# 9 TERRESTRIAL FAUNA

## 9.1 EPA Environmental Factor Objective

The EPA Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) lists the following as its objective for Terrestrial Fauna:

**To protect terrestrial fauna so that biological diversity and ecological integrity are maintained**

For assessment by the EPA, terrestrial fauna is defined as animals living on land or using land for all or part of their lives. Terrestrial fauna includes vertebrates (birds, mammals including bats, reptiles and amphibians) and invertebrates (arachnids, crustaceans, insects, molluscs and worms (EPA 2016e)). Aquatic fauna are not expected to be relevant to this Proposal and; therefore, are not addressed further.

Fauna habitat is defined as the natural environment of an animal or assemblage of animals, including biotic and abiotic elements, that provides a suitable place for them to live (e.g. breed, forage, roost or seek refuge (EPA 2016e)).

## 9.2 Relevant Policy and Guidance

Table 9-1 presents the relevant policy and guidance for Terrestrial Fauna.

**Table 9-1: Relevant Policy and Guidance for Terrestrial Fauna**

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| **Environmental Protection Authority** | |
| Statement of Environmental Principles, Factors, Objectives and Aims for EIA (EPA 2023b) | The EPA objective for terrestrial fauna forms the basis of this assessment. This assessment has regard to the aims of EIA, consideration of significance and the application of the mitigation hierarchy |
| Environmental Factor Guideline: Terrestrial Fauna (EPA 2016e) | The information required for impact assessment has been considered in the scope of this chapter |
| Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020) | Considered in the design (methods and approach) of terrestrial fauna surveys |
| Technical Guidance: Sampling of Short-Range Endemic Invertebrate Fauna (EPA 2016h) | |
| Instructions on how to prepare an Environmental Review Document (EPA 2024e) | This document forms the basis of the headings and content provided in this ERD |
| Instructions on how to prepare *Environmental Protection Act 1986* Part IV Environmental Management Plans (EPA 2024f) | Considered during the development of this document and the EMP (Appendix A05) |
| Instructions on how to prepare *Environmental Protection Act 1986* Part IV Impact Reconciliation Procedures and Impact Reconciliation Reports (EPA 2024g) | Considered in the impact assessment and offset strategy for terrestrial fauna |
| Template for *Environmental Protection Act 1986* Part IV Reconciliation Procedures (EPA 2021f) | |

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| Cumulative environmental impacts of development in the Pilbara region – Advice of the Environmental Protection Authority to the Minister for Environment under Section 16(e) of the *Environmental Protection Act 1986* (EPA 2014) | Considered in understanding cumulative impacts and supports conclusions on significance, and therefore offsets required for clearing of habitat based on its significance |
| Instructions for the preparation of data packages for the Index of Biodiversity Surveys for Assessments (IBSA) (EPA 2021c) | Considered in the compilation of biological data packages and during the submission process of these packages |
| **Other State or Commonwealth** | |
| Guidelines for Mine Closure Plans (DMPE 2025b) | The MCP has been prepared in accordance with the guidance. It addresses matters related to Terrestrial Fauna habitat rehabilitation (Appendix A03) |
| Guideline for preparing Mining Development and Closure Proposals (DEMIRS 2025) | |
| Mining Development and Closure Proposal and Approvals Statement Framework (DMPE 2025c) | |
| A framework for developing mine site completion criteria in Western Australia (Young et al. 2019) | |
| Environmental Management Plan Guidelines (DCCEEW 2024b) | Considered during the development of the EMP (Appendix A05) |
| WA Environmental Offsets Policy (GoWA 2011) | Considered in the impact assessment and offset strategy for Terrestrial Fauna |
| WA Environmental Offsets Guidelines (GoWA 2014a) | |
| EPA Public Advice - Considering environmental offsets at a regional scale (EPA 2024h) | |
| EPBC Act Environmental Offsets Policy (DSEWPaC 2012a) | |
| WA Environmental Offsets Template (GoWA 2014b) | |
| Guidelines for surveys to detect the presence of Bilbies and assess the importance of habitat in Western Australia (DBCA 2017a) | Considered in the design (methods and approach) of the fauna surveys |
| Guidelines for determining the likely presence and habitat usage of night parrot (*Pezoporus occidentalis*) in Western Australia (DBCA 2024) | |
| Survey guidelines for Australia's threatened bats (DEWHA 2010a) | |
| Survey guidelines for Australia's threatened birds (DEWHA 2010b) | |
| Survey guidelines for Australia's threatened mammals (DSEWPaC 2011a) | |
| Survey guidelines for Australia's threatened reptiles (DSEWPaC 2011b) | |
| Survey guidelines for Australia's threatened frogs (DEWHA 2010c) | |

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| A review of ghost bat ecology, threats and survey requirements (Bullen 2021) | |
| Conservation Advice *Pezoporus occidentalis* Night Parrot (DCCEEW 2025a) | Considered in the impact assessment for Terrestrial Fauna |
| Conservation Advice *Falco Hypoleucos* Grey Falcon (TSSC 2020) | |
| Conservation Advice *Polytelis alexandrae* Princess Parrot (TSSC 2018) | |
| Conservation Advice *Petrogale lateralis lateralis* Black-flanked Rock-wallaby (TSSC 2016b) | |
| Recovery Plan for Five Species of Rock Wallabies: Black-footed Rock Wallaby (*Petrogale lateralis*), Rothschild Rock Wallaby (*Petrogale rothschildi*), Short-eared Rock Wallaby (*Petrogale brachyotis*), Monjon (*Petrogale burbidgei*) and Nabarlek (*Petrogale concinna*) (Pearson 2013) | |
| Commonwealth Listing Advice on Northern Quoll (*Dasyurus hallucatus*) (TSSC 2005) | |
| EPBC Act referral guideline for the endangered Northern Quoll (*Dasyurus hallucatus*) (DoE 2016) | |
| National Recovery Plan for the Northern Quoll *Dasyurus hallucatus* (Hill and Ward 2010) | |
| Conservation Advice *Macrotis lagotis* Greater Bilby (TSSC 2016a) | |
| Recovery Plan for the Greater Bilby (*Macrotis lagotis*) (Commonwealth of Australia 2023) | |
| Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015b) | |
| *Conservation and Land Management Act 1984* (CALM Act) joint management plan for parks and reserves of the south-west Kimberley and north-west Pilbara (DBCA 2019) | |
| National Light Pollution Guidelines for Wildlife (DCCEEW 2023b) | |

## 9.3 Receiving Environment

### 9.3.1 Studies

The terrestrial fauna values within the Development Envelope are well understood. Numerous surveys have been conducted within the area including baseline surveys, targeted conservation significant species surveys and targeted short-range endemic (SRE) surveys.

The most recent terrestrial fauna surveys were conducted by Biota Environmental Sciences (Biota). This included a review and consolidation of all previous survey effort to produce a consolidated report (Biota 2025g; Appendix E01). A number of additional surveys and desktop assessments were conducted in 2025–2026, focusing on bilby abundance, MNES, Migratory Birds, and fauna within the Percival Palaeovalley (Biota 2026a, 2026d, 2026c, 2026e).

Table 9-2 provides the location, types and timing for each of the surveys/studies.

A total of 741 sites were surveyed across the consolidated survey effort, with 398 of these located inside of the Development Envelope and 343 located outside. Systematic sampling comprised pitfall, funnel and Elliott trapping, in addition to bird censuses at each of the systematic pitfall sites. Non-systematic sampling techniques comprising motion cameras, acoustic recorders, ultrasonic bat recorders, nocturnal searches and marsupial mole trenches were employed to detect additional fauna species not readily trapped using systematic sampling methods (Biota 2026h). Table 9-3 and Figure 9-1 to Figure 9-4 provide detail of the vertebrate fauna survey coverage and sampling effort within and surrounding the Development Envelope, respectively (Biota 2026h).

Further detail on survey effort for key conservation significant species is provided in Sections 9.3.4, for SREs in Section 9.3.5, and for bats in Section 9.3.4.9.

**Table 9-2: Summary of Technical Studies for Terrestrial Fauna Environmental Factor**

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| Winu Project Bilby Habitat Assessment (Biota 2026b)<br><br>(Appendix E10) | Development Envelope | 23,649 | Assessment of Greater Bilby habitat prospectivity within the Development Envelope in response to requests from regulators. | N/A | This report was undertaken and prepared consistent with related studies, with reference to:<br>• Guideline for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA 2017b)<br>• Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact (EPA 2020b)<br>• Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011a) |
| Winu Project Bilby Abundance Study 2025 (Biota 2026a)<br><br>(Appendix E05) | Original survey area (outside Development Envelope near MIA): Area 0 (A0)<br><br>Partly outside Development Envelope (at MIA): Additional Area 1 (AA1)<br><br>Outside Development Envelope near MIA: Additional Area 2 (AA2) and Additional Area 3 (AA3)<br><br>Partly outside Development Envelope (Rimfire access corridor): Additional Area 4 (AA4) | 714 | Phase 4 of the Greater Bilby census within and near to the Development Envelope, consolidated with the results from the 2019, 2022 and 2024 Greater Bilby abundance surveys | Targeted survey timing not constrained for mammals<br><br>Survey Area:<br><br>A0:<br>Sep 2019, Jul 2022, May 2024, Oct 2025<br><br>AA1:<br>May 2024, Oct 2025<br><br>AA2:<br>May 2024, Oct 2025<br><br>AA3:<br>May 2024, Oct 2025 | This survey and report was undertaken and prepared with reference to:<br>• Guideline for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA 2017b)<br>• Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact (EPA 2020b)<br>• Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011a) |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| | | | | AA4:<br>May 2024,<br>Oct 2025 | |
| Winu Project Bilby Population Abundance Study (Biota 2024) | Survey Area (partly outside Development Envelope)<br>Additional Area 1 (AA1)<br>Near MIA (i.e. outside Development Envelope)<br>Additional Area 2 (AA2) | 528 | Phase 3 of the Greater Bilby census of the survey area, consolidated with the results from the 2019 (Biota 2020a) and 2022 (Biota 2024) Greater Bilby abundance surveys | Targeted survey timing not constrained for mammals<br>Survey Area:<br>Phase 1: 23 September 2019<br>Phase 2: 19–21 July 2022<br>Phase 3: 9 May 2024<br>AA1:<br>Phase 1: 14 May 2024<br>AA2:<br>Phase 1: 14–15 May 2024 | This survey and report was undertaken and prepared with reference to:<br>• Guideline for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA 2017b)<br>• Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013) |
| Winu Project Migratory Bird Review (Biota 2026c)<br>(Appendix E11) | Development Envelope and regional | 23,649 | Consolidation and integration of previous surveys<br>Response to request for further information from DCCEEW on migratory birds | Refer to Table 2.2 of the Winu Project Bilby Population Abundance Study 2025 (Biota 2026a); Appendix E05<br>Consolidation of multiple avifauna surveys, automated recording units, and general/targeted/ nocturnal searches of Winu and AREH | This report has been prepared based on surveys that have regard to:<br>• Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013)<br>• DRAFT Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015a) |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| | | | | between 2017 and 2024 | • EPBC Act Policy Statement 3.21 Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoE 2017)<br>• Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species (van Swinderen et al. 2025)<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b)<br>• Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016g) |
| Winu Project MNES Fauna Supporting Information (Biota 2026d)<br>(Appendix E12) | Development Envelope | 23,649 | Provision of baseline data and related discussion of survey effort and findings regarding 4 EPBC-listed Threatened species | N/A | This report has been prepared based on surveys that have regard to:<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020)<br>• Environmental Factor Guideline: Terrestrial Fauna (EPA 2016e) |
| Winu Project Percival Palaeovalley Tributary and MNES Fauna (Biota 2026e)<br>(Appendix E13) | Percival Palaeovalley tributary | 8,866 (indicative) | Desktop study and on-ground habitat assessment to investigate the potential significance of the palaeovalley tributary for MNES fauna | December 2025 | This report has been prepared based on surveys that have regard to:<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b)<br>• Environmental Factor Guideline: Terrestrial Fauna (EPA 2016e) |
| Winu Project Infiltration Pond Impact | MIA | 532 | Impact assessment of proposed infiltration | N/A | This assessment was undertaken with reference to: |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| Assessment (Biota 2025a)<br>(Appendix D05) | | | strategies and their potential impact on environmental values, including fauna habitat | | • EPA Statement of environmental principles, factors, objectives and aims of EIA (EPA 2023b)<br>• EPA Instructions: How to prepare an environmental review document Environmental Protection Authority March 2024 (EPA 2024e)<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b)<br>• Environmental Factor Guideline: Terrestrial Fauna (EPA 2016e) |
| Winu Project Night Parrot Impact Assessment (Biota 2025b) and Peer Review (Leseberg 2025a)<br>(Appendix E04 and E4a) | Development Envelope | 23,649 | Impact assessment of the Proposal's potential impacts on Night Parrot | | This assessment and reports have been prepared and conducted in accordance with:<br>• Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013)<br>• Guidelines for Determining the Likely Presence and Habitat Usage of Night Parrot (*Pezoporus occidentalis*) in Western Australia (DBCA 2024)<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b) |
| Winu Project Noise and Vibration Impact Assessment (Biota 2025c)<br>(Appendix E06) | Development Envelope and regional | 44,478 | Impact assessment of proposed noise and vibration emissions and their potential impact on significant fauna | | This assessment has been undertaken in accordance with and in consideration of:<br>• EPA Statement of environmental principles, factors, objectives and aims of EIA (EPA 2023b) |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| | | | | | • EPA Instructions: How to prepare an environmental review document Environmental Protection Authority March 2024 (EPA 2024e)<br>• Guideline: Assessment of environmental noise emissions (DWER 2021b)<br>• Noise Regulations fact sheet: Regulation 11 – Blasting Operations (DWER 2021d)<br>• Guidelines for Wind Farm Development (WAPC 2004)<br>• Wind turbine sound limits: Current status and recommendations based on mitigating noise annoyance (Davy et al. 2018)<br>• DCCEEW Independent Scientific Committee on Wind Turbines (DCCEEW 2022) |
| Winu Project SRE Invertebrate Fauna Assessment (Biota 2025d)<br>(Appendix E02) | Development Envelope and regional | 684,000 | Consolidation and integration of previous surveys (listed below) | | This report has been prepared with reference to:<br>• Technical Guidance: Sampling of Short-Range Endemic Invertebrate Fauna (EPA 2016h) |
| Winu Project Targeted Night Parrot Survey (Biota 2026g) and Peer Review (Leseberg 2025b)<br>(Appendix E03 and E03a) | MIA, Rimfire, Texas Borefield and regional | 62,650 (indicative) | Targeted Night Parrot assessment | April 2024 – September 2025 | This targeted survey and reports have been conducted and prepared in accordance with:<br>• Guidelines for Determining the Likely Presence and Habitat Usage of Night Parrot (*Pezoporus occidentalis*) in Western Australia (DBCA 2024) |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| | | | | | • Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b) |
| Winu Project Vertebrate Fauna Consolidation Report (Biota 2026h)<br>(Appendix E01) | MIA, RAC, Regional Rimfire | N/A | Consolidation and integration of previous surveys (listed below). | N/A | This report has been prepared with reference to:<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b)<br>• Environmental Factor Guideline: Terrestrial Fauna (EPA 2016e) |
| Winu Project Wind Turbine Avifauna and Bat Risk Assessment (Biota 2026i)<br>(Appendix E07) | Development Envelope and regional | N/A | Risk assessment of proposed wind turbines and their potential impact on birds and bats | N/A | This assessment was undertaken with reference to:<br>• Impacts on birds and bats from onshore windfarms in Australia: an ecological risk assessment (Reid and Baker 2025)<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b)<br>• Survey guidelines for Australia's Threatened birds (DEWHA 2010b) |
| Ambient Noise Monitoring – Winu Copper-Gold Project, WA (Lloyd George Acoustics 2025a)<br>(Appendix E09) | East of the MIA | 10,182 (indicative) | Ambient noise monitoring to determine the baseline noise levels prior to commencing mining operation | Recorded over a six-day period | This study was undertaken in accordance with:<br>• Environmental Protection (Noise) Regulations 1997 |
| Environmental Noise Assessment Winu Project, WA (Lloyd | Development Envelope | 23,649 (indicative) | Noise modelling and assessment of mining operation | N/A | This study was undertaken in accordance with:<br>• Environmental Protection (Noise) Regulations 1997 |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| George Acoustics 2025b)<br>(Appendix E14) | | | | | and with regard for<br>• Guideline – Assessment of Environmental Noise Emissions (DWER 2021b)<br>• AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction |
| Winu Project: Aircraft Noise Assessment (Lloyd George Acoustics 2025c)<br>(Appendix E15) | East of the MIA | N/A | Desktop assessment of aircraft noise | | This study was undertaken in accordance with:<br>• Environmental Protection (Noise) Regulations 1997 |
| Winu Project Rimfire Bore Field Noise Assessment (Lloyd George Acoustics 2025d)<br>(Appendix E08) | Rimfire | 6,820 (indicative) | Impact assessment of proposed noise emissions and their potential impact on significant fauna | | This study was undertaken in accordance with:<br>• Environmental Protection (Noise) Regulations 1997 |
| Winu Project – Percival Palaeovalley Assessment (Worley 2025i)<br>(Appendix C15) | Rimfire and Percival Palaeovalley | N/A | Assessment of potential impacts to the Percival Palaeovalley by abstraction from Rimfire | July 2025 | Prepared consistent with the information requirements in:<br>• EPA Environmental Factor Guideline: Inland Waters (EPA 2018)<br>• Water in Mining Guidelines (DoW 2013) and Operational Policy 5.12 – Hydrogeological reporting associated with a groundwater well licence (DoW 2009) |
| Winu Mine Pit Lake Environmental Risk Assessment (ERA) – 2024 Update (Mine Lakes Consulting 2025)<br>(Appendix C11) | MIA | N/A | Pit lake environmental risk assessment | February 2025 | |
| Winu Project Water Borefield Targeted | Texas and Rimfire | 556 | Single phase targeted terrestrial fauna | Targeted survey timing not | These surveys were undertaken in accordance with: |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| Fauna Survey (Biota 2023b) | | | | constrained for mammals<br>15-22 July 2022 | • Survey guidelines for Australia's Threatened birds (DEWHA 2010b)<br>• Survey guidelines for Australia's Threatened Reptiles (DSEWPaC 2011b)<br>• Survey guidelines for Australia's Threatened mammals (DSEWPaC 2011a)<br>• Guidelines for surveys to detect the presence of bilbies, and assess the importance of habitat in Western Australia (DBCA 2017b)<br>• Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b) |
| Winu Project Area Extension Targeted Fauna Survey (Biota 2022b) | MIA | 3,521 | Single phase targeted terrestrial fauna | Targeted survey timing not constrained for mammals<br>15-17 July 2022 | |
| Winu Project Fauna Assessment (Biota 2020b) | MIA, RAC, Regional Borefields | 30,160 | Level 2 Fauna Survey<br>Targeted Bilby assessment<br>Targeted Black-footed Rock-wallaby assessment | Phase 1 slightly later than optimal for reptiles (September – April) for Great Sandy Desert region<br>Phase 2 within optimal range<br>12 May – 20 May 2019<br>24 August – 26 August 2019<br>18 September – 26 September 2019<br>12 July – 20 July 2020 | This assessment was undertaken in accordance with:<br>• Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016g)<br>• Technical Guidance – Terrestrial Fauna Surveys (EPA 2016i)<br>• Environmental Factor Guideline – Terrestrial Fauna (EPA 2016e)<br>• Matters of National Environmental Significance – Significant Impact Guidelines (DoE 2013)<br>• Guidelines for surveys to detect the presence of bilbies, and asses the importance of habitat in Western Australia (DBCA 2017a)<br>• Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) Western Australia (DPaW 2017) |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| Asian Renewable Energy Hub Detailed Fauna Assessment (Biota 2020 as cited in Biota 2026h) | RAC | 660,686 | Three phase seasonal detailed fauna survey | Optimal timing for mammals and reptiles<br>**Phase 1**: 24 August – 5 September 2017<br>**Phase 2**: 13 March – 21 March 2018<br>**Phase 3**: 8 March – 19 March 2021 | These surveys were undertaken in accordance with:<br>• Environmental Factor Guideline: Terrestrial Fauna (EPA 2016e)<br>• Technical Guidance – Terrestrial Fauna Surveys (EPA 2016i)<br>• Technical Guidance: Sampling of Short-Range Endemic Invertebrate Fauna (EPA 2016h) |
| Asian Renewable Energy Hub Terrestrial Fauna and SRE Fauna Survey (Biota 2018c) | Asian Renewable Energy Hub | 660,686 | Level 2 terrestrial vertebrate fauna survey<br>Targeted sampling for conservation significant fauna species<br>SRE invertebrate fauna sampling | Both phases fall within the optimal range for reptile detection (September – April)<br>**Phase 1**: 24 August – 5 September 2017<br>**Phase 2**: 13 March – 21 March 2018 | These surveys were undertaken in accordance with:<br>• Environmental Factor Guideline: Terrestrial Fauna (EPA 2016e)<br>• Technical Guidance – Terrestrial Fauna Surveys (EPA 2016i)<br>• Technical Guidance: Sampling of Short-Range Endemic Invertebrate Fauna (EPA 2016h) |
| Asian Renewable Energy Hub Migratory Shorebirds and Waterbirds Study (Biota 2018b) | Asian Renewable Energy Hub<br>Eighty Mile Beach | 660,686 | Targeted fauna survey | Timings chosen to coincide with shorebirds arriving in Australia in Spring and departing in Autumn, as well as when floodwaters were receding<br>24 August – 5 September 2017<br>31 October – 1 November 2017 | This study was undertaken in accordance with:<br>• Survey guidelines for Australia's Threatened birds (DEWHA 2010b)<br>• EPBC Act Policy Statement 3.21 – Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebirds (DoE 2017)<br>• Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna for Environmental Impact Assessment (EPA 2020b) |

| Title | Location | Area (ha) | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|---|
| | | | | 15 February – 16 February 2018<br>13 March – 21 March 2018<br>19 April 2018<br>27 June 2018 | |

**Table 9-3: Vertebrate Fauna Survey Effort Within and Surrounding the Development Envelope - Overview**

| Survey Methodology | Survey Effort | | |
|---|---|---|---|
| | Inside Development Envelope | Outside Development Envelope | Total |
| **Systematic** | | | |
| Combination pitfall/funnel/Elliott trap sites | 38 sites (3,801 nights) | 28 (2,777 nights) | 66 (6,578 nights) |
| Funnel trap sites | - | 3 sites (400 nights) | 3 sites (400 nights) |
| Elliott cage trap sites | 6 sites (570 nights) | 4 sites (800 nights) | 10 (1,370 nights) |
| Avifauna Surveys | 32 sites (1,910 minutes) | 30 sites (1,690 minutes) | 62 sites (3,600 minutes) |
| **Non-systematic** | | | |
| Motion Camera (short and long-term deployments) | 12 sites (44 nights) | 34 sites (1,702 nights) | 46 sites (1,746 nights) |
| Acoustic recorders (short and long-term deployments) | 29 sites (3,123 nights) | 33 sites (3,368 nights) | 62 sites (6,491 nights) |
| Ultrasonic recorders | 14 sites (21 nights) | 10 sites (37 nights) | 24 sites (58 nights) |
| General Searches | 157 searches | 39 searches | 196 searches |
| Targeted Searches | 100 searches | 150 searches | 250 searches |
| Transect Searches | - | 28 searches | 28 searches |
| 2 ha sign plot | 9 | 6 | 15 |
| Nocturnal Searches | 9 searches | 1 search | 10 searches |
| Marsupial Mole trench | 1 site | 11 sites | 12 sites |
| Habitat Assessments | 36 | 109 | 145 |

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

N

Great Northern Hwy

Nyangumarta Hwy

KARAJARRI PEOPLE (AREA A)

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

**Legend**

- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Highway
- Winu Terrestrial Fauna Surveys
- AREH Terrestrial Fauna Surveys
- Mining Lease
- Development Envelope
- Native Title Determinations

0 10 20 Kilometres

RioTinto

**Figure 9-1: Terrestrial Fauna Studies Undertaken within and Surrounding the Development Envelope**




Rio Tinto Copper (RTC)

**Publisher:** B.Gardiner
Date Published: Friday, 19 June 2026

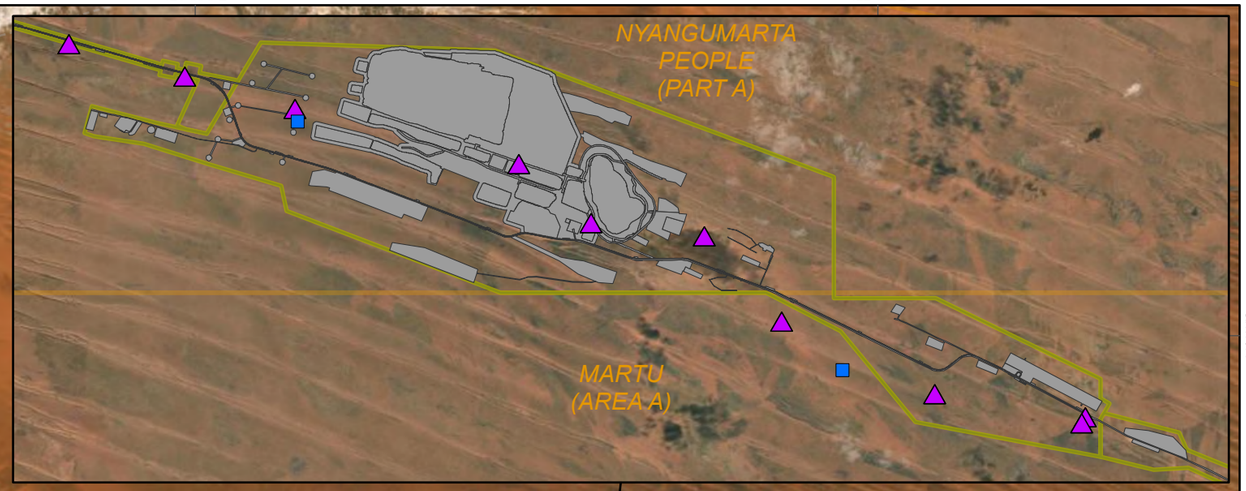
**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
21°0'0"S

Great Northern Hwy
Nyangumarta Hwy

NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)




## Legend

Fauna Trapping Methods

- Elliott
- Elliott and Cage
- Funnel
- Combination Pitfall, Funnel, Elliott
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

RioTinto

# Figure 9-2: Terrestrial Fauna Survey Effort within and Surrounding the Development Envelope - Systematic Trapping




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 25 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright

0 10 20
Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Terrestrial fauna Survey Effort within and Surrounding the Development Envelope Systematic Trapping

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
21°0'0"S

Great Northern Hwy
Nyangumarta Hwy

NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

N

## Legend

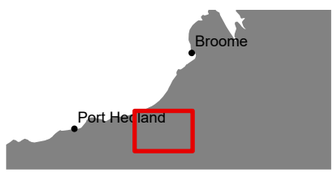
Fauna Survey Methods

- Acoustic Recorder
- Avifauna Census
- Motion Camera
- Ultrasonic Recorder
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

0 10 20
Kilometres

RioTinto

**Figure 9-3: Terrestrial Fauna Survey Effort within and Surrounding the Development Envelope - Targeted Sampling**




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 19 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Terrestrial Fauna Survey Effort within and Surrounding the Development Envelope - Targeted Sampling

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
21°0'0"S

Great Northern Hwy
Nyangumarta Hwy
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

N

## Legend

Fauna Searches

- General Search
- Marsupial Mole Trench
- Nocturnal Search
- Targeted Search
- Habitat Assessment Site
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

0 10 20
Kilometres

RioTinto

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 19 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright

**Figure 9-4: Terrestrial Fauna Survey Effort within and Surrounding the Development Envelope - Targeted Searches**




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Terrestrial Fauna Survey Effort within and Surrounding the Development Envelope - Targeted Searches

### 9.3.2 Fauna Habitat

#### 9.3.2.1 Categories of Habitat Significance

**Critical** and **supporting** habitat has been defined for conservation significant fauna species relevant to the Proposal. For the purposes of this assessment:

- **Critical** habitat is defined as 'habitat critical to the survival of a species' (DoE 2013), which includes habitats that are known for or are likely to be utilised for key ecological activities such as nesting, breeding, refugia and important foraging areas (Biota 2026h). A proportion of these habitats must be maintained across the species' range to ensure persistence of the species in the region
- **Supporting** habitat includes habitats which may be used for lesser foraging or on a transitory, dispersing, or occasional basis, but do not represent critical habitat (Biota 2026h).

#### 9.3.2.2 Fauna Habitat Types

Five broad fauna habitat types have been mapped across the Development Envelope (Biota 2026h) (Figure 9-5):

- Shrub and Spinifex on Sandplain
- Inland Sand Dune
- Gravelly Lateritic Rises
- Clayey Sandplain with Termitaria
- Ephemeral Claypan.

Descriptions and the values for significant fauna of each habitat type identified within the Development Envelope and the proxy representation of each habitat type surrounding the Development Envelope (Section 9.3.2.3) are provided in Table 9-5. Disturbed/cleared areas have also been mapped.

Night Parrot habitat is discussed in Table 9-5 (and Section 9.3.4.3) as an additional 'habitat type' as it is not readily defined within the above broad categories.

#### 9.3.2.3 Regional Representation of Fauna Habitat

Although detailed fauna habitat mapping has been completed within the Development Envelope, detailed mapping at the same scale is unavailable for the wider region. Land System mapping for the Rangelands regions of WA (van Vreeswyk et al. 2004) has been used as a proxy to provide regional context for the habitat types within the Development Envelope (Biota 2026h). The relationship between the Land Systems, land units (components of Land Systems that reflect landform, as well as soils and vegetation associations) and the habitat types within the Development Envelope is shown in Table 9-4.

Each of the Land Systems are extensive and well-represented at a regional scale, and their extents within the Development Envelope represent less than 2.1% of their subregional occurrence (Biota 2025g).

**Table 9-4: Relationship Between Land Systems and the Fauna Habitat Types within the Development Envelope**

| Habitat Type | Land System* | Related Land Unit* | Subregional Extent** (ha) | Extent within Development Envelope (ha) | Proportion of Subregional Extent within Development Envelope (%) |
|---|---|---|---|---|---|
| Inland Sand Dune | **Little Sandy**<br>Sandplains with linear and reticulate dunes supporting shrubby hard and soft spinifex grasslands | 2. Linear Sand Dunes | 1,287,831 | 11,839 | 0.9 |
| Shrub and Spinifex on Sandplain | | 3. Sandplains and Swales | | | |
| Clayey Sandplain with Termitaria | | | | | |
| Ephemeral Claypan | | 7. Drainage Foci | | | |
| Shrub and Spinifex on Sandplain | **Nita**<br>Sandplains supporting shrubby spinifex grasslands with occasional trees | 4. Sandplains | 1,443,080 | 2,221 | 0.2 |
| Gravelly Lateritic Rises | **Callawa**<br>Highly dissected low hills, mesas and gravelly plains of sandstone and conglomerate supporting soft and hard spinifex grasslands | 2. Gravelly Rises and Plains | 97,602 | 2,061 | 2.1 |
| | **Buckshot**<br>Gravelly sandplains and occasional sand dunes supporting hard spinifex grasslands | 4. Gravelly Sandplains | 8,775 | 96 | 1.1 |

**Source: (van Vreeswyk et al. 2004) – Land Unit numbering as per Land Systems descriptions in (Ibid.)] **Extent within McLarty, Mackay and Pindanland IBRA Subregions*

#### 9.3.2.4 Significant Fauna Habitat Features

Each habitat type within the Development Envelope represents either critical or supporting habitat for conservation significant fauna (Table 9-5; Section 9.3.4) (Biota 2026h). Outside of these broad habitat types, no distinct significant habitat features such as rocky outcroppings, caves or permanent/persistent surface water bodies or waterways have been identified within the Development Envelope (Biota 2026h).

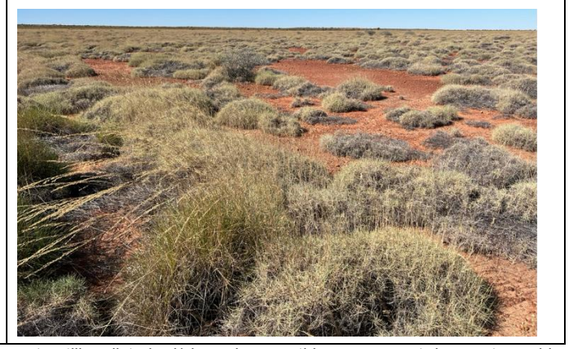
Rocky outcropping, consisting of rock piles, rocky ridges and breakaway landforms, has been mapped outside of the Development Envelope, adjacent to the RAC (Figure 9-5).

A total of 2,475 ha of Night Parrot habitat has been mapped outside of the Development Envelope, extending from approximately 200 m to 13 km south of the Development Envelope and approximately 12 km from south-east around to the north-west of the Development Envelope. Additionally, two small areas of potential roosting habitat have been mapped immediately north (approximately 5 m) of the boundary of the Rimfire pipeline corridor (Section 9.3.4.2; Figure 9-6) (Biota 2025b). Mapped habitat includes approximately 2,168 ha of roosting/nesting habitat and 307 ha of foraging habitat. No Night Parrot habitat has been mapped within the Development Envelope.

**Table 9-5: Broad Fauna Habitat Types within and Surrounding the Development Envelope**

| Habitat Type | Description | Value for Significant Fauna | | Regional* Extent (ha) | Extent within the Development Envelope (ha) | Representative Photo (Biota 2026h) |
|---|---|---|---|---|---|---|
| | | Critical | Supporting | | | |
| Shrub and Spinifex on Sandplain | These broad plains comprise pink to red pindan soils. The habitat is in Excellent condition and supports typical pindan vegetation, comprising occasional trees of species such as *Corymbia zygophylla* (Broome Bloodwood), *Erythrophleum chlorostachys* (Ironwood) and *Owenia reticulata* (Native Walnut) over open to moderately dense mixed shrublands, typically dominated by wattles (*Acacia* spp.), over hummock grasslands of *Triodia schinzii* and *T. epactia*. | • Greater Bilby<br>• Brush-tailed Mulgara<br>• Spectacled Hare-wallaby<br>• Dampierland Plain Slider | • Northern Marsupial Mole<br>• Northern Quoll<br>• Black-footed Rock-wallaby<br>• Short-tailed Mouse<br>• Grey Falcon<br>• Oriental Plover<br>• Australian Tern<br>• Little Curlew<br>• Oriental Pratincole<br>• Pacific Swift<br>• Peregrine Flacon<br>• Princess Parrot<br>• Barn Swallow | 636,108.3 (detailed mapping)<br>1,443,080 (Nita Land System) | 17,037.5 |  |
| Inland Sand Dune | Substrate consists of red loose sand. The vegetation is dominated by *Corymbia chippendalei*, *Erythrophleum chlorostachys* and *Owenia reticulata* low woodland and scattered trees over mixed Acacia low open shrublands over open hummock grasslands dominated by *Triodia schinzii.* | • Greater Bilby<br>• Northern Marsupial Mole | • Grey Falcon<br>• Pacific Swift<br>• Peregrine Falcon<br>• Princess Parrot | 29,045.8 (detailed mapping)<br>1,287,831 (Little Sandy Land System) | 3,105.5 |  |
| Gravelly Lateritic Rises | Low rises with a surface covering of laterite gravel and pebbles occurred sporadically, supporting open hummock grasslands of *Triodia epactia* with a low open shrubland of the wattles *Acacia hilliana* (Hill's Tabletop Wattle) and *A. adoxa* var. *adoxa* (Grey Whorled Wattle); taller shrubs were typically sparse but included species, such as *Grevillea refracta* (Silver-leaf Grevillea) and *G. wickhamii* (Wickham's Grevillea).<br>Patchily distributed habitat type, although much of its regional extent occurs within the Development Envelope and surrounding locality. | • Western Pebble-mound Mouse | • Brush-tailed Mulgara<br>• Northern Quoll<br>• Black-footed Rock-wallaby<br>• Grey Falcon<br>• Pacific Swift<br>• Peregrine Falcon<br>• Barn Swallow<br>• Greater Bilby | 33,200.4 (detailed mapping)<br>106,377 (Callawa and Buckshot Land Systems) | 3,116.2 |  |

| Habitat Type | Description | Value for Significant Fauna | | Regional* Extent (ha) | Extent within the Development Envelope (ha) | Representative Photo (Biota 2026h) |
|---|---|---|---|---|---|---|
| | | Critical | Supporting | | | |
| Clayey Sandplain with Termitaria | The substrate of these plains comprises clayey sand to a loose depth of 2 cm. Vegetation comprising *Acacia bivenosa* shrubland over *Triodia brizoides* open hummock grassland. | - | • Short-tailed Mouse<br>• Grey Falcon<br>• Oriental Plover<br>• Australian Tern<br>• Little Curlew<br>• Oriental Pratincole<br>• Pacific Swift<br>• Peregrine Falcon<br>• Barn Swallow | 130.5 (detailed mapping)<br>1,287,831 (Little Sandy Land System) | 124.7 |  |
| Ephemeral Claypan | Claypans with *Eucalyptus* spp. scattered low trees and *Acacia* spp. very open shrubland represents a very small proportion of the Development Envelope. Dominated by *Eragrostis* sp. grassland. Seasonally inundated. | - | • Grey Falcon<br>• Oriental Plover<br>• Oriental Pratincole<br>• Pacific Swift<br>• Peregrine Falcon | 479.0 (detailed mapping)<br>1,287,831 (Little Sandy Land System) | 49.3 |  |
| Rocky Outcropping | Patchily distributed and occurs as rock piles, rocky ridges and breakaway landforms. | • Black-footed Rock-Wallaby<br>• Northern Quoll | - | 387.2 (detailed mapping) | - |  |

| Habitat Type | Description | Value for Significant Fauna | | Regional* Extent (ha) | Extent within the Development Envelope (ha) | Representative Photo (Biota 2026h) |
|---|---|---|---|---|---|---|
| | | Critical | Supporting | | | |
| Disturbed / cleared | Areas that have been cleared or disturbed and were largely or entirely devoid of native vegetation. | | • Barn Swallow^ | - | 215.8 |  |
| Night Parrot Habitat | Characterised by flat, very open areas with few trees or shrubs. Roosting habitat comprises extensive and complex bare clay or stony patches where spinifex (*Triodia* spp.) grasses are dominant, particularly in longer unburned areas with ring-formed spinifex hummocks of differing sizes and complexity.<br>Foraging habitat typically associated with larger areas of potential roosting habitat and consist of open areas, floodplains and low-lying depressions supporting a diverse assemblage of native grasses and forbs. | • Night Parrot | • 2,475.1 (detailed mapping) | - | Refer to Plate 9-1 and Plate 9-2 |  |

**Detailed habitat mapping outside of the Development Envelope, where available, and Land System mapping within the Mackay, McLarty and Pindanland subregion as defined in Section 2.3.1. ^While Barn Swallow is known to utilise disturbed/cleared areas, this assessment does not consider disturbed/cleared areas with respect to impacts to this species.*

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
21°0'0"S

Eighty Mile Beach System
Great Northern Hwy
N
Mandora
Bedamoral
Bulgamulgardy Soak
Djimakarra Soak
Winu Soak
Toramah Soak
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

## Legend

- Regional Surface Water Features (Golder)
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Highway
- Mainstream
- Conceptual Footprint
- Mining Lease
- Development Envelope
- Native Title Determinations
- Wetlands (DBCA)

### Fauna Habitat

- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

RioTinto

**Figure 9-5: Fauna Habitat Recorded within and Surrounding the Development Envelope**

Rio Tinto Copper (RTC)

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright




0 20 40 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: Fauna Habitat

121°50'0"E

122°0'0"E

20°50'0"S

N

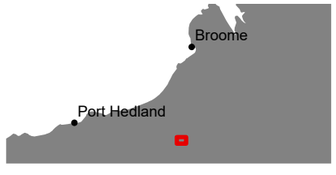
RioTinto

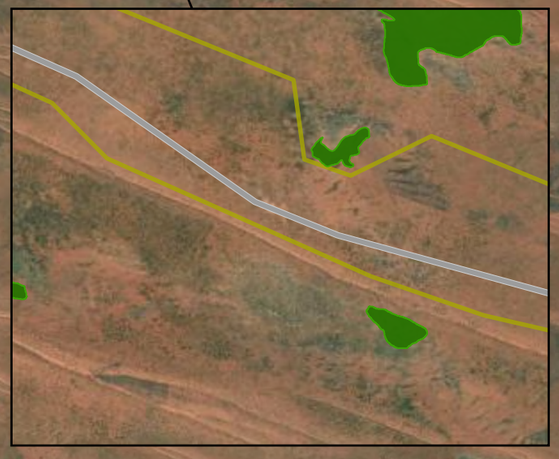
# Figure 9-6: Night Parrot Habitat Surrounding the Development Envelope

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:80,000
Rio Tinto © Copyright



0 2 4 Kilometres

## Legend

Night Parrot Habitat
- Foraging
- Roosting

Conceptual Footprint

Development Envelope

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: Night Parrot Habitat

121°50'0"E

122°0'0"E

### 9.3.3 Vertebrate Fauna Assemblages and Species Diversity

A total of 151 vertebrate fauna species have been recorded within the Development Envelope (Biota 2026h) (Table 9-6).

**Table 9-6: Summary of Vertebrate Fauna Species**

| Fauna Group | Status | Number of Species | Number of Conservation Significant Species |
|---|---|---|---|
| Amphibians | Native | 1 | - |
| Reptiles | Native | 69 | 1 |
| Ground-dwelling Mammals | Native | 15 | 4 |
| | Introduced | 5 | - |
| Bats | Native | 5 | - |
| Birds | Native | 56 | 6 |
| **Total** | | **151** | **11** |

#### 9.3.3.1 Amphibians

One amphibian (a frog, *Notaden nichollsi;* Desert Spadefoot) was recorded within the Development Envelope (Biota 2026h). This species is widely distributed across the northern arid zone of Western Australia and Northern Territory (WAM n.d.), and is not listed under the BC Act, EPBC Act or a Priority species. As such, Desert Spadefoot is not considered a significant species.

#### 9.3.3.2 Reptiles

A total of 69 reptile species were recorded within the Development Envelope (Biota 2026h). The most abundant was the Desert Fait-tailed Gecko (*Diplodactylus laevis*) with 57 records.

One DBCA-listed Priority 2 reptile, the Dampierland Plain Slider (*Lerista separanda*), was recorded within the Development Envelope.

#### 9.3.3.3 Mammals (including Bats)

Twenty native mammal (15 ground-dwelling and five bat) species were recorded within the Development Envelope (Biota 2026h). The Western Pebble-mound Mouse (*Pseudomys chapmani*) was the most abundantly recorded, with 40 records.

Four conservation significant mammal species were recorded (Biota 2026h), including:

- Greater Bilby (*Macrotis lagotis*) (Vulnerable [VU] under the BC Act and EPBC Act)
- Northern Marsupial Mole (*Notoryctes caurinus*) (P4)
- Brush-tailed Mulgara (*Dasycercus blythi*) (P4)
- Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4).

##### 9.3.3.3.1 Bats

Consolidated bat survey effort within Proposal and AREH project areas was based on ultrasonic recorders, amounting to a total of 24 ultrasonic recorder sites across 58 survey nights (Biota 2026i).

None of the five bat species recorded within the Development Envelope are conservation significant species listed under the BC Act, EPBC Act or a Priority species (Biota 2026h). The bat species recorded included:

- White-striped Free-tailed Bat (*Austronomus australis*)
- Gould's Wattled Bat (*Chalinolobus gouldii*)
- Greater Northern Free-tailed Bat (*Chaerephon jobensis*)
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*)
- Little Broad-nosed Bat (*Scotorepens greyii*).

These species are common and widespread in the Pilbara bioregion (Biota 2026i).

#### 9.3.3.4 Birds

A total of 56 bird species were recorded within the Development Envelope (Biota 2026h, 2026i). The most abundant was the Budgerigar (*Melopsittacus undulatus*) with 307 records.

Conservation significant bird species recorded included:

- One Vulnerable (BC Act and EPBC Act) species, Grey Falcon (*Falco hypoleucos*)
- Five migratory (BC Act and EPBC Act) species:
  - Pacific Swift (*Apus pacificus*)
  - Little Curlew (*Numenius minutus*)
  - Oriental Pratincole (*Glareola maldivarum*)
  - Oriental Plover (*Charadrius veredus*)
  - Australian Tern (Gelochelidon [nilotica] macrotarsa).

Note the Australian Tern (*Gelochelidon [nilotica] macrotarsa*) was recorded within the Development Envelope, however there are two populations of Gull-billed Tern now recognised in Australia: a resident population (*G. nilotica macrotarsa*; Australian Tern) and a migratory population (*G. nilotica affinis*; Asian Gull-billed Tern). Although it is not migratory, the Australian Tern is still listed as such under the EPBC Act and BC Act due to a lag in updating the taxonomy of the species (Biota 2026h). The species recorded within the Development Envelope is the Australian Tern. As the relevant population is not Migratory, the Gull-billed Tern is not considered further in this assessment.

#### 9.3.3.5 Introduced Fauna

Five feral fauna species have been recorded within the Development Envelope and are known from the region surrounding the Development Envelope (Biota 2026h). This includes the Feral Cat (*Felis catus*), Feral Dog[3] (*Canis familiaris*), European Red Fox (*Vulpes vulpes*), Dromedary Camel (*Camelus dromedarius*) and the House Mouse (*Mus musculus*).

It is acknowledged that the dingo is a culturally important species and, from a Traditional Owner perspective, should not be classified as a feral or introduced species.

### 9.3.4 Significant Vertebrate Fauna

'Significant' fauna discussed in this chapter refers to those identified as Threatened or Priority species, with restricted distribution, subject to a degree of historical impact from threatening process or provide an important function required to maintain the ecological integrity of a significant ecosystem (EPA 2016e).

[3](Biota 2026h)

#### 9.3.4.1 Species Recorded, Likely or with Potential to Occur

Of the 151 vertebrate fauna species recorded within the Development Envelope, 10 species of significance were recorded, whilst an additional eight species were considered likely to or may occur within the Development Envelope (Table 9-7; Figure 9-7). As per Section 9.3.3.3.1, the Australian Tern recorded within the Development Envelope is not considered to represent the significant Migratory Gull-billed Tern.

Each significant species recorded or with potential to occur within the Development Envelope is described in further detail in the following sections.

**Table 9-7: Significant Fauna Recorded or Considered Likely to or May Occur within the Development Envelope**

| Species | EPBC Act Listing | BC Act Listing | DBCA Listing | Presence within the Development Envelope | Description |
|---|---|---|---|---|---|
| **Birds** | | | | | |
| Night Parrot (*Pezoporus occidentalis*) | Critically Endangered | Critically Endangered | - | Likely to Occur | Section 9.3.4.3 |
| Grey Falcon (*Falco hypoleucos*) | Vulnerable | Vulnerable | - | Recorded | Section 9.3.4.4 |
| Princess Parrot (*Polytelis alexandrae*) | Vulnerable | - | Priority 4 | May Occur | Section 9.3.4.5 |
| Pacific Swift (*Apus pacificus*) | Migratory | Migratory | - | Recorded | Section 9.3.4.9 |
| Barn Swallow (*Hirundo rustica*) | Migratory | Migratory | - | May Occur | Section 9.3.4.9 |
| Little Curlew (*Numenius minutus*) | Migratory/ Marine | Migratory | - | Recorded | Section 9.3.4.9 |
| Oriental Plover (*Charadrius veredus*) | Migratory/ Marine | Migratory | - | Recorded | Section 9.3.4.9 |
| Oriental Pratincole (*Glareola maldivarum*) | Migratory/ Marine | Migratory | - | Recorded | Section 9.3.4.9 |
| Peregrine Falcon (*Falco peregrinus)* | - | Other specially protected species | - | May Occur | Section 9.3.4.10 |
| **Mammals** | | | | | |
| Black-footed Rock-wallaby / Mororong (*Petrogale lateralis lateralis)* | Endangered | Endangered | - | Likely to Occur | Section 9.3.4.6 |
| Northern Quoll (*Dasyurus hallucatus*) | Endangered | Endangered | - | Likely to Occur | Section 9.3.4.7 |
| Greater Bilby / Mankarr (*Macrotis lagotis*) | Vulnerable | Vulnerable | - | Recorded | Section 9.3.4.8 |

| Species | EPBC Act Listing | BC Act Listing | DBCA Listing | Presence within the Development Envelope | Description |
|---|---|---|---|---|---|
| Brush-tailed Mulgara (*Dasycercus blythi*) | - | - | Priority 4 | Recorded | Section 9.3.4.10 |
| Northern Marsupial Mole (*Notoryctes caurinus*) | - | - | Priority 4 | Recorded | Section 9.3.4.10 |
| Short-tailed Mouse (*Leggadina lakedownensis*) | - | - | Priority 4 | May Occur | Section 9.3.4.10 |
| Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) | - | - | Priority 4 | Likely to Occur | Section 9.3.4.10 |
| Western Pebble-mound Mouse (*Pseudomys chapmani*) | - | - | Priority 4 | Recorded | Section 9.3.4.10 |
| **Reptiles** | | | | | |
| Dampierland Plain Slider (*Lerista separanda*) | - | - | Priority 2 | Recorded | Section 9.3.4.10 |

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

Eighty Mile Beach System
Mandora Salt Marsh
Wallal Well
Great Northern Hwy
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)
Bulgamulgardy Soak
Djimakarra Soak
Winu Soak
Toramah Soak
Nyangumarta Hwy

**Legend**

- Regional Surface Water Features (Golder)
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Mainstream
- Development Envelope
- Native Title Determinations
- Conceptual Footprint
- Highway
- Wetlands (DBCA)
- Pacific Swift (Apus pacificus) (MI)
- Oriental Pratincole (Glareola maldivarum)(IA)
- Dampierland plain slider (Lerista separanda) (P2)
- Bilby Macrotis lagotis (VU)
- Northern Marsupial Mole (Notorcytes caurinus)(P4)
- Western pebble-mound mouse (Pseudomys chapmani)(P4)
- Brush-tailed Mulgara (Dasycercus blythi) (P4)
- Grey Falcon (Falco hypoleucos)(VU)
- Gull-billed Tern (Gelochelidon nilotica)(MI)
- Little Curlew (Numenius minutus)(MI)
- Oriental Plover (Charadrius veredus)(MI)

0 20 40 Kilometres

RioTinto

# Figure 9-7: Significant Fauna Records within the Development Envelope

Rio Tinto Copper (RTC)

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 24 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: Significant Fauna

#### 9.3.4.2 Culturally Significant Fauna

A total of 151 fauna species recorded within the Development Envelope, are considered to be culturally significant (Biota 2026h). Of these, four are also conservation significant (i.e. as described in the introduction to Section 9.3.4):

- Night Parrot
- Bilby, Dalgyte – historically, also acted as a food source and tails were used for decoration
- Great Desert Skink, Tjakura – historically, was a favoured food resource
- Black-footed Rock Wallaby – hunted for food and fur.

The Dingo, a native species and also culturally significant, has also been recorded but not able to be distinguished from the introduced dog in fauna surveys (Biota 2026h).

These species are culturally significant as they form an important component of tjukurrpa (Dreamtime) (Biota 2026h). Kangaroo/Euro (*Osphranter* spp.), varanid species (*Varanus* spp.) and the bustard (*Ardeotis australis*) are also recognised as culturally significant food sources (Biota 2026h). These species are considered abundant and common locally and regionally.

Culturally significant fauna species are discussed in more detail in Social Surroundings (Section 6).

#### 9.3.4.3 Night Parrot (*Pezoporus occidentalis*)

##### 9.3.4.3.1 Conservation Status

The Night Parrot is listed as Critically Endangered under the BC Act and Endangered under the EPBC Act. The following policy and guidance documents are relevant to this species:

- Conservation Advice *Pezoporus occidentalis* Night Parrot (DCCEEW 2025a).

##### 9.3.4.3.2 Ecology and Distribution

Historically, the Night Parrot was found across remote arid and central semi-arid Australia (Murphy et al. 2017b, Leseberg et al. 2021a as cited in DCCEEW 2025a), with records having been recorded from western Queensland, southern Northern Territory, north-western Victoria, the Gawler Ranges and north-eastern South Australia and central and northern WA (Higgins 1999, Horton et al. 2021, Leseberg et al. 2021a, c, Birdlife International 2022 as cited in DCCEEW 2025a). Reliable records indicate that populations are likely to now only persist in western Queensland and central and northern WA (DCCEEW 2025a). The species was recorded on Martu country in 2020 (Australian Geographic 2020). A recent study by Ngururrpa Rangers detected what has been characterised as the largest Night Parrot population in the world on the Ngururrpa IPA within the Great Sandy Desert bioregion, approximately 650 km east of the Development Envelope (Ngururrpa Rangers et al. 2024).

Areas of soil with high moisture contents support vegetation that possibly offers an important source of metabolic water for Night Parrot (Kearney et al. 2016 cited in DCCEEW 2025a). Sources of permanent water are therefore likely to influence the distribution of the species, particularly as it relates to diet (Kearney et al. 2016 as cited in DCCEEW 2025a). Recent evidence from the Ngururrpa IPA suggests that in landscapes where standing water is not available year-round, the Night Parrot may leave such areas when water is not available (Ngururrpa Rangers et al. 2024 as cited in Leseberg 2025b).

The species was assumed to be nomadic, moving in response to seasonal and environmental conditions (Higgins 1999, Forshaw 2002, cited in Leseberg 2022 cited in DCCEEW 2025a). However, monitoring observations made in Queensland found that Night Parrots regularly roosted in the same location, corroborating reports that in some parts of the range birds may remain sedentary under suitable conditions, or suggesting that Night Parrot may be periodically nomadic (DCCEEW 2025a). It is likely that Night Parrot movements are highly environment-dependent due to variations in habitat and resources across its distribution, with time and between subpopulations (DCCEEW 2025a).

#### 9.3.4.3.3 Critical Habitat

Habitat critical to the survival of Night Parrot have been defined by Burbidge et al. 2020 and Leseberg 2022 (as cited in DCCEEW 2025a) as the following:

- Breeding and roosting habitat: low dense vegetation on flat and open terrain, which is most commonly long-unburnt old growth (>20 years old) *Triodia* patches, but may also be provided by thickets of lignum, dense shrubby samphire, and chenopods (Plate 9-1)
- Food resource habitat: run-on areas, floodplains, salt or clay pans, salt-lake margins, and other areas of relatively high vegetative or seed productivity, including those associated with palaeodrainage systems (Plate 9-2)
- Flyways: areas between feeding and breeding or roosting habitat through which Night Parrot traverse
- Water: permanent or ephemeral sources of free water, and potentially areas that support vegetation that offers a source of metabolic water for vertebrates
- Gastrolith sources: ironstone plains, rocky breakaways, and other areas where stones of appropriate size and shape can be ingested to aid in food digestion.

Currently in WA within the Ngururrpa IPA, known Night Parrot habitat is confined to ironstone or laterite plains below breakaways or a laterised and deeply weathered plateau, and areas of calcrete along former drainages that may extend to salt lake surrounds (Ngururrpa Rangers et al. 2024 cited in DCCEEW 2025a). Roosting and nesting sites are consistently reported to be within clumps of dense vegetation, primarily old and large spinifex clumps densely lined with terminal section of spinifex spines, although other vegetation types, such as samphire brush have been reported (Higgins 1999; Murphy and Night Parrot recovery Team 2015).

Foraging habitat is generally characterised by floristically diverse run-on areas that may provide a broad array of grasses and forbs, ranging from small depressions and gilgai formations to large floodplains (Murphy et al. 2017 as cited in Biota 2026g). As Night Parrots are known to travel up to 10 km from their roosting sites to forage, foraging habitat within 10 km of roosting habitat is likely to be of higher significance than that outside of this range (DBCA 2024).

#### 9.3.4.3.4 Survey Adequacy

A targeted Night Parrot survey involving long-term passive acoustic recording and detailed habitat mapping was undertaken, and peer reviewed, to assess the species' occurrence within and surrounding the Development Envelope (Biota 2026g).

A summary of the survey effort applicable to the targeted Night Parrot survey is provided in Table 9-8 and Figure 9-8.

Passive acoustic surveys are widely regarded as the most effective field survey technique for Night Parrots as research has shown that Night Parrots call reliably year-round around dusk and dawn from roost sites (Murphy et al. 2017 as cited in Biota 2026g).

Long-term autonomous recording units (ARUs) were deployed in potentially suitable areas of habitat (refer below) within the targeted Night Parrot survey area and immediate surrounds (Table 9-8) (Biota 2026g). The majority of potentially suitable habitat was located within the Texas Borefield area and surrounds, so the majority of ARU survey effort was concentrated in these areas. For the targeted survey, ARU deployment occurred over nine separate field trips between March 2024 and February 2025. At the time of targeted survey report preparation, April 2026, 21 ARUs remained deployed across the survey areas of Texas Borefield, Rimfire Borefield, and Lake Waukarlicarly. An additional 94 recording nights, with no Night Parrot detections, also occurred within the Development Envelope during general detailed terrestrial fauna surveys that are not shown in Table 9-8 (Biota 2026g).

Short-term (single night) ARUs were also deployed in an overlapping pattern within suitable habitat in the area of the Texas Borefield during the field survey in September 2024 (Table 9-8). This was undertaken in an attempt to determine whether a Night Parrot was actively roosting within the survey

area, as the results from a prior data collection indicated that a Night Parrot had been roosting in the Texas borefield, but had since moved (Biota 2026g).

In order to better understand the movements and presence of Night Parrot within the targeted survey (Biota 2026g) study area in the Proposal area, additional survey effort was undertaken at Lake Waukarlicarly, approximately 50 km south of the Development Envelope and identified as the closest area of Night Parrot habitat to that in the targeted survey area, based on examination of aerial imagery. While the habitat here was not formally mapped as a part of the Night Parrot targeted survey, satellite imagery suggested it had much more extensive roosting and foraging habitat than was present in the targeted survey study area (Biota 2026g). A preliminary reconnaissance confirmed this, and six target sites were selected from a candidate set of potential locations for Night Parrot. Long-term ARUs were deployed at these locations.

**Table 9-8: Night Parrot Survey Effort in the Proposal Locality**

| Survey Methodology | Survey Effort<br>Recording Nights (No. of ARU sites) | | | | |
|---|---|---|---|---|---|
| | MIA | Texas Borefield and Surrounds | Rimfire Borefield and Surrounds | Rimfire Pipeline Corridor | Lake Waukarlicarly |
| Long term ARUs | 28 (1) | 1,065 (16) | 375 (9) | 56 (2) | 502 (7) |
| Short terms ARUs | - | 30 | - | - | - |

#### 9.3.4.3.5 Habitat Mapping

The targeted survey was based on a desktop assessment that identified local landforms, substrate and vegetation types potentially preferred by the Night Parrot (Biota 2026g). A uniform mapping effort was applied encompassing the MIA, former Texas Borefield, Rimfire Borefield, prospective new bore locations, and intervening areas to identify all potentially suitable Night Parrot habitat. The assessment also specifically considered the potential occurrence of chenopod-dominated habitats (e.g. samphire, *Sclerolaena* spp.) as possible roosting and foraging habitat, consistent with DBCA guidance (DBCA 2024), although no such habitats were present within the extent of Night Parrot habitat mapping undertaken for the Proposal.

Aerial surveys were conducted to assess areas earmarked as potential habitat during the desktop exercise, as well as areas considered not to represent Night Parrot habitat (Biota 2026g). Where aerial survey was insufficient to determine Night Parrot suitability in some locations, on-ground surveys and vegetation complexity assessments were conducted using DBCA (2024) diagnostic criteria.

Roosting habitat field verification focused on assessing the structural characteristics of *Triodia* spp., including hummock height, the presence of ring-forming species, the degree of structural complexity, the extent of long-unburnt vegetation and protection from fire (Biota 2026g). Foraging habitat field verification criteria included the presence of native grasses and forbs characteristic of productive run-on or low-lying drainage areas. Claypans and low-lying depressions were mapped as foraging habitat only where they exhibited a native grass layer indicative of productive run-on hydrology, and were excluded where they were dominated by bare, scalded, or sparsely vegetated surfaces, or by halophytic or salt-tolerant species without an associated grass/forb assemblage.

Roosting/breeding habitat was considered to also represent seasonal foraging habitat, a dual function characterisation supported by contemporary research (e.g. Murphy et al. 2017, Ngurrurrpa Rangers at al. 2024 cited in Biota 2026g). Smaller ‘satellite’ areas of potential roosting habitat were also included in the mapping, as patch size has been shown to be unimportant for breeding or roosting, consistent with DBCA (2024) guidance. Habitat mapping is shown in Figure 9-6.

121°30'0"E

122°0'0"E

21°0'0"S

Toramah Soak

NYANGUMARTA PEOPLE (PART A)

N

Barnicarndy Hills

Cuncudgerie Hill

MARTU (AREA A)

Muttarbarty Hill

Chirit Native Well

Tyama Hill

Coolyu Native Well

Lake Waukarlicarly

Ghost Castle

Minyari Hill

Telfer

Kaliranu Hill

## Legend

Night Parrot Detections (ARU)

- No Detections
- Detections
- Mining Lease
- Development Envelope
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

0 10 20

Kilometres

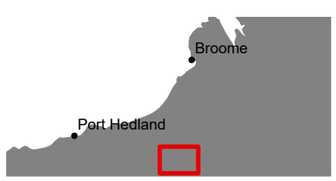
RioTinto

**Figure 9-8: Location of ARUs Deployed in the Lake Waukarlicarly Area**

Rio Tinto Copper (RTC)

**Publisher:** B.Gardiner
Date Published: Tuesday, 7 July 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:332,218
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - ARU Locations at Lake Waukarlycarly Area

121°30'0"E

122°0'0"E

#### 9.3.4.3.6 Occurrence and Habitat in the Region and Development Envelope

The targeted survey found that, notably, no Night Parrot calls were detected within the current Development Envelope (Biota 2026g) (Figure 9-9). Night Parrot calls were detected from eight locations within the targeted survey area and surrounds, all within the now excluded Texas Borefield area and adjacent suitable habitat south of Rimfire, and two locations at Lake Waukarlicarly.

