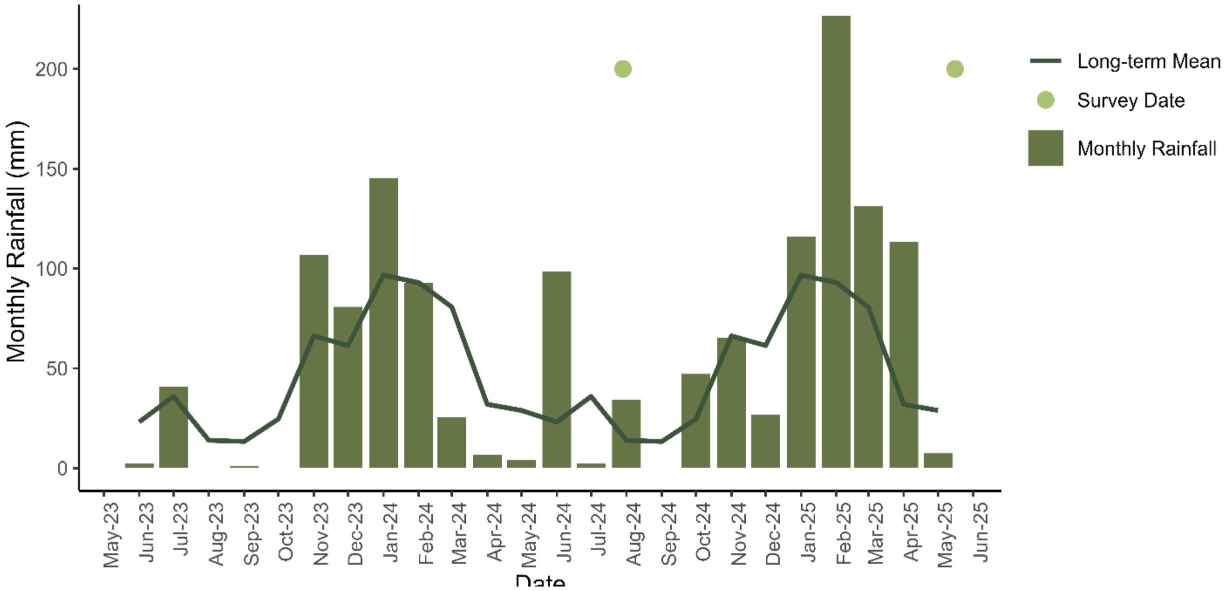


Figure 13-2 Monthly total rainfall compared to long-term average at weather station 035035 (Moranbah Airport) from 1 May 2023 to 26 May 2025.

13.3.2.3 Aquatic Habitat

In-stream habitat attributes and condition were assessed using a method based on the Australian River Assessment System (AUSRIVAS) protocol described in the Queensland Sampling and Processing Manual (DES 2018); see also DNRM (2001). The following parameters were assessed:

- Channel shape and pattern,
- Bank slope, composition, stability and vegetative cover,
- Bed substrate composition and stability,
- In-stream habitat features, including submerged or emergent aquatic plants, large woody debris, undercut banks and boulders,
- Water velocity, depth and width, and continuity through the site, and
- Riparian vegetation composition, extent and condition.

Riverine bioassessment scores (**Table 13-2**) were also recorded at sites where macroinvertebrates were sampled using the AUSRIVAS riverine bioassessment proforma (DES 2018; DNRM 2001), to aid interpretation of macroinvertebrate results.

Table 13-2 Riverine Habitat Bioassessment Criteria and Scores, and Overall Aquatic Habitat Quality Categories.

Habitat Category	Category Score Range			
	Excellent	Good	Moderate	Poor
Bed substrate or available cover	16–20	11–15	6–10	0–5
Embeddedness	16–20	11–15	6–10	0–5
Water velocity and depth	16–20	11–15	6–10	0–5
Channel alteration	12–15	8–11	4–7	0–3
Bed scouring & deposition	12–15	8–11	4–7	0–3
Pool:riffle and run:bend ratio	12–15	8–11	4–7	0–3
Bank stability	9–10	6–8	3–5	0–2
Bank vegetative stability	9–10	6–8	3–5	0–2
Streamside vegetation cover	9–10	6–8	3–5	0–2
Total (Habitat Bioassessment Score for the Site)	**111–135**	**75–110**	**39–74**	**0–38**

13.3.2.4 Water Quality

In situ water quality was measured for temperature, electrical conductivity, pH and dissolved oxygen using an AquaTroll 500 hand-held meter that was maintained and calibrated in accordance with OEM recommendations. Measurements were taken mid-channel and 0.3 m below the surface of the water, as described in DES (2018). Turbidity was also measured using this procedure and a calibrated Hach turbidity meter.

Water samples collected by SLR Consulting in July 2024 and May 2025 were analysed by a NATA-accredited laboratory for:

- Electrical conductivity (EC), pH, turbidity, and total suspended solids (TSS),
- Nutrients (total nitrogen, oxides of nitrogen, ammonia, nitrate, nitrite and total phosphorus),
- Major ions (sulphate, fluoride, sodium and water hardness),
- Dissolved and total metals and metalloids (As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, U, V, Zn), and
- Total petroleum hydrocarbons C6–C9 and C10–C36, and total recoverable petroleum hydrocarbons.

Water quality results were compared to the applicable WQOs or ANZG toxicant DGVs (ANZG 2018), and discussed with reference to the National Guidelines for Assessing and Managing Water Quality in Temporary Waters (ANZG 2020).

13.3.2.5 Aquatic Plants

Aquatic plants were surveyed at each site using a timed meander survey (i.e. 15 minutes – 20 minutes per site) across in-stream and riparian habitats, as recommended in the Queensland Government's *Flora Survey Guidelines – Protected Plants* (DES 2020). Plants were identified to species level if they were flowering, otherwise they were identified to genus. It was noted if plants were growing in the water, or in dry in-stream or riparian areas. The growth form of plants growing in water was also recorded (**Table 13-3**).

Raw aquatic plant data was tabulated, noting growth form and location with reference to water (i.e. in water, or on dry bed or bank). Any aquatic plant species listed as threated under the EPBC Act or the Nature Conservation Regulation was noted and proximity to the Project Area assessed, and aquatic plant species that are restricted biosecurity matters under the *Biosecurity Act 2014* were recorded.

Table 13-3 Growth forms of aquatic plants growing in water.

Growth Form	Description
Submerged	Submerged aquatic plants are rooted in the bed of the stream or wetland, with leaves totally covered by water most of the time. Some species may have underwater flowers, whereas other species may require water levels to decrease to trigger flowering and have flowers above the water level.
Attached floating	Attached floating aquatic plants are rooted in the bed of the stream or wetland, with leaves typically floating on top of the water. Flowers are usually above the water.
Free floating	Free floating plants float on top of the water, or in the water column, with roots trailing into the water column. Flowers are typically above the water.
Emergent	Emergent plants are rooted in the bed of the stream or wetland, with leaves and flowers above the water.

13.3.2.6 Aquatic Biota

Macroinvertebrate Communities

Macroinvertebrates were sampled from bed and edge habitat at each site holding water during the field survey using the AUSRIVAS sampling method as described in the Queensland AUSRIVAS manual (DNRM 2001) and the Queensland Monitoring and Sampling Manual (DES 2018). Samples were collected by disturbing a 10 m long section of bed or edge habitat with a standard triangular-framed dip net (250 µm mesh size), preserved using ethanol, and transported to SLR's biological laboratory.

In the laboratory, samples were sorted, identified to the lowest practical taxonomic level (in most instances family) and counted in accordance with Chessman (2003). For QA/QC procedures, macroinvertebrates in 10 per cent of the samples were re-identified and re-counted and 10 per cent of the data was re-entered by an ecologist other than the one who completed the original identifications and data entry. If any errors were found, then this process was repeated until no errors are found or they were within the accepted range (< 5 per cent (DES 2018); noting that final error rates in our laboratory are consistently < 2 per cent).

Standard freshwater macroinvertebrate indices were calculated and tabulated for macroinvertebrate communities: taxonomic richness, PET (Plecoptera / Ephemeroptera / Trichoptera) richness, SIGNAL-2 (Stream Invertebrate Grade Number – Average Level) scores and percent tolerant taxa. Macroinvertebrate results were compared to relevant WQOs (**Table 13-4**) and discussed with reference to the riverine bioassessment scores that were derived as part of the aquatic habitat assessment.

Table 13-4 Macroinvertebrate WQO for Upper Isaac River catchment waters.

Parameter	Bed/Composite WQO	Edge WQO
Taxa Richness	12 – 21	23 – 33
PET Richness	2 – 5	2 – 5
SIGNAL-2 Score	3.33 – 3.85	3.31 – 4.20
% Tolerant Taxa	25 – 50	44 – 56

Fish Communities

Fish were surveyed using fyke nets in accordance with recommendations in the Commonwealth Government's Survey Guidelines for Australia's Threatened Fish (DSEWPC 2012). Fishes were sampled under General Fisheries Permit (permit number 255214) and Animal Ethics Approval (permit number CA2024/01/1810) held by SLR.

Fish were identified to species and counted, with native species released unharmed to the place of capture and pest species euthanised using methods approved under our animal ethics approval. Raw fish data was tabulated, and for each species we noted the conservation status and migratory pattern. Pest fish species were noted for biosecurity classification.

Turtle Communities

Turtles were surveyed using fyke nets and baited cathedral traps in accordance with the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2022) and the Commonwealth's Survey Guidelines for Australia's Threatened Reptiles (DSEWPC 2012). Specimens were identified to species by experienced aquatic ecologists and native species released unharmed at the location of capture.

Stygofauna Communities

Stygofauna survey at ten bores was completed in July 2024 and May 2025 (**Table 13-5**, **Figure 13-3**). The full water column in each bore was sampled using six hauls of a weighted phreatobiological net (similar to a plankton net). Three of the hauls with a very fine net (mesh size 50 µm), and three hauls with a fine net (mesh size 150 µm) were used. Samples were preserved in 100 per cent ethanol and transported to SLR's laboratory where stygofaunal specimens were identified to Order or Family using available taxonomic keys. Each specimen was then identified to morpho-species by trained ecologists as taxonomic keys are not available for species-level identification of stygofauna.

Table 13-5 Bores sampled for stygofauna in the Project Area in July 2024 and May 2025.

Bore	Easting	Northing	Drilled depth (m)	Lithology	Electrical conductivity (µS/cm)	TDS (mg/L)	pH
ODH (Olive Downs House)	633884	7553065	NDA	Alluvium	NDA	NDA	NDA
MB01P	634583	7553819	24.4	Mudstone/sandstone	NDA	NDA	NDA
PZ04	635531	7554554	90.0	Sandstone/Siltstone	18208.9	12328.9	7.7
MB19DNM01P	635935	7553717	67.5	Coal seam	NDA	NDA	NDA
MB02P	635301	7552706	36.4	Coal seam	12600.0	8465.0	7.3
PZ05	632576	7561914	49.0	Sandstone	6552.5	3759	7.5
MB20DNM01P	635874	7558005	NDA	Coal seam	NDA	NDA	NDA
OBS8*	631867	7553656	20.5	Alluvium	NDA	NDA	NDA
MB20DNM05A*	634551	7553825	8.5	Alluvium	NDA	NDA	NDA
MB02A*	635292	7552696	8.5	Coal seam	NDA	NDA	NDA

NDA = no data available
* dry

13.4 Existing Environmental Values

13.4.1 Aquatic Ecological Values

13.4.1.1 Aquatic Matters of National Environmental Significance

Aquatic MNES under the EPBC Act indicated by the Protected Matters Search were:

- White-throated snapping turtle (Elseya albagula) (critically endangered), and
- Fitzroy River turtle (*Rheodytes leukops*) (vulnerable).

However, detailed review of distribution records for these species indicated they have not been recorded within approximately 160 km from the Project Area. Additionally, assessment of habitat suitability and flow regime requirements for these species indicated that suitable habitat and environmental conditions for these species do not occur in or near the Project Area. Therefore, there are no aquatic MNES relevant to this study.

13.4.1.2 Aquatic Matters of State Environmental Significance

Aquatic MSES under the *Environmental Offsets Act 2014* indicated by Queensland Globe were:

- Regulated vegetation intersecting a watercourse (i.e. REs within a defined distance of a watercourse) in and adjacent to the Project Area,
- Regulated vegetation (i.e. REs) within 10 m and 50 m of a waterway in and adjacent to the Project Area, and
- Waterways that provide fish passage - low (green) risk in the Project Area and moderate (amber) risk downstream of the Project Area.

Platypus (*Ornithorhynchus anatinus*), listed as Special Least Concern under the NC Act, is not recorded in the Project Area, no suitable habitat was recorded in the Project Area and the nearest known records are from the more permanent waters of the Connors River (ALA 2025).

13.4.1.3 Other Aquatic Matters

Aquatic Habitat, Flow Regime, and Surface Expression Groundwater-dependent Ecosystems

Waterways within the Project Area comprise dry sand/clay channels, and when water is present it is generally restricted to shallow isolated pools. The channels of moderate and major waterways are well-defined, while those of the minor waterways were varied, having sections with well-defined channels and sections with no defined bed and banks. Riparian vegetation was partially or totally cleared, and sites that held water generally had limited aquatic habitat present consisting of low density and diversity of aquatic plants and some sticks, logs and overhanging banks providing habitat for aquatic fauna. Aquatic sites of the Project Area showed moderate levels of disturbance related to clearing of vegetation, access to channels by cattle and terrestrial weeds (e.g. *Parthenium*).

Flow regime is ephemeral, with >68% of days having zero flow recorded. Flows, when they occur, are discrete short-duration events coinciding with rainfall. Water quality is variable and often does not achieve default WQO (e.g. turbidity often higher than WQO, and dissolved oxygen often lower than WQO range), as expected for ephemeral waterways (ANZG 2020).

There are no surface expression groundwater-dependent ecosystems mapped in the Project Area, and the predominantly dry waterway channels indicates that there are no areas of groundwater discharge to waterways. Natural wetlands (i.e. excluding bunded farm dams and mine water dams) are also ephemeral and typically dry with limited aquatic habitat.

Aquatic Biota

Aquatic biota of the Project Area comprises:

- Turtles, with broad-shelled river turtle (*Chelodina expansa*) are known to occur, and eastern long-neck turtle (*Chelodina longicollis*) and Krefft's river turtle (*Emydura krefftii*) possibly occurring. No threatened species of turtle occurs in or near the Project Area,
- Fish, with a range of native species (e.g. Agassiz's glassfish, common gudgeon, spangled perch, eastern rainbowfish, southern purple spotted gudgeon, bony bream, Rendahl's catfish, Hyrtl's catfish, sleepy cod and flyspecked hardyhead) are known to occur, and a few other species (e.g. blue catfish and longfin eel) possibly occurring. No threatened species of fish occurs in or near the Project Area, and all species have a potadromous migration pattern (i.e. migration only within freshwaters), excluding eels that migrate between freshwater and marine waters to complete their life cycle,
- Macroinvertebrates, with macroinvertebrate communities dominated by insects (e.g. Coleoptera, Diptera, Ephemeroptera, Hemiptera, Odonata and Trichoptera) and other taxa including arachnids, molluscs, decapod crustaceans (prawns, crayfish and freshwater crabs) and segmented worms. Macroinvertebrate communities of the Project Area generally do not attain a 'mature' or 'stable' condition due to the brief periods that sites hold water (i.e. insufficient time for colonisation of any one site by the full suite of taxa that occur before the site dried), and so macroinvertebrate communities are generally more impoverished than expected by the default biological objectives. No threatened macroinvertebrate taxa occur in or near the Project Area, and
- Aquatic plants, noting only low diversity and low percent cover of aquatic plants have been recorded, and aquatic plants are absent from many sites. Aquatic plants that have been recorded are dominated by species with an emergent growth form such as sedges (e.g. *Cyperus* spp.), rushes (e.g. *Juncus* spp.), primrose (*Ludwigia* spp.), matrush (*Lomandra* spp.) and knotweeds (*Persicaria* spp.), and few species of aquatic plants are found growing in water or with a submerged (e.g. *Potamogeton* spp., and aquatic algae *Chara* spp.) growth form. No threatened aquatic plant species occurs in or near the Project Area.

13.4.2 Stygofauna Values

The GDE Atlas indicated that there are no subterranean GDEs within or near the Project Area. Field based assessments of stygofauna (i.e. subterranean aquatic fauna that live in groundwater ecosystems) indicated:

- No obligate (stygobite) taxon is present in or surrounding the Project Area, and
- One stygoxene taxon (i.e. facultative groundwater inhabitants, not groundwater-dependent) (e.g. a nematode) was only recorded in the Olive Downs House bore (ODH) to the south-east of the Project Area.

13.4.3 Summary of Aquatic Ecology and Stygofauna Values

13.4.3.1 Aquatic Ecology

Using the HEVAE criteria (DAWE 2012), the assessment indicated that:

- The Unnamed Creek that flows through the Project Area had refugial pools for periods of time through the dry season and provided fish habitat to several common native species, but was highly modified through clearing and cattle access and had low aquatic value,
- Isaac River, has very brief periods of flow and holds water for short periods after heavy rain, but provides important movement corridors for migration of aquatic fauna, has a moderate level of naturalness and is a good example of ephemeral waterways of central Queensland, and had moderate aquatic value, and
- New Chum Creek has very low aquatic values due to only providing aquatic habitat and migration pathways at limited times of flow, having very low diversity of aquatic habitat, very low distinctiveness of aquatic habitat and aquatic communities, not providing vital habitat for aquatic communities, and is highly modified through clearing and cattle access.

The aquatic ecological receptors of the Project Area are not considered to be sensitive receptors because:

- Waterways are ephemeral and predominantly in dry condition, during which time they do not support aquatic species,
- Natural water quality is highly variable, which is typical for ephemeral systems (ANZG 2020),
- Threatened aquatic species do not occur in or near the Project Area, and
- Aquatic species known from and likely to occur in the Project Area are tolerant of, and resilient to, a range of water quality and aquatic habitat conditions (e.g. many fish species are early colonisers of aquatic habitat following flow events after long periods of no flow; macroinvertebrate communities are dominated by tolerant taxa; aquatic plants are uncommon and dominated by low cover of ubiquitous emergent taxa).

13.4.3.2 Stygofauna

The stygofauna community of the Project Area was assessed as having low environmental value due to:

- Stygofauna being recorded in only one of the bores sampled,
- The occurrence of one stygoxene taxon (and only one individual), and no stygobite taxa, and
- The suitability of groundwater for stygofauna being variable across the Project Area, notably with high TDS.

The results of this assessment indicate that groundwater of the Project Area is unlikely to provide supporting services to environmental third-party users of the water resource (i.e. groundwater dependent stygobitic fauna), as defined under the EPBC Act.