The calls detected at the Texas Borefield, considered to be from a single individual, are the most north-westerly records of Night Parrot in the Great Sandy Desert to date, approximately 100 km north of the nearest recent record (Biota 2026g). The majority of the detections were of the 'two-note trill' call type, a known type that has previously been detected from the Great Sandy Desert. However, the peak frequency of the Proposal targeted survey 'two-note trill' calls was a higher frequency than is typical for this call type. The remaining confirmed calls were 'one-note trill' calls that were very similar in structure and frequency to a single note of the 'two-note trill' calls detected, - in many cases these calls were faint and the second trill note may have been present but not detectable at that range. The very similar call structure and frequency of these calls are the basis for the suggestion that they are attributable to a single individual. Several 'hollow whistle' type calls were also detected that may be attributable to Night Parrots, but this call type can be difficult to distinguish from a particular Pallid Cuckoo call, and so Biota (2026g) considered these calls should only be treated as possible detections.

The presence of the individual detected at Texas Borefield is considered likely to be coincident with the presence of high quality foraging resources in proximity to roosting habitat following significant rainfall in January and March of 2024 (Biota 2026g); and the availability of surface water in the area following this rainfall may have also been a factor (Leseberg 2025 cited in (Leseberg 2025 cited in Biota 2026g).

The calls detected at Lake Waukarlicarly represent the first confirmed records of the species from the lake. The range of calls detected at Lake Waukarlicarly suggests that at least four individual Night Parrots were detected in the area. This included at least one call very similar to the individual detected at the Texas Borefield, with the call at the same unusually high frequency, suggesting that this may have been the same individual; however, it is not possible to conclude this with certainty. The recording of the same call type provides some support to a view by Biota (2026g) that Lake Waukarlicarly is likely to be the source population for the bird recorded in the targeted survey area at the now excluded Texas Borefield area, which does not appear to have a permanent Night Parrot presence.

Detailed habitat mapping was undertaken in consultation with DBCA and Dr Nick Leseberg (Biota 2026g). Areas of potentially suitable Night Parrot habitat were initially identified via a desktop assessment of satellite imagery, vegetation mapping (Western Botanical 2026a) and other available spatial data, such as soil mapping (Biota 2026g). As discussed above, areas of potential habitat were then verified via helicopter survey and/or on-ground habitat assessment. Areas of potential habitat were defined as either roosting/breeding or foraging habitat, in line with DBCA guidance (DBCA 2024). Any areas outside of these mapped habitat types were considered to be of low suitability for Night Parrot.

Based on the habitat mapping, the Development Envelope was amended to exclude all Night Parrot habitat. A total of 2,475 ha of Night Parrot habitat (all of which is considered critical habitat) was mapped within the surrounding area, the majority of which comprised roosting/nesting habitat (2,168 ha) and the remainder being foraging habitat (307 ha) (Biota 2026g) (Figure 9-9). This habitat mapping was peer reviewed by Dr Nick Leseberg (Leseberg 2025b).

As show in Figure 9-9, potential roosting/nesting and foraging habitat is present adjacent to the Rimfire pipeline corridor, extending from approximately 200 m to 13 km south of the Development Envelope and approximately 12 km from south-east around to the north-west of the Development Envelope. Additionally, two small areas of potential roosting habitat have been mapped immediately north (approximately 5 m) of the boundary of the Rimfire pipeline corridor.

Based on the proximity of mapped potential roosting habitat and the confirmed records of the species within the surrounding area, it is considered likely that the species may periodically occur as a foraging

visitor or occasionally overfly the Rimfire pipeline corridor. However, its occurrence would be expected to be transitory only and restricted to this south-east portion of the Development Envelope (Biota 2026g).



*Source: (Biota 2026g)*

**Plate 9-1: Night Parrot – Roosting/Breeding Habitat in Winu Area, South of Development Envelope**



*Source: (Biota 2026g)*

**Plate 9-2: Night Parrot – Foraging Habitat in Winu Area, South of Development Envelope**

[redacted]

#### 9.3.4.4 Grey Falcon (*Falco hypoleucos*)

##### 9.3.4.4.1 Conservation Status

The Grey Falcon (Plate 9-3) is listed as Vulnerable under the BC and EPBC Acts. The following policy and guidance documents are relevant to this species:

- Conservation Advice *Falco hypoleucos* Grey Falcon (TSSC 2020).



*Source: Owen Lishmund - https://creativecommons.org/licenses/by-nc/4.0/*

**Plate 9-3: Grey Falcon**

##### 9.3.4.4.2 Ecology and Distribution

The Grey Falcon is endemic to mainland Australia and is the rarest of the six Australian members of the raptor genus *Falco* (TSSC 2020). The species occurs across arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and WA. Its population size is small and estimated to be fewer than 1,000 individuals (TSSC 2020).

The Grey Falcon is carnivorous, feeding almost exclusively on birds, including doves, pigeons, small parrots, cockatoos and finches, although other bird prey species have been recorded (TSSC 2020). Breeding occurs from June to November, when eggs are laid in the old nests of other birds, particularly those of other raptors or corvids. The nests chosen are usually in the tallest trees along watercourses, particularly River Red Gum (*Eucalyptus camaldulensis*) and Coolibah (*E. coolabah*). Falcons are also known to nest in telecommunication towers (TSSC 2020).

##### 9.3.4.4.3 Important Populations and Critical Habitat

There are currently no species-specific guidelines which define critical and supporting habitat for the Grey Falcon's survival.

This species typically occurs in timbered lowland plains, particularly *Acacia* shrublands near tree-lined watercourses. It has been observed in treeless areas and tussock grassland, open woodland (Garnett et al. 2014). The Grey Falcon has been observed hunting in treeless areas and frequenting tussock

grassland and open woodland, particularly in winter (TSSC 2020). Natural breeding sites are usually in trees, such as eucalypts, typically in the abandoned nests of crows and butcherbirds (Marchant and Higgins 1993, Johnstone and Storr 1998 cited in (Marchant and Higgins 1993, Johnstone and Storr 1998 cited in Biota 2026c). Telecommunications towers are also used regularly (Biota 2026d).

#### 9.3.4.4.4 Survey Adequacy

With a combined total of 62 avifauna survey sites, comprising 60 hours of survey effort expended across the locality of the Proposal (including 31.8 hours across 32 sites within the Development Envelope), the survey effort is considered sufficient for detection of the Grey Falcon (Biota 2026d), with a map of the survey effort shown in Figure 9-10.

#### 9.3.4.4.5 Occurrence and Habitat in the Region and Development Envelope

A single record of the species has been observed within the Development Envelope, in the MIA. The raptor was sighted over the main drilling area west of the Winu camp, initially sighted in active flight at relatively low altitude (approximately 10 m above ground) before gaining height and soaring over the area for an extended period before disappearing to the west (Biota 2026d). The observation occurred during a subterranean fauna survey, with overall observed bird numbers higher than on the two phases of terrestrial fauna survey. Large numbers of smaller birds, including Zebra Finches, Pied Honeyeaters, Masked Woodswallows and Budgerigars, were observed drinking from surface water retained in sumps around the drilling area. (Biota 2026c) considered it likely that the Grey Falcon was hunting within the MIA, attracted by the higher density of prey species.

The Grey Falcon is considered likely to occur in the Development Envelope as a foraging visitor given the diverse range of habitats utilised (Biota 2026d). There is no critical habitat within the Development Envelope as suitable nesting habitat (major drainages) and locally or regionally restricted foraging habitat do not occur (Biota 2026h, 2026d) (Figure 9-11).

Each of the five habitat types within the Development Envelope are considered supporting habitat for the Grey Falcon in the form of suitable foraging habitat (23,433 ha, representing 99% of the total Development Envelope (Biota 2026h).

Potential supporting habitats for the Grey Falcon within the Percival Palaeovalley do not host the large Eucalyptus trees utilised by the species for nesting (Biota 2026e).

Supporting habitat for the Grey Falcon throughout and surrounding the Development Envelope is shown in Table 9-9 and Figure 9-11, and records of the Grey Falcon in the surrounding region shown in Figure 9-12.

**Table 9-9: Grey Falcon Supporting Habitat in the Locality of the Proposal**

| Habitat Category | Total Extent Mapped (ha) | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) |
|---|---|---|---|
| **Supporting** – Shrub and Spinifex on Sandplain, Inland Sand Dune, Gravelly Lateritic Rises, Clayey Sandplain with Termitaria, Ephemeral Claypan | 698,964 | 23,433 | 4,775 |

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

N

Great Northern Hwy

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

NYANGU
PEO
(PAR

MARTU (AREA A)

## Legend

- Avifauna Census Site
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

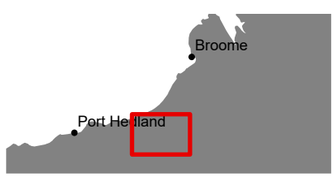
RioTinto

# Figure 9-10: Grey Falcon Survey Effort

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright




0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Survey Effort - Grey Falcon

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

Great Northern Hwy
Nyang_marta Hwy

N

NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

## Legend

- Grey Falcon
- Highway
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

### Fauna Habitat

- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

0 10 20
Kilometres

RioTinto

# Figure 9-11: Grey Falcon Records and Potential Habitat within and Surrounding the Development Envelope

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:450,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Grey Falcon Records and Potential Habitat

118°0'0"E
120°0'0"E
122°0'0"E
124°0'0"E
126°0'0"E
20°0'0"S
22°0'0"S
24°0'0"S

## Legend

- Grey Falcon Record (Biota)
- Grey Falcon Record (ALA Oct. 2025)
- Development Envelope
- Native Title Determinations

N

Great Northern Hwy
North West Coastal Hwy

RUBIBI COMMUNITY
BIRRIMAN-GAN
NYIKINA MANGALA and NYIKINA MANGALA #2
NYIKINA MANGALA
NOONKANBAH
GOONIYANDI COMBINED #2
YI-MARTUWARRA NGURRARA PART A
KARAJARRI PEOPLE (AREA A)
KARAJARRI PEOPLE (AREA B)
NGARLA AND NGARLA 2 (AREA A)
NYANGUMARTA PEOPLE (PART A)
NGURRARA (AREA A)
KARIYARRA PEOPLE
NYAMAL PEOPLE #10
NYAMAL PEOPLE #1
NGARLUMA / YINDJIBARNDI
KULYAKARTU & KULYAKARTU 2 PART A
NYAMAL PALYKU PROCEEDINGS
MARTU #2
YINDJIBARNDI #1
PALYKU PART A
EASTERN GURUMA
BANJIMA PEOPLE
MARTU (AREA A)
NYIYAPARLI PEOPLE
MARTU (PART B)
NGAANYATJARRA
BIRRILIBURU PEOPLE (PART A)

0 50 100 Kilometres

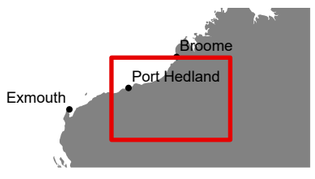
RioTinto

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:2,500,000
Rio Tinto © Copyright

# Figure 9-12: Grey Falcon Records in the Wider Region




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Records in Wider Region - Grey Falcon

#### 9.3.4.5 Princess Parrot (*Polytelis alexandrae*)

##### 9.3.4.5.1 Conservation Status

The Princess Parrot (Plate 9-4) is listed as Vulnerable under the EPBC Act and as a Priority 4 species by DBCA. The following policy and guidance documents are relevant to this species:

- Conservation Advice *Polytelis alexandrae* Princess Parrot (TSSC 2018)
- Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b).



*Source: Ted - https://www.flickr.com/photos/31801622@N07/4036548672*

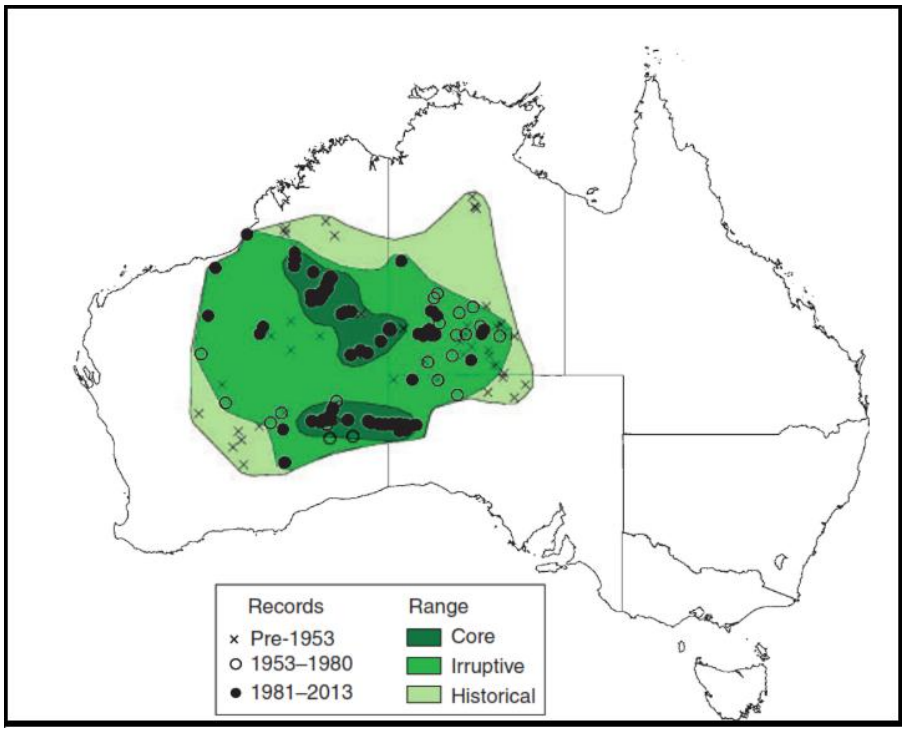
**Plate 9-4: Princess Parrot**

##### 9.3.4.5.2 Ecology and Distribution

The Princess Parrot is confined to arid regions of WA, the Northern Territory and South Australia, with the population understood to be mostly concentrated in the Great Sandy, Gibson, Tanami and Great Victoria Deserts, as well as the central ranges (Figure 9-13) (DCCEEW 2026). Little is known of its biology or ecology (Higgins 1999 cited in Biota 2026d) and its distribution is not well understood, with suggestions that it is centred on the eastern Great Sandy Desert, while others suggest that it may be the eastern Gibson Desert and western Great Victoria Desert (Pavey et al. 2014 cited in Biota 2026b), with the population estimated to consist of 5,000 breeding birds (DCCEEW 2026). Lake Tobin (the largest salt lake within the Percival Lakes chain, approximately 380 km east of the Proposal) is known to be an important area for the Princess Parrot (Biota 2026d).

The Princess Parrot feeds on grass seeds, *Acacia* seed pods, leaves and nectar (Higgins 1999 and Pavey et al. 2014 as cited in TSSC 2018). It is considered that the species may breed at any time of the year following rainfall, with nesting occurring in hollows or holes in *Eucalyptus* trees close to a watercourse (DCCEEW 2026).

The preferred habitat for the Princess Parrot includes sand dunes and sand flats; however, the species is also known to occur in open savanna woodlands and shrublands which typically consist of scattered strands of *Allocasuarina*, *Casuarina* or *Eucalyptus* (Biota 2026h).




*Source: Reproduced from Pavey et al. cited in Biota 2026d*

**Figure 9-13: The Geographical Range of the Princess Parrot**

#### 9.3.4.5.3 Important Populations and Critical Habitat

The importance of local or regional Princess Parrot populations is difficult to determine due to the lack of knowledge about the species (DCCEEW 2026). However, the population around Lake Tobin in the Percival Lakes chain of the Great Sandy Desert, approximately 380 km east of the Development Envelope, is considered likely to be of greatest importance (Carter 1993, cited in DCCEEW 2024).

The preferred habitat for the Princess Parrot includes sand dunes and sand flats; however, the species is also known to occur in open savanna woodlands and shrublands which typically consist of scattered strands of *Allocasuarina, Casuarina* or *Eucalyptus* (Biota 2026h).

Currently, no species-specific guidelines define critical or supporting habitat for the survival of the Princess Parrot.

#### 9.3.4.5.4 Survey Adequacy

With a combined total of 62 avifauna survey sites, comprising 60 hours of survey effort expended across the locality of the Proposal (31.8 hours across 32 sites within the Development Envelope), the DEWHA (2010b) survey effort recommendations for Princess Parrot have been met and exceeded (Biota 2026d), with a map of the survey effort shown in Figure 9-14. No waterholes were present within the Development Envelope during the survey period. Though the Winu avifauna surveys were recording the general avifauna assemblage, the Princess Parrot's distinctive colouration and noisy behaviour during morning and evening means that it if was present, it could have been recorded during any of the vertebrate fauna surveys undertaken over the 2017–2024 period, as well as opportunistically during subterranean fauna surveys (Biota 2026d).

The irruptive nature of populations of this species means that it could be present within the Development Envelope on occasion, likely foraging on spinifex during seeding events; however, it would be difficult to confirm this unless survey timing coincided with this species' periodic presence (Biota 2026d).

#### 9.3.4.5.5 Occurrence and Habitat in the Region and Development Envelope

The Princess Parrot has not been recorded within the Development Envelope or the locality; however, the species is considered to potentially occur within the Development Envelope due to the presence of suitable habitat (Biota 2026h). Although there is no species-specific guidance on critical or supporting habitat for the Princess Parrot, the Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types within the Development Envelope are considered to provide supporting habitat for the Princess Parrot.

*Eucalyptus victrix* tall open woodland habitats within the Percival Palaeovalley also provide potential supporting habitat as a 'secondary' foraging resource for the Princess Parrot (Biota 2026e).

Supporting habitat for the Princess Parrot throughout and surrounding the Development Envelope is shown in Table 9-10 and Figure 9-15, and records of the Princess Parrot in the surrounding region shown in Figure 9-16. This data and mapping do not include additional potential supporting habitat available in the Percival Palaeovalley.

**Table 9-10: Princess Parrot Supporting Habitat in the Locality of the Proposal**

| Habitat Category | Total Extent Mapped (ha) | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) |
|---|---|---|---|
| **Supporting** – Inland Sand Dune and Shrub and Spinifex on Sandplain | 665,154 | 20,143 | 4,498 |

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
21°0'0"S

N

Great Northern Hwy

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

## Legend

- Avifauna Census Site
- Development Envelope
- Conceptual Footprint
- Native Title Determinations

RioTinto

# Figure 9-14: Princess Parrot Survey Effort




**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright

0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Survey Effort - Princess Parrot

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

KARAJARRI PEOPLE (AREA B)
KARAJARRI PEOPLE (AREA A)
N
Great Northern Hwy
Nyangumarta Hwy
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

**Legend**

- Highway
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Development Envelope
- Conceptual Footprint
- Native Title Determinations

Fauna Habitat

- Inland Sand Dune
- Shrub and Spinifex on Sandplain

0 10 20 Kilometres

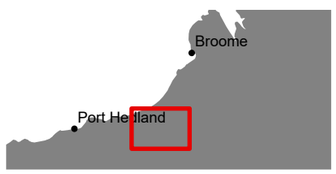
RioTinto

**Figure 9-15: Princess Parrot Records and Potential Habitat Surrounding the Development Envelope**

Rio Tinto Copper (RTC)

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright




Path: _\\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx/

118°0'0"E
120°0'0"E
122°0'0"E
124°0'0"E
126°0'0"E
20°0'0"S
22°0'0"S
24°0'0"S

N

BIRRIMAN-GAN
NYIKINA MANGALA
NYIKINA MANGALA and NYIKINA MANGALA #2
NOONKANBAH
GOONIYANDI COMBINED #2
KARAJARRI PEOPLE (AREA A)
KARAJARRI PEOPLE (AREA B)
YI-MARTUWARRA NGURRARA PART A
NGARLA AND NGARLA 2 (AREA A)
NYANGUMARTA PEOPLE (PART A)
NGURRARA (AREA A)
North West Coastal Hwy
KARIYARRA PEOPLE
NYAMAL PEOPLE #10
NYAMAL PEOPLE #1
NGARLUMA / YINDJIBARNDI
KULYAKARTU & KULYAKARTU 2 PART A
NYAMAL PALYKU PROCEEDINGS
MARTU #2
YINDJIBARNDI #1
PALYKU PART A
MARTU (AREA A)
Great Northern Hwy
NYIYAPARLI PEOPLE
MARTU (PART B)
NGAANYATJARRA LANDS (AREA A)
BIRRILIBURU PEOPLE (PART A)
WAJARRI YAMATJI PART A
GINGIRANA
PILBARA NATURE RESERVE
PILBARA NATURE RESERVE

## Legend

- Princess Parrot Record (ALA Oct. 2025)
- Development Envelope
- Native Title Determinations

0 50 100 Kilometres

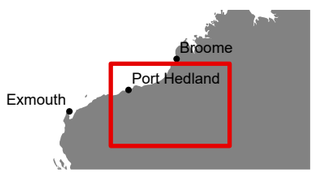
RioTinto

# Figure 9-16: Records of the Princess Parrot in the Wider Region

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:2,500,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx| Layout: EPBC Records in Wider Region - Princess Parrot

#### 9.3.4.6 Black-footed Rock-wallaby/Moororong (*Petrogale lateralis lateralis*)

##### 9.3.4.6.1 Conservation Status

Black-footed Rock-wallaby (Plate 9-5) is listed as Endangered under the BC Act and EPBC Act. The following policy and guidance documents are relevant to this species:

- Conservation Advice *Petrogale lateralis lateralis* Black-flanked Rock-wallaby (TSSC 2016b)
- Recovery Plan for Five Species of Rock Wallabies: Black-footed Rock Wallaby (*Petrogale lateralis*), Rothschild Rock Wallaby (*Petrogale rothschildi*), Short-eared Rock Wallaby (*Petrogale brachyotis*), Monjon (*Petrogale burbidgei*) and Nabarlek (*Petrogale concinna*) (Pearson 2013)
- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011a).



*Source: Third Silence Nature Photography - https://creativecommons.org/licenses/by-sa/4.0/*

**Plate 9-5: Black-footed Rock-wallaby**

##### 9.3.4.6.2 Ecology and Distribution

Although sporadically distributed, the Black-footed Rock-wallaby was once widespread throughout most of WA. It is known to have occurred from just south of the Kimberley Region to the southern coastline of WA and east to Mount Ragged in Cape Arid National Park (TSSC 2016b). The species distribution has since greatly declined and is now restricted to a few subpopulations in small patches of suitable habitat in central and southern WA as well as some offshore islands.

The Black-footed Rock-wallaby is an herbivorous marsupial. They are primarily crepuscular (active during twilight) and nocturnal, emerging from their shelters to feed on grasses, forbs, shrubs and occasionally seeds and fruits. Typically, they forage close to their rocky refuges but are known to move up to several hundred metres away if food is unavailable near their shelter. Breeding can occur throughout the year depending on rainfall and food availability (Willers et al. 2011, cited in TSSC 2016b). The species is also known to exhibit embryonic diapause where an embryo may become dormant until suitable conditions occur for development.

Black-footed Rock-wallaby primarily inhabits rockpiles and other rocky habitats that provide shelter in the form of caves, cliffs and boulder screes during the day. Habitat critical to the species' survival requires sufficient cave and crevice development to provide shelter from extreme temperatures and predation (Biota 2026h). Feeding occurs as close to shelter as possible (especially if predators are present); however, if food is not available near an area of shelter, they will move up to several hundred metres away to obtain it.

#### 9.3.4.6.3 Important Populations and Critical Habitat

Important populations of Black-footed Rock-wallaby identified in the species' Recovery Plan are the populations occurring within Barrow Island, Cape Range, Calvert Range, Salisbury Island and the WA Wheatbelt (Pearson 2013).

Black-footed Rock-wallaby primarily inhabits rockpiles and other rocky habitats that provide shelter in the form of caves, cliffs and boulder screes during the day. Habitat critical to the species' survival requires sufficient cave and crevice development to provide shelter from extreme temperatures and predation (Biota 2026h). Feeding occurs as close to shelter as possible (especially if predators are present); however, if food is not available near an area of shelter, they will move up to several hundred metres away to obtain it.

According to the species' Conservation Advice, habitat critical to the survival of the Black-footed Rock-wallaby comprises rocky areas such as caves, cliffs, screes and rockpiles which occur within the species' distribution, and surrounding native grasses (TSSC 2016b). Rocky areas provide protection from predators and cool refuges from heat extremes (Pearson 2013).

#### 9.3.4.6.4 Survey Adequacy

The Black-footed Rock-wallaby was initially detected in the Winu locality within an area of rockpiles east of the RAC (Biota 2026d). Additional search effort was then targeted at the neighbouring rockpiles in this area. Rockpiles were recorded opportunistically during helicopter flyovers and were then ground-truthed, with targeted searches and habitat assessments undertaken. Sign evidence of the Black-footed Rock-wallaby (scats or tracks) and potential food sources (e.g. *Ficus* spp.) were recorded (Biota 2026d). Most effort targeting this species was directed at recording presence via sign, in order to maximise the amount of prospective rocky habitat that could be searched. In addition to this, one combination Elliott and cage trap transect was also deployed, as well as 13 baited motion cameras which were set up in rocky areas to target the species. These methods are in accordance with those recommended for the species (DSEWPaC 2011a).

A description and map of the survey effort is provided below, summarised in Table 9-11 and shown in Figure 9-17.

One combination Elliott and cage trap transect was deployed in Rocky Outcropping habitat outside of the Development Envelope during Phase 1 of the detailed survey for the AREH project (Biota 2026d). This trap line was not run for subsequent phases due to temperature constraints. Five cages were run over seven nights, amounting to a total effort of 35 nights.

A total of 13 baited motion cameras were deployed targeting the Black-footed Rock-wallaby in Rocky Outcropping habitat outside of the Development Envelope (Biota 2026d). The total survey effort was 937 camera nights, which comprised eight cameras deployed for between 4-7 nights and five long-term camera deployments, each for 179 nights. None of the motion camera sites were located within the Development Envelope due to an absence of suitable habitat for the species there.

In addition, 196 diurnal (157 inside the Development Envelope) and 10 nocturnal searches (nine within Development Envelope) were also conducted, which had potential to record the species through direct observation or detection of secondary signs (Biota 2026d).

A total of 45 targeted searches were undertaken specifically targeting the Black-footed Rock-wallaby in Rocky Outcropping habitat (Biota 2026d). At the time the searches were completed, the Development

Envelope encompassed a greater proportion of rocky habitat. However, due to changes in the definition of the project, only two of these search locations now sit within the current Development Envelope as the Development Envelope was modified to avoid the Rocky outcropping habitat.

Ten nocturnal searches were undertaken (nine within the Development Envelope), which had potential to record the species through direct observation or detection of secondary signs (Biota 2026d).

**Table 9-11: Summary of Survey Effort targeting Black-footed Rock-wallaby in the Locality of the Proposal**

| Survey Methodology | Survey Effort | |
|---|---|---|
| | Inside Development Envelope | Outside Development Envelope |
| **Systematic** | | |
| Elliott/Elliott and cage trap sites | Nil (due to lack of habitat) | 1 site (35 cage nights) |
| **Non-systematic** | | |
| Motion Camera (short and long-term deployments) | Nil (due to lack of habitat) | 13 sites (937 camera nights) |
| General Searches | 157 | 39 |
| Targeted Searches | 2 | 43 |
| Nocturnal Searches | 9 | 1 |

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

N

Great Northern Hwy

KARAJARRI PEOPLE (AREA A)

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

0 500 1,000
Metres

0 10 20
Kilometres

## Legend

- Development Envelope
- Native Title Determinations
- Conceptual Footprint
- Targeted Search
- Nocturnal Search
- Motion Camera Site
- General Search
- Elliot/cage Site

RioTinto

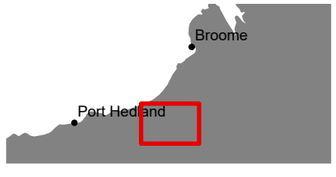
# Figure 9-17: Black-footed Rock-wallaby Survey Effort


**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 25 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000

Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Survey Effort - BFRW

#### 9.3.4.6.5 Occurrence and Habitat in the Region and Development Envelope

Rockpiles and rocky outcroppings in the locality of the Proposal represent locally restricted shelter habitat for the Black-footed Rock-wallaby (Biota 2026d).

The Black-footed Rock-wallaby has not been recorded within the Development Envelope. However, the species has been recorded approximately 2 km east of the Development Envelope at the eastern section of the RAC through both direct observations and secondary evidence (scats and tracks) and is known to occur throughout the wider region (Biota 2026h). The location of this population is at the margin of the distribution of the nominate subspecies *lateralis* and the West Kimberley subspecies *kimberleyensis*, formally described in 2020 (Eldridge and Potter 2020 cited in (Biota 2026d). The next nearest records of the species are more than 300 km from the Winu records (Biota 2026d).

The species is considered likely to occur within the Rocky Outcropping habitat that occurs adjacent to the Development Envelope near this section of the RAC, which is considered critical habitat for the species (Figure 9-18) (Biota 2026h). Individuals would also occasionally travel outside of these areas for the ecological functions discussed below (e.g. long-range dispersal), but this is expected to be an infrequent occurrence, and these areas have not been characterised as either critical or supporting habitat.

Targeted searches provided numerous scat and track records, and two individuals were also recorded in cage traps and multiple individuals recorded on motion cameras and sighted on rockpiles after dawn (Biota 2026d). The records were concentrated around two rockpile areas north-east of the RAC:

- Rockpile area A: approximately 1-3 km east-north-east of the RAC. Abundant scats recorded and individuals regularly sighted and recorded on motion cameras from 2017–2023
- Rockpile area B: approximately 16 km north-east of the eastern RAC. Abundant scats recorded in 2018.

The closest distance between records from these two areas is approximately 14 km and it is not known if individuals move between the two (Biota 2026d). Outside of these two rockpile areas, a single track and scat were also recorded approximately 22 km and 34 km south of the western section of the RAC, respectively, during a 2023 survey for the AREH project (Figure 9-18, Figure 9-19). The scat was found in Rocky Outcropping habitat and was not fresh. Attempted molecular analysis failed to confirm species identification. The scat location is approximately 65-75 km west-south-west of rockpile areas A and B.

The assessment indicated that although home ranges can vary, the majority of studies suggested a 400 m foraging limit from the rock-wallabies' diurnal refuges. Variability in range was thought to possibly relate to weight, sexual and food availability differences. Furthermore, a lower limit of 100 m was suggested in another study (Pearson 2013 cited in Biota 2025c). Another study noted the typically sedentary habitat of the rock-wallaby, with movements of up to 300 m to forage appearing to occur in exceptional circumstances, with their instincts, based on predator-fear behaviour, usually restricting foraging to 30 m from shelter sites (Pentland 2015 cited in Biota 2025c). Dispersal can occur over several kilometres; however, such long-range dispersal is infrequent, based on genetic structuring of populations, and they appear to be able to tolerate high levels of in-breeding (Pearson et al. 2016 cited in Biota 2025c). Given the infrequency of these longer range movements, areas outside the Rocky Outcropping habitat were not considered critical habitat (Biota 2026d).

While the numbers of animals present in the colonies cannot be determined from available survey records, research from other rock-wallaby species indicates that group size appears to be linked to the number and size of caves – i.e. the more shelter sites available the larger the colony (Biota 2026d). As such the presence of numerous scats and regular sightings of individuals, along with the regular records of the species in these areas from 2017-2023 suggest the presence of resident populations in the rockpiles areas A and B, outside the Development Envelope.

Although no 'supporting' habitat has been identified outside the (critical) Rocky Outcropping habitat identified by Biota (2026b), given some foraging can occur at the fringes of rock outcrops to a likely

maximum of up to 400 m, the Proponent proposes supporting habitat notionally and conservatively be considered to include a 500 m buffer around Rocky Outcropping habitat areas.

The Black-footed Rock-wallaby is considered likely to occur as a transient visitor within the Development Envelope in areas of supporting habitat. As the species is known to forage approximately 300 m from critical habitat, supporting habitat for the Black-footed Rock-wallaby has been conservatively defined as the Shrub and Spinifex on Sandplain and Gravelly Lateritic Rises habitat types which occur within 500 m of Rocky Outcropping habitat (G. Humphreys pers. comms. July 2025).

Critical and supporting habitat extents are described in Table 9-12 and Figure 9-18.

**Table 9-12: Black-footed Rock-wallaby Critical and Supporting Habitat in the Locality of the Proposal**

| Habitat Category | Total Extent Mapped (ha) | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) |
|---|---|---|---|
| **Critical** – Rocky Outcropping | 387.2 | - | - |
| **Supporting** – 500 m buffer around Rocky Outcropping (Shrub and Spinifex on Sandplain / Gravelly Lateritic Rises) | 4,410.2 | 18.8 | 3.6 |

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

Great Northern Hwy
Nyangumarta Hwy
N

NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

0 250 500
Metres

0 2 4
Kilometres

0 10 20
Kilometres

**Legend**

- Black-footed Rock-wallaby
- Highway
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Conceptual Footprint
- Development Envelope
- Native Title Determinations
- Rock Outcropping - 500m Buffer

Fauna Habitat

- Gravelly lateritic rises
- Inland sand dunes
- Rock outcropping
- Shrub and spinifex on sandplain

RioTinto

**Figure 9-18: Black-footed Rock-wallaby Records and Potential Habitat Surrounding the Development Envelope**

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:450,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Black Footed Rock Wallaby Records and Potential Habitat

118°0'0"E
120°0'0"E
122°0'0"E
124°0'0"E
126°0'0"E
20°0'0"S
22°0'0"S
24°0'0"S

N

BIRRIMAN-GAN
NYIKINA MANGALA
NOONKANBAH
GOONIYANDI
KARAJARRI PEOPLE (AREA A)
KARAJARRI PEOPLE (AREA B)
NGARLA AND NGARLA 2 (AREA A)
NYANGUMARTA PEOPLE (PART A)
North West Coastal Hwy
KARIYARRA PEOPLE
NYAMAL PEOPLE #10
NYAMAL PEOPLE #1
NGARLUMA / YINDJIBARNDI
KULYAKARTU & KULYAKARTU 2 PART A
NYAMAL PALYKU PROCEEDINGS
PALYKU PART A
Great Northern Hwy
NYIYAPARLI PEOPLE
MARTU (PART B)
NGAANYATJARRA LANDS (AREA A)
BIRRILIBURU PEOPLE (PART A)
WAJARRI YAMATJI PART A
GINGIRANA
RESERVE
RESERVE

0 1 2
Kilometers

0 1 2
Kilometers

0 50 100
Kilometres

## Legend

- BFRW Record (Biota)
- BFRW Record (ALA Oct. 2025)
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

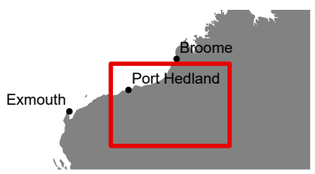
RioTinto

# Figure 9-19: Records of the Black-footed Rock-wallaby in the Wider Region

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:2,500,000
Rio Tinto © Copyright



#### 9.3.4.7 Northern Quoll (*Dasyurus hallucatus*)

##### 9.3.4.7.1 Conservation Status

The Northern Quoll (Plate 9-6) is listed as Endangered under the BC Act and EPBC Act. The following policy and guidance documents are relevant to this species:

- Commonwealth Listing Advice on Northern Quoll (*Dasyurus hallucatus*) (TSSC 2005)
- National Recovery Plan for the Northern Quoll *Dasyurus hallucatus* (Hill and Ward 2010)
- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011a)
- EPBC Act Referral Guideline for the Endangered Northern Quoll *Dasyurus hallucatus* (DoE 2016).



*Source Nature: 2018*

**Plate 9-6: Northen Quoll**

##### 9.3.4.7.2 Ecology and Distribution

Historically, the Northern Quoll extended across much of northern Australia from the North West Cape of WA to south-east Queensland. However, in the past 50 years the species' abundance and geographic extent has significantly declined, and it is currently restricted to five regional populations across Queensland, the Northern Territory and WA on the mainland and offshore islands (DCCEEW 2026).

The Northern Quoll is a nocturnal, carnivorous marsupial, that feeds opportunistically, preying on invertebrates, small mammals, reptiles, birds and carrion. Northern Quolls breed once each year, producing on average seven offspring born after a gestation period of 21 to 26 days. Young become reproductively mature at about 11 months (DCCEEW 2026). The discrete male cohorts that arise within populations can make quolls susceptible to local population extinctions, particularly if no juvenile male quolls survive to adulthood for mating given the loss of older males after breeding (Braithwaite and Griffiths 1994, Oakwood 2000 cited in Biota 2025c). As a result, any factor that results in significant

increases in mortality rates of female and juvenile quolls could result in the loss of local populations (Biota 2026d). Northern Quolls are considered sedentary with a home range of about 35 ha.

#### 9.3.4.7.3 Important Populations and Critical Habitat

Northern Quolls occupy a variety of habitats, including iron and sandstone ridges, scree slopes, granite boulders and outcrops, drainage lines, riverine habitats, dissected rocky escarpments, open forest of lowland savannah and woodland (Hill and Ward 2010). Core populations of the Northern Quoll persist in dissected rocky habitats (ranges, escarpments, gorges, boulder fields) as well as along major drainage lines and treed creek lines which support tree hollows and hollow logs (Turpin and Bamford 2015 cited in Biota 2025c).

Habitat important to the survival of Northern Quoll is characterised by protection from threats. Areas of rocky outcrops, gorge habitats and offshore islands are particularly important (i.e. critical to the species' survival), providing a diversity of microhabitats, retention of water and protection from predators (Hill and Ward 2010).

Northern Quoll populations which constitute an 'important population' include (DoE 2016):

- High-density populations that occur in refuge-rich habitat critical to the survival of the species and can include habitat where Cane Toads are present
- Populations free of Cane Toads and unlikely to sustain Cane Toad populations upon their arrival, for example, populations within a desert context and without permanent water
- Populations subject to conservation or research programs – that is, populations monitored by government agencies or universities.

The National Recovery Plan for Northern Quoll (Hill and Ward 2010) defines critical habitat as a habitat 'where Northern Quolls are least exposed to threats or least likely to be in the future… two particular broad habitat types fall into this category: rocky areas and offshore islands. Daytime den sites, in particular, provide important shelter and protection for Northern Quolls from predators and weather'.

#### 9.3.4.7.4 Survey Adequacy

Due to the overlap in habitat preferences between the Northern Quoll and Black-footed Rock-wallaby, the survey effort expended across both the Proposal and AREH project is the same for both species, with the exception of an additional Elliott trap transect being deployed for the Northern Quoll (Biota 2026d). Survey methods involved targeted and general searches (diurnal and nocturnal), baited motion camera deployment and Elliott and cage trapping within and outside the Development Envelope. These methods are in accordance with those recommended for the species by DSEWPaC (2011a).

A description and map of the survey effort is provided below, summarised in Table 9-13 and shown in Figure 9-20.

Two Elliott trap lines were deployed; one was a combination of 10 large and 25 medium sized traps run over two phases (total effort = 245 nights) (Biota 2026d). The other was a combination of 40 medium, 20 large Elliott traps and 5 cage traps run only during one phase due to temperature considerations (total effort = 420 nights for Elliott traps, 35 nights for cage traps). Both sites were located in Rocky Outcropping habitat outside of the Development Envelope.

A total of 13 motion cameras were deployed targeting the Northern Quoll in Rocky Outcropping habitat (Biota 2026d). The survey effort totalled 937 nights, comprised of eight cameras deployed for between 4-7 nights and five long-term camera deployments, each for 179 nights. None of the motion camera sites were located within the Development Envelope due to an absence of suitable habitat for Northern Quoll.

In addition to the cage and camera trapping, 196 diurnal (157 inside the Development Envelope) and 10 nocturnal searches (nine within the Development Envelope) were conducted, which had potential to record the species via direct observation, or via secondary signs (Biota 2026d).

A total of 45 targeted searches were undertaken specifically targeting the Northern Quoll in Rocky Outcropping habitat (Biota 2026d). Only two of these searches which were within the Development Envelope, reflecting the lack of preferred habitat for this species in the area.

Ten nocturnal searches were undertaken (nine within the Development Envelope), which had potential to record the species through direct observation or detection of secondary signs (Biota 2026d).

**Table 9-13: Summary of Survey Effort targeting Northern Quoll in the Locality of the Proposed Action**

| Survey Methodology | Survey Effort | |
|---|---|---|
| | Inside Development Envelope | Outside Development Envelope |
| **Systematic** | | |
| Elliott/Elliott and cage trap sites | Nil (due to lack of habitat) | 2 site (665 nights) |
| **Non-systematic** | | |
| Motion Camera (short and long-term deployments) | Nil (due to lack of habitat) | 13 sites (937 nights) |
| General Searches | 157 | 39 |
| Targeted Searches | 2 | 43 |
| Nocturnal Searches | 9 | 1 |

#### 9.3.4.7.5 Occurrence and Habitat in the Region and Development Envelope

The Northern Quoll has not been recorded within the Development Envelope. However, secondary evidence (one scat) was recorded approximately 0.3 km outside the RAC in the Rocky Outcropping habitat type (Figure 9-21) (Biota 2026h). Another scat was found approximately 25 km south of the RAC. These records occurred in Shrub and Spinifex on Sandplain and Gravelly Lateritic Rises habitats, and both further than 3 km from any Rocky Outcropping habitat.

No evidence of denning in the form of larger scat piles was recorded, no individuals were trapped and none were recorded on automated cameras. Areas utilised intensively by Northern Quolls are readily identified by the presence of latrines at their dens, which remain in the landscape for many years even when the dens cease to be used (Biota 2026d).

Although the species has been recorded immediately adjacent to the Development Envelope, it is likely that it occurs primarily as a transient visitor and/or at low density within the Development Envelope, given the paucity of records despite extensive survey effort (Biota 2026h). This is supported by an analysis of Northern Quoll movements and home ranges undertaken by Biota (2026b). One analysis of six home range studies of Northern Quolls in the Pilbara provided home range estimates using two methods: minimum convex polygons (MinCP) and kernel density estimation (KDE) (Cowan et al 2020 cited in (Biota 2026d). The analysis found that females (up to 31 ha) occupied smaller home ranges than males (up to 643 ha) as follows:

- Female home range: between 13.7 to 25.9 ha (MinCP) and 17.5 to 30.9 ha (KDE)
- Male home range: between 90.4 to 213.7 ha (MinCP) and 341.5 to 643.1 ha (KDE).

Males are known to travel long distances during breeding season, which means it is justifiable to presume that any quolls moving large distances from critical habitat are likely to be males in that season (Biota 2026d). As discussed, the scat records found in the locality of the Proposal were observed in Shrub and Spinifex on Sandplain and Gravelly Lateritic Rises habitat further than 3 km from Rocky Outcropping and not associated with denning habitat. These are considered to represent an individual, most likely a male, dispersing through the wider Winu locality, and not part of a resident population.

No Rocky Outcropping habitat or habitat otherwise considered critical to the species' survival occurs within the Development Envelope.

Critical habitat for Northern Quoll in the locality of the Proposal is considered to be mapped areas of Rocky Outcropping (i.e. 'core' habitat) to encompass breeding, shelter and foraging habitat with supporting habitat notionally and conservatively comprising a buffered zone of 1 km to encompass any potential foraging excursions around the core.

This definition of critical and supporting habitat is based on:

- A study of the species' movement ecology, confirming their strong preference for rocky habitats (Cowan et al. 2024 and Gibson et al. 2023 cited in Biota 2025b)
- The EPBC Act referral guidelines for Northern Quoll, which recognises the above point and considers foraging and dispersal habitat to be the immediate area (i.e. 1 km) of shelter habitat, quoll records, or land comprising predominantly native vegetation that is connected to shelter habitat within the range of the species (Commonwealth of Australia 2016 cited in Biota 2025b).

While it is possible that all habitat types mapped within the Development Envelope may be used by the species to disperse or forage, the 1 km area around surrounding Rocky Outcropping is more likely to be used by the Northern Quoll, as potential supporting habitat, given the strong home range preference within rocky outcrops, transient visitation within the broader area and low local population density (Biota 2025b).

The habitat types which are intercepted by the 1 km buffer near the Development Envelope are Shrub and Spinifex on Sandplain, and Gravelly Lateritic Rises.

Habitat for the Northern Quoll within and surrounding the Development Envelope is shown on Figure 9-21 and records of the Northern Quoll in the surrounding region are shown on Figure 9-22.

**Table 9-14: Northern Quoll Critical and Supporting Habitat in the Locality of the Proposal**

| Habitat Category | Total Extent Mapped (ha) | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) |
|---|---|---|---|
| **Critical** – Rocky Outcropping | 387.2 | -- | -- |
| **Supporting** – 1 km buffer around Rocky Outcropping (Shrub and Spinifex on Sandplain / Gravelly Lateritic Rises) | 33,055.9 | 87.1 | 15.4 |

**Rounding to one decimal place from 99.95%*

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

KARAJARRI PEOPLE (AREA B)

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

Great Northern Hwy

N

0 500 1,000
Metres

0 10 20
Kilometres

## Legend

- Motion Camera Site
- Elliot Site
- Elliot/cage Site
- Targeted Search
- Nocturnal Search
- General Search
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

RioTinto

# Figure 9-20: Northern Quoll Survey Effort




**Rio Tinto Copper (RTC)**

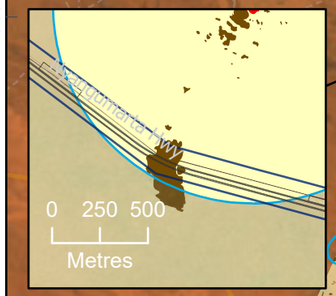
**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

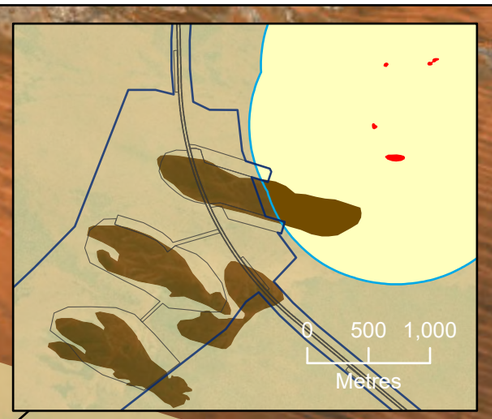
**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright

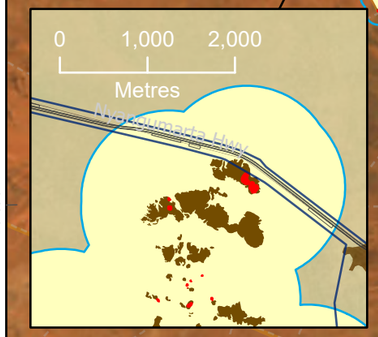
Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Survey Effort - Northern Quoll

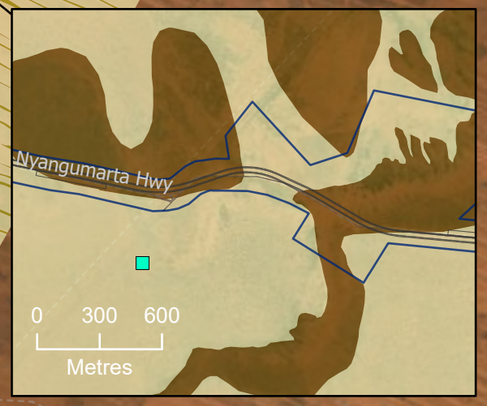
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
120°30'0"E

Great Northern Hwy
Nyangumarta Hwy
Nyangumarta Hwy




NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

0 10 20 Kilometres

N

## Legend

- Northern Quoll
- Highway
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Development Envelope
- Conceptual Footprint
- Native Title Determinations
- Rock Outcropping - 1km Buffer
- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

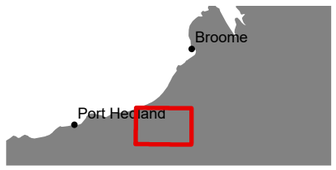
RioTinto

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter
**Scale:** 1:450,000
Rio Tinto © Copyright

**Figure 9-21: Northern Quoll Records and Potential Habitat Surrounding the Development Envelope**




Path: _\\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx - ERD - Northern Quoll Records and Potential Habitat

116°0'0"E
118°0'0"E
120°0'0"E
122°0'0"E
124°0'0"E
18°0'0"S
20°0'0"S
22°0'0"S
24°0'0"S

N

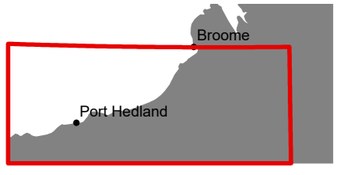
NYIKINA MANGALA
NYIKINA MANGALA and NYIKINA MANGALA #2
KARAJARRI PEOPLE (AREA A)
NYANGUMARTA PEOPLE (PART A)
NGURRARA (AREA A)
NGARLA AND NGARLA 2 (AREA A)
Great Northern Hwy
KARIYARRA PEOPLE
NYAMAL PEOPLE #10
NYAMAL PEOPLE #1
YABURARA AND MARDUDHUNERA PEOPLE
NGARLUMA / YINDJIBARNDI
North Coastal Hwy
NYAMAL PALYKU PROCEEDINGS
PALYKU PART A
Nyangumarta Hwy
EASTERN GURUMA
BANJIMA PEOPLE
PINIKURA
MARTU (AREA A)
NYIYAPARLI PEOPLE
JARNUWANGGA
WAJARRI AND
GARLAWANGGA
BIRRILIBURU PEOPLE (PART A)

## Legend

- Northern Quoll Record (Biota)
- Northern Quoll Record (ALA Oct. 2025)
- Development Envelope
- Native Title Determinations

RioTinto

**Figure 9-22: Records of the Northern Quoll in the Wider Region**




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 19 June 2026

**Coordinate System:**
GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter
**Scale:** 1:2,500,000
Rio Tinto © Copyright

0 150 300 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx - ERD - Northern Quoll Records Wider Region

#### 9.3.4.8 Greater Bilby/Mankarr (*Macrotis lagotis*)

##### 9.3.4.8.1 Conservation Status

The Greater Bilby (Plate 9-7) is listed as Vulnerable under the BC Act and EPBC Act. The following policy and guidance documents are relevant to this species:

- Conservation Advice *Macrotis lagotis* Greater Bilby (TSSC 2016a)
- Recovery Plan for the Greater Bilby (*Macrotis lagotis*) (Commonwealth of Australia 2023)
- Guidelines for Surveys to Detect the Presence of Bilbies, and Assess the Importance of Habitat in Western Australia (DBCA 2017b)
- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011a)(Commonwealth of Australia 2023).



*Source: Queensland Government - https://creativecommons.org/licenses/by/4.0/deed.en*

**Plate 9-7: Greater Bilby**

##### 9.3.4.8.2 Ecology and Distribution

Historically, the Greater Bilby extended across over 70% of the Australian mainland in mostly the arid and semi-arid interior (Commonwealth of Australia 2023). Since the late 1800s, the species' abundance and geographic extent has significantly declined and is currently restricted to approximately 20% of its historic range. The species is patchily distributed from the Tanami Desert in the Northern Territory to Broome and Warburton in WA with a smaller isolated extent occurring in southwest Queensland (Commonwealth of Australia 2023).

The Greater Bilby is an omnivorous mammal that often digs for food such as invertebrates, larvae, bulbs, fruit, seeds, and fungi (Commonwealth of Australia 2023). Breeding occurs once each year, with litters between one and three offspring depending on season conditions and food availability. The gestation period is 12–14 days, while young will stay in the pouch for approximately 75–80 days, with females tending their young in a burrow for another two weeks (Southgate et al. 2019). The Greater Bilby is solitary and shelters in deep burrows. Burrow use is relatively dynamic, with individuals maintaining several burrows at once and continually abandoning, re-using, or excavating new burrows.

#### 9.3.4.8.3 Important Populations and Critical Habitat

The Greater Bilby is considered a single population which has been fragmented into smaller groups (Commonwealth of Australia 2023). Each of these groups are considered important, with the concept of 'important populations' not considered relevant to the species' conservation.

The Greater Bilby occupies a range of habitats, including desert sandplains and dunefields, typically with Acacia shrubland and or spinifex hummock grasslands.(Commonwealth of Australia 2023). The species have large, shifting home ranges that change in response to food availability (Southgate et al. 2007).

At the time of drafting the Greater Bilby Recovery Plan (Commonwealth of Australia 2023), 'a set of comprehensive habitat descriptions to define habitat critical to survival was unavailable'. However, the plan provides interim guidance on critical habitat that includes:

- Any area where the species is known or likely to occur as shown on the distribution map on the Greater Bilby Species Profile and Threats Database (SPRAT) profile
- Any location outside of the known likely distribution where Greater Bilbies are found to occur
- Any area between the areas noted above that may be periodically occupied by Greater Bilbies
- Any area which Greater Bilbies may naturally colonise or may feasibly be reintroduced.

The Recovery Plan acknowledges that a greater understanding of Greater Bilby habitat should be sought from published literature and experts, including Indigenous experts (Commonwealth of Australia 2023).

#### 9.3.4.8.4 Survey Adequacy

A significant amount of survey effort has been undertaken in the Development Envelope and the broader Winu locality between 2017 and 2025 for both the Proposal and AREH projects (Biota 2026a), including:

- A three-phase seasonal detailed fauna survey for the AREH Project (which overlaps the RAC)
- A targeted fauna survey for AREH
- A two-phase seasonal detailed fauna survey of the MIA
- Targeted surveys of a Bilby population south of the MIA (2019, 2022, 2024 and 2025 censuses)
- Six basic and targeted fauna surveys across the MIA, RAC and regional borefield options as the Proposal developed.

Survey methodology employed across these surveys includes:

- Targeted searches for secondary evidence in highly suitable habitat
- General searches for secondary evidence in broadly suitable habitat
- 2 ha sign plots
- Nocturnal surveys
- Deployment of motion cameras
- Searches on transect in areas known to support bilbies.

A summary of the consolidated survey effort applicable to the Greater Bilby from 2017 to 2025 is provided in Table 9-15 and Figure 9-23.

**Table 9-15: Greater Bilby Survey Effort in Proposal Locality**

| Survey Methodology | Survey Effort | | |
|---|---|---|---|
| | Inside DE | Outside DE | Total |
| Targeted searches | 67 | 71 | **138** |
| General searches | 178 | 59 | **237** |
| 2 ha sign plot | 9 | 6 | **15** |
| Nocturnal searches | 9 | 1 | **10** |
| Motion camera (short and long-term deployments) | 12 sites (44 nights) | 31 sites (1,340 night) | **43** |
| Transect searches | - | 28 | **28** |

Consolidated records of Bilby sign evidence (comprising evidence of both current use and past use) from the Winu and AREH projects from 2017-2025 are presented in Figure 9-26.Following identification of a Bilby population to the south-east of the Development Envelope from the above survey effort, targeted Greater Bilby Abundance Surveys were commissioned to be undertaken every two years. The abundance surveys comprised strip transect traverses to record sign evidence of the species (tracks, scats, diggings and/or burrows) (Biota 2026a). Habitat mapping was also undertaken.

The area known to support the Greater Bilby population encompassed approximately 344 ha of highly prospective Bilby habitat. Following the initial detection of the population, Biota conducted four Greater Bilby abundance surveys within this extent in 2019, 2022, 2024 and 2025. After a bushfire in 2023 impacted the original study area (Area 0), subsequent surveys were expanded to additional areas beyond the extent of the fire.

Extents surveyed during the Bilby Abundance Study from 2019 to 2025, and 2025 traverse distances, are summarised in Table 9-16 with the 2025 traverses presented in Figure 9-24 (Biota 2026a). Additional unrecorded distances were also walked by Martu Rangers who accompanied the Biota team during the 2025 survey.

**Table 9-16: Summary of Survey Effort (2019–2025) Targeting Greater Bilby in the Locality of the Proposal**

| Area | Dates Surveyed | 2025 Traverse Distance (km)* | Total Survey Extent (ha) |
|---|---|---|---|
| Area 0 (A0) | September 2019, July 2022, May 2024 October 2025 | 21.5 | 344.1 |
| Additional Area 1 (AA1) | May 2024, October 2025 | 18.3 | 131.7 |
| Additional Area 2 (AA2) | May 2024, October 2025 | 9.6 | 68.9 |
| Additional Area 3 (AA3) | July 2024, October 2025 | 12.5 | 129.7 |
| Additional Area 4 (AA4) | July 2024, October 2025 | 5.2 | 39.8 |

**Excludes distances covered by Martu Rangers*

Additionally, an opportunistic, non-systematic targeted search was undertaken in October 2025 in a previously unsurveyed area approximately 1 km south of AA2 (Figure 9-24) (Biota 2026a). Habitat at this location was mapped by Western Botanical (Western Botanical 2026a) as *Acacia* shrubland with

*Acacia monticola*, a key food source plant for Bilby, as a dominant species. This habitat is considered highly prospective for bilbies and approximately 6 km was traversed.

This survey effort is considered to meet the recommendations for Bilby survey methods provided by the Guidelines (DBCA 2017a; DSEWPaC 2011a).

#### 9.3.4.8.5 Habitat Mapping

Of the habitat types mapped for the Proposal, potential core habitat for the Greater Bilby in its vicinity is represented by Shrub and Spinifex on Sandplain and Inland Sand Dune habitats, which provide appropriate substrate for burrows and preferred foraging plants. On the basis of the precautionary approach, and in keeping with the definition of critical habitat in the Greater Bilby Recovery Plan (Commonwealth of Australia 2023), the Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types are considered critical habitat. Gravelly Lateritic Rises habitat may also provide supporting habitat for the Greater Bilby, particularly if food source plants such as *Acacia hilliana* (Hill's Tabletop Wattle) are present (Biota 2026a).

At a landscape scale, there are a multitude of factors that affect suitability of habitat for the Greater Bilby, and thus its occurrence, including landform, substrate, vegetation, fire frequency, rainfall, land clearance and presence of introduced herbivores and carnivores (Cramer et al. 2017 as cited in Biota 2026b).

Within WA, three landforms have been identified as primary Greater Bilby habitat, described broadly as (1) residual landforms, (2) fluvial landforms and (3) plains and dune fields (Biota 2026b). Additionally, soil, sand, sandy clay or sandy gravel substrates have been identified as critical to the Greater Bilby presence, as they enable burrow construction.

Suitable landforms within the Development Envelope are consistent with:

- Plains and dune fields – this includes Shrub and Spinifex on Sandplain and Inland Sand Dune habitats
- Residual landforms – this includes Gravelly Lateritic Rises.

The Development Envelope substrate is suitably sandy throughout.

Acknowledging the complexity of the factors that define Greater Bilby habitat, a finer scale, survey-specific approach was developed by Biota (2026b) to map their habitat. The approach recognised that the species' presence is strongly linked to food resource availability and intrinsically dependent on fire history (Southgate 2005 cited in Biota 2026b). Greater Bilbies have been recorded in habitats with a range of fire-ages, including recently burnt (1-2 years), unburnt (3-6 years) and long unburnt (>6 years) areas (Southgate 2005, Southgate and Carthew 2007, DBCA 2017 cited in Biota (2026b). This has been attributed to fire influencing food availability; fire (and subsequent rainfall) promotes regeneration of some short-lived species such as the grass *Yakirra australiensis*, the seeds of which form dominant dietary components when available. Fire also promotes the growth of other short-lived species such as *Senna notabilis*, the roots of which host larvae, another key component in Greater Bilby diet (Liddle 2016, DBCA 2018 cited in Biota 2026b). Conversely, fire kills long-lived larvae host species, such as *Acacia hilliana*. These long-lived species only develop hosting capacity for larvae after the plant reaches a certain age (Liddle 2016 cited in Biota 2026b), suggesting that unburnt stands of these species are important from the dietary perspective for the Greater Bilby.

Biota (2026b) developed a set of criteria to determine the prospectivity of Greater Bilby habitat, based on field notes, vegetation mapping of the area and fire scar mapping produced by North Australia and Rangelands Fire Information (NAFI) mapping. As Greater Bilby habitat is influenced by dynamic ecosystem shifts, habitat mapping undertaken for the Proposal over time should be considered a guide to areas that may have been important for Greater Bilby at that time, noting that factors such as fire, rainfall, and introduced predators may alter suitability over time.

Reproducing a Bilby habitat prospectivity map that combines previously mapped habitat areas is therefore challenging, as habitat mapping reflected the biotic and abiotic conditions present at the time of assessment (Biota 2026b). Consequently, successive reports have identified changes in habitat status over time in response to changing environmental conditions.

To address this challenge, a modified approach has been taken for the Proposal that adapted criteria originally developed by Biota for assessing prospective Bilby habitat (Table 9-17), with the modified approach excluding fire recency from the habitat prospectivity classification. This approach enabled the development of a baseline prospectivity map identifying High, Moderate and Low prospectivity habitat areas based primarily on the distribution of food source plants, in addition to supporting mapped evidence. Fire regime data can then be applied as an overlay to demonstrate temporal variation in habitat suitability relative to the baseline prospectivity layer.

Mapping Greater Bilby habitat in this way represents a conservative approach, as it is based primarily on the presence of suitable food source plants, rather than their abundance or age class (Biota 2026b).

**Table 9-17: Criteria used to Assess Greater Bilby Habitat**

| Habitat Prospectivity | Criteria |
|---|---|
| High | Sandy habitat supporting long-lived shrubs or forbs known to contain root-dwelling larvae and other important food source plants (e.g. *Acacia monticola*, *A. eriopoda*, *A. dictyophleba*, *A. melleodora*, *A. stellaticeps*, *A. hilliana*, *Senna notabilis* and *Indigofera georgei*),<br>and/or<br>Sandy habitat supporting short-lived shrubs or forbs known to contain root-dwelling larvae and other important food source plants (e.g. *Senna notabilis* and *Yakirra australiensis*)<br>and/or<br>Mapped records of evidence (tracks, scats, diggings and burrows attributed to Bilby with High certainty) |
| Moderate | Sandy habitat supporting plant species that are broadly typical of suitable Bilby habitat in the Great Sandy Desert or Little Sandy Desert (e.g. other *Acacia* spp., *Melaleuca* spp. and *Triodia* grasslands), but with no mapped records of important food source plant species |
| Low | Habitat does not meet any of the criteria listed above |

Within the Development Envelope, mapping based on the above approach resulted in a total of (Table 9-18; Figure 9-25):

- 12,655 ha High prospectivity habitat
- 10,893 ha Moderate prospectivity habitat
- 100 ha Low prospectivity habitat.