13.5 Potential Impacts

The Project may cause adverse impacts to aquatic ecology receptors via:

- Increased turbidity and sedimentation associated with stormwater runoff from disturbed areas and earthworks, causing impacts on water quality and aquatic biota in receiving waters,
- Contamination of waterways during construction from fuel or chemical spills, causing direct impacts to water quality and aquatic biota in receiving waters,
- Contamination from introduction and spread of weeds within waterways and wetlands, which causes an indirect impact to aquatic ecology,
- Instream works and permanent waterway barriers (i.e. partial infilling of the Unnamed Creek with the OOPD) within Unnamed Creek, which causes direct impact to aquatic habitat and fish passage,
- Permanent waterway barriers associated with haul road waterway crossings over the unnamed waterway in the Project Area,
- Potential changes to downstream water quality, and
- Potential changes to downstream flow patterns.

The Project will likely require clearing of REs within a Defined Distance of a Watercourse, noting that this impact pathway and mitigations are assessed in the Terrestrial Ecology Assessment Report in **Appendix B**.

13.5.1 Stygofauna

The Project may cause adverse impacts to aquatic ecology receptors via:

- Vegetation clearing, which may cause direct impact to stygofauna habitat, and
- Localised contamination of groundwater, which may cause lethal (i.e. mortality of stygofauna) or sub-lethal (i.e. reduced rate of reproduction, impacted physiology) impacts.

13.6 Mitigation and Management Measures

13.6.1 Aquatic Ecology

Risk-based assessment of the sources of potential impact indicated low risk to aquatic ecological receptors where mitigations are applied, with the exception of infilling the Unnamed Creek with the OOPD, which has a high risk of impact to aquatic ecology. This waterway has been mapped as low risk for fish passage. The following should be / should continue to be implemented:

- To mitigate the risk of impacts from increased turbidity and sedimentation:
  - The Project will comply with the DNM Erosion and Sedimentation Control Plan as per the existing EA,
  - Works in proximity to waterways will preferentially be undertaken at times of no rainfall, and

  - Monitoring (e.g. FRREMP) will be implemented when required, and if water quality is adversely impacted then remedial actions will be undertaken to correct water quality issues.
- To mitigate risks of waterway contamination due to fuel and chemical spills DNM has in place a Spill Prevention and Response Procedure which includes:
  - Refuelling in designated areas, which are located away from waterways (e.g. >50m),
  - Storing fuels and chemicals in bunded designated areas designed, constructed and maintained in accordance with Australian Standard 1940,
  - Storing and handling of fuels and chemicals will be in accordance with the relevant legislative requirements and Australian Standards,
  - Storage of fuels and chemicals away from waterways, farm dams and drainage features,
  - Deploying suitable spill kits for containment of any spill, and
  - Monitoring will be implemented when required, and if water quality is adversely impacted then remedial actions will be undertaken to correct water quality issues.
- To mitigate the introduction and spread of weeds DNM has implemented a Weed Management Procedure which incorporates vehicle and machinery hygiene protocols.
- To mitigate the risk of impacts from permanent waterway barrier works associated with haul roads crossing a waterway with moderate risk to fish passage:
  - The Project will ensure that the design of waterway barriers achieve the ADR for Waterway Barrier Works. Where achievement of the ADR is not possible, then a suitably qualified person will be engaged in the detailed design process to ensure the design achieves positive fish passage outcomes, and secondary approval will be sort.
- To mitigate changes to downstream water quality:
  - The Project will not require additional release points to those already used and approved under the EA, and any releases will continue to be made in accordance with the EA and as per current operations, and
  - The Project will continue ongoing water quality monitoring (i.e. FRREMP) will further contribute to the ability to control this source of impact to aquatic ecology by enabling investigation of potential exceedances and implementation of suitable remedial actions as needed.
- To mitigate changes to downstream hydrology:
  - The Project will ensure any releases of MAW are in accordance with the existing EA release criteria, and
  - The Project will minimize changes to downstream flow patterns related to rainfall through clean water diversion infrastructure in accordance with DNM's existing Water Management System.

Infilling a section of the unnamed waterway (i.e. green (low) waterway) will cause blockages to fish passage and stream flows that will prevent migration by aquatic fauna into, within and upstream of the Project Area, and this will impact their ability to access different habitats along a waterway, including habitats that may be important in their life cycle. Stranding of fish at temporary waterway barriers may also lead to fish mortality, especially in ephemeral waterways if the barriers prevent access to dry season refugial habitat.

The Project will not likely have a significant impact on aquatic MNES but will have a significant residual impact on an aquatic MSES (i.e. waterways that provide fish passage). The proponent acknowledges this impact and proposes a financial offset as outlined in Section 18 of the *Environmental Offsets Act 2014*.

13.6.2 Stygofauna

Risk-based assessment of the sources of potential impact indicated low risk to aquatic ecological receptors relevant to stygofauna where mitigations are applied. The following should be / should continue to be implemented:

- To mitigate the risk of contamination of groundwater by fuel and chemical spills DNM has in place a Spill Prevention and Response Procedure which includes:
  - Storing and handling of fuels and chemicals will be in accordance with the relevant legislative requirements and Australian Standards, and
  - Refuelling facilities are predominantly undertaken within the mine infrastructure area (MIA) within bunded locations.

14.0 Groundwater Dependent Ecosystems

14.1 Introduction

A desktop-based groundwater-dependent ecosystem (GDE) risk assessment was undertaken for the Project. Large coal mining developments have the potential to alter natural groundwater regimes and impact groundwater quality (Independent Expert Scientific Committee (IESC, 2018; Doody et al., 2019). Therefore, an assessment of the Project's potential impacts on GDEs is required as a component of the project approval process. The study aims to provide an assessment of the potential risks to GDEs resulting from project-related impacts to groundwater resources.

The GDE assessment includes:

- A review of the potentially groundwater-dependent assets within the area of potential groundwater impact, including the presence of groundwater-dependent species and associated habitats,
- An assessment of the potential impacts to groundwater-dependent assets based on predicted impacts to the local groundwater regime,
- Provision of management and mitigation measures to ameliorate any identified GDE impacts, and
- Completion of a risk assessment that details residual risks to GDE function and condition and identifies GDE areas that may require additional management.

14.2 Ecohydrological Setting

14.2.1 Climatic Considerations

The Project Area has a semi-arid climate, with the highest temperatures, humidity, and rainfall occurring in the summer months. The mean monthly maximum temperature of 35.0°C occurs in December, and the monthly mean minimum temperature of 8.7°C occurs in July (BOM, 2025). Long-term climate data from the now-defunct Moranbah Water Treatment Plant (BOM Station 034038), approximately 25 km northwest of the Project Area, indicate an average rainfall of 590 mm for the 35 years between 1990 and 2025 (including constructed data from 2012 as per SILO, 2025). The highest average monthly rainfall occurs in February (112.9 mm), with the lowest occurring in September (7.9 mm). The average annual pan evaporation for the same period is 2245.05 mm, with the highest evaporation rates occurring in December (average of 257.52 mm) and the lowest occurring in June (103.26 mm) (**Figure 14-1**). Vegetation development is limited by moisture rather than temperature (Hutchinson et al., 1992), as indicated by the disparity between pan-evaporation and rainfall.

The region has experienced several significant drought and flood events, illustrated in **Figure 14-2**, with calculation of cumulative rainfall departure (CRD) (Weber & Stewart, 2004), representing the cumulative departure of monthly rainfall from the long-term mean monthly rainfall between January 1990 and February 2025 (SILO, 2025). Strongly decreasing rainfall trends between 1990 to 1996 and 2000 to 2007, representing significant drought periods, are strongly evident. The analysis of CRD is relevant to this assessment as shallow, unconfined groundwater tables generally follow similar trends, with rising water tables and increased occupation of surface waters coincident with increasing trends in the CRD curve.

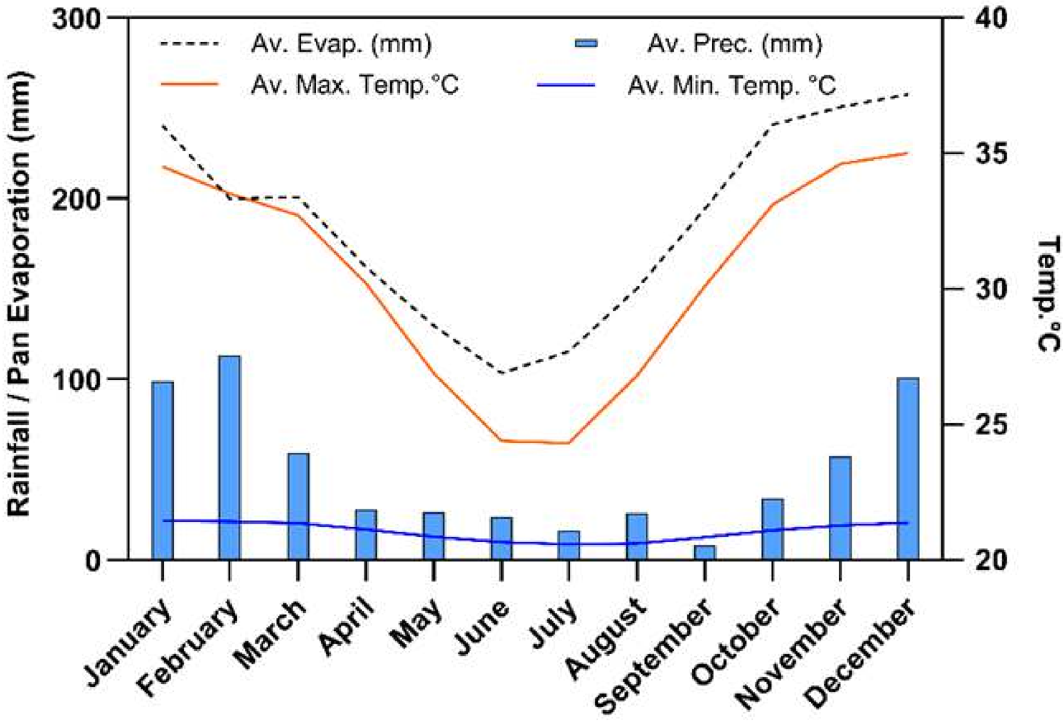


Figure 14-1 Average minimum and maximum temperatures, average monthly rainfall and pan-evaporation

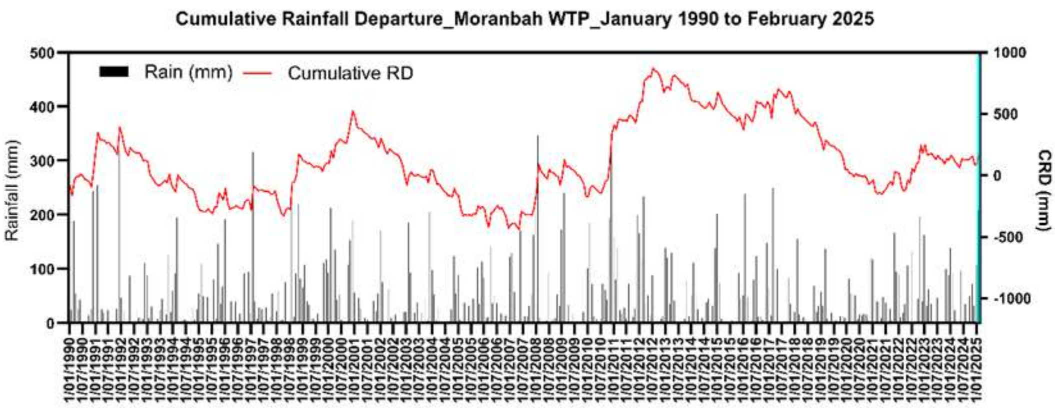


Figure 14-2 Cumulative rainfall departure (CRD) calculated between January 1990 and February 2025.

14.2.2 Hydrogeology and Groundwater

The Groundwater Impact Assessment Report (SLR, 2025b, **Appendix D**) describes the broader geological and hydrogeological setting. The following section provides a summary of this information, focusing on areas directly relevant to the assessment of GDEs.

There are two central hydrogeological units:

- Cainozoic sediments and weathered strata, including aquifers associated with Quaternary alluvium and Quaternary to Tertiary colluvium, and
- Permian coal measures (unweathered) with low permeability interburden (mudstone, siltstone) with aquitard properties; and Coal seams with higher permeability due to secondary porosity (cleats and fissures).

Quaternary alluvium aquifers are unconfined and restricted to recent alluvium associated with the Isaac River, while the Tertiary colluvium and regolith are regularly unsaturated. The coal seams form fractured rock aquifers, confined between low-permeability interburden.

The active groundwater monitoring network comprises 16 groundwater monitoring bores with active monitoring data, installed into Permian coal measures, interburden, with a single bore installed into regolith (DNMMB08_01) (**Figure 14-3**). **Table 14-1** provides a summary of the groundwater monitoring bore network, including the aquifer being monitored. The shallowest reported groundwater level is observed in monitoring bore MB01P, within the Permian Vermont Seam (~14 mbgl). In comparison, 'BMB' installed in the Permian interburden has groundwater levels as high as 17 mbgl. However, these levels are highly variable, attributed to its use as a water supply bore for the local landowner (SLR, 2025b).

Bores screened within the Quaternary sediments have been dry since installation, and groundwater levels have not been monitored. Monitoring completed at three alluvial monitoring bores (Knob Hill 1, 2, and Winnet bore) at the Winchester South tenement (west across the river) indicates groundwater levels at ~14 mbgl (3d Environmental, 2023) with ECs from 870 to 8780 µS/cm. Groundwater EC's in the deeper regolith are typically more saline, ranging from 1730 to 29060 µS/cm. (SLR, 2025b).

Reconciliation of groundwater levels with CRD indicates weak correlation between these parameters, suggesting that regional groundwater levels respond slowly to rainfall (**Figure 14-4**).

This implies limited groundwater recharge through preferential flow, which may also restrict the capacity of tree roots to penetrate the groundwater table. There is some correlation between CRD and groundwater levels for BMB between 2013 and 2020, although fluctuations associate with groundwater abstraction obscures natural groundwater response.

Figure 14-3. Location of groundwater monitoring bores

Table 14-1 Groundwater monitoring bores with active groundwater level data

Bore_ID	North	East	TD_ mbgl	Screen Interval (mbgl)	Groundwater Unit	SWL_Range (m)
	GDA2020 MGA Zone 55					
PZ01	-22.0425	148.2843	72	66 - 72	FCCM	28.85 - 31.04
PZ02	-22.0574	148.3112	87	75 - 81	RCM Interburden	40.13 - 50.39
PZ03	-22.0749	148.2826	78	72 - 82	RCM Interburden	34.87 - 36.04
PZ04	-22.1087	148.3139	90	81 - 90	RCM Overburden	22.37 - 23.11
PZ05	-22.0425	148.2847	49	30.2 - 48.2	RCM Interburden	32.78 - 35.22
PZ06	-22.0488	148.2770	56.4	34.5 - 55.5	Vermont Coal Seams	16.29 - 23.27
PZ07	-22.0640	148.2757	109	99 - 105	FCCM	32.3 - 34.3
PZ08	-22.0589	148.3102	85	79 - 85	Leichhardt Coal Seams	45.01 - 47.96
BMB	-22.0567	148.3517	66	30 - 50	RCM Interburden	14.38 - 39.46
MB19DNM01P	-22.1162	148.3179	67.5	60.5 - 66.5	Leichhardt Coal Seams	23.69 - 24.43
MB19DNM02P	-22.1162	148.3178	104.4	94.4 - 100.5	Vermont Coal Seams	23.39 - 24.24
MB20DNM01P_R01	-22.0775	148.3170	66.5	57.6 - 63.6	FCCM	21.3 - 22.26
MB01P_HY_R01	-22.1153	148.3048	24.4	30 - 24	FCCM	13.93 - 14.11
MB02P	-22.1254	148.3119	36.4	32 -3 6	Vermont Coal Seams	23.9 - 25.53
DNMMB08_01	-22.0744	148.3127	27.8	16.8 - 24.8	Tertiary	23.21 - 23.79

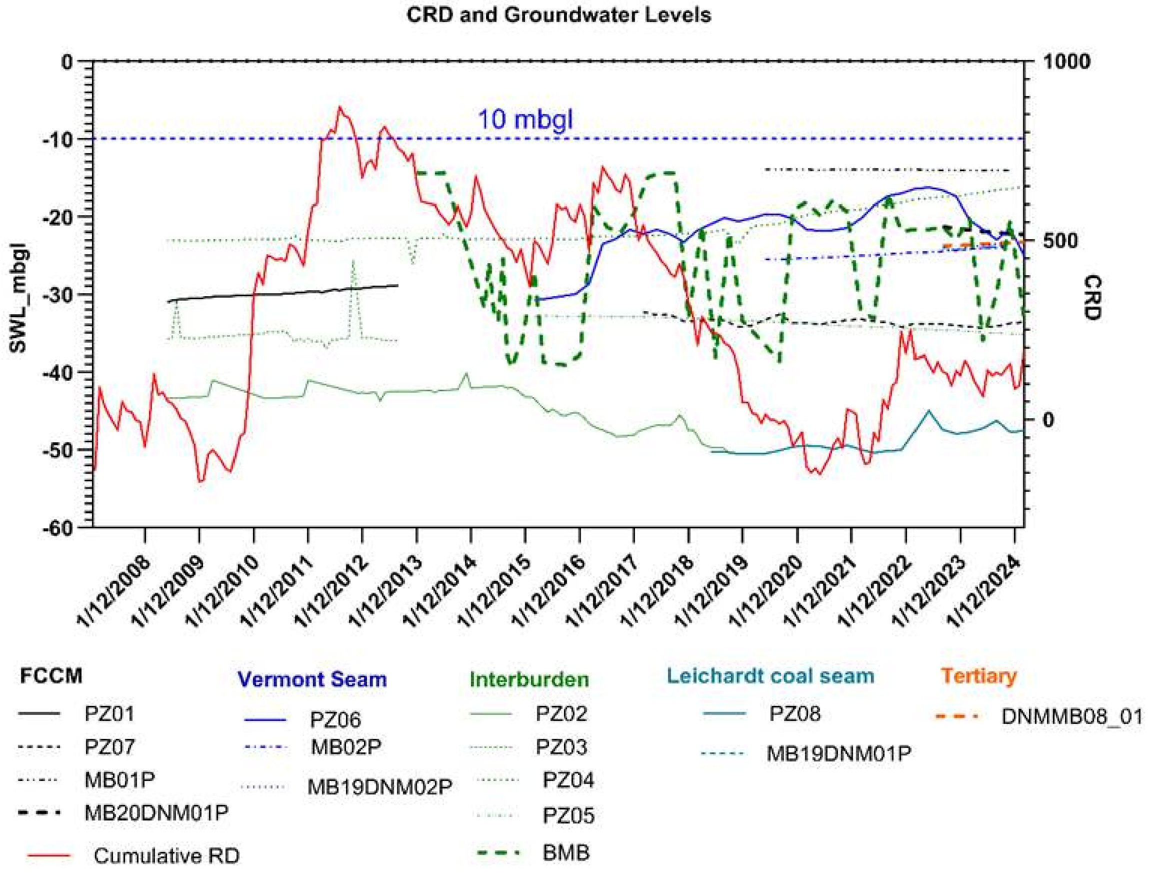


Figure 14-4 Relationship between aquifer groundwater levels and CRD

14.2.3 Groundwater Recharge, Discharge and Surface Flows

Shallow monitoring bores at Winchester South (Knob Hill 1 & 2, and Winnet bore as per **Figure 14-5**) indicate that alluvial groundwater levels range from 0.5 to 5 m below the invert level of the adjacent Isaac River. Knob Hill 2 shows higher groundwater levels in 2012, following a period of high to very high rainfall and resultant river flows (SLR, 2025b). That these groundwater levels were slightly higher than the Isaac channel invert level following this period indicates baseflow discharge into the river following wet periods. However, baseflow conditions rapidly subsides as bank storage drains and the climate dries.