**Table 9-18: Greater Bilby Habitat Prospectivity Mapping within the Development Envelope- Area Calculations**

| Classification | High (ha) | Moderate (ha) | Low (ha) | Total (ha) |
|---|---|---|---|---|
| Recently Burnt (1-2 years; 2026, 2025) | 806 | 593 | 0 | **1,400** |
| Unburnt (3-6 years; 2024, 2023, 2022, 2021 | 4,641 | 3,665 | 11 | **8,317** |
| Long Unburnt (>6 years; 2020, 2019 onwards) | 7,208 | 6,635 | 89 | **13,932** |
| **Total** | **12,655** | **10,893** | **100** | **23,649** |

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

N

Great Northern Hwy

KARAJARRI PEOPLE (AREA B)

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

KARAJARRI

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

0 2 4
Kilometres

0 10 20
Kilometres

## Legend

- 2 ha sign plot
- General search
- Motion camera
- Nocturnal search
- Targeted search
- Transect search
- Highway
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

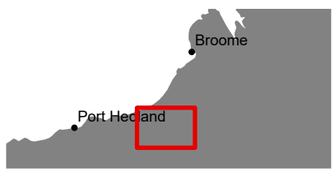
RioTinto

**Figure 9-23: Consolidated Greater Bilby Survey Effort in the Winu Development Envelope and Surrounding Locality**

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Survey Effort - Bilby

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
Great Northern Hwy
N
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)
0 500 1,000
Metres
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)
0 250 500
Metres
MARTU (AREA A)
0 200 400
Metres
MARTU (AREA A)
0 10 20
Kilometres

**Legend**

- Foot Traverse (2025)
- Bilby Transect design
- Area 0 (A0)
- Additional Area 1 (AA1)
- Additional Area 2 (AA2)
- Additional Area 3 (AA3)
- Additional Area 4 (AA4)
- Development Envelope
- Conceptual Footprint
- Native Title Determinations

RioTinto

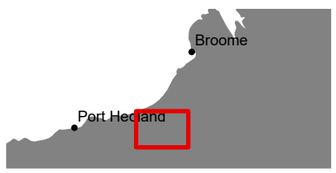
# Figure 9-24: Greater Bilby Abundance Study 2025 Survey Effort


**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:450,000

Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Survey Effort - Bilby (Transects)

120°30'0"E 121°0'0"E 121°30'0"E 122°0'0"E 122°30'0"E

20°0'0"S 20°30'0"S 21°0'0"S

N

Great Northern Hwy

Nyangumarta Hwy

KARAJARRI PEOPLE (AREA A)

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

## Legend

- Conceptual Footprint
- Highway
- Native Title Determinations

Greater Bilby Habitat Prospectivity

- High
- Moderate
- Low

0 10 20 Kilometres

RioTinto

**Figure 9-25: Greater Bilby Habitat Prospectivity**

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 18 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:600,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout : ERD - Greater Bilby Habitat Prospectivity

#### 9.3.4.8.6 Occurrence and Habitat in the Region and Development Envelope

The Greater Bilby has been recorded throughout the Development Envelope and wider region. Surveys undertaken within the Development Envelope recorded evidence such as recent diggings, scats, tracks and active burrows (Figure 9-26) (Biota 2026h, 2024). Secondary evidence was also found at multiple locations surrounding the Development Envelope (Figure 9-26) (Biota 2026h, 2024). No active signs were recorded during the most recent survey, in October 2025, with the scat collected being dry and aged.

Genotyping of scats confirmed the presence of nine individual Greater Bilbies within the survey areas covered by the Winu Greater Bilby Abundance Study, i.e. on and adjacent to the southern boundary of the Development Envelope at the MIA, from 2019 to 2025 (Figure 9-26 and Figure 9-27) (Biota 2026a, 2024). As DNA extraction was only partially successful, additional individuals may occur within the surveyed areas. However, it is not considered that any additional records, had the DNA extraction yielded more results, would change the conclusions made about the Greater Bilby population in a regional context.

At the time of the most recent Greater Bilby Abundance Study, in October 2025, the population appeared to have moved beyond the bounds of the previously occupied areas into unsurveyed territory (Biota 2026a). The recording of additional sign evidence and scat samples suggests Bilbies were still utilising the study area for some time after the previous, May 2024, survey. Given Bilbies' known propensity to move in response to resource availability and environmental variables, it is likely the population still exists and is currently occupying areas outside of the current scope of the study. Alternatively, the local population may have been extirpated; however, although predators are known from the area, given the population persistence since 2019 (and likely years prior) and no unusually extreme weather events, this hypothesis is considered by Biota (Biota 2026a) to be unlikely.

The relationship between Greater Bilby occurrence and fire is complex, with some studies indicating long-unburnt areas are preferred but others found areas with more homogenous vegetation have a positive relationship between Bilby occurrence and fire frequency. Fire frequency has been found to be the most important predictor in contemporary ecological niche models, indicating that bilbies have contracted to areas with higher fire frequencies. The Development Envelope has directly experienced fire multiple times before survey work has been undertaken for the Proposal with fires occurring in:

- 2018, 2022 and 2023 within the MIA
- 2017, 2018, 2019, 2022 and 2023 within the RAC
- 2018 and 2023 within the Rimfire Borefield.

The Winu Bilby population has demonstrated resilience to fire, with evidence of the species persisting in the landscape less than 2 km from where a fire event occurred in 2023 (Biota 2026a).

Compared to the estimated Greater Bilby populations in the Pilbara, the population within and surrounding the Development Envelope does not represent a large, regionally significant source population for breeding or dispersal within the Great Sandy Desert bioregion (Biota 2026a). The largest Greater Bilby population recorded to date has been at Anna Plains within the Dampierland bioregion, with approximately 44 individuals recorded (Biota 2026a). This population is likely to be an important key source population within the Dampierland bioregion. The population within and surrounding the Development Envelope, along with other low abundance populations in the Pilbara, Gibson Desert and Dampierland, is likely an important population for maintaining genetic diversity within the bioregion.

The Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types within the Development Envelope are considered to be critical habitat for the Greater Bilby (Biota 2026h).

Sparse occurrences of *Acacia monticola*, a key foraging resource for Bilby, was observed within the Percival Palaeovalley, but when combined with a lack of evidence of Bilby presence, habitats present within the palaeovalley were not considered to be representative of primary foraging areas, rather they may represent 'secondary' foraging habitat (Biota 2026e). *Acacia monticola* is not a groundwater

dependent species. Although habitat at this location is recognised as secondary foraging habitat, the habitat type is nonetheless considered critical habitat in accordance with the Greater Bilby Recovery Plan (Commonwealth of Australia 2023).

Habitat for the Greater Bilby throughout and surrounding the Development Envelope is described in Table 9-19 and shown on Figure 9-26.

**Table 9-19: Greater Bilby Critical and Supporting Habitat in the Locality of the Proposal**

| Habitat Category | Total Extent Mapped (ha) | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) |
|---|---|---|---|
| **Critical** – Shrub and Spinifex on Sandplain | 636,108.3 | 17,037.5 | 3,700.0 |
| **Critical** – Inland Sand Dune | 29,045.8 | 3,105.5 | 798.0 |
| **Supporting** – Gravelly Lateritic Rises | 33,200.4 | 3,116.2 | 237.9 |



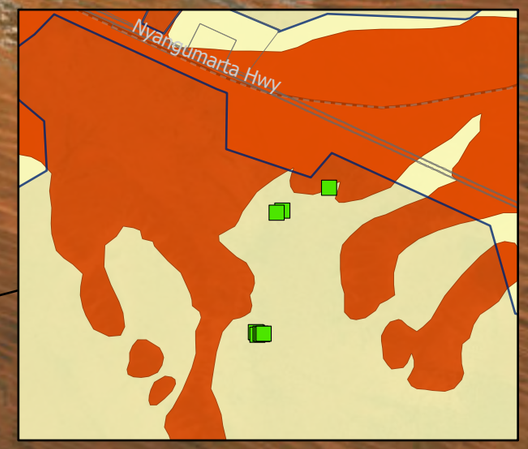
*Source: (Biota 2024)*

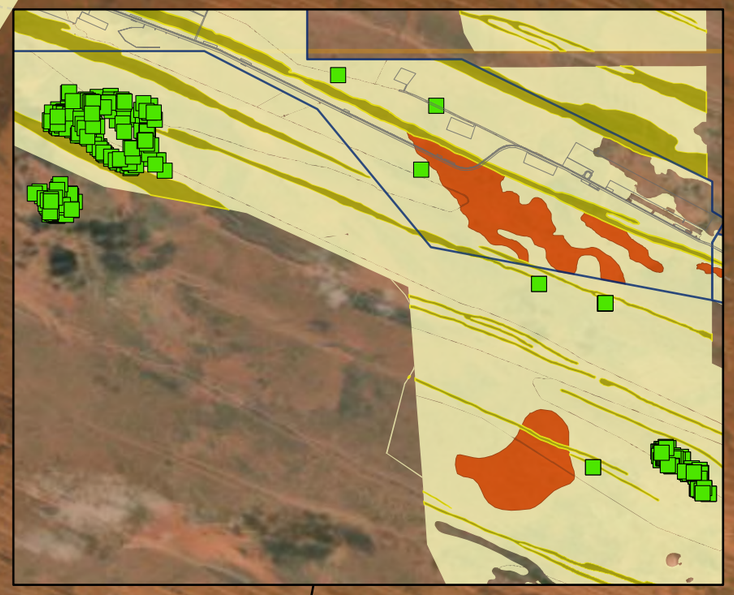
**Plate 9-8: Greater Bilby Burrow Entrance Example from AA2**

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

Great Northern Hwy
Nyangumarta Hwy
N

NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)



**Legend**

- Bilby
- Highway
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

**Fauna Habitat**

- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

0 10 20 Kilometres

RioTinto

**Figure 9-26: Greater Bilby Records and Potential Habitat Surrounding the Development Envelope**




Rio Tinto Copper (RTC)

**Publisher:** B.Gardiner
Date Published: Wednesday, 1 July 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:450,000
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx - ERD - Greater Bilby Records and Potential Habitat

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

N

2019 2019 2019 

N

2024
2024
2024
2024
2024
2024
2024
2025
2024

MARTU
(AREA A)

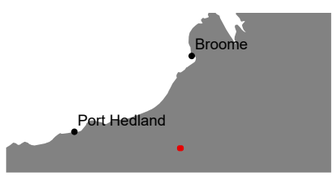
RioTinto

# Figure 9-27: Greater Bilby Records as Determined through Molecular Genotyping (Sheet 2 of 2)

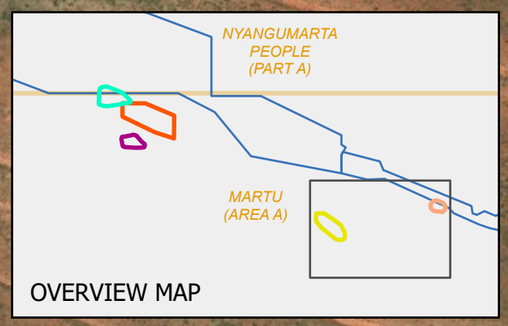
**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:20,000
Rio Tinto © Copyright




0 500 1,000
Metres




**Legend**

Bilby Scat Analysis (by Genotype)
- H
- I
- Not Identified
- Development Envelope
- Native Title Determinations
- Additional Area 3 (AA3)
- Additional Area 4 (AA4)

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Greater Bilby Records MolecGenotyp (Map Series)

#### 9.3.4.9 Migratory Bird Species

A summary of migratory species listed under the BC Act or EPBC Act and recorded, or with potential to occur, within the Development Envelope, is presented in Table 9-20 and Figure 9-29. Figure 9-29 also shows mapped habitat within and surrounding the Development Envelope. None of these species are listed as Threatened under the BC Act or EPBC Act.

The following policy and guidance documents are relevant to the Migratory bird species associated with the Proposal:

- Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015a)
- Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015b)
- EPBC Act Policy Statement 3.21 – Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebird Species (DoE 2017)
- National Light Pollution Guidelines for Wildlife (DCCEEW 2023b).
- Matters of National Environmental Significance: Significance Impact Guidelines 1.1 (DoE 2013)
- *Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species* (van Swinderen et al. 2025)
- Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020b)
- Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016g)

**Table 9-20: Migratory Species Listed Under the BC Act**

| Species | Known Occurrence and Preferred Broad Habitat Type | Presence within the Development Envelope |
|---|---|---|
| Barn Swallow (*Hirundo rustica*) | Occurs as a non-breeding migrant to Australia (Biota 2026h)<br>The species is known to occur in areas of open country in coastal lowlands, often near water | **May Occur**<br>Not recorded within the Development Envelope; however, historical records occur within the locality<br>Supporting habitat within the Development Envelope includes Shrub and Spinifex on Sandplain, Gravelly Lateritic Rises, Clayey Sandplain with Termitaria and cleared/disturbed areas |
| Little Curlew (*Numenius minutus*) | Occurs as a non-breeding migrant to Australia during September and April (Menkhorst et al. 2017 cited in Biota 2023c)<br>The species forages over short grasslands, and occasionally other open habitats including tidal flats and drying river beds (Johnstone and Storr 1998 cited in Biota 2023c) | **Recorded**<br>Recorded on four acoustic recording units in Rimfire and south of Rimfire (Biota 2026h)<br>Supporting habitat occurs throughout the Development Envelope and is comprised of Shrub and Spinifex on Sandplain and Clayey Sandplain on Termitaria habitat types |
| Oriental Plover (*Charadrius veredus*) | Occurs as a non-breeding migrant to Australia from September to April (Johnstone and Storr 1998 cited in Biota 2023c)<br>Preferred foraging habitat included sparsely vegetated open areas (Johnstone and Storr 1998 cited in Biota 2023c). The species is also known to utilise tidal mudflats, beaches, sewage ponds and freshwater wetlands | **Recorded**<br>Recorded within and surrounding the Development Envelope (MIA) on four occasions (Biota 2023c)<br>Supporting habitat occurs throughout the Development Envelope, comprising Shrub and Spinifex on Sandplain, Clayey Sandplain with Termitaria and Ephemeral Claypan habitat types |
| Oriental Pratincole (*Glareola maldivarum*) | Occurs as a non-breeding migrant to Australia, typically from December to March (Johnstone and Storr 1998 and Sitters et al. 2004 cited in Biota 2026h)<br>The species forages aerially over a wide range of open habitat types, and occasionally over more wooded areas (Johnstone and Storr 1998) | **Recorded**<br>Recorded within the Development Envelope and multiple records occur in the surrounding locality<br>Supporting habitat occurs throughout the Development Envelope within the Shrub and Spinifex on Sandplain, Clayey Sandplain with Termitaria and Ephemeral Claypan habitat types |
| Pacific Swift (*Apus pacificus*) | Occurs as a non-breeding migrant across much of Australia from September to April, particularly in the northern half of the continent<br>Within Australia, the species is entirely aerial (Johnstone and Storr 1998 cited in Biota 2026h) | **Recorded**<br>Recorded from within the RAC and the locality surrounding the Development Envelope<br>Supporting habitat occurs throughout the Development Envelope within all five of the mapped habitat types |

| Species | Known Occurrence and Preferred Broad Habitat Type | Presence within the Development Envelope |
|---|---|---|
| Australian (Gull-billed) Tern (*Gelochelidon nilotica macrotarsa*) | Two populations are now recognised in Australia: a resident population (*G. nilotica macrotarsa*; Australian Tern) and a migratory population (*G nilotica affinis*; Asian Gull-billed Tern). Although not migratory, the Australian Tern is still listed as such under the EPBC Act and BC Act due to a lag in updating the taxonomy of the species (Biota 2026h)<br><br>Occurs across much of Australia, including coastal and inland areas, particularly in the northern half of the continent<br><br>The species breeds colonially on flooded inland wetlands. When not breeding, the species is most common in coastal and estuarine areas with tidal flats or freshwater and saline wetlands, but will also forage over dry grassland areas (Biota 2026c) | **Recorded**<br><br>Recorded once within the Development Envelope and multiple records occur in the surrounding locality, with most records along Eighty Mile Beach and in the Mandora Marsh (Walyarta) system. Breeding is also known from Walyarta when the system is in flood<br><br>Potentially suitable foraging habitat exists within habitats within the Development Envelope outside the Conceptual Footprint, while Ephemeral Claypan habitat (when inundated) represents suitable roosting habitat and potentially suitable breeding habitat. However, the limited extent of this Ephemeral Claypan habitat means it is unlikely that the Development Envelope would support breeding. (Biota 2026c) |

#### 9.3.4.9.1 Ecologically Significant Populations and Important Habitat

Significant impact criteria for Migratory-listed species are based on the concepts of 'ecologically significant proportion' of populations, and 'important habitat' (DoE 2013). To define a population of Migratory birds as ecologically significant, it must generally constitute one of the following proportions of the species' estimated flyway population (DoE 2015a):

- 0.1% or greater is considered nationally significant
- 1% or greater is considered internationally significant.

The thresholds for ecologically significant population proportions for the Migratory bird species relevant to the Proposal are presented in Table 9-21.

**Table 9-21: Ecologically Significant Population Thresholds for Migratory-listed Bird Species**

| Species | Ecologically Significant Population Thresholds | |
|---|---|---|
| | Nationally Significant (0.1%) | Internationally Significant (1%) |
| Australian Gull-billed Tern | 100[1] | 1,000[1] |
| Barn Swallow | 1,000 | 10,000 |
| Little Curlew | 110 | 1,100 |
| Oriental Plover | 230 | 2,300 |
| Oriental Pratincole | 2,880 | 28,800 |
| Pacific Swift | 100 | 1,000 |

[1]*Inferred from published 1% threshold. Source: (Biota 2026c)*

Within Australia, important habitats for Migratory birds listed under the EPBC Act include sites recognised as nationally or internationally important, as detailed in the *EPBC Act Policy Statement 3.21: Industry Guidelines for Avoiding, Assessment and Mitigating Impacts of EPBC Act Listed Migratory Shorebird Species* (DoE 2017). The widely adopted approach to identifying internationally important habitat is through the use of criteria adopted under the Ramsar Convention on Wetlands.

According to this approach, Migratory bird habitat should be considered internationally important if it regularly supports:

- 1% of the individuals in a population of one species (or subspecies) OR
- A total abundance of at least 20,000 waterbirds.

Nationally important habitat for Migratory birds can be defined using a similar approach to these international criteria. A habitat is nationally important if it regularly supports:

- 0.1% of the flyway population of a single species of Migratory birds OR
- 2,000 Migratory birds OR
- 15 Migratory bird species.

The Significant Impact Guidelines define an area of important habitat for a Migratory species as (DoE 2013) habitat:

- Utilised by a Migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the species
- That is of critical importance to the species at particular life-cycle stages
- Utilised by a Migratory species which is at the limit of the species range
- Within an area where the species is declining.

#### 9.3.4.9.2 Survey Adequacy

A significant amount of biological survey work has been undertaken by Biota within the Winu Development Envelope and in the broader locality between 2017 and 2024 for both the Proposal and AREH projects, including:

- A three-phase seasonal detailed fauna survey for the AREH Project (which overlaps the RAC)
- A targeted fauna survey for AREH
- Three phases of migratory shorebird and waterbird studies for AREH
- A two-phase seasonal detailed fauna survey of the MIA
- Six basic and targeted fauna surveys across the MIA, RAC and regional borefield options as the Proposal developed.

Survey methodology employed across these surveys includes:

- Avifauna surveys
- ARUs
- General or Targeted searches
- Nocturnal searches.

A summary of the consolidated survey effort applicable to the Greater Bilby is provided in Table 9-22 and Figure 9-28.

**Table 9-22: Consolidated Survey Effort Suitable for Detecting Migratory Bird Species**

| Survey Methodology | Consolidated Survey Effort | |
|---|---|---|
| | Inside Development Envelope | Outside Development Envelope |
| Avifauna Surveys | 32 sites (1,790 minutes) | 30 sites (1,660 minutes) |
| ARUs | 28 sites (2,514 nights) | 39 sites (5,161 nights) |
| General or Targeted Searches | 113 searches (6,032 minutes)[1] | 181 searches (15,112 minutes)[1] |
| Nocturnal Searches | 9 searches (1,888 minutes)[1] | 1 search (928 minutes)[1] |

[1]*Duration data not available for some searches, so indicated durations are underestimations. Source: (Biota 2026c)*

#### 9.3.4.9.3 Occurrence and Habitat in the Regional and Development Envelope

All fauna habitats identified within the Development Envelope may be used by the Migratory species relevant to the Proposal, particularly species that forage aerially over most habitat types such as the Pacific Swift, Barn Swallow, and Oriental Pratincole (Biota 2026c). Habitats with the greatest importance for Migratory species within the Development Envelope are likely to be Ephemeral Claypan and Clayey Sandplain with Termitaria, as these are expected to provide the most suitable foraging and potential roosting habitat for ground-foraging waterbirds such as the Oriental Plover and Little Curlew. Similar habitats are widespread across the approximately 30 million ha Great Sandy Desert IBRA region, with the Development Envelope accounting for less than 0.08% of potential suitable habitat in the region. Higher quality habitat also occurs at regional salt lake systems, near the coastal plains that are adjacent to Eighty Mile Beach and Mandora Marsh (Walyarta) (Biota 2026c).

A summary of the Migratory species occurrence and habitat within and surrounding the Development Envelope is presented in Table 9-23 and Figure 9-29.

**Table 9-23: Migratory Bird Occurrence and Habitat Within and Surrounding the Development Envelope**

| Species | Occurrence and Habitat Within and Surrounding the Development Envelope | Likely Significance of Population utilising the Development Envelope | |
|---|---|---|---|
| | | Nationally Significant (0.1%) | Internationally Significant (1%) |
| Barn Swallow (*Hirundo rustica*) | The Barn Swallow has not been recorded within the Development Envelope. A few historical records occur within the locality, mostly along Eighty Mile Beach and the Mandora Marsh (Walyarta) wetland system. There are few counts of the number of individuals anywhere in Australia that would constitute a nationally significant population (i.e. >1,000 individuals). It is extremely unlikely that the Development Envelope would support an ecologically significant proportion of the population (Biota 2026c)<br><br>All five mapped habitat types and cleared/disturbed areas within the Development Envelope are considered to provide supporting habitat for the species. The absence of surface water in most parts of the Development Envelope for the majority of the time means it is only likely to constitute supporting habitat. Cleared areas with infrastructure are the most suitable habitat within the Development Envelope for roosting and likely constitute the most suitable foraging habitat when surface water is not available elsewhere. The species does not breed in Australia, so would not use the Development Envelope for breeding, if present<br><br>Given the above, it is considered extremely unlikely that habitats within the Development Envelope are considered important to the species according to the *EPBC Act Policy Statement 3.21* (DoE 2017) | **Negligible likelihood**<br><br>Extremely rare | **Negligible likelihood**<br><br>Extremely rare |
| Little Curlew (*Numenius minutus*) | The Little Curlew has been recorded on three ARUs within the Development Envelope, and 5 ARUs within 200 m surrounding the Development Envelope, with no visual observations. Conservative estimates of population size from acoustic recordings suggest that it is possible that Development Envelope may occasionally support a nationally significant proportion of the species' population (i.e. 110 individuals), though the likelihood of this is considered low<br><br>The Ephemeral Claypan, Shrub and Spinifex on Sandplain, Gravelly Lateritic Rises and Clayey Sandplain with Termitaria habitat types are considered to provide supporting habitat for the species, along with cleared/disturbed areas for foraging. Ephemeral Claypan habitat may be utilised for roosting. Due to the species' decline in Australia, these habitats within the Development Envelope could be considered important to the species according to the *EPBC Act Policy Statement 3.21* (DoE 2017)<br><br>Similar suitable foraging habitat to that available in the Development Envelope occurs widely throughout the Great Sandy Desert and the sandplains extending north towards Eighty Mile Beach. Higher quality foraging habitat also exists in the region at Lake Waukarlicarly and the former Texas borefield, and further afield on the near-coastal plains adjacent to Eighty Mile Beach and the Mandora Marsh (Walyarta) system | **Low likelihood**<br><br>Occasional | **Low likelihood**<br><br>Rare |

| Species | Occurrence and Habitat Within and Surrounding the Development Envelope | Likely Significance of Population utilising the Development Envelope | |
|---|---|---|---|
| | | Nationally Significant (0.1%) | Internationally Significant (1%) |
| Oriental Plover (*Charadrius veredus*) | The broader region supports large numbers of Oriental Plovers, with counts of up to 144,300 recorded along Eighty Mile Beach and frequent counts over the internationally significant population threshold of 2,300. These records are all from Eighty Mile Beach and the adjacent coastal plains, but none from further inland<br><br>The Oriental Plover has been recorded within the Development Envelope at five locations, and on six ARUs located within 200 m of the Development Envelope. All records within the Development Envelope involved less than 10 individuals. The overall population within the Development Envelope is expected to be relatively small (<100 individuals); although it is possible that a nationally significant population number of over 230 individuals may use the Development Envelope. It is considered unlikely that the Development Envelope supports an internationally significant proportion of the species' population (>2,300 individuals). Given the possibility the Development Envelope may host 230 birds habitat there constitutes important habitat<br><br>The Shrub and Spinifex on Sandplain, Clayey Sandplain with Termitaria, Gravelly Lateritic Rises and Ephemeral Claypan habitat types are considered to provide supporting habitat for the species, along with cleared/disturbed areas for foraging. Ephemeral Claypan habitat may be utilised for roosting<br><br>Similar suitable foraging habitat to that available in the Development Envelope occurs widely through the Great Sandy Desert and the sandplains extending north towards Eighty Mile Beach. Higher quality foraging habitat also exists in the region at Lake Waukarlicarly and the former Texas Borefield, and further afield on the near-coastal plains adjacent to Eighty Mile Beach and the Mandora Marsh (Walyarta) system<br><br>Oriental Plovers congregate along Eighty Mile Beach and the adjacent plains on arrival in Australia, reportedly remaining in these areas until the wet season begins before spreading out across inland areas of northern Australia. Although this pattern is evident in their occurrence along Eighty Mile Beach, birds have been observed inland around the locality of the Proposal from their arrival in September, so some individuals clearly move inland upon arrival. It is possible that these birds move between these inland areas and the coast to seek thermal refuges for roosting until the wet season rains make wetland areas available inland for this purpose | **Moderate likelihood**<br><br>Occasional | **Low likelihood**<br><br>Rare |
| Oriental Pratincole (*Glareola maldivarum*) | The Eighty Mile Beach area often hosts extremely high numbers of this species, most notably in 2004 when an aerial count estimated 2.88 million individuals loafing along the beach during the heat of the day. While these exceptional counts have been primarily observed along Eighty Mile Beach or foraging over adjacent coastal and near-coastal plains, large numbers have also been reported further inland. In recent years, regional records have included flocks of up to 50,000, mostly at Eighty Mile Beach and immediately adjacent near-coastal plains | **High likelihood**<br><br>Occasional | **Moderate likelihood**<br><br>Rare |

| Species | Occurrence and Habitat Within and Surrounding the Development Envelope | Likely Significance of Population utilising the Development Envelope | |
|---|---|---|---|
| | | Nationally Significant (0.1%) | Internationally Significant (1%) |
| | The Oriental Pratincole was recorded within the Development Envelope at six locations and another seven by ARUs located within 200 m of the Development Envelope. All records were either within or in the vicinity of the RAC. The records are primarily concentrated relatively close to the coast. This is anticipated to be an artefact of survey effort as observations from AREH surveys demonstrated the species also occurs widely further inland. The three opportunistic visual observations within the Development Envelope involved between 35 and 1,000 individuals, with remaining acoustic recordings suggesting the presence of large flocks<br><br>It is expected that the Development Envelope supports more than 2,880 individuals on occasion, constituting an ecologically (nationally) significant proportion of the population, with the Development Envelope also constituting important habitat for the species<br><br>Due to the species' aerial foraging behaviour, all five mapped habitat types within the Development Envelope are considered to provide supporting habitat for the species, along with cleared/disturbed areas. Clayey Sandplain with Termitaria and Ephemeral Claypan habitats may be used for loafing or roosting<br><br>Similar suitable foraging habitat to that available in the Development Envelope occurs widely throughout the Great Sandy Desert and the sandplains extending north towards Eighty Mile Beach, while Eighty Mile Beach itself, and the Mandora Marsh (Walyarta) system and nearby coastal plains are listed as important sites for the species | | |
| Pacific Swift (*Apus pacificus*) | The Pacific Swift has been recorded within the RAC portion of the Development Envelope and within the surrounding locality. Regional records involve counts ranging from single individuals to flocks of 2,000, primarily concentrated relatively close to the coast. However, this is expected to be primarily driven by relative survey effort, as observations from the AREH project demonstrated that the species also occurs widely further inland<br><br>A flock of 110 birds was observed over the RAC in March 2021. Regional records and ARU detections suggest that, although no counts of larger scale were observed over the Development Envelope, flocks of over 1,000 birds will occasionally utilise the area. This indicates the airspace above the Development Envelope at least occasionally supports a nationally (>100) or even internationally significant (>1,000) proportion of the species' population<br><br>Pacific Swifts were recorded from the Development Envelope from October to April, but the majority of records fall between December and March. This may be due to the increased prevalence of tropical low-pressure systems and associated unsettled weather during this period | **Confirmed**<br>Frequent | **High likelihood**<br>Occasional |

| Species | Occurrence and Habitat Within and Surrounding the Development Envelope | Likely Significance of Population utilising the Development Envelope | |
|---|---|---|---|
| | | Nationally Significant (0.1%) | Internationally Significant (1%) |
| | Pacific Swifts are likely to use airspace over all habitats within the Development Envelope for foraging and potentially roosting on the wing. The species does not breed in Australia, so will not use the Development Envelope for breeding<br><br>As the species is highly transient, the population of Pacific Swifts using the Development Envelope will be highly variable and therefore difficult to adequately estimate. The majority of records obtained are based on call recordings detected on ARUs, which do not allow accurate counts of individuals, though the continuous chorus of calling in some detections indicates that large flocks do occur at times<br><br>Due to the species' entirely aerial nature when in Australia, all five mapped habitat types within the Development Envelope are considered to provide important supporting foraging habitat for the species. However, similar suitable foraging habitat is widely available throughout the region, extending very widely throughout much of the Great Sandy Desert, and the sandplains extending north to Eighty Mile Beach - so habitat impacted by the Development Envelope is only a small proportion of available important habitat | | |
| Australian (Gull-billed) Tern (*Gelochelidon nilotica macrotarsa*) | A single Australian Tern was observed within the MIA during field surveys, while calls were detected on an ARU within 200 m of the RAC. The bird observed within the Development Envelope was in flight over Shrub and Spinifex on Sandplain habitat surrounding the existing Winu camp. It is not possible to determine the number of individuals involved in the ARU detection with certainty, though only a small number of calls were detected<br><br>Based on the very limited numbers of observations and the nature of available habitat, it is considered unlikely 100 or more (i.e. a nationally significant proportion of) Australian Terns are supported within the Development Envelope. The population trend of the species also appears to be increasing over both the short and medium term. Hence, it is considered unlikely that the Development Envelope constitutes important habitat for the species<br><br>Australian Terns have regularly been recorded in the region, with most records along Eighty Mile Beach and in the Mandora Marsh (Walyarta) system. Breeding is also known from Walyarta when the system is in flood<br><br>Potentially suitable foraging habitat exists within habitats within the Development Envelope outside the Conceptual Footprint, while Ephemeral Claypan habitat (when inundated) represents suitable roosting habitat and potentially suitable breeding habitat. However, the limited extent of this Ephemeral Claypan habitat means it is unlikely that the Development Envelope would support breeding | **Low likelihood**<br><br>Rare | **Negligible likelihood**<br><br>Extremely rare |

*Source: Biota 2025g, 2026a*

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
122°30'0"E
20°0'0"S
20°30'0"S
21°0'0"S

N

Great Northern Hwy

KARAJARRI PEOPLE (AREA B)

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

MARTU (AREA A)

MARTU #3

## Legend

Migratory-list Bird Survey Effort Inside the DE

- ARU
- Avifauna Census
- General/Targeted Search
- Nocturnal Search

Outside the DE

- ARU
- Avifauna Census
- General/Targeted Search
- Nocturnal Search
- Development Envelope
- Conceptual Footprint
- Native Title Determinations

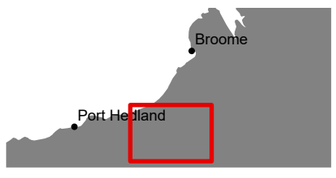
RioTinto

# Figure 9-28: Migratory Birds Survey Effort

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:700,000
Rio Tinto © Copyright




0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Survey Effort - Migratory Birds

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
N
Great Northern Hwy
Nyang Marta Hwy
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)
0 10 20 Kilometres

## Legend

- Little Curlew
- Oriental Plover
- Oriental Pratincole
- Pacific Swift
- Highway
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Development Envelope
- Conceptual Footprint
- Native Title Determinations

### Fauna Habitat

- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

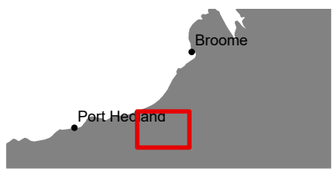
RioTinto

**Figure 9-29: Migratory Bird Records and Potential Habitat surrounding the Development Envelope**

Rio Tinto Copper (RTC)

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:450,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx| Layout: ERD - Migratory Bird Records

#### 9.3.4.10 Priority and Other Significant Vertebrate Fauna

A summary of other significant species, as listed under the BC Act and considered as Priority species by DBCA, recorded within the Development Envelope is presented in Table 9-24 and Figure 9-30. Other significant fauna, not recorded within the Development Envelope but with the potential to occur, are presented in Table 9-25.

**Table 9-24: Priority Fauna Records within the Development Envelope**

| Species | BC Act / DBCA Listing | Known Occurrence and Preferred Broad Habitat Type | Presence within the Development Envelope |
|---|---|---|---|
| **Mammals** | | | |
| Brush-tailed Mulgara (*Dasycercus blythi*) | Priority 4 | Known to inhabit spinifex grasslands on sandy plains and sandy swale between low dunes from south-western Queensland across the Simpson, Tanami and Great Sandy Deserts of southern and central Northern Territory and central WA<br><br>Also known to inhabit areas on gibber (rock and pebble covered flat plains)<br><br>Closely associated with gently sloping to flat topographic positions rather than steep-sided sand ridges (Pavey et al. 2011 cited in Biota 2026h) | **Recorded**<br><br>Recorded within the MIA and RAC sections of the Development Envelope, within the Shrub and Spinifex Sandplain habitat type. Records also occur within the locality outside of the Development Envelope (Biota 2026h)<br><br>Critical habitat within the Development Envelope includes the Shrub and Spinifex on Sandplain habitat type. The Gravelly Lateritic Rises habitat type is considered supporting habitat for the species |
| Northern Marsupial Mole (*Notoryctes caurinus*) | Priority 4 | Known to occur in the vast sandy deserts of central Australia (Biota 2026h)<br><br>Adapted to an almost entirely subterranean habitat, inhabiting dunes and, to a lesser extent, adjacent swales where sand is suitably deep and loose (Warburton 2006 cited in Biota 2026h) | **Recorded**<br><br>Recorded both within and outside of the Development Envelope in proximity to the MIA via secondary evidence (mole-holes) in the Inland Sand Dune habitat type (Biota 2026h)<br><br>Critical habitat within the Development Envelope includes the Inland Sand Dune habitat type. The Shrub and Spinifex on Sandplain habitat type is considered supporting habitat for the species |
| Western Pebble-mound Mouse (*Pseudomys chapmani*) | Priority 4 | Known to be distributed throughout the Pilbara region and into the Gascoyne (Biota 2026h)<br><br>Inhabits stony hillsides with hummock grasslands (Menkhorst and Knight 2011 cited in Biota 2026h) | **Recorded**<br><br>Recorded within the RAC section of the Development Envelope, with additional adjacent records occurring outside of the Development Envelope<br><br>The Gravelly Lateritic Rises habitat type is considered critical habitat for the species |

| Species | BC Act / DBCA Listing | Known Occurrence and Preferred Broad Habitat Type | Presence within the Development Envelope |
|---|---|---|---|
| **Reptiles** | | | |
| Dampierland Plain Slider (*Lerista separanda*) | Priority 2 | Historically, this species was thought to occur solely on the Dampier Peninsula (Biota 2026h). Recent records at Warrawagine station and the western portion of the RAC have extended the species' range<br><br>Known to inhabit dune crests and sandy areas (Biota 2023c) | **Recorded**<br><br>Recorded within the RAC and MIA sections of the Development Envelope (Biota 2026h). Also recorded in the locality outside of the Development Envelope<br><br>The records within the MIA represent a range extension for this species<br><br>The Shrub and Spinifex on Sandplain habitat type is considered critical habitat for the species |

**Table 9-25: Priority and Other Significant Fauna Species with the Potential to Occur within the Development Envelope**

| Species | DBCA Listing | Known Occurrence and Preferred Broad Habitat Type | Discussion |
|---|---|---|---|
| **Birds** | | | |
| Peregrine Falcon (*Falco peregrinus)* | Other specially protected species | Widespread throughout Australia (Marchant and Higgins 1993 cited in Biota 2026h)<br>Prefers short grasslands, including naturally short or recently burnt grasslands, airfields and sports grounds (Biota 2026h) | **Likely to Occur**<br>Not recorded within the Development Envelope; however, regional records are known from the locality (Biota 2026h)<br>Each of the five habitat types within the Development Envelope are considered supporting habitat for the species |
| **Mammals** | | | |
| Short-tailed Mouse (*Leggadina lakedownensis*) | Priority 4 | Within WA, the Short-tailed Mouse occurs throughout the Pilbara and Kimberley regions and is also known from the Great Sandy Desert (Menkhorst and Knight 2011 cited in Biota 2026h)<br>Known to utilise habitat that includes open tussock and hummock grassland, *Acacia* shrubland, savannah woodland, sandy soils and cracking clays (Morris et al. 2008) | **Potential to Occur**<br>Not recorded within the Development Envelope, although there are records within the locality (Biota 2026h)<br>The Shrub and Spinifex on Sandplain and Clayey Sandplain on Termitaria habitat types within the Development Envelope are considered supporting habitat for the species |
| Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) | Priority 4 | Scattered records occur throughout the Kimberley and Pilbara regions of WA (Biota 2026h)<br>Habitat includes long unburn spinifex on sandy or stony plains. | **Likely to Occur**<br>Recorded outside of the Development Envelope, adjacent to the western end of the RAC Envelope (Biota 2026h)<br>The Shrub and Spinifex on Sandplain habitat type within the Development Envelope is considered critical habitat for the species |

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
21°0'0"S

Wallal Well
Eighty Mile Beach System
Great Northern Hwy
Mandora Salt Marsh
Bedam Well
N
NYANGUMARTA PEOPLE (PART A)
Nyangumarta Hwy
MARTU (AREA A)
Bulgamulgardy Soak
Djimakarra Soak
Winu Soak
Toramah Soak

## Legend

- Wetlands (DBCA)
- Mainstream
- Native Title Determinations
- Conceptual Footprint
- Regional Surface Water Features (Golder)
- Highway
- Development Envelope
- Mining Lease
- Bilby Macrotis lagotis (VU)
- Black-footed Rock-wallaby (Petrogale lateralis lateralis)(EN)
- Brush-tailed Mulgara (Dasycercus blythi) (P4)
- Dampierland plain slider (Lerista separanda) (P2)
- Grey Falcon (Falco hypoleucos)(VU)
- Gull-billed Tern (Gelochelidon nilotica) (MI)
- Little Curlew (Numenius minutus)(MI)
- Night Parrot (Pezoporous occidentalis) (CR)
- Northern Marsupial Mole (Notorcytes caurinus)(P4)
- Oriental Plover (Charadrius veredus)(MI)
- Western pebble-mound mouse (Pseudomys chapmani)(P4)
- Pacific Swift (Apus pacificus) (MI)
- Northern Quoll (Dasyurus hallucatus)(EN)
- Oriental Pratincole (Glareola maldivarum) (IA)
- Spectacled Hare Wallaby (Logorchestes conspicillatus)(P4)

0 20 40 Kilometres

RioTinto

# Figure 9-30: Priority and Other Significant Fauna Records within and Surrounding the Development Envelope

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 24 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout:

#### 9.3.4.11 Significant Vertebrate Fauna Species Unlikely to Occur

Twelve conservation significant fauna species identified during desktop assessments are considered unlikely to occur within the Development Envelope (Table 9-26) (Biota 2026h). Twenty-eight Migratory coastal/wetland species are also considered unlikely to occur. The reasons for this conclusion are based on a range and combination of factors such as a lack of records in the locality, no or little suitable habitat available, survey area outside current documented distribution, low level of visitation to the region and/or preferred habitat at the coast.

**Table 9-26: Significant Vertebrate Fauna Species Unlikely to Occur within the Development Envelope**

| Species | EPBC Act Listing | BC Act Listing | DBCA Listing |
|---|---|---|---|
| **Birds** | | | |
| Australian Painted Snipe (*Rostratula australis*) | Endangered | Endangered | - |
| Red Goshawk (*Erythrotriorchis radiatus*) | Endangered | - | - |
| Eastern Yellow Wagtail (*Motacilla tschutschensis*) | Migratory | Migratory | - |
| Gull-billed Tern (*Gelochelidon nilotica*) | Migratory | Migratory | - |
| Oriental Cuckoo (*Cuculus optatus*) | Migratory | Migratory | - |
| Osprey (*Pandion haliaetus*) | Migratory | Migratory | - |
| **Mammals** | | | |
| Ghost Bat (*Macroderma gigas*) | Vulnerable | Vulnerable | - |
| Orange Leaf-nosed Bat (*Rhinonicteris aurantia*) | Vulnerable | Vulnerable | - |
| Long-tailed Dunnart (*Antechinomys longicaudata*) | - | - | Priority 4 |
| **Reptiles** | | | |
| Great Desert Skink (*Liopholis kintorei*) | Vulnerable | Vulnerable | - |
| Pilbara Olive Python (*Liasis olivaceus*) | Vulnerable | Vulnerable | - |
| Spotted Ctenotus (*Ctenotus uber johnstonei*) | - | - | Priority 2 |

Species considered unlikely to occur within the Development Envelope are discussed in Table 4.4 of Appendix E01 (Biota 2026h) and are not discussed further in this chapter.

#### 9.3.4.12 Range Extensions

Range extensions to the known distributions were identified for eight species recorded during several of the detailed surveys undertaken for the Proposal (Table 9-27; Figure 9-31) (Biota 2025g). None of these species are threatened, with the Dampierland Plain Slider listed as Priority 2 by DBCA.

**Table 9-27: Terrestrial Fauna – Range Extensions**

| Species | Conservation Status | Description |
|---|---|---|
| Dampierland Plain Slider (*Lerista separanda*) (P2) | P2 (DBCA) | Significant range extension<br>Refer to Section 9.3.4.10 and Table 9-24 for further detail |
| Black-necked Whipsnake (*Demansia calodera*) | Not threatened | Significant range extension – approximately 800 km<br>Endemic to WA. Current known range documented in Atlas of Living Australia (ALA 2026c) from 88 records in coastal and near coastal areas in the Edel (YAL01) IBRA subregion south of Shark Bay and the Cape Range (CAR01) subregion at North West Cape |
| Interior Blind Snake (*Anilios endoterus*) | | Significant range extension<br>Current known range documented in Atlas of Living Australia (ALA 2026a) from 1,288 records across majority of central Australia, with closest record approximately 6 km northwest of the Proposal in the Mackay (GSD02) IBRA subregion from 2021 |
| Northern Pilbara Tree Dragon (*Diporiphora vescus*). | | Significant range extension<br>Endemic to WA. Current known range documented in Atlas of Living Australia (ALA 2026e) from 33 records focused around Port Hedland, with the closest record approximately 285 km west of the Proposal, in the Chichester (PIL1) IBRA subregion from 2018 |
| Perentie (*Varanus giganteus*) | | Minor range extension<br>Current known range documented in Atlas of Living Australia (ALA 2026g) from 1,072 records across central and Western Australia, with the closest record approximately 120 km west of the Proposal, in the Chichester (PIL1) IBRA subregion from 2012. Only other records within the Mackay (GSD02) IBRA subregion occur within the Northern Territory approximately 880 km to the east |
| Pilbara Planigale (*Planigale kendricki*) | | Significant range extension<br>Endemic to WA. Current known range documented in Atlas of Living Australia (ALA 2026f) from 472 records focused around the Pilbara region, with the closest record approximately 60 km northeast of the Proposal in the McLarty (GSD01) IBRA subregion from 2005 |
| Rufous Whipsnake (*Demansia rufescens*) | | Minor range extension<br>Endemic to WA. Current known range documented in Atlas of Living Australia (ALA 2026d) from 53 records focused around the Pilbara region, with the closest record approximately 140 km southwest of the Proposal, in the Chichester (PIL1) IBRA subregion from 2000 |
| Children's Python (*Antaresia childreni*) | | Minor range extension<br>Current known range documented in Atlas of Living Australia (ALA 2026b) from 3,733 records from across the Australian mainland, with the closest record approximately 100 km south of the Proposal, in the Mackay (GSD02) IBRA subregion (date not provided) |

114°0'0"E 116°0'0"E 118°0'0"E 120°0'0"E 122°0'0"E 124°0'0"E 126°0'0"E 128°0'0"E

14°0'0"S 16°0'0"S 18°0'0"S 20°0'0"S 22°0'0"S 24°0'0"S

N

0 25 50 Kilometres

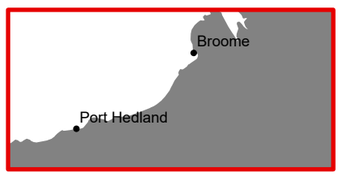
0 100 200 Kilometres

## Legend

- Development Envelope
- Conceptual Footprint
- Stimson's Python *(Antaresia Childreni)*
- Perentie *(Varanus Giganteus)*
- Rufous Whipsnake *(Demansia Rufescens)*
- Pilbara Planigale *(Planigale Kendricki)*
- Dampierland Plain Slider *(Lerista Separanda)*
- Black-necked Whipsnake *(Demansia Calodera)*
- Interior Blind Snake *(Anilios Endoterus)*
- Northern Pilbara Tree Dragon *(Diporiphora Vescus)*

RioTinto

**Figure 9-31: Range Extensions Recorded During Proposal Surveys**




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Tuesday, 23 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:4,656,613
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Range Extensions Recorded during Proposal Surveys

### 9.3.5 Short-range Endemic Invertebrate Fauna

#### 9.3.5.1 Regional Context

Short-range endemism refers to the restriction of a species at a local scale. It is influenced by several factors, including life history, physiology, habitat requirements, dispersal capabilities, biotic and abiotic interactions and historical conditions (Harvey 2002).

Better-known SRE invertebrate fauna species have been listed under State or Commonwealth legislation or as Priority species by the DBCA. However, most SRE species have not been listed, often due to a lack of knowledge or data. In the absence of formal listings, SRE fauna are assigned an SRE status category: Confirmed SRE, Potential SRE or widespread (i.e. not an SRE). This categorisation indicates the potential for range restriction and, therefore, informal conservation significance. These groupings are based on the Western Australian Museum's (WAM) categorisation for SRE invertebrates. As many SRE invertebrate fauna are taxonomically poorly known, the majority of morphospecies are assigned as 'Potential SREs' and invariably fall within one (or several) of the five 'Potential SRE' sub-categories described in Table 9-28 (i.e. data deficient, habitat indicators, morphology indicators, molecular evidence and/or research/expertise).

**Table 9-28: SRE Categorisation Used by WAM Taxonomists**

| Distribution | Taxonomic Certainty | Taxonomic Uncertainty |
|---|---|---|
| Distribution <10,000 km$^2$ | **Confirmed SRE:**<br>• A known distribution of <10,000 km$^2$<br>• Taxonomy well-known, group is represented in collections and/or via comprehensive sampling | **Potential SRE:**<br>• Patchy sampling resulting in incomplete knowledge of geographic distribution<br>• Incomplete taxonomic knowledge<br>• Group not well represented in collections<br>• Category applies where there are significant knowledge gaps<br>**Potential SRE sub-categories (may apply):**<br>• Data deficient<br>• Habitat indicators<br>• Morphology indicators<br>• Molecular evidence<br>• Research and expertise |
| Distribution >10,000 km$^2$ | **Widespread (not an SRE):**<br>• A known distribution of >10,000 km$^2$<br>• Taxonomy well known, group is well represented in collections and/or via comprehensive sampling | N/A |

#### 9.3.5.2 SRE Survey Approach and Effort

The total SRE survey effort within and surrounding the Development Envelope is described in Table 9-29 and Figure 9-32.

SRE surveys were based on total of (Biota 2025d):

- 62 targeted searches (19 within the Development Envelope), undertaken during detailed and targeted fauna surveys (Table 9-2)
- 68 systematic pitfall traps (38 within the Development Envelope), undertaken during detailed vertebrate fauna surveys, when invertebrate specimens were captured as bycatch.

A total of seven survey phases were conducted between August 2017 and May 2024, in conjunction with two detailed vertebrate fauna surveys (using the above two methods) and one targeted SRE fauna survey (using targeted searches only).

**Table 9-29: Consolidated Survey Effort Within and Surrounding the Development Envelope**

| Study | Survey Area | Timing | Total Pitfall Trap Sites (No. within DE*) | Total SRE Search Sites (No. within DE) | Total SRE Search Effort (Person Minutes) (Within DE) |
|---|---|---|---|---|---|
| AREH Detailed (Biota 2018, 2022 cited in Biota 2025d) | RAC and surrounds | Phase 1: 24 Aug to 5 Sep 2017<br>Phase 2: 13 to 21 Mar 2018<br>Phase 3: 8 to 19 Mar 2021 | 48 (20) | 29 (3) | 1,364 (120) |
| Winu Detailed (Biota 2021, cited in Biota 2025d) | MIA | Phase 1: 12 to 20 May 2019<br>Phase 2: 18 to 25 Sep 2019 | 20 (18) | 17 (11) | 3,039 (1,449) |
| Winu Borefields Targeted SRE<br>(Biota 2025d) | 1. RAC and surrounds<br>2. Rimfire and surrounds | 1. 26 Feb to 4 Mar 2024<br>2. 7 to 13 May 2024 | 0 | 16 (5) | 1,404 (372) |

**DE – Development Envelope*

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

N

KARAJARRI

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

**Legend**

- Pitfall Trap
- SRE Search Site
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

RioTinto

**Figure 9-32: SRE Search Sites and Pitfall Trap Locations within and Surrounding the Development Envelope**

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 25 June 2026

**Coordinate System:**
GDA2020 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA2020
Units: Meter
**Scale:** 1:500,000
Rio Tinto © Copyright




0 20 40 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - SRE Search sites and pitfall trap locations

#### 9.3.5.3 SRE Invertebrate Fauna Habitat

Five broad SRE habitat types have been mapped across the Development Envelope (Biota 2025d) (Figure 9-5):

- Shrub and Spinifex on Sandplain
- Inland Sand Dune
- Gravelly Lateritic Rises
- Clayey Sandplain with Termitaria
- Ephemeral Claypan.

These habitats were identified through a desktop study in conjunction with an on-ground habitat assessment, which took into consideration the ecological niches relevant to SRE fauna. Descriptions, including condition and microhabitat for each habitat type identified within the Development Envelope are provided in Table 9-30. Disturbed/cleared areas have also been mapped as seen in Figure 9-33.

Generally, habitats within the Development Envelope do not have significant potential to support SRE fauna (Biota 2025d). Most (72%) of the Development Envelope is represented by Shrub and Spinifex on Sandplain habitat, followed by Inland Sand Dune (13%) and Gravelly Lateritic Rises (13%), none of these are isolated landforms or host microhabitats conducive to short-range endemism. These habitats are widely connected with no obvious geographic barriers to dispersal, that could restrict gene flow and promote short-range endemism, or contain elevated habitat isolates that could represent long-term refugia (EPA 2016 cited in Biota 2025d). The Development Envelope also lacks the type of drainage features which typically support sheltered microhabitats that provide greater moisture retention than the surrounding areas and that can support SREs.

Based on the distribution of the SRE assemblage documented for the Proposal, field observations, and the premise that 'Habitat isolates are more likely to yield SREs than are extensive swathes of contiguous habitat' (EPA 2016 cited in Biota 2025d), Biota considered the soil landscape unit B30, which is considered to have higher clay content preferred by SREs, potentially represents a habitat isolate and therefore a higher likelihood of supporting SREs than the rest of the Development Envelope. That unit overlaps less than 1% of the Development Envelope and extends south of the Rimfire pipeline corridor outside of the Development Envelope.

**Table 9-30: SRE Habitat Types within the Development Envelope (Biota 2025d)**

| Habitat Type | Description | SRE Micro-habitats | Condition | Extent within the Development Envelope (ha) | Representative Photo (Biota 2025d) |
|---|---|---|---|---|---|
| Shrub and Spinifex on Sandplain | Substrate consisted of pink to red pindan soils. The vegetation was dominated by *Corymbia zygophylla*, *Erythrophleum chlorostachys* and *Owenia reticulata* trees over open to moderately dense mixed shrublands, typically dominated by wattles (*Acacia* spp.), over hummock grasslands of *Triodia schinzii* and *T. epactia*. | **Limited**: deposits of leaf litter and mature *Triodia* spp. hummocks provide some refuge for mesic and soildwelling groups. | Pre-2024 vegetation condition was excellent; fire has impacted much of this fauna habitat type | 17,037.5 |  |
| Inland Sand Dune | The sand dunes in inland areas had a pink to red pindan sand substrate and were typically long linear dunes trending east-west. These were dominated by mixed open shrublands over open hummock grasslands of *Triodia schinzii*. | **Limited**: deposits of leaf litter and mature *Triodia* spp. hummocks provide some refuge for mesic and soildwelling groups. | Exellent | 3,105.5 |  |
| Gravelly Lateritic Rises | Low rises with a surface covering of laterite gravel and pebbles occurred sporadically. These supported open hummock grasslands of *Triodia epactia* with a low open shrubland of the wattles *Acacia hilliana* and *A. adoxa* var. *adoxa*; taller shrubs were typically sparse but included species such as *Grevillea refracta* and *G. wickhamii*. | **Limited:** mature Triodia spp. Hummocks provide some refuge for mesic and soil-dwelling groups. | Excellent | 3,116.2 |  |
| Clayey Sandplain with Termitaria | The substrate of these plains comprises clayey sand to a loose depth of 2 cm. Vegetation comprising *Acacia bivenosa* shrubland over *Triodia brizoides* open hummock grassland. | Extensive areas of higher clay-content soils are preferred habitat for some mygalomorph spider species (e.g.clay-lid trapdoor spiders). | Almost all had been recently burnt | 124.7 |  |

| Habitat Type | Description | SRE Micro-habitats | Condition | Extent within the Development Envelope (ha) | Representative Photo (Biota 2025d) |
|---|---|---|---|---|---|
| Ephemeral Claypan | Sandy clay loam plain in between dunes. Mixed spinifex groves. | Extensive areas of higher clay-content soils are preferred habitat for some mygalomorph spider species (e.g. clay-lid trapdoor spiders). | Excellent | 49.3 |  |
| Disturbed / cleared | Road reserve | None | Disturbed | 215.8 | N/A |

#### 9.3.5.4 SRE Invertebrate Fauna Assemblage

A total of 23 taxa belonging to invertebrate groups prone to short-range endemism have been recorded and sequenced from within the Development Envelope, comprising 18 mygalomorph (trapdoor) spider taxa and five scorpion taxa (Biota 2025d) (Table 9-31). Of these, one (*Kwonkan* sp. N151) was recorded both within the Conceptual Footprint and the Development Envelope.

A total of 15 mygalomorph species are considered potential SREs, of which eight are known only from within the Development Envelope. The remaining species are widespread and are not considered SREs.

Two scorpion taxa are also potential SREs recorded within the Development Envelope but have also been previously recorded outside the Development Envelope from elsewhere in the region (Table 9-31; Figure 9-33). The remaining three species are widespread and are not considered SREs.

A total of three specimens have an indeterminate SRE status. Of these, one was recorded within the Conceptual Footprint only, while the remaining two were recorded within the Development Envelope only and outside the Development Envelope respectively (Table 9-31).

**Table 9-31: Potential SRE Species Recorded within the Development Envelope**

| Family | Species | Recorded only within CF* | Recorded within CF & DE | Recorded within DE but not CF* | Recorded outside DE | Habitat Type |
|---|---|---|---|---|---|---|
| **Spiders** | | | | | | |
| Barychelidae | *Idommata* sp. B39 | - | - | ✓ | - | Shrub on Spinifex on Sandplain |
| Anamidae | *Aname* sp. N138 | - | - | ✓ | - | Shrub on Spinifex on Sandplain |
| | *Aname* sp. N140 | - | - | ✓ | - | Shrub on Spinifex on Sandplain |
| | *Aname* sp. N149 | - | - | ✓ | - | Inland Sand Dune |
| | *Aname* sp. N152 | - | - | ✓ | - | Shrub on Spinifex on Sandplain |
| | *Aname* sp. N153 | - | - | ✓ | - | Shrub on Spinifex on Sandplain |
| | Genus? sp. N150 | - | - | ✓ | - | Shrub on Spinifex on Sandplain |
| | *Aname* sp. N139 | - | - | - | - | Shrub on Spinifex on Sandplain |
| | *Aname* sp. N147 | - | - | - | ✓ | Inland Sand Dune |
| | *Aname* sp. N148 | - | - | ✓ | ✓ | Shrub on Spinifex on Sandplain, Inland Sand Dune |
| | *Aname* sp. H-N205 | - | - | - | ✓ | Shrub on Spinifex on Sandplain |
| | *Aname* sp. H-N206 | - | - | - | ✓ | Shrub on Spinifex on Sandplain |

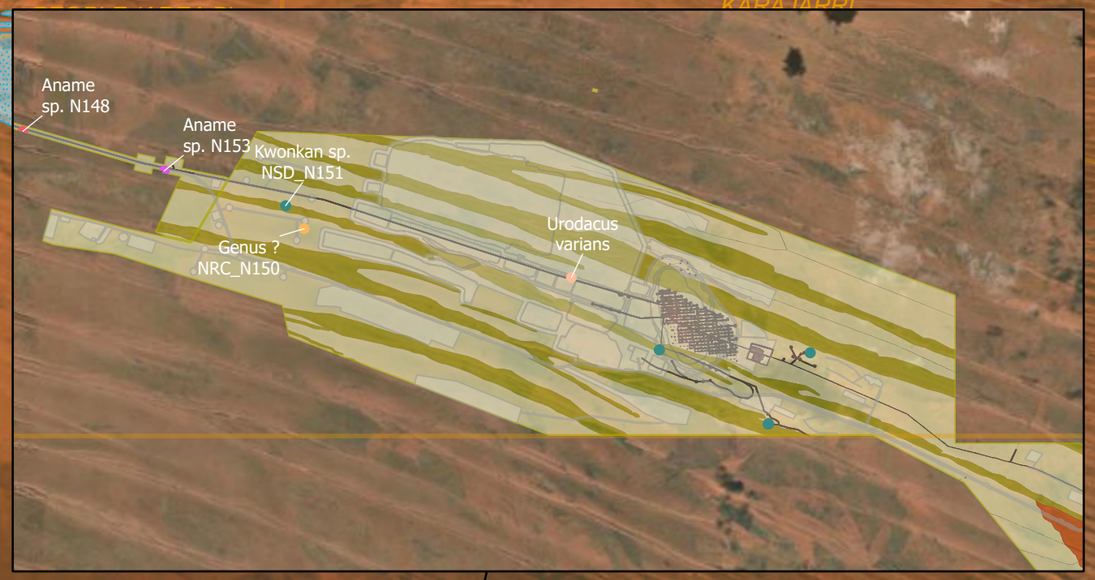
| Family | Species | Recorded only within CF* | Recorded within CF & DE | Recorded within DE but not CF* | Recorded outside DE | Habitat Type |
|---|---|---|---|---|---|---|
| | *Kwonkan* sp. N151 | - | ✓ | - | ✓ | Inland Sand Dune, Shrub on Spinifex on Sandplain |
| Idiopidae | *Idiosoma* sp.H-l90 | - | - | - | ✓ | Shrub on Spinifex on Sandplain |
| | *Idiosoma* sp.H-l91 | - | - | - | ✓ | Shrub on Spinifex on Sandplain |
| **Scorpions** | | | | | | |
| Urodacidae | *Urodacus* sp. 'telfer' | - | - | ✓ | - | Inland Sand Dune |
| | *Urodacus* 'yaschenkoi' species complex' | - | - | ✓ | - | Inland Sand Dune |
| **Indeterminate SREs** | | | | | | |
| Buthidae | *Lychas* sp. | ✓ | - | - | - | Shrub on Spinifex on Sandplain |
| Anamidae | *Anamidae* sp. | - | - | ✓ | - | Shrub on Spinifex on Sandplain |
| Barychelidae | Barychelidae sp. | - | - | - | ✓ | Shrub on Spinifex on Sandplain |

**CF – Conceptual Footprint; DE – Development Envelope*

121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

N

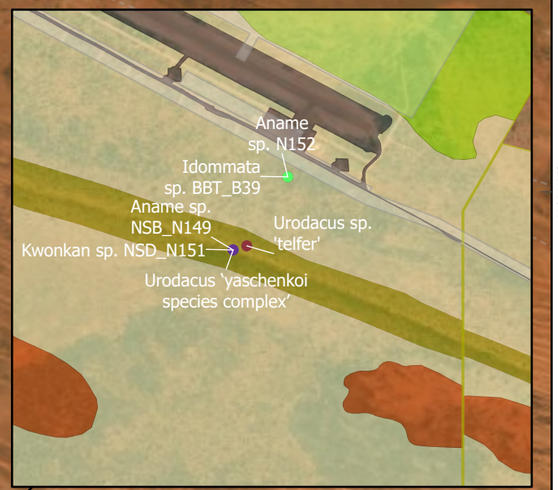
Wallal Well
Eighty Mile Beach System
Mandora Salt Marsh
Great Northern Hwy
Nyangumarta Hwy
Bulgamulgardy Soak
Djimakarra Soak
Winu Soak
Toramah Soak
KARAJARRI
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)













**Legend**

- Conceptual Footprint
- Development Envelope
- Native Title Determinations
- Mainstream
- Wetlands (DBCA)

**Fauna Habitat**

- Ephemeral Claypan
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

**Potential SRE Species**

- Aname (N138)
- Aname (N140)
- Aname sp. N148
- Aname sp. N152
- Aname sp. N153
- Aname sp. NSB_N149
- Genus ? NRC_N150
- Idommata sp. BBT_B39
- Kwonkan sp. NSD_N151
- Urodacus sp. 'telfer'
- Urodacus varians
- Urodacus 'yaschenkoi species complex'

RioTinto

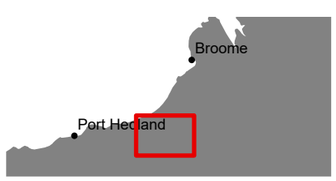
**Figure 9-33: SRE Records and Habitat within the Development Envelope**


**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000

Rio Tinto © Copyright




0 20 40 Kilometres

## 9.4 Potential Environmental Impacts

### 9.4.1 Direct Impacts

Potential direct impacts of the Proposal to Terrestrial Fauna have been identified as:

- Loss of fauna habitat as a result of clearing and fragmentation
- Loss of fauna individuals as a result of clearing, infrastructure and mining operations
- Loss of SRE individuals and SRE habitat as a result of clearing.

#### 9.4.1.1 Loss of Fauna Habitat as a result of Clearing and Fragmentation

##### 9.4.1.1.1 Clearing

The Proposal will clear up to 4,878 ha (20.8%) of native fauna habitat within the Development Envelope across five mapped fauna habitat types (Table 9-32; Figure 9-34).

Clearing of habitat can lead to the direct mortality of individuals, displacement or forced relocation of fauna and reduction of breeding, foraging, shelter and dispersal habitat.

##### 9.4.1.1.2 Night Parrot (Critically Endangered – BC Act; Endangered – EPBC Act)

The Development Envelope does not intersect with any roosting/nesting or foraging habitat (i.e. critical habitat). As such these habitat types will not be directly affected by clearing (Table 9-32).

##### 9.4.1.1.3 Grey Falcon (Vulnerable – BC Act and EPBC Act)

The Proposal may result in the clearing of 4,775 ha of supporting habitat for Grey Falcon which occurs within the Conceptual Footprint, comprising all five fauna habitat types (Table 9-32).

##### 9.4.1.1.4 Princess Parrot (Vulnerable – EPBC Act, Priority 4 – BC Act)

The Proposal may result in the clearing of 4,498 ha of supporting habitat for Princess Parrot which occurs within the Conceptual Footprint, comprising the Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types (Table 9-32).

##### 9.4.1.1.5 Black-footed Rock-wallaby (Endangered – BC Act and EPBC Act)

Rocky Outcropping, critical habitat for the Black-footed Rock-wallaby, will not be directly affected by clearing as it only occurs outside the Development Envelope. The Proposal may result in the clearing of 4 ha of supporting habitat for this species within the Conceptual Footprint, comprising the Shrub and Spinifex on Sandplain and Gravelly Lateritic Rises habitat types which occur within 500 m of Rocky Outcropping habitat (Table 9-32).

##### 9.4.1.1.6 Northern Quoll (Endangered – BC Act and EPBC Act)

Rocky Outcropping, critical habitat for the Northern Quoll, will not be directly affected by clearing as it only occurs outside the Development Envelope. The Proposal may result in the clearing of 16 ha of supporting habitat for this species within the Conceptual Footprint, comprising the Shrub and Spinifex on Sandplain and Gravelly Lateritic Rises habitat types which occur within 2 km of Rocky Outcropping habitat (Table 9-32).

##### 9.4.1.1.7 Greater Bilby (Vulnerable – BC Act and EPBC Act)

The Proposal may result in the clearing of 4,498 ha of critical habitat and 238 ha of supporting habitat for Greater Bilby which occurs within the Conceptual Footprint, with critical habitat comprising the Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types, and supporting habitat comprising of the Gravelly Lateritic Rises habitat type (Table 9-32).

#### 9.4.1.1.8 Migratory species

The Proposal may result in the clearing of 4,775 ha of supporting habitat for Migratory bird species which occurs within the Conceptual Footprint across all five fauna habitats (Table 9-32), including the following:

- 4,775 ha of supporting habitat for Pacific Swift
- 3,977 ha of supporting habitat for Barn Swallow
- 3,739 ha of supporting habitat for Little Curlew
- 3,739 ha of supporting habitat for Oriental Plover
- 3,739 ha of supporting habitat for Oriental Pratincole
- 3,739 ha of supporting habitat for Australian (Gull-billed) Tern.

#### 9.4.1.1.9 Priority and Other Significant Species

The Proposal may result in the clearing of critical and supporting habitat for Priority and other significant fauna species, including the following:

- 3,700 ha of critical habitat and 238 ha of supporting habitat for Brush-tailed Mulgara
- 798 ha of critical habitat and 3,700 ha of supporting habitat for Northern Marsupial Mole
- 3,739 ha of supporting habitat for Short-tailed Mouse
- 3,700 ha of critical habitat for Spectacled Hare-wallaby
- 238 ha of critical habitat for Western Pebble-mound Mouse
- 3,700 ha of critical habitat for Dampierland Plain Slider
- 4,775 ha of supporting habitat for Peregrine Falcon.

**Table 9-32: Indicative Clearing of Fauna Habitat**

| Habitat Type | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) | Approximate % Loss within Development Envelope | Approximate Extent Remaining within the Development Envelope (ha) | Survey Extent* |
|---|---|---|---|---|---|
| Shrub and Spinifex on Sandplain | 17,037.5 | 3700.0 | 21.7 | 13,337.5 | 636,108.3 |
| Inland Sand Dune | 3,105.5 | 798.0 | 25.7 | 2,307.5 | 29,045.8 |
| Gravelly Lateritic Rises | 3,116.2 | 237.9 | 7.6 | 2,878.3 | 33,200.4 |
| Clayey Sandplain with Termitaria | 124.7 | 39.3 | 31.6 | 85.4 | 130.5 |
| Ephemeral Claypan | 49.3 | - | - | 49.3 | 479.0 |
| **Black-footed Rock-wallaby Supporting Habitat** | | | | | |
| 500 m buffer around Rocky Outcropping (Shrub and Spinifex on Sandplain / Gravelly Lateritic Rises) | 18.8 | 3.6 | 19.0 | 15.2 | 14,410.2 |
| **Northern Quoll Supporting Habitat** | | | | | |
| 1 km buffer around Rocky Outcropping (Shrub and Spinifex on Sandplain / Gravelly Lateritic Rises) | 87.1 | 15.4 | 17.7 | 71.7 | 33,055.9 |

**Surveyed extent of fauna habitat within and surrounding the Development Envelope*

#### 9.4.1.1.10 Fragmentation

Fragmentation, the process by which contiguous areas of habitat are interrupted or separated into two or more smaller areas, can result in the following impacts on fauna:

- Altered movement patterns or reduced ability to disperse and recolonise
- Genetic isolation
- Increased competition for resources
- Habitat degradation
- Reduced species richness.

Clearing and construction of infrastructure for the Proposal has the potential to result in habitat fragmentation unless appropriately managed.

121°0'0"E

Eighty Mile Beach System

Mandora Salt Marsh

N

Great Northern Hwy

NYANGUMARTA PEOPLE (PART A)

Nyangumarta Hwy

20°0'0"S

## Legend

- Highway
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Conceptual Footprint
- Development Envelope
- Native Title Determinations
- Wetlands (DBCA)

### Fauna Habitat

- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

RioTinto

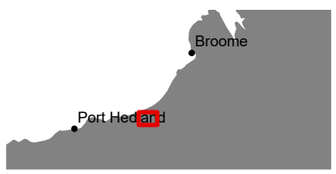
**Figure 9-34: Conceptual Footprint in the Context of Fauna Habitat Sheet 1 of 4**


**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000

Rio Tinto © Copyright




0 5 10 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: Fauna Habitat_MapSeries

121°0'0"E

121°30'0"E

N

## Legend

- Regional Surface Water Features (Golder)
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Minor Road, Sealed
- Minor Road, Unsealed
- Track
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

### Fauna Habitat

- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

Nyangumarta Hwy

NYANGUMARTA PEOPLE (PART A)

RioTinto

**Figure 9-34: Conceptual Footprint in the Context of Fauna Habitat Sheet 2 of 4**




**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000
Rio Tinto © Copyright

0 5 10 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: Fauna Habitat_MapSeries

121°30'0"E

121°30'0"E

20°30'0"S

N

## Legend

- Regional Surface Water Features (Golder)
- Track
- Track
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

### Fauna Habitat

- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

NYANGUMARTA PEOPLE (PART A)

Winu Soak

Teramah Soak

RioTinto

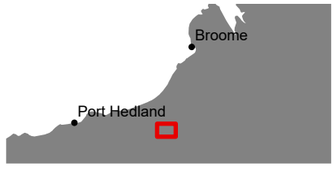
# Figure 9-34: Conceptual Footprint in the Context of Fauna Habitat Sheet 3 of 4


**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000

Rio Tinto © Copyright




0 5 10 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: Fauna Habitat_MapSeries

121°30'0"E

122°0'0"E

N

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

**Legend**

- Conceptual Footprint
- Development Envelope
- Native Title Determinations

Fauna Habitat

- Ephemeral Claypan
- Rock Outcropping
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

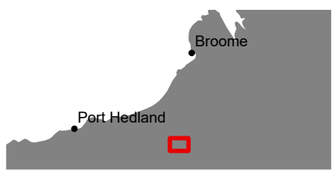
RioTinto

# Figure 9-34: Conceptual Footprint in the Context of Fauna Habitat Sheet 4 of 4

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Wednesday, 17 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000
Rio Tinto © Copyright




0 5 10 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: Fauna Habitat_MapSeries

122°0'0"E

#### 9.4.1.2 Loss of Fauna Individuals as a Result of Clearing, Infrastructure and Mining Operations

Fauna within the Development Envelope may be at risk of death, injury or displacement as a result of:

- Interaction with earthmoving equipment, vehicles or aircraft during construction, operation and closure
- Entrapment within excavations or bins and other waste facilities
- Interaction with infrastructure such as fencing
- Interaction with wind turbines
- Interaction with second-generation anticoagulant rodenticides (SGARs).

##### 9.4.1.2.1 Interaction with Mining Equipment, Vehicles, Aircraft and Infrastructure, and Entrapment

Species at risk of vehicle strike include slow-moving animals, easily startled species and nocturnal animals. Vehicles at night are more likely to strike native fauna when visibility is reduced and more animals move through the landscape. Species such as birds of prey are also likely to feed off dead carcasses on roads and may be subject to vehicle strikes.

Trenches, excavations and water storage structures often have steep, slippery sides which prevent fauna that fall into them from escaping. Fauna may also be attracted to waste storage bins or domestic waste facilities and become trapped. Entrapment may lead to fauna injury or death from starvation, dehydration, drowning, bogging or injury.

Birds may become entangled in barbed-wire fences causing injury or death. Night Parrots are known to be particularly vulnerable to entanglement, due to relatively poor eyesight and low flight heights.

Bird strike with aircraft may occur, with this impact considered as having some potential to occur, with the risk likely to be highest at lower altitudes as aircraft approach or depart the airstrip (Varnousfaderani and Shihab 2025).

##### 9.4.1.2.2 Interaction with Wind Turbines

Birds and bats may be struck by the blades of wind turbines.

Wind farm design is a major factor in avifauna collision risk, with multiple reviews indicating that the design, layout and spacing of turbines can have a significant influence on any movement barrier and the likelihood of bird and bat collisions with blades.

The turbines will be located within the MIA. The RAC extends 138 km from the MIA to the Great Northern Highway. This means that some of the Proposal's consolidated avifauna records come from habitats in relatively distant and coastal areas than the proposed turbine locations. To provide a more representative avifauna assemblage for the current assessment, the consolidated records from the past four years were spatially queried to the subset recorded within a 50 km radius of the proposed turbine locations (Biota 2026i). This yielded a documented avifauna assemblage of 49 species, dominated by songbird species typical of the north-west arid zone (Table 9-33).

Of the nine (three non-migratory and six migratory) significant bird species considered relevant to the Proposal, six have been recorded within the 50 km limit used for the risk assessment (Table 9-33), with two assessed as having a high risk of individuals being impacted through collision:

- Pacific Swift
- Grey Falcon.

This is due to their commonly reported soaring altitudes overlapping with the turbine's rotor swept area (RSA), discussed below (Biota 2026h).

The assessment of risk to birds and bats from the wind turbines (Biota 2026h) was based on a turbine hub height of 150 m above ground level (magl) and a rotor diameter of 172 m, in accordance with Proponent design parameters current at the time. This results in a maximum rotor height of 236 m and

a minimum blade clearance height of 64 magl – the physical area swept by the rotating blades in this zone is referred to as the RSA. The conceptual design arrangement is for the eleven turbines to be placed in two rows, between 1.3 km to 1.8 km apart, along a north-north-east to south-south-west orientation. Individual turbines within each row are separated by between approximately 450 m and 900 m. The wind farm is proposed to be situated at the western end of the MIA, approximately 145 km from the coast at its nearest point.

With respect to potential impacts on the migratory shorebirds and waterbird occupying the Eighty Mile Beach Ramsar site and Walyarta (Mandora Marsh), these areas are located approximately 140 km and 90 km, respectively, from the proposed wind farm location. Early studies on wind farms detected disturbance and displacement effects on birds extending to less than one kilometre from turbines, with reviews indicating disturbance effects on birds extended up to 600-800 m (Drewitt and Langston 2006 cited in Biota 2026h), and that most displacement impacts on birds extend out to a maximum of 100-200 m (Pearce-Higgin et al. 2012 cited in Biota 2026h). As a result, recommended buffer zones around important wetland areas for birds found in the literature, in the order of 400 m to one kilometre, are all substantially less than the separation distance applicable to the Proposal (approximately 90 km) (Biota 2026i). More recent studies have detected disturbance impacts from wind farms extending to greater distances, up to within 5 km (Pearse et al. 2021 cited Biota 2026h).

Spacing of greater than 200 m between turbines has been recommended to avoid inhibiting bird movement (Powlesland 2009 cited in Biota 2026h). However, there are relatively few empirical studies regarding the effect of turbine spacing available. Birds have been observed to avoid flying between turbines spaced 200 m apart, but flew more regularly between more widely spaced turbines 500 m apart (Bai et al. 2021 cited in Biota 2026h). Common Eiders (*Somateria mollissima*) were observed avoiding flying between turbines of an offshore wind farm with turbines arranged in rows 850 m apart, with turbines within rows 480 m apart (Masden et al. 2009 cited in Biota 2026h).

Elevated mortality rates from turbine collisions have been observed in bats in North America and Europe, but there is very little information in the literature regarding barrier effects to bats (Biota 2026h).

The lack of empirical studies means that there is uncertainty around assessing the risk of movement barriers, particularly for bats. Similarly, bat movement pathways and migratory behaviour in Australia are not mapped or understood with the same resolution as major avian flyways, therefore studies indicating the absence of mapped bat flyways should not be interpreted as evidence that bat movement does not occur across a project area (Reid and Baker 2025 cited in Biota 2026h).

Given these uncertainties and parameters, the Proponent commissioned the risk assessment, based on whether the proposed turbine layout intersects features likely to concentrate bird or bat movement, roosting or foraging activity (Biota 2026h). The proposed turbine locations are situated in extensive sandplain habitat and are not located adjacent to features identified in bat wind farm guidance as potential higher-risk siting contexts, such as caves, cliffs, rocky escarpments, permanent water, riparian corridors, or known congregational roost sites or repeated flight paths between roosts and foraging areas. The proposed distances between the turbines were considered in the assessment as also sufficiently large to suggest that the risk of significant barrier effects is low, based on the available literature and general information on arid-zone bat ecology.

Turbine design is also an important parameter with respect to risk for birds and bats. Review of turbine size suggest that the effect of turbine height on collision risk is also, and likely to be strongly, influenced by other species-specific and site-specific factors (Biota 2026h). For example, in an area where bird and bat species occur that have low average flight heights, even larger turbines may present a low collision risk as the minimum height of the RSA is higher than the aerial space routinely used by the fauna. The minimum planned height of the RSA for the Proposal's turbines is approximately 64 m, which is likely to be higher than typical flight heights for most of the locally-occurring bird and bat species (Biota 2026h). Species that typically fly at higher altitudes, such as raptors and other soaring birds, and higher-flying bats, are, axiomatically, at the highest risk of impact.

Five bat species have been recorded within the 50 km limit used for the risk assessment, none of which are significant at either the State or Commonwealth level, and none were assessed as having a high risk of being impacted through collision.

Potential impacts from wind turbines to non-listed bird and bat assemblages in the locality are similarly limited, with the only species at high risk of collision being the Australian Bustard (*Ardeotis australis*) due to its large body reducing manoeuvrability of avoidance behaviours, though the species is not known to occur in the turbine locality in large numbers. Most other recorded avifauna and bats either fly below the RSA, or are regionally widespread such that potential collisions will not result in population level effects (Biota 2026i).

Table 9-34 summarises the risk assessment for significant bird species recorded within the 50 km assessment zone.

**Table 9-33: Avifauna and Bats Recorded within a 50 km Radius of the Proposed Turbine Locations**

| Family | Common Name | Species | Listing |
|---|---|---|---|
| **Birds** | | | |
| Apodidae | Pacific Swift | *Apus pacificus* | Migratory (BC Act, EPBC Act) |
| Otididae | Australian Bustard | *Ardeotis australis* | - |
| Caprimulgidae | Spotted nightjar | *Eurostopodus argus* | - |
| Cuculidae | Horsfield's Bronze cuckoo | *Chrysococcyx basalis* | - |
| Columbidae | Diamond Dove | *Geopelia cuneata* | - |
| Turnicidae | Little Buttonquail | *Turnix velox* | - |
| Charadriidae | Oriental Plover | *Anarhynchus veredus* | Migratory (BC Act, EPBC Act) |
| Scolopacidae | Little Curlew | *Numenius minutus* | Migratory (BC Act, EPBC Act) |
| Laridae | Common Gull-billed Tern | *Gelochelidon nilotica* | Migratory (BC Act, EPBC Act) |
| Accipitridae | Brown Goshawk | *Accipiter fasciatus* | - |
| | Spotted Harrier | *Circus assimilis* | - |
| | Whistling Kite | *Haliastur sphenurus* | - |
| Alcedinidae | Red-backed Kingfisher | *Todiramphus pyrrhopygius* | - |
| Meropidae | Rainbow Bee-eater | *Merops ornatus* | - |
| Falconidae | Brown Falcon | *Falco berigora* | - |
| | Nankeen Kestrel | *Falco cenchroides* | - |
| | Grey Falcon | *Falco hypoleucos* | Vulnerable (BC Act, EPBC Act) |
| | Australian Hobby | *Falco longipennis* | - |
| Cacatuidae | Little Corella | *Cacatua sanguinea* | - |
| | Cockatiel | *Nymphicus hollandicus* | - |

| Family | Common Name | Species | Listing |
|---|---|---|---|
| Psittaculidae | Budgerigar | *Melopsittacus undulatus* | - |
| | Night Parrot | *Pezoporus occidentalis* | Critically Endangered (BC Act, EPBC Act) |
| Maluridae | Purple-backed Fairywren | *Malurus assimilis* | - |
| | White-winged Fairywren | *Malurus leucopterus* | - |
| Meliphagidae | Pied Honeyeater | *Certhionyx variegatus* | - |
| | Crimson Chat | *Epthianura tricolor* | - |
| | Singing Honeyeater | *Gavicalis virescens* | - |
| | Brown Honeyeater | *Lichmera indistincta* | - |
| | Yellow-throated Miner | *Manorina flavigula* | - |
| | Grey-headed Honeyeater | *Ptilotula keartlandi* | - |
| | White-plumed Honeyeater | *Ptilotula penicillata* | - |
| | White-fronted Honeyeater | *Purnella albifrons* | - |
| | Black Honeyeater | *Sugomel nigrum* | - |
| Psophodidae | Chiming Wedgebill | *Psophodes occidentalis* | - |
| Artamidae | Black-faced Woodswallow | *Artamus cinereus* | - |
| | Little Woodswallow | *Artamus minor* | - |
| | Masked Woodswallow | *Artamus personatus* | - |
| | Pied Butcherbird | *Cracticus nigrogularis* | - |
| Campephagidae | Black-faced Cuckooshrike | *Coracina novaehollandiae* | - |
| | White-winged Triller | *Lalage tricolor* | - |
| Oreoicidae | Crested Bellbird | *Oreoica gutturalis* | - |
| Pachycephalidae | Rufous Whistler | *Pachycephala rufiventris* | - |
| Rhipiduridae | Willie Wagtail | *Rhipidura leucophrys* | - |
| Corvidae | Little Crow | *Corvus bennetti* | - |
| Petroicidae | Hooded Robin | *Melanodryas cucullata* | - |
| Locustellidae | Brown Songlark | *Cincloramphus cruralis* | - |
| | Rufous Songlark | *Cincloramphus mathewsi* | - |
| | Spinifexbird | *Poodytes carteri* | - |
| Estrildidae | Australian Zebra Finch | *Taeniopygia castanotis* | - |
| **Bats** | | | |
| Molossidae | White-striped Free-tailed Bat | *Austronomus australis* | - |
| | Greater Northern Free-tailed Bat | *Chaerephon jobensis* | - |
| Vespertilonidae | Gould's Wattled Bat | *Chalinolobus gouldii* | - |

| Family | Common Name | Species | Listing |
|---|---|---|---|
| | Little Broad-nosed Bat | *Scotorepens greyii* | - |
| Emballonuridae | Yellow-bellied Sheath-tailed Bat | *Saccolaimus flaviventris* | - |

**Table 9-34: Summary of Risk Assessment and Environmental Outcomes for Significant Avifauna Species Recorded within a 50 km radius of the Proposed Turbine Locations**

| Species | Collision Risk | Occurrence | Risk Outcome |
|---|---|---|---|
| Pacific Swift<br>*Apus pacificus*<br>(Migratory) | High | Migrant to broader region. Likely sporadic occurrence, primarily from Sep-Apr, particularly in association with unsettled weather | Risk of individual collision mortality, low risk of significant displacement impacts. Negligible risk of broader population impacts from collision mortality given the relatively small number of turbines proposed and that the species is likely to occur over the project area only sporadically, and in lower numbers overall than over more coastal areas in the Pilbara |
| Grey Falcon<br>*Falco hypoleucos*<br>(Vulnerable) | High | Resident in broader region at relatively low density, occurs in Development Envelope | Risk of individual collision mortality and/or displacement impacts, with a small potential for local population impacts. Very low risk of population impacts at State-wide scale due to wide distribution in Western Australia |
| Oriental Plover<br>*Anarhynchus veredus*<br>(Migratory) | Medium | Migrant to broader region, primarily Sep-Apr, but number of records and overall numbers much lower inland than in coastal Pilbara and (particularly) Kimberley regions | Potential for individual collision mortality, low risk of displacement impacts. Impacts on broader population likely to be negligible |
| Little Curlew<br>*Numenius minutus*<br>(Migratory) | Medium | Migrant to, and nomadic within, the broader region, but number of records and overall numbers much lower than in coastal Pilbara and northern Australia | Potential for individual collision mortality, low risk of displacement impacts. Impacts on broader population likely to be negligible |
| Common Gull-billed Tern<br>*Gelochelidon nilotica*<br>(Migratory) | Medium | Migrant to, and nomadic within, the broader region, but number of records and overall numbers much lower than coastal Pilbara | Potential for individual collision mortality, low risk of displacement impacts. Impacts on broader population likely to be negligible |
| Night Parrot<br>*Pezoporus occidentalis*<br>(Critically Endangered) | Very low | Occurs in the south-east of the Proposal area but not recorded within 26 km of the turbine locations and habitat there of low suitability | Very low risk of individual collision mortality and displacement due to very low numbers (if any) moving in the Proposal area and likely low flight heights even if present |

#### 9.4.1.2.3 Interaction with SGARs

SGARs will be deployed through implementation of the EMP in an effort to control feral rodents within the Proposal. Recent research (Lohr et al. 2025) found that five threatened dasyurid species, including the Northern Quoll, contained SGAR residues. As secondary evidence of Northern Quoll has been recorded 0.3 km from the Development Envelope, it is potentially at risk of consuming SGARs as it traverses through baited areas.

### 9.4.1.3 Loss of SRE Individuals and SRE Habitat as a Result of Clearing

Clearing for the Proposal will directly impact up to 4,878 ha of potential SRE habitat within the Development Envelope (Table 9-35).

**Table 9-35: Indicative Clearing of SRE Habitat**

| Habitat Type | SRE Microhabitats | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) | Approximate % Loss within Development Envelope | Approximate Extent Remaining within the Development Envelope (ha) | Survey Extent* |
|---|---|---|---|---|---|---|
| Shrub and Spinifex on Sandplain | Limited | 17,037.5 | 3,700.0 | 21.7 | 13,337.5 | 636,108.3 |
| Inland Sand Dune | Limited | 3,105.5 | 798.0 | 25.7 | 2,307.0 | 29,045.8 |
| Gravelly Lateritic Rises | Limited | 3,116.2 | 237.9 | 7.6 | 2,878.3 | 33,200.4 |
| Clayey Sandplain with Termitaria | Preferred habitat for some mygalomorph species | 124.7 | 39.3 | 31.6 | 85.4 | 130.5 |
| Ephemeral Claypan | Preferred habitat for some mygalomorph species | 49.3 | - | - | 49.3 | 479.0 |

** Surveyed extent of fauna habitat within and surrounding the Development Envelope*

121°15'0"E

121°30'0"E

20°15'0"S

Aname (N138)

Aname (N140)

**Legend**

Potential SRE Species

- Aname (N138)
- Aname (N140)
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

Fauna Habitat

- Rock Outcropping
- Disturbed/Cleared
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

RioTinto

**Fig 9-35: Conceptual Footprint in the Context of SRE Records and Habitat within and Surrounding the Development Envelope (1 of 3)**

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 25 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: **Degree**
**Scale:** 1:160,000
Rio Tinto © Copyright

0 2.5 5 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout : ERD - SRE Records and Habitat_MapSeries

121°15'0"E

121°30'0"E

121°45'0"E

N

Aname sp. N148

Aname sp. N153

Kwonkan sp. NSD_N151

Kwonkan sp. NSD_N151

Genus ? NRC_N150

Urodacus varians

Kwonkan sp. NSD_N151

Kwonkan sp. NSD_N151

Kwonkan sp. NSD_N151

Kwonkan sp. NSD_N151

Kwonkan sp. NSD_N151

Kwonkan sp. NSD_N151

Kwonkan sp. NSD_N151

Idommata sp. BBT_B39

Aname sp. NSB_N149

Aname sp. N152

Urodacus 'yaschenkoi species complex'

Urodacus sp. 'telfer'

Kwonkan sp. NSD_N151

20°45'0"S

**Legend**

Potential SRE Species

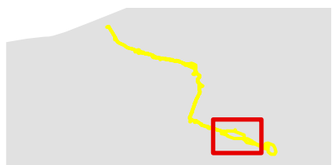
- Aname sp. N148
- Aname sp. N152
- Aname sp. N153
- Aname sp. NSB_N149
- Genus ? NRC_N150
- Idommata sp. BBT_B39
- Kwonkan sp. NSD_N151
- Urodacus sp. 'telfer'
- Urodacus varians
- Urodacus 'yaschenkoi species complex'
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

Fauna Habitat

- Ephemeral Claypan
- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

RioTinto

**Fig 9-35: Conceptual Footprint in the Context of SRE Records and Habitat within and Surrounding the Development Envelope (2 of 3)**



Rio Tinto Copper (RTC)

**Publisher:** B.Gardiner
Date Published: Thursday, 25 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:110,000
Rio Tinto © Copyright

0 2.5 5 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout : ERD - SRE Records and Habitat_MapSeries

121°45'0"E

20°45'0"S

Kwonkan sp.
NSD_N151

Kwonkan sp.
NSD_N151

Aname
sp. N152

Idommata sp. BBT_B39

Urodacus sp.
'telfer'

Aname sp.
NSB_N149

Urodacus 'yaschenkoi species complex'

Urodacus 'yaschenkoi
species complex'

Kwonkan sp.
NSD_N151

Aname sp.
NSB_N149

Idommata sp. BBT_B39

Aname
sp. N152

Urodacus 'yaschenkoi species complex'

Kwonkan sp.
NSD_N151

Urodacus sp.
'telfer'

20°45'0"S

20°45'0"S

**Legend**

Potential SRE Species

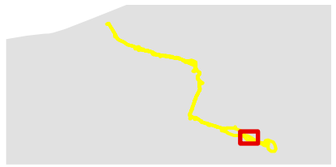
- Aname sp. N152
- Aname sp. NSB_N149
- Idommata sp. BBT_B39
- Kwonkan sp. NSD_N151
- Urodacus sp. 'telfer'
- Urodacus 'yaschenkoi species complex'
- Conceptual Footprint
- Development Envelope
- Native Title Determinations

Fauna Habitat

- Disturbed/Cleared
- Clayey Sandplain with Termitaria
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

RioTinto

**Fig 9-35: Conceptual Footprint in the Context of SRE Records and Habitat within and Surrounding the Development Envelope (3 of 3)**



**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 25 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:40,000
Rio Tinto © Copyright

0 2.5 5 Kilometres

### 9.4.2 Indirect Impacts

Potential indirect impacts of the Proposal on Terrestrial Fauna have been identified as:

- Degradation or alteration of habitat as a result of altered hydrological regimes
- Degradation of fauna habitat as a result of increased weeds, dust, introduced fauna and altered fire regimes
- Disturbance and displacement of fauna from increased light, noise and/or vibration.

#### 9.4.2.1 Degradation or Alteration of Habitat as Result of Altered Hydrological Regimes

No natural permanent, persistent or significant water features that would potentially be important fauna habitat occur within or nearby the Development Envelope.

The construction of mining infrastructure will introduce new, or increase the extent of existing, unnatural impervious surfaces (such as roads and buildings) within the Development Envelope. This will lead to localised reduction in infiltration and an increase in localised surface water runoff, which could potentially cause prolonged inundation or flooding in low-lying areas. Prolonged inundation may cause altered vegetation composition within the Development Envelope, impacting the structure of fauna habitats.

The region experiences climate extremes where severe droughts can be followed by significant flooding, particularly during cyclonic events, as such its vegetation and fauna habitats are expected to be well adapted to any inundation exacerbated by the placement of infrastructure, with any such eventuality expected to be temporary and of short duration, in keeping with the existing environment (Section 7). The implementation of appropriate surface water management strategies (Section 9.5 and Section 7) to retain, divert or assist water flows as appropriate are expected to mitigate any risk of impact to terrestrial fauna habitat within and surrounding the Development Envelope.

Management of excess dewatering water into infiltration ponds and MAR bores will be undertaken (Section 7). This has potential to lead to localised groundwater mounding and surface water expressions in areas around the ponds and MAR borefield, which may lead to indirect impacts including changes in fauna habitat structure.

Access to water is a key component of the pest Cane Toad advance from northern Australia southwards. The State Government's Cane Toad 'waterless' barrier plan (Toad Containment Zone) aims to prevent the toad's further spread and involves upgrading pastoral and irrigation infrastructure across a 150 km stretch between the coast and the Great Sandy Desert, and is therefore relevant to the western end of the RAC (GoWA 2024a).

##### 9.4.2.1.1 Management of Surplus Water

Where surplus water cannot be managed in a Clean Water Dam, an infiltration area will be used (MAR preferentially, and then infiltration ponds). Only clean water will be used for infiltration and MAR processes. Potentially contaminated surface water will be used only in the processing circuit. This will allow infiltration in the surficial sands and sandstone as well as some evaporation. Discharge of excess dewatering water into infiltration areas has potential to impact groundwater quality in areas around the ponds. This has potential to lead to localised groundwater mounding and surface water expressions in areas around the ponds and MAR borefield, which may lead to indirect impacts including changes in fauna habitat structure.

Surplus water discharge to the infiltration ponds and MAR bores is expected to peak in Year 9 when pit dewatering requirements will be at their greatest, reducing to zero by Year 20 when operational water demand is modelled to exceed dewatering rates (Section 7) (Worley 2025e). Field investigations and predictive groundwater flow modelling was used to estimate effects on groundwater around the proposed infiltration ponds and MAR bores. This indicated that mounding of the watertable is expected to occur around the ponds due to seepage (Worley 2025d). The MAR borefield itself is not expected to lead to mounding in the surficial sands. While the infiltration ponds and bores will be located to provide

distance from and reduce circulation back into the mine pit, the modelling indicates some influence from mine pit dewatering.

An assessment was undertaken on the potential impact of the groundwater mounding on vegetation, including fauna habitat, based on groundwater modelling (Biota 2025a; Worley 2025d). Based on the modelling:

- Two groundwater mounds will develop around the ponds within the surficial sands, but most of the water volume is predicted to seep down to the sandstone aquifer
- The mounds in the surficial sands at the predicted peak of infiltration volume (Year 9) covers a relatively small footprint
- Mounding of the deeper sandstone aquifer will occur over a larger footprint, with the groundwater mound supplying some of the infiltrated water to flow back to the mining pit
- From peak infiltration in Year 9, the surplus volume will gradually reduce which will also result in a smaller infiltration mound footprint over time.

Two fauna habitat types occur within the groundwater mounding study area, Shrub and Spinifex on Sandplain habitat and Inland Sand Dune habitat. Of these, only the Shrub and Spinifex on Sandplain habitat type has potential to be indirectly impacted by groundwater mounding (Biota 2025a). Inland Sand Dune habitat is not expected to be impacted as the habitat type only intersects the groundwater contours of 7 mbgl and above (Table 9-36). Approximately 12 ha of Shrub and Spinifex on Sandplain habitat was recorded within the predicted groundwater mounding contours that were less than 2 mbgl (Table 9-36). This represents 0.002% of the known mapped extent of this habitat type. It is considered likely that only 3 ha of habitat within the 1 mbgl contour may be impacted by groundwater mounding, representing less than 0.001% of the total mapped extent.

**Table 9-36: Potential Indirect Impacts on Fauna Habitat Surrounding the Winu Infiltration Ponds**

| Indirect Impact (Groundwater Mounding) (mbgl) | Fauna Habitat (ha) within Extent of Predicted Groundwater Mounding | |
|---|---|---|
| | Shrub and Spinifex on Sandplain | Inland Sand Dune |
| <1 | 3.1 | - |
| 1-2 | 8.4 | - |
| 2-5 | 28.5 | - |
| 5-7 | 34.7 | - |
| 7-10^ | 48.3 | 1.8 |
| 10-35* | 292.1 | 50.2 |
| **Total** | **415.1** | **52.0** |

*^10 mbgl mounding extent represents the expected rooting depth of vegetation in the relevant area. *35 mbgl contours represent extent of study area.*

#### 9.4.2.1.2 Formation of a Mine Pit Lake

The mine pit will not be backfilled at completion of mining, and water balance modelling indicates that a pit-lake will form as the pit fills with groundwater (Mine Lakes Consulting 2025). The pit lake has potential to contain elevated concentrations of contaminants of potential concern, which may present a risk to Threatened and Migratory species accessing the Development Envelope. Fauna species may be attracted to the pit lake as a water source.

#### 9.4.2.1.3 Groundwater Drawdown in the Percival Palaeovalley

The Percival Palaeovalley within and south of Rimfire is assumed to host GDV due to a shallow watertable (Section 8.3.2.5). A reduction in groundwater levels due to drawdown from Rimfire has the

potential to impact any GDV in the palaeovalley (Worley 2025e). Areas of assumed GDV within the palaeovalley are presented in Figure 9-36, overlain by the modelled existing depth to groundwater of the deeper fracture rock aquifer.

Of the conservation significant fauna species that are known to, or that may, occur in the vicinity of the Proposal, the Princess Parrot has the most potential to be indirectly impacted by the effect of groundwater drawdown on GDVs in the palaeovalley due to the presence of *Eucalyptus victrix* potential foraging habitat (Section 9.3.2.4). In the palaeovalley, *E. victrix* occurs within GDV units P23a and C1+P23. A combined approximately 950 ha of these units overlie the zone of influence of the drawdown cone of depression from abstraction at Rimfire under the theoretical worst case 2.8 GL/a Project licensing case (Figure 9-37). It should be noted that within unit P23a *E. victrix* occurs only occasionally, although it is a defining feature of the mosaic unit C1+23a. Within the 929 ha of P23a mapped, the potential impact on foraging resources thus represents a much smaller, albeit not quantified, subset of the total area.

While drawdown from Rimfire has the potential to affect areas of assumed GDV - which include P23 vegetation sub-units other than P23a, that do not include *Eucalyptus victrix* as a defining or dominant species (Section 8.3.2.5) - in the Percival Palaeovalley the risk of a significant indirect impact to potential habitat for other MNES that may occur within the palaeovalley is expected to be negligible as none are reliant on GDV plant species (Section 9.3.2.4). This potential impact extent discussed here is based on the theoretical maximum Project licensing case. The more realistic and conservative Project water demand case (P90) will result in a much smaller potential groundwater drawdown zone of influence (Figure 9-38). Furthermore:

- No GDV is expected to be impacted due to groundwater drawdown from mine pit dewatering
- No habitat used by threatened and migratory species for denning, breeding, refugia and primary foraging activities has been identified in the palaeovalley
- The Proponent will implement the Rimfire Groundwater Licence Operating Strategy (Appendix C19) which will include groundwater drawdown triggers to ensure that monitoring and management of groundwater draw down anticipated from the Rimfire borefield does not significantly impact GDV in the palaeovalley, as discussed in Sections 8.5.1.1 and 10.5.1.1.

Areas of potential GDV within areas of groundwater drawdown under different Project licensing and Project water demand cases are presented in Figure 9-37 and Figure 9-38 respectively.

122°0'0"E

## Legend

- Conceptual Footprint
- Development Envelope
- Native Title Determinations

### Fauna Habitat

- Calcrete outcropping
- Disturbed/cleared
- Ephemeral Claypan
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

### Melaleuca-dominated Vegetation Type

- C1+P23
- P23
- P23a
- P23b
- P23c
- P23d

### Groundwater Level (mBGL)

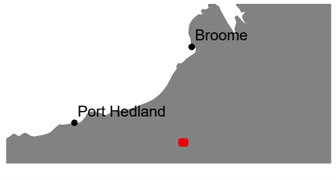
- 1
- 2
- 5
- 10
- 20
- 30
- 40
- 50
- 60

N

0 1 2
Kilometres

RioTinto

**Figure 9-36: Potential GDV (P23a-d and C1+P23) of the Percival Palaeovalley and Baseline Deeper Fracture Rock Aquifer Groundwater Depths**




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Wednesday, 1 July 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:50,000
Rio Tinto © Copyright



122°0'0"E

122°0'0"E

## Legend

- Conceptual Footprint
- Development Envelope
- Native Title Determinations

### Melaleuca-dominated Vegetation Type

- C1+P23
- P23
- P23a
- P23b
- P23c
- P23d

### Fauna Habitat

- Calcrete outcropping
- Disturbed/cleared
- Ephemeral Claypan
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

### Maximum Drawdown Contours

Contours (m)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

MARTU (AREA A)

P23c P23b P23a P23c P23b P23a P23c P23a P23b P23c C1+P23 P23b P23c P23c P23a P23c P23b P23d P23d P23 P23d P23 P23

0 5 10

Kilometres

N

RioTinto

**Figure 9-37: Potential GDV (P23a-d and C1+P23) of the Percival Palaeovalley and Rimfire Borefield Maximum Drawdown**

Rio Tinto Copper (RTC)

**Publisher:** B.Gardiner
Date Published: Wednesday, 1 July 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:100,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Potential GDV Max Drawdown

21°0'0"S

122°0'0"E

122°0'0"E

KYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

N

1

2

5

7

P23b

P23c

P23a

C1+P23

P23d

P23

## Legend

- Conceptual Footprint
- Development Envelope
- Native Title Determinations
- Rimfire P90 Drawdown (m)

### Melaleuca-dominated Vegetation Type

- C1+P23
- P23
- P23a
- P23b
- P23c
- P23d

### Fauna Habitat

- Calcrete outcropping
- Disturbed/cleared
- Ephemeral Claypan
- Gravelly Lateritic Rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain

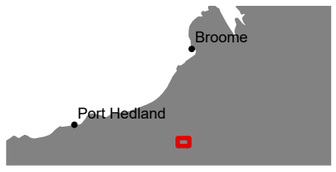
RioTinto

**Figure 9-38: Potential GDV (P23a-d and C1+P23) of the Percival Palaeovalley and Rimfire Borefield Project Demand Drawdown**

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Wednesday, 1 July 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:100,000
Rio Tinto © Copyright




0 2 4
Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx | Layout: ERD - Potential GDV Project Demand Drawdown

122°0'0"E

#### 9.4.2.2 Degradation of Fauna habitat as a Result of Increased Weeds, Dust, Introduced Fauna, and Altered Fire Regimes

##### 9.4.2.2.1 Weeds

Existing weed presence, abundance and diversity within the Development Envelope is very low (Section 8). Small populations of weeds have been noted, with a total of ten weed species encountered across the Development Envelope to date (Western Botanical 2025b; Biota 2026h) (Appendix D01). The majority of records are from the north-western extent of the RAC within the Wallal Downs pastoral lease. Species recorded include Buffel Grass, Bitter Melon, Coast Button Grass, Tomato, Giant Pigweed, Khaki Weed, Tridax, Verano Stylo, Caltrop and *Euphorbia prostrata*.

Increased vehicle presence and movement and earthmoving activities associated with Proposal implementation may potentially introduce, or increase the spread of, weeds within the Development Envelope. This has the potential to affect fauna by:

- Increasing fuel loads, potentially altering natural fire regimes
- Degrading the condition of, or structurally changing, native vegetation habitat.

##### 9.4.2.2.2 Dust

Dust levels in the Great Sandy Desert bioregion are considered relatively low with respect to other Australian rangeland areas (DSEWPaC 2011c; DCCEEW n.d.).

Dust can be generated and dispersed in windy conditions during clearing and operations, which may deposit on vegetation, potentially impacting fauna habitat quality.

##### 9.4.2.2.3 Introduced Fauna

Five introduced fauna species have been recorded within the Development Envelope and are known from the region.

The development of new tracks, increased water points and the production of domestic waste has the potential to attract and increase the abundance and diversity of introduced fauna species within the Development Envelope. This may result in increased competition with, and predation of, native fauna species.

##### 9.4.2.2.4 Fire

Fire may directly impact fauna or modify habitat through altered frequency and intensity. Too frequent, hot or extensive fires during hot, dry times of the year can reduce habitat capacity to support diverse fauna assemblages by altering vegetation structure and composition, resulting in changes in food quantity and quality and changes in cover and microhabitats (Griffiths and Brook 2014).

Species such as Night Parrot and Spectacled Hare-wallaby are known to require long unburnt spinifex habitat, and the Greater Bilby is known to forage on food resources offered by habitats of a range of fire-ages (Biota 2026h). As such, these species have potential to be affected by increased fire frequency and/or intensity.

#### 9.4.2.3 Disturbance and Displacement of Fauna from Increased Light, Noise and/or Vibration

Existing artificial light, noise and vibration levels within the Development Envelope and surrounds are very low due to its remote location and lack of development.

##### 9.4.2.3.1 Light

Light emissions can disorient flying birds, particularly during migration, and cause them to divert from efficient migratory routes or collide with infrastructure (DCCEEW 2023b). Artificial light may interfere with activities governed by the length of the day, including reproduction, dormancy, foraging and migration. Light emissions may attract invertebrates and alter the foraging activities of nocturnal species,

potentially making small mammals vulnerable to predation. Artificial light may also result in increased risk of bird collision with infrastructure at night due to interference with an individual's vision.

Light emissions generally attenuate with distance, with the habitat and fauna within and near the MIA (i.e. mine pit and areas of most intense operational activity, including processing facilities, airstrip and wind turbines) expected to have the most potential to be affected. MIA lighting will be in use all night, seven nights a week, throughout construction and operation. Lighting elsewhere will be restricted to that only required for safe operations (Table 9-40).

Although no direct evidence is available regarding the potential effects of artificial light pollution on Night Parrot, there is an increasing body of evidence indicating that artificial light pollution can have noticeable effects on both diurnal and nocturnal animals (Biota 2025b), including increasing the risk of birds colliding with artificial structures at night, particularly in poor visibility conditions, changes to timing of behaviour within a day and seasonally, physiological changes associated with breeding, increased risk of predation and decreased or increased survival rates for some bird species.

There is also some evidence that exposure to artificial noise (see below) and light pollution in combination may have a greater impact than predicted by additive effects (Biota 2025b). Of these, the most plausible risks to Night Parrots are likely to be increased risks of collisions with artificial structures where light spill interferes with their vision, and increased risk of predation as predators take advantage of greater nocturnal visibility.

##### 9.4.2.3.2 Noise

Increased noise can disturb fauna and cause an interruption in feeding and resting behaviour, reduced population densities, nest failure, abandonment of habitat area and roost sites and reduced hunting efficiency (Newport et al. 2014).

Noise emissions will arise from the construction and operation of the mine, particularly from blasting within the pit. Other noise sources will include light and heavy vehicles and plant, ore and mineral waste crushing, handling and processing, wind turbines and the airfield.

A Noise and Vibration Impact Assessment has been undertaken for the Proposal to determine the likely impacts of proposed noise emissions on significant fauna species (Biota 2025c). Based on a literature review, the assessment adopted a conservative threshold of 50 dB(A) (quieter than normal conversation) to identify any areas where a risk of behavioural impacts on significant fauna may occur. Considering a small proportion (<0.1%) of suitable habitat for some significant fauna species occurs within areas which may experience day-to-day operational noise emissions greater than 50 dB(A), the assessment determined that it is unlikely that any significant species will be significantly impacted by noise (Biota 2025c) (Table 9-37). Noise emissions from the airfield greater than 50 dB(A) will also affect a small proportion (1.7%) of suitable habitat for some significant fauna species, but due to the nature of this noise being infrequent and very short-lasting this is considered to be significantly less than those produced by natural events such as thunderstorms (Biota 2025c). Behavioural responses and masking effects may occur where noise emissions exceed 50-60 dB(A), however, significant impacts such as injury or hearing damage are known to occur at a much higher level (i.e. up to 140 dB(A) (Dooling and Popper 2007 as cited in Biota 2025c).

Baseline ambient noise monitoring at locations east of the MIA and close to the airfield showed that noise levels are consistently up to 55 dB(A) $L_{A90}$, between 6pm and 8pm (Lloyd George Acoustics 2025a). This was observed in the digital audio recordings as being caused by prevailing noise from insects in the vicinity of the equipment.

A desktop Noise Assessment of operational plant noise has also been undertaken for Rimfire (Lloyd George Acoustics 2025d) (Appendix E14). The assessment focused primarily on noise emitted from generators at the borefield as pumps do not emit significant noise above the surface and considers all noise predicted as an $L_{Amax}$ level as noise impacts from the airfield were also included (Lloyd George

Acoustics 2025d). The assessment determined that noise emissions from Rimfire will not significantly contribute to the overall noise levels ($L_{A10}$) of the Proposal (Lloyd George Acoustics 2025d).

Little is known about the potential effects of noise on Night Parrot, but exposure to anthropogenic noise has been demonstrated to have a variety of impacts on animals (Biota 2025b). CT scans of the skull of the holotype Night Parrot specimen suggest that the species is likely to have particularly acute hearing, as expected for a nocturnal species; however, it is suggested that Night Parrots may be particularly susceptible to impacts from noise disturbance.

Modelled airfield noise intersects areas of potential roosting and foraging Night Parrot habitat. Approximately 254 ha of potential roosting habitat and 117 ha of potential foraging habitat occur within areas exposed to noise levels exceeding 50 dB(A). These noise emissions are infrequent and of short duration (approximately 15–20 seconds). No Night Parrot habitat occurs within areas where noise levels exceed 75 dB(A). Overall, areas of potential Night Parrot habitat outside the Conceptual Footprint that may be affected by noise above 50 dB(A) represent approximately 15% of the total locally mapped habitat (Lloyd George Acoustics 2025c) (Appendix E15).

Areas of Night Parrot habitat that may be impacted by operational noise are shown in Table 9-38 and Figure 9-39.

**Table 9-37: Fauna Habitat Noise Levels**

| Fauna Habitat | Total | | Noise Study | | Extent within Noise Contours >50 dB $L_{A10}$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Mine Operations / Wind Farm | | | Airfield | | |
| | Surveyed Extent (ha) | Within DE# (ha) | Noise Study Area (ha) | Within CF# (ha) | Total Area (ha)^ | % of Extent Within DE# | % of Surveyed Extent^ | Total Area (ha) | % of Extent Within DE# | % of Surveyed Extent |
| Clayey Sandplain with Termitaria | 130.5 | 124.7 | 130.4 | 39.3 | - | - | - | 20.6 | 16.5 | 15.8 |
| Ephemeral Claypan | 479.0 | 49.3 | - | - | - | - | - | - | - | - |
| Gravelly Lateritic Rises | 33,200.4 | 3,116.2 | 935.3 | 237.9 | - | - | - | 921.4 | 29.6 | 2.8 |
| Inland Sand Dune | 29,045.8 | 3,105.5 | 4,142.1 | 798.0 | 346.8 | 11.2 | <0.1 | 1,703.9 | 54.9 | 5.9 |
| Shrub and Spinifex on Sandplain | 636,108.3 | 17,037.5 | 17,343.0 | 3,700.0 | 610.9 | 3.6 | <0.1 | 9,163.9 | 53.8 | 1.4 |
| Disturbed / cleared | 262.6 | 215.8 | 118.8 | 102.4 | 2.0 | 0.9 | 0.8 | 37.3 | 17.3 | 14.2 |
| **Total** | **699,226.5** | **23,649** | **22,669.6** | **4,876.7** | **959.7** | **4.1** | **0.1** | **11,847.2** | **50.1** | **1.7** |

*Source: (Biota 2025c) *Note some minor area discrepancies, adjusted here from those shown Biota 2025c (Appendix E06), due to rounding, project changes since the study. No Rocky Outcropping habitat occurs within the Noise Study Area ^Excludes area within Conceptual Footprint #DE – Development Envelope, CF – Conceptual Footprint.*

**Table 9-38: Night Parrot Habitat Noise Levels**

| Night Parrot Habitat | Total Mapped Area | Area (ha) within Mine Operations and Wind Farm Noise Levels | Area (ha) within Airfield Noise Levels | | Proportion (%) of Total Survey Area | |
|---|---|---|---|---|---|---|
| | | >50 dB $L_{A10}$ | 50-75 dB $L_{AMAX}$ | >75 dB $L_{AMAX}$ | 50-75 dB(A) | >75 dB(A) |
| Roosting | 2,166.8 | - | 254.3 | - | 11.7 | - |
| Foraging | 307.1 | - | 116.9 | - | 38.1 | - |
| **Total** | **2,473.9** | **-** | **371.2** | **-** | **15.0** | **-** |

*Source: (Biota 2025c)*

#### 9.4.2.3.3 Vibration

The potential for vibration to impact fauna is mostly associated with blasting as it can affect fauna behaviour. As such, this issue is only considered applicable to the MIA, where the mine pit is located. However, no Rocky Outcropping or similar structures that can form important habitat and upon which vibration is expected to be of most impact occur within or close to the MIA.

No regular or prolonged periods of blasting, if any at all, are anticipated to be required in construction of the access road within the RAC (e.g. for excavation of borrow pits) or borefields.

Vibration levels have been predicted to the nearest occurrence of Night Parrot habitat, approximately 5.6 km from the pit, considered the closest sensitive receptor to potential blasting activities (Biota 2025c). The assessment identified that a worst-case blast would produce 94 dB $_{Z\ Peak}$ and 0.1 mm/s at the nearest occurrence of Night Parrot roosting/nesting habitat. This area of Night Parrot habitat is a small patch which is isolated from the larger area of potential habitat where all confirmed Night Parrot detections have been recorded. The closest confirmed recording is approximately 16 km from the mine pit.

On the above basis, the Proposal is not expected to have any impacts on significant fauna given the lack of nearby vulnerable habitat to the mine pit. As such, this potential impact is not discussed further in this section.

[redacted]

### 9.4.3 Cumulative Impacts

The Proposal will contribute to cumulative regional loss of fauna habitats and species present within the Development Envelope.

For the purposes of assessing potential impacts to Terrestrial Fauna, cumulative impacts have been considered based on any existing or reasonably foreseeable projects that occur within the three Land Systems that have been identified as being representative of the fauna habitat within the Development Envelope (Section 9.3.2).

As discussed in Section 9.3.2, detailed habitat mapping at a regional scale is not available, and Land System mapping can be used as a surrogate for assessing the fauna habitat within the Development Envelope in a regional context where more detailed mapping is unavailable. Where possible, the assessment has considered impacts based on the expected clearing footprints of each project. Where footprints are not publicly available, the entire development envelope of the project is used, to be conservative.

The potential cumulative loss of fauna habitat within the boundaries of the Callawa, Little Sandy and Nita Land Systems is shown in Table 9-39.

The proliferation of wind turbines in the Pilbara region may also result in cumulative impacts to avifauna and bat aerial habitat. The only other existing or reasonably foreseeable project identified in the vicinity of the Proposal (Section 2.3.9) that is known to include wind turbines is the AREH project, which intersects the Development Envelope and has been approved to allow development of approximately 1,743 wind turbines.

**Table 9-39: Cumulative Impacts on Land Systems within the Pilbara Region**

| Land System | Related Habitat Type within the Development Envelope | Relevant Fauna Species | Current Subregional Extent (ha) | Impact within Development Envelope (ha) | Cumulative Impact | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Australian Renewable Energy Hub | Gas Pipeline to Nifty Copper Operations | Pardoo Irrigated Agriculture Project – Stage 3 | Telfer Project, Power Supply and Infrastructure Corridor | Telfer Project, Expansion of Telfer Gold Mine | Telfer-Havieron Gold Mining Project | Area (ha) | % of Current Subregional Extent |
| Nita | Shrub and Spinifex on Sandplain | • Greater Bilby<br>• Brush-tailed Mulgara<br>• Spectacled Hare-wallaby<br>• Dampierland Plain Slider<br>• Northern Marsupial Mole<br>• Northern Quoll<br>• Black-footed Rock-wallaby<br>• Short-tailed Mouse<br>• Grey Falcon<br>• Oriental Plover<br>• Australian Tern<br>• Little Curlew<br>• Oriental Pratincole<br>• Pacific Swift<br>• Peregrine Flacon<br>• Princess Parrot<br>• Barn Swallow | 1,443,080 | 341.5 | 20,188.9 | - | 987.5 | 313.0 | 156.8 | 2,542.7 | 24,530.4 | 1.7 |
| Little Sandy | Inland Sand Dunes<br>Shrub and Spinifex on Sandplain<br>Clayey Sandplain on Termitaria<br>Ephemeral Claypan | • Greater Bilby<br>• Brush-tailed Mulgara<br>• Spectacled Hare-wallaby<br>• Dampierland Plain Slider<br>• Northern Marsupial Mole<br>• Northern Quoll<br>• Black-footed Rock-wallaby<br>• Short-tailed Mouse<br>• Grey Falcon<br>• Oriental Plover<br>• Australian Tern<br>• Little Curlew<br>• Oriental Pratincole<br>• Pacific Swift<br>• Peregrine Flacon<br>• Princess Parrot<br>• Barn Swallow | 1,287,831 | 3,918.8 | 9,858.5 | 371.1 | - | 710.3 | 395.1 | 2,990.2 | 18,244.0 | 1.4 |
| Callawa | Gravelly Lateritic Rises | • Greater Bilby<br>• Western Pebble-mound Mouse<br>• Brush-tailed Mulgara<br>• Northern Quoll<br>• Black-footed Rock-wallaby | 97,602 | 301.1 | 1,256.6 | - | - | 27.7 | 13.9 | 346.4 | 1945.7 | 2.0 |

| Land System | Related Habitat Type within the Development Envelope | Relevant Fauna Species | Current Subregional Extent (ha) | Impact within Development Envelope (ha) | Cumulative Impact | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Australian Renewable Energy Hub | Gas Pipeline to Nifty Copper Operations | Pardoo Irrigated Agriculture Project – Stage 3 | Telfer Project, Power Supply and Infrastructure Corridor | Telfer Project, Expansion of Telfer Gold Mine | Telfer-Havieron Gold Mining Project | Area (ha) | % of Current Subregional Extent |
| | | • Grey Falcon<br>• Pacific Swift<br>• Peregrine Falcon<br>• Barn Swallow | | | | | | | | | | |
| Buckshot | Gravelly Lateritic Rises | • Greater Bilby<br>• Western Pebble-mound Mouse<br>• Brush-tailed Mulgara<br>• Northern Quoll<br>• Black-footed Rock-wallaby<br>• Grey Falcon<br>• Pacific Swift<br>• Peregrine Falcon<br>• Barn Swallow | 8,775 | 15.8 | 895.6 | - | - | - | - | - | 911.4 | 10.4 |
| AB40 | Inland Sand Dunes<br>Shrub and Spinifex on Sandplain<br>Clayey Sandplain on Termitaria<br>Ephemeral Claypan | • Greater Bilby<br>• Brush-tailed Mulgara<br>• Spectacled Hare-wallaby<br>• Dampierland Plain Slider<br>• Northern Marsupial Mole<br>• Northern Quoll<br>• Black-footed Rock-wallaby<br>• Short-tailed Mouse<br>• Grey Falcon<br>• Oriental Plover<br>• Australian Tern<br>• Little Curlew<br>• Oriental Pratincole<br>• Pacific Swift<br>• Peregrine Flacon<br>• Princess Parrot<br>• Barn Swallow | 5,183,380 | 290.8 | - | - | - | - | 19.7 | 2,856.0 | 3,166.5 | 0.1 |
| B30 | Inland Sand Dunes<br>Shrub and Spinifex on Sandplain<br>Clayey Sandplain on Termitaria<br>Ephemeral Claypan | • Greater Bilby<br>• Brush-tailed Mulgara<br>• Spectacled Hare-wallaby<br>• Dampierland Plain Slider<br>• Northern Marsupial Mole<br>• Northern Quoll<br>• Black-footed Rock-wallaby<br>• Short-tailed Mouse<br>• Grey Falcon<br>• Oriental Plover | 195,230 | 10.0 | - | - | - | - | - | - | 10.0 | <0.1 |

| Land System | Related Habitat Type within the Development Envelope | Relevant Fauna Species | Current Subregional Extent (ha) | Impact within Development Envelope (ha) | Cumulative Impact | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Australian Renewable Energy Hub | Gas Pipeline to Nifty Copper Operations | Pardoo Irrigated Agriculture Project – Stage 3 | Telfer Project, Power Supply and Infrastructure Corridor | Telfer Project, Expansion of Telfer Gold Mine | Telfer-Havieron Gold Mining Project | Area (ha) | % of Current Subregional Extent |
| | | • Australian Tern<br>• Little Curlew<br>• Oriental Pratincole<br>• Pacific Swift<br>• Peregrine Flacon<br>• Princess Parrot<br>• Barn Swallow | | | | | | | | | | |
| **Total** | | | **8,215,898** | **4,878.0** | **32,199.6** | **371.1** | **987.5** | **1,051.0** | **585.5** | **8,735.3** | **48,808.0** | **0.6** |

## 9.5 Mitigation

The Proponent is committed to ensuring that the Proposal avoids or minimises, where practicable, impacts on significant fauna and significant fauna habitat within the Development Envelope.

During Proposal design, the mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to mitigate the potential impacts of the Proposal on Terrestrial Fauna as far as practicable. Table 12-7 summarises the application of the mitigation hierarchy.

### 9.5.1 Avoidance and Minimisation

The Proponent has refined the Development Envelope and Conceptual Footprint to ensure the Proposal prioritises the avoidance of significant fauna habitat where other options were available.

Key outcomes of the Proposal design refinements have been described in Section 2.2. Those relevant to Terrestrial Fauna are summarised below.

During the planning phase, the RAC has been designed to avoid all occurrences of Rocky Outcropping habitat, which is likely to represent critical habitat for Black-footed Rock-wallaby and Northern Quoll.

In addition, the Proposal has been designed to avoid all occurrences of roosting/nesting and foraging habitat for the Night Parrot. Habitat was mapped within the Texas Borefield, which has now been removed from the scope of the Proposal. In addition, the pipeline corridor between the MIA and Rimfire has been refined to avoid Night Parrot habitat.

As discussed, (Section 8.5) the Proponent will implement a groundwater monitoring and management strategy to mitigate potential groundwater drawdown impacts to GDV from operation of the Rimfire Borefield, and therefore mitigate any related effects to fauna that may forage on GDV in the Percival Palaeovalley.

#### 9.5.1.1 Environmental Management Plan

An Environmental Management Plan (EMP; Appendix A05) has been developed to manage potential impacts of the Proposal and ensure environmental outcomes and objectives are met.

#### 9.5.1.2 Management Areas

Three Managements Areas have been delineated to manage any increase in abundance or introduction of pest species (feral/invasive fauna and weeds) across the Development Envelope attributable to the Proposal. The different Management Areas have been selected based on the management targets and operational controls that can be reasonably expected to be implemented given the size, access and abundance of existing pest species for each of the Management Areas.

Management Area 1 comprises the section of the RAC within the Wallal Downs pastoral lease, which is known to have weed species present (Figure 9-40). The Proponent will implement weed monitoring within Management Area 1.

The Proponent considers that any introduction or increase in abundance of pest species in Management Area 2 (RAC east of Wallal Downs pastoral lease; Figure 9-40) cannot be wholly attributable to the Proposal given the extent (183 km) of non-exclusive access, and potential for translocation of existing weed species from Management Area 1. Therefore, the Proponent will implement management measures to minimise the introduction and spread of weeds and the introduction of feral/invasive fauna within Management Area 2. This will include a vehicle inspection and washdown station at the western entrance to Management Area 2.

Any introduction or increase in abundance of pest species in Management Area 3 (MIA and Rimfire; Figure 9-40) are likely to be attributable to the Proposal, given the Proponent's control of access, intensity of activities and the lack of existing weed species present in the Management Area. Therefore, the Proponent will implement extensive management within Management Area 3 to control any

introduction of feral/invasive fauna, prevent the introduction or spread of weed species and ensure a prompt response to all weeds identified within the area.

### 9.5.2 Mitigation of Risks at Closure

The MCP has been prepared to address closure requirements for the Proposal (Appendix A03). The MCP will be updated regularly (at intervals not exceeding five years) to ensure its objectives remain relevant and aligned to stakeholder expectations and its strategies and plan are appropriate to achieve closure outcomes.

To meet closure outcomes and manage closure risks, the following strategies that relate to the Terrestrial Fauna environmental factor will be implemented at the Proposal:

- Rehabilitation of ex-pit WRLs, with design informed by waste characterisation, to ensure long term stability and minimise the risk of erosion
- Implementation of progressive rehabilitation to promote revegetation and habitat development
- Surface water and groundwater modelling to inform operations, closure planning and design and ensuring no unacceptable impacts to sensitive receptors
- Rehabilitation monitoring of progressive rehabilitation to inform closure planning, closure outcomes and completion criteria development and refinement
- Ensure significant ACH values are protected and adequate post-mining land access is facilitated
- Design and placement of closure safety bunding to manage risks associated with inadvertent public access post-closure
- Removal of infrastructure to 1 m below ground level at closure unless otherwise agreed with relevant stakeholders
- Ongoing closure engagement with internal and external stakeholders to ensure technical and stakeholder input is considered and incorporated, where appropriate, into life of mine and closure planning and decision-making processes
- Contaminated sites assessment and remediation, where required.