Recharge to the alluvium and underlying / adjacent unconsolidated sediments occurs mostly via leakage of Isaac River surface flows into the alluvium, occasional inundation of the flood plain associated with flood overbank bank, and minor direct rainfall infiltration into alluvial soils where there are no substantial clay barriers in the shallow subsurface (SLR, 2025b).

Groundwater within the Isaac River alluvium discharges as evapotranspiration from riparian vegetation along the Isaac River when the groundwater occurs within the root zone of deep-rooted vegetation, and short-term baseflow discharge back into the river channel following flooding and alluvial groundwater recharge. Minor downward leakage of alluvial groundwater may occur, although the low hydraulic conductivity of the underlying formations (i.e. claystone, siltstone, fine sandstone) will limit this leakage (SLR, 2025b).

Regolith, including Tertiary sediments and weathered coal measures strata (such as claystone, siltstone, and fine sandstone), typically has low hydraulic conductivity, which restricts rainfall recharge. Groundwater discharge from the regolith may occur through evapotranspiration when groundwater is at accessible depths (<10 mbgl) for terrestrial vegetation and has suitable water quality.

14.2.4 Groundwater Dependent Vegetation

The GDEs are natural ecosystems that require access to groundwater on a permanent or intermittent basis to meet all or some of their water needs, thereby maintaining their communities of plants and animals, ecological processes, and ecosystem services (Richardson et al., 2011).

The GDE Atlas (BOM, 2025) identifies the presence of GDEs within the Project Area, including:

- Terrestrial GDEs (TGDEs) rely on groundwater's sub-surface expression (into the tree-rooting zone), and
- Aquatic GDEs (AGDEs) depend on the groundwater surface expression (springs and baseflow).

'High' potential TGDEs are associated with the immediate channel of the Isaac River, extending away from the river across the alluvial flood plain with 'Moderate' potential TGDEs, and 'Low' potential GDEs at more distal locations, primarily on residual/Tertiary sediments. High-potential AGDEs, directly influenced by groundwater discharge to surface waters, are centred on the channel of the Isaac River and scattered floodplain wetlands (**Figure 14-5**).

The GDE Atlas is based on the attribution of Broad Vegetation Communities (BVGs) and does not consider the floristic complexity of REs. A review of current RE mapping (DNRMMRRD Version 13.0) identifies eight REs occurring within the Project Area and surrounds (**Figure 14-6**), with nine REs identified in the ground truthed RE mapping layer (SLR, 2025a) **(Figure 14-7**), including RE 11.4.13 which is only recorded in the ground truthed layer. Because groundwater-related impacts will extend beyond the physical disturbance footprint, it is necessary to assess potential impacts to vegetation beyond the Project Area boundary, hence the use of the regional RE mapping dataset adds necessary context.

Figure 14-5. BOM GDE Atlas (2024) mapping of Terrestrial and Aquatic GDEs

Figure 14-6. DRNM Regional Ecosystems mapping for the Project Area and surrounds

Figure 14-7. Ground-truthed Regional Ecosystems (SLR 2025)

A summary of these REs with dominant and occasional canopy species is provided in **Table 14-2**. Canopy trees within these ecosystems are critical to the assessment of potential groundwater dependence as these will have the most developed and deepest root architecture and be more likely to be utilising groundwater than underlying shrub species (Barbeta et al, 2017). Eucalypts (including Corymbia species) are the predominant species in most ecosystems, with other genera represented including Acacia, Casuarina and Brachychiton. Species occurring within representative REs have been subdivided based on bark groupings for ease of reference, as listed below:

1 Eucalypts:

- a) Gums
  - i. *Eucalyptus camaldulensis* – river red gum (11.3.25)
  - ii. *Eucalyptus tereticornis* – forest red gum (11.3.25, 11.3.27)
- b) Box trees
  - i. *Eucalyptus populnea* - poplar box (11.3.2, 11.5.3).
  - ii. *Eucalyptus coolabah* – coolabah (11.3.3)
  - iii. *Eucalyptus orgadophila* – mountain coolabah (11.4.13)
- c) Ironbark
  - i. *Eucalyptus melanophloia* – silver leaf ironbark (11.5.3)
  - ii. *Eucalyptus crebra* – narrow leaf ironbark (11.3.7)
- d) Bloodwood
  - i. *Corymbia clarksoniana* – Clarkson's bloodwood (11.3.7, 11.3.25)
  - ii. *Corymbia tessellaris* – Moreton Bay ash (11.3.7, 11.3.25)
  - *iii.* *Corymbia dallachiana* – Dallachy's bloodwood (11.3.7)
- e) Lophostemon
  - *i.* *Lophostemon suaveolens – swamp box (11.3.25)*

2 Casuarina:

  - *i.* *Casuarina cunninghamiana – river she-oak (11.3.25)*
  - *ii.* *Casuarina cristata – belah (11.3.1, 11.4.9)*

3 Acacia:

  - *i.* *Acacia harpophylla – brigalow (11.3.1, 11.4.9)*

4 Melaleuca:

  - *i.* *Melaleuca bracteata – black tea tree (11.3.25)*
  - *ii.* *Melaleuca fluviatilis (11.3.25)*

5 Brachychiton

  - i. *Brachychiton rupestris* – narrow leaf bottle tree (11.3.1, 11.4.9)

Table 14-2 Regional ecosystems in the Project Area and associated canopy species

Regional Ecosystem	Description	Landform	*Dominant Tree*	*Occasional Tree 1*	*Occasional Tree 2*
11.3.1**	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Alluvial plains generally contiguous with creek channels and riparian vegetation	*Eucalyptus harpophylla*	*Casuarina cristata*	
11.3.2**	*Eucalyptus populnea woodland on alluvial plains*	Alluvial plains generally contiguous with creek channels and riparian vegetation	*Eucalyptus populnea*		*Corymbia clarksoniana*
11.3.3**	*Eucalyptus coolabah woodland on alluvial plains*	Alluvial plains typically associated with heavy clay soils in flood overflows	*Eucalyptys populnea*		*Acacia harpophylla*
11.3.25**	*Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines*	Incised drainage channels on alluvium	*Eucalyptus tereticornis / Eucalyptus camaldulensis*	*Corymbia tessellaris*	*Casuarina cunninghamiana, Melaleuca fluviatilis,*
11.3.27**	*Freshwater wetlands*	Shallow drainage depressions and flood overflows	*Eucalyptus tereticornis,*		*Eucalyptus coolabah*
11.3.7**	*Corymbia spp. open woodland on alluvial plains*	Alluvial plains generally contiguous with creek channels and riparian vegetation	*Corymbia clarksoniana*	*Corymbia tessellaris*	*Corymbia dallachiana, Eucalyptus crebra*
11.4.9**	*Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains*	Elevated clay plains	*Acacia harpopylla*	*Casuarina cristata*	
11.4.13*	*Eucalyptus orgadophila open woodland on Cainozoic clay plains*	Older elevated clay plains	*Eucalyptus orgadophila*		
11.5.3**	*Eucalyptus populnea +/- E. melanophloia +/- Corymbia*	Elevated residual plains above flood level	*Eucalyptus populnea*	*Eucalyptus melanophloia,*	*Eucalyptus crebra, Corymbia clarksoniana*

Regional Ecosystem	Description	Landform	*Dominant Tree*	*Occasional Tree 1*	*Occasional Tree 2*
	clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces				
***Recorded in the ground truthed RE mapping layer and DNRMMRRD Version 13.0 RE layer. *Recorded in the ground truthed RE mapping layer only*					

14.2.5 Groundwater Usage by Canopy Species

All eucalyptus species are potential users of groundwater although few studies demonstrating this dependence exist, and groundwater dependence will likely vary from complete dependence (obligate phreatophyte) to occasional usage when groundwater is available within the tree root zone (facultative phreatophytes), to no usage of groundwater across any season. The various water usage strategies of eucalyptus species in the Project Area and surrounds are discussed in the following sections.

14.2.5.1 Forest and river red gum

For ongoing assessment, the physiological attributes of river red gum and forest red gum are assumed to be similar as both species can inhabit and mix within a similar ecological niche. Forest red gum is however a more adaptable species, occupying dry hill slopes in some localities and it would be expected to be more tolerant of changes to hydrological regime than *Eucalyptus camaldulensis* which is a riparian specialist.

River red gum is a well-studied species known to have deep sinker roots, hypothesised to grow down towards zones of higher water supply (Bren et al., 1986). River red gum is adapted to arid and semi-arid environments and will go through alternate phases of shedding and regaining its crown, depending on the availability of water. It is adapted to do so over time and across the flood frequency classes. River red gum have the capacity to self-regulate and adjust their transpiration rates to match the average flood return interval (Colloff, 2014). The species maintains a strong capacity for genetic selection to increase the capacity of the species to survive drought stress. Trees less able to survive drought tend to die off, hence the genes that are associated with drought tolerance traits become more common in the remaining population.

The species is considered opportunistic in its water use, sourcing water according to osmotic and matric water potential and source reliability (Thorburn et al., 1993; Mensforth et al., 1994; Holland et al., 2006; Doody et al., 2009) with the water requirements obtained from three main sources being groundwater, and soil moisture following rainfall, and river flooding. Flooding enables the species to survive in semi-arid areas (ANBG, 2004) where stands are intimately associated with the surface-flooding regime of watercourses and related groundwater flow. The high-water use of river red gums contributes to maintaining watertables at depth (Mensforth et al., 1994; Lamontagne et al, 2005). River red gums are considered a facultative phreatophyte, shifting between a combination of surface soil moisture and groundwater during periods of high rainfall, then shifting to exclusive use of groundwater during drier periods. They are likely to achieve this shift through inactivation of surface roots during drier periods with increased reliance on deeper tap roots when surface water is unavailable. River red gum will often use saline groundwater in preference to fresh surface water, probably because it represents a more reliable supply (Colloff, 2014). Doody et al. (2015) demonstrated that soil moisture alone can sustain the health of *Eucalyptus* *camaldulensis* through periods of drought for up to six years before significant decline in tree health is noted.

River red gum has a number of traits that enable the species to be relatively resilient to all but the most extreme ecological change as listed:

- The species is adapted to arid and semi-arid environments, and is opportunistic in its water use, sourcing water according to osmotic and matric water potential and source reliability (Thorburn et al., 1993; Mensforth et al., 1994; Holland et al., 2006; Doody et al., 2009),
- The species has capacity to survive high levels of water deficit with the major sources of water utilised for transpiration include:
    - Groundwater including fresh to moderately saline aquifers,
    - Surface water held in river pools, and
    - Soil moisture in the unsaturated zone, including infiltration of moisture from lateral bank recharge, overbank flooding and rainfall which also act to recharge groundwater (Doody et al, 2015).
- River red gum also has a capacity for genetic selection to increase capacity for the species to survive drought stress. Trees less able to survive drought tend to die off, hence the genes that are associated with drought tolerance traits become more common in the remaining population, and
- River red gum will go through alternate phases of shedding and regaining its crown, depending on the availability of water and it is adapted to do so and over time and across the flood frequency classes. Trees have capacity to self-regulate and adjust their transpiration rates to match the average flood return interval (Collof, 2014).

The maximum potential rooting depth of river red gum is subject to considerable conjecture in current literature, although it is widely accepted that the species has capacity to access deep groundwater sources (Eamus et al., 2006a). Horner et al. (2009) found rooting depths at 12 mbgl – 15 mbgl based on observed mortality in plantation river red gum forests on the Murray River floodplain. Jones et al. (2020) found maximum rooting depths of 8.1 mbgl in river red gum in a broad study area in the Great Artesian Basin. In conclusion, maximum rooting depth of river red gum is likely to be variable, dependent on-site geology and depth to saturation with the capillary fringe being the general depth at which root penetration will be arrested (Eamus et al, 2006b).

14.2.5.2 Box species (poplar box and coolabah)

Fensham and Fairfax (2007) consider poplar box *(Eucalyptus populnea)* as having a shallow rooting system with limited investment in deep root architecture, rendering the species susceptible to droughting. Based on field observation, tree roots would not be expected to penetrate beyond 4 mbgl. While GDE mapping datasets (BOM, 2025) frequently represent poplar box woodlands on alluvium (11.3.2), as a high potential GDE, this situation would likely only occur when fresh groundwater is relatively close to the surface (<4 mbgl), and there would be almost no potential for groundwater dependence when the species occurs on higher residual surfaces (11.5.3).

Coolabah: Coolabah (*Eucalyptus coolabah),* which is the dominant species in 11.3.3, favours sites with heavier clay soils, typically close to drainage lines and requires flooding for regeneration (Roberts, 1993). There are few studies that attempt to detail the moisture sources and usage strategies of *Eucalyptus coolabah.* Costelloe et al (2008) suggest that coolibah avoids using saline groundwater via the following mechanisms:

- Growing at sites that maximise the frequency of soil moisture replenishment (i.e. on drainage lines and overflow channels),
- Having extremely low transpiration rates, and
- Strong capacity to extract moisture from soils with extremely low osmotic / matric potentials.

Costelloe et al. (2008) concluded that coolibah avoided using hypersaline groundwater (71,000 mg/L chloride), instead favouring the use of low salinity soil moisture in the vadose zone above the watertable. Coolibah can however continue to extract moisture at chloride concentrations up to 30,000 mg/L chloride in soils where matric potential in the upper soil profile is extremely low due to a combination of extreme drying coupled with a clayey substrate.

The heavy clay that is typically associated with occurrences of 11.3.3 in the assessment area presents a physical limitation on tree root penetration. Clay substrates are an unsuitable medium for development of a deep tap root system that would be necessary to penetrate to the watertable (Dupuy et al., 2005) and soils with low hydraulic conductivities, such as clays, greatly limit the ability of trees to utilise groundwater (Feikema, 2010). Hence, it is not expected that coolibah would have the same capacity to develop the deeper tap roots that characterise river red gum, and maximum rooting depth would be shallower, considerably less than 10 m, and possibly like poplar box with estimated maximum rooting depth of 4 mbgl. Coolibah would be likely to utilise groundwater only when groundwater is < 5 mbgl and moisture availability in the vadose zone is extremely limited.

Mountain coolabah: There is no information in literature on moisture sources and requirements for mountain coolabah *(Eucalyptus orgadophila)*. The species occurrence on heavy clay soils (11.4.13) suggest limited capacity for development of deep sinker roots and reliance on moisture retained in clay soils in the shallow soil profile.

14.2.5.3 Ironbark species

Fensham and Fairfax (2007) consider ironbark, which includes both narrow leaf ironbark (*Eucalyptus crebra*) and silver leaf ironbark (*Eucalyptus melanophloia*), to possess shallow rooting systems with limited investment in deep root architecture, rendering them susceptible to droughts. Based on field observation, tree roots would not be expected to penetrate beyond 5 mbgl. These species are more typically associated older elevated residual landforms and foothills which have greater depth to the watertable than alluvial landforms and it is considered unlikely that ironbark dominant ecosystems would have capacity to utilise groundwater.

14.2.5.4 Bloodwood species

O'Grady et al. (2006) concluded the following regarding bloodwood species when studying groundwater usage of trees on a tropical floodplain savannah. Clarkson's bloodwood (*Corymbia clarksoniana*) utilised groundwater when the watertable was at 10 mbgl indicating the potential for the species to develop a deep sinker root. Clarkson's bloodwood should be considered a facultative phreatophyte. It is likely that Clarkson's bloodwood occurring on the banks of ephemeral watercourses will utilise groundwater if it is within reach of rooting depth and not saline.

Moreton Bay ash (*Corymbia tessellaris*) demonstrated groundwater usage when the watertable was at 4 mbgl, although it is not known whether the species has capacity to utilise deeper groundwater sources. Moreton Bay ash should be considered a facultative phreatophyte although may have similar water use strategies to poplar gum, with limited capacity to utilise deeper groundwater sources. Due to ecological similarities with Moreton Bay ash, Dallachy's bloodwood is assumed to have similar moisture requirements. The species should be considered a facultative phreatophyte though with limited capacity to utilise deeper groundwater sources.

14.2.5.5 Lophostemon

O'Grady et al. (2006) demonstrated that swamp mahogany (*Lophostemon suaveolens*) utilised moisture from the top 5 m of the soil profile in preference to groundwater, even when the groundwater table was 4 mbgl – 7 mbgl. Swamp mahogany is unlikely to be dependent on groundwater in most ecological situations, although its use of groundwater when the watertable is at shallow depths cannot be discounted.

14.2.5.6 River oak

The water use strategy of river oak (*Casuarina cunninghamiana*) appears dependent on its position relative to a watercourse. O'Grady et al. (2006) determined that river oak mainly utilised river water when adjacent to a stream channel, which is its most common topographic position. There has been no demonstration that river oak has capacity to utilise deeper groundwater sources. River Oak is may occasionally utilise groundwater when it is present at shallow depths in river alluvium.

14.2.5.7 Brigalow

Brigalow (*Acacia harpophylla*) habitats and individual trees regularly occur adjacent to the floodplain of the major and ephemeral drainage systems and generally occupy heavy clay soils (vertosols) with well-developed gilgai microtopography in the upper soil profile (0.6 m to surface) where the bulk of nutrient recycling occurs. The subsoil components are however typically strongly cohesive clays with high levels of salinity, sodicity, acidity and phytotoxic concentrations of chloride which may reduce the effective rooting depth in these soils (Dang et al. 2012). Johnson et al. (2016) describe brigalow as 'a clonal species with stems arising from horizontal roots which draw resources from a substantial area around the plant'.

The concentration of the brigalow root mass in the upper soil profile enables the species to sucker profusely from horizontal roots after physical disturbance and limits the capacity for other woody species to compete for moisture and nutrients. Brigalow's shallow rooting habitat is evident with the tendency of mature trees to topple because of churning in the upper soil profile with fallen trees universally exposing a well-developed lateral root system with little evidence for development of deeper sinker roots that would have capacity to propagate to deeper watertable depths. Brigalow is not considered to represent groundwater dependent vegetation.

14.2.5.8 Melaleuca species

Fringing weeping paperbark, including both *Melaleuca leucadendra* and *Melaleuca fluviatilis*, are almost ubiquitous species in riparian vegetation along semi-arid watercourses, occurring on the riparian fringes of the Isaac River to the immediate west of the Project Area. Despite a widespread occurrence, their ecology is poorly understood. They are generally considered phreatophytes although O'Grady et al (2006a) determined that river water was the predominant source of water for melaleuca's fringing the Daly River in northern Australia.

O'Grady (2006b) also suggests that highly variable stable isotope signatures of weeping paperbark fringing a tropical watercourse indicated opportunistic water usage from variable sources.

14.2.6 Depth of Tree Rooting and Salinity Tolerances

As discussed in previous sections, tree rooting depth is a difficult parameter to predict and measure as it depends on several factors including tree species, substrate, edaphic conditions, as well as depth to groundwater. Tree root penetration is typically arrested at the capillary fringe (Eamus et al., 2006b), with depth is determined by gradients in the watertable and where resources are most available (Barbeta et al., 2017). Most studies have suggested rooting depths ranging from 10 mbgl – 15 mbgl including the following:

- Horner et al. (2009) found rooting depths at 12–15 mbgl based on observed mortality in plantation river red gum forests on the Murray River Floodplain,
- From excavations in 20-year-old plantation forests of Eucalytpus tereticornis, Kallarackal and Somen (1998) found that roots were traceable to depths of 9.3 mbgl, and
- Jones et al. (2020) found maximum rooting depths of 8.1 mbgl in river red gum in a broad study area in the Great Artesian Basin.
- For brigalow, the phytotoxic composition of soils at depth limits the effective rooting depth, with root matter largely confined to the upper 2 mbgl of the soil profile.

In conclusion, maximum rooting depth is likely to be variable, dependent species, on-site geology, water quality and depth to saturation with the capillary fringe being the general depth at which root penetration will be arrested (Eamus et al., 2006b). For this assessment, considering the generally poor development of flood plain sediments in the Project Area, maximum rooting depth has been set conservatively at 15 mbgl for river red gum, and is likely to be considerably shallower for other assessed species including eucalypts.

A summary of the likelihood of groundwater usage of various tree species and their associated REs is presented in **Table 14-3**. The threshold groundwater depth is an estimate of the maximum rooting depth for each of those species. Regional ecosystem mapping has been correlated with the constituent species, and the maximum likely rooting depth has been allocated and the following relationships identified:

- Vegetation communities that contain river red gum (*Eucalyptus camaldulensis*) and forest red gum, which includes 11.3.25 and 11.3.4 are the most likely users of groundwater, with the potential to utilise groundwater down to depths of 15 mbgl.
- Other species that may occur in 11.3.4 or 11.3.25 including Clarkson's bloodwood (*Corymbia clarksoniana*), Moreton Bay ash (*Corymbia tessellaris*) and river oak (*Casuarina cunninghamiana*) are less likely users of groundwater with a groundwater threshold depth set at <10 mbgl, and probably significantly shallower for casuarina.
- The remainder of trees and REs have a significantly lower groundwater threshold depth set at <5 mbgl with likelihood of groundwater usage decreasing through box communities (11.3.2/ 11.5.3) with the lowest likelihood of groundwater usage predicted for brigalow habitats that are associated with heavy clay soils. This would include brigalow dominant habitats including 11.3.1 and 11.4.9.

Table 14-3 Predicted likelihood of groundwater usage and threshold depths for various species and regional ecosystems

RE	Species	Common name	Deep sinker roots	Threshold Groundwater Depth
11.3.25 / 11.3.27	*Eucalyptus camaldulensis / Eucalyptus tereticornis*	River red gum / Forest red gum	Known	<15 m
11.3.25 / 11.3.7	*Cormbia clarksoniana*	Clarksons bloodwood	High potential	<10 m
	Corymbia tessellaris	Moreton Bay ash	High potential	<10 m
11.3.7	*Corymbia dallachiana*	Dallachy's bloodwood	High potential	<10 m
11.3.25	*Lophostemon suaveolens*	Swamp box	High potential	<10 m
11.3,3	*Eucalyptus coolabah*	Coolabah	Moderate potential	<5 m
11.3.2 / 11.5.3	*Eucalyptus populnea*	Poplar box	Moderate potential	<5 m
11.3.25	*Casuarina cunninghamiana*	River oak	Moderate potential	<5 m
11.3.25	*Melaleuca fluviatilis*	Weeping paperbark	Moderate potential	<5 m
11.4.13	*Eucalyptus orgadophila*	Mountain coolabah	Moderate potential	<5 m
11.5.3	*Eucalyptus crebra*	Narrow leaf ironbark	Moderate potential	<5 m
11.5.3	*Eucalyptus melanophloia*	Silver leafed ironbark	Moderate potential	<5 m
11.3.1/ 11.4.9	*Acacia harpophylla*	Brigalow	Unlikely	<5 m
11.3.1/ 11.4.9	*Brachychiton rupestris*	Narrow leaf bottletree	Unlikely	<5 m
11.3.1/ 11.4.9	*Casuarina cristata*	Belah	Unlikely	<5 m
11.3.25	*Melaleuca bracteata*	Black tea-tree	Unlikely	<5 m

Assuming tree roots have capacity to penetrate to the depth of the watertable, trees will utilise saline groundwater when the moisture potential of soil in the vadose zone falls below the moisture potential in the phreatic zone (or osmotic potential of the groundwater). Hence as soil in the vadose zone dries and moisture potential decreases, there will be increasing tendency to utilise saline groundwater where it is available. There is however a salinity limit above which groundwater will be toxic to trees and cause dieback. Based on evidence from published literature and the authors personal observation, it is unlikely that the terrestrial woody vegetation that characterises the Project Area would have capacity to utilise groundwater that has salinity greater than 30,000 µS/cm, instead relying on moisture that can be extracted from the vadose zone. It is also unlikely that any tree would invest in the development of a deep root system to tap a saline watertable where the benefits in terms of increased water availability during dry periods would be very marginal.

For risk assessment purposes, increasing groundwater salinity decreases the likelihood of groundwater usage with a threshold set at 30,000 µS/cm, above which usage will ultimately result in vegetation senescence and dieback.

14.2.7 Groundwater Dependent Ecosystems in the Project Area

The Winchester South GDE assessment (3d Environmental, 2023), conducted within a study area directly to the southwest of the Project Area across the Isaac River, concluded that vegetation associated with Tertiary/residual surfaces presented relatively limited moisture availability, without any evidence of groundwater utilisation. Within the Project Area, habitats on residual surfaces include small areas of 11.5.3, dominated by poplar box. The lack of evidence for groundwater usage is consistent with the shallow rooting depth of poplar box (<5 mbgl), the considerable depth to groundwater (~14 m), and the generally saline nature of groundwater hosted at the base of the regolith (up to 29,000 µS/cm). For other ecosystems, including Brigalow (11.3.1 and 11.4.9), the shallow rooting depth (<5 m) and the considerable depth to groundwater again preclude groundwater utilisation for these habitats and associated species.

The Winchester South GDE assessment (3d Environmental, 2023), however, concluded that fringing riparian vegetation (11.3.25) may be utilising groundwater hosted in the sandy bed channel and recent alluvium associated with the Isaac River, although groundwater usage is likely to be restricted to trees on the lower riverbanks. The potential for groundwater utilisation decreases with distance from, and height above, the river as the depth to alluvial groundwater sources increases.

The perched groundwater within the river sand and fringing alluvial terraces supports well-developed riparian vegetation (11.3.25) characterised by deep-rooted facultative phreatophytes, including river and forest red gums. These deep-rooted species utilise the shallow alluvial groundwater resources when seasonally present, shifting to deeper sources of alluvial groundwater as the perched groundwater dries, becoming reliant on soil moisture alone during drier periods when discharge of alluvial groundwater has occurred through transpiration.

A more localised conceptualisation of the perched groundwater system in the Isaac River is provided in **Figure 14-10** to **Figure 14-10** . Permian sediments form the basement of the river sand, which supports a perched groundwater unit. The river sand may extend underneath the western and eastern banks of the river, where it supports riparian terrestrial GDEs. The dry season model illustrates the reliance of riparian vegetation on the perched groundwater unit, as shown in **Figure 14-10**, which is recharged during surface flows (wet season model) in **Figure 14-9**, including bank storage of recent recharge.

There may be discharge of bank storage back into the river sand as surface flows subside, which extends the period of river flow and sustains water levels in the river sand (**Figure 14-10**). Importantly:

- Auger profiling in the river sand (3d Environmental, 2023) confirmed that groundwater in the river sand is perched directly on weathered Permian sediments without a clay basal layer, and
- The groundwater unit represented at the base of the weathered zone is conceptual only, and may have variable degrees of saturation (SLR, 2025b).

Locally, the extent of GDEs is restricted to the margins of the Isaac River, attenuating upstream along any major tributaries, including Cherwell Creek, which flows eastward into the Isaac River to the north of the Project area. Additional terrestrial GDE areas may coincide with floodplain wetlands where they occur outside the Project Area. The spatial distribution of Type 1 (riverine) and Type 2 (wetland) GDEs from 3d Environmental (2023) is shown in **Figure 14-11**.

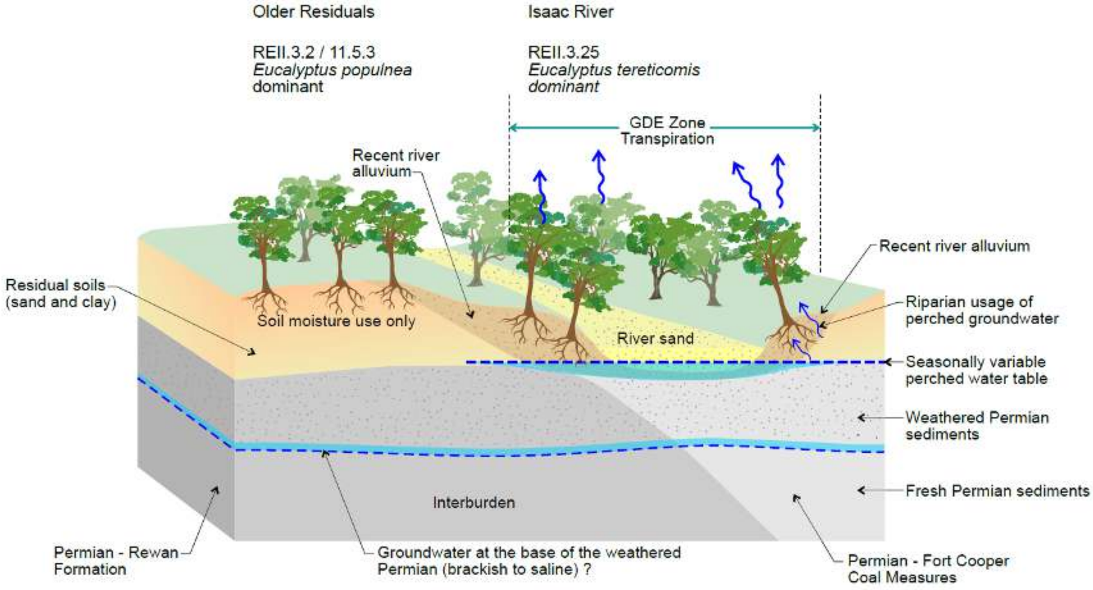


Figure 14-8 Isaac River - Dry season

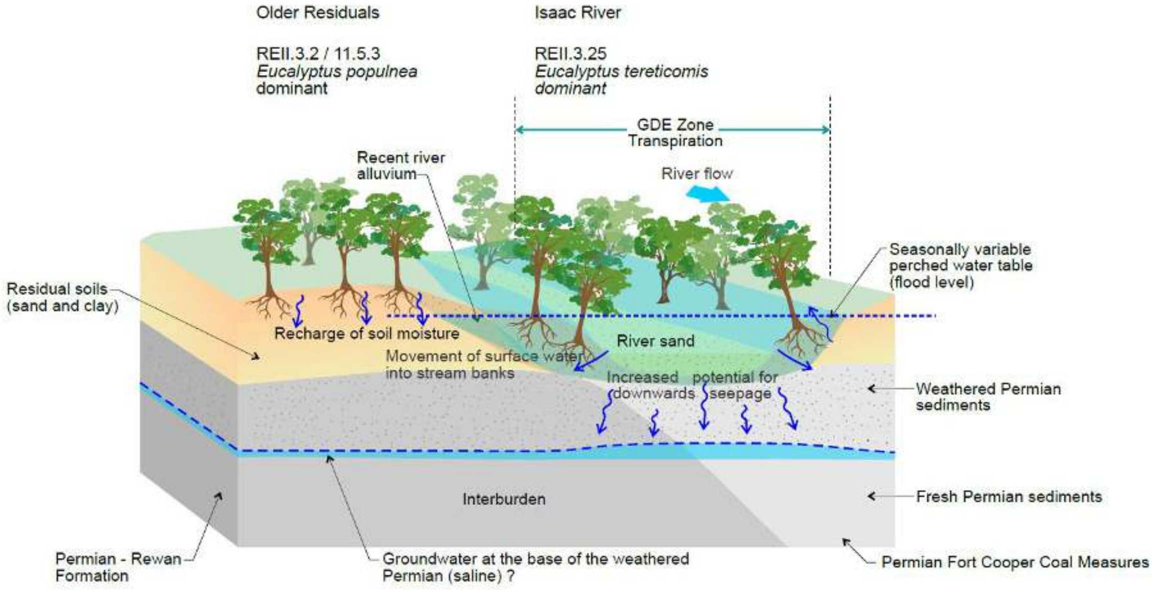


Figure 14-9 Isaac River - Wet season

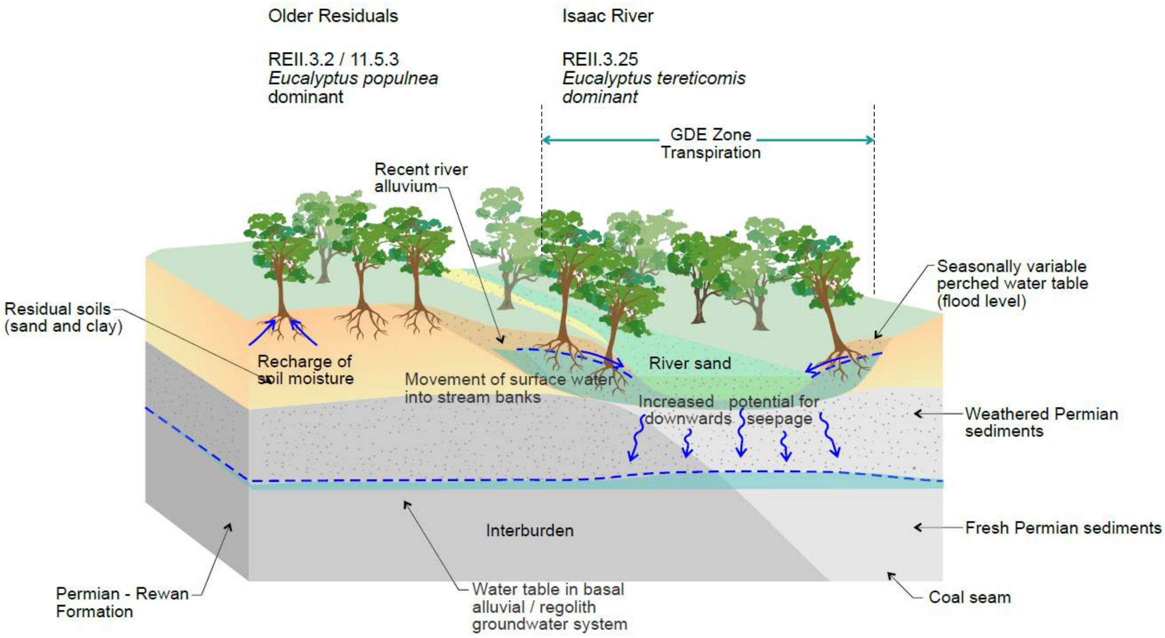


Figure 14-10 Isaac River – Base flow regime

The perched groundwater in the river sand supporting terrestrial groundwater dependent vegetation in the dry season is show in **Figure 14-10**. Riverbanks are recharged during wet season surface flow events with groundwater stored in riverbanks returning as short duration baseflow as river surface levels recede. Groundwater in the river sand is perched directly on weathered Permian sediments, in this location and the groundwater represented at the base of the weathered zone is conceptualised.

Figure 14-11. The location of field verified GDEs

14.3 Potential Impacts

Richardson (2011) identifies several pathways that will result in impacts to the health and ecological function of a GDE which may include:

- Direct clearing of a GDE,
- A total or partial loss or reduction in the volume or pressure of the aquifer being utilised by GDEs,
- A change in the magnitude and timing of volume fluctuations in the aquifer being utilised by GDEs,
- Changes to the interaction between surface flows and aquifers being utilised by a GDE, and
- Change in chemical composition of an aquifer detrimentally impacting the health of a GDE.

The Project does not propose direct clearing of GDEs. Additionally, surface flows in the Isaac River, the primary source of groundwater recharge to riparian GDEs, will not be interrupted. Groundwater modelling completed by SLR (2025b) predicts that construction of the OOPD will increase local groundwater recharge, resulting in groundwater mounding rather than aquifer depressurisation. Therefore, the most likely GDE impact pathways will be through changes to the magnitude and timing of volume fluctuations of an aquifer utilised by a GDE (3), and possible indirect impacts associated with changes to aquifer chemistry (5). A discussion of these potential mechanisms is provided below.

14.3.1 Change in the Magnitude and Timing of Volume Fluctuations

Drawing on information on ecohydrological function from previous sections, the only likely GDE within the broader Project Area is associated with the riparian fringe of the Isaac River, with the likelihood of a GDE occurring decreasing with distance from the river channel where the effect of bank recharge during flooding diminishes. Groundwater modelling from SLR (2025b) predicting up to 5 m of groundwater mounding within the Isaac River alluvium (Model Layer 1), beneath the Isaac River channel where GDEs are supported, as demonstrated in **Figure 14-12**. Predicted groundwater mounding in the Tertiary / regolith (Model Layer 2) mounding arises due to a greater volume of water infiltrating and being retained by the spoil, with increased rates of recharge to the underlying strata, as shown in **Figure 14-3**.

Groundwater mounding beneath the OOPD will migrate outwards towards the Pandora Pit void which will act as a strong local sink for groundwater, and west across the Isaac River (SLR, 2025b). Notably, groundwater mounding will result in a net increase in the groundwater availably to GDEs, resulting in:

- Elevated groundwater levels which may increase the period for which groundwater is accessible in the tree root zone, and
- Increase the periods of baseflow discharge from perched alluvial groundwater tables into the Isaac River surface flows.