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

Great Northern Hwy

**Management Area 1**

Cattle Grid

*WALLAL DOWNS*

*NYANGUMARTA PEOPLE (PART A)*

**Management Area 2**

**Management Area 3**

Winu Camp

*MARTU (AREA A)*

N

0 10 20 Kilometres

## Legend

- Management Area 1
- Management Area 2
- Management Area 3
- Development Envelope
- Wallal Downs Pastoral Station
- Native Title Determinations

RioTinto

**Figure 9-40: Management Areas within the Development Envelope**

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Tuesday, 16 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:475,811
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Management Areas within DE

**Table 9-40: Application of the Mitigation Hierarchy for Terrestrial Fauna**

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| **Direct Impacts** | | | | |
| Loss of fauna habitat | **Measure to Avoid** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to avoid direct impacts to approximately 14,000 ha of critical or supporting habitat for significant fauna species. This includes complete avoidance of Rocky Outcropping habitat known to support Black-footed Rock-wallaby and Northern Quoll, and nesting/roosting and foraging habitat for Night Parrot<br><br>The total extent of clearing will not exceed 4,878 ha within the 23,649 ha Development Envelope | Proposal specific | No | Avoidance is the first and preferred step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b)<br><br>Avoidance of significant habitat is a key recommendation for species conservation |
| | **Measure to Minimise** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to minimise direct impacts to Inland Sand Dunes habitat which provides critical and supporting habitat for significant fauna species<br><br>Known locations of fauna habitat will be included in the Proponent's GIS system to ensure impacts to known locations of significant habitat types are minimised and adhere to authorised extents | Proposal specific | No | Retention of significant habitat is a key recommendation for species conservation |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement | A Proposal specific MCP has been developed | Yes – DMPE approval is required under the Mining Act for the implementation of an | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c) |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Habitat elements to be considered for Terrestrial Fauna as part of rehabilitation design includes:<br>• Vegetation that is known to provide preferred food or shelter preference<br>• Retaining and replacing woody debris<br>Rehabilitation will be undertaken progressively to minimise disturbed areas, reducing fragmentation and barriers to fauna movement | | MDCP and MCP (Appendix A03) | The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b)<br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025)<br>Rehabilitation will be required to provide a vegetated and stable landform with habitat features. However, the uncertainty in relation to the re-creation of habitat values following mining is acknowledged. Therefore, clearing is treated as a long-term or permanent impact for this assessment |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | Limit clearing of fauna habitat | | Clearing limits to be included as a Ministerial Condition | |
| Loss of fauna individuals | **Measure to Avoid** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to completely avoid direct impacts to approximately 14,000 ha of critical or supporting habitat for significant fauna species. This includes complete avoidance of Rocky Outcropping habitat known to support Black-footed Rock-wallaby and Northern Quoll, and nesting/roosting and foraging habitat for Night Parrot<br>Pre-clearance surveys for Greater Bilby will be undertaken to ascertain no active individuals are present within the clearing footprint | Standard practice | No | There are no industry or best practice standards established in relation to protection of native fauna. Avoidance is the first and preferred step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | No-go zones will be established around any active Greater Bilby burrows (should they be identified during pre-clearance surveys). No-go zones will remain in place until either:<br>• A fauna specialist has relocated the individual or<br>• The individual has been observed to have moved on from the area to adjoining suitable habitat, or the burrow is observed to no longer be active | | | |
| | **Measure to Minimise** | | | |
| | Clearing will be undertaken progressively to allow fauna to migrate away from clearing activities or machinery movements<br>Within 14 days prior to clearing, a fauna pre-clearance survey will be undertaken<br>Should Night Parrot individuals be visually identified during construction, work will cease immediately and all personnel will leave the vicinity<br>Construction of the Rimfire pipeline and borefield will only occur during daylight hours so as to not disturb Night Parrot behavioural patterns<br>Operational access to Rimfire (via the Rimfire pipeline) for routine maintenance activities will be planned for daylight hours (unless due to emergency circumstances or unplanned maintenance) so as to not disturb Night Parrot behavioural patterns<br>Speed limits will be implemented to minimise the risk of fauna injury or mortality from vehicle strike, including a 40 km/h speed limit along the Rimfire pipeline adjacent to Night Parrot habitat<br>Vehicle traffic will be confined to defined roads and tracks and required to travel at designated operating | Standard practice | No | These measures will minimise impacts to fauna species but will not avoid all injuries<br>Where avoidance is not possible, minimisation of impacts is the next preferred step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | speeds on all roads and will be restricted from accessing rehabilitated surfaces except for management purposes<br><br>Site induction programs will provide information on significant fauna, including their appearance and habitats. Training would also discuss standard operating procedures in the event of fauna interactions<br><br>Artificial water sources will have egress points<br><br>Wind turbine design will consider mitigation controls to reduce the likelihood of avian fauna strike<br><br>Implement a Bird and Bat Adaptive Management Plan that may include, but not be limited to:<br>• Survey and study findings<br>• Bird and bat risk assessment<br>• Monitoring program – including but not limited to carcass monitoring<br>• Adaptive management triggers<br><br>The airstrip will be fenced and fauna clearance runs will be undertaken prior to aircraft movements<br><br>Reflectors will be attached to fencing in accordance with the EMP to ensure it is visible and reduce the risk of fauna injury or mortality due to entanglement<br><br>No fencing will be constructed in areas adjoining known or potential Night Parrot roosting/nesting and foraging habitat<br><br>Investigate the effectiveness of noise deterrents and enhanced blade visibility of wind turbines<br><br>The length of any open trenches will be minimised and backfilled progressively where possible | | | |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Duration of open excavations will be minimised and backfilled immediately following completion of construction<br><br>Fauna egress and fauna refuge will be installed in all excavations left open overnight<br><br>Trench inspections for fauna and clearance are to be carried out within two hours of sunrise and before sunset unless backfilled, in which case inspection shall precede backfilling, as identified below<br><br>Construction crews shall inspect trenches half an hour before backfilling. If trapped fauna are present, a fauna handler will be notified and engaged to assist before backfilling<br><br>Measures to reduce exposure to SGARs such as non-lethal control or alternative products will be investigated by the Proponent and implemented where practicable | | | |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement<br><br>Habitat elements to be considered for Terrestrial Fauna as part of rehabilitation design includes:<br>• Vegetation that is known to provide preferred food or shelter preference<br>• Retaining and replacing woody debris<br><br>Rehabilitation will be undertaken progressively to minimise disturbed areas, reducing fragmentation and barriers to fauna movement | A Proposal specific MCP has been developed | Yes – DMPE for implementation of the MCP (Appendix A03) | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br><br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b)<br><br>There is a moderate certainty that rehabilitation measures will provide a vegetated and stable landform. However, there is uncertainty in relation to the recreation of habitat values following mining. Therefore, clearing is treated as a |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | | | | long-term or permanent impact for this assessment |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limit proposed – managed through standard industry practices | | N/A | |
| Loss of SRE species and habitat | **Measure to Avoid** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to avoid direct impacts to SRE habitat where practicable | Proposal specific | No | Avoidance is the first and preferred step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) |
| | **Measure to Minimise** | | | |
| | Known locations of suitable SRE habitat will be included in the Proponent's GIS system to ensure impacts to known locations of significant habitat types are minimised and adhere to authorised extents | Proposal specific | No | Retention of suitable habitat is a key recommendation for species conservation |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement<br><br>Habitat elements to be considered for Terrestrial Fauna as part of rehabilitation design includes:<br>• Vegetation that is known to provide preferred food or shelter preference<br>• Retaining and replacing woody debris | A Proposal specific MCP has been developed | Yes – DMPE for implementation of the MCP (Appendix A03) | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c). The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b)<br><br>There is a moderate certainty that rehabilitation measures will provide a vegetated and stable landform. However, there is uncertainty in relation to the recreation of habitat values following mining. Therefore, clearing is treated as a |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Rehabilitation will be undertaken progressively to minimise disturbed areas, reducing fragmentation and barriers to fauna movement | | | long-term or permanent impact for this assessment |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | Limit clearing of SRE habitat | | Clearing limits to be included as a Ministerial Condition | |
| **Indirect Impacts** | | | | |
| Degradation or alteration of habitat as a result of altered hydrological regimes | **Measure to Avoid** | | | |
| | N/A | | | |
| | **Measure to Minimise** | | | |
| | Perimeter bunds will be constructed on the upper surface and benches of the WRL to ensure surface water retained within the bunds infiltrates into the WRL or evaporates<br><br>A network of ponds, drains and flood protection bunds will be installed around the MIA to redirect stormwater from mining operations to be retained on site for re-use or to infiltrate/evaporate in situ<br><br>Waterway crossings will be installed along the RAC to prevent ponding upstream, water shadows downstream and to maintain flows downstream<br><br>Infiltration ponds and MAR bore management of surplus water is designed to minimise the potential for groundwater mounding on surface habitats<br><br>Infiltration ponds are designed to minimise the risk of overtopping due to storage capacity exceedance, or forming a surface expression of groundwater or near surface groundwater table | Standard practice – surface water management<br><br>Proposal specific – infiltration pond and MAR borefield | No - for surface water management<br><br>Yes – DWER – Ground - Groundwater Bore Licence (26D) to construct or alter a well and EP Act Part V licence and works approval<br><br>Yes – DWER – Groundwater Licence (5C) and Groundwater Operating Strategies developed as part of the Groundwater Licences for dewatering of the BWT mine pit | Minimum design requirements for mine and linear infrastructure are standard practice and effective at preventing ponding and maintaining flow regimes downstream<br><br>Construction and operation of the MAR and associated limits will be subject to assessment from DWER |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Infiltration ponds will be positioned to align with the existing dunes, to also minimise disturbance to the local topography | | | |
| | **Measure to Rehabilitate** | | | |
| | Groundwater bores will be decommissioned in accordance with DWER relevant guidelines, once no longer required<br>The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DEMIRS guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement<br>All disturbed areas that are no longer required will be stabilised and, if appropriate, rehabilitated<br>All surface water diversions remaining after closure are designed and engineered to minimise impacts on local hydrological regimes, ensure long term stability across the realistic range of expected flow events, and do not significantly cause or contribute to water quality impacts | Standard practice | Yes – DEMIRS approval is required under the Mining Act for the implementation of the MDCP and MCP | Guidelines for preparing MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b)<br>The MDCP must also detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | Two infiltration ponds and MAR borefield to manage excess water | | Ministerial condition requiring monitoring of groundwater levels and vegetation changes in the area of the infiltration ponds and MAR | |
| Degradation of fauna habitat as a result of increased weeds, dust, introduced fauna, and altered fire regimes | **Measure to Avoid** | | | |
| | N/A | | | |
| | **Measure to Minimise** | | | |
| | The RAC will be sealed to minimise dust emissions | Standard practice | No | These measures have been developed to meet the current industry standards |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Artificial water sources will be kept to the minimum required for operations. Leaking water sources will be repaired and minimised<br><br>Fixed plant dust suppression will be included in the design<br><br>Appropriate dust controls (including but not limited to water carts, non-toxic stabilisers, speed limits, and progressive rehabilitation) to be implemented throughout construction and operations as required<br><br>Vehicle traffic will be confined to defined roads and tracks and required to travel at designated operating speeds on all roads and will be restricted from accessing rehabilitated surfaces except for management purposes<br><br>Minimise the spread of weeds in Management Area 1 by implementing the following:<br>• Undertake weed monitoring within Management Area 1<br><br>Minimise the entry and spread of weeds in Management Area 2 by implementing the following:<br>• Engage with the Nyangumarta People and Rangers to undertake intermittent weed monitoring within Management Area 2<br>• Active guidance from and participation of the Nyangumarta Traditional Owner group representatives, including the installation of a washdown facility at the intersection of Management Area 2 and the Wallal Downs Pastoral Lease, which will include:<br>  ○ Vehicle inspection and washdown at the entry to Management Area 2<br>  ○ Equipment inspection and washdown at the entry to Management Area 2 | | | |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | • The washdown facility will be co-managed with the Nyangumarta People<br>• Treatment of identified weeds either by application of appropriate herbicide and/or manual extraction from the ground<br><br>Minimise the introduction of feral fauna in Management Area 1 and 2 by implementing the following:<br>• Undertake opportunistic feral fauna monitoring within Management Area 2 with active guidance from and participation of the relevant Traditional Owner group representatives<br><br>Control any introduction of feral fauna to minimise impacts on fauna populations and habitat in Management Area 3 by implementing the following:<br>• No domestic animals are permitted within Management Area 3<br>• Undertake feral fauna control within Management Area 3, with active guidance from and participation of the relevant Traditional Owner group representatives<br>• Only where necessary, install and maintain fencing around landfills, airstrip and, where appropriate, water storage areas and infiltration ponds. Fencing will include reflectors to deter birds.<br>• Establish designated points to assess feral fauna presence<br><br>Prevent the introduction and spread of weeds in Management Area 3 by implementing the following:<br>• Undertake weed inspections on all vehicles and equipment entering Management Area 3 | | | |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | • Vehicle washdown before entry to Management Area 3 (will occur at the entry to Management Area 2)<br>• Equipment washdown before entry to Management Area 3 (will occur at the entry to Management Area 2)<br>• Include weed checks in routine work area inspections<br>• Undertake targeted weed monitoring within Management Area 3, including the area surrounding the infiltration ponds, in consultation with the Traditional Owners<br>• Personnel to report any weed sightings<br>• Weed hygiene measures for incoming personnel<br>• Weed management training in personnel inductions<br>• Treatment of identified weeds either by application of appropriate herbicide and/or manual extraction from the ground<br>Implement a Fire Management Plan | | | |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed – managed through standard industry practises | | N/A | |
| Disturbance and displacement of fauna from increased light, noise and/or vibration | **Measure to Minimise** | | | |
| | Lighting will be designed and managed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW 2023b)<br>No permanent lighting will be installed along the RAC. Limited temporary lighting may be used during construction of the road to support safe operations | Standard practice | No | These measures have been developed to meet the current industry standards for managing light and noise pollution |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | No permanent lighting will be installed along pipeline corridors or at the production or monitoring bores. Limited temporary lighting may be used occasionally if required to support safe operations<br><br>Lighting at Rimfire collection tanks will be limited to that required for safe operations noting that the borefield will be remotely operated so light usage will be minimal<br><br>Permanent lighting will only be installed where required, mainly operational areas<br><br>Permanent lighting and temporary lighting will be shielded and directed to active mine areas to minimise light spill<br><br>Ensure all vehicles and machinery are serviced and maintained to minimise machinery noise<br><br>Equipment design will be specified to be within Australia standard noise limits and/or fitted with noise mufflers in accordance with manufacturing specifications<br><br>Undertake post-construction noise and ongoing occupancy monitoring within Night Parrot habitat areas to minimise impacts of light and noise on Night Parrot | | | |

## 9.6 Assessment of Significance of Residual Impacts

### 9.6.1 Assessment of Direct Impacts

#### 9.6.1.1 Loss of Fauna Habitat as a result of Clearing and Fragmentation

The Proposal will clear up to 4,878 ha of native vegetation representing fauna habitat within the 23,649 ha Development Envelope (Table 9-41).

This Proposal includes flexibility to alter the location of Proposal elements within the Development Envelope, however, clearing will not exceed 4,878 ha of fauna habitat.

The clearing of fauna habitat will result in reduced local availability of breeding, foraging and dispersal habitat for several vertebrate fauna species, including conservation significant species. The significance of species-specific impacts of habitat clearing as a result of the Proposal are described in further detail below.

Clearing for the Proposal may result in habitat fragmentation, although this is not expected to significantly impact any native fauna species. Clearing associated with the RAC involves expansion and upgrade of an existing access track. Given the linear nature of the RAC, clearing of fauna habitat is not expected to result in fragmentation of populations, genetic isolation or reduced species richness.

Fauna species may be affected by habitat fragmentation at a local scale as a result of clearing for the MIA. However, the Conceptual Footprint has been designed to maintain habitat connectivity between habitat within the Development Envelope and outside in the wider region. As such, fauna are expected to continue dispersing and foraging more broadly in the habitat surrounding the Development Envelope and are not expected to be significantly impacted by habitat fragmentation.

Using Land Systems as a surrogate for regional fauna habitat where detailed mapping is unavailable, each habitat type is well represented outside of the Development Envelope in the wider region (Section 9.3.2). An assessment of cumulative impacts to regional fauna habitat is provided in Section 9.6.3.

**Table 9-41: Indicative Clearing for Fauna Habitat within the Development Envelope**

| Habitat Type | Survey Extent* (ha) | Extent in Development Envelope (ha) | Approximate Extent within Conceptual Footprint (ha) | Approximate % Loss within Development Envelope | Approximate % Loss from Survey Extent* |
|---|---|---|---|---|---|
| Shrub and Spinifex on Sandplain | 636,108.3 | 17,037.5 | 3,700.0 | 21.7 | 0.6 |
| Inland Sand Dune | 29,045.8 | 3,105.5 | 798.0 | 25.7 | 2.7 |
| Gravelly Lateritic Rises | 33,200.4 | 3,116.2 | 237.9 | 7.6 | 0.7 |
| Clayey Sandplain with Termitaria | 130.5 | 124.7 | 39.3 | 31.6 | 30.1 |
| Ephemeral Claypan | 479.0 | 49.3 | - | - | - |

** Surveyed extent of fauna habitat within and surrounding the Development Envelope*

**Assessment of Significant Fauna Species-specific Impacts of Habitat Clearing**

This section describes the species-specific impacts of habitat clearing for conservation significant fauna relevant to the Proposal.

#### 9.6.1.1.1 Night Parrot

The Proposal has been designed to avoid any direct impacts to roosting/nesting and foraging habitat for the Night Parrot, through the design of the Development Envelope. No other significant habitat for this species has been mapped within the Development Envelope and as such, no significant residual impacts to Night Parrot are expected to occur as a result of the Proposal.

#### 9.6.1.1.2 Black-footed Rock-wallaby

The Proposal has been designed to avoid any direct impacts to critical Rocky Outcropping habitat for the Black-footed Rock-wallaby through the design of the Development Envelope. The Proposal will clear up to 4 ha of notional supporting habitat mapped within the Development Envelope for this species comprising the Shrub and Spinifex on Sandplain and Gravelly Lateritic Rises habitat types which occur within 500 m of Rocky Outcropping habitat, though no species records occur in this area. All 387.2 ha of mapped critical Rocky Outcropping habitat will remain undisturbed.

Supporting habitat types for the species occur widely in the area surrounding the Development Envelope, with 15 ha remaining within the Development Envelope and approximately 14,389 ha outside of the Development Envelope. Clearing for the Proposal represents approximately 0.02% of the total mapped survey extent of supporting habitat for this species. The Black-footed Rock-wallaby is expected to continue to utilise the remaining habitat. As such, impacts from the Proposal are not expected to significantly impact the species at a local or regional scale.

#### 9.6.1.1.3 Grey Falcon

The Proposal will clear up to 4,775 ha of supporting habitat for the Grey Falcon, comprising all five fauna habitats mapped within the Development Envelope.

Supporting habitat for the species is widespread, with approximately 18,658 ha remaining within the Development Envelope, and an additional 675,531 ha occurring outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the survey extent of supporting habitat. The Grey Falcon is expected to utilise the remaining supporting habitat within and surrounding the Development Envelope, such that the impacts from the Proposal are not expected to significantly impact the species at a local or regional scale.

#### 9.6.1.1.4 Princess Parrot

The Proposal will clear up to 4,498 ha of supporting habitat for Princess Parrot mapped within the Development Envelope, comprising the Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types.

Supporting habitat for the species is widespread, with approximately 15,645 ha remaining within the Development Envelope and an additional 645,011 ha occurring outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the survey extent of supporting habitat. As such, clearing of supporting habitat as a result of the Proposal is not expected to significantly impact the Princess Parrot at a local or regional scale.

#### 9.6.1.1.5 Northern Quoll

The Proposal has been designed to avoid any direct impacts to Rocky Outcropping critical habitat for the Northern Quoll through the design of the Development Envelope; however 16 ha of 1 km buffer surrounding Rocky Outcropping habitat, comprising Shrub and Spinifex on Sandplain and Gravelly Lateritic Rises habitat types, notionally and conservatively considered supporting habitat for the purpose of this assessment, falls within the Conceptual Footprint. All Rocky Outcropping critical habitat will

remain undisturbed. Clearing for the Proposal represents <0.05% of the total survey extent of notional supporting habitat for Northern Quoll.

Supporting habitat for the species occurs widely in the area surrounding the Development Envelope, with 402 ha remaining within the Development Envelope and approximately 78,232 ha outside the Development Envelope. Clearing for the Proposal represents approximately 0.01% of the total survey extent of supporting habitat for this species. The Northern Quoll is expected to continue to utilise the remaining habitat. As such, impacts from the Proposal are not expected to significantly impact the species at a local or regional scale.

#### 9.6.1.1.6 Greater Bilby

The Proposal will clear up to 4,498 ha of critical habitat and 238 ha of supporting habitat for the Greater Bilby, with critical habitat comprising the Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types, and supporting habitat comprising the Gravelly Lateritic Rises habitat type.

Critical habitat for the species is considered to be widespread in the region surrounding the Development Envelope, with approximately 15,645 ha remaining within the Development Envelope and an additional 645,011 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the survey extent of critical habitat. Supporting habitat for the species is also considered widespread in the region surrounding the Development Envelope, with approximately 2,878 ha remaining within the Development Envelope and an additional 30,084 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the survey extent of supporting habitat.

As such, the Proposal is not expected to adversely affect the regional population or the conservation status of the species. Nevertheless, the clearing of critical habitat for the Greater Bilby is considered to represent a significant residual impact. This impact will be compensated by the application of offsets, as outlined in Section 17.

#### 9.6.1.1.7 Migratory Species

An assessment of the impacts of clearing of fauna habitat on Migratory species relevant to the Proposal is provided in Table 9-42 below.

#### 9.6.1.1.8 Priority and Other Significant Fauna

An assessment of the impacts of clearing of fauna habitat on Priority and Other Significant species relevant to the Proposal is provided in Table 9-43 below.

**Table 9-42: Assessment and Significance of Impacts to Migratory Species**

| Species | Assessment and Significance of Residual Impact |
|---|---|
| Barn Swallow (*Hirundo rustica*) | The Proposal will result in the clearing of up to 3,977 ha of supporting habitat for the Barn Swallow, comprising the Shrub and Spinifex on Sandplain, Gravelly Lateritic Rises and Clayey Sandplain with Termitaria habitat types<br><br>The Barn Swallow has not been observed within the Development Envelope and it is extremely unlikely that:<br>• The Development Envelope would support an ecologically significant proportion of the population<br>• Habitats within the Development Envelope are considered important to the species<br><br>Supporting habitat for the species is widespread, with approximately 16,301 ha remaining within the Development Envelope and an additional 649,1601 ha occurring outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the total survey extent of supporting habitat for Barn Swallow<br><br>As such, clearing of supporting habitat is not expected to significantly impact the Barn Swallow at a local or regional scale. |
| Little Curlew (*Numenius minutus*) | The Proposal will result in the clearing of up to 3,739 ha of supporting habitat for the Little Curlew, comprising the Shrub and Spinifex on Sandplain and Clayey Sandplain with Termitaria habitat types within the Development Envelope<br><br>The Little Curlew has been observed within the Development Envelope, and it may occasionally support an ecologically (nationally) significant proportion of the species' population, though the likelihood of this is considered low. Ephemeral Claypan, Shrub and Spinifex on Sandplain, Gravelly Lateritic Rises and Clayey Sandplain with Termitaria habitat types are considered important habitats within the Development Envelope<br><br>Supporting habitat for the species is widespread, with approximately 13,423 ha remaining within the Development Envelope and an additional 619,077 ha mapped outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the total survey extent of supporting habitat for the Little Curlew. Similar suitable foraging habitat also occurs widely throughout the Great Sandy Desert and towards Eighty Mile Beach, with higher quality foraging habitat at Lake Waukarlicarly and the former Texas Borefield<br><br>Although clearing of supporting habitat will disturb some habitat that qualifies as important, given 99.4% of that mapped important habitat will remain intact, along with additional unmapped habitat, the Proposal is not expected to significantly impact the Little Curlew at a local or regional scale |
| Oriental Plover (*Charadrius veredus*) | The Proposal will result in the clearing of up to 3,739 ha of supporting habitat for the Oriental Plover, comprising the Shrub and Spinifex on Sandplain, Clayey Sandplain with Termitaria and Ephemeral Claypan habitat types within the Development Envelope<br><br>The overall population within the Development Envelope is expected to be relatively small (<100 individuals); although it is possible that a nationally significant population number of over 230 individuals may use the Development Envelope<br><br>Supporting habitat for the species is widespread, with approximately 13,423 ha remaining within the Development Envelope and an additional 619,077 ha occurring outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the total survey extent of supporting habitat for the Oriental Plover<br><br>As such, although clearing of supporting habitat will disturb some habitat classified as important, it is not expected to significantly impact the Oriental Plover at a local or regional scale given 99.4% of mapped important habitat will remain intact, along with additional unmapped habitat |

| Species | Assessment and Significance of Residual Impact |
|---|---|
| Oriental Pratincole (*Glareola maldivarum*) | The Proposal will result in the clearing of up to 3,739 ha of supporting habitat for the Oriental Pratincole, comprising the Shrub and Spinifex on Sandplain, Clayey Sandplain with Termitaria and Ephemeral Claypan habitat types within the Development Envelope<br><br>Although less than 1,000 individuals have been observed in the Development Envelope, it is likely a nationally significant population of over 2,880 individuals may be occasionally present and utilise supporting important habitat within the Development Envelope<br><br>Supporting habitat for the species is widespread, with approximately 13,423 ha remaining within the Development Envelope and an additional 619,077 ha occurring outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the total survey extent of supporting habitat for the Oriental Pratincole. Similar suitable foraging habitat to that available in the Development Envelope occurs widely throughout the Great Sandy Desert and the sandplains extending north towards Eighty Mile Beach<br><br>As such, although clearing of supporting habitat will disturb some important habitat given 99.4% of that mapped habitat will remain intact, along with additional unmapped habitat, the Proposal is not expected to significantly impact the Oriental Pratincole at a local or regional scale |
| Pacific Swift (*Apus pacificus*) | The Proposal will result in the clearing of up to 4,775 ha of supporting habitat for the Pacific Swift, comprising all five habitat types within the Development Envelope<br><br>Up to 110 birds have been observed in the airspace over the Development Envelope, qualifying as nationally important population, and it is anticipated an internationally important population may occasionally occur. All habitat within the Development Envelope is considered to provide supporting foraging habitat<br><br>Supporting habitat for the species is widespread, with approximately 18,658 ha remaining within the Development Envelope and an additional 675,531 ha occurring outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the total survey extent of supporting habitat for the Pacific Swift. As such, clearing of supporting habitat is not expected to significantly impact the Pacific Swift at a local or regional scale<br><br>As such, although clearing of supporting habitat will disturb some important habitat, given 99.4% of that mapped habitat will remain intact, along with additional unmapped habitat, the Proposal is not expected to significantly impact the Pacific Swift at a local or regional scale |
| Australian (Gull-billed) Tern (*Gelochelidon nilotica macrotarsa*) | The Proposal will result in the clearing of up to 3,739 ha of supporting habitat for the Australian (Gull-billed) Tern, comprising Shrub and Spinifex on Sandplain and Clayey Sandplain with Termitaria habitat<br><br>It is considered unlikely that the Development Envelope constitutes important habitat for the species<br><br>Potential supporting habitat for the species is widespread, with approximately 13,423 ha remaining within the Development Envelope and an additional 619,077 ha occurring outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the total survey extent. As such, clearing of supporting habitat is not expected to significantly impact the Australian (Gull-billed) Tern at a local or regional scale<br><br>As such, given 99.4% of potential supporting habitat will remain intact, along with additional unsurveyed habitat, the Proposal is not expected to significantly impact the Australian (Gull-billed) Tern at a local or regional scale |

**Table 9-43: Assessment and Significance of Impacts to Priority and Other Significant Species Recorded within the Development Envelope**

| Species | Assessment and Significance of Residual Impact |
|---|---|
| **Species Recorded within the Development Envelope** | |
| Brush-tailed Mulgara (*Dasycercus blythi*) | The Proposal will clear up to 3,700 ha of critical habitat for Brush-tailed Mulgara comprising the Shrub and Spinifex Sandplain habitat type. Approximately 13,337 ha of critical habitat will remain within the Development Envelope and an additional 619,071 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the survey extent of critical habitat<br><br>The Proposal will also result in the clearing of up to 238 ha of supporting habitat for Brush-tailed Mulgara comprising the Gravelly Lateritic Rises habitat type. Approximately 2,878 ha of supporting habitat will remain within the Development Envelope and an additional 30,084 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the survey extent of supporting habitat<br><br>Given the extent of habitat remaining, the Proposal is not expected to adversely impact the Brush-tailed Mulgara at a local or regional scale. Nevertheless, impacts to critical habitat for the species are considered a significant residual impact proposed to be offset, as outlined in Section 17 |
| Northern Marsupial Mole (*Notoryctes caurinus*) | The Proposal will clear up to 798 ha of critical habitat for Northern Marsupial Mole comprising the Inland Sand Dune habitat type. Approximately 2,308 ha of critical habitat will remain within the Development Envelope and an additional 25,940 occurs outside of the Development Envelope, with clearing for the Proposal representing 2.7% of the survey extent of critical habitat<br><br>The Proposal will clear up to 3,700 ha of supporting habitat for Northern Marsupial Mole comprising the Shrub and Spinifex Sandplain habitat type. Approximately 13,337 ha of supporting habitat will remain within the Development Envelope and an additional 619,071 occurs outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the survey extent of supporting habitat<br><br>Given the extent of habitat remaining, the Proposal is not expected to adversely impact the Northern Marsupial Mole at a local or regional scale. Nevertheless, impacts to critical habitat for the species are considered a significant residual impact proposed to be offset, as outlined in Section 17 |
| Western Pebble-mound Mouse (*Pseudomys chapmani*) | The Proposal will clear up to 238 ha of critical habitat for Western Pebble-mound Mouse comprising the Gravelly Lateritic Rises habitat type. Approximately 2,878 ha of critical habitat will remain within the Development Envelope and an additional 30,084 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the survey extent of critical habitat<br><br>Given the extent of habitat remaining, the Proposal is not expected to adversely impact the Western Pebble-mound Mouse at a local or regional scale. Nevertheless, impacts to critical habitat for the species are considered a significant residual impact proposed to be offset, as outlined in Section 17 |
| Dampierland Plain Slider (*Lerista separanda*) | The Proposal will clear up to 3,700 ha of critical habitat for Dampierland Plain Slider comprising the Shrub and Spinifex Sandplain habitat type. Approximately 13,337 ha of critical habitat will remain within the Development Envelope and an additional 619,071 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the survey extent of critical habitat<br><br>Given the extent of habitat remaining, the Proposal is not expected to adversely impact the Dampierland Plain Slider at a local or regional scale. Nevertheless, impacts to critical habitat for the species are considered a significant residual impact proposed to be offset, as outlined in Section 17 |

| Species | Assessment and Significance of Residual Impact |
|---|---|
| **Species with Potential to Occur within the Development Envelope** | |
| Peregrine Falcon (*Falco peregrinus)* | The Proposal will clear up to 4,775 ha of supporting habitat for Peregrine Falcon comprising all five habitat types present within the Development Envelope. Approximately 18,658 ha of supporting habitat will remain within the Development Envelope and an additional 675,531 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.7% of the survey extent of supporting habitat<br><br>Given the extent of habitat remaining, the Proposal is not expected to adversely impact the Peregrine Falcon at a local or regional scale |
| Short-tailed Mouse (*Leggadina lakedownensis*) | The Proposal will clear up to 3,739 ha of supporting habitat for Short-tailed Mouse comprising the Shrub and Spinifex on Sandplain and Clayey Sandplain with Termitaria habitat types. Approximately 13,422 ha of supporting habitat will remain within the Development Envelope and an additional 619,077 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the survey extent of supporting habitat<br><br>Given the extent of habitat remaining, the Proposal is not expected to adversely impact the Short-tailed Mouse at a local or regional scale |
| Spectacled Hare-wallaby (*Lagorchestes conspicillatus leichardti*) | The Proposal will clear up to 3,700 ha of critical habitat for Spectacled Hare-wallaby comprising the Shrub and Spinifex Sandplain habitat type. Approximately 13,337 ha of critical habitat will remain within the Development Envelope and an additional 619,071 ha occurs outside of the Development Envelope, with clearing for the Proposal representing 0.6% of the survey extent of supporting habitat<br><br>Given the extent of habitat remaining, the Proposal is not expected to adversely impact the Spectacled Hare-wallaby at a local or regional scale. Nevertheless, impacts to critical habitat for the species are considered a significant residual impact proposed to be offset, as outlined in Section 17 |

#### 9.6.1.2 Loss of Fauna Individuals as a result of Clearing, Infrastructure and Mining Operations

##### 9.6.1.2.1 Interaction of Mining Equipment, Vehicles, Aircraft and Infrastructure, and Entrapment

Following the implementation of mitigation actions, there is not expected to be a significant residual impact from the loss of fauna individuals as a result of clearing, infrastructure and mining operations.

Risk of vehicle strike will temporarily increase during construction; however, overall vehicle movements will reduce during the operational phase. The mitigation measures outlined in Section 9.5 and implementation of the EMP (Appendix A05) will ensure that no significant loss of fauna individuals occurs as a result of vehicle strike.

The Proponent will implement management measures, as outlined in Table 9-40 and the EMP (Appendix A05), to minimise fauna entrapment within excavations. Fauna egress and refuges will be installed and trenches will be monitored regularly. Without dedicated management and monitoring fauna individuals can become entrapped in excavations, which may result in significant numbers being injured or dying. However, with appropriate management and monitoring as outlined, fauna injury or mortality is expected to be a rare occurrence. Any impacts of entrapment are not expected to be significant to the extent that native fauna are impacted at a population scale.

No significant impacts to fauna are expected to occur as a result of fencing, as fencing will be minimised and where required reflectors will be installed to deter fauna, such as Night Parrots, and minimise risk of entanglement. No fences will be installed adjacent to Night Parrot roosting/nesting or foraging habitat.

The risk of significant impacts to bird species from aircraft movements associated with the Proposal is considered low. Air traffic will be intermittent/low frequency (i.e. one or two airplane flights a day and irregular helicopter or other [e.g. drone] flights), and these will tend to occur only during daylight hours unless there is an emergency. The Oriental Plover is known to forage on airfields; however, at night (DCCEEW 2026) and, although the species is expected to be a foraging visitor during non-breeding periods, given it is not expected to be dependent on habitat within the Development Envelope the potential for any significant impact to the species from bird strike is anticipated to be negligible. All other conservation significant bird species are not expected to be present to the extent that could result in significant numbers of individuals being at risk of bird strike.

##### 9.6.1.2.2 Interaction with Wind Turbines

The risk of significant impacts to bird and bat species from wind turbines associated with the Proposal is considered low to negligible (Biota 2026i). The most notable site of importance for birds in the locality is Eighty Mile Beach Ramsar site, including the Mandora (Walyarta) Marsh. The proposed turbines will be approximately 90 km to Walyarta (Mandora Marsh) and approximately 140 km to Eight Mile Beach. These distances are orders of magnitude greater than the spatial extent of disturbance and displacement effects reported in the literature around existing wind farms of up to 5 km (Biota 2026h). While the Ramsar site is a very significant habitat for migratory shorebirds and waterbirds, the Proposal's location relative to the site means that the turbines would not present a significant risk to birds and bats using the habitats of the Ramsar site itself.

The planned siting and arrangement of the two rows of turbines is not in a location where there would be any ecologically significant movement of large number of birds. The rows are proposed to be sited on Shrub and Spinifex on Sandplain habitat, with no features that might represent a driver creating pathways for avifauna or bat movements, such as large wetland features or major roost sites, present in the immediately adjoining locality (Biota 2026h). There are no known significant bird migratory pathways or bat flyways through the proposed turbine location. The spacing between the turbines and the placing of turbines in rows is expected to allow bird and bat passage between them while also reducing likelihood of entry to the RSA. The Proponent will also implement an EMP, including measures for a mortality monitoring program aligned with the proposed Bird and Bat Adaptive Management Plan to monitor potential impacts from wind turbines to birds and bats and implement adaptive management measures if required. Therefore, and also in consideration of the proposed spacing between the

turbines, the potential for barrier effects from the turbines to lead to any significant impact on birds and bats is considered low (Biota 2026h).

Further detail on the two significant bird species identified to be of high risk of collision, Pacific Swift and Grey Falcon, and other migratory bird species, is presented below.

**Pacific Swift (Migratory)**

There is little data on the susceptibility of Pacific Swifts to collision, although two dead individuals have been found at one project in Queensland, and a survey of experts identified the species as a high risk for collision (Lumsden et al. 2019 cited in Biota 2026h). Related species have also been reported as relatively frequent victims of collision strike (Biota 2026h).

Pacific Swifts are expected to be at relatively high risk of collisions based on proportion of flight heights and observed susceptibility to turbine strike. Avoidance behaviour in the species has not been quantified, but observed collisions with wind turbines for this species (and related species) indicates that a high risk of collisions exists even taking into account any avoidance behaviour (Biota 2026h).

The species is, however, likely to occur over Development Envelope, and therefore in the area of the proposed wind farm, only sporadically, and in lower numbers overall than over more coastal areas in the Pilbara. On this basis the risk of population-level impacts from the proposed wind farm on the Pacific Swift is considered negligible (Table 9-21; Biota 2026h).

**Grey Falcon (Vulnerable)**

Grey Falcons are known to soar high, with a pair of Grey Falcons reportedly observed soaring at altitudes up to 600 m, and observations indicating “soaring between 100 m and 300 m is common” (Czechura and Debus 1985 cited in Biota 2026h). This suggests that individuals of this species are likely to fly regularly within the RSA if present. Falcon species accounted for 11.2% of the total number of birds observed to be killed (95 out of 848) by collisions with wind turbines across a review of 20 wind farms in South Africa, with six out of the seven local falcon species recorded as casualties (Perold et al. 2020 cited in Biota 2026h). This suggests that falcons as a group are susceptible to collisions at least as a broader taxonomic group.

Avoidance behaviour has been observed in a variety of raptor species, although no direct evidence is available for Grey Falcons (Biota 2026h). The species typically occurs in low densities, and the number of turbines proposed is relatively small, so the absolute number of individuals anticipated to be impacted by the proposed wind turbines is very low. Overall, there is a small risk of localised impacts to the species through turbine strikes on individuals, but the risk of broader population-level impacts from the Proposal is very low (Table 9-21; Biota 2026h).

**Other Migratory Birds**

Several shorebird species are known to travel south from Eighty Mile Beach to non-breeding areas in southern Australia (Minton et al. 2013 cited in Biota 2026h). Migratory shorebirds also move between the Roebuck Bay and Eighty Mile Beach area and locations further south in both western and eastern Australia (Minton et al. 2011 cited in Biota 2026h). However, other data on the flight routes used between north-western and southern Australia are very limited and the routes are not well understood (Biota 2018 cited in Biota 2026h). This includes locations in south-western Australia where a ‘Great Circle’ route (the shortest distance migratory route between two points [Alerstam et al. 2001 cited in Biota 2026h]) could potentially take some migratory birds over the Development Envelope. While the separation distance between the Ramsar site and the planned turbine locations is very substantial (i.e. approximately 90 km at its closest point on Eighty Mile Beach), it is not impossible that migratory shorebirds may overfly the western end of the MIA during southward movement.

If some migratory birds do overfly the Development Envelope when moving to southern parts of Australia, then the potential for collision with the proposed wind turbines becomes a function of the flight heights of the bird species relative to the RSA, and of the wind farm scale and design (Section 9.4.1.2).

Migratory shorebirds typically fly at high altitudes during migration and when undertaking movements at large geographic scale (Biota 2026h). Flight heights of 1,000-5,000 m are reported as typical (Geering et al. 2007 cited in Biota 2026h), although there is also significant variation reported, which suggests that shorebirds will use a range of flight heights during migration (Biota 2018 cited in Biota 2026h). This is expected to be weather-related, with migratory birds shown to vary their flight heights in response to wind direction and variation in winds at different altitudes, and to keep themselves below the prevailing cloud base (Newton 2008 cited in Biota 2026h).

Given the proposed turbines' RSA of 64 m to 236 magl, allowing for the full range of flight heights considered, there is virtually no overlap between the rotor swept area and the flight heights documented for migratory shorebirds. The overall body of data indicates that a representative range of shorebirds generally fly considerably higher than the uppermost swing of the proposed turbines once underway, at a minimum elevation of at least 500 m and more commonly considerably higher (Biota 2018 cited in Biota 2026h). Therefore the Proponent considers there is only a very low risk of interaction of individuals with the turbine rotors, even assuming that migratory birds transiting to southern Australia directly overfly the relatively small footprint of the proposed wind farm.

**Other Avifauna**

The broader avifauna assemblage recorded near the proposed turbine locations consists of small to medium-sized passerines or parrots typical of arid-zone shrubland and spinifex habitats (Biota 2026h). These birds typically display low-altitude flights between ground-level shrubs and other foraging resources, far below the RSA minimum height of 64 m.

The White-winged Triller is a partial exception, as its foraging ecology also involves hunting flying insects from perches which may lead it to traverse the RSA (Biota 2026h). However, given the species' small size and high manoeuvrability combined with the low recorded occurrences within the proposed turbine area, it is considered a medium risk of collision.

Budgerigars can occur in large nomadic flocks in arid landscapes in response to increased rainfall and food availability through plant seeding, which suggests that the collision risk to this species may vary with seasonal conditions and resource availability (Biota 2026h). However, the planned arrangement and spacing of turbines combined with the open extensive landscape are not expected to form barriers that would funnel flocks of budgerigars through the RSA.

The only non-listed species identified to be of high risk of collision, the Australian Bustard, also typically flies below the minimum RSA height and was not found to aggregate in the proposed turbine area. This bird is considered high risk due to morphological and life history attributes – namely its larger size corresponds to less manoeuvrability when attempting avoidance behaviours, and may result in occasional flights near the minimum RSA height (Biota 2026h). While small numbers of individuals may be impacted by wind turbine strikes, it is not expected that the species will suffer resultant population-level impacts.

Overall, the non-listed avifauna assemblage is dominated by common, widespread arid-zone species, with individual collisions mortality anticipated for some species but with a low risk of broad population level impacts (Biota 2026h).

**Bats**

The bat assemblage recorded near the proposed turbine locations consists of five species that are common and widespread in the Pilbara bioregion (Biota 2026h). Two of these species were recorded 260 m from the nearest proposed turbine, and have been assessed at a medium risk of collision due to their open-air flight foraging behaviour having potential to overlap the rotor-swept area, being the Greater Northern Free-tailed Bat and the Yellow-bellied Sheath-tailed Bat (Biota 2026h).

The proposed turbines are located on extensive open sandplain habitat, and are not adjacent to habitats or features likely to concentrate bat roosting or foraging activity, such as caves, escarpments, permanent

water, or riparian corridors (Biota 2026h). The Proponent acknowledges some uncertainty due to the tendency of bat activity to vary in response to environmental conditions, and the limited bat sampling near to the proposed turbine locations. However, overall, the recorded bat assemblage is dominated by unlisted, common, widespread arid-zone species, with occasional individual collision mortality anticipated for the Greater Northern Free-tailed Bat and Yellow-bellied Sheath-tailed Bat, but with a low risk of broad population level impacts (Biota 2026h).

##### 9.6.1.2.3 Interaction with SGARs

The Proponent recognises the recent evidence of the potential effect of SGARs on Northern Quoll and other dasyurid species (Lohr et al. 2025). In March 2026, the Australian Pesticides and Veterinary Medicines Authority declared SGARs as restricted chemical products, enabling tighter controls on the purchase and use of SGARs, including restricting access to personnel who meet specific training and licensing requirements (APVMA 2026). Accordingly, measures to reduce exposure, such as non-lethal controls or alternative products without second-generation poisons, consistent with the Wildlife Health Australia position on SGARs (Wildlife Health Australia 2022, 2023) will be investigated and implemented where practicable. The use of SGARs will be restricted to licensed and qualified personnel and align with approved methods for use that reduce exposure to significant fauna. This will minimise the ongoing exposure risk to Northern Quolls and other significant fauna that may traverse the Development Envelope, particularly where they may interact with accommodation and other workforce activity areas where SGARs are most likely to be deployed and ensure no significant impact to terrestrial fauna.

#### 9.6.1.3 Loss of SRE Individuals and SRE Habitat as a Result of Clearing

Clearing, earthworks and excavation may result in the loss of individual potential SRE taxa recorded within the Development Envelope.

Of the 15 potential SRE mygalomorph species recorded within the Development Envelope, seven are known only from single records within the Development Envelope (Biota 2025d). Each of these species were recorded within the Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types. Two potential SRE scorpion species have been recorded within the Development Envelope, both of which were recorded within the Inland Sand Dune habitat type (Biota 2025d). Each of these habitat types are widespread outside of the Development Envelope and throughout the region (Table 9-35).

The habitats within the Development Envelope are not considered to have significant potential to support SRE fauna (Biota 2025d). The majority of the Development Envelope is represented by the Shrub and Spinifex on Sandplain, Inland Sand Dune and Gravelly Lateritic Rises habitat types, none of which are isolated landforms or host microhabitats suitable for SREs (Biota 2025d). These habitat types are widely connected and have no obvious barriers to dispersal which may restrict gene flow, or contain elevated habitat isolates which may represent long-term refugia. The Development Envelope lacks the drainage features which typically support sheltered, moist microhabitats which can support SRE fauna (Biota 2025d).

Soil landscape unit B30 potentially represents a habitat isolate with a higher likelihood of supporting SREs than the rest of the Development Envelope. This unit overlaps less than 1% (10 ha) of the Development Envelope, with approximately 99.9% of its 195,230 ha mapped extent (Table 9-39) located outside the Development Envelope, extending south of the Rimfire pipeline corridor.

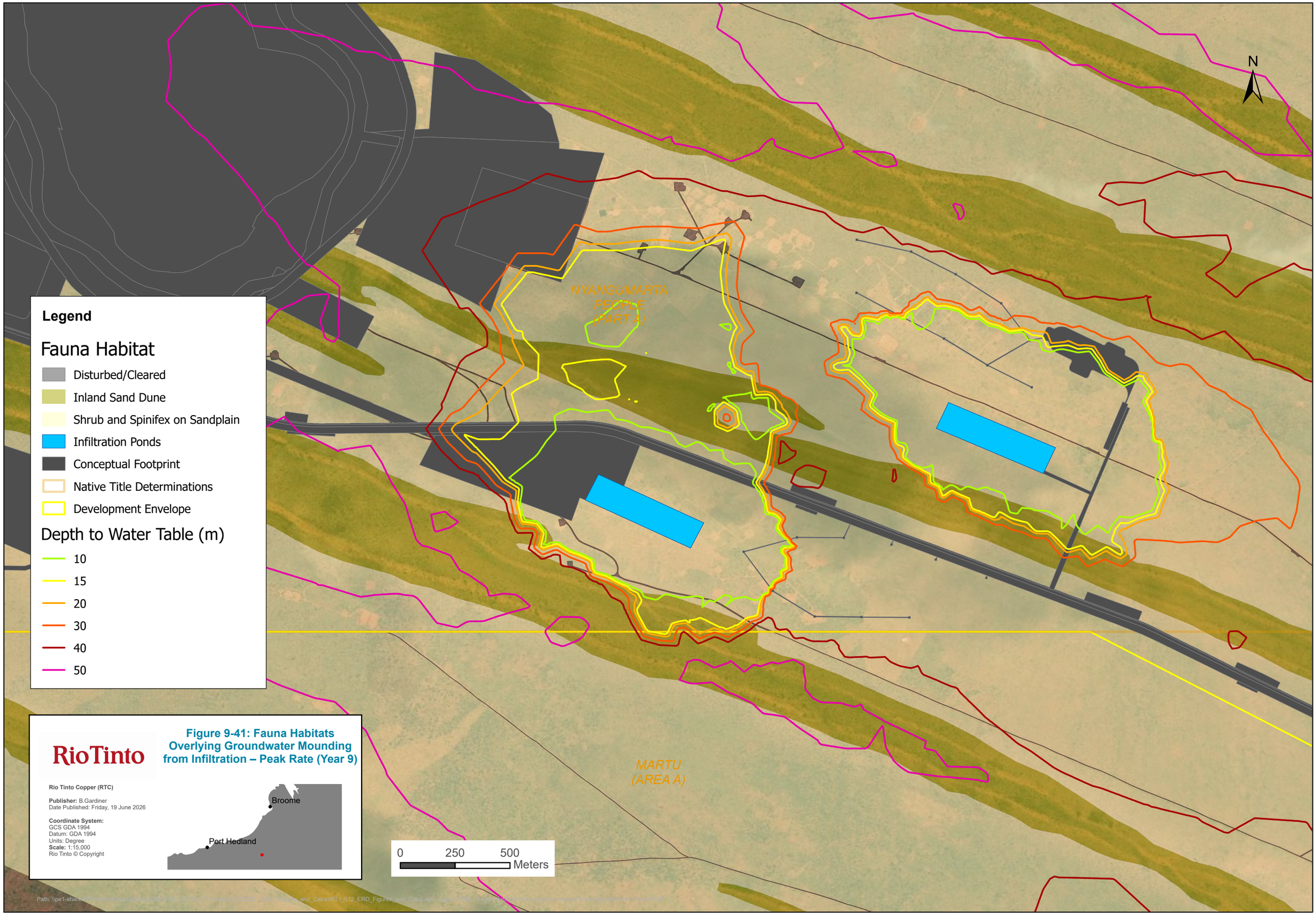
West of the MIA, only spider species belonging to the family Anamidae were recorded, a family which dominates in the sandier substrates of the arid zone. The likelihood of the species recorded from the RAC and MIA being restricted to very small distributions the size of the RAC and MIA parts of the Development Envelope is considered low (Biota 2025d). Therefore, it is not expected that any of these species would be restricted to the Development Envelope.

On this basis, all of the potential SRE species recorded within the Development Envelope are considered unlikely to be restricted to the Development Envelope and impacts to SREs and SRE habitats are not considered significant.

### 9.6.2 Assessment of Indirect Impacts

#### 9.6.2.1 Degradation or Alteration of Habitat as a Result of Altered Hydrological Regimes

Indirect impacts from the operation of infiltration ponds and MAR are largely associated with groundwater mounding. Groundwater mounding has the potential to affect the Shrub and Spinifex on Sandplain habitat type which falls within the 2 mbgl mounding contour (Table 9-36; Figure 9-41). Approximately 12 ha of habitat within this contour may be impacted, representing approximately 0.002% of the known extent of this habitat type within and surrounding the Development Envelope. On this basis, the Proposal is not expected to result in significant impacts to fauna species as a result of altered hydrological regimes.


N
NYANGUMARTA
PEOPLE
(PART A)
MARTU
(AREA A)
Legend
Fauna Habitat
Disturbed/Cleared
Inland Sand Dune
Shrub and Spinifex on Sandplain
Infiltration Ponds
Conceptual Footprint
Native Title Determinations
Development Envelope
Depth to Water Table (m)
10
15
20
30
40
50
0
250
500
Meters
RioTinto
Figure 9-41: Fauna Habitats Overlying Groundwater Mounding from Infiltration – Peak Rate (Year 9)
Rio Tinto Copper (RTC)
Publisher: B.Gardiner
Date Published: Friday, 19 June 2026
Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree
Scale: 1:15,000
Rio Tinto © Copyright
Broome
Port Hedland

#### 9.6.2.1.1 Princess Parrot

The Princess Parrot is not expected to be impacted by groundwater drawdown from the Proposal such that it could significantly affect potential foraging habitat within GDV.

In the Percival Palaeovalley, *Eucalyptus victrix* (potential foraging habitat for the Princess Parrot) occurs within vegetation units P23a (929 ha) and C1+P23 (21 ha). The zone of influence of the drawdown from Rimfire Borefield is predicted to underlie most of the approximately 950 ha of these potential GDV units mapped within the palaeovalley (Section 8.6.2.1).

While drawdown from Rimfire has the potential to affect approximately 950 ha of the potential GDV containing *E. victrix*, the risk of a significant impact to that foraging habitat within the palaeovalley from groundwater drawdown is expected to be negligible (Section 8.6.2.1).

In addition, potential foraging resources within the C1 vegetation unit will not be impacted by drawdown (or direct disturbance). C1 comprises *Eucalyptus victrix* Open Woodland over *Triodia epactia*, 230 ha of which was mapped within the Texas Borefield survey area (Western Botanical 2026a).

As discussed (in Section8.5), the Proponent will implement a groundwater monitoring and management strategy under the Rimfire Groundwater Operating Strategy to ensure that groundwater drawdown from the Rimfire Borefield does not significantly impact GDV in the palaeovalley using specific triggers to inform appropriate contingency actions.

No significant potential impact on Princess Parrot from drawdown from the Proposal is expected given any potential effect on GDV is not expected to be significant, and as:

- The Princess Parrot has not been recorded within the Development Envelope or nearby, including within the Percival Palaeovalley
- The Princess Parrot is expected to be only an occasional visitor
- The GDV vegetation at most only supports secondary foraging habitat, with the largest relevant GDV unit in the palaeovalley only hosting occasional occurrences of *Eucalyptus victrix*
- There are other known and likely areas hosting *E. victrix* outside the potential area of influence
- Impacts to *E. victrix* (as a component of GDV) are addressed in Sections 8.4.2.1, 8.5, and 8.6.2.1.

### 9.6.2.2 Degradation of Fauna Habitat as a Result of Increased Weeds, Dust, Introduced Fauna, and Altered Fire Regimes

#### 9.6.2.2.1 Weeds

The Proposal is not expected to result in the introduction or spread of weeds within the Development Envelope to the extent that fauna habitat is significantly degraded. While there is an inherent risk that increased vehicle movement and earthmoving activities may introduce or spread weeds within the Development Envelope, the Proponent will implement well established weed hygiene procedures and management practices throughout the construction and operation phases of the Proposal, through the implementation of the EMP (Appendix A05).

Weed management measures include the targeted management of weed populations within Management Area 3 (MIA and Rimfire), and Clean on Entry procedures within both Management Area 2 (RAC) and 3. Weeds identified during monitoring of Management Area 2 and 3 will be treated by application of herbicide and/or manual extraction as outlined in the EMP.

Impacts related to the introduction or spread of weeds within fauna habitat are expected to be localised to areas of disturbance. As such, it is considered unlikely that habitat values within the Development Envelope will be degraded to the extent that native fauna are significantly impacted.

#### 9.6.2.2.2 Dust

The Proposal is not expected to result in a level of dust emissions that will significantly impact native fauna or fauna habitat. Impacts to fauna from dust emissions are generally non-lethal and typically take the form of behaviour changes, such as avoidance of an area with very dusty conditions. Through the implementation of management measures outlined in Section 9.5 and the EMP (Appendix A05), dust emissions are expected to be minimal and confined to the Development Envelope. Given the amount of habitat surrounding the Development Envelope, susceptible fauna are likely to move away from any areas impacted by dust into adjacent habitat. As such, no significant impacts on fauna individuals or habitats are expected due to dust emissions from the Proposal.

#### 9.6.2.2.3 Introduced Fauna

The Proposal is not expected to result in the introduction or increase in abundance of introduced fauna within the Development Envelope to the extent that native fauna populations will be significantly impacted. The development of new tracks, increased water points and the production of domestic waste has the potential to attract and increase the abundance and diversity of introduced fauna species within the Development Envelope.

The Proponent will implement feral fauna control in accordance with the EMP (Appendix A05). This will include feral fauna control within Management Area 1 (MIA and Rimfire), with active guidance and participation of the relevant Traditional Owner group representatives. Within Management Area 2 (RAC), the Proponent will undertake opportunistic feral fauna monitoring with guidance and participation of the relevant Traditional Owner group representatives. Furthermore, fencing of attractant areas (waste disposal/landfill) will be undertaken within the Development Envelope to limit the increase of pest species by decreasing access.

Through the implementation of the EMP, the Proposal is not expected to have a significant impact on the native fauna as a result of increased abundance of introduced fauna within the Development Envelope.

#### 9.6.2.2.4 Altered Fire Regimes

The Proposal is not expected to result in a significant impact to native fauna populations and/or habitat as a result of altered fire regimes. The highest risk of ignition occurs during construction while undertaking hot work activities. The Proponent will implement a Fire Management Plan which includes appropriate work procedures to reduce the risk of fires starting from activities associated with the Proposal. The Proponent considers that through the implementation of management measures outlined in Section 9.5, the EMP (Appendix A05) and the Fire Management Plan, the Proposal is not expected to significantly increase the risk of fire leading to significant impacts to native fauna.

### 9.6.2.3 Disturbance and Displacement of Fauna from Increased Light and/or Noise

The Proposal is not expected to result in a significant impact to native fauna populations as a result of increased light or noise.

Habitat and fauna within and near the MIA are expected to have the most potential to be affected. Although a small proportion (2.2%) of suitable habitat for some significant fauna species occurs within areas which may experience day-to-day operational noise emissions greater than 50 dB(A), the noise impact assessment determined that it is unlikely that any significant species, including Night Parrot, a species that is particularly susceptible to noise disturbance, will be significantly impacted by noise (Biota 2025c). Behavioural responses and masking effects may occur where noise emissions exceed 50-60 dB(A), however, significant impacts such as injury or hearing damage are known to occur as much higher level (i.e. up to 140 dB(A) (Dooling and Popper 2007 as cited in Biota 2025c). The habitats which may be impacted include Shrub and Spinifex on Sandplain and Inland Sand Dunes, both of which extent beyond the Development Envelope and are widely distributed throughout the region (Table 9-5).

The distance to the MIA from Night Parrot habitat significantly reduces the potential for impact from noise, light and vibration.

No Night Parrot habitat was mapped within areas near the mine pit which may experience noise emissions greater than 50 dB(A), however, a small proportion (15%) of foraging and roosting/nesting habitat was mapped within the 50 to 75 dB(A) noise contours for the airfield (Biota 2025c). Night Parrot detections have been recorded in that habitat area intersecting the short duration increase in noise levels. However, Night Parrot occupation in the habitat south of the proposed Rimfire pipeline is low and infrequent, after 1.5 years of data collection only one individual has been confirmed occupying habitat near this area for a limited duration post seasonal rainfall. Noise emissions from Proposal sources will be largely comparable to existing evening peak ambient noise levels (Section 9.4.2.3). Noise emissions associated with airfield operations will be intermittent/low frequency and of short duration. Given the presence of the Night Parrot in the vicinity of the airfield is occasional and limited to one or two individuals, noise impacts associated with the airfield are not expected to significantly impact the Night Parrot at a population scale (Biota 2025b). Noise impacts associated with the airfield are unchanged when considering the addition of noise from mining operations and Rimfire plant (principally generators; Lloyd George Acoustics 2025d) (Appendix E14). Noise emissions from Rimfire are not predicted to significantly contribute to the overall noise levels of the Proposal and will not significantly impact any Night Parrot habitat (Lloyd George Acoustics 2025d) (Appendix E14).

There is very little artificial lighting in the region outside of existing project exploration and development activities, so the lighting associated with the fully operational Proposal is likely to represent a significant increase in artificial lighting in the local area (Biota 2025b). Lighting for the Proposal will be designed and managed in accordance with the National Light Pollution Guidelines (DCCEEW 2023b). Permanent lighting will only be installed where required, and all lighting will be shielded and directed to active mine areas to minimise light spill. Adherence to best practice guidelines is expected to reduce potential impacts, though is unlikely to eliminate light spill entirely. However, the majority of Night Parrot habitat (including all habitat with detections) is over 12 km from the MIA, so impacts from lighting there are expected to be minor (Biota 2025b). Airfield lighting has more potential to affect Night Parrots as this area is closer to their habitat, but as airfield operations are proposed for daylight wherever possible (excepting emergency situations), lighting is expected to be limited and/or able to be largely switched off during the night. Thus, impacts to Night Parrots are expected be minimised. As Night Parrots are present intermittently and in low numbers, it is not anticipated that any local effects would result in significant population level impacts.

The Proponent considers that through the implementation of management measures outlined in Section 9.5 and the EMP (Appendix A05), including a commitment to undertake post-construction noise and occupancy monitoring within Night Parrot habitat, the Proposal will not result in significant impacts to native fauna.

### 9.6.3 Assessment of Cumulative Impacts

The estimated cumulative impacts from this Proposal and reasonably foreseeable projects within the subregions on the fauna habitat and Land Systems are anticipated to be a total of 48,808 ha (0.8% of the current subregional extent) (Table 9-39). The Proposal's contribution is 4,878 ha (<0.1% of the current subregional extent and 7.8% of total cumulative impact).

The maximum cumulative impact of clearing will be to the Buckshot Land System, with a 10.4% loss of its current extent, with the Proposal contributing to the loss of 0.2% of this Land System (Table 9-39). All other Land Systems will be impacted by less than 3% of their current extent.

With respect to airborne fauna interactions with wind turbines, the estimated cumulative effect of this Proposal and reasonably foreseeable projects within the vicinity of the Proposal are a combined total of 1,754 wind turbines. The Proposal's contribution to that total is 11 turbines (0.9%). Given the AREH project represents the 99.1% of the approved wind turbines in the subject area the Proposal is not expected to result in a significant cumulative impact to birds or bats.

On this basis, cumulative impacts to fauna habitats are not considered to be significant.