Groundwater mounding is not considered a significant direct risk to GDEs, because:

- Increased groundwater levels will likely be met with a commensurate increase in the rate of groundwater discharge through transpiration by deep-rooted vegetation.

- The greatest magnitude of mounding will coincide with wet periods when perched groundwater tables are likely to be elevated due to recharge from surface flows.

Figure 14-12. Extent of groundwater mounding in Model Layer 1- Alluvium

Figure 14-13. Extent of groundwater mounding in Model Layer 2 - Regolith

14.3.2 Change in the Chemical Composition of an Aquifer

The Groundwater Impact Assessment Report (SLR 2025b, **Appendix D**), based on modelling by (Terrenus, 2025) details the likely impact of leachate from the OOPD on groundwater chemistry. The most salient points are:

- There is the potential for water infiltrating through the OOPD to leach substances from the waste rock, which may result in changes in groundwater quality beneath the OOPD,
- DNM spoil will generate pH-alkaline to highly alkaline contact water (run-off and seepage), which is typical for mine spoil in the Bowen Basin, and will have a low potential to generate acid and metalliferous drainage, and
- Expectations are that seepage from the OOPD will pose a “Low” Acid Mine Drainage (AMD) hazard, with AMD generation rated as “Highly Unlikely”.

In addition, particle tracking indicates that seepage from the western edge of the OOPD is likely to migrate off-site, with most of the seepage migrating back towards the Pandora Pit void, captured as mine-affected water (SLR 2025b). It is predicted that only seepage from the western edge of the OOPD is likely to migrate off site, and that this groundwater will remain in the deeper coal measures, below the shallow groundwater system hosted in the Quaternary and Tertiary sediments that may support GDEs. Based on the preceding information, there is no predicted impact on the quality of groundwater supporting GDEs.

14.4 Risk Assessment

Drawing on information on ecohydrological function from previous sections, the only likely GDE within the broader Project Area is associated with the riparian fringe of the Isaac River, with the likelihood of a GDE occurring decreasing with distance from the Isaac River. Based on the known distribution of GDEs (**Figure 14-3**) a risk assessment has been prepared which presents the likelihood of an impact to GDEs within the area of groundwater impact.

The significance of potential impacts is described as:

- High significance: Complete destruction of a GDE in terms of complete loss of keystone species and conversion to an alternate degraded ecological state. Impacts are irreversible and the only feasible option for mitigation is an environmental offset under relevant environmental policy,
- Moderate significance: Degradation of a GDE to an extent such that 25% or more keystone species are affected by the action. Impacts will be reversible only with mitigation,
- Low significance: Impacts are short in duration and reversible without mitigation required, and
- Insignificant: Impacts are undetectable when assessed against a relevant ecological baseline.

The ranking applied to the likelihood assessment, including the descriptor is shown in **Table 14-4**, descriptions of impact magnitude are shown in **Table 14-5**, and the derived risk matrix is shown **Table 14-6**. The constructed risk assessment with a residual risk score is presented in **Table 14-7**. The following assessment presents unmitigated risk, with no specific management actions or mitigations applied. Based on the risk assessment outcomes in **Table 14-7**, unmitigated risk to GDEs identified in this assessment are classified as ‘*Insignificant*’.

Table 14-4 Descriptors and ranking for the likelihood of impact occurring

Rank	Likelihood	Description
1	Highly unlikely	There is no precedent for this event in the industry and similar events have not previously occurred.
2	Unlikely	Impacts have been associated with previous industry actions although similar impact pathways are not identified for the Project.
3	Possible	Impact pathways are not clearly understood and impacts have been previously associated with a similar industry action
4	Likely	Impacts have previously been associated with the industry and a clear impact pathway exists.
5	Highly likely	A common event that is consistently associated with a similar industry action/ of an action that is proposed to occur.

Table 14-5 Descriptors of Impact Magnitude applied in the risk assessment

Magnitude	Description
Negligible	No impact identifiable above baseline ecological conditions
Low	Plant stress linked to mining development that results in the reduction in volume and duration of groundwater supporting a GDE system that does not result in more than 5% dieback of 'mature canopy trees'*. Impact localised and reversible with mitigation.
Moderate	Plant stress linked to mining development that results in the reduction in volume and duration of groundwater supporting a GDE system that does not result in more than 25% dieback of mature canopy trees (defined as a canopy tree with DBH > 60 cm). Impact is reversible with mitigation.
High	Significant harm (loss of 25 to 50% of mature canopy trees). Impact is reversible although a significant lag in return to pre-disturbance condition occurs (lag >20 years). Vegetation is converted from remnant to non-remnant status and significant impacts to habitat for protected fauna species occurs. Biodiversity offsets may be required.
Severe	Irreversible impact to > 50% 'mature canopy trees'* that cannot be mitigated. Vegetation is converted from remnant to non-remnant status and significant impacts to habitat for protected fauna species occurs. Biodiversity offsets will be required.
*A 'mature canopy tree' is defined for the purpose of this risk assessment as a tree that forms a component of the undisturbed canopy (T1 or upper structural layer) of a remnant vegetation community.	

Table 14-6 Matrix applied in the risk assessment

		Likelihood				
		Highly Unlikely (1)	Unlikely (2)	Possible (3)	Likely (4)	Highly Likely (5)
Consequence	Severe	Insignificant	Low	High	High	High
	High	Insignificant	Low	Moderate	High	High
	Moderate	Insignificant	Low	Moderate	Moderate	Moderate
	Low	Insignificant	Low	Low	Low	Low
	Negligible	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

Table 14-7 Risk assessment for potential impacts and unmitigated risk scores

Impact Pathway	Comments	Pre-mitigated Risk		
		Likelihood	Consequence	Risk
Direct clearing of a GDE	No direct clearing of GDEs associated with Isaac River will occur.	1	Severe	Insignificant
A total or partial loss or reduction in the volume or pressure of the aquifer being utilised by TGDEs	The zone of 'High Potential' GDEs fringing the Isaac River and the associated alluvial groundwater table is not impacted by groundwater drawdown. There is no impact pathway which could reduce the volume of the alluvial/Tertiary aquifer which supports GDEs.	1	Moderate	Insignificant
A change in the magnitude and timing of volume fluctuations in the aquifer being utilised by GDEs	Seepage through the OOPD will result in groundwater mounding due to a greater volume of water infiltrating and being retained by the spoil, Groundwater mounding will result in a net increase in the groundwater availably to GDEs, resulting in elevated groundwater levels within the tree root zone, and increased period and magnitude of baseflow discharge back into the Isaac River following withdrawal of surface flows. Groundwater mounding is not considered a significant risk to GDEs because increased groundwater levels will result in increased transpiration discharge, and the greatest magnitude of mounding will coincide with wet periods when perched groundwater tables are likely to be elevated due to recharge from surface flows.	1	Moderate	Insignificant
Changes to the interactions between surface flows and aquifers being utilised by a GDE	There is no mechanism for the OOPD to impact the interaction between surface flows and the alluvial aquifer supporting groundwater-dependent vegetation associated with the Isaac River.	1	Moderate	Insignificant
Change in chemical composition of an aquifer detrimentally impacting the health of a GDE	The likely seepage quality from the OOPD will be below WQOs. Seepage from the OOPD will be captured by the Pandora Pit void and only seepage from the very western margin of the OOPD will migrate off site to the west and south. Migrating seepage will remain in the deeper coal measures, below the shallow	1	Moderate	Insignificant

Impact Pathway	Comments	Pre-mitigated Risk		
		Likelihood	Consequence	Risk
	groundwater system hosted in the Quaternary and Tertiary sediments that may support GDEs.			

14.5 Conclusion

An assessment of the ecohydrological function of woody vegetation within and adjacent to the OOPD concludes that:

- Groundwater within and adjacent to the OOPD areas is typically too deep (~14 mbgl) to support most woody vegetation species in the Project Area and surrounds, meaning that most woody vegetation is reliant on soil moisture to support transpiration.
- Facultative groundwater dependence for riparian vegetation fringing the Isaac River (11.3.25) is likely where deep-rooted vegetation accesses alluvial groundwater resources on a permanent or seasonal basis, depending on its position relative to the channel and distance from the watercourse.

Several factors indicate that the development of the OOPD will not significantly impact the ecohydrological function of groundwater dependent vegetation within and surrounding the Project. Groundwater modelling concludes that groundwater mounding will occur due to a greater volume of water infiltrating and being retained by the spoil. Groundwater mounding will result in a net increase in groundwater availability to GDEs, leading to elevated groundwater levels within the tree root zone, as well as an extended period and increased magnitude of baseflow discharge back into the Isaac River following the withdrawal of surface flows. The assessment concludes that increased transpiration by deep-rooted vegetation will balance the increased volume and duration of groundwater within the tree root zone. In addition, there is no pathway through which leachate from the OOPD will affect the quality of groundwater utilised by GDEs.

15.0 Greenhouse Gas

15.1 Introduction

This chapter contains the Greenhouse Gas (GHG) Assessment that was completed by SLR for the Project in order to address the requirements of the *Guideline Greenhouse Gas Emissions* (DETSI, 2025) (hereafter 'the Guideline'). The Guideline sets out application requirements under the EP Act and provides information about how to meet these requirements in relation to GHG emissions.

The Guideline, Section 3.5.2 (amendment application requirements), describes the information required for '*a site-specific application, but only to the extent they relate to the proposed amendment*'. The requirements for the proposed amendment are described in **Table 15-1** including where they are addressed in this chapter.

Section 3.2 of the Guideline states:

- Applications with expected GHG emissions (Scope 1 and Scope 2) of 25,000 tonnes of carbon dioxide equivalent (t CO_2-e) or more per year, at any time during the life of the project, are considered medium to high emitters, and
- Applications with expected GHG emissions (Scope 1 and Scope 2) of less than 25,000 t CO_2-e per year are considered low emitters.

Table 15-1 The Guideline, Section 3.5.2 (amendment application requirements)

Requirements	Section of this report
A GHG emissions inventory (Scope 1, 2 and 3), only referring to GHG emissions that will be generated as a result of the proposed amendment, including the determination of the GHG emission category for the application	**Sections 15.4.1** and **15.4.2**
Details of any GHG emission mitigation and management practices proposed to be implemented to reduce GHG emissions associated with the proposed amendment	**Section 15.7**
A risk assessment that outlines the scale of expected GHG emissions from the proposed amendment and how they are expected to contribute to climate change impacts on Queensland's environmental values	**Sections 15.5** and **15.6**
A GHG abatement plan for the proposed amendment that meets the requirements of Appendix A – *only required for activities that meet the medium to high emission category at any point during the carrying out of the authorised activity*	**Section 15.9.1**

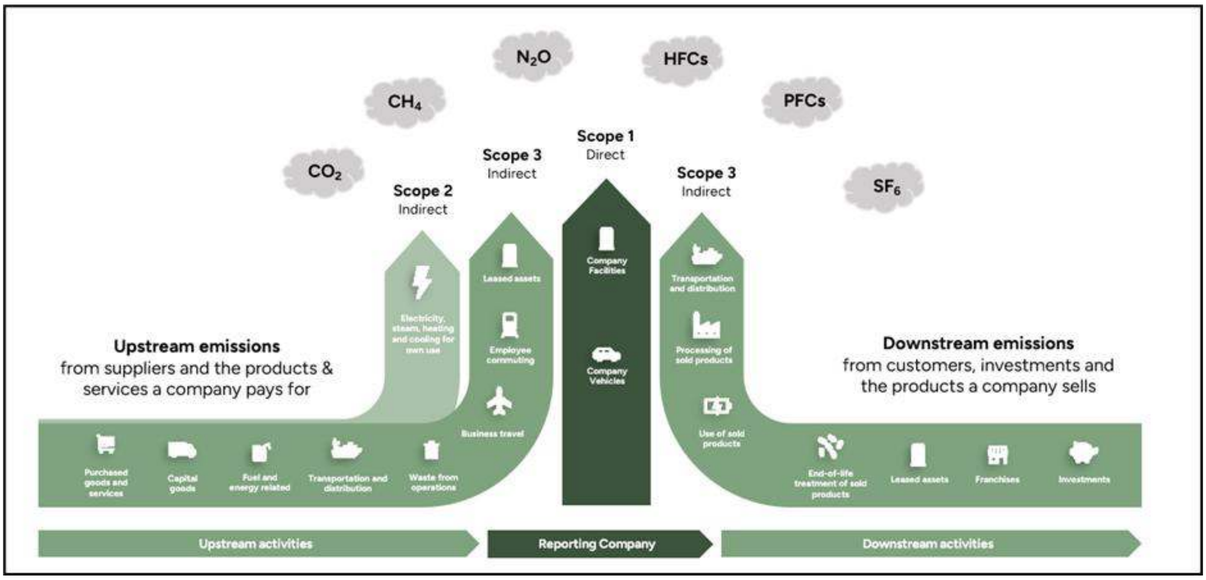
15.2 Background

15.2.1 Greenhouse Gas Scope Definitions

Emissions of GHG are categorised as Scope 1, Scope 2 or Scope 3, and 'direct' or 'indirect' emissions (refer to **Figure 15-1**). The sources of the definitions for each scope are:

- The GHG Protocol, developed by the World Resources Institute (WRI),
- A U.S. based environmental, non-governmental organisation, and

- The World Business Council for Sustainable Development (WBCSD), a Geneva-based coalition of 170 international companies (WRI/WBCSD, 2004).



Source: WRI/WBCSD, 2004

Figure 15-1 Scope 1, 2 and 3 GHG Emissions as Defined in the GHG Protocol

The GHG Protocol provides detailed information on the activities that should be included within the boundaries of each Scope. The boundary definitions allow the determination of those sources of GHG emissions that can be directly controlled by a project (Scope 1), and those that a Project would have less control over (Scope 2 and Scope 3).

Direct Emissions (Scope 1):

Direct emissions of GHG are termed Scope 1 emissions and are those produced from sources within the boundary of the organisation, and as a result of the organisation's activities.

Indirect Emissions (Scope 2 and Scope 3):

Indirect emissions are generated in the wider economy as a consequence of one organisation's activities, although they are physically produced by the activities of another organisation. They are separated into Scope 2 and Scope 3 as follows:

- **Scope 2 Emissions:** Scope 2 emissions are those that are associated with the generation of energy consumed by a facility (such as electricity, steam, heating and cooling), which occur beyond the facility's boundaries. Commonly the most important category of Scope 2 emissions is associated with the consumption of purchased electricity. Scope 2 emissions physically occur at the facility where the electricity (or other purchased energy) is generated.
- **Scope 3 Emissions:** Scope 3 emissions are those that occur upstream and downstream of an organisation's activities and may include the following categories:
    - Extraction and production of purchased materials and fuels
    - Transport-related activities
    - Electricity-related activities not included under Scope 2, e.g. extraction, production and transportation of fuels consumed in the generation of electricity

- Leased assets, franchises and outsourced activities.
- Use of sold products and services.
- Waste disposal.

15.2.2 Global Warming Potentials

For comparative purposes, non-CO_2 GHGs are assigned a 'CO_2 equivalence' (CO_2-e) based on their contribution to the greenhouse effect. The CO_2-e of a gas is calculated using an index called the Global Warming Potential (GWP). As an example, the GWP for methane is 28, so the emission of one tonne of methane is expressed as 28 t CO_2-e.

The GWPs are periodically updated by the Intergovernmental Panel on Climate Change (IPCC), as the science is improved. The 100 year GWPs from the IPCC's Fifth Assessment Report (AR5) (IPCC, 2013) have been used in this assessment (see **Table 15-2**), in accordance with Australia's current reporting requirements (DCCEEW, 2025).

No significant sources of other GHGs, such as hydrofluorocarbons or sulfur hexafluoride, were identified as part of the Project, and as such they have not been considered further in this assessment.

Table 15-2 GHGs and 100-year Global Warming Potentials

Gas	Chemical Formula	IPCC Global Warming Potentials (100-year horizon)
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265
Source: IPCC, 2013		

15.3 GHG Inventory Methodology

15.3.1 Overview

The calculation of GHG emissions from the Project has been performed in a five-stage desktop assessment process:

- Definition of the Project boundary (i.e. the Project disturbance footprint),
- Identification of GHG emission sources within the Project during construction and operation,
- Identification of emission calculation methods and emission factors for each source,
- Identification of the activity data for each emission source required for the calculations, and
- Calculation of estimated GHG emissions.

Emissions were predominantly calculated based on the NGER Measurement Determination (NGER Measurement Determination, 2008) and the Australian National Greenhouse Account Factors (DCCEEW, 2025).

The GHG emissions estimated for the Project were compared against the most recent publicly available state and national GHG emissions to assess their potential contribution to

Australia's emissions inventory and thus their potential impact on Australia's ability to meet GHG reduction targets and policies.

A number of assumptions have been relied upon in compiling the GHG emission inventory for the Project. The GHG emissions from the key sources identified for the Project have been estimated based on the current emission factors published for use in reporting GHG emissions under the NGER Scheme, which rely on estimates of the level of intensity of each activity (referred to as activity data). This includes parameters such as projected fuel consumption rates and electricity consumption. The activity data used in the calculations has been compiled based on the current available Project design information and in consultation with Whitehaven Daunia. The basis of the emission estimates and activity data are detailed in the relevant subsections in **Section 15.3.4**.

15.3.2 Boundary Definition

The boundaries adopted for the GHG emission inventory compiled for the Project as part of this GHG assessment are defined as follows:

- The geographical boundary set for the Scope 1 emissions considered in the GHG assessment covers the DNM. All related activities outside of this geographical boundary have been addressed under Scope 2 or Scope 3,
- The assessment has considered potential Scope 1, Scope 2 and Scope 3 emissions associated with the Project only. GHG emissions associated with the wider mine activities, such as coal extraction, processing, delivery to customers, and end use will not change as a result of the Project, and have not been addressed in this assessment, and
- The GHG emissions will occur during decommissioning and rehabilitation of the mine at the end of its life. Due to the uncertainty regarding the timing and activity data relevant to the mine closure and rehabilitation, and given that the Project would not significantly impact the scale of the related emissions, GHG emissions associated with the end-of-life phase of the mine and associated infrastructure have not been estimated as part of this study.

15.3.3 Identification of GHG Emission Sources

The GHG emission sources were identified through a review of previous GHG emission inventories compiled for DNM, historic NGER reporting, and the Project description.

The key Scope 1 emissions at DNM that would be impacted by the Project are:

- Biogenic emissions associated with vegetation removal as part of construction of the OOPD – these emissions are primarily composed of CO_2 from biomass combustion and decay, and methane (CH_4) from anaerobic decomposition,
- CO_2, CH_4 and nitrous oxide (N_2O) emissions associated with the combustion of fuels – particularly in haul trucks transporting overburden and interburden from the Pandora Pit to the new OOPD instead of the existing OOPD areas, and
- CO_2, CH_4 and nitrous oxide (N_2O) emissions associated with the consumption of petroleum-based oils and greases in the haul trucks transporting overburden and interburden to the new OOPD instead of the existing OOPD areas.

The following Scope 1 and Scope 2 GHG emission sources are also associated with DNM's current and future mining activities, however they will not be impacted by the Project as no new coal extraction, CHPP modifications, or changes to water, power or waste systems are proposed as part of the Project, and they have therefore not been considered further:

- Fugitive emissions of CH_4 and carbon dioxide CO_2 from the extraction of coal,
- Leakage of sulfur hexafluoride (SF_6) from gas-insulated switchgear installed on site, and
- Consumption of electricity from the grid.

Similarly, as the scope of the assessment is limited to the GHG emissions that will be generated as a result of the Project, the only relevant scope 3 emissions that would be impacted by the Project are:

- Emissions associated with the production and supply of fuels consumed, and
- Emissions associated with the production and supply of oils and greases consumed.

The main Scope 3 emissions associated with DNM's current and future operations, i.e. those associated with the transport and end use of the product coal, will not be affected by the Project and have not been considered further.

Based on the above, the emission sources that were included in the emission calculations are summarised in **Table 15-3**.

Table 15-3 Project Scope 1, Scope 2 and Scope 3 GHG emission sources

Emission Source	Scope 1	Scope 2	Scope 3
Vegetation clearing	✓	×	×
Consumption of petroleum-based oils and greases	✓	×	✓
Use of diesel fuel	✓	×	✓

15.3.4 Calculation Methods and Emission Factors Used

Details of the calculation methods used to estimate the impact of the Project on the identified emission Scope 1 and Scope 3 GHG emission sources that would potentially be impacted by the Project are provided below.

Each emission factor requires information on anticipated activity levels, such as the projected quantities of fuels to be consumed. The data and assumptions relating to activity levels used in this assessment are also outlined in the relevant subsection.

15.3.4.1 Vegetation Clearing

Activity Data

Whilst vegetation removal (excluding diesel used in the vegetation removal equipment) is not a direct GHG emission, the net impact of removing vegetation (which is a carbon sink) is that the removal of CO_2 from the atmosphere by this vegetation will no longer occur. The resulting effect is that an equivalent amount of CO_2 will remain in the atmosphere. Hence, vegetation removal is categorised as a Scope 1 emission.

Disposal of the vegetation will also result in GHG emissions, in addition to those related to the loss of a carbon sink. Where vegetation is reused or left to decompose naturally on site, the rate at which GHGs are emitted is very slow and can be considered negligible. However, if vegetation is disposed of to landfill or combusted, the rate is much higher.

The OOPD footprint is proposed to disturb approximately 282 ha, a portion of which (39 ha) will be located on the existing and authorised ML 1781.

Prior to mining, DNM had been largely cleared of native vegetation and was being utilised for cattle grazing pastures. The disturbance footprint has also been optimised to avoid clearing of ecologically sensitive areas and to minimise disturbance as far as practicable. As a result, the disturbance footprint is constrained to an area adjacent to the existing DNM operations, and on land subject to prior and existing disturbance. The vegetation within the Project Area predominantly comprises scrub or mixed scrub woodland, with savannah woodland with eastern mid-height grasses present in the southern portion of the Project Area.

Based on aerial imagery, and noting the recent clearing that has been undertaken in the Project Area by the landholder (see **Section 12.4.2.2**), approximately 50% of the proposed OOPD footprint comprises grassland with very few trees or shrubs. To avoid overestimating the Scope 1 emissions associated with clearing, an area of 150 ha has been used in the calculations. In addition to this, the proposed clearing of approximately 16 ha of remnant 'Of Concern' Regional Ecosystems was estimated separately to account for remnant vegetation potentially having a higher carbon mass intensity than previously disturbed land.

Emission Factor

The GHG emissions associated with vegetation removal by a facility are not reportable under the NGER Scheme and no emission calculation methodologies or emission factors are given for vegetation removal in the Measurement Determination 2008 (Cth, 2008) or the National Greenhouse Accounts (NGA) Factors Workbook (DCCEEW, 2025a). Therefore, for the purposes of this assessment, GHG emissions associated with the proposed vegetation removal were estimated using the Department of Industry Science Environment and Resources' (DISER) Full Carbon Accounting Model (FullCAM) to derive an emission factor in 'tonnes CO2-e per hectare cleared'.

FullCAM was developed under the National Carbon Accounting System (NCAS) at the then Australian Greenhouse Office to provide a dynamic account of the changing stocks of carbon in Australia's land systems since 1970 by integrating data on land cover change, land use and management, climate, plant productivity, and soil carbon over time. FullCAM estimates carbon stock change and GHG emissions at fine spatial and temporal scales and uses a wide range of spatially referenced data.

The FullCAM model (2020 version) was run with reference to *the Requirements for use of the Full Carbon Accounting Model (FullCAM) with the Emissions Reduction Fund (ERF) methodology determination: Carbon Credits (Carbon Farming Initiative—Avoided Clearing of Native Regrowth) Methodology Determination 2015* (referred to as the 'FullCAM ERF guide) (DISER, 2020).

The model settings used are summarised in **Table 15-4** and discussed further below.

Table 15-4 FullCAM inputs

Parameter	Value/Setting
Template	'HIR NFMR and Avoided Clearing Methods - greater than 500 mm' *
Configuration	Forest System*

Parameter	Value/Setting
Simulation steps	Monthly
Location	-22.09634 Lat, 148.2939 Long
Start and end of simulation	Jan 2015 - Jan 2027 (12 years) – previously cleared areas
	Jan 1927 – Jan 2027 (100 years) – remnant vegetation
Data	Apply downloaded spatial data* Native species regeneration ≥500 mm rainfall ^ All other settings at default options
Site	All settings at default options
Trees	All settings at default options
Soil	All settings at default options
Initial conditions	The forest has trees growing in it at the start of the simulation: off Debris: all values set to zero All other settings at default options
Event	Regeneration event - tree planting 1 day after start of simulation, standard values used for 'natural regeneration in regeneration systems'. Thinning event – not modelled Forest fire – not modelled

* As per the FullCAM ERF guide (DISER, 2020).

^ Based on data from the nearest Bureau of Meteorology weather station (Moranbah Airport, Stn ID 034035, 20 km west-northwest of DNM; median rainfall of 548.6 mm for the period 2012-2025.

A review of historical aerial imagery was performed to select a suitable start date for the simulation as required by the ERF guide. This review indicated that the scrub and trees in the Project Area have been generally undisturbed since around 2015. Based on this, the start of the simulation was set at 1 January 2015 with monthly simulations until 1 January 2027 to provide an estimate of carbon mass potentially accumulated in this vegetation between 2015 and when the proposed clearing is likely to place. For the remnant vegetation areas, a worst case estimate of 100 years growth was assumed. No thinning or wildfire events were simulated for either model scenarios.

The results of the FullCAM Model simulation are summarised in **Table 15-5**. The tonnes of carbon per hectare (t C/ha) outputted by FullCAM were converted to tonnes CO2-e/ha using a factor of 44/12 (ratio of the molecular weights of CO2 and carbon). The resulting factor of 11.96 t CO2-e/ha was used to provide a conservative estimate of Scope 1 emissions associated with vegetation removal.

Table 15-5 FullCAM outputs

Output	Scenario	Carbon (t C/ha)	CO_2-e Equivalent (t CO_2-e/ha)
Carbon mass at 1/1/2027 – previously cleared areas	Trees	2.93	11.96
	Forest debris	0.33	
Carbon mass at 1/1/2027 – remnant vegetation	Trees	16.67	78.62
	Forest debris	4.78	

15.3.4.2 Fuel Combustion

Activity Data

The projected impact of the Project on diesel consumption at DNM provided by Whitehaven Daunia, based on the mine plan with and without the Project, is shown in Table 15-6. As shown in the table, the Project is not anticipated to have any impact on diesel consumption in vehicles registered for road use (i.e. transport use), therefore this emission source has not been considered further in this assessment.

Construction of the OOPD and new haul road will involve the use of DNM's existing heavy equipment fleet, including excavators, dozers, graders etc. Fuel use in this equipment for construction purposes is accounted for in the 'with Project' estimates shown in **Table 14-6**. Despite this additional fuel demand, **Table 15-6** show that there is anticipated to be an approximate 6% reduction in diesel use in off-road equipment, which is due to the reduced haul road length to the proposed OOPD compared with the existing OOPD.

As the Project is not anticipated to have any impact on diesel consumption for transport use.

Table 15-6 Projected impact of the Project on diesel consumption

Financial Year	Transport Use (kL)		Stationary/Off-Road Use (kL)	
	Without Project	With Project	Without Project	With Project
2026	263	263	65,712	65,712
2027	266	266	66,596	66,596
2028	270	270	74,602	67,452
2029	270	270	71,817	67,438
2030	263	263	72,402	65,687
2031	266	266	70,618	66,577
Total	1,598	1,598	421,747	399,462
Impact of Project	***No change***		***-22,286 kL***	

Emission Factors

The impact of the Project on DNM's annual GHG emissions from the combustion of diesel in haul trucks and other off-road equipment were estimated by multiplying the reduction in projected quantities of fuel to be combusted each year shown in **Table 15-6** by the energy content factor for diesel of 38.6 gigajoules per kilolitre (GJ/kL) and the fuel-specific CO2-e emission factors summarised in **Table 15-7**.

In accordance with NGER reporting requirements, the Scope 1 emission factors used for the combustion of diesel fuel in the haul trucks and other off-road equipment are those given for stationary energy use rather than transport, as these vehicles are not registered for road use.

Table 15-7 Emission factors used - diesel consumption (stationary/off-road use)

Emission Source	Scope 1 Emission Factors (kg CO_2-e/GJ)				Scope 3 Emission Factor (kg CO_2-e/GJ)
	CO_2	CH_4	N_2O	Total	
Combustion of diesel (Stationary Use)	69.9	0.1	0.2	70.2	17.3
Source: NGA Factors 2025, Table 8 (DCCEEW, 2025).					

15.3.4.3 Consumption of Oils and Greases

Activity Data

The estimated impact of the Project on the consumption of oils and greases at DNM is shown in **Table 15-8**. These consumption rates have been estimated based on the relative consumption rates of oils and greases compared to diesel consumed for stationary use in DNM's FY24 NGER report (being 1.4% and 0.2% respectively) and applying the same ratios to the diesel consumption projections for stationary use shown in **Table 15-6**.

Accordingly, the Project is estimated to result in an approximate 6% reduction in consumption of oils and greases due to the reduced haulage requirements.

Table 15-8 Projected impact of the Project on consumption of oils and greases

Financial Year	Oils (kL)		Greases (kL)	
	Without Project	With Project	Without Project	With Project
2026	898	898	152	152
2027	910	910	154	154
2028	1019	922	173	156
2029	981	921	166	156
2030	989	897	168	152
2031	965	910	163	154
Total	**5,762**	**5,458**	**976**	**924**
Impact of Project	***-304 kL***		***-52 kL***	

Emission Factors

Annual GHG emissions from the consumption of oils and greases in haul trucks and other off-road equipment were estimated by multiplying projected quantities of fuel to be combusted each year shown in **Table 15-8** by the energy content factor for oils and greases of 38.8 GJ/kL and the relevant CO_2-e emission factors summarised in **Table 15-9**.

Table 15-9 Emission factors used – oil and grease consumption

Emission Source	Scope 1 Emission Factors ($kg CO_2$-e/GJ)				Scope 3 Emission Factor ($kg CO_2$-e/GJ)
	CO_2	CH_4	N_2O	Total	
Petroleum-based oils	13.9	0	0	13.9	18.0
Petroleum-based greases	3.5	0	0	3.5	18.0
Source: NGA Factors 2025, Table 8 (DCCEEW, 2025).					

15.4 Estimated GHG Emissions

15.4.1 Estimated Scope 1 and Scope 3 Emissions

The effect of the Project on the annual estimated Scope 1 and Scope 3 GHG emissions for DNM over the life of Project are summarised in Table 15-10, and plotted in **Figure 15-2** (Scope 1) and

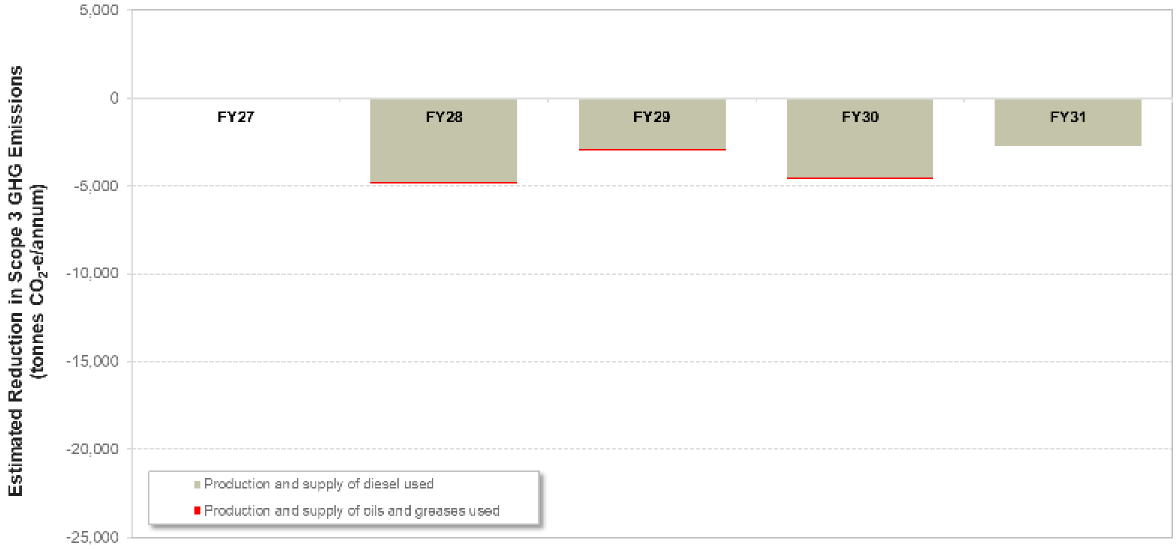


Figure 15-3 (Scope 3). Further details are provided in **Appendix K**.

The main impact of the Project would be a reduction in Scope 1 GHG emissions associated with the reduced diesel consumption, as shown in **Table 15-10** and **Figure 15-2**. These reductions significantly outweigh the very conservatively estimated GHG emissions associated with vegetation clearing for the new OOPD, resulting the net impact of the Project being a reduction in Scope 1 GHG emissions from DNM of 57.5 kt CO_2-e.

A moderate reduction in upstream Scope 3 emissions associated with the production and supply of diesel used by DNM of just over 15 kt CO_2-e is also estimated, mainly due to the reduced diesel consumption.

Table 15-10 Estimated changes in DNM's annual GHG emissions due to the Project

Financial Year	Scope 1 Emissions (t CO_2-e/annum)				Scope 3 Emissions (t CO_2-e/annum)		
	Vegetation Clearing	Fuel Combustion	Oils and Greases	Total	Fuel Combustion	Oils and Greases	Total
2027	3,051	-	-	3,051	-	-	-
2028	-	-19,372	-55	-19,427	-4,774	-80	-4,854
2029	-	-11,867	-34	-11,900	-2,924	-49	-2,973
2030	-	-18,197	-52	-18,249	-4,484	-75	-4,559
2031	-	-10,951	-31	-10,982	-2,699	-45	-2,744
Total	**3,051**	**-60,388**	**-171**	**-57,507**	**-14,882**	**-249**	**-15,130**

15.4.2 Emission Category Determination

Section 3.2 of the Guideline (DETSI, 2025) states that:

- Applications with expected GHG emissions (Scope 1 and Scope 2) of 25,000 tonnes of carbon dioxide equivalent (t CO_2-e) or more per year, at any time during the life of the project, are considered medium to high emitters, and
- Applications with expected GHG emissions (Scope 1 and Scope 2) of less than 25,000 t CO_2-e per year are considered low emitters.

The Project is estimated to result in changes in DNM's Scope 1 emissions of between +3,051t CO_2-e to -19,427 t CO_2-e across the life of the Project. Given this, the Project would be categorised as a low emitter, even for FY2026 when accounting for potential emissions associated with vegetation clearing. For all other years, the Project is either neutral or has a mitigating effect on emissions that would have occurred without the Project.

Figure 15-2 Estimated changes in DNM's Scope 1 GHG emissions due to the Project

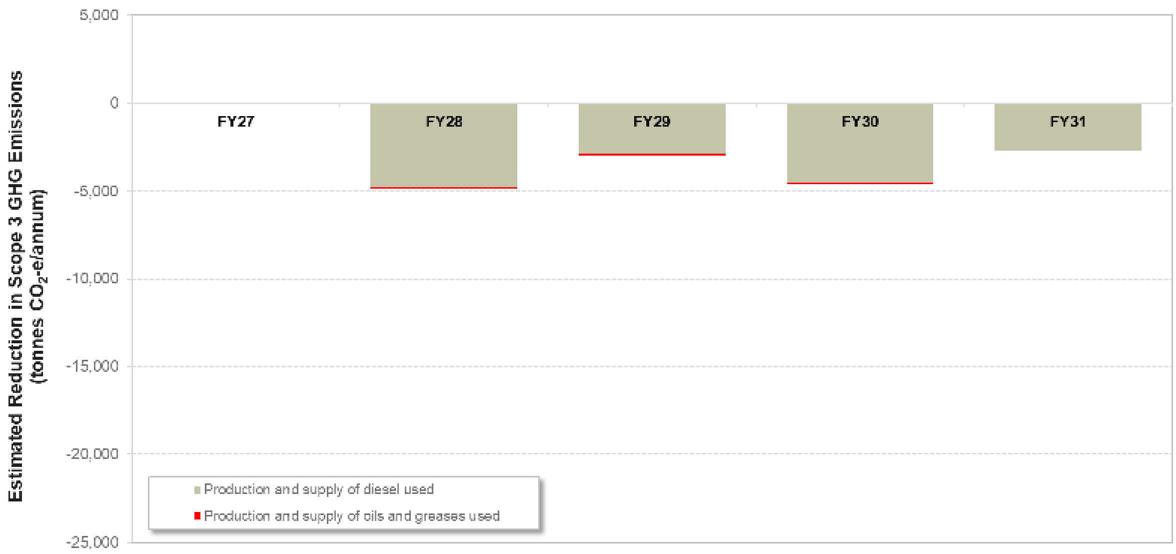


Figure 15-3 Estimated changes in DNM's Scope 3 GHG emissions due to the Project

15.5 Impact on DNM's Scope 1 GHG Emissions

To provide context for the estimated reductions in Scope 1 GHG emissions associated with the Project, **Table 15-11** shows that total site emissions reported by Whitehaven Daunia under the NGER Scheme in FY24. As Whitehaven Daunia took ownership of DNM on April 2, 2024, the NGER report only covered 3 months of operations during the FY24 reporting period (column 2 of **Table 15-11**). To provide an estimate of annual emissions, the data for 3 months have been scaled up by a factor of 4 (column 3 of **Table 15-11**).