## 9.7 Likely Environmental Outcomes

In consideration of the proposed management measures and likely residual impacts associated with the Proposal, the anticipated environmental outcomes that apply to Terrestrial Fauna include:

- No more than 4,878 ha of fauna habitat will be cleared within the Development Envelope comprising the following approximate habitat extents for significant fauna species:
  - 4,498 ha of critical habitat and 238 ha of supporting habitat for Greater Bilby
  - 3,700 ha of critical habitat and 238 ha of supporting habitat for Brush-tailed Mulgara
  - 798 ha of critical habitat and 3,700 ha of supporting habitat for Norther Marsupial Mole
  - 238 ha of critical habitat for Western Pebble-mound Mouse
  - 16 ha of supporting habitat for Northern Quoll
  - 4 ha of supporting habitat for Black-footed Rock-wallaby
  - 3,700 ha of critical habitat for Spectacled Hare-wallaby
  - 3,739 ha of supporting habitat for Short-tailed Mouse
  - 3,700 ha of critical habitat for Dampierland Plain Slider
  - 4,775 ha of supporting habitat for Grey Falcon
  - 3,739 ha of supporting habitat for Oriental Plover
  - 3,739 ha of supporting habitat for Little Curlew
  - 3,739 ha of supporting habitat for Oriental Pratincole
  - 4,775 ha of supporting habitat for Pacific Swift
  - 4,775 ha of supporting habitat for Peregrine Falcon
  - 4,498 ha of supporting habitat for Princess Parrot
  - 3,977 ha of supporting habitat for Barn Swallow
  - 3,739 ha of supporting habitat for Australian (Gull-billed) Tern
- No direct impacts to Rocky Outcropping habitat
- No direct impacts to roosting/nesting or foraging habitat for Night Parrot
- Minimise direct and indirect impacts from the Proposal to native fauna individuals and habitat in accordance with the EMP.

The Proponent will implement the EMP as per Appendix A05 to achieve these outcomes.

Environmental offsets are proposed for this clearing and are discussed in Section 15:

- 4,498 ha of Greater Bilby critical habitat
- 3,700 ha of Brush-tailed Mulgara critical habitat
- 798 ha of Northern Marsupial Mole critical habitat
- 238 ha of Western Pebble-mound Mouse critical habitat
- 3,700 ha of Spectacled Hare-wallaby critical habitat
- 3,700 ha of Dampierland Plain Slider critical habitat.

The Proponent considers that the Proposal can be implemented to meet the EPA's objective to protect Terrestrial Fauna so that biological diversity and ecological integrity are maintained.

# 10 SUBTERRANEAN FAUNA

## 10.1 EPA Environmental Factor Objective

The EPA Statement of Environmental Principles, Factors and Objectives (EPA 2023b) lists the following as its objective for Subterranean Fauna:

**To protect subterranean fauna so that biological diversity and ecological integrity are maintained**

The EPA (2016c) defines subterranean fauna as: *fauna which live their entire lives (obligate) below the surface of the earth.* They are divided into two groups:

- Stygofauna: aquatic fauna living in groundwater (aquifers), waterbodies in caves and smaller voids below water table
- Troglofauna: air-breathing fauna living in caves and small voids above water table.

Obligate subterranean fauna (troglobites and stygobites) are species that live their entire lives underground and are completely dependent upon and restricted to subterranean habitats (EPA 2016c, 2021e). These species are considered by the EPA to have an increased likelihood of short-range endemism and therefore increased vulnerability to impacts from development.

Geology, hydrology and the availability of suitable micro-habitats are strong indicators of the presence of subterranean fauna. Subterranean fauna are generally accepted to occur in geological formations that support interconnected pores or voids necessary to facilitate the circulation of air and water (EPA 2016; 2021b).

The Proposal is located in the Pilbara region, which is known to support highly diverse assemblages of subterranean fauna (EPA 2016c). However, the occurrence of subterranean fauna in deserts, such as the Great Sandy Desert, is variable, with poor to moderately diverse communities present (Biota 2022c, 2022a). The lack of records is likely a combination of the lower suitability of Great Sandy Desert geological units as subterranean fauna habitat, and the limited survey effort in the region (Biota 2022c). In consideration of this uncertainty in subterranean fauna prospectivity, subterranean fauna has been identified as a key environmental factor to be assessed for this Proposal.

## 10.2 Relevant Policy and Guidance

Table 10-1 presents the relevant policy and guidance for Subterranean Fauna.

**Table 10-1: Relevant Policy and Guidance for Subterranean Fauna**

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| **Environmental Protection Authority** | |
| Instructions on how to prepare an Environmental Review Document (EPA 2024e) | This document forms the basis of the headings and content provided in this ERD |
| Statement of Environmental Principles, Factors, Objectives and Aims for EIA (EPA 2023b) | The EPA objective for subterranean fauna forms the basis of this assessment. This assessment has regard to the aims of EIA, consideration of significance and the application of the mitigation hierarchy |
| EPA Environmental Factor Guideline – Subterranean Fauna (EPA 2016c) | The information required for impact assessment has been considered in the scope of this chapter |

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| Technical Guidance – Sampling methods for subterranean fauna – updated 2021 (EPA 2021e) | Considered in the design (methods and approach) of the subterranean fauna surveys |
| Technical Guidance – Subterranean fauna surveys for Environmental Impact Assessment (EPA 2021a) | |
| **Other State or Commonwealth** | |
| Guidelines for Mine Closure Plans (DMPE 2025b) | The MCP has been prepared in accordance with the guidance. It addresses matters related to groundwater level recovery and rehabilitation (Appendix A03) |
| Guideline for preparing Mining Development and Closure Proposals (DEMIRS 2025) | |
| Mining Development and Closure Proposal and Approvals Statement Framework (DMPE 2025c) | |
| A framework for developing mine-site completion criteria in Western Australia (Young et al. 2019) | |

### 10.2.1 Conservation Status and Short-Range endemic (SRE) Classification

Few subterranean species and assemblages from the Pilbara region are formally listed under the EPBC Act or the BC Act as threatened species, or as TEC or PEC. This is a result of gaps in sampling and taxonomic knowledge for the majority of the subterranean fauna collected (EPA 2021e). The lack of knowledge of species distribution ranges for subterranean fauna has necessitated the categorisation of subterranean fauna according to the WAM categorisation for SRE invertebrates. This categorisation uses three broad categories based upon the 10,000 $km^2$ range criterion proposed by Harvey (2002): Confirmed SRE, Potential SRE or Widespread.

## 10.3 Receiving Environment

### 10.3.1 Studies and Survey Effort

This assessment focuses on two sections of the Development Envelope: MIA and Rimfire (Figure 10-1, Figure 10-2, Figure 10-3). Stygofauna have not been assessed for the RAC given the low volumes and temporary nature of abstraction at bores required for that element of the Proposal.

Four subterranean fauna surveys (comprising 15 phases) have been undertaken within and surrounding the Development Envelope (Table 10-2). The surveys utilised standard sampling methodologies as outlined in contemporary EPA guidance. For troglofauna, this included the use of colonisation traps and scraping, and for stygofauna, sampling methods consisted of the use of modified plankton haul nets (Biota 2022b).

To date, a two phase troglofauna survey and a three phase stygofauna survey have been undertaken within the MIA and a seven phase stygofauna survey at Rimfire (Biota 2022c, 2026f). A single phase stygofauna survey was undertaken at Wallal (Biota 2023a; Figure 10-4) and a two phase stygofauna survey at Texas (Biota 2025e). In total, 29 sample events have been undertaken across the Development Envelope for troglofauna and 108 for stygofauna (MIA – 25, Rimfire – 83) (Figure 10-1 to Figure 10-4). The Rimfire sampling works were undertaken with the involvement of Martu People monitors.

During Phase 3 of the Rimfire program, sampling included an historical bore ‘Old Bore’, approximately 125 km south-east of Rimfire and AKD10 bore within the Percival Palaeovalley (Biota 2026f). The ‘Old Bore’ was identified during the desktop study as a potential reference site due to its location within the Percival Palaeovalley and having had stygofauna recorded from it previously.

EPA technical guidance for subterranean fauna surveys notes the following considerations for sampling effort for detailed subterranean fauna surveys leading into EIA (EPA 2021e):

- Scale of the impact
- Time since borehole construction
- Number of sampling phases
- Number of sampling sites
- Seasonality.

Based on the above criteria, the sampling effort at the MIA and Rimfire met guidance current at the time of sampling (Biota 2026f, 2022c; EPA 2016c, 2021e), for a basic and detailed subterranean survey, respectively. Sampling at Rimfire exceeded current technical guidance (Biota 2026f; EPA 2021e). No constraints in terms of seasonality, sampling after rainfall, or time since bore/drill hole construction were noted from the survey efforts at the MIA (Biota 2022c). Best efforts were made to ensure the greatest spatial extent of the available/suitable drill holes/bores were sampled within the MIA and Rimfire; however, it is acknowledged that locations of bores were limited to areas of interest for geological or hydrological exploration (Biota 2026f, 2022c). Few of the Rimfire sample sites were located outside of proposed groundwater extraction areas (five sample drillholes occur outside the limits of modelled groundwater drawdown under the Proposal ‘Project licensing case’ [i.e. 2.8 GL/a abstraction]) and sampling did not extend beyond the footprint of the target mineralisation body in the MIA (Biota 2022c).

**Table 10-2: Summary of Technical Studies for Subterranean Fauna Environmental Factor**

| Title | Location | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|
| Winu Project Rimfire Borefield Stygofauna Assessment (Biota 2026f)<br><br>(Appendix F02) | Rimfire | 3 phase targeted stygofauna survey in 2024<br><br>4 phase targeted stygofauna survey in 2025 | 6-8 May 2024 - 12 drillholes + 2 of these drillholes also sampled in Mar 2024<br><br>21-25 Aug 2024 - 12 drillholes<br><br>25-30 Nov 2024 - 12 drillholes + Old Bore + AKD10<br><br>11-12 Mar 2025 - 15 drillholes<br><br>19-23 May 2025 – 27 drillholes<br><br>11-18 August 2025 – 27 drillholes<br><br>17-24 November 2025 – 27 drillholes | These surveys were undertaken in accordance with the following guidance:<br>• Technical Guidance: Subterranean Fauna Surveys for Environmental Impact Assessment (EPA 2021c)<br>• Environmental Factor Guideline: Subterranean Fauna (EPA 2016c)<br>Limitations:<br>• The Great Sandy Desert region is under surveyed compared to other regions known for high levels of stygofauna diversity. While contextual records are limited, they indicate low subterranean diversity<br>• The majority of the stygofauna samples retrieved from the drillholes at Rimfire were very sedimented during all phases of sampling |
| Winu Project Texas Borefield Stygofauna Assessment (Biota 2025e) | Texas | 2 phase targeted stygofauna survey in 2024-2025 | 10-13 May 2024 – 12 drillholes<br><br>23-25 August 2025 – 11 drillholes | These surveys were undertaken in accordance with the following guidance:<br>• Technical Guidance: Subterranean Fauna Surveys for Environmental Impact Assessment (EPA 2021c)<br>• Environmental Factor Guideline: Subterranean Fauna (EPA 2016c)<br>Limitations:<br>• The majority of the stygofauna samples retrieved from the drillholes at Texas were very sedimented during both phases of sampling |
| Winu Project Wallal Borefield Stygofauna Assessment (Biota 2023a) | Wallal Area | Desktop assessment<br><br>Single phase stygofauna sampling in May 2023 | 3 – 4 May 2023 – 9 drillholes | These studies were undertaken with regard to the following guidance: |

| Title | Location | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|
| | | | | • Technical Guidance: Subterranean Fauna Surveys for Environmental Impact Assessment (EPA 2021e)<br>• Environmental Factor Guideline: Subterranean Fauna (EPA 2016c)<br>Limitations:<br>• For many of the sites sampled, the drillholes were blank cased to depths below where stygofauna would typically be expected to occur in more prospective geological settings |
| Winu Texas Stygofauna Desktop Study (Biota 2023d) | Texas Area | Desktop assessment | May 2023 | Desktop assessment meets relevant EPA Act policy and guidance. The study was undertaken in accordance with the following:<br>• Technical Guidance: Subterranean fauna surveys for environmental impact assessment (EPA 2021e)<br>• Environmental Factor Guideline: Subterranean Fauna (EPA 2016c) |
| Winu Production Bores Stygofauna Desktop Study (Biota 2022a) | Texas and Wallal Rimfire borefields | Desktop assessment | October 2022 | Desktop assessment meets relevant EPA Act policy and guidance. The study was undertaken in regard to the following:<br>• Technical Guidance: Subterranean fauna surveys for environmental impact assessment (EPA 2021e)<br>• Environmental Factor Guideline: Subterranean Fauna (EPA 2016c) |

| Title | Location | Type | Survey Season and Dates | Consistency with Guidance |
|---|---|---|---|---|
| Winu Project Subterranean Fauna Desktop Study and Basic Survey (Biota 2022c)<br><br>(Appendix F01) | MIA | Desktop assessment<br><br>2 phase troglofauna survey<br><br>3 phase stygofauna survey | **Troglofauna – 29 sites**<br><br>25-26 Sep 2019 – trap and scrape<br><br>14 Nov 2019 - haul<br><br>9-13 Sep 2021 – trap, scrape and haul<br><br>27 Oct 2021 – trap collection<br><br>**Stygofauna – 25 sites**<br><br>25-26 Sep 2019 – haul<br><br>14 Nov 2019 - haul<br><br>9-13 Sep 2021 – haul | The study and survey were implemented in accordance with the following EPA Act policy and guidance:<br><br>• Technical Guidance: Subterranean fauna surveys for environmental impact assessment (EPA 2021e)<br><br>• Environmental Factor Guideline: Subterranean Fauna (EPA 2016c)<br><br>Limitations:<br><br>• Drill holes were cased with blank PVC until approximately 30-45 mbgl. As the water table across the survey area was approximately 50 mbgl, traps were positioned at varying depths between 30-50 mbgl to ensure contact with surrounding geology above water table (AWT)<br><br>• Drill hole scraping was undertaken at 11 sites only, as most sites were angled rendering scraping ineffective |

### 10.3.2 Hydrogeological Setting and Proposal Water Balance

The Proposal involves BWT mining and associated infrastructure, waste landforms, ore processing facilities, tailings and stockpiles (Figure 10-1). Excess water generated from pit dewatering during initial phases of operation will be managed within the MIA through the use of infiltration ponds and adjacent bores for MAR. The Proposal will have surplus water until approximately Year 17 with excess water management required during that time (Section 7).

Rimfire is required to supplement Proposal water supply from approximately Year 17. Although modelling indicates that the actual water requirements through the life of the Proposal will be substantially less, the current assessment of potential impacts to subterranean fauna will be based on the conservative (P90 probability) Project water demand case, in which Rimfire Borefield abstraction starts 13 years after the commencement of mining. Under this scenario, borefield flows vary from zero to a peak in Year 26 of approximately 2.0 GL/a. Another scenario has also been used, for reference, termed the 'Project licensing case', in which up to 2.8 GL/a, is abstracted continuously over 32 years. This rate of continuous abstraction over the LoM is not realistic but is used for reference purposes as this reflects the proposed borefield licence limit and could therefore be considered a theoretical maximum. .

Rimfire will consist of a network of production bores feeding a pipeline for transfer of the water to the processing and non-processing areas (Worley 2025c; Fortin 2025). An associated network of monitoring bores would also be required to manage the borefield. The borefield is proposed to be ready for use by Year 13 of operation (water deficit estimated from Year 17 to cessation of operations), to ensure reliable supply under all climatic conditions.

The Development Envelope is located between the Percival Palaeovalley to the south, and which intersects the Development Envelope at Rimfire, and the Wallal Palaeovalley, approximately 20 km to the north (Biota 2023b, Section 7). The Proposal and its surrounds are located within the Anketell Shelf subdivision of the Canning Basin, comprised of metasedimentary and intrusive rocks. The Proposal is located along the eastern margin of the Anketell fault, which separates the stratigraphic units of the Barnicarndy Graben (previously named the Waukarlicarly Embayment; a fault-bounded depression) in the west to the Anketell Shelf in the east.

The Canning-Wallal aquifer is the predominant groundwater resource for the region and is continuous across the Canning Basin, with an approximate thickness onshore of 425 m (Advisian 2023a). The aquifer occurs within the various cemented and uncemented sandstones of the Canning Basin, with the saturation thickness increasing in the aquifer's northern extents as the sandstone layers deepen (Golder 2022b). For most of its extent the aquifer is unconfined except where it is overlain by the Jarlemai Siltstone, north-north-west of the MIA, separating it from the overlying Broome Sandstone unconfined aquifer (Golder 2022b).

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S
21°0'0"S

N

Great Northern Hwy

KARAJARRI PEOP
NYANGUMARTA PEO

Mandora

Parda Formation (K-_pr-sf)

Callawa Formation (K-_ca-sp)

SEE FIGURE 10-4 FOR WALLAL DETAIL

Wallal

SEE FIGURE 10-3 FOR MINE INFRASTRUCTURE AREA DETAIL

Oakover

Broadhurst Formation (P_-THb-shh)

Paterson Formation (CP-_pa-sepg)

Poole Sandstone (P-_po-st)

Percival

MARTU #3

MARTU (AREA A)

SEE FIGURE 10-2 FOR RIMFIRE DETAIL

Frezier Sandston (K-_fz-st)

Anketell Formation (K-_an-st)

Mount Crofton Granite (P_-_cr-g)

Malu Formation (P_-LAm-stq)

0 10 20 Kilometres

## Legend

### Subterranean Fauna Sampling

- Stygofauna Sampling Site
- Troglofauna Sampling Site
- Native Title Determinations
- Development Envelope
- Proposed Mine Pit
- Conceptual Footprint
- Great Northern Highway
- Palaeovalleys (Geoscience Aus. 2012)
- Anketell Fault
- Thorny Devil Fault

### 1:500 000 State interpreted bedrock geology

- K-_ca-sp; Callawa Formation; Very fine-grained to coarse-grained sandstone, and conglomerate
- K-_pr-sf; Parda Formation; Mudstone; interbedded fine-grained sandstone
- K-_an-st; Anketell Formation; Fine-grained sandstone and siltstone; lesser coarse-grained sandstone and conglomerate
- K-_fz-st; Frezier Sandstone; Fine- to coarse-grained sandstone; minor granule conglomerate
- P-_po-st; Poole Sandstone; Quartz sandstone and minor siltstone
- CP-_pa-sepg; Paterson Formation; Conglomerate (including diamictite), sandstone, and siltstone; largely glacigene
- P_-_cr-g; Mount Crofton Granite; Syenogranite and monzogranite
- P_-LAm-stq; Malu Formation; Fine- to medium-grained quartz sandstone
- P_-THb-shh; Broadhurst Formation; Carbonaceous shale and siltstone, pyritic and pyrrhotitic shale, siltstone, and fine-grained sandstone

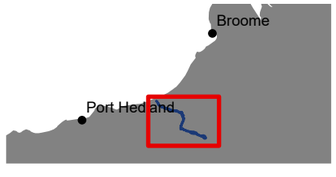
RioTinto

# Figure 10-1: Subterranean Fauna Sampling in the Winu Project Area

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Tuesday, 30 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: **Degree**
**Scale:** 1:550,000
Rio Tinto © Copyright



122°0'0"E

N

Parda Formation
(K-_pr-sf)

Frezier Sandstone
(K-_fz-st)

NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

Anketell Formation
(K-_an-st)

Percival

(CP-_pa-sepg)

Poole Sandstone
(P-_po-st)

200
100
50
20
10
5
2
30
25
15
10
5
2

21°0'0"S

122°0'0"E

## Legend

Subterranean Fauna Sampling

- Stygofauna Sampling Site
- Pit Dewatering Predicted Maximum Drawdown (m)
- Contour Drawdown (m) 2.8 GL/a Maximum Abstraction
- Native Title Determinations
- Development Envelope
- Proposed Mine Pit
- Conceptual Footprint
- Palaeovalleys (Geoscience Aus. 2012)
- Anketell Fault
- Thorny Devil Fault

1:500 000 State interpreted bedrock geology

- K-_ca-sp; Callawa Formation; Very fine-grained to coarse-grained sandstone, and conglomerate
- K-_pr-sf; Parda Formation; Mudstone; interbedded fine-grained sandstone
- K-_an-st; Anketell Formation; Fine-grained sandstone and siltstone; lesser coarse-grained sandstone and conglomerate
- K-_fz-st; Frezier Sandstone; Fine- to coarse-grained sandstone; minor granule conglomerate
- P-_po-st; Poole Sandstone; Quartz sandstone and minor siltstone
- CP-_pa-sepg; Paterson Formation; Conglomerate (including diamictite), sandstone, and siltstone; largely glacigene

0 2 4 Kilometres

RioTinto

**Figure 10-2: Subterranean Fauna Sampling in the Winu Project Area - Rimfire**



**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Tuesday, 30 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:130,000
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_SubterraneanFauna.aprx Layout: ERD - Subterranean fauna Sampling in the Winu Project Area - Rimfire

## Legend

### Subterranean Fauna Sampling

- Stygofauna Sampling Site
- Troglofauna Sampling Site
- Pit Dewatering Predicted Maximum Drawdown (m)
- Native Title Determinations
- Development Envelope
- Proposed Mine Pit
- Conceptual Footprint
- Anketell Fault
- Thorny Devil Fault

### 1:500 000 State interpreted bedrock geology

- K-_ca-sp; Callawa Formation; Very fine-grained to coarse-grained sandstone, and conglomerate
- K-_pr-sf; Parda Formation; Mudstone; interbedded fine-grained sandstone
- K-_an-st; Anketell Formation; Fine-grained sandstone and siltstone; lesser coarse-grained sandstone and conglomerate
- K-_fz-st; Frezier Sandstone; Fine- to coarse-grained sandstone; minor granule conglomerate
- P-_po-st; Poole Sandstone; Quartz sandstone and minor siltstone

RioTinto

**Figure 10-3: Subterranean Fauna Sampling in the Winu Project Area - MIA**



**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Tuesday, 30 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:100,000
Rio Tinto © Copyright

0 2 4 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_SubterraneanFauna.aprx Layout: ERD - Subterranean fauna Sampling in the Winu Project Area - MIA

121°0'0"E

20°0'0"S

N

Parda Formation (K-_pr-sf)

Parda Formation
(K-_pr-sf)

Callawa Formation
(K-_ca-sp)

Parda Formation
(K-_pr-sf)

Wallal

**Legend**

## Subterranean Fauna Sampling

- Stygofauna Sampling Site
- Development Envelope
- Conceptual Footprint
- Palaeovalleys (Geoscience Aus. 2012)

1:500 000 State interpreted bedrock geology

- K-_ca-sp; Callawa Formation; Very fine-grained to coarse-grained sandstone, and conglomerate
- K-_pr-sf; Parda Formation; Mudstone; interbedded fine-grained sandstone

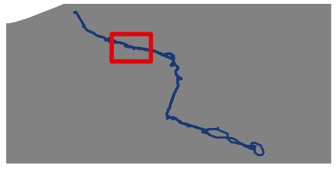
RioTinto

**Figure 10-4: Subterranean Fauna Sampling in the Winu Project Area - Wallal**

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Tuesday, 30 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:80,000
Rio Tinto © Copyright



0 2 4 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_SubterraneanFauna.aprx Layout: ERD - Subterranean fauna Sampling in the Winu Project Area - Wallal

121°0'0"E

### 10.3.3 Subterranean Fauna Habitat

The prospectivity of the Development Envelope to support subterranean fauna was characterised using regional geology mapping, hydrological and hydrogeological information, stratigraphic logging and information from drillholes, identification of rock types that have previously yielded fauna records and results from previous sampling effort in the local area (Table 10-3) (Biota 2026f). The following characteristics were used in determining habitat prospectivity for troglofauna and stygofauna:

- Presence of fractures, caverns, vugs or interstitial spaces above or below the water table
- Presence of impeding layers to maintain stable humidity
- Continuity and transmissivity of the submerged geological units
- Known occurrence of troglofauna or stygofauna from desert environments in equivalent geology types
- Absence of large amounts of fine sediments such as clays, silts and sands within the geological unit description
- Substrate permits inflow of surface water and nutrients
- Substrate location in relation to the water table (Biota 2022c).

**Table 10-3: Criteria Used to Assess Habitat Prospectivity of Geological Units**

| Likelihood | Criteria |
|---|---|
| Low | Geology may include impeding layers to maintain stable humidity, however no suitable space is available, and suitable geology only occurs below water table (for stygofauna) or above water table (for troglofauna). Troglofauna or stygofauna not previously recorded from previous sampling of similar geologies in desert environments |
| Moderate | Geology contains suitable spaces and may include impeding layers to maintain stable humidity. Suitable geology likely partially or completely submerged below the water table (for stygofauna); or above the water table (for troglofauna). Low numbers of troglofauna or stygofauna have been recorded from similar geologies in desert environments previously |
| High | Geology contains suitable spaces and presence of continuous, transmissive aquifer in suitable geology which is partially or completely submerged below the water table (for stygofauna); or presence of impeding layers to maintain stable humidity above suitable geology situated above the water table (for troglofauna). Troglofauna or stygofauna documented from similar geologies in desert environments |

#### 10.3.3.1 MIA

The MIA is conceptualised as having two main aquifer systems, the unconfined Permian sandstone aquifer (primary porosity) and the Proterozoic metasediments aquifer separated by the Permian mudstone, where present (Worley 2025b). The mudstone unit thickness varies significantly across the MIA. Using the assessment criteria in Table 10-3, the MIA geology was generally not found to contain suitable habitat to support subterranean fauna (fractures, caverns or vugs) (Biota 2022c). The upper sand unit was assessed as having Low prospectivity as habitat for troglofauna and was not suitable for stygofauna. The thick upper sand unit (up to 20 m), limits the transfer of water and nutrients through the soil profile (Biota 2022c). The sandstone units were found to have some limited porosity, with some small interstitial spaces that could represent potential habitat for both troglofauna and stygofauna (Biota 2022c). The sandstone unit (including sandstone aquifer) was assessed as Moderately prospective for troglofauna (AWT) and stygofauna (BWT) (Biota 2022c). The prospectivity of mudstone and metasediment units occurring below the sandstone were assessed as Low for stygofauna and were not considered suitable troglofauna habitat (Table 10-4, Section 7.3.2.1).

The desktop assessment identified a small area of gravelly lateritic rise habitat in the eastern section of the MIA as having a Moderate level of prospectivity for troglofauna and stygofauna due to increased likelihood of subsurface vugs and cavities (Biota 2022c). Additionally, a large geological fault and dyke were identified (through desktop assessments) running through the eastern section of the MIA. These

features could form a barrier for movement of any potential subterranean communities, if present (Biota 2022c). The Thorny Devil Fault was confirmed as at least a partial barrier to groundwater flow through pumping tests conducted in two test production bores, WINU0913 (2022) and WINU0925 (2024) on either side of the fault (Worley 2025b).

#### 10.3.3.2 Rimfire

The stratigraphic units at Rimfire consists of aeolian sand and silcrete units (which extend to approximately 30 mbgl), underlain by sandstone and granite units (Table 10-4; Worley 2025c). The stratigraphic units at Rimfire were categorised overall as Low-Moderate prospectivity as stygofauna habitat (Biota 2026f) (Table 10-4). The upper sand unit occurs, for the most part, above the watertable and would therefore not represent habitat for stygofauna (although suitable for troglofauna). Beneath these units, the sandstone is considered to have a Moderate prospectivity as stygofauna habitat. The remaining metasediment units have Low prospectivity, except where highly weathered, which imparts Moderate prospectivity (Biota 2026f). Stygofauna have previously been recorded in sandstone units from eastern Australia (Hose et al. 2015 cited in Biota 2026f). Therefore, it may be possible that when located below the watertable at Rimfire, sandstone could potentially support stygofauna. The high proportion of fine sediments present in the sandstone unit at Rimfire was considered to reduce its suitability for supporting stygofauna (Biota 2026f). Depending on the level of fracturing, the granite unit was also considered to have a Moderate prospectivity for stygofauna as it provides suitable cavities to support fauna. In the Gascoyne region, stygofauna have been recorded from granite units where suitable fracturing has occurred to create large enough pore spaces to support fauna (Ecoscape 2016 cited in Biota 2026f). At Rimfire, the granite units occur at depths where nutrient and primary production energy inputs are beginning to attenuate; therefore, reducing the likelihood of supporting a stygofauna community, even if sufficient fracturing was present. Previous studies have found that fractured rock aquifers typically yield depauperate stygofauna communities, which are often dominated by widespread copepod species (Bennelongia 2017b as cited in Biota 2026f).

Stygofauna are also known to tolerate a range of groundwater physicochemical conditions, including low to high dissolved oxygen concentrations, fresh to brackish water, and pH ranging from moderately acidic (5.6) to slightly alkaline (8.2) (Biota 2022c). Groundwater physico-chemistry at Rimfire suggests that groundwater is within the habitable ranges for stygofauna (Subterranean Ecology 2012 cited in (Subterranean Ecology 2012 cited in Biota 2026f) with an EC (electrical conductivity) ranging between 580 and 1,330 µS/cm, and a neutral to slightly basic pH between 7.4 to 8.0. No obvious spatial, vertical or lithology trends in groundwater EC or pH have been observed (Worley 2025c).

#### 10.3.3.3 Percival Palaeovalley

The most recent stygofauna assessment undertaken at Rimfire supports previous assessments that the most prospective stygofauna habitat in the Winu area is in and around the Percival Paleochannel, with the most prospective habitat where groundwater levels are closest to the surface (Biota 2026f).

The Percival Palaeovalley is located to the south of Rimfire and is described as an infilled tributary valley for a river that once discharged into the main Percival Palaeoriver 40 km to the south (Worley 2025c). The sedimentary infill geology of the palaeovalleys typically comprises basal gravels and sands deposited under high-velocity flow, which are overlayed by fine-grained fluvial-lacustrine sediments (Worley 2025c). Although historic drilling in the palaeovalley south of Rimfire is limited (Worley 2025c), a previous desktop study for the Proposal identified the shallow aquifers beneath palaeovalleys as the most prospective stygofauna habitat within the region. The geological units supporting this habitat are described as ‘Alluvial and lacustrine sand, silt, mud and calcrete’ (Geological Survey of Western Australia 2022 cited in Biota 2026f). However, based on the Rimfire drill logs examined, no calcrete units have been intercepted within the Rimfire drillholes within or near to the palaeovalley tributary (though calcrete outcropping on the ground surface has been noted further south of Rimfire (Biota 2026f).

The distinction between the lithologies (in terms of prospectivity for stygofauna) within the Percival Palaeovalley are less clear when compared to palaeovalley systems in other regions of WA where prospective stygofauna habitat appears well stratified (Biota 2026f). This indicates that while the Percival Palaeovalley is in general, much less prospective due to the fine-grained nature of the rock types (i.e. granite), it is the highly weathered nature of these lithologies which allow sufficient pore space for stygofauna to inhabit, occurring in conjunction with the palaeohistory of ancient rivers which continue to flow beneath the surface (Biota 2026f). This makes it difficult to quantify the extent of potential suitable stygofauna habitat available at Rimfire due to the lack of distinction in prospectivity between the lithologies and because stygofauna have been recorded within geological units not generally considered prospective for stygofauna (Biota 2026f). As indicated, adopting a precautionary approach, it is assumed the entire Percival palaeovalley tributary hydrostratigraphic unit represents potential stygofauna habitat, with the most prospective stygofauna habitat occurring in areas where the groundwater level is the closest to the ground surface.

The extent of the palaeovalley has been refined using a combination of airborne transient electromagnetics data and drillhole validation (Worley 2025c). The areas of high conductivity along the palaeovalley are interpreted as an increased clay content and corresponds with the inferred palaeochannel presented in the WASANT Palaeovalley Map (Worley 2025c). The extent of the palaeochannel has been delineated based on this dataset and is referred to as the Inferred Percival Palaeochannel in the Rimfire area (Worley 2025c), although the seismic signatures of the inferred palaeovalley sediments and the Permian sandstone into which palaeochannel has incised were not discernible, making the true edges of the palaeochannel difficult to identify (Worley 2025 cited in Biota 2026f). Within the geophysics-inferred palaeovalley, only one bore (WINU1446) exhibited the characteristic palaeovalley sequence of interbedded clay and sandstone. Other bores located within the geophysics-inferred extent and on the branches adjacent to this main channel encountered either outcropping bedrock (WINU1445, WINU1452, WINU1453) or ferricrete and sandstone (WINU1444, WINU1454), consistent with the surrounding cover. These results suggest that the actual extent of the palaeovalley may be more limited than indicated by the geophysics, and it may potentially be confined only to the main high-conductivity channel area (Worley 2025c).

Vegetation mapping in the Rimfire and Percival Palaeovalley provides other evidence of the paleochannel through the presence of potential GDV units that correlate approximately with the mapped boundary of the Inferred Percival Palaeochannel (Section 8.3.2.5).

At Rimfire, stygofauna were recorded from 17 locations in and around the Percival Palaeovalley tributary, including from locations outside of the Inferred Percival Palaeochannel boundaries and outside the WASANT Palaeovalley mapping (Biota 2026f). This suggests that there is some level of hydraulic connectivity between the aquifer beneath the palaeovalley and the surrounding areas where the habitat is considered less prospective. Currently available information indicates that the saturated thickness of the palaeovalley sequence at WINU1446 is approximately 30 m, with the watertable approximately 4 mbgl. Stygofauna abundance and diversity is expected to be higher where groundwater is closer to the ground surface, where oxygen levels and organic matter are more abundant (Serov 2017 cited in Biota 2026f), thus providing sufficient energy inputs to support a stygofaunal community. The findings from Rimfire (Section 10.3.3.2) are consistent with this, with two of the five higher level groups recorded, the Amphipoda and Isopoda - the two orders of malacostracan crustaceans, only being recorded from sites where groundwater was very close to the ground surface (between 4-6 mbgl). This was in contrast to the oligochaetes and two orders of copepods, which were found throughout a broader range of groundwater levels (including from depths greater than 28 mbgl).

In contrast to the much deeper groundwater of the majority of the Proposal area, the groundwater levels along the palaeovalley tributary are close to the surface, with the watertable becoming much deeper immediately outside the tributary's extent, which has been assumed to show this is where the shallow, alluvial aquifer reaches its limits, and is replaced by the deeper metasedimentary aquifer (Biota 2026f).

The level of hydraulic connection between the palaeovalley aquifer and the metasedimentary aquifer at Rimfire has not been sufficiently assessed, although initial test pumping also suggests a potential hydraulic connection between the two aquifers (Section 7).

**Table 10-4: Overview of Subterranean Fauna Habitat Prospectivity at the MIA and Rimfire**

| Stratigraphic Unit/ Formation | Lithology | Thickness (m) | Hydrological function | Present at MIA | Present at Rimfire | Troglofauna Habitat suitability | Stygofauna Habitat suitability |
|---|---|---|---|---|---|---|---|
| Quaternary aeolian sand/Silcrete/Sandstone | Silty sand, very fine to medium grained and variable ferricrete | 0-30 | Unsaturated | Yes | Yes | Moderate<br>where sandstone occurs AWT | Moderate: where sandstone occurs BWT |
| Permian mudstone | Mudstone, claystone | 0-250 | Sedimentary aquitard, discontinuous, low permeability confining unit not found at Rimfire | Yes | No | None | NA |
| Weathered metasediment | Moderately to highly weathered metasediment | 20-80 | Aquifer<br>unconfined primary aquifer | Yes | Yes | None | Low: Metasediment geologies typically cemented and high portion of fine sediments<br>Moderate – where highly weathered |
| Fresh metasediment | Slightly weathered to fresh metasediment, massive, fine to coarse grained | >80 | Fractured aquifer | Yes | Yes | None | Low: Metasediment geologies typically cemented and high portion of fine sediments |
| Weathered granite | Moderately to highly weathered granite, generally occurs as quartz, feldspar, and biotite in a matrix | 20-80 | Aquifer (primary weathered aquifer) | Yes | Yes | None | Moderate |
| Fresh granite | Slightly weathered to fresh granite, massive, fine to coarse grained | >80 | Fractured aquifer | Yes | Yes | None | Moderate |

*Source: Adapted from Worley, 2025b*

### 10.3.4 Subterranean Fauna Species Values

Database searches did not identify any records of subterranean fauna within 40 km and 50 km of the MIA and Rimfire, respectively (Biota 2022c, 2026f). This is consistent with review of the literature indicating that the occurrence of troglofauna and stygofauna in deserts (including the Great Sandy Desert) is variable, with poor to moderately diverse communities present (Biota 2022c, 2026f). The lack of records is likely a reflection of both the lower suitability of Great Sandy Desert geological units as subterranean fauna habitat, and the limited survey effort in the region (Biota 2022c).

#### 10.3.4.1 Troglofauna

The basic subterranean survey conducted by Biota (2022b) of the MIA recorded no troglobitic fauna specimens, which is consistent with the conclusions of the desktop studies. The overall prospectivity of troglofauna occurrence within the MIA is considered Low with the sandstone unit presenting the only habitat in which troglofauna may potentially occur (Moderate suitability - Table 10-4; (Biota 2022c). Based on the limited extent of suitable troglofauna habitat within the MIA and the absence of fauna records in the proposed pit area, troglofauna are not considered further in this assessment with respect to the MIA. The sandstone unit at Rimfire was also considered Moderately suitable for troglofauna (AWT); however, as no direct impacts (i.e. pit excavation) to troglofauna are proposed at Rimfire, troglofauna were not considered further at Rimfire.

#### 10.3.4.2 Stygofauna

##### 10.3.4.2.1 MIA

No stygofauna have been collected across the three phases of survey undertaken at the MIA (Biota 2022c). It was concluded from these studies that the likelihood of stygofauna occurrence within the MIA is Low, with the sandstone unit representing the only potential habitat (Table 10-4, Biota 2022b). Therefore, as no stygofauna were recorded within the MIA and limited suitable habitat has been identified, it is not considered further in this assessment.

##### 10.3.4.2.2 Rimfire

A total of 22 species-level stygofauna taxa have been identified at Rimfire to date (within Development Envelope and palaeovalley to the south) (Biota 2026f). Of these, none were assigned to a formally described species and as such, were assigned to a molecular species at either the order, family or genus level. Stygofauna records comprise five higher order groups, including Harpacticoida and Cyclopoida, Isopoda, Oligochaete and Amphipoda (Biota 2026f) (Figure 10-5; Table 10-5). Details of these records are provided in Table 10-5 and depicted in Figure 10-5. Noting that there are 25 records shown in Table 10-5 (and Table 10-9; Table 10-10), that number includes the 22 species-level taxa discussed here, plus three records that have not been identified to species-level. Figure 10-5 (and Figure 10-6; Figure 10-7) show only the 22 species-level taxa as only this level is mapped.

Two additional groups of aquatic fauna belonging to the phyla Rotifera and Nematoda were also recorded, however no further identification was sought for these groups as they are generally widespread in surface waters, and typically not assessed as part of EIA. The Rotifera and Nematoda records are not discussed further (Biota 2026f).

Of the 22 taxa recorded, 20 were found to be newly detected molecular species based on available reference data and 18 of the 20 new taxa were recorded as singletons (only recorded from a single site).

The amphipod taxon was recorded from site Winu 1451 and Winu 1452 and assigned to a new molecular species within the family Paramelitidae (Paramelitidae sp. H-AMP051).

Two isopod taxa, Microcerberidae sp. H-ISM003 and Microcerberidae sp. H-ISM005, were recorded. Microcerberidae sp. H-ISM005 was recorded from a single site (Winu 1451), and Microcerberidae sp. H-ISM003 was recorded from AKD10 and Winu 1446, which are approximately 500 m apart (Biota

2026f). The two isopod taxa recorded were assigned to new molecular species within the family Microcerberidae as they showed approximately 8% divergence from each other, suggesting they represent two different species. There are no Australian molecular systematic studies published for this family and undescribed species from Australia have yet to be formally documented. Given that Microcerberid isopods are a cryptic group, morphological identifications are unlikely to further delimit the species, validating the molecular approach undertaken to assign the specimens a species-level identification (Biota 2026f).

Six Harpacticoid copepods were recorded from five sites. Molecular analysis determined 12 previously undetected taxa, six of which were assigned to the genus *Parastenocaris*. The remaining six taxa were placed to order level (Harpacticoida sp.). Four Harpacticoids were recorded from a single site each, and two taxa were recorded from three sites.

Two cyclopoid copepods, Cyclopoid asp. H-CYC010 and Cyclopoida sp. H-CYC036, were recorded from a single site each, Winu1453 and Winu1447, respectively. Both specimens were new putative species, sharing *Dussartcyclops* sp. Biologic -CYCL007 as the nearest relative.

Five oligochaete worms were recorded from seven sites. Of these, two species have been previously recorded, Enchytraeidae sp. H-OLE026 as a widespread species and Enchytraeidae sp. H-OLE063 having been recorded from the Havieron project and wider Telfer area. The remaining three taxa are newly detected species that were not detected prior to Phase 6 of the survey and were recorded from a single site each.

With respect to the Proposal, stygofauna have only been recorded within, and in proximity, to the Percival Palaeovalley, including where it overlaps the Rimfire Borefield (Table 10-5, Figure 10-5). The shallow aquifers within palaeovalley settings (such as recorded at WINU1446) were identified as representing the most prospective habitat for stygofauna (Biota 2025a). The stygofauna study undertaken for the Proposal (Biota 2026f) suggests the conservative approach would be to assume a palaeovalley tributary-scale distribution for the newly recorded stygofauna taxa at Rimfire until additional specimens are recorded or sites further south are sampled. The Anketell Fault bisects the palaeovalley tributary approximately where it meets the main body of the Percival Palaeovalley (Figure 10-1; Figure 10-2). This fault has the potential to act as a barrier to stygofauna distribution, but this is uncertain.

None of the stygofauna taxa recorded are listed or recognised as conservation priorities under state or federal legislation.

Three orders of stygofauna were recorded from the reference site, Old Bore, located approximately 125 km south-east of Rimfire within the Percival Palaeovalley (Biota 2025a). None of the taxa recorded at Old Bore represent the same species recorded from Rimfire.

122°0'0"E

## Legend

- Subterranean Fauna Specimen

### Stygofauna Bores

- Stygofauna Absent
- Stygofauna Present
- Inferred Palaeochannel
- Rimfire Borefield Predicted Maximum Drawdown (m)
- Native Title Determinations
- Development Envelope
- Conceptual Footprint
- Palaeovalleys (Geoscience Aus. 2012)

**Subterranean Fauna Specimen**

- *Amphipoda*
- *Cyclopoida*
- *Oligochaeta*
- *Harpacticoida*
- *Isopoda*

*Label colour indicates **order**, text indicates **species***

N

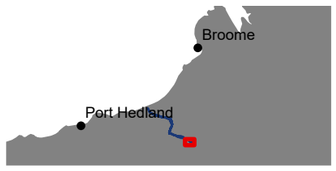
WINU1380
WINU1422
WINU1377
WINU1381
WINU1375
WINU1427
Parastenocaris sp. H-HAR010A
WINU1423
WINU1424
Enchytraeidae sp. H-OLE064
Enchytraeidae sp. H-OLE065
WINU1378
WINU1384
WINU1374
WINU1373
WINU1379
WINU1383
WINU1371
Parastenocaris sp. H-HAR010A
WINU1372
Enchytraeidae sp. H-OLE063
WINU1438
WINU1437
Parastenocaris sp. H-HAR024
WINU1385
WINU1426
Parastenocaris sp. H-HAR010A
WINU1436
WINU1425
Parastenocaris sp. H-HAR010B
Parastenocaris sp. H-HAR026
Enchytraeidae sp. H-OLE026
WINU1439
WINU1440
WINU1441
WINU1442
MARTU (AREA A)
Enchytraeidae sp. H-OLE026
WINU1443
WINU1445
WINU1444
Harpacticoida sp. H-HAR027
AKD10
WINU1446
Microcerberidae sp. H-ISM003
Harpacticoida sp. H-HAR023
Microcerberidae sp. H-ISM003
Harpacticoida sp. H-HAR016
Cyclopoida sp. H-CYC036
WINU1447
Percival
WINU1448
Paramelitidae sp. H-AMP051
Parastenocaris sp. H-HAR029
WINU1452
Enchytraeidae sp. H-OLE063
WINU1449
WINU1450
Parastenocaris sp. H-HAR028
WINU1451
Enchytraeidae sp. H-OLE066
Harpacticoida sp. H-HAR017A
Enchytraeidae sp. H-OLE026
Microcerberidae sp. H-ISM005
Paramelitidae sp. H-AMP051
Harpacticoida sp. H-HAR017A
Harpacticoida sp. H-HAR017B
WINU1453
Cyclopoida sp. H-CYC010
WINU1455
Harpacticoida sp. H-HAR015
WINU1454
WINU1456
Harpacticoida sp. H-HAR017A

15
20
25
30
10
5
2

0 5 10 Kilometres

RioTinto

**Figure 10-5: Stygofauna Records from Rimfire and Surrounds**




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 2 July 2026

**Coordinate System:**
GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter
**Scale:** 1:75,000
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_SubterraneanFauna.aprx Layout: ERD - Stygo Records from Rimfire and Surrounds

122°0'0"E

**Table 10-5: Stygofauna Taxa Records from Rimfire and Surrounds**

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| **AMPHIPODA** | | | | | | | |
| Paramelitidae | | | | | | | |
| Paramelitidae sp. H-AMP051 | 20 | 2 | WINU1452, WINU1451 | No | Yes | WINU1452 – Sand, granite (groundwater encountered)<br>WINU1451 - Sand, ferricrete, sandstone (groundwater encountered), siltstone, sandstone, metasediment<br>Potential depth of habitat 2-48 mbgl | New molecular species within Paramelitidae. Species of paramelitid amphipod are stygobites (obligate stygofauna), includes widespread and SREs (Biota 2026f). Closest relative to this taxon were two Paramelitidae taxa recorded for the Havieron Project 95 km south-east of Rimfire (Biota 2026f)<br>One site (WINU1452) within WASANT Palaeovalley, outside Inferred Percival Palaeochannel<br>One site (WINU1451) on boundary of, WASANT Palaeovalley, outside Inferred Percival Palaeochannel |
| **ISOPODA** | | | | | | | |
| Microcerberidae | | | | | | | |
| Microcerberidae sp. H-ISM003 | 19 | 2 | WINU1446, AKD10 | No | Yes | WINU1446 – Sand, claystone (groundwater encountered), sandstone, claystone, sand, metasandstone, granite, Metasandstone, granite, Metasandstone<br>AKD10 - Lithology unknown, historic bore. Groundwater level 3.82 m<br>Potential depth of habitat 1-50 mbgl | Within both Inferred Percival Palaeochannel and WASANT Palaeovalley<br>Known range of 0.5 km. Cryptic group - predisposition for endemism not known |

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | (Potentially suitable lithology to 66 mbgl) | |
| Microcerberidae sp. H-ISM005 | 18 | 1 | WINU1451 | No | No | Sand, ferricrete, sandstone (groundwater encountered), siltstone, sandstone, metasediment<br>Potential depth of habitat 5-48 mbgl | Near boundary of WASANT Palaeovalley, outside Inferred Percival Palaeochannel<br>Single site. Cryptic group - predisposition for endemism not known |
| Microcerberidae sp. indet. | 16 | 1 | AKD10 | No | Yes | Lithology unknown, historic bore | Single site. Within both Inferred Percival Palaeochannel and WASANT Palaeovalley |
| **HARPACTICOIDA** | | | | | | | |
| Parastenocarididae | | | | | | | |
| *Parastenocaris* sp. H-HAR010A | 10 | 3 | WINU1372, WINU1437, WINU1423 | Yes | No | WINU1372 – Ferricrete, silcrete, claystone (groundwater encountered at claystone), mafic intrusive<br>WINU1437 – Sand, ferricrete, siltstone, sandstone, granite (groundwater encountered)<br>WINU1423 – Ferricrete, sandstone (groundwater encountered), metasediment, granite, sandstone<br>Potential depth of habitat 9-50 mbgl<br>(Potentially suitable lithology to 70 mbgl) | Three sites, all outside both Inferred Percival Palaeochannel and WASANT Palaeovalley<br>Species of harpacticoid copepods the genus Parastenocaris can be widespread or have catchment-scale ranges (Biota 2026f) |

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| *Parastenocaris* sp. H-HAR010B | 12 | 1 | WINU1425 | Yes | Yes | Sand, sandstone (groundwater encountered), granite, metasediment<br>Potential depth of habitat 2-46 mbgl | Single site. Within WASANT Palaeovalley, outside Inferred Percival Palaeochannel<br>Species of harpacticoid copepods the genus Parastenocaris can be widespread or have catchment-scale ranges (Biota 2026f) |
| *Parastenocaris* sp. H-HAR024 | 4 | 1 | WINU1437 | No | No | Sand. ferricrete, siltstone, sandstone (groundwater encountered), granite<br>Potential depth of habitat 26-42 mbgl | One site outside Inferred Percival Palaeochannel and WASANT Palaeovalley<br>Species of harpacticoid copepods the genus Parastenocaris can be widespread or have catchment-scale ranges (Biota 2026f) |
| *Parastenocaris* sp. H-HAR026 | 3 | 1 | WINU1425 | Yes | Yes | Sand, sandstone (groundwater encountered), granite, Metasediment<br>Potential depth of habitat 2-46 mbgl | Single site. Within WASANT Palaeovalley, outside Inferred Percival Palaeochannel.<br>Species of harpacticoid copepods the genus Parastenocaris can be widespread or have catchment-scale ranges (Biota 2026f) |
| *Parastenocaris* sp. H-HAR028 | 3 | 1 | WINU1451 | No | Yes | Sandstone (groundwater encountered), metasandstone, granite<br>Potential depth of habitat 18-50 mbgl<br>(Potentially suitable lithology to 54 mbgl) | Single site. On boundary of WASANT Palaeovalley, outside Inferred Percival Palaeochannel<br>Species of harpacticoid copepods the genus Parastenocaris can be widespread or have catchment-scale ranges (Biota 2026f) |
| *Parastenocaris* sp. H-HAR029 | 1 | 1 | WINU1450 | No | No | Sandstone (groundwater encountered), Metasandstone, Granite<br>Potential depth of habitat 18-50 mbgl<br>(Potentially suitable lithology to 54 mbgl) | One site outside Inferred Percival Palaeochannel and WASANT Palaeovalley<br>Species of harpacticoid copepods the genus Parastenocaris can be widespread or have catchment-scale ranges (Biota 2026f) |

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| *Parastenocaris* sp. indet. | 15 | 1 | WINU1372 | Yes | No | Ferricrete, silcrete, claystone (groundwater encountered), mafic intrusive<br>Potential depth of habitat 26-50 mbgl<br>(Potentially suitable lithology to 54 mbgl) | Single site, outside Inferred Percival Palaeochannel and WASANT Palaeovalley |
| Indeterminate | | | | | | | |
| Harpacticoida sp. H-HAR015 | 2 | 1 | WINU1454 | No | Yes | Sand, sandstone (groundwater encountered), metasandstone, granite, metasandstone<br>Potential depth of habitat 33-48 mbgl | Single site, within Inferred Percival Palaeochannel and WASANT Palaeovalley |
| Harpacticoida sp. H-HAR016 | 3 | 1 | WINU1447 | No | No | Sandstone (groundwater encountered), claystone, sandstone, claystone, metasandstone<br>Potential depth of habitat 19-50 (mbgl<br>(Potentially suitable lithology to 66 mbgl) | Single site, outside Inferred Percival Palaeochannel and WASANT Palaeovalley |
| Harpacticoida sp. H-HAR017A | 17 | 3 | WINU1453,<br>WINU1450,<br>WINU1454 | No | Yes | WINU1453 – sand, metasandstone, granite (groundwater encountered), metasandstone<br>WINU1450 – sandstone (groundwater encountered), metasandstone, granite | Three sites, , one site (WINU1453) within Inferred Percival Palaeochannel, one site (WINU1454) within both Inferred Percival Palaeochannel and WASANT Palaeovalley<br>One site (WINU1450) outside palaeovalley |

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | WINU1454 – sand, sandstone (groundwater encountered), metasandstone, granite, metasandstone<br>Potential depth of habitat 16-50 mbgl<br>(Potentially suitable lithology to 54 mbgl) | |
| Harpacticoida sp. H-HAR017B | 2 | 1 | WINU1453 | No | Yes | Sand, metasandstone, granite (groundwater encountered), metasandstone<br>Potential depth of habitat 16-50 mbgl<br>(Potentially suitable lithology to 54 mbgl) | Single site, within in Inferred Percival Palaeochannel, outside WASANT Palaeovalley |
| Harpacticoida sp. H-HAR023 | 13 | 1 | WINU1444 | No | Yes | Sand, ferricrete (groundwater encountered), sandstone, granite<br>Potential depth of habitat 8-48 mbgl | Single site, within both Inferred Percival Palaeochannel and WASANT Palaeovalley |
| Harpacticoida sp. H-HAR027 | 10 | 1 | WINU1444 | No | Yes | Sand, ferricrete (groundwater encountered), sandstone, Granite<br>Potential depth of habitat 8-48 mbgl | Single site, within both Inferred Percival Palaeochannel and WASANT Palaeovalley |
| **CYCLOPOIDA** | | | | | | | |
| Indeterminate | | | | | | | |

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| Cyclopoida sp. H-CYC010 | 14 | 1 | WINU1453 | No | Yes | Sand, metasandstone, granite (groundwater encountered), metasandstone<br>Potential depth of habitat 16-50 mbgl<br>(Potentially suitable lithology to 54 mbgl) | Single site, within Inferred Percival Palaeochannel, outside WASANT Palaeovalley |
| Cyclopoida sp. H-CYC036 | 1 | 1 | WINU1447 | No | No | Sandstone (groundwater encountered), claystone, sandstone, claystone, metasandstone<br>Potential depth of habitat 19-50 mbgl<br>(Potentially suitable lithology to 66 mbgl) | Singleton, outside both Inferred Percival Palaeochannel and WASANT Palaeovalley |
| Cyclopoida sp. | 1 | 1 | WINU1447 | No | No | As above | Singleton, outside both Inferred Percival Palaeochannel and WASANT Palaeovalley |
| **SUBCLASS OLIGOCHAETA** | | | | | | | |
| Enchytraeidae | | | | | | | |
| Enchytraeidae sp. H-OLE026 | 26 | 4 | WINU1436, WINU1437, WINU1445, WINU1451 | No | Yes | WINU1436 – aeolian sand, ferricrete, sandstone, ferricrete, granite (groundwater encountered), metasandstone, granite, metasandstone<br>WINU1437 – sand, ferricrete, siltstone, sandstone | Widespread.<br>One site (WINU1436) within WASANT Palaeovalley, outside Inferred Percival Palaeochannel<br>One site (WINU1437) outside both Inferred Percival Palaeochannel and WASANT Palaeovalley<br>One site (WINU1445) within WASANT Palaeovalley, on boundary of Inferred Percival Palaeochannel |

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | (groundwater encountered), granite<br>WINU1445 – ferricrete, sandstone, metasandstone, granite (groundwater encountered), metasandstone, granite, metasandstone<br>WINU1451 – sand, ferricrete, sandstone (groundwater encountered), siltstone, sandstone, metasediment<br>Potential depth of habitat 5-50 mbgl<br>(Potentially suitable lithology to 60 mbgl) | One site (WINU1451) outside Inferred Percival Palaeochannel, on boundary of WASANT Palaeovalley |
| Enchytraeidae sp. H-OLE063 | 4 | 2 | WINU1438, WINU1452 | No | No | WINU1438 – aeolian sand, ferricrete, sandstone (groundwater encountered), claystone, metasandstone, granite, metasandstone, granite<br>WINU1452 – sand, granite (groundwater encountered)<br>Potential depth of habitat 2-48 mgbl | One site (WINU1452) within WASANT Palaeovalley, outside Inferred Percival Palaeochannel<br>One site (WINU1438) outside both WASANT Palaeovalley and Inferred Percival Palaeochannel<br>Also recorded for the Havieron Project 95 km south-east of Rimfire and the wider Telfer area (Biota 2026f) |
| Enchytraeidae sp. H-OLE064 | 13 | 1 | WINU1424 | Yes | Yes | Residual soil, ferricrete, sandstone (groundwater encountered), metasediment, granite, metasediment | Single site, within WASANT Palaeovalley, outside Inferred Percival Palaeochannel |

| Taxon | No. Specimens | No. Sites | Sites | Inside DE^ | Occurrence within Percival Palaeovalley | Drillhole geology / lithology* | Taxonomic / Habitat / Distribution Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | Potential depth of habitat 21-50 mbgl<br>(Potentially suitable lithology to 70 mbgl) | |
| Enchytraeidae sp. H-OLE065 | 1 | 1 | WINU1424 | Yes | Yes | Residual soil, ferricrete, sandstone (groundwater encountered), metasediment, granite, metasediment<br>Potential depth of habitat 21-50 mbgl<br>(Potentially suitable lithology to 70 mbgl) | Single site, within WASANT Palaeovalley, outside Inferred Percival Palaeochannel |
| Enchytraeidae sp. H-OLE066 | 1 | 1 | WINU1451 | No | Yes | Sand, ferricrete, sandstone (groundwater encountered), siltstone, Sandstone, metasediment<br>Potential depth of habitat 5-48 mbgl | Single site, on boundary of WASANT Palaeovalley, outside Inferred Percival Palaeochannel |

*^Development Envelope. *Potentially suitable lithologies deeper than 50 mbgl are not considered potentially suitable habitat for this assessment.*

## 10.4 Potential Environmental Impacts

### 10.4.1 Direct Impacts

Potential direct impacts of the Proposal to stygofauna include:

- Loss of individuals as a result of groundwater drawdown
- Loss of, or permanent reduction in stygofauna habitat as a result of groundwater drawdown.

To conservatively assess the drawdown impacts on local and regional aquifers at Rimfire (and therefore potential stygofauna communities), modelling included the predicted borefield drawdown based on the Project water demand case, utilising the conservative P90 scenario. The Project licensing case was also modelled, for reference as a theoretical maximum – i.e. if water was abstracted continuously at the licence limit for LoM (Section 10.3.1; Worley 2025b).

The modelling included groundwater response to abstraction from the current production bore. The model was used to simulate a nominal nine bore borefield intersecting the highly weathered fractured rock aquifer incorporating the granite and metasediments. The palaeovalley was not included in the model as a feature with its own distinct hydraulic properties given the lack of information on the tributary palaeovalley (Worley 2025b), this approach provides a conservative worst case assessment of potential drawdown between the two aquifers

There is limited information available on changes to stygofauna as a result of groundwater abstraction or variations in flow rates (Humphreys 2009 cited in Biota 2026f). Most impact assessments have focused on large scale advance dewatering rather than localised abstraction bores. The effect of water abstraction will depend on whether the drawdown proceeds to a level below the zone of voids suitable as habitat, or whether a species is restricted to the area of impact, as well as the overall magnitude of the dewatering operations. There is evidence that the response of stygofauna to water abstraction may be taxon-specific, with those restricted to larger pore spaces being affected more immediately by a lowering of the watertable, since larger pores drain first while water may remain in smaller pores (Stumpp and Hose 2013 cited in Biota 2026f). The fate of groundwater fauna in response to changes in water level may also be closely related to their mode of locomotion, with crawling fauna (e.g. syncarids) being able to actively hold on to the sediment, compared to swimming fauna (e.g. copepods) that prefer to be in open water spaces. The rate of lowering is also likely to be a factor in a stygofauna's ability to adapt to the changing water level.

The documentation of stygofauna impacts is often subjective or anecdotal and there is a general paucity of empirical data from field programs that adequately quantify the impacts on subterranean ecosystems (Biota 2026f). In order to assess potential impacts, the spatial extent of the predicted impact needs to be quantified. This therefore requires consideration of the following:

- The documented, or inferred distribution of the species or assemblage
- The spatial and vertical extent of suitable subterranean fauna habitats.

Habitat extent and species assemblages have been introduced and discussed in Sections 10.3.3 and 10.3.4, respectively, and both parameters are explored further in the relevant sections assessing impacts, i.e. Section 10.6.1.1 (impact on individuals) and Section 10.6.1.2 (impact on habitat).

### 10.4.2 Indirect Impacts

Potential indirect impacts of the Proposal may result in degradation of stygofauna habitat and disturbance of individuals as a result of construction and operation activities. Indirect impacts are typically more subtle or gradational than direct impacts and may be expressed at varying distances from the source of impact or activity. The following are potential indirect impacts from the Proposal that may affect the known subterranean (stygofauna) fauna values:

- Changes to surface inputs to flow/volume of water, nutrients and oxygen from vegetation clearing and changed hydrological regime

- Degradation of habitat as a result of contamination from spills, leaching and environmental incidents.

Indirect impacts to subterranean (stygofauna) fauna habitats are difficult to quantify and assess, particularly where evidence of the environmental tolerances of subterranean species is limited.

### 10.4.3 Cumulative Impacts

The Proposal has potential to contribute to cumulative degradation or loss of subterranean fauna (stygofauna) habitat due to impacts on groundwater aquifers, particularly within the Percival Palaeovalley. No cumulative impacts are expected for subterranean fauna (stygofauna) given the relative isolation of the Proposal.

Cumulative impacts to stygofauna represent the combination of the maximum direct impacts resulting from groundwater extraction as a result of the Proposal and any existing operations and reasonably foreseeable projects within 100 km of Rimfire.

Although dewatering will be undertaken within the confined metasediment aquifer of the MIA to facilitate BWT mining, it is not considered relevant to cumulative impacts as the aquifer was not found to support stygofauna (no stygofauna collected) and likelihood of occurrence was considered Low. Additionally, drawdown from BWT mining within the metasediment aquifer at the MIA will largely be contained within the Thorny Devil Fault and the Mafic sill as these features act as flow barriers (Worley 2025b). Therefore, drawdown from BWT mining within this aquifer is unlikely to contribute to existing groundwater drawdown related effects on the regional Canning-Wallal aquifer.

Rimfire will also draw on the metasediment aquifer for water supply. Modelling indicates that there is sufficient distance between Rimfire and the MIA so that there will be no spatial or temporal cumulative effects to the local groundwater aquifers (Worley 2025b; 2025c; Section 7.4.3.2).

Three reasonably foreseeable projects are within 100 km of Rimfire being the Telfer-Havieron Gold Mining Project, Telfer Goldmine Expansion and Infrastructure Project and Gas Pipeline to Nifty Copper Operations / Nifty Copper Operations (Table 10-6).

**Table 10-6: Existing and Foreseeable Projects within 100 km of Rimfire**

| Project | Status | Approximate Distance to Rimfire^ (km) |
|---|---|---|
| Telfer-Havieron Gold Mining Project | Pending | 95 |
| Telfer Project, Expansion of Telfer Gold Mine | Existing | 92 |
| Gas Pipeline to Nifty Copper Operations / Nifty Copper Operations | Existing | 70 |

There are three active groundwater licences in the vicinity of Rimfire (Table 10-7), all issued to Rio Tino Exploration Pty Ltd, one of which is associated with the Proposal (Worley 2025c). Groundwater extraction allowed by these licences has been permitted within the Canning-Wallal Aquifer with a total annual allocation of 0.3315 GL. The Canning-Wallal aquifer is the predominant groundwater resource for the region and is continuous across the Canning Basin (Advisian 2023, see Section 7.3.4.2).