Table 15-11 DNM's reported GHG emissions – FY24

Emission Type	April to June 2024 [3 months] (t CO_2-e)	Estimated Annual Emissions (t CO_2-e)
Fugitive emissions from coal mining (open cut)	11,969	47,876
Diesel consumption (stationary)	41,448	165,792
Diesel consumption (transport)	312	1,248
Fleet diesel (transport)	13	52
LPG consumption (stationary)	1	4
SF_6 from switchgear	12	48
Scope 1 Emissions	***53,754***	***215,016***
Purchased Electricity *	7,513	30,052
Scope 2 Emissions	***7,513***	***30,052***
Total Scope 1 and Scope 2	**61,268**	**245,072**

As shown in **Table 15-10**, once the OOPD is constructed and being used, the annual reduction in Scope 1 GHG emissions is estimated to range from 11.0 - 19.4 kt CO2-e/annum. This represents a reduction of approximately 5% - 9% of DNM's total Scope 1 emissions.

15.6 Risk Assessment

The Project is anticipated to result in reductions in DNM's Scope 1 emissions compared to the 'without Project' scenario, and will therefore act as an abatement measure, assisting the mine in meeting its obligations under the Safeguard Mechanism. As a result, the Project is expected to make a small, but positive contribution to mitigating climate change impacts on Queensland's environmental values.

15.7 Emissions Abatement and Management Measures

15.7.1 Legislative Requirements

15.7.1.1 The National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting (NGER) Scheme is Australia's principal legislative framework for collecting and publishing data on GHG emissions, energy production, and energy consumption from corporations. The NGER Scheme is administered by the Clean Energy Regulator (CER) and aims to provide consistent, transparent, and reliable data to inform government policy, support international reporting obligations, and guide climate-related initiatives.

Corporations that exceed the following thresholds are required to register and report annually through the Emissions and Energy Reporting System (EERS) administered by the CER:

- Facility-Level Thresholds:
  - 25,000 tonnes or more of CO_2-e emissions, or

    - 100 terajoules or more of energy produced or consumed at a single facility within a financial year.
- Corporate Group-Level Thresholds:
    - 50,000 tonnes or more of CO_2-e emissions, or
    - 200 terajoules or more of energy produced or consumed across all facilities under the corporate group within a financial year.

These thresholds are designed to ensure that significant emitters and energy users contribute to national emissions and energy data. Compliance involves rigorous record-keeping, transparent reporting, and potential audits, with penalties for non-compliance.

Whitehaven Daunia is required to report the emissions from DNM's operations annually under the NGER Scheme.

15.7.1.2 The Safeguard Mechanism

The Safeguard Mechanism applies to facilities with direct Scope 1 emissions of more than 100,000 tonnes of CO2-e per year, which are defined as "covered facilities". This framework establishes a baseline against which a facility's emissions reported under the NGER Scheme are compared. During 2022 – 2023, major reforms to the Safeguard Mechanism were enacted to reflect Australia's Nationally Determined Contribution (NDC) to reduce emissions by 43% (on a 2005 base) by 2030. These reforms require covered facilities to deliver a proportional share of Australia's 2030 climate target.

The reforms are based on the facility's emission intensity, with the baseline emission intensity subject to legislated decline rates so that it reduces in a predictable and gradual way across all covered facilities. Compliance (or otherwise) with the required reductions is to be reported annually under the NGER Scheme, providing transparency and assurance of compliance.

If a facility exceeds its baseline in a given year, it has the option to surrender Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs) to offset emissions. If a facility's emissions are less than its baseline, it will be awarded SMCs, which it can choose to bank for future use or sell to other Safeguard facilities.

DNM is a covered facility under the Safeguard Mechanism and is legally required to achieve a predictable, gradual decline in its emissions baseline. To do so, Whitehaven Daunia will need to deliver progressive emissions reductions in its emissions intensity to remain compliant, and the Project will assist in achieving this.

In FY24, DNM's Scope 1 emissions remained below its Safeguard site-specific emissions intensity baseline, and accordingly generated 3,353 SMCs (Whitehaven, 2025).

15.7.1.3 The ACCU Scheme

The ACCU Scheme aims to provide incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions, and to provide a legal obligation for Australia's top emitters to maintain their emissions below their emissions limit (or baseline) (defined by the Safeguard Mechanism). It allows for the generation of ACCUs, which are a tradeable financial product, with one ACCU representing one tonne of CO2-e that would have otherwise been released to the atmosphere.

The Australian National Registry Emissions Unit (ANREU) is an online system that allows users to track ownership and transactions of emissions units, including ACCUs.

Organisations and individuals can own, transfer, cancel, deliver, surrender or relinquish ACCUs via ANREU.

If, after the implementation of all reasonable and feasible GHG emissions abatement and management measures have been applied (including this Project), DNM is required to off-set residual emissions above its annual Safeguard baseline, ACCUs or Safeguard Mechanism Credits may be used as offsets. Where possible, the offsets would be located in Queensland.

15.8 Whitehaven's GHG Management Strategy

Whitehaven's climate strategy is focused on supporting economic development and energy security in our customer countries, predominantly in Asia, in tandem with meeting decarbonisation goals. Whitehaven aims to play a practical and positive role in the journey towards a lower-carbon future by:

- Supporting the global energy transition, which relies on metallurgical coal to produce steel for renewable energy infrastructure,
- Supporting global energy security and its customers' decarbonisation goals, and
- Investing in technologies and initiatives to progressively decarbonise its operations.

Accordingly, Whitehaven has set FY30 Scope 1 emissions intensity reduction targets for its operations, including DNM, that align with its obligations under the reformed Safeguard Mechanism (Whitehaven, 2024).

For DNM this equates to:

- An effective annual decline rate from FY23 to FY30 of 1% per annum, and
- An annual decline rate to FY30 of 3.6% per annum based on DNM's historical site-specific emissions intensity.

15.9 GHG Emissions Abatement Measures for the Project

15.9.1 Abatement Plan

As discussed in **Section 15.4.2**, the Project is estimated to result in changes in DNM's annual Scope 1 emissions of between +1,793 t CO2-e (increase) to -19,427 t CO2-e (reduction) across the life of the Project, and is therefore categorised as a low emitter under the Guideline Greenhouse Gas Emissions (DETSI, 2025). On this basis, an Abatement Plan is not required by DETSI for the Project. Potential Project-specific abatement measures are summarised below in **Section 15.9.2**.

15.9.2 Abatement Opportunities

Currently available and emerging GHG abatement technologies have been reviewed to identify reasonable and feasible GHG emissions controls that potentially could be adopted over the life of the Project. These opportunities will be reviewed by Whitehaven Daunia prior to the commencement of the Project, and subject to a biennial review and revision over the life of the Project.

Potential GHG emissions abatement opportunities have been identified by Whitehaven from a range of sources including:

- The WHC's existing technical experience and exposure to emerging abatement measures and technologies on other mine sites, including open cut coal mines and other open cut mining sectors.
- Site-specific GHG abatement opportunity analyses and workshops undertaken by Whitehaven.
- Consultation with key consumable suppliers about low-emission alternatives (e.g. renewable fuels).
- Consultation with key Original Equipment Manufacturers about emerging low-emission equipment/technology.
- Industry working groups and committees and attending industry forums and conferences focussed on decarbonisation opportunities.
- Independent advice from subject matter experts.

The main source of GHG emissions associated with the Project and contributing to DNM's residual Scope 1 emissions is diesel fuel use. As shown in **Table 15-11**, more than 75% of DNM's Scope 1 emissions is associated with the consumption of diesel in stationary and off-road mining equipment.

While the Project is estimated to facilitate a reduction of approximately 5% - 9% of DNM's total Scope 1 emissions, diesel use is the main target for further reducing GHG emissions through the Project and from DNM wider operations. On this basis, the management and abatement measures to be implemented by the Project, where reasonable and feasible, are set out in **Table 15-12**. The Project will take any further steps necessary to ensure compliance with the Safeguard Mechanism and any other requirements of the Clean Energy Regulator.

Table 15-12 Project-Specific GHG Emissions Management and Abatement Measures

Aspect	GHG Management/Abatement Measure
Diesel engine technology	Acquisition and use of high-efficiency engine technology. Use of procurement policies that preference the selection of energy efficient equipment and vehicles.
Logistics	Optimising diesel consumption through logistics analysis and planning e.g. review of mine plan to optimise haul lengths, dump locations, reduction of engine idle times and minimising road gradients.
Fuel choice	Premium diesel is in use at WHC's Queensland mining operations and potentially provides improved engine performance and fuel efficiency, subsequently resulting in reduced GHG emissions. Whitehaven is continuing to monitor the viability of renewable diesel as a diesel replacement, or for blending with petroleum diesel.
Equipment manufacturers' requirements	Monitoring and maintaining equipment in accordance with equipment manufacturers' maintenance and operating manuals to optimise engine performance and fuel efficiency, subsequently resulting in reduced GHG emissions.
Maintenance and training	Regular maintenance of plant and equipment to minimise fuel consumption including training staff on strategies for continuous improvement regarding the efficient use of plant and equipment.

Aspect	GHG Management/Abatement Measure
Monitoring and reporting	Diesel usage and other GHG emissions from the Project will be tracked and reported each year in the Annual Energy Audit and through NGERS reporting for DNM's wider operations.

15.10 Conclusions

This assessment has been performed to address the requirements of the *Guideline Greenhouse Gas Emissions* (DETSI, 2025), which sets out application requirements under the EP Act and provides information about how to meet these requirements in relation to GHG emissions. Section 3.5.2 of the Guideline specifies that the information required for a site-specific application is to be limited '*only to the extent they relate to the proposed amendment*'.

The following Scope 1 and Scope 3 emissions at DNM that would be impacted by the Project were identified to be:

- Scope 1 emissions associated with vegetation removal as part of construction of the OOPD,
- Scope 1 emissions associated with the combustion of fuels,
- Scope 1 emissions associated with the consumption of petroleum-based oils and greases, and
- Scope 3 emissions associated with the production and supply of fuels, oils and greases consumed.

As no new coal extraction, CHPP modifications, or changes to water, power or waste systems are proposed as part of the Project, it will not result in any changes in:

- Scope 1 fugitive emissions of CH_4 and CO_2 from the extraction of coal,
- Scope 1 emissions of SF_6 from gas-insulated switchgear installed on site,
- Scope 2 emissions associated with the consumption of electricity from the grid,
- Scope 3 emissions associated with the transport of the product coal,
- Scope 3 emissions associated with combustion of product coal by the end user, and

As the above emissions will not be affected by the Project they were not considered further.

The emissions estimates show the following:

- The main impact of the Project would be a reduction in DNM's Scope 1 GHG emissions due to a reduction in diesel consumption for hauling due to the shorter haulage distance for overburden,
- These reductions significantly outweigh the conservatively estimated GHG emissions associated with vegetation clearing for the new OOPD, resulting in the net impact of the Project being a reduction in Scope 1 GHG emissions from DNM of 57.5 kt CO2-e over the life of the Project,
- A reduction in upstream Scope 3 emissions associated with the production and supply of diesel used by DNM of just over 15 kt CO2-e is also estimated, almost entirely due to the reduced diesel consumption,

- Once the OOPD is constructed and being used, the annual reduction in Scope 1 GHG emissions is estimated to range from 11.0 - 19.4 kt CO2-e/annum. This represents a reduction of approximately 5% - 9% of DNM's total Scope 1 emissions,
- The Project would be categorised as a low emitter, even for FY2026 when accounting for potential emissions associated with vegetation clearing. For all other years, the Project is either neutral or has a mitigating effect on emissions that would have occurred without the Project, and
- As a low emitter, an Abatement Plan is not required by DETSI for the Project. A range of Project-specific abatement measures can be found in **Section 15.7** to further optimise the emissions reductions currently forecasted to be achieved as a result of the Project.

16.0 Waste Management

16.1 Waste Management Overview

Waste generated from the Project will be managed in line with the existing DNM Waste Management Plan (WstMP). The WstMP aims to minimise adverse impacts from DNM waste to environmental values. This includes impacts to the health and wellbeing of site personnel, the diversity of surrounding ecological processes and associated ecosystems, and other environmental factors including land, surface water, groundwater and air quality.

Given the existing WstMP was prepared in accordance with Schedule D, Condition D1 of the EA, and the proposed EA Amendment does not seek to change any of Schedule D, implementation of the existing WstMP is considered appropriate for the Project. However, the WstMP will be updated to accommodate changes resulting from the Project.

The following subsections provides an overview of the waste management objectives, strategy, plan and waste production for the Project.

16.2 Waste Management Objectives

The following waste management objectives have been established for DNM and these will apply to the Project:

- Minimise waste-related adverse effects for the integrity and function of the air, land and water environmental values,
- Minimise the generation of waste through applying the avoidance, minimisation, and mitigation principles to reduce, reuse, recycle, treat, and dispose of waste, and
- Ensure safe management and disposal of waste that cannot be reused or recycled.

16.3 Waste Management Strategy

Environmental harm may occur if wastes are not managed properly, especially where there is the potential for waste to cause land, surface water, and/or groundwater contamination. The waste management strategy proposed for the Project will be consistent with Schedule D: Waste of the EA and the WstMP, and will incorporate the continued operation, decommissioning and closure phases. Waste planning for the Project will allow for flexibility in the management of all wastes likely to be generated.

Under Schedule D of the EA, disposal of certain waste streams is permitted within specified features and/or on relevant MLs. Under EA conditions D6 and D7, disposal per waste type is permitted as follows:

- Rejects are permitted to be disposed of within spoil emplacements for rejects.
- The following types of waste are permitted to be disposed of within the MLs listed on the EA, in pits or voids; in spoil emplacements; and left in situ below ground level:
    - Bulk rubber,
    - Inert waste,
    - Poly-pipe and other plastic,
    - Fibreglass,
    - Treated and untreated timber,

  - Asphalt, and
  - Asbestos.
- In addition, Condition D4 within Schedule D of the EA provides for waste reprocessing of:
  - Spoil or overburden,
  - Vegetation,
  - Water or sediment containing hydrocarbons,
  - Fuels, oils, lubricants and coolants,
  - Bulk rubber,
  - Inert waste,
  - Poly-pipe and other plastic,
  - Fibreglass,
  - Treated and untreated timber, and
  - Asphalt.

Condition D5, Schedule D of the EA requires that unless otherwise specified in Conditions D6 and D7 (inclusive), waste, other than spoil or overburden or vegetation removed as part of the mining activity, must not be disposed of within the MLs listed on the EA and must be taken to a facility that is lawfully allowed to accept such waste under the provisions of the EP Act. Accordingly, waste that cannot be reprocessed or disposed of as per the EA will be transported off-site by a licenced waste management contractor to a licenced waste disposal facility.

16.4 Waste Management Plan

The WstMP covers the reporting requirements and responsibilities for DNM regarding waste management to ensure consistency, clarity, and safety. The WstMP uses the waste management hierarchy as a framework for prioritising waste management practices to achieve the best environmental outcome. The production of waste is avoided where practicable on-site. However, where the production of waste is unavoidable, waste re-use is the preferred option, followed by waste recycling and finally disposal. The waste management hierarchy is presented in **Figure 16-1**.

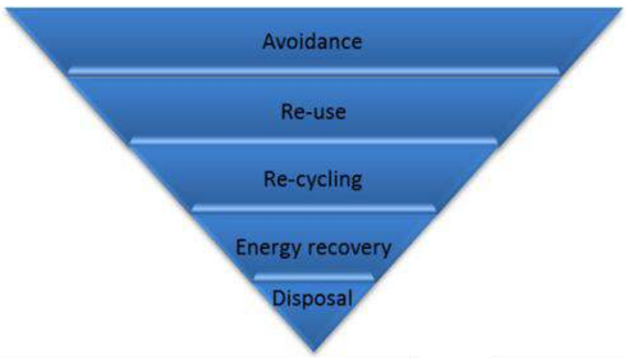


Figure 16-1 DNM waste management hierarchy

16.4.1 Waste Avoidance and Minimisation

The WstMP focuses on the following areas of waste management to meet the principles of the waste hierarchy:

- Avoidance and reduction. DNM purchases and stores high use materials such as lubricants and chemicals in bulk to reduce packaging waste,
- Waste segregation. Colour coded and signed bins are used to separate general waste, recyclable waste, and regulated waste streams, and
- Reuse and recycling. Waste is segregated into timber, steel/iron, recyclable plastics, batteries and used oil for appropriate re-use or recycling.

16.4.2 Waste Segregation

The waste that is generated at DNM can be separated into the following main groups:

- Regulated waste including hydrocarbon waste (oils, emulsions, oily wastewaters, oily sludge, grease, oil rags, filters, and drums), solvents, paints, batteries, sewage sludge,
- Recyclable waste including tyres, scrap metal, paper, cardboard, plastic, and glass,
- General waste including putrescibles and organic (food waste), packaging and containers not suitable for recycling,
- Green waste arising from vegetation clearance, and
- Wood waste including timber pallets and off-cuts.

16.4.3 Waste Reuse, Recycle and Recovery

Waste reuse, recycling and recovery measures at DNM include water conservation, treatment and reuse, efficient energy usage and classification and sorting of wastes.

DNM also has several disposal processes in place which assist with waste reuse, recycling and recovery. These include:

- Green waste, where suitable, is used on site to provide fauna habitat. Remaining material is to be reused during progressive rehabilitation and revegetation,
- Recycled waste is transported to the Mackay Materials Recovery Facility for consolidation and processing. Waste is segregated and bailed, crushed and/or transported to various companies for reuse,
- Scrap metal is collected from site during various “campaigns” every 12 months to 18 months by a scrap metal contractor where it is then able to be recycled and reused,
- Waste oil is filtered and used for onsite blasting activities or transported to a licenced waste storage facility located in Mackay for storage and then onto Townsville facility for processing,
- Scrap tyres that can be recycled are taken offsite. Scrap tyres are buried to a designated area in the spoil in accordance with the environmental authority,
- Used oil filters and drums are taken to an off-site licenced waste management facility, for processing. Excess oil is recovered and sold as waste oil, and
- Sewage sludge is removed from the STP for composting and use as a soil conditioner.

16.4.4 Waste Disposal

Waste generated on-site during the operational and decommissioning phases that cannot be recycled, reused or disposed of at DNM under the EA will be transported off-site to an alternate licenced waste disposal facility. All wastes transported from the site will be transported by licensed waste transport carriers.

16.4.5 Monitoring and Reporting of Waste

Monitoring and tracking of waste are an important element of waste management, providing a mechanism for assessing waste management performance.

Monitoring at DNM includes:

- Volume of general waste,
- Recyclable material contamination, and
- Monthly reports.

All waste transported by the waste contractors, including waste source and quantity, is reported monthly.

16.5 Waste Production

Waste generated from the Project will be managed under the WstMP and will generally comprise waste from vegetation clearing, general waste streams and regulated wastes. Key waste producing activities, potential waste produced, potential impacts and disposal/control methods are summarised in **Table 16-1** and detailed in the WstMP.

Table 16-1 Project waste generation and potential impacts

Activity	Waste Type	Potential Impacts	Disposal/Control measures
Ancillary infrastructure (roads, earthworks, fencing) Maintenance activities (equipment and infrastructure)	Chemicals (e.g. Solvents and paints)	• Spill to land and/or water resulting in contamination • Impact on aquatic ecosystems • Risks to human health and safety	Disposal - labelled and disposed of as per the Safety Data Sheet disposal requirements. Chemicals are stored in the designated area within the site's waste management compound (or similar) prior to disposal by a licenced waste management contractor at a licensed waste management facility.
Ancillary infrastructure (roads, earthworks, fencing) Clearing Maintenance activities (equipment and infrastructure)	Scrap steel	• Increased volume of waste going to landfill instead of being recycled • Lost opportunity for resource reuse/recycling if product is disposed	Reprocessing - placed in the designated scrap steel skip bins outside workshop facilities. Bulk steel is placed in a designated area until a licenced waste management contractor can remove the material.
Vegetation clearing	Vegetation	• Spread of pest plants	Reuse - Suitable material is stockpiled and used on-site to provide fauna habitat. Remaining material is chipped / mulched and reused during progressive rehabilitation and revegetation.
Maintenance activities (equipment and infrastructure)	Water or sediment containing hydrocarbons	• Pollution of soil, groundwater, or surface water (e.g., through accidental spills or releases) • Increased costs to manage the clean-up of accidental spills	Contaminated water captured via drains, sumps and bunds are pumped out by a licenced waste management contractor and passed through an oil water separator system and water reused via the mine water management system. Silt / sediment removed from sediment basins regularly by a licenced waste management contractor and disposed of in consultation with the HSE Department on-site in designated facility. Contaminated soil is to be collected immediately and stored in drums or other containers (ensure these are labelled). These containers / drums are to be transported to the designated waste management compound (or similar) which are then taken off-site by a licenced waste management contractor. Alternately, contaminated soil may be disposed of on-site in a designated location in consultation with the HSE Department.

Activity	Waste Type	Potential Impacts	Disposal/Control measures
Maintenance activities (equipment and infrastructure)	Regulated waste - oily rags, hoses, gloves, hydraulic hoses	• Pollution of soil, groundwater, or surface water	Disposal - Placed in designated regulated waste bins and transported off-site by a licenced waste management contractor.
	Ozone depleting substances (ODS). Applicable examples of ODS include chemical refrigerants and fire extinguishers (e.g., Halons, CFCs and HCFCs)	• Depletion of the ozone • Contamination of air • Risks to human health or safety	Disposal - in accordance with the *Environmental Protection Regulation 2019*, all ODS are to be captured by a qualified person and disposed of at a licenced facility. Equipment containing ODS is to be labelled with a sticker identifying the specific substance.
	Polychlorinated biphenyls (PCB)	• Bioaccumulation in fauna. • Spill to land and/or water resulting in contamination • Incorrect disposal • Potential non-compliance • Risks to human health or safety	Disposal - if waste containing PCBs is verified, disposal will be arranged by a licenced waste management contractor. All sources of PCBs have been removed where known, for example old transformers. However, if it is suspected that PCBs may be present in any materials the HSE Department will be notified. The HSE Department will investigate and manage each reported location of PCBs on a case-by case basis.
	Seal-zit	• Spill to land and/or water resulting in contamination • Potential non-compliance • Impact on aquatic ecosystems	Disposal - recovered during change out and/or removal of large earthmoving tyres and stored in containers that are bunded. These are taken to the assigned section of the waste management compound (or similar) for collection by the licenced waste management contractor.
	Bulk rubber (tyres)	• Increased volume of waste going to landfill • Groundwater aquifer impediment	Disposal - taken to the designated on-site tyre disposal area. Refer to the *WHC-DNM-PRO-Tyre Storage and Disposal Procedure*.
	Grease, oil, coolant, oil filters	• Spill to land and/or water resulting in contamination	Reprocessing – collected / stored in designated containers at waste management compound and transported off-site by a licenced waste

Activity	Waste Type	Potential Impacts	Disposal/Control measures
		• Potential non-compliance • Impact on aquatic ecosystems • Risks to human health or safety • Increased volume of waste going to landfill instead of being recycled • Increased volume of waste being disposed of as regulated waste	management contractor. Alternatively transferred into the mine infrastructure area's bulk waste oil tank for use on-site in blasting operations. Oil filters - reprocessing - following draining of excess fluid used oil filters are placed in designated blue bins located at workshops and service bays. These bins are collected by a licenced waste management contractor and disposed of at a licensed waste management facility.
	Vehicle batteries	• Contamination of soil / water • Risks to human health or safety	Reprocessing - placed in the designated areas, collected by a licenced waste management contractor and recycled/disposed of at a licensed waste management facility.
	Polypipe	• Consumption of landfill space	Reuse or disposal - On-site reuse or removed from site by a licenced waste management contractor for disposal at a licensed waste management facility.
Receiving goods / warehouse	Other non-recyclable packaging	• Impact/harm to fauna from ingestion • Increased volume of waste going to landfill	Disposal - disposed in designated bins. The contents of the bins are transferred to the industrial bins which are then emptied by a licenced waste management contractor directly to the designated landfill on-site.
	Timber packaging	• Increased volume of waste going to landfill instead of being recycled • Lost opportunity for resource reuse/recycling if product is disposed	Disposal - collected in the designated skip bins and taken to the designated waste timber disposal area (which includes disposal of other waste timber).
	Recyclable packaging	• Increased volume of waste going to landfill instead of being recycled	Reprocessing - disposed of in the designated bins which are taken off-site by a licenced waste management contractor to a licensed waste management facility.

Activity	Waste Type	Potential Impacts	Disposal/Control measures
		• Lost opportunity for resource reuse/recycling if product is disposed	

16.6 Summary of Mitigation Measures and Commitments

A summary of the waste management mitigation measures and commitments is provided below:

- Waste streams will be identified and minimised,
- All waste generated on-site will be disposed of in accordance with the EA and WstMP,
- The WstMP will be revised and updated, if required, in accordance with the conditions of the EA, and
- Waste monitoring will be undertaken.

16.7 Conclusion

Waste will be managed to avoid adverse impacts on the life, health and wellbeing of people and the diversity of ecological processes and associated ecosystems surrounding the Project. Wastes will be managed as per Schedule D of the EA and the WstMP.

The current EA, and specifically the conditions relevant to the management of waste at DNM, is appropriately conditioned for management of the current operations. In addition, these conditions are also appropriate to management the potential impacts from the Project. Further, the WstMP will be reviewed and updated, as required, to capture changes to waste streams and waste management requirements.

The DNM will continue to maintain segregation of different types of waste during generation, storage and transportation. The appropriate management and storage of wastes will prevent on-site and off-site pollution and enhance opportunities for reuse and/or recycling. All waste streams will be assessed for potential reuse, prior to transport to an approved waste disposal facility.

17.0 Proposed Environmental Authority Amendment

The following amendments to EA EPML00561913 are proposed to authorise the Project.

17.1 Addition of new Mining Lease

It is proposed the MLA area (i.e. the Project Area), once approved by DNRMMRRD, is added as a location under the existing 'Schedule 3 13: Mining black coal' (**Figure 17-1**) in order to authorise the Project Area to be used for the proposed mining infrastructure.

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Schedule 3 13: Mining black coal	ML1781 ML70115 ML70116
Ancillary 08 - Chemical Storage 1: Storing a total of 50t or more of chemicals of dangerous goods class 1 or class 2, division 2.3 under subsection (1)(a)	ML1781 ML70115 ML70116
Ancillary 31 - Mineral processing 2: Processing, in a year, the following quantities of mineral products, other than coke (b) more than 100,000t	ML1781 ML70115 ML70116
Ancillary 62 - Resource recovery and transfer facility operation 1: Operating a facility for receiving and sorting, dismantling, baling or temporarily storing- (c) category 2 regulated waste	ML1781 ML70115 ML70116
Ancillary 63 - Sewage Treatment 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (b-i) more than 100 but not more than 1500EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme	ML1781 ML70115 ML70116

Figure 17-1 Existing environmentally relevant activities and locations in the EA

17.2 Update to Table E3

An update to Table E3 is required to authorise the additional disturbance on the proposed new ML.

Table E3 (Significant Residual Impacts to Prescribed Environmental Matters)

Prescribed Environmental Matter	Location of Impact	Maximum Extent of Impact	Environmental Offset Required
Endangered Regional Ecosystem – RE 11.4.9 and RE 11.9.5	ML1781	40.9 ha	Yes
Protected wildlife habitat – vulnerable species Ornamental Snake Regulated vegetation – essential habitat Ornamental Snake	ML1781	44.34 ha	Yes
Protected wildlife habitat – species least concern Echidna	ML1781	36.1 ha	No
Connectivity	ML1781	40.9 ha	Yes

Figure 17-2 Existing Table E3 in the EA

Table E3 is to be updated with the new prescribed environmental matters as shown in **Table 17-1**.

Table 17-1 Proposed additions to Table E3 of the EA

Prescribed Environmental Matter	Location of Impact	Maximum Extent of Impact	Environmental Offset Required
Protected wildlife habitat (breeding and foraging habitat) – vulnerable species Ornamental Snake	[ML number]	23.66 ha	Yes
Of Concern Regional Ecosystem – RE 11.3.3	[ML number]	16.26 ha	Yes
Regulated vegetation – REs within a Defined Distance of a Watercourse	[ML number]	5.94 ha	Yes
Fish passage	[ML number]	1.59 ha	Yes

17.3 Addition of Figure 3

It is proposed that Conditions E21 and E22 include ‘Figure 3’ in addition to Figure 1, to include the proposed Project disturbance outlined in **Table 17-1**. It is proposed

Figure 17-3 is included in the EA as Figure 3.

Figure 17-3 Proposed Figure 3 in the EA

17.4 Additional Condition

It is proposed a new condition is added to the EA to formalise the ROM production rate of 6.5 Mtpa.

18.0 Conclusion

This EA Amendment Application has been prepared in accordance with the requirements of the EP Act and seeks to obtain authorisation for the Project. As such, the following amendments to EPML00561913 are required:

- Addition of the new ML under the existing 'Schedule 3 13: Mining black coal',
- Update to Table E3 (Significant Residual Impacts to Prescribed Environmental Matters) to include the significant residual impacts for the Project,
- Include figures in EA appendix and Conditions E21 and E22, to illustrate Project disturbance footprint and ensure the Project complies with Conditions E21 and E22, and
- Additional condition for ROM up to 6.5 Mtpa.

This application is supported by technical environmental assessments for the critical matters. Key findings from the assessments confirm that:

- The Project will not result in significant residual impacts on land resources, groundwater, surface water, air quality, noise, or vibration,
- Geochemical risks are low and manageable through routine monitoring,
- The GHG emissions will decrease due to improved haulage efficiency, aligning with WHC's sustainability targets,
- Waste streams can be effectively managed under existing frameworks, and
- While unavoidable impacts to certain MSES and aquatic ecosystems will occur, these will be addressed through offsets in accordance with the *Environmental Offsets Act 2014.*

In line with the mitigation hierarchy, the Project has been designed to avoid areas of high ecological significance where practicable, minimise environmental disturbance by using existing infrastructure, reducing haulage distances, and implementing relevant mitigation measures. Suitable offsets, as required under the Queensland environmental offset framework, are expected to be conditioned as part of approvals for the Project.

The Project will be integrated into the PRCP to ensure safe, stable, and non-polluting landforms that support sustainable PMLUs.

Whitehaven Daunia is committed to maintaining transparency, meeting all regulatory obligations, and continually improving environmental performance. Approval of this amendment will allow the Project to progress in a way that achieves operational efficiency while upholding strong environmental standards and community expectations.

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Appendix A Aquatic Ecology Assessment

Appendix B Terrestrial Ecology Assessment

Appendix C Surface Water Resources Assessment

Appendix D Groundwater Impact Assessment

Appendix E Groundwater Modelling Technical Report

Appendix F Air Quality Impact Assessment

Appendix G Land Resources Assessment

Appendix H Geochemistry Assessment

Appendix I Noise and Vibration Assessment

Appendix J Stygofauna Assessment

Appendix K Emissions Inventory

K.1 Activity Data Used in Calculations

		Y1	Y2	Y3	Y4	Y5	Y7	
Production Data	**Units**	**FY25-26**	**FY26-27**	**FY27-28**	**FY28-29**	**FY29-30**	**FY30-31**	**Total**
Waste rock - With and without project	bcm	50,635,538	56,094,275	56,062,287	56,099,776	55,302,503	56,537,609	**330,731,989**
ROM coal tonnage - With and without project	tpa	5,644,606	6,109,079	6,157,329	6,087,922	6,025,613	6,499,972	**36,524,522**
Product tonnage - With and without project	tpa	4,431,612	4,566,882	4,514,939	4,636,928	4,619,743	5,079,902	**27,850,006**
Activity Data	**Units**	**FY25-26**	**FY26-27**	**FY27-28**	**FY28-29**	**FY29-30**		**Total**
Diesel (Stationary use) - Without Project	kL/annum	65,712	66,596	74,602	71,817	72,402	4,042	**355,170**
Diesel (Stationary use) - With Project	kL/annum	65,712	66,596	67,452	67,438	65,687	-	**332,885**
Diesel (Transport) - With and without Project	kL/annum	263	266	270	270	263	-	**1,332**
Diesel consumption (with project)	***kL/annum***	***65,975***	***66,862***	***67,722***	***67,708***	***65,949***	**-**	**334,216**
Diesel consumption (without Project)	***kL/annum***	***65,975***	***66,862***	***74,871***	***72,087***	***72,665***	*4,042*	**356,502**
Petroleum-based oils - Without Project	kL/annum	898	910	1,019	981	989	55	**4,852**
Petroleum-based oils - With Project	kL/annum	898	910	922	921	897	-	**4,548**
Petroleum-based greases - Without Project	kL/annum	152	154	173	166	168	9	**822**
Petroleum-based greases - With Project	kL/annum	152	154	156	156	152	-	**771**
Vegetation clearing								
Areas cleared for project	ha		150					**150**

K.2 Project GHG Emissions Inventory

Emission Calculations - Project Impact

NGER Category	NGER Emission Source	NGER Measurement Determination Reference	NGER Method	Emission Source / Activity	Units	Y1 FY25-26	Y2 FY26-27	Y3 FY27-28	Y4 FY28-29	Y5 FY29-30	Y7 FY30-31	Total
Scope 1 Emissions: Total tonnes as CO2-equivalents												
Not reported under NGER				Vegetation clearing (FullCAM-derived emission factor)	t CO2-e	-	1,793	-	-	-	-	**1,793**
Emissions and Energy from Fuel Combustion	Diesel - Stationary Energy	Part 2.4 Emissions released from the combustion of liquid fuels	Method 1	Off-road vehicles	t CO2-e	-	-	- 19,372	- 11,867	- 18,197	- 10,951	**- 60,388**
	Petroleum based oils (other than used as a fuel)			Petroleum based oils (other than used as a fuel)	t CO2-e	-	-	- 53	- 32	- 49	- 30	**- 164**
	Petroleum based greases (other than used as a fuel)			Petroleum based greases (other than used as a fuel)	t CO2-e	-	-	- 2.2	- 1.4	- 2.1	- 1.3	**- 7.0**
				Total Scope 1 Emissions	**t CO2-e**	**-**	**1,793**	**- 19,427**	**- 11,900**	**- 18,249**	**- 10,982**	**- 58,765**
Scope 1 Emissions: tonnes CO2 (t CO2-e)												
Emissions and Energy from Fuel Combustion	Diesel - Stationary Energy	Part 2.4 Emissions released from the combustion of liquid fuels	Method 1	Off-road vehicles	t CO2-e	-	-	- 19,290	- 11,816	- 18,119	- 10,905	**- 60,129**
	Petroleum based oils (other than used as a fuel)			Petroleum based oils (other than used as a fuel)	t CO2-e	-	-	- 53	- 32	- 49	- 30	**- 164**
	Petroleum based greases (other than used as a fuel)			Petroleum based greases (other than used as a fuel)	t CO2-e	-	-	- 2	- 1	- 2	- 1	**- 7**
				Total CO2 Emissions	t CO2-e	-	-	- 19,344	- 11,850	- 18,171	- 10,936	**- 60,301**
Scope 1 Emissions: tonnes CH4 (t CO2-e)												
Emissions and Energy from Fuel Combustion	Diesel - Stationary Energy	Part 2.4 Emissions released from the combustion of liquid fuels	Method 1	Off-road vehicles	t CO2-e	-	-	- 27.6	- 16.9	- 25.9	- 15.6	**- 86.0**
	Petroleum based oils (other than used as a fuel)			Petroleum based oils (other than used as a fuel)	t CO2-e	-	-	-	-	-	-	**-**
	Petroleum based greases (other than used as a fuel)			Petroleum based greases (other than used as a fuel)	t CO2-e	-	-	-	-	-	-	**-**
				Total CH4 Emissions	**t CO2-e**	-	-	- 27.6	- 16.9	- 25.9	- 15.6	**- 86.0**
Scope 1 Emissions: tonnes N2O (t CO2-e)												
Emissions and Energy from Fuel Combustion	Diesel - Stationary Energy	Part 2.4 Emissions released from the combustion of liquid fuels	Method 1	Off-road vehicles	t CO2-e	-	-	- 55.2	- 33.8	- 51.8	- 31.2	**- 172.0**
	Petroleum based oils (other than used as a fuel)			Petroleum based oils (other than used as a fuel)	t CO2-e	-	-	-	-	-	-	**-**
	Petroleum based greases (other than used as a fuel)			Petroleum based greases (other than used as a fuel)	t CO2-e	-	-	-	-	-	-	**-**
				Total N2O Emissions	**t CO2-e**	-	-	- 55	- 34	- 52	- 31	**- 172**
Scope 3 Emissions												
Not reported under NGER				Production and supply of diesel used	t CO2-e	-	-	- 4,774	- 2,924	- 4,484	- 2,699	**- 14,882**
Not reported under NGER				Production and supply of oils used	t CO2-e	-	-	- 65	- 40	- 61	- 37	**- 203**
Not reported under NGER				Production and supply of greases used	t CO2-e	-	-	- 11	- 7	- 10	- 6	**- 34**
				Total Scope 3 Emissions	**t CO2-e**	**-**	**-**	**- 4,850**	**- 2,971**	**- 4,556**	**- 2,742**	**- 15,120**