**Table 10-7: Active Groundwater Licences within the Vicinity of Rimfire**

| Licence number | Licenced party | Issue date | Expiry date | Licenced aquifer | Annual allocation (GL) |
|---|---|---|---|---|---|
| 200009 | Rio Tinto Exploration Pty Limited | 22/06/2017 | 21/06/2027 | Canning-Wallal (Canning-Kimberley) | 0.0015 |

| Licence number | Licenced party | Issue date | Expiry date | Licenced aquifer | Annual allocation (GL) |
|---|---|---|---|---|---|
| 201165(8) | Rio Tinto Exploration Pty Limited (Winu) | 14/4/2025 | 13/4/2030 | Canning-Wallal (Canning-Kimberley) | 0.3 |
| 206212(1) | Rio Tinto Exploration Pty Limited | 9/08/2021 | 8/08/2031 | Canning-Wallal (Canning-Kimberley) | 0.03 |

## 10.5 Mitigation

The Proponent is committed to ensuring that the Proposal avoids or minimises, where practicable, impacts to subterranean fauna species, assemblage and habitats within the Development Envelope.

During Proposal design, the mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to mitigate the potential impacts of the Proposal on subterranean fauna species and habitats as far as practicable. Table 10-8 summarises the application of the mitigation hierarchy.

### 10.5.1 Avoidance and Minimisation

The Proponent has refined the Conceptual Footprint and Development Envelope to ensure that the Proposal prioritises the avoidance and/or minimisation of impacts to stygofauna values to the greatest extent possible, including impacts to habitat connectivity. Key outcomes of these refinements have been described in Table 10-8.

As part of the mine planning process the Proponent has implemented the following avoidance measures:

- The proposed Development Envelope has been reduced from 37,365 ha to 23,649 ha, representing a 36% reduction since the Proposal was referred
- The Wallal and Texas Borefields were removed from the Proposal which has reduced the area in which groundwater abstraction is proposed to occur
- The Proposal will use mine water to meet most operational water demand, and the TSF has been designed to ensure maximum water recovery throughout the processing circuit, reducing the need for additional non-potable water supply from Rimfire.

#### 10.5.1.1 Stygofauna Management within the Percival Palaeovalley

To mitigate the potential impact of groundwater drawdown from the operation of the Rimfire Borefield on stygofauna within the Percival Palaeovalley, the Proponent proposes to implement a groundwater monitoring and adaptive management program under the Rimfire Groundwater Operating Strategy (Appendix C19). The program encompasses monitoring specific bores against a set of water trigger values and mitigation measures designed to allow for early detection of drawdown and mitigation of potential impacts to stygofauna habitat. Monitoring bores under the Rimfire Groundwater Operating Strategy:

- Are not proposed as operational water supply bores
- Are not predicted to go dry during water supply operation
- Have a predicted drawdown of less than 5 m at end of water supply operation.

Groundwater drawdown trigger levels have been informed by hydrogeological modelling developed for Rimfire (Section 7.3.4.1), which indicates drawdown contours have the potential to reach the palaeovalley. Due to limited monitoring data currently available, trigger levels are defined conceptually from interpolated water levels and will be refined once baseline water level data becomes available prior to operations of the Rimfire borefield. The drawdown triggers are based on the P50 (median) and P90 (maximum) modelled Project water demand case scenario. Trigger levels incorporate an allowance for 2 m seasonal fluctuation in keeping with accepted stygofaunal tolerance levels (Section 10.6.1.1), with

this baseline to be updated with long term monitoring data prior to commencement of borefield operations.

The following environmental criteria are defined to inform ongoing performance assessments and contingency actions associated with potential impacts on stygofauna in the palaeovalley:

- **Early response indicators** – measures groundwater levels deviating from natural fluctuation, meaning two consecutive monitoring periods of drawdown of more than 0.1 m (i.e. reduction of groundwater levels of approximately 2.1 m across all monitoring bores)
- **Trigger criteria** – measures set at a conservative level to forewarn the approach of threshold criteria and ensure trigger level actions are implemented well in advance of the environmental outcome being compromised. The trigger criteria are met when two consecutive monitoring periods of drawdown are greater than that predicted by the P50 scenario.
- **Threshold criteria** – indicates there is risk and that the environmental outcome will not be met. This occurs when drawdown greater than that predicted by the P90 scenario occurs over two consecutive monitoring periods.

Where any of these are met, measures will be undertaken in cascading levels of intensity and timeliness. These include implementing operational adjustments at Rimfire and methods to maintain groundwater levels above trigger levels by undertaking redistribution planning, reducing abstraction and/or implementing stronger flow reductions.

### 10.5.2 Mitigation of Risks at Closure

The Winu MCP has been prepared to address closure requirements for the Proposal (Appendix A03). The MCP will be updated regularly (at intervals not exceeding five years) to ensure its objectives remain relevant and aligned to stakeholder expectations and that its strategies and plan are appropriate to achieve closure outcomes.

**Table 10-8: Application of the Mitigation Hierarchy for Subterranean fauna (Stygofauna)**

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| **Direct Impacts** | | | | |
| Loss of individuals or reduction in stygofauna habitat | **Measure to Avoid** | | | |
| | The Wallal Borefield was removed from the Proposal which has reduced the area in which groundwater abstraction is proposed to occur<br><br>The Texas Borefield was removed from the Proposal which has reduced the area in which groundwater abstraction is proposed to occur | Proposal specific | No | Project optimisation through reducing Proposal extents is the most effective control to ensure impacts are as low as reasonability practicable |
| | **Measure to Minimise** | | | |
| | The Proponent will implement the Rimfire Groundwater Licence Operating Strategy (Appendix C19) which will include:<br>• A groundwater level monitoring program within both the Percival Palaeovalley system and deeper fractured rock aquifer system to assess and monitor differences in water levels<br>• Groundwater level triggers to ensure the protection of stygofauna habitat<br>• Environmental criteria to inform ongoing performance assessments and contingency actions<br><br>Proposed abstraction volumes to be within the sustainable yield of the Rimfire Borefield's groundwater resources | Standard practice with Proposal specific limits | Yes – DWER – Groundwater Abstraction Licence (5C) | Ongoing groundwater level monitoring is used to verify models and adjust dewatering programs as required to ensure that impacts to stygofauna habitat are not significant<br><br>Abstraction from the Proposal's groundwater resources and associated limits will be subject to assessment from DWER |
| | Operational water demand will be supplied from mine dewatering in the first instance, anticipated to reduce the requirement for water supply from Rimfire Borefield | Proposal specific in line with standard business approach to groundwater management | No – the use of surplus water does not need approval for production use | Impact minimised by use of existing water resource from MIA |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | **Measure to Rehabilitate** | | | |
| | Groundwater bores will be decommissioned in accordance with relevant DWER guidelines, once no longer required | Standard practice, in accordance with DWER bore decommissioning guidelines and licence conditions | Yes – DWER – Groundwater Bore Licence (26D) to construct or alter a well | The bore decommissioning guidelines in place at the time would be recognised by industry and relevant government stakeholders |
| | Groundwater level recovery timeframes will be modelled in future iterations of the MCP (Appendix A03) | Standard practice | No | Groundwater recovery trends have already been recorded where other dewatering programs have concluded across projects operated by the Proponent |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | Abstraction of no more than 2.8 GL/a for Rimfire | | Addressed in the Rimfire Groundwater Licence Operating Strategy under Licence (5C) (Appendix C19) | |
| **Indirect Impacts** | | | | |
| Changes to surface inputs to flow/volume of water, nutrients and oxygen from vegetation clearing or changed hydrological regime | **Measure to Avoid** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to minimise the size of the footprint where practicable<br>The proposed Development Envelope has been reduced from 37,365 ha to 23,649 ha, representing a 36% reduction since the Proposal was referred<br>The total extent of clearing will not exceed 4,878 ha within the 23,649 ha Development Envelope | Standard practice | No | Project optimisation through reducing Proposal extents is the most effective control to ensure impacts are as low as reasonability practicable |
| | **Measure to Minimise** | | | |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | The Proponent will implement an Operational Surface Water Management Plan (Appendix C01) to ensure inputs are managed such that water flows and quality are maintained | Standard practice | No | Consistent with the Proponent's industry standard established practices for managing surface water |
| | Rimfire pipeline will be buried<br><br>Limited infrastructure will be installed at Rimfire including, but not limited to, pumping bores, monitoring bores and collection tanks | Standard practice | No | Project optimisation through reducing Proposal extents is the most effective control to ensure impacts are as low as reasonably practicable |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement<br><br>All disturbed areas that are no longer required will be stabilised and, if appropriate, rehabilitated | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MDCP and MCP | Guidelines for preparing MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025a)<br><br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DEMIRS 2025)<br><br>The MDCP must also detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed | | N/A | |

## 10.6 Assessment of Significance of Residual Impacts

The spatial extent, duration and magnitude of the direct impacts on subterranean fauna were assessed considering what is known or can be reasonably inferred about the fauna recorded.

### 10.6.1 Assessment of Direct Impacts

#### 10.6.1.1 Loss of Individuals as a Result of Groundwater Drawdown

Groundwater abstraction at Rimfire will create a reduction in groundwater levels within the unconfined aquifer where stygofauna have been recorded. The potential impacts of the proposed groundwater abstraction at Rimfire on stygofauna were conservatively assessed (Biota 2026f), based on both the Project licencing and the actual Project water demand cases considering the spatial extent of the predicted impact (as a surrogate for population impacts); and the duration of the impact (short-term less than one year, long-term considered years to decades, or permanent).

To conservatively assess drawdown impacts on stygofauna, the worst-case abstraction scenario (Project licensing case) was modelled at 2.8 GL/a for the life of mine (32 years) (Worley 2025c). The results of this modelling predict a drawdown of ten to two metres may extend approximately 17 km from the borefield (Table 10-9; Table 10-10; Figure 10-6). Under this scenario:

- Three of the 22 stygofauna species were located outside of the groundwater drawdown area - Harpacticoida sp. H-HAR015, Harpacticoida sp. H-HAR017B and Cyclopoida sp. H-CYC010
- One species (Harpacticoida sp. H- HAR017A) was located outside of the groundwater drawdown area at two sites (WINU1453 and WINU1454) and within the 2 m to 5 m drawdown area at one site (WINU1450)
- Four taxa were solely recorded within the predicted 10 m or greater drawdown area - *Parastenocaris* sp. H-HAR010B, *Parastenocaris* sp. H-HAR026, Enchytraeidae sp. H-OLE064 and Enchytraeidae sp. H-OLE065
- Four taxa were recorded solely within the 5 m to 10 m drawdown area from two separate bores - *Parastenocaris* sp. H-HAR024, Harpacticoida sp. H-HAR023, Harpacticoida sp. H-HAR027, Microcerberidae sp. H-ISM003
- One species (*Parastenocaris* sp. H-HAR010A) was located within both the 5 m to 10 m drawdown at one site and predicted 10 m or greater drawdown area at two sites
- Two species were located within both the 2 m to 5 m (Enchytraeidae sp. H-OLE026 – one site and Enchytraeidae sp. H-OLE063 – one site) and the 5 m to10 m drawdown area (Enchytraeidae sp. H-OLE026 – three separate bores and Enchytraeidae sp. H-OLE063 – one site)
- Seven taxa were recorded solely within the 2 m to 5 m drawdown area from two separate bores - Cyclopoida sp. H-CYC036, *Parastenocaris* sp. H-HAR028, *Parastenocaris* sp. H-HAR029, Harpacticoida sp. H- HAR016, Microcerberidae sp. H-ISM005, Enchytraeidae sp. H-OLE066 and Paramelitidae sp. H-AMP051.

The majority of these species were recorded as singletons (Table 10-9).

Data continues to be collected from bores in the palaeovalley to inform the Proponent's understanding of natural fluctuations in groundwater levels in the Rimfire area (); however, groundwater drawdown of less than two metres is generally not considered to be detrimental to stygofauna (EPA 2016c) and is expected to be within natural seasonal groundwater table fluctuations. Predictive simulations indicate that water levels would recover to within two metres of original levels more than 150 years after cessation of pumping (Worley 2025c; Appendix C09). Recovery to within five metres of original groundwater levels is predicted to occur in approximately 50 years (Section 7).

Discussion of potential wider distributions for these 22 identified taxa beyond the areas of potential impacts is difficult, given 20 are new species, and 18 of the 20 new taxa were singleton records (only recorded from a single location) (Biota 2026f). When compared to stygofauna recorded from the Havieron project (also located on, or adjacent to the Percival Palaeovalley), stygofauna assemblages at Rimfire are very similar (17 stygofauna taxa from six orders) (Biologic 2021 as cited in Biota 2026f).

Knowledge of the stygofauna groups recorded from Rimfire from other regions of Western Australia can be used to infer the likelihood of short-range endemism or restriction to small spatial scales for the Rimfire taxa. For example, stygal copepods in the Pilbara have been found to be widespread, whereas others can have distributions limited to single catchments of tributaries. Neither would have distributions as small as the Proposal's area of predicted groundwater impact at Rimfire (Biota 2026f). Similarly, some species of the *Parastenocaris* and *Paramelitidae* genus and oligochaete worms demonstrate large catchment-scale distributions, while others display localised distributions within tributaries. None of the single catchment distribution areas for these would be as small an extent as the predicted Proposal groundwater drawdown area, under Project water demand case or the Project licensing case.

The predisposition of microcerberid isopods to short-range endemism is not yet clear, though it has been suggested that while marine microcerberids are typically widespread, freshwater taxa may have more restricted distributions (Coineau and Albuquerque 2001 cited in Biota 2026f). However, they are extremely small animals (<1 mm) that live interstitially (within the spaces between sand or sediment), possibly suggesting that, while they may not travel far as individuals, it is also likely that geological units with only small interstices may not represent barriers to gene flow.

As suggested (Section 10.3.3.2), a conservative approach of a tributary-scale distribution for newly recorded stygofauna taxa at Rimfire is assumed, although noting stygofauna distributions within the tributary may be affected by the Anketell Fault, south-west of Rimfire approximately where the tributary meets the main Percival Palaeovalley. As such, stygofauna are not thought to be restricted to the area of drawdown impacts at Rimfire (Biota 2026f). Three different and new species level stygofauna taxa (Paramelitidae sp. H-AMP050, Microcerberidae sp. H-ISM004 and Harpacticoida sp. H-HAR011) from three orders were recorded from the reference site, Old Bore, approximately 125 km south-east of Rimfire within the Percival Palaeovalley (Biota 2026f). These results confirm the wider distribution of stygofauna in suitable habitat surrounding Rimfire, particularly within the palaeovalley.

Given the presence of records within the area of influence of dewatering loss of individual stygofauna is expected to be unavoidable; however, suitable connected habitat is expected to extend outside the groundwater drawdown cone of depression. Furthermore, the worst-case scenario (Project licensing case) has been utilised for this assessment, and the extent of drawdown is expected to be much reduced with respect to the conservative (P90) Project water demand case. As such, the loss of some individuals is not anticipated to represent a significant residual impact.

Under the conservative Project water demand case (P90), where Rimfire is required to supplement mine water supply from Year 13 to 32 at a peak of approximately 2.0 GL/a in Year 26 of mining, and a median demand of approximately 0.5 GL/a, modelling predicts a decreasing drawdown of 7 m to 2 m, over a distance of approximately 6.4 - 8.8 km from the centre of the borefield as it propagates south along the line of palaeovalley, impacting five of the 17 locations where stygofauna were recorded.

Under this scenario, one site (WINU1424) is modelled to be subject to a drawdown of 7 m, two sites (WINU1423 and WINU1425) are modelled to be subject to a drawdown of 5 m to 7 m, and two sites (WINU1372 and WINU1436) are modelled to be subject to a drawdown of 2 m to 5 m.

Six sites (WINU1437, WINU1438, WINU1444, WINU1445, WINU1446 and AKD10) are modelled to be subject to a drawdown of 1 m to 2 m, within the expected range of natural fluctuation.

Four stygofauna taxa have been recorded only from the five locations predicted to be subject to greater than 2 m of drawdown under the P90 Project water demand case.

The remaining 18 stygofauna taxa recorded from Rimfire will be outside of the area of impact under the P90 Project water demand case (Table 10-9; Figure 10-6) (Worley 2025c; Biota 2026f).

For the avoidance of doubt, the Proponent is seeking approval for abstraction from Rimfire in accordance with the annual worst-case abstraction scenario, however, is proposing trigger values to protect stygofauna to limit drawdown within a threshold defined by the predicted P90 Project water demand case.

**Table 10-9: Stygofauna Records Relative to Groundwater Drawdown at Rimfire**

| Taxon | No. Specimens | No. Sites | Sites | Outside Impact Zone | |
|---|---|---|---|---|---|
| | | | | PLC* | PDC# |
| **AMPHIPODA** | | | | | |
| Paramelitidae | | | | | |
| Paramelitidae sp. H-AMP051 | 20 | 2 | WINU1452, WINU1451 | No | Yes |
| **ISOPODA** | | | | | |
| Microcerberidae | | | | | |
| Microcerberidae sp. H-ISM003 | 13 | 2 | WINU1446, AKD10 | No | Yes |
| Microcerberidae sp. H-ISM005 | 18 | 1 | WINU1451 | No | Yes |
| Microcerberidae sp. indet. | 16 | 1 | AKD10 | No | Yes |
| **HARPACTICOIDA** | | | | | |
| Parastenocarididae | | | | | |
| *Parastenocaris* sp. H-HAR010A | 10 | 3 | WINU1372, WINU1437, WINU1423 | No | No |
| *Parastenocaris* sp. H-HAR010B | 12 | 1 | WINU1425 | No | No |
| *Parastenocaris* sp. H-HAR024 | 4 | 1 | WINU1437 | No | Yes |
| *Parastenocaris* sp. H-HAR026 | 3 | 1 | WINU1425 | No | No |
| *Parastenocaris* sp. H-HAR028 | 3 | 1 | WINU1451 | No | Yes |
| *Parastenocaris* sp. H-HAR029 | 1 | 1 | WINU1450 | No | Yes |
| *Parastenocaris* sp. indet. | 15 | 1 | WINU1372 | Yes | Yes |
| Indeterminate | | | | | |
| Harpacticoida sp. H-HAR015 | 2 | 1 | WINU1454 | Yes | Yes |
| Harpacticoida sp. H-HAR016 | 3 | 1 | WINU1447 | No | Yes |
| Harpacticoida sp. H-HAR017A | 17 | 3 | WINU1453, WINU1450, WINU1454 | Yes | Yes |
| Harpacticoida sp. H-HAR017B | 2 | 1 | WINU1453 | Yes | Yes |
| Harpacticoida sp. H-HAR023 | 13 | 1 | WINU1444 | No | Yes |
| Harpacticoida sp. H-HAR027 | 10 | 1 | WINU1444 | No | Yes |
| **CYCLOPOIDA** | | | | | |
| Indeterminate | | | | | |
| Cyclopoida sp. H-CYC010 | 14 | 1 | WINU1453 | Yes | Yes |
| Cyclopoida sp. H-CYC036 | 1 | 1 | WINU1447 | No | Yes |
| Cyclopoida sp. | 1 | 1 | WINU1447 | No | Yes |
| | | | | | |

| Taxon | No. Specimens | No. Sites | Sites | Outside Impact Zone | |
|---|---|---|---|---|---|
| | | | | PLC* | PDC# |
| **SUBCLASS OLIGOCHAETA** | | | | | |
| Enchytraeidae | | | | | |
| Enchytraeidae sp. H-OLE026 | 26 | 4 | WINU1436, WINU1437, WINU1445, WINU1451 | No | No |
| Enchytraeidae sp. H-OLE063 | 4 | 2 | WINU1438, WINU1452 | No | Yes |
| Enchytraeidae sp. H-OLE064 | 13 | 1 | WINU1424 | No | No |
| Enchytraeidae sp. H-OLE065 | 1 | 1 | WINU1424 | No | No |
| Enchytraeidae sp. H-OLE066 | 1 | 1 | WINU1451 | No | Yes |

**Groundwater impacts modelled under 'Project licensing case' (2.8 GL/a), #Groundwater impacts modelled under 'Project water demand case' (P90 ~0.5 GL/a from Year 13)*

#### 10.6.1.2 Loss of Stygofauna Habitat as a Result of Groundwater Drawdown

The most prospective stygofauna habitat in the Proposal area is in and around the Percival Palaeochannel (Biota 2026f).

The drillhole lithology, groundwater levels and predicted drawdown under both the Project demand case and the Project licensing case for sites recording stygofauna is presented in Table 10-10.

Under the worst-case Project licensing case abstraction model, the extent of the paleochannel that will be impacted is approximately 17 km from the centre of the borefield to the outermost drawdown contour (2 m) (Figure 10-6). The paleochannel tributary then extends a further 21 km to the main body of the Percival Paleochannel and it is considered likely that the stygofauna habitat would become more prospective closer to the main body of the Percival Palaeovalley, where the paleochannel is significantly larger and where calcrete outcropping has been noted (at least on the ground surface) (Biota 2025a), although it is uncertain if the Anketell Fault could act as a barrier to stygofauna distributions within the tributary (Biota 2026f). Of the total regional extent of the palaeovalley, only 0.15% will be impacted by the groundwater drawdown under the Project licensing (Table 10-11).

The saturated thickness of the palaeovalley sequence habitat is approximately 30 m (Worley 2025c). Under the worst-case abstraction model, drawdown propagates from the centre of the borefield as expected, with the deepest drawdown of greater than 10 m in areas in the northern areas of the palaeovalley tributary (Table 10-10; Figure 10-5; Figure 10-6)

Under this scenario approximately two-thirds of the available saturated habitat will remain intact at the single location where palaeovalley lithology has been identified (Biota 2026f). Spatially, this scenario also potentially impacts approximately 38% of the length of the tributary.

Under the P90 Project water demand case, the spatial extent of the Paleochannel predicted to be impacted by groundwater drawdown extends approximately 7 km from the centre of the borefield to the outer drawdown contour of 2 m (Biota 2026f).

Further to the plan-view spatial assessment described above, which is useful, considering the three-dimensional properties of stygofauna habitat below the watertable, habitat impacts must also take into account that groundwater drawdown attenuates with distance from the borefield. This results in an increasing proportion of stygofauna habitat predicted to remain saturated at sites further south-west down the palaeovalley tributary (Biota 2026f).

Continuous suitable habitat extends southwards beyond the extent of the proposed groundwater drawdown, and a substantial volume of the palaeovalley habitat in the tributary would remain unaffected by even the worst-case Project licensing scenario. Stygofauna habitat is also predicted to increase in prospectivity further south along the tributary where calcrete outcropping has been noted (Geoscience Australia 2008, Western Botanical 2025, cited in Biota 2026f), and beyond this where the tributary connects to the main body of the Percival Palaeovalley.

**Table 10-10: Sites Recording Stygofauna by Drillhole Lithology, Groundwater Levels and Predicted Drawdown**

| Site | Drillhole stratigraphy* | Depth to water (mbgl) | Predicted drawdown extent (mbgl) | | ORDER<br>Species | Notes (number of sites) |
|---|---|---|---|---|---|---|
| | | | Project demand case (P90) | Project licensing case | | |
| WINU1372 | 0-8 m: Ferricrete<br>8-26 m: Silcrete<br>26-41 m: Claystone<br>41-58 m: Mafic intrusive | 26 | 2-5 | >10 | HARPACTICOIDA<br>• Parastenocaris sp. H-HAR010A | • New species (3) |
| WINU1423 | 0-9 m: Ferricrete<br>9-35 m: Sandstone<br>35-37 m: Metasediment<br>57-60 m: Granite<br>60-70: Sandstone | 30 | 5-7 | >10 | | |
| WINU1424 | 0-6 m: Residual soil<br>6-20 m: Ferricrete<br>21-32 m: Sandstone<br>32-37 m: Metasediment<br>37-48 m: Granite<br>48-70 m: Metasediment | 28 | 7 | >10 | Subclass OLIGOCHAETA<br>• Enchytraeidae sp. H-OLE064<br>• Enchytraeidae sp. H-OLE065 | • New species (1)<br>• New species (1) |
| WINU1425 | 0-2 m: Sand<br>2-25 m: Sandstone<br>25-37 m: Granite<br>37-46 m: Metasediment | 15 | 5-7 | >10 | HARPACTICOIDA<br>• Parastenocaris sp. H-HAR010B<br>• Parastenocaris sp. H-HAR026 | • New species (1)<br>• New species (1) |
| WINU1436 | 0-2 m: Aeolian sand<br>2-5 m: Ferricrete | 28 | 2-5 | 5-10 | Subclass OLIGOCHAETA<br>• Enchytraeidae sp. H-OLE026 | • Widespread (4) |

| Site | Drillhole stratigraphy* | Depth to water (mbgl) | Predicted drawdown extent (mbgl) | | ORDER<br>Species | Notes (number of sites) |
|---|---|---|---|---|---|---|
| | | | Project demand case (P90) | Project licensing case | | |
| | 5-17 m: Sandstone<br>17-25 m: Ferricrete<br>25-32 m: Granite<br>32-36 m: Metasandstone<br>36-40 m: Granite<br>40-48 m: Metasandstone | | | | | |
| WINU1437 | 0-8 m: Sand<br>8-12 m: Ferricrete<br>12-19 m: Siltstone<br>19-26 m: Sandstone<br>26-42 m: Granite | 22 | (Outside of drawdown impact area – within natural fluctuation) | 5-10 | Subclass OLIGOCHAETA<br>• Enchytraeidae sp. H-OLE026<br>HARPACTICOIDA<br>• Parastenocaris sp. H-HAR010A<br>• Parastenocaris sp. H-HAR024 | • Widespread (4)<br>• New species (3)<br>• New species (1) |
| WINU1438 | 0-4 m: Aeolian sand<br>4-12 m: Ferricrete<br>12-33 m: Sandstone<br>33-36 m: Claystone<br>36-38 m: Metasandstone<br>38-44 m: Granite<br>44-46 m: Metasandstone<br>46-48 m: Granite | 28 | (Outside of drawdown impact area – within natural fluctuation) | 5-10 | Subclass OLIGOCHAETA<br>• Enchytraeidae sp. H-OLE063 | • Previously recorded from Havieron and Telfer as Enchytraeidae sp. Biologic-OLIG024 (2) |
| WINU1444 | 0-2 m: Sand | 5 | (Outside of drawdown | 5-10 | HARPACTICOIDA | • New species (1) |

| Site | Drillhole stratigraphy* | Depth to water (mbgl) | Predicted drawdown extent (mbgl) | | ORDER<br>Species | Notes (number of sites) |
|---|---|---|---|---|---|---|
| | | | Project demand case (P90) | Project licensing case | | |
| | 28 m: Ferricrete<br>8-40 m: Sandstone<br>40-48 m: Granite | | impact area – within natural fluctuation) | | • Harpacticoida sp. H-HAR023<br>• Harpacticoida sp. H-HAR027 | • New species (1) |
| WINU1445 | 0-2 m: Ferricrete<br>2-6 m: Sandstone<br>6-20 m: Metasandstone<br>20-24 m: Granite<br>24-32 m: Metasandstone<br>32-58 m: Granite<br>58-60 m: Metasandstone | 7 | (Outside of drawdown impact area – within natural fluctuation) | 5-10 | Subclass OLIGOCHAETA<br>• Enchytraeidae sp. H-OLE026 | • Widespread (4) |
| AKD10 | Blank cased to 46 m<br>Total depth – 50 m | 4 | (Outside of drawdown impact area – within natural fluctuation) | 5-10 | | |
| WINU1446 | 0-1 m: Sand<br>1-10 m: Claystone<br>10-22 m: Sandstone<br>22-29 m: Claystone<br>29-40 m: Sand<br>40-55 m: Metasandstone<br>55-57 m: Granite | 4 | (Outside of drawdown impact area – within natural fluctuation) | 5-10 | ISOPODA<br>• Microcerberidae sp. H-ISM003 | • New species (2) |

| Site | Drillhole stratigraphy* | Depth to water (mbgl) | Predicted drawdown extent (mbgl) | | ORDER<br>Species | Notes (number of sites) |
|---|---|---|---|---|---|---|
| | | | Project demand case (P90) | Project licensing case | | |
| | 57-59 m: Metasandstone<br>59-63 m: Granite<br>63-66 m: Metasandstone | | | | | |
| WINU1447 | 0-19 m: Sandstone<br>19-27 m: Claystone<br>27-29 m: Sandstone<br>29-37 m: Claystone<br>37-66 m: Metasandstone | 16 | Outside of drawdown impact area | 2-5 | HARPACTICOIDA<br>• Harpacticoida sp. H-HAR016<br>CYCLOPOIDA<br>• Cyclopoida sp. H-CYC036 | • New species (1)<br>• New species (1) |
| WINU1450 | 0-18 m: Sandstone<br>18-51 m: Metasandstone<br>51-54 m: Granite | 13 | Outside of drawdown impact area | 2-5 | HARPACTICOIDA<br>• Harpacticoida sp. H-HAR016<br>• Parastenocaris sp. H-HAR29 | • New species (3)<br>• New species (1) |
| WINU1451 | 0-4 m: Sand<br>4-5 m: Ferricrete<br>5-16 m: Sandstone<br>16-17 m: Siltstone<br>17-28 m: Sandstone<br>28-48 m: Metasediment | 6 | Outside of drawdown impact area | 2-5 | AMPHIPODA<br>• Paramelitidae sp. H-AMP051<br>ISOPODA<br>• Microcerberidae sp. H-ISM005<br>HARPACTICOIDA<br>• Parastenocaris sp. H-HAR028<br>Subclass OLIGOCHAETA<br>• Enchytraeidae sp. H-OLE026<br>• Enchytraeidae sp. H-OLE066 | • New species (2)<br>• New species (1)<br>• New species (1)<br>• Widespread (4)<br>• New species (1) |

| Site | Drillhole stratigraphy* | Depth to water (mbgl) | Predicted drawdown extent (mbgl) | | ORDER<br>Species | Notes (number of sites) |
|---|---|---|---|---|---|---|
| | | | Project demand case (P90) | Project licensing case | | |
| WINU1452 | 0-2 m: Sand<br>2-34 m: Granite | 6 | Outside of drawdown impact area | 2-5 | AMPHIPODA<br>• Paramelitidae sp. H-AMP051<br>Subclass OLIGOCHAETA<br>• Enchytraeidae sp. H-OLE063 | • New species (2)<br>• Previously recorded from Havieron and Telfer as Enchytraeidae sp. Biologic-OLIG024 (2) |
| WINU1453 | 0-2 m: Sand<br>2-3 m: Metasandstone<br>3-16 m: Granite<br>16-54 m: Metasandstone | 14 | Outside of drawdown impact area | | HARPACTICOIDA<br>• Harpacticoida sp. H-HAR017A<br>• Harpacticoida sp. H-HAR017B<br>CYCLOPOIDA<br>• Cyclopoid asp. H-CYC010 | • New species (3)<br>• New species (3)<br>• New species (3) |
| WINU1454 | 0-2 m: Sand<br>2-16: Sandstone<br>16-33 m: Granite<br>36-48 m: Metasandstone | 10 | Outside of drawdown impact area | | HARPACTICOIDA<br>• Harpacticoida sp. H-HAR015<br>• Harpacticoida sp. H-HAR017A | • New species (1)<br>• New species (3) |

**Unit intersecting water table is underlined*

**Table 10-11: Assessment (2D) of Potential Stygofauna Habitat Impacted by Groundwater Abstraction at Rimfire under the Project Water Demand Case vs the Project Licencing Case**

| Habitat | Total extent regionally (ha) | Project Water Demand Case | | Project Licencing Case | |
|---|---|---|---|---|---|
| | | Total area of groundwater drawdown >2 m | Area impacted (%) | Total area of groundwater drawdown >2 m | Area impacted (%) |
| Anketell formation | 8,304,980 | 10,079 | 0.12 | 98,042 | 1.18% |
| Frezier Sandstone | 2,940,868 | 0 | 0 | 15,147 | 0.52% |
| Percival Palaeovalley | 3,497,766 | 2,107 | 0.06 | 5,279 | 0.15% |

At closure, after 32 years of continuous abstraction at 2.8 GL/a under the worst-case Project licensing scenario, it is predicted the 2 m drawdown contour, will extend radially up to approximately 17 km from the borefield. The model indicated that groundwater levels will recover to within two metres after 50 years and to within a metre in approximately 100 years post closure (Worley 2025c). The recovery process might be accelerated if vertical recharge is incorporated into the model.

The modelling suggests that approximately one-third of suitable stygofauna habitat is expected to be impacted by the groundwater drawdown cone of depression at Rimfire. Shallow groundwater levels (as indicated by WASANT Palaeovalley mapping) representing the most prospective stygofauna habitat occur along the palaeovalley tributary and extend both to the east and the south where the tributary joins the main body of the Percival palaeodrainage outside of the Development Envelope; stygofauna habitat continues to extend southwards along the palaeovalley tributary. Furthermore, the worst-case scenario (Project licensing case) has been utilised for this assessment, and the extent of drawdown is expected to be much reduced with respect to the conservative (P90) Project water demand case. As such, the dewatering of Rimfire is not anticipated to represent a significant residual impact.

122°0'0"E

## Legend

- Subterranean Fauna Specimen

### Stygofauna Bores

- Stygofauna Absent
- Stygofauna Present
- Rimfire Borefield Predicted Maximum Drawdown (m)
- Inferred Palaeochannel
- Palaeovalleys (Geoscience Aus. 2012)
- Native Title Determinations
- Development Envelope
- Thorny Devil Fault
- Anketell Fault

### 1:500 000 State interpreted bedrock geology

- K-_ca-sp; Callawa Formation; Very fine-grained to coarse-grained sandstone, and conglomerate
- K-_an-st; Anketell Formation; Fine-grained sandstone and siltstone; lesser coarse-grained sandstone and conglomerate
- Conceptual Footprint

## Subterranean Fauna Specimen

- *Amphipoda*
- *Cyclopoida*
- *Oligochaeta*
- *Harpacticoida*
- *Isopoda*

*Label colour indicates **order**, text indicates **species***

WINU1380
WINU1422
WINU1377
WINU1381
WINU1375
WINU1427
Enchytraeidae sp. H-OLE064
WINU1424
Enchytraeidae sp. H-OLE065
WINU1378
Parastenocaris sp. H-HAR010A
WINU1423
WINU1384
WINU1374
WINU1373
WINU1379
WINU1383
WINU1371
Parastenocaris sp. H-HAR010A
Enchytraeidae sp. H-OLE063
WINU1438
WINU1372
WINU1437
WINU1385
Parastenocaris sp. H-HAR024
WINU1436
WINU1426
Enchytraeidae sp. H-OLE026
Parastenocaris sp. H-HAR010A
WINU1425
Parastenocaris sp. H-HAR010B
Parastenocaris sp. H-HAR026
Enchytraeidae sp. H-OLE026
WINU1439
WINU1440
WINU1441
WINU1442
Anketell Formation (K-_an-st)
Enchytraeidae sp. H-OLE026
WINU1443
WINU1445
WINU1444
AKD10
Harpacticoida sp. H-HAR027
WINU1446
Microcerberidae sp. H-ISM003
Harpacticoida sp. H-HAR023
Microcerberidae sp. H-ISM003
Harpacticoida sp. H-HAR016
Cyclopoida sp. H-CYC036
Percival
WINU1447
WINU1448
Paramelitidae sp. H-AMP051
Harpacticoida sp. H-HAR017A
WINU1452
WINU1449
Enchytraeidae sp. H-OLE063
Parastenocaris sp. H-HAR029
WINU1450
Enchytraeidae sp. H-OLE026
WINU1451
Enchytraeidae sp. H-OLE066
Parastenocaris sp. H-HAR028
Microcerberidae sp. H-ISM005
Paramelitidae sp. H-AMP051
Harpacticoida sp. H-HAR017A
Harpacticoida sp. H-HAR017B
WINU1453
Cyclopoida sp. H-CYC010
WINU1455
Harpacticoida sp. H-HAR015
WINU1454
WINU1456
Harpacticoida sp. H-HAR017A

25
20
15
25
10
5
2

N

0 5 10 Kilometres

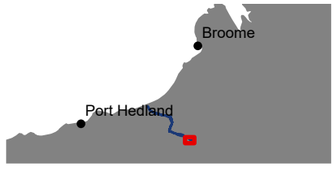
RioTinto

**Figure 10-6: Stygofauna Records Relative to Direct and Indirect Impacts within Rimfire - Project Licensing Case**

Rio Tinto Copper (RTC)

**Publisher:** B.Gardiner
Date Published: Thursday, 2 July 2026

**Coordinate System:**
GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter
**Scale:** 1:75,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_SubterraneanFauna.aprx Layout: ERD - Stygo Records Relative to Direct and Indirect Impacts within Rimfire (worst case)

122°0'0"E

122°0'0"E

## Legend

- Subterranean Fauna Specimen

### Stygofauna Bores

- Stygofauna Absent
- Stygofauna Present
- Inferred Palaeochannel
- Rimfire P90 Drawdown Contours (m)
- Development Envelope
- Conceptual Footprint
- Native Title Determinations
- Palaeovalleys (Geoscience Aus. 2012)
- Thorny Devil Fault
- Anketell Fault

### 1:500 000 State interpreted bedrock geology

- K-_ca-sp; Callawa Formation; Very fine-grained to coarse-grained sandstone, and conglomerate
- K-_an-st; Anketell Formation; Fine-grained sandstone and siltstone; lesser coarse-grained sandstone and conglomerate

## Subterranean Fauna Specimen

- *Amphipoda*
- *Cyclopoida*
- *Oligochaeta*
- *Harpacticoida*
- *Isopoda*

*Label colour indicates **order**, text indicates **species***

N

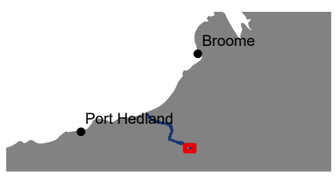
WINU1380
WINU1422
WINU1377
WINU1381
WINU1375
WINU1427
Enchytraeidae sp. H-OLE065
Enchytraeidae sp. H-OLE064
WINU1424
WINU1378
Parastenocaris sp. H-HAR010A
WINU1423
WINU1384
WINU1379
WINU1374
WINU1373
WINU1383
WINU1371
Parastenocaris sp. H-HAR010A
Enchytraeidae sp. H-OLE063
WINU1438
WINU1372
WINU1437
WINU1385
Parastenocaris sp. H-HAR024
WINU1426
WINU1436
Parastenocaris sp. H-HAR010A
Enchytraeidae sp. H-OLE026
WINU1425
Enchytraeidae sp. H-OLE026
Parastenocaris sp. H-HAR010B
Parastenocaris sp. H-HAR026
WINU1440
WINU1439
WINU1441
WINU1442
Anketell Formation (K-_an-st)
WINU1443
WINU1445
Enchytraeidae sp. H-OLE026
Microcerberidae sp. H-ISM003
WINU1444
Harpacticoida sp. H-HAR027
AKD10
WINU1446
Harpacticoida sp. H-HAR023
Microcerberidae sp. H-ISM003
Harpacticoida sp. H-HAR016
Cyclopoida sp. H-CYC036
Percival
WINU1447
WINU1448
Paramelitidae sp. H-AMP051
Enchytraeidae sp. H-OLE063
WINU1452
WINU1449
Enchytraeidae sp. H-OLE026
Harpacticoida sp. H-HAR017A
WINU1450
WINU1451
Enchytraeidae sp. H-OLE066
Parastenocaris sp. H-HAR029
Parastenocaris sp. H-HAR028
Microcerberidae sp. H-ISM005
Paramelitidae sp. H-AMP051
Harpacticoida sp. H-HAR017A
Harpacticoida sp. H-HAR017B
WINU1453
Cyclopoida sp. H-CYC010
WINU1455
Harpacticoida sp. H-HAR015
WINU1454
WINU1456
Harpacticoida sp. H-HAR017A

5
7
2

0 5 10 Kilometres

RioTinto

**Figure 10-7: Stygofauna Records Relative to Direct and Indirect Impacts within Rimfire - Project Water Demand Case**




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Thursday, 2 July 2026

**Coordinate System:**
GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter
**Scale:** 1:75,000
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_SubterraneanFauna.aprx Layout: ERD - Stygo Records Relative to Direct and Indirect Impacts within Rimfire (Water demand case)

122°0'0"E

### 10.6.2 Assessment of Indirect Impacts

#### 10.6.2.1 Changes to Surface Water Inputs to Flow/Volume of Water, Nutrients and Oxygen from Vegetation Clearing or Changed Hydrological Regimes

Development of infrastructure (i.e. transfer pumping station(s) and storage tanks) at the borefield have the potential to cause alterations in the existing surface water (hydrological) environment (Figure 10-6). The changes to surface hydrology associated with the placement of infrastructure and vegetation clearing at Rimfire is expected to result in changes to surface inputs of water, nutrients and oxygen to the subterranean habitat. However, given the limited extent of clearing and scale of infrastructure required to construct and operate the borefield – a limited network of roads, pipelines, bores and small scale ancillary support infrastructure (tanks and pump station 6.5 ha) – the potential for any significant impact is considered very low.

#### 10.6.2.2 Increased Risk of Contamination from Spills, Leaching, Environmental Incidents

During the construction and operation of the Rimfire Borefield, environmentally hazardous materials may be handled and stored. These materials may include hydrocarbons, industrial chemicals, and waste materials. Inappropriate storage and handling of these materials can lead to accidental leaks and spills, which may contaminate soils, infiltrate into groundwater. Site inspection, maintenance and implementation of a Spill Response Management Plan are expected to effectively mitigate the risk of contamination.

### 10.6.3 Assessment of Cumulative Impacts

No obvious spatial or temporal cumulative effects to the local groundwater aquifers and associated values are expected in relation to the interaction of mine pit dewatering and the Rimfire Borefield (Section 10.4.3). Three groundwater licences are located within the vicinity of Rimfire (Table 10-7). Given the low annual allocation limits of these licences they are unlikely to have any discernible impact on groundwater levels within the Development Envelope.

After simulation of 32 years of continuous abstraction from nine bores at Rimfire (which far exceeds what is forecast to be actually required) the 2 m drawdown contour is predicted to extend 15 km from the borefield (Worley 2025c). Based on the borefield model predictions it is considered unlikely for drawdown to have any impact on third-party receptors in the area (Table 10-6), or GDEs or soaks located 50 km north-west to north-east. Groundwater abstraction at Rimfire is unlikely to contribute to existing groundwater drawdown related effects on the regional Canning-Wallal aquifer and its values. Under the Project water demand case the extent of groundwater drawdown contours for the life of the mine (32 years) is only 7.5 km from the centre of the borefield, therefore unlikely to have any cumulative impact on third-party receptors.

With respect to other existing and reasonably foreseeable projects, the Nifty Copper mine operates BWT, dewatering its pit as well as operating a water supply borefield. The mining operation commenced prior to when the EP Act was enacted. Limited relevant information is publicly available for Nifty. One source indicates a subterranean fauna study was conducted in 2003, which found no stygofauna, concluding the orebody and surrounding lithology represented poor stygofauna habitat (Listcorp 2024).

An assessment for the Telfer-Havieron proposal, which includes BWT mining, concluded stygofauna occur within the superficial aquifer and within some of the shallower strata in the upper confined aquifer at that mine (Talis Consultants 2024). The assessment also considered studies from the existing Telfer mine. The rock strata supporting the superficial and confined aquifers are of different lithologies to that found at Rimfire. The superficial aquifer at Telfer-Havieron is composed of calcrete, alluvium and weathered saprolite, and is not located within the regional extent of the Percival Palaeovalley. The confined aquifer at the project is within Upper Williams Mudstone, not the Proterozoic metasediment and granite aquifer represented at Rimfire.

Given the isolation of the Proposal from other existing and reasonably foreseeable projects, the difference in aquifer characteristics from those existing projects and the limited extent of drawdown in stygofauna habitat at Rimfire, the Proposal is not expected to contribute to cumulative impacts to stygofauna.

## 10.7 Likely Environmental Outcomes

In consideration of the proposed management measures and likely residual impacts associated with the Proposal, the anticipated environmental outcomes that apply to Subterranean fauna (stygofauna) include:

- Abstraction of no more than 2.8 GL/a for the Rimfire Borefield, expected to affect no more than approximately one-third of surrounding stygofauna habitat under the worst case Project licensing scenario, with the extent of drawdown expected to be much reduced with respect to the conservative (P90) Project water demand case
- Minimise the Proposal's impact on stygofauna habitat, by implementing a groundwater monitoring and adaptive management program based on defined early response indicators and trigger and threshold mitigation criteria
- Minimise the Proposal's impact on surface water and groundwater quality, by implementing mitigation measures consistent with leading industry practices and government regulations.

Of the two abstraction cases, the P90 Project water demand case represents the conservative scenario for the implementation of the Proposal, while the Project licensing case represents the 'worst-case scenario' used for reference here, but which therefore has a theoretically greater impact on the palaeovalley tributary. At most, under the Project licensing scenario, up to one-third of available saturated habitat would potentially be removed at the single location where palaeovalley lithology has been identified. Spatially, this case also potentially impacts up to one third of the length of the tributary.

However, stygofauna utilise a three-dimensional habitat below the watertable, meaning that while a plan-view spatial assessment is useful, habitat impacts must consider that groundwater drawdown attenuates with distance from the borefield – this results in an increasing proportion of stygofauna habitat predicted to remain saturated at sites further south-west down the palaeovalley tributary.

Continuous suitable habitat extends southwards beyond the extent of the proposed groundwater drawdowns and a substantial volume of the palaeovalley habitat in the tributary would remain unaffected by even the worst-case Project licensing case. Stygofauna habitat is also predicted to increase in prospectivity further south along the tributary where calcrete outcropping has been noted, and beyond this where the tributary connects to the main body of the Percival Palaeovalley system.

The Proponent will implement the Rimfire Groundwater Operating Strategy (Appendix C19), once the draft is finalised and approved in accordance with licensing requirements, EMP (Appendix A05), Operational Surface Water Management Plan (Appendix C01), Cyanide Management Plan (Appendix C10), Mine Closure Plan (Appendix A03) and a Spill Response Management Plan to achieve these outcomes.

Following the implementation of the mitigation hierarchy, no significant residual impacts were identified. As such, the Proponent considers that the Proposal can be implemented to meet the EPA's objective for the Subterranean fauna factor to maintain biological diversity and ecological integrity (EPA 2016c).

# 11 TERRESTRIAL ENVIRONMENTAL QUALITY

## 11.1 EPA Environmental Factor Objectives

The EPA Statement of Environmental Principles, Factors, Objectives, and Aims of EIA (EPA 2023b) lists the following as its objective for Terrestrial Environmental Quality (TEQ):

**To maintain the quality of land and soils so that environmental values are protected**

### 11.1.1 Definitions

For assessment by the EPA, the following terms have been defined:

- **Terrestrial Environmental Quality** – the chemical, physical, biological and aesthetic characteristics of soils (EPA 2016d)
- **Soils** – the layer of organic and inorganic weathered material that accumulates at the Earth's surface (EPA 2016d).
- **Environmental Values** – beneficial uses, or an ecosystem condition (EPA 2016d).

The beneficial uses of good quality soil are primarily; agriculture, maintaining drinking water quality, recreation and cultural values. Ecosystem health values including biodiversity, water quality and seed banks.

## 11.2 Relevant Policy and Guidance

Table 11-1 presents the relevant policy and guidance for Terrestrial Environmental Quality.

**Table 11-1: Relevant policy and guidance for Terrestrial Environmental Quality**

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| **Environmental Protection Authority** | |
| Statement of Environmental Principles, Factors, Objectives and Aims for EIA (EPA 2023b) | The EPA objective for terrestrial environmental quality forms the basis of this assessment. This assessment has regard to the aims of EIA, consideration of significance and the application of the mitigation hierarchy |
| Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016d) | The information required for impact assessment has been considered in the scope of this chapter. |
| Instructions on how to prepare an Environmental Review Document (EPA 2024e) | This document forms the basis of the headings and content provided in this ERD, that has been prepared by WA EIA practitioners |
| Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans (EPA 2024f) | This document was considered in the preparation of the Acid and Metalliferous Drainage Strategy and Management Plan (AMD S&MP) (Appendix C07) for the Proposal |
| WA Environmental Offsets Policy (GoWA 2011) | Considered in the impact assessment and offset strategy for terrestrial environmental quality |
| WA Environmental Offsets Guidelines (GoWA 2014a) | |
| **Other State or Commonwealth** | |

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| Guidelines for preparing Mine Closure Plans (DMPE 2025b) | The MCP has been prepared in accordance with the guidance. It addresses matters related to terrestrial environment rehabilitation (Appendix A03)<br><br>Note that since Proposal referral and commencement of preparation of the MCP, mine closure planning requirements under the Mining Act have been amended. Proponents no longer need to submit an MCP at the mining approval stage, instead are required to submit a Mine Development and Closure Proposal (MCDP). MCPs submission dates are then defined in an Approvals Statement should the mining activities outline in the MDCP be approved |
| Guideline for preparing Mining Development and Closure Proposals (DEMIRS 2025) | |
| Mining Development and Closure Proposal and Approvals Statement Framework (DMPE 2025c) | |
| A framework for developing mine-site completion criteria in Western Australia (Young et al. 2019) | |
| Statutory Guidelines for Mining Proposals (DEMIRS 2023b) | Used to guide the analysis of materials to be extracted and processed or reused |
| Guide to Departmental requirements for the management and closure of tailings storage facilities (TSFs) (DMP 2015a) | Considered in TSF design |
| Tailings Storage Facilities in Western Australia – Code of Practice (DMP 2013) | |
| Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2019 (ANZECC & ARMCANZ 2000) | Used as guidance during EIA for Terrestrial Environment Quality and the preparation of the AMD S&MP (Appendix C07) for the Proposal |
| Environmental Management Plan Guidelines (DCCEEW 2024b) | Considered in the preparation of the AMD S&MP (Appendix C07) for the Proposal |
| Preventing Acid and Metalliferous Drainage: Leading Practice Sustainability Development Program for the mining industry (Australian Government 2016) | Used as guidance during EIA for Terrestrial Environment Quality and the preparation of the AMD S&MP (Appendix C07) for the Proposal |
| Global Acid Rock Drainage (GARD) Guide (INAP 2024) | |
| ARD Test Handbook: Project P387A: Prediction and kinetic control of acid mine drainage (AMIRA 2002) | |
| Acid Rock Drainage Prediction Manual (MEND Program 1991) | |
| Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DER 2015a) | |
| Treatment and Management of Soil and Water in Acid Sulfate Soil Landscapes (DER 2015b) | |
| The Australian Soil Classification (Isbell and NCST 2025) | |
| Soils Groups of Western Australia soil classification (Schoknecht and Pathan 2013) | |
| Australian Rainfall and Runoff Guideline (Australian Government 2019) | |

## 11.3 Receiving Environment

### 11.3.1 Studies

Table 11-2 provides the location, types and timing for each of the surveys/studies and summarises their limitations and to which guidelines/policies they are considered to be in accordance with.

Various studies supporting an impact assessment on the Terrestrial Environmental Quality focus on the MIA, as the highest risk activities (e.g. mining and tailing storage) associated with this environmental factor are expected to apply only to the MIA. A similar level of detail is therefore not expected to be required for the RAC or Rimfire. Notwithstanding, detailed soil characterisation has been completed over the entire Development Envelope.

**Table 11-2: Summaries of Technical Studies for Terrestrial Environmental Quality**

| Title | Location | Type | Timing | Consistency with Guidance |
|---|---|---|---|---|
| Winu Soil Characteristics Report: Rio Tinto Copper and Diamonds (Landloch 2020b) | MIA<br>Sampling locations are presented in Figure 11-1 | Soil Characterisation | November 2020 | Report prepared in accordance with:<br>• Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016d)<br>• Guidelines for Survey Soil and Land Resources (N. J. McKenzie et al. 2008)<br>• Statutory Guidelines for Mining Proposals (DEMIRS 2023b) |
| Waste Rock Landform (WRL) Winu Project - Mine Planning (Rio Tinto 2025b)<br>(Appendix G10) | MIA | Landform Design Assessment | April 2024 | Report prepared in accordance with:<br>• Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016d) |
| J24050-Winu ASS Desktop Study (Red Earth Engineering 2024) | MIA | Acid Sulfate Soils | July 2024 | Technical memorandum prepared with reference to:<br>• National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual (Sullivan et al. 2018) |
| Winu AMD S&MP (Rio Tinto 2025c)<br>(Appendix C07) | MIA | AMD S&MP | August 2025 | Report prepared in accordance with:<br>• Preventing Acid and Metalliferous Drainage: Leading Practice Sustainability Development Program for the mining industry (Australian Government 2016)<br>• Global Acid Rock Drainage (GARD) Guide (INAP 2024)<br>• Environmental performance standard E13: Chemically Reactive Mineral Waste Control Standard (Rio Tinto 2017) |
| Winu Waste Characterisation - Primary Sulfide (Hypogene) Zone (Rio Tinto 2025e)<br>(Appendix G01) | MIA<br>Sampling locations are presented in Figure 11-2 | Waste Rock Characterisation | July 2025 | Reports prepared in accordance with:<br>• ARD Test Handbook: Project P387A: Prediction and kinetic control of acid mine drainage (AMIRA 2002) |

| Title | Location | Type | Timing | Consistency with Guidance |
|---|---|---|---|---|
| Winu Waste Characterisation - Upper (Oxidised and Overburden) Zone (Rio Tinto 2024b)<br><br>(Appendix G03) | MIA<br><br>Sampling locations are presented in Figure 11-2 | Waste Rock Characterisation | July 2024 | • Preventing Acid and Metalliferous Drainage: Leading Practice Sustainability Development Program for the mining industry (Australian Government 2016)<br>• Global Acid Rock Drainage (GARD) Guide (INAP 2024)<br>• Acid Rock Drainage Prediction Manual (MEND Program 1991) |
| Winu Waste Characterisation - Secondary Sulfide (Enriched) Zone (Rio Tinto 2024a)<br><br>(Appendix G02) | MIA<br><br>Sampling locations are presented in Figure 11-2 | Waste Rock Characterisation | July 2024 | |
| Winu Waste Characterisation - Tailings (Rio Tinto 2025f)<br><br>(Appendix G04) | MIA | Tailings Characterisation | July 2025 | |
| Winu HDTSF 5H 10 Mtpa Pre-Feasibility Closure Report (WWL 2025b)<br><br>(Appendix G08) | MIA | TSF closure design | March 2025 | Reports prepared in accordance with:<br>• Guide to Departmental requirements for the management and closure of tailings storage facilities (TSFs) (DMP 2015a)<br>• Global Industry Standard for Tailings Management (ICMM 2020)<br>• Integrated Mine Closure Good Practice Guide (ICMM 2019)<br>• Rio Tinto Standard: D5 Management of Tailings and Water Storage Facilities (Rio Tinto 2020) |
| Winu HDTSF 5H 10 Mtpa Pre-feasibility Design Report (WWL 2025a)<br><br>(Appendix G06) | MIA | TSF operations analysis, design and management | March 2025 | |
| Winu Tailings Storage Facility High Sulfur Tailings Cover System Numerical Modelling (Okane 2024)<br><br>(Appendix G07) | MIA | Conceptual cover system design numerical modelling for high sulfur tailings | June 2024 | |

| Title | Location | Type | Timing | Consistency with Guidance |
|---|---|---|---|---|
| Winu Copper Project – Conceptual Cover System Modelling (Okane 2020)<br>(Appendix G12) | MIA | Preliminary conceptual cover system design numerical modelling for the WRL and low and high sulfur tailings | November 2020 | |
| Winu Project: Soil Characterisation. (Landloch 2025)<br>(Appendix G05) | Development Envelope, including MIA, RAC and Rimfire<br>Sampling locations are presented in Figure 11-1 | Soil Characterisation | May 2025 | Report prepared in accordance with:<br>• Guidelines for preparing Mine Closure Plans (DMPE 2025b)<br>• Guideline for preparing Mining Development and Closure Proposals (DEMIRS 2025)<br>• The Australian Soil Classification (Isbell and NCST 2025)<br>• Soils Groups of Western Australia soil classification (Schoknecht and Pathan 2013)<br>• Guidelines for Survey Soil and Land Resources (N. J. McKenzie et al. 2008) |
| 2020 Geotechnical Studies Winu Project Final Study (Golder 2022a) | MIA | Geotechnical analysis | February 2022 | Report prepared in accordance with:<br>• Rio Tinto Standard: D3 Management of slope geotechnical hazards (Rio Tinto 2019)<br>• Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016d) |
| Tailings Storage Facility Seepage Modelling (SRK 2025)<br>(Appendix G11) | MIA | TSF seepage | May 2025 | Prepared consistent with the information requirements in:<br>EPA Environmental Factor Guideline: Inland Waters (EPA 2018) |

| Title | Location | Type | Timing | Consistency with Guidance |
|---|---|---|---|---|
| Winu Pit Lake Model (HGL 2024a)<br><br>(Appendix C14) | MIA | Pit lake model | June 2024 | Prepared consistent with the information requirements in:<br>• EPA Environmental Factor Guideline: Inland Waters (EPA 2018)<br>• Water in Mining Guidelines (DoW 2013) and Operational Policy 5.12 – Hydrogeological reporting associated with a groundwater well licence (DoW 2009) |

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

Great Northern Hwy

HR06
HR04
HR03
HR05
HR02
HR01

NYANGUMARTA PEOPLE (PART A)

S19
S17
S18
S06
S07c
S05
S04
S15c
S14c
S03
S16c
S01
S02
S09
S10
S08
S11c

MARTU (AREA A)

RF15
RF14
RF13
RF12
RF11
RF10
RF05
RF09
RF04
RF06
RF07
RF08
RF03
RF01
RF02
RF16
RF18
RF17

MARTU (AREA A)

S13c
S12

N

## Legend

- Ground True Soil Inspection Sites (Landloch 2025)
- Soil Survey Sites (Landloch 2020)
- Geotechnical Test Pit Locations
- Soil check Sites (Landloch 2020)
- Highway
- Native Title Determinations
- Development Envelope

### Conceptual Footprint

- ANFO
- Aerodrome
- Bore Fields
- Borrow Pits
- Camp
- Fly Camps
- Laydown
- Mine Construction Area
- Mine Pit
- Ore Stockpiles
- Ponds
- Processing Plant
- ROM Pad
- Roads
- Solar Farm
- Tailings Storage Facility
- Topsoil Stockpiles
- Waste Rock Landform
- Water Pipelines
- Weed Wash

RioTinto

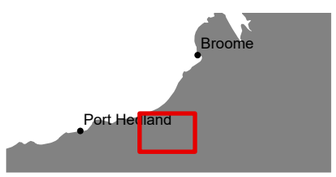
# Figure 11-1: Surface Soil Sampling Locations


**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:480,000

Rio Tinto © Copyright




0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Soil Sampling Locations

N

**Legend**

ZONE
- Oxide/Overburden
- Secondary Sulfides
- Primary Sulfides
- Completed Drill Collars
- Development Envelope
- Native Title Determinations

Conceptual Footprint
- ANFO
- Borrow Pits
- Camp
- Laydown
- Mine Construction Area
- Mine Pit
- Ore Stockpiles
- Ponds
- Processing Plant
- ROM Pad
- Roads
- Tailings Storage Facility
- Topsoil Stockpiles
- Waste Rock Landform
- Water Pipelines

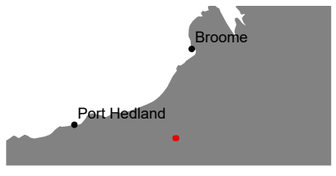
RioTinto

**Figure 11-2: Winu Project Environmental Geochemistry Sampling Locations**

**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:20,000
Rio Tinto © Copyright




NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)

0 500 1,000 Meters

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20230627_Referral_Figures\W21_012_Referral_Figures.aprx | Layout: EPBC Overburden Sampling Locations

### 11.3.2 Landforms and Soils

#### 11.3.2.1 Geomorphological Regions and Soil-Landscape Zones

The Proposal occurs within the major geomorphic region of the Great Sandy Desert and is split across two soil-landscape zones as defined by regional soil mapping (DPIRD 2018), with the:

- MIA and Rimfire within the Great Sandy Desert Zone
- RAC intersecting the Great Sandy Desert and Nita Sandplain zones.

#### 11.3.2.2 Soil-Landscape Systems

Each soil-landscape zone is further divided into soil landscape systems.

The Development Envelope intersects five soil-landscape systems (Table 11-3; Figure 11-3) (Government of Western Australia 2019).

**Table 11-3: Soil-Landscape Systems within the Development Envelope**

| Soil Landscape Systems | Unit Description | Area within the Development Envelope | |
|---|---|---|---|
| | | ha | % |
| Little Sandy System | Sandplains with linear and reticulate dunes supporting shrubby hard and soft spinifex grasslands | 11,839.3 | 30.6 |
| Nita System | Sandplains supporting shrubby spinifex grasslands with occasional trees | 2220.4 | 0.8 |
| Callawa System | Highly dissected low hills, mesas and gravelly plains on sandstone and conglomerate supporting soft and hard spinifex grasslands | 2061.4 | 0.4 |
| Buckshot System | Gravelly sandplains and occasional sand dunes supporting shrubby hard spinifex grasslands | 96.0 | 8.7 |
| AB40 System | Gently undulating plain slightly more elevated than unit AB39, and dominated by longitudinal dunes, many exposures of ironstone gravels and some breakaways capped by ironstone (laterite) duricrust | 7,240.4 | 50.1 |
| B30 System | Dune fields--largely stable linear dune fields with swales opening locally into sand plains dune lineation is generally east to west. but in the area west of 123º east longitude the trend is northwest to southeast.; considerable areas of clay pans and salt pans | 191.4 | 9.4 |

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
20°0'0"S
20°30'0"S

KARAJARRI PEOPLE (AREA A)

N

Mannerie system
Eighty Mile system
Anna system
Great Northern Hwy
Nita system
Callawa system
Callawa system
Buckshot system
Callawa system
Callawa system
Buckshot system
AB21 atlas system
NYANGUMARTA PEOPLE (PART A)
Little Sandy system
Callawa system
Little Sandy system
Buckshot system
AB40 atlas system
B30 atlas system
MARTU (AREA A)

## Legend

- Development Envelope
- Native Title Determinations

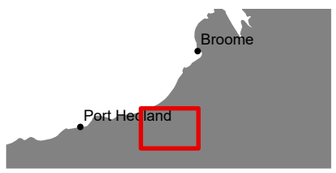
Map unit name

- AB21 atlas system
- AB40 atlas system
- Anna system
- B30 atlas system
- Buckshot system
- Callawa system
- Eighty Mile system
- Little Sandy system
- Mannerie system
- Nita system

0 10 20 Kilometres

RioTinto

# Figure 11-3: Soil Landscape Mapping across the Development Envelope




**Rio Tinto Copper (RTC)**

**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:500,000
Rio Tinto © Copyright

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Soil Landscape

#### 11.3.2.3 Soil Mapping Units

Three Soil Mapping Units (SMUs) were recorded within the MIA, RAC and Rimfire (Landloch 2025) (Figure 11-4):

- **Deep Sands** – Deep wind-blown aeolian sands associated with the interdunal sandplains, sand dunes and swales that dominate the landscape. Sands dominate these soils with no appreciable silt or clay content and no pedological development beyond the topsoils
- **Gradational Sands** – Similar to Deep Sands, except for an increase in clay within deeper subsoils. They are associated with interdunal sandplains and stony rises.

Another SMU occurs in Rimfire only and occurs as an isolated anomaly, as it is not well represented in the Great Sandy Desert:

- **Shallow Sands** – Shallow sandy soils with little to no pedagogical development laying atop a shallow hardpan at depths greater than 0.3 m.

As the major units within the Development Envelope, Deep Sands and Gradational Sands are discussed further below. The characteristics of these SMUs are consistent with those soils commonly associated with the sand dunes within the Little Sandy Landscape System. They are also less commonly associated with the interdune sandplains and swales of the same Landscape System.

SMU mapping was developed from soil surveys conducted across 13 soil inspection sites within the MIA in September 2020 and a further 24 sites across the RAC and Rimfire in 2025. This was further refined via the extrapolation of geotechnical data from 123 geotechnical test pits within the MIA and 418 geotechnical test pits along the RAC (Landloch 2025). The soils within the Development Envelope were initially classified using the National (Australian Soil Classification) and Western Australian (Soils Groups of Western Australia) classification systems, using a combination of observations and laboratory results. These soils were further divided into the SMUs, the characteristics of which are strongly related to the National and State classifications but have been further grouped based on their management requirements.

##### 11.3.2.3.1 Deep Sands

The Deep Sands SMU is ubiquitous across the Development Envelope except for the airstrip, comprising approximately 81% of the extent of the Development Envelope. The key defining attribute of the Deep Sands is their consistent sandy texture throughout the profile, with no appreciable clay and no pedological development (Landloch 2025).

Median salinity values ($EC_{1:5}$) for both topsoils and sub-soils were 0.01, dS/m, indicating that both are non-saline. Topsoil and subsoils are considered moderately acidic, with a median $pH_w$ of 6.0 and 5.9 respectively (Landloch 2025). The characteristics of the Deep Sands SMU are presented in Table 11-4.

The Proponent notes the sand dunes within the MIA were not geotechnically assessed due to Traditional Owner requests to defer sand dune interactions until the Proposal is authorised to proceed. However, Landloch (2020b) has inferred that the dunes would have similar characteristics to the Deep Sands SMU. This is based on site observations and material data of the dunes at other sites within the Little Sandy System (e.g. Nifty Copper Mine).

##### 11.3.2.3.2 Gradational Sands

The Gradational Sands SMU is widespread across the Development Envelope, comprising approximately 17% of the extent of the Development Envelope. The SMU occurs within the RAC, Rimfire, and the MIA, although within the MIA its presence is confined to the airstrip and immediate surrounds.

Gradational Sands are similar to Deep Sands, with a slight elevation in clay content at depth. The key defining attribute of the Gradational Sands is their change in texture from sand on the surface to sandy loams at depths >0.5 m.

Similarly, median salinity values ($EC_{1:5}$) for both topsoils and sub-soils were 0.01, dS/m, indicating that both are non-saline. Topsoil and subsoils are also considered moderately acidic, with a median $pH_w$ of 5.8 and 5.9 respectively (Landloch 2025). The characteristics of the Gradational Sands SMU are presented in Table 11-4.

#### 11.3.2.3.3 Shallow Sands

The Shallow Sands SMU is isolated to Rimfire and considered an anomaly within the Development Envelope, comprising 2% of total extent. Shallow Sands are similar to Deep Sands, although are differentiated by a cemented hardpan occurring at depths of approximately 0.3m (Landloch 2025).

Median salinity values ($EC_{1:5}$) for both topsoils and sub-soils were 0.01, dS/m, indicating that both are non-saline. Topsoil and subsoils are considered moderately acidic, with a median $pH_w$ of 6.0 (Landloch 2025). The characteristics of the Shallow Sands SMU are presented in Table 11-4.

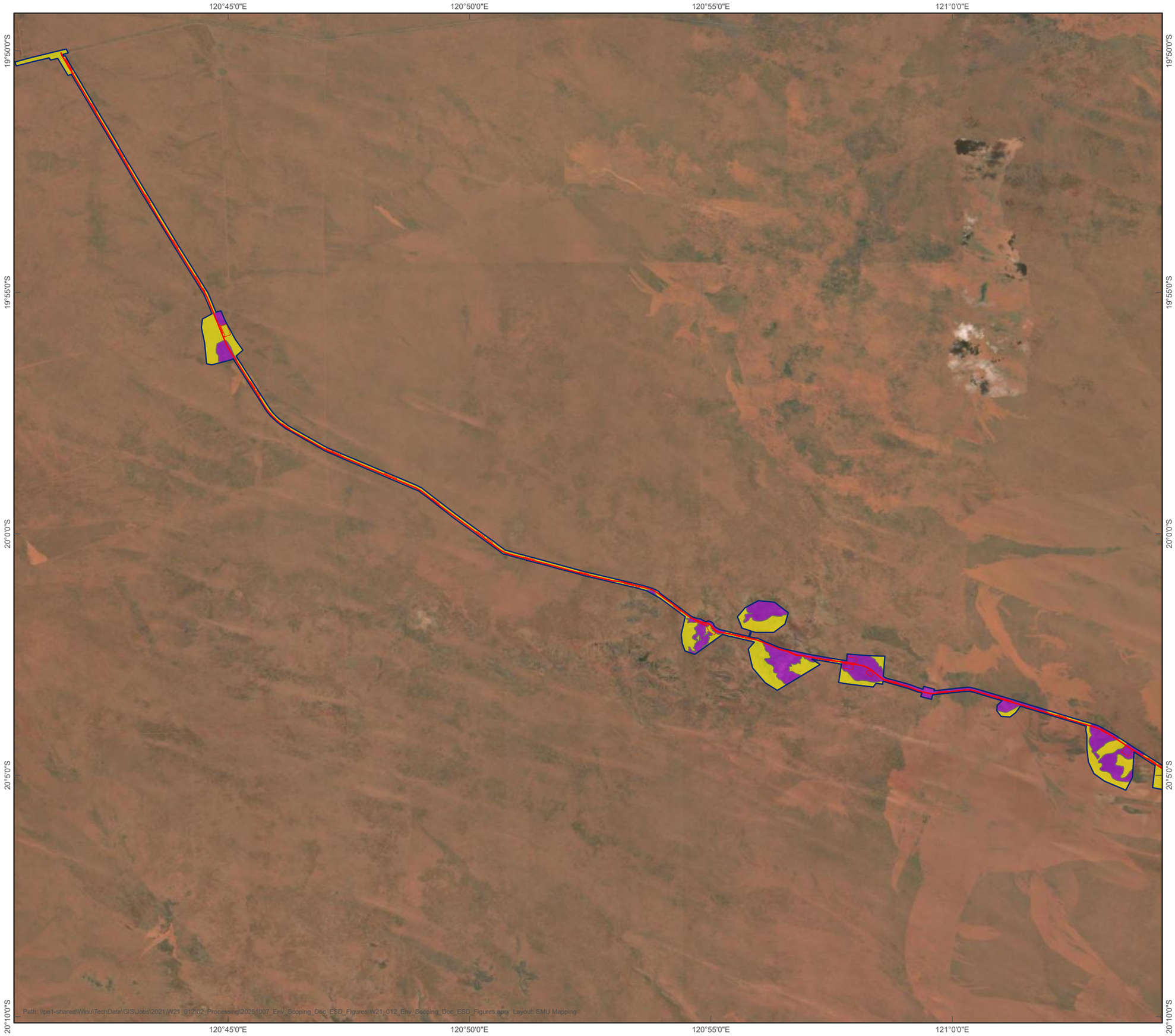
**Table 11-4: Typical Physical and Chemical Characteristics of Development Envelope SMUs**

| Soil Characteristics | Deep Sands | | | Gradational Sands | | | Shallow Sands | |
|---|---|---|---|---|---|---|---|---|
| **Physical** | | | | | | | | |
| Moist Colour | Dark Red to Very Dusky Red at depth | | | Dark Reddish Brown to Dark Red at depth | | | Light Red to Yellowish Red | |
| Texture | Loamy Sand to Clayey Sand at depth | | | Loamy Sand to Sandy Loam at depth | | | Clayey and loamy sands to Sandy loam | |
| Structure | Weak surface structure to massive structure with depth | | | Weak surface structure to massive structure at depth | | | Weak to no structure | |
| Consistency | Weak dry surface consistency to loose dry consistency at depth | | | Weak surface consistency to very firm consistency at depth | | | Loose dry to weak dry consistency | |
| Coarse fragments | Low coarse fragment abundance is present throughout the profile | | | Low coarse fragment abundance present at the surface, increasing with depth | | | Low to moderate coarse fragment abundance present above the hardpan layer | |
| **Chemical** | **Topsoil** | **Sub-soil B1** | **Sub-soil B2** | **Topsoil** | **Sub-soil B1** | **Sub-soil B2** | **Topsoil** | **Sub-soil** |
| Acidity (pH) | 6.0 -6.3 (6.0) | 5.5 -6.2 (5.9) | 5.5 -6.6 (6.0) | 5.5 -6.6 (5.8) | 5.7 -6.4 (6.1) | 5.7 -6.6 (5.9) | 5.5 -6.2 (6.0) | 5.7 -6.2 (6.0) |
| Salinity (dS/m) | 0.01 – 0.2 (0.01) | 0.1 -0.03 (0.01) | 0.1 -0.02 (0.01) | 0.01 | 0.01 | 0.01 -0.02 (0.01) | 0.01 -0.02 (0.01) | 0.01 -0.02 (0.01) |
| Sodicity | 2.8 –4.2 (3.5) - non-sodic | 2.9 –7.9 (3.8) - non-sodic | 1.4 –7.1 (3.2) - non-sodic | 2.0 –3.9 (2.9) - non-sodic | 1.9 –3.4 (3.0) - non-sodic | 12 –5.1 (2.4) - non-sodic | 3.5 –4.0 (3.9) - non-sodic | 2.0 –4.1 (3.2) - non-sodic |
| Fertility | Moderate/high | | | Moderate/high | | | Moderate/high | - |

| Soil Characteristics | Deep Sands | Gradational Sands | Shallow Sands |
|---|---|---|---|
| **Landscape Photos** | | | |
| |  |  |  |

**Values denoted within brackets signify the median value*

# Figure 11-4: Winu Project SMU Mapping




**Legend**

- Disturbance Footprint
- Development Envelope

Soil Mapping Units (SMU)

- Deep Sands
- Gradational Sands

N

0 2.5 5

Kilometres

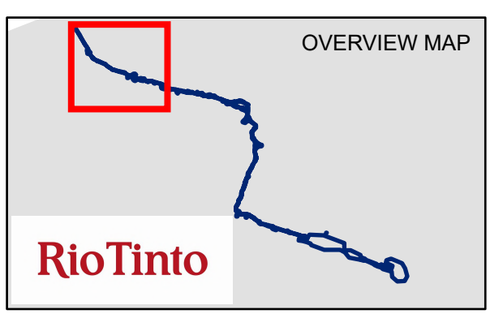
**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree

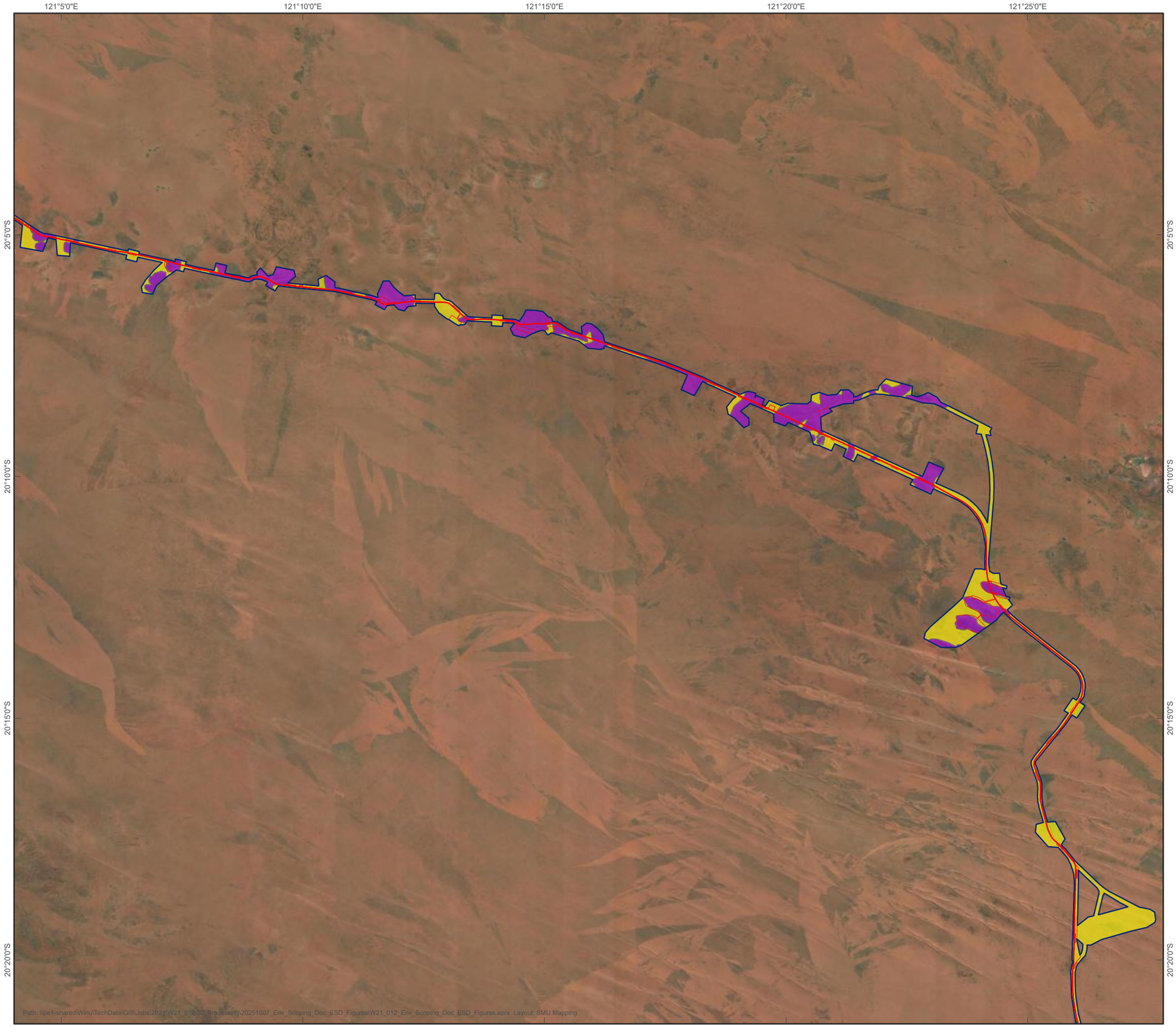
**Scale:** 1:140,000

Rio Tinto © Copyright





# Figure 11-4: Winu Project SMU Mapping




**Legend**

- Disturbance Footprint
- Development Envelope

Soil Mapping Units (SMU)

- Deep Sands
- Gradational Sands

N

0 2.5 5

Kilometres

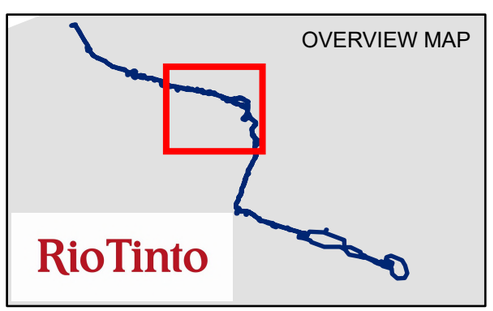
**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree

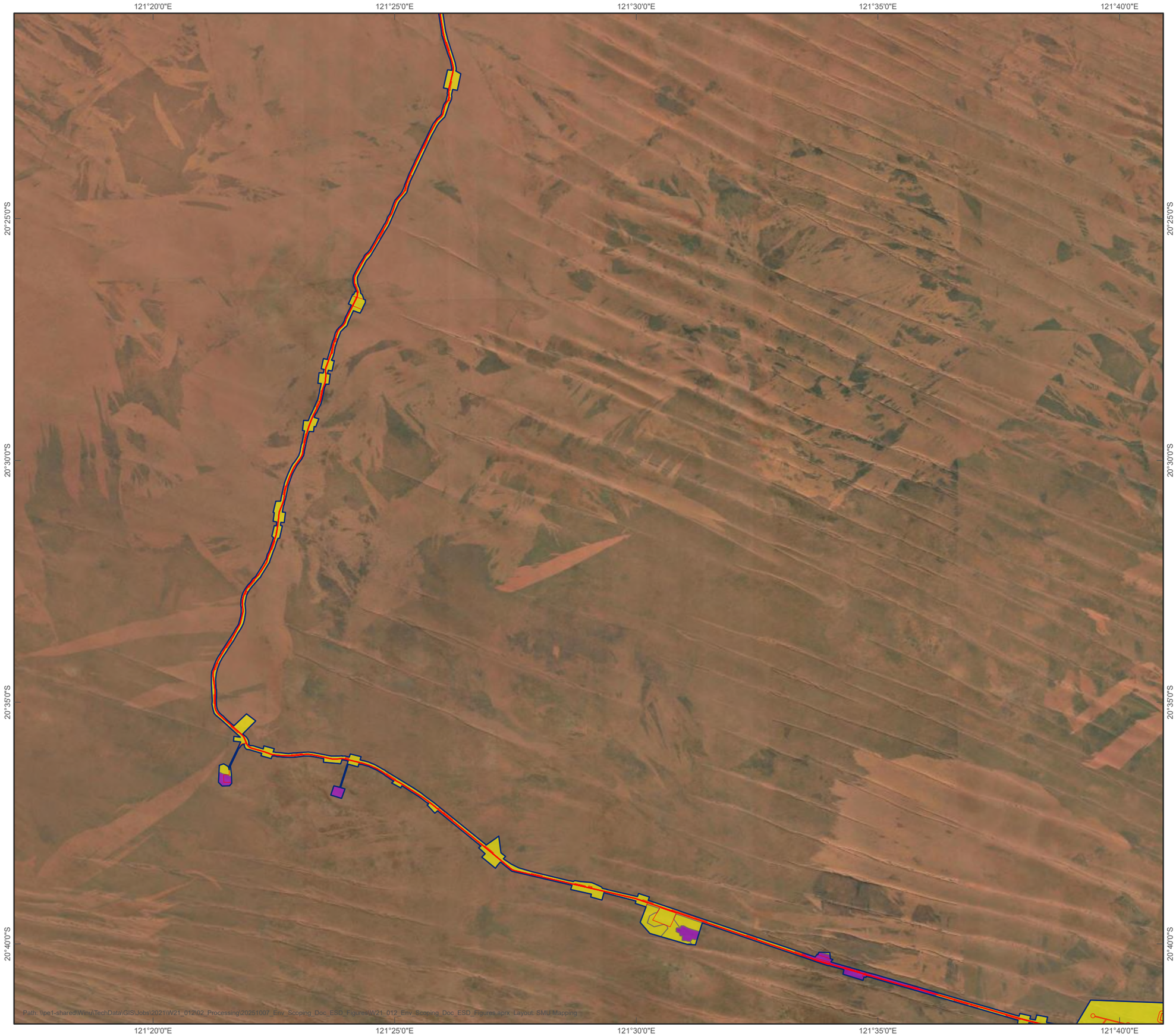
**Scale:** 1:140,000

Rio Tinto © Copyright





# Figure 11-4: Winu Project SMU Mapping




**Legend**

- Disturbance Footprint
- Development Envelope

Soil Mapping Units (SMU)

- Deep Sands
- Gradational Sands

N

0 2.5 5

Kilometres

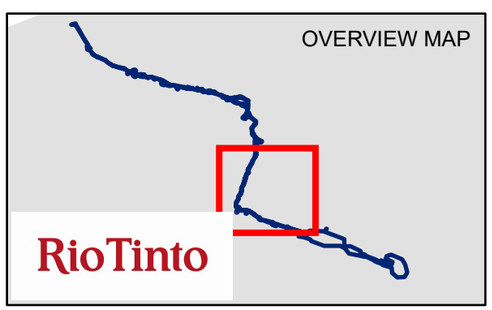
**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree

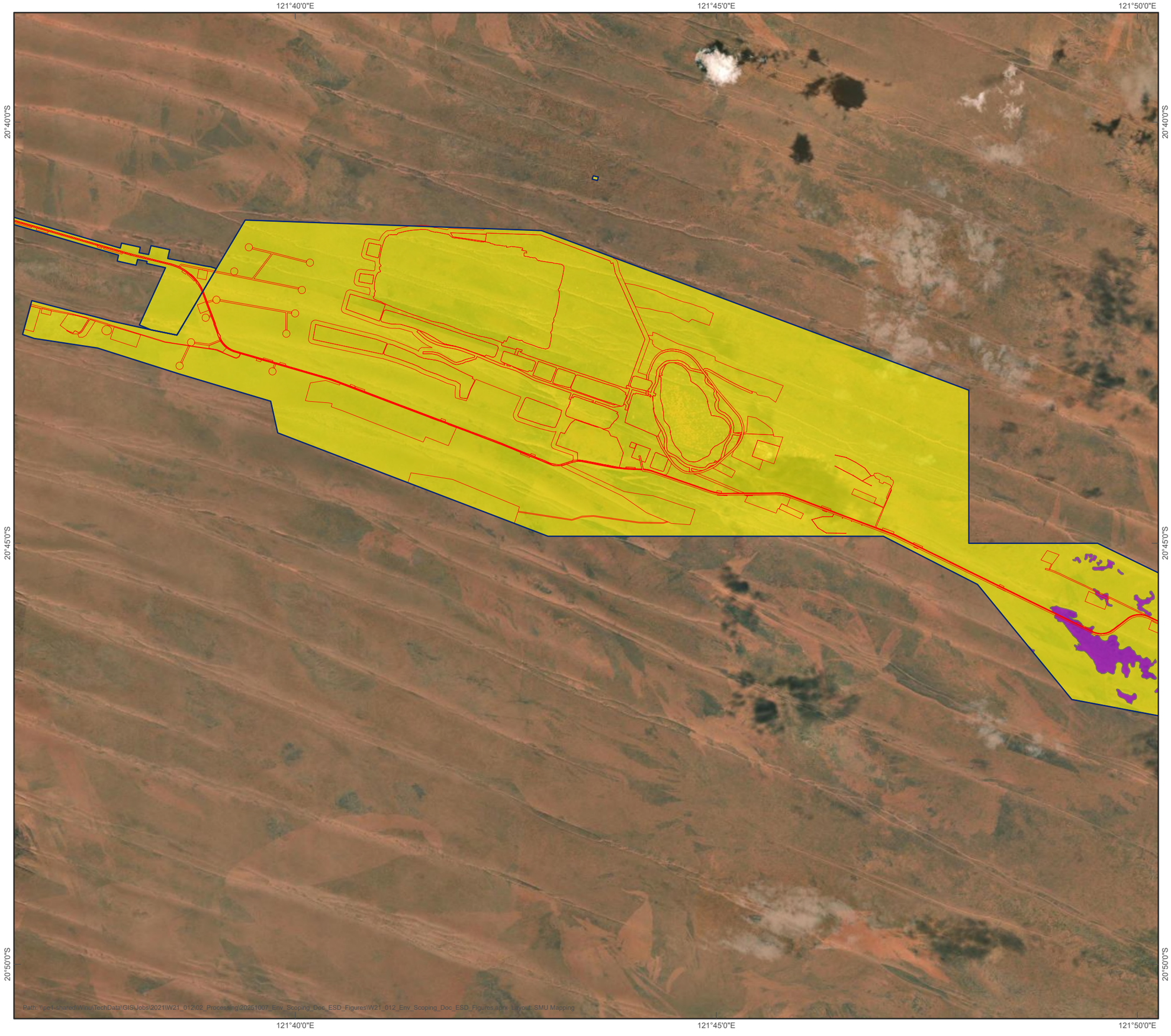
**Scale:** 1:140,000

Rio Tinto © Copyright





# Figure 11-4: Winu Project SMU Mapping




**Legend**

- Disturbance Footprint
- Development Envelope

Soil Mapping Units (SMU)

- Deep Sands
- Gradational Sands

N

0 2.5 5

Kilometres

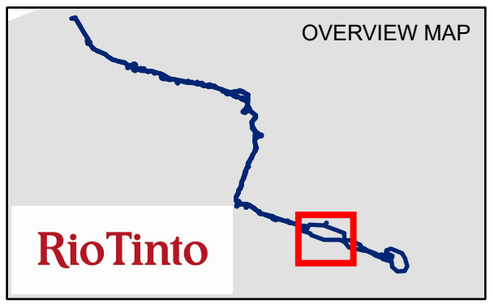
**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree

**Scale:** 1:80,000

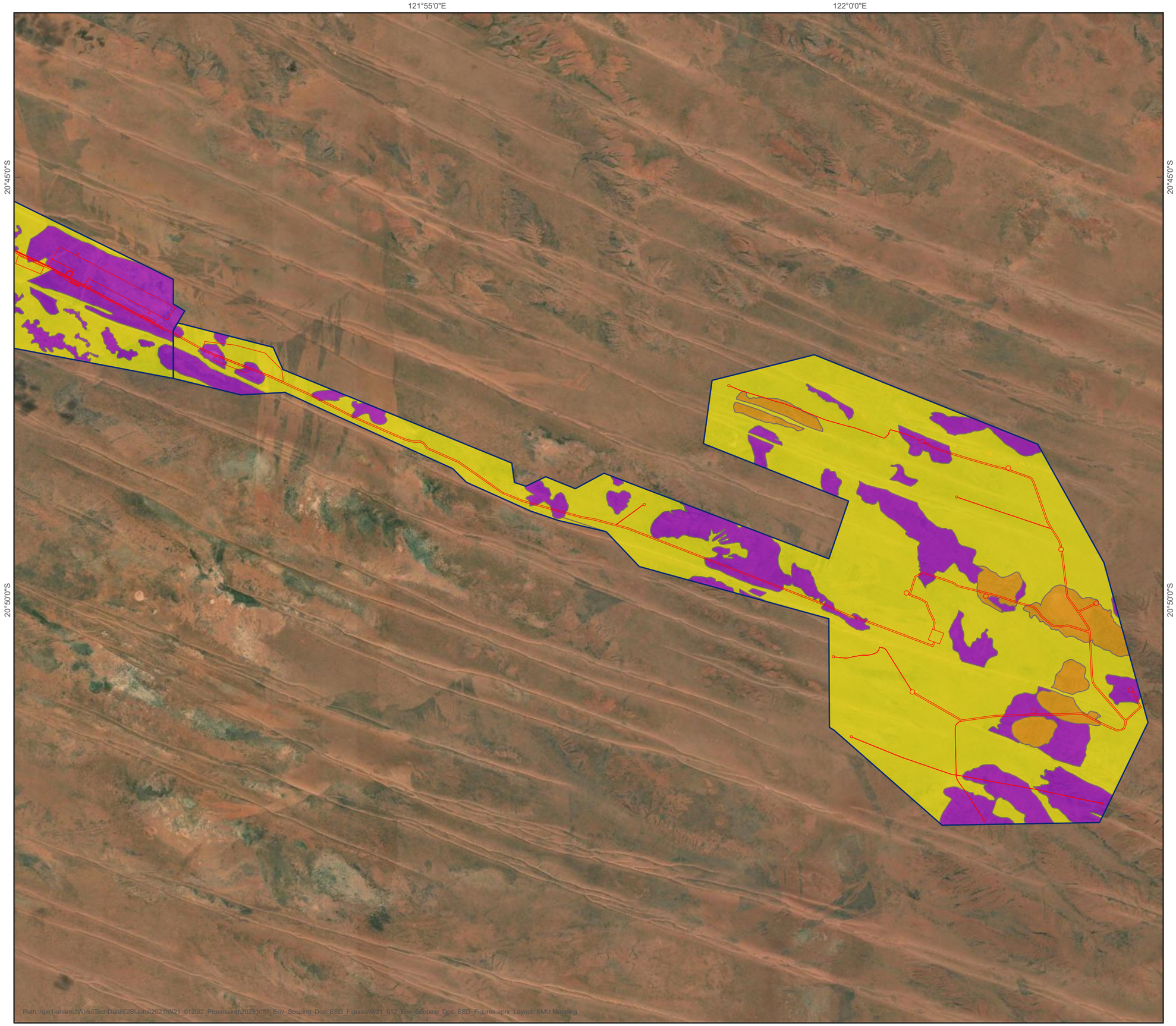
Rio Tinto © Copyright






Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20251007_Env_Scoping_Doc_ESD_Figures\W21_012_Env_Scoping_Doc_ESD_Figures.aprx Layout: SMU Mapping

# Figure 11-4: Winu Project SMU Mapping




**Legend**

- Disturbance Footprint
- Development Envelope

Soil Mapping Units (SMU)

- Deep Sands
- Gradational Sands
- Shallow Sands

N

0 2.5 5

Kilometres

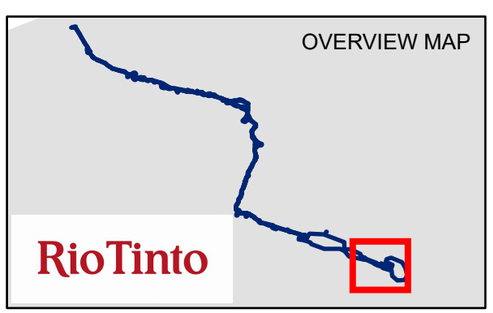
**Publisher:** Gavin.Jackson
Date Published: Tuesday, 9 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree

**Scale:** 1:80,000

Rio Tinto © Copyright






Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20251007_Env_Scoping_Doc_ESD_Figures\W21_012_Env_Scoping_Doc_ESD_Figures.aprx Layout: SMU Mapping

#### 11.3.2.4 Acid Sulfate Soils

The soils that characterise the Development Envelope - aeolian sediments inclusive of dunal soils and Cenozoic sediments above the groundwater table - have a very low potential of containing Acid Sulfate Soils (ASS).

ASS's are naturally occurring soils or sediments containing iron sulfides or subsequent oxidisation products, predominantly pyrite materials. ASS are generally formed under waterlogged conditions and are known to occur in coastal or low-lying areas (DER 2015a).

Broadscale ASS mapping is available through the Atlas of Australian Sulphate Soils (Fitzpatrick et al. 2011). According to this mapping, Development Envelope soils were found to have an 'extremely low probability of occurrence' of forming ASS.

The risk of ASS was reviewed by Red Earth Engineering (Rio Tinto 2024b). ASS's are unlikely to exist within the Development Envelope due to the following:

- Shallow dunal soils (to a depth of 1.5 mbgl) are dry and fully oxidized
- The shallow stratigraphic sequence is expected to be dry most of the year, if not permanently dry/unsaturated, as:
    - Permanent surface water is not known to exist within the Development Envelope
    - Depth to groundwater is typically more than 50 mbgl.

On this basis, the Proposal is not expected to disturb any ASS and ASS is not discussed further in this assessment.

#### 11.3.2.5 Contaminated Sites

A desktop search of the DWER contaminated sites database indicated that no contaminated sites occur within or near the Development Envelope (DWER 2025).

### 11.3.3 Material Characterisation

#### 11.3.3.1 Waste Rock

The current mine plan estimates that approximately 434 Mt of waste rock will be generated over the life of the mine and sent to various destinations depending on the physical and chemical characteristics of the waste rock (Table 11-5). As mine plans change over the life of mine, the generation of 490 Mt of waste rock has been allowed for under this Proposal, as a contingency. The mine plan will be reviewed annually to ensure the same methodology is applied with any increase and the WRL sequence updated to ensure effective encapsulation. Under the current mine plan, approximately 105 Mt of appropriate waste rock will be used in the construction and eventual covering of the TSF, while a further 19 Mt of waste rock will be used to construct infrastructure (mostly the ROM pad and stockpile base) across the site. The remaining approximately 356 Mt will be stored in a WRL. The Proponent notes that the approximately 19 Mt of waste rock used for infrastructure construction will be rehandled into the WRL to ensure closure requirements are met.

**Table 11-5: Waste Material by Destination**

| Destination | Suitability Criteria (Physical and chemical characteristics) | Million Dry Tonnes (M dt) | Million Loose Cubic Metres (M LCM) |
|---|---|---|---|
| TSF - Construction | NAF, fine grain material | 56 | 29 |
| TSF – Rock Cover | NAF, competent erosion resistant | 49 | 22 |
| WRL - Base Layer | NAF, clay content | 44 | 29 |

| Destination | Suitability Criteria (Physical and chemical characteristics) | Million Dry Tonnes (M dt) | Million Loose Cubic Metres (M LCM) |
|---|---|---|---|
| WRL - NAF | NAF | 131 | 107 |
| WRL – PAF | PAF | 98 | 37 |
| WRL – Erodible | NAF, loose consolidated or friable material | 28 | 13 |
| WRL - Cover | NAF, non-sodic, competent material | 9 | 5 |
| ROM Pad | NAF | 15 | 10 |
| Stockpiles - Base Layer | Mudstone | 4 | 3 |
| **Total** | | **434** | **255** |

The geology of the Winu deposit is divided into three waste rock strata:

- Leached Cap / Upper Oxidised
- Enrichment Secondary Sulfide Zone
- Hypogene Primary Sulfide Zone.

An extensive geochemical characterisation program has been conducted on the waste rock lithologies within the Winu pit area (Rio Tinto 2025e, 2024b, 2024a). A total of 269 samples were assessed, with 63 from the Upper Oxidised Leached Cap, 35 from the Enrichment Secondary Sulfide Zone and 171 from the Hypogene Primary Sulfide Zone.

#### Leached Cap/Upper Oxidised (78% of Waste Rock Volume [339 m dt])

The leached cap unit is situated above the copper oxides and enriched metasediments as a highly weathered metamorphosed sedimentary rock. Physically, the leached cap is described as a cobbly waste with a high coarse fraction that occurs in three zones:

- Upper metal depleted leached cap
- Goethitic leached cap
- Lower hematitic leached cap.

Landform design studies (Landloch 2020a; Rio Tinto 2023) determined that geotechnically, the leached cap had a high resistance to erosion and was assessed as having moderate permeability with a low tendency for structural decline. As such, the leached cap is considered a suitable material covering slopes and top surfaces.

This stratum mainly contains Non Acid Forming (NAF) materials with seven of the 63 samples identified as Potentially Acid Forming (PAF) (Rio Tinto 2024b). All PAF material was encountered at a depth of greater than 160 m below the surface.

Most of this layer has been classified as NAF, although it has also been identified as ‘Barren’ as it has a limited Acid Neutralising Capacity (ANC) (Rio Tinto 2024b). So, whilst the majority of the Upper zone is not considered a risk for potential acid generation, it is also an unsuitable material for neutralising acid that may be generated from the other waste rock lithologies.

No significant metalliferous leaching was observed during the sample analysis (Rio Tinto 2024b).

Salinity values were assessed from leachate testing and the risk was deemed low, with the exception of two mudstone samples (Rio Tinto 2024b). The mudstone sample with the greatest Electrical Conductivity (1,660 µs/cm) in the leach tests had considerably more sulfur (1.4% total sulfur) than that typical for the lithology (95$^{th}$ percentile 0.42% total sulfur) and is considered an outlier.

**Enrichment Secondary Sulfide Zone (3% of Waste Rock Volume [13 M dt])**

Located below copper oxide are the enriched secondary sulfides units. The physical characteristics of this unit are similar to those of the leached cap units, that being, a cobbly waste with a high coarse fraction. Landform design studies (Rio Tinto 2023) determined that the secondary sulfide zone had a moderate resistance to erosion.

Approximately 83% of waste and plant feed samples that were analysed within the secondary sulfide enrichment zone were classified as PAF (Rio Tinto 2024a). The remaining NAF fraction is classified as 'Barren' as ANC is mostly absent or unavailable for net acid neutralisation.

Constituent release was generally higher in the 'low' pH leachates (~pH 5), particularly Cd, Cu, Co, Mn, Ni, and Zn. In addition, samples from the pre-mineral mafic units with higher K concentrations were more likely to release F at elevated levels (>1.5 mg/L). Typically, the metal release in kinetic tests was greater from pre-mineral mafic samples and included elevated Al and Fe. Some samples acidified rapidly, whilst others had an acidification lag (median acid neutralisation depletion time of 2.5 years).

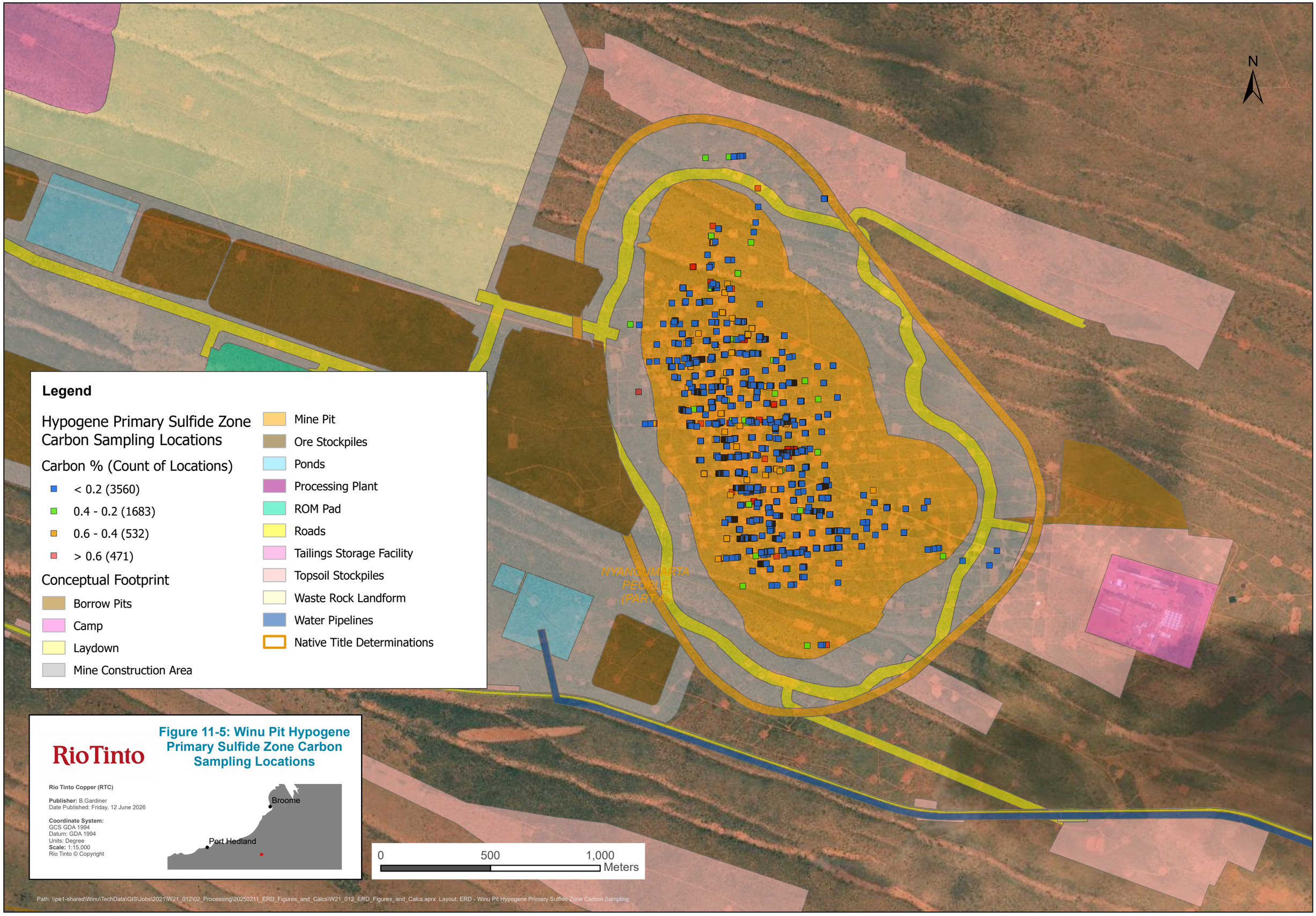
**Hypogene Primary Sulfide Zone (19% of Waste Rock Volume [82 M dt])**

The primary sulfide units present as metamorphosed sedimentary rocks, sandstone with occasional siltstone layers. Geotechnically, they are medium to high strength rocks. Landform design studies (Landloch 2020a; Rio Tinto 2023) determined that the primary sulfide zone had a very high resistance to erosion. As such, the primary sulfide zone is considered a suitable material covering slopes and top surfaces.

Due to the presence of acid neutralising minerals, the primary sulfide zone had a lower proportion of PAF samples compared with the secondary sulfide zone test work, with 42% of the primary sulfide waste samples and 29% of plant feed samples classified as NAF (Rio Tinto 2025e). Focusing on waste and using over 136,000 assays with sulfur concentrations within this zone (metasandstone), it was found that 57% of samples exceed 0.2% total sulfur and may be PAF if there are no neutralising minerals present (AMD S&MP). Some of the NAF material, particularly within the Metasediment and Quartz Sandstone lithologies, exhibited readily available ANC properties (up to 473 kg $H_2SO_4$/t). For those samples classified as PAF, the presence of readily available ANC also makes it unlikely that any acidification will occur within the short term (less than eight years).

Extensive work has been undertaken to assess the neutralisation potential in the primary sulfide waste material. This includes development of a new test method (Gerson et al. 2021), which will enable the rapid assessment of neutralisation potential during mine operations using a muffle furnace and Leco C analysis. This work was undertaken in recognition that there can be non-neutralising carbonates (siderite), particularly in the region between the secondary sulfide and primary sulfide zones. Hence, the method Winu will use is superior to typical industry analysis of carbonate neutralising potential through Leco analysis alone.

The spatial extent of carbonates within the primary sulfide zone is continuous work, with further data collected as drilling advances. To date, 7,652 carbon samples have been analysed (Figure 11-5) and a further 1,000 samples are planned in 2026 for neutralising carbon analysis.


N
NYANGUMARTA PEOPLE (PART A)
Legend
Hypogene Primary Sulfide Zone Carbon Sampling Locations
Carbon % (Count of Locations)
< 0.2 (3560)
0.4 - 0.2 (1683)
0.6 - 0.4 (532)
> 0.6 (471)
Conceptual Footprint
Borrow Pits
Camp
Laydown
Mine Construction Area
Mine Pit
Ore Stockpiles
Ponds
Processing Plant
ROM Pad
Roads
Tailings Storage Facility
Topsoil Stockpiles
Waste Rock Landform
Water Pipelines
Native Title Determinations
RioTinto
Figure 11-5: Winu Pit Hypogene Primary Sulfide Zone Carbon Sampling Locations
Rio Tinto Copper (RTC)
Publisher: B.Gardiner
Date Published: Friday, 12 June 2026
Coordinate System:
GCS GDA 1994
Datum: GDA 1994
Units: Degree
Scale: 1:15,000
Rio Tinto © Copyright
Broome
Port Hedland
0
500
1,000
Meters
Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Winu Pit Hypogene Primary Sulfide Zone Carbon Sampling

If PAF material acidifies, it is expected to release Cd, Co, Cu, Mn, Ni and Zn, although large concentrations have not been observed in kinetic test work due to the mostly circumneutral pH levels being experienced after more than 240 weeks for some tests (Rio Tinto 2025e). NAF and PAF material during the neutral pH acidification lag phase had low metal release.

Table 11-6 provides information regarding the proportions of PAF and NAF that are destined for the WRL, ROM pad and stockpiles base layer as per the current mine plan (Appendix A03). The remaining NAF material (105 Mt) will be used for the TSF embankment and cover. Additional information on the specifics of the storage of PAF material is presented in the Waste Rock Landform Report (Rio Tinto 2025b) (Appendix G10) and the AMD S&MP (Appendix C07).

**Table 11-6: Expected Volume of Ex-pit Waste to WRL**

| Material | M dt | % (dt) | M BCM |
|---|---|---|---|
| PAF | 98 | 30 | 37 |
| NAF | 231 | 70 | 167 |
| **Total** | **329** | **100** | **204** |

#### 11.3.3.2 Tailings

Two types of tailings streams will be generated (Rio Tinto 2025f):

- High Sulfur (HS) flotation tailings; from the 'cleaner' scavenger flotation processing circuits - containing up to 300 kg $H_2SO_4$/t. Low to Negligible ANC. Due to the high sulfide content and negligible ANC, all samples were classified as PAF
- Low Sulfur (LS) flotation tailings; from the 'rougher' flotation processing circuits - containing up to 35 kg $H_2SO_4$/t. Low to Negligible ANC:
    - 53% of the samples were classified as PAF – noting that although some LS samples were classified as PAF the low sulfide content means that their acid-generating capacity is low and thus referred to as PAF-LC
    - 47% were classified as NAF or Barren.

The dominant sulfide minerals in both tailings streams were pyrite and chalcopyrite.

Under unsaturated conditions expected on the beaches for the LS tailings, metal leaching was typically only observed in samples with low pH levels. If acidic conditions develop, there may be elevated concentrations of Al, Be, Cd, Co, Cu, Cr, Mn, Ni, Pb, U and Zn (Rio Tinto 2025f). Cyanide concentrations remained consistently low in both streams despite changes in pH. The LS tailings are expected to be NAF in bulk based on:

- The bulk of the tailings containing primary sulfide feed material (85%)
- The alkaline process solutions
- The lag time until acidification for tailings classified as PAF and likely burial with new tailings
- The expected high degree of saturation.

Under the saturated conditions that the HS tailings will be stored and some low sulfur tailings, neutral pH is expected to be maintained for the tailings streams, due to limited oxygen ingress and subsequent sulfide oxidation when Winu tailings are maintained saturated (Rio Tinto 2025f). Additionally, under these conditions, leached metals will be very low concentrations after the first flush. Similarly to the unsaturated testing, the cyanide concentrations in both streams remained low. Hence HS tailings are PAF, but if maintained in a saturated state are not expected to generate AMD.

#### 11.3.3.3 Fibrous Materials

Asbestiform minerals have a fibrous crystal habitat of long and thin fibres that can easily be separated. The minerals that can crystalise as asbestiform belong to two groups:

- Serpentine (chrysotile)
- Amphibole (crocidolite, amosite, anthophyllite, tremolite and actinolite).

Both mineral groups have fibrous and non-fibrous varieties; however, only the fibrous varieties are characterised as asbestiform minerals.

A review of the geological database was conducted to determine further instances of fibrous materials within the Development Envelope (Rio Tinto 2024b). The review identified three drill holes that contained actinolite. All samples were analysed and minerally mapped using Short Wave InfraRed (SWIR). Of the samples tested 63 contained actinolite, of which 27 occurred within the Winu pit design. However, none of the actinolites were identified as being in the fibrous form. Drilling is currently done under an asbestiform mineral management plan and there will similarly be an asbestiform mineral management plan during active mining which will be developed in due course.

The mining asbestiform mineral management plan will be in alignment with the DMP Management of fibrous minerals in Western Australian mining operations - guideline (DMP 2015b).

#### 11.3.3.4 Radionuclides

At Winu, the exploration geology team routinely check for Uranium pXRF (X-Ray fluorescence) readings through all core types, with special attention to carbonaceous clays. Uranium pXRF readings have been below detection limits with random maximums of 10-30 ppm. As a result, the radionuclides risk is considered by the Proponent negligible and will not be assessed further in this document.

#### 11.3.3.5 Spontaneous Combustion

Some organic carbon has been measured in waste material at the MIA, in particular the Permian reduced mudstones (average organic carbon of 0.45%). However, generally the Proponent expects that organic carbon will be low in the majority of waste and the risk of spontaneous combustion is likely low.

Organic material can be present in the cover material (black carbonaceous Permian clays and random black shales) outside of the Winu mining area (north of WRL and stockpile area). Although the risk of spontaneous combustion of organic compounds is considered low, monitoring (visual and carbon assays) will continue to assess if elevated organic carbon and sulfur are present in new materials in the future. Given the low risk this issue will not be assessed further in this document.

### 11.3.4 Geotechnical – Site Stability

#### 11.3.4.1 TSF

Detailed and extensive field and laboratory testing has occurred with continued assessment remaining in progress, building on a range of geotechnical and related investigations conducted since 2019 (WWL 2025a) (Appendix G06). The geological and geotechnical properties of foundations of the proposed TSF site are expected to be similar to a site investigated earlier (ruled out for heritage site protection), located immediately to the south (WWL 2025a) (Appendix G06). The information from the adjacent site have been incorporated into the current TSF design, which will be reviewed as necessary when the updated results are available. This reflects the TSF investigations and design process being at the pre-feasibility study stage, with studies continuing to progress to completion in the final feasibility stage. Aspects of design are subject to further iterations as these stages progress; however, any further changes are not expected to be of a magnitude that may materially affect the impact assessment in this ERD.

Testing has included assessment of the underlying site foundation materials, that reflect local stratigraphy, i.e. aeolian sands, cemented sands, Permian mudstone and metasediments. This has included assessment of site stability and suitability of superficial (i.e. surface and near surface) layers

to be accessed at the TSF site, along with mine waste, as construction materials for the embankments. The assessment of material properties reflected different fill zones (including sub-zones) that have specific design criteria:

- Zone 2A: Engineered fill comprised of selected pit waste that serves as a transition zone between the overlying Zone 2B and underlying Zone 4 material in the lined embankments
- Zone 2B: Engineered fill comprised of selected fine grained pit waste that serves as a liner bedding layer
- Zone 4A: Bulk fill material comprised of selected pit waste that is placed in thinner lifts than Zone 4B
- Zone 4B: Bulk fill material that comprises the outer base of the embankments. Comprised of sandstone from the open pit.

TSF embankment slope stability analyses have been conducted based on suitable modelled seepage conditions and material parameters derived from the geotechnical testing. Analysis has also considered the consolidation settlement characteristics of constructed embankment materials, the WRL and the natural dune landforms that form segments of the embankments. Analysis included incorporation of seismic (earthquake) parameters, noting the Proposal is not located in a highly seismic region. As noted (Section 11.3.4.1), further design progress continues to occur as TSF pre-feasibility assessment tracks to the final feasibility stage; however, these analyses provide confidence the TSF can be constructed to design requirements and maintained safely (WWL 2025b) (Appendix G06).

Geotechnical piping analysis of the TSF has also been undertaken (WWL 2025a) (Appendix G06). Geotechnical piping is a form of erosion with potential to occur on the internal walls and foundation of the TSF due to water seepage, with implications for embankment stability. The analysis concluded the probability of wall failure resulting from piping leading to major environmental damage is negligible (less than 1 in 1 million).

The conceptual TSF design has been analysed to simulate the impact of a failure of the embankment or other retaining structure, where the tailings slurry material is released to surrounding areas (WWL 2025a). This analysis, based on both static (typical) and seismic conditions, has been used to inform planning of the WRL and other infrastructure, as well as emergency planning. The failure analysis incorporated the estimated construction sequence, in which the tailings cells are built in stages, and assessed different sections of embankments where breaches have the potential to occur (WWL 2025a). Under current planning, noting design feasibility studies continue to progress (Section 11.3.4.1), the cell development sequence is proposed to begin with HS cell 1 and LS cell 2, then after approximately eleven years of operation, operation of HS cell 2 and LS cell 1 is expected to commence, for a period of approximately ten years, after which deposition will occur alternatively between the HS cells, and also between the LS cells.

#### 11.3.4.2 Pit and WRL

Geotechnical studies have been undertaken with respect to pit slopes and WRL location and design to support Proposal feasibility assessments and mine design (Golder 2022a). The studies were based on extensive drilling records, field investigations and laboratory analyses in accordance with the relevant Rio Tinto (2020) standard.

Pit design to meet safety requirements has been based on detailed characterisation of the materials that will form the open pit walls, backed by 2D and 3D stability analyses and kinematic assessment (Golder 2022a).

The WRL foundation and design has been assessed to ensure it occupies a suitable location and can be constructed to remain safe and stable (Golder 2022a). The study considered Permian mudstone material may lead to instability if inappropriately placed but identified strategies to counteract this concern. The high intensity rainfall events that can occur in the region were identified as a risk factor for erosion and gullying of the WRL, with surface water management recognised as a key requirement to ensure erosion is mitigated during operations and following closure. Settlement and compaction of

foundation sands is expected to occur immediately on placement of WRL materials with the risk of this affecting WRL stability considered negligible. The assessment concluded that the proposed WRL meets design criteria for operational and long-term stability. Further assessments remain ongoing and will be addressed through the MDCP and updates to the MCP.

## 11.4 Potential Environmental Impacts

Proposal activities that have the potential to impact TEQ include clearing of vegetation and disturbance to soils for mining activities.

The potential impacts that may occur to TEQ as a consequence of implementing the Proposal are:

- Soil contamination from waste rock, plant feed or tailings spillage or loss of containment
- Soil contamination from TSF seepage and WRL or plant feed stockpiles seepage and/or runoff
- Soil erosion (wind and water) from clearing native vegetation and constructed landforms
- Soil contamination from the seepage, leaks or spills of chemicals (including hydrocarbons).

The Proponent considerers that soil contamination from the seepage, leaks or spills of chemicals (including hydrocarbons) will be regulated through other legislative mechanisms, including Part V of the EP Act and the Mining Development and Closure Proposal under the Mining Act. As such it is not considered further in this assessment

Related potential impacts to groundwater and surface water, including the pit lake at closure, i.e. from chemical or TSF, WRL or other seepage, leaks, spills and AMD, are assessed in Section 7 – Inland Waters. As discussed in Section 7.6.2.1, at closure the open pit is predicted to act as a long-term, evaporative hydraulic sink with no expected discharge to the environment. Therefore, migration of solutes from the pit lake into surrounding soils or terrestrial environments is not expected. The pit lake has no predicted surface water decant, including during extreme rainfall events. No surface pathways exist to transport lake water, salts or metals into surrounding terrestrial soil or vegetation.

### 11.4.1 Direct and Indirect Impacts

#### 11.4.1.1 Soil Contamination from Waste Rock, Plant Feed or Tailings Spillage

The Proposal will include the excavation of lithologies characterised as PAF. When these lithologies are exposed to an oxygen-rich environment the sulfide minerals present undergo a chemical reaction that forms sulfuric acid. The sulfuric acid can then react with the surrounding geology resulting in the leaching of minerals including heavy metals. Hence, any PAF waste rock or PAF mine stockpile material that is not appropriately identified and placed in accordance with the AMD S&MP has the potential to leach AMD.

The TSF will be constructed in a staged sequence (Section 11.3.4.1). A breach of the HS cells once deposition into the second LS cell (LS cell 1) commences is not considered possible due to containment by the LS cells and the WRL but has potential to occur in earlier stages when the first HS cell is separated from the first LS cell (WWL 2025a).

TSF failure simulations showed the maximum modelled areas of impact from the potential breach flow paths considered for the HS cells, prior to installation of LS cell 1, as (WWL 2025a):

- ‘HS Flow Path 1’ (Figure 11-6) – 23.0 ha
- ‘HS Flow Path 2’ (Figure 11-6) – 33.5 ha.

These impact areas occur inside the eventual conceptual footprint of the TSF.

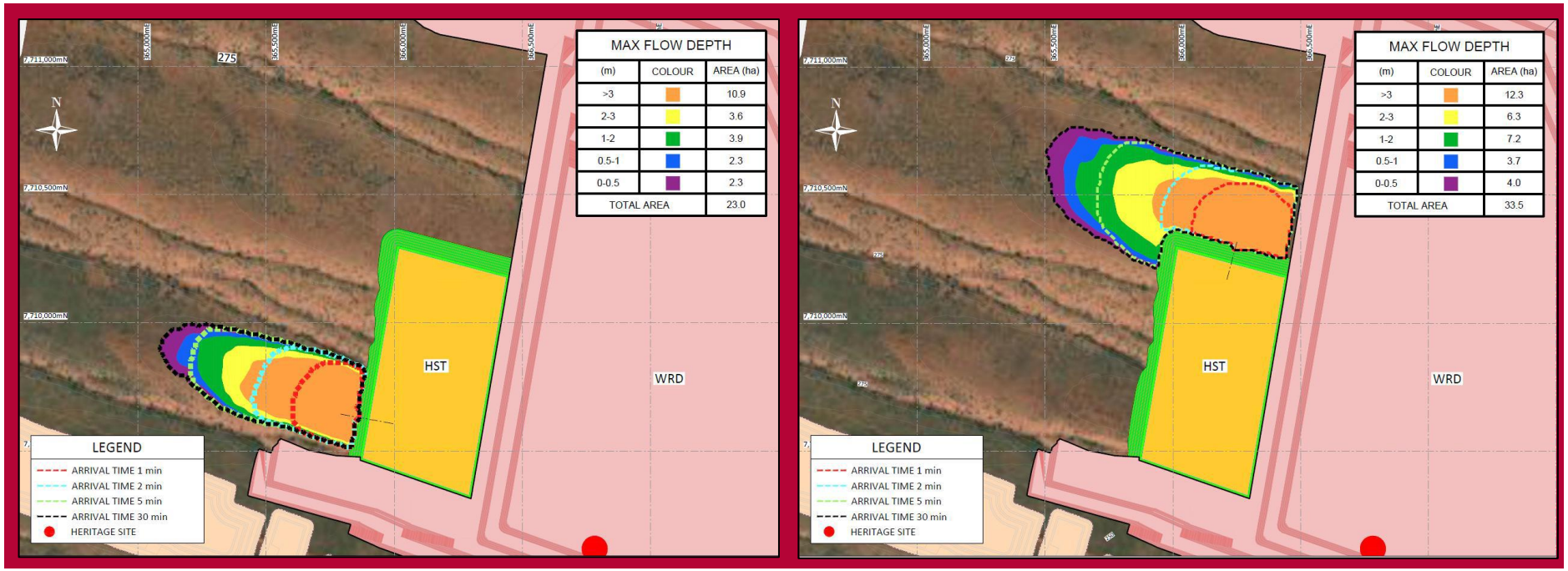
With respect to final TSF configuration the failure modelling included scenarios that both included and excluded adjacent stockpiles on the southern side, as these influence the potential area of inundation in the event of a breach on that side (WWL 2025a). As noted, the figures below for ‘LS 1 Flow Path 4’ refers to a scenario without stockpiles, to reflect conditions when the stockpiles are mined and removed

for cover at closure, to show - the maximum potential area of impact for the southern side of the TSF, due to the loss of the containing effect the stockpiles would have on a spillage. Note that the material properties adopted for the LS tailings are likely very conservative and result in a much larger inundation area than would be likely to occur. This modelling will be further refined as the design progresses.

The maximum modelled areas of impact from the potential breach flow paths are (WWL 2025a):

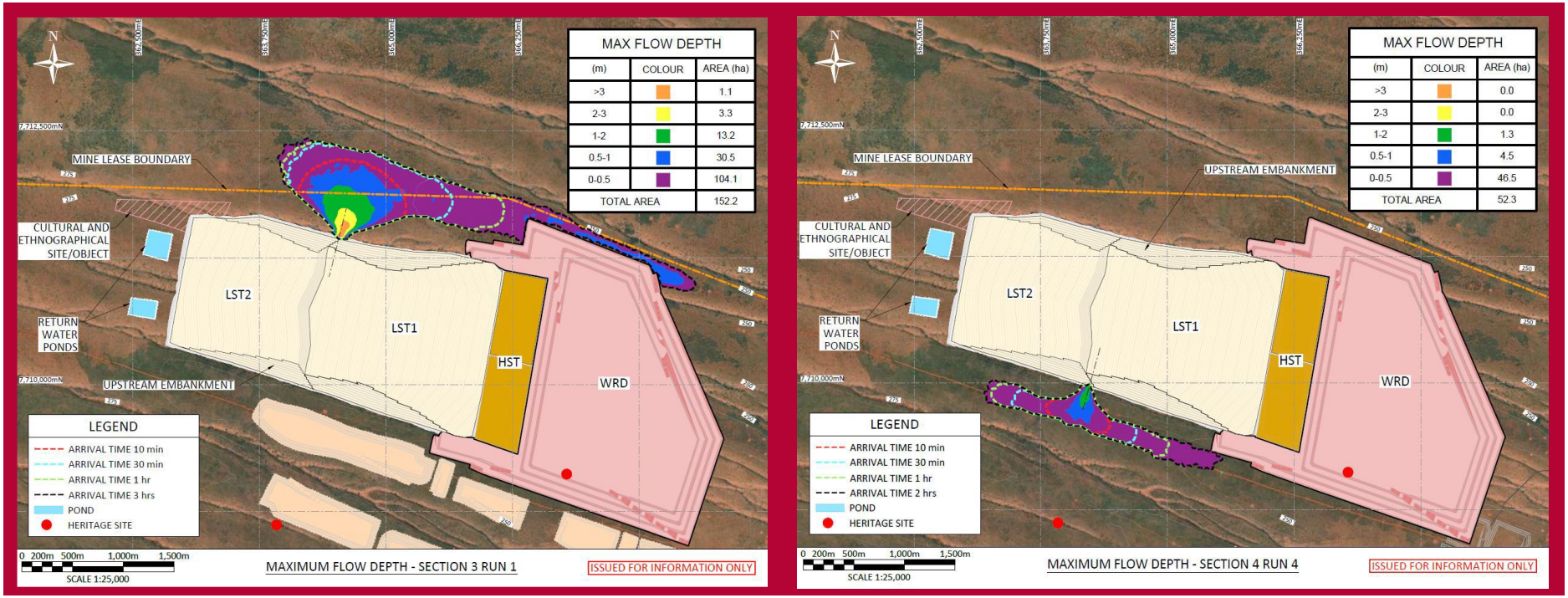
- ‘LS1 Flow Path 3’ (Figure 11-7) – 152.2 ha
- ‘LS 1 Flow Path 4’ (without stockpiles; Figure 11-7) – 92.8 ha
- ‘LS 2 Flow Path 5’ (Figure 11-8) – 5.3 ha
- ‘LS 2 Flow Path 6’ (Figure 11-8) – 4.9 ha.

A breach to the north of the TSF (i.e. LS 1 Flow Path 3) has the potential to extend outside the Development Envelope. The other potential flow paths would remain within the Development Envelope.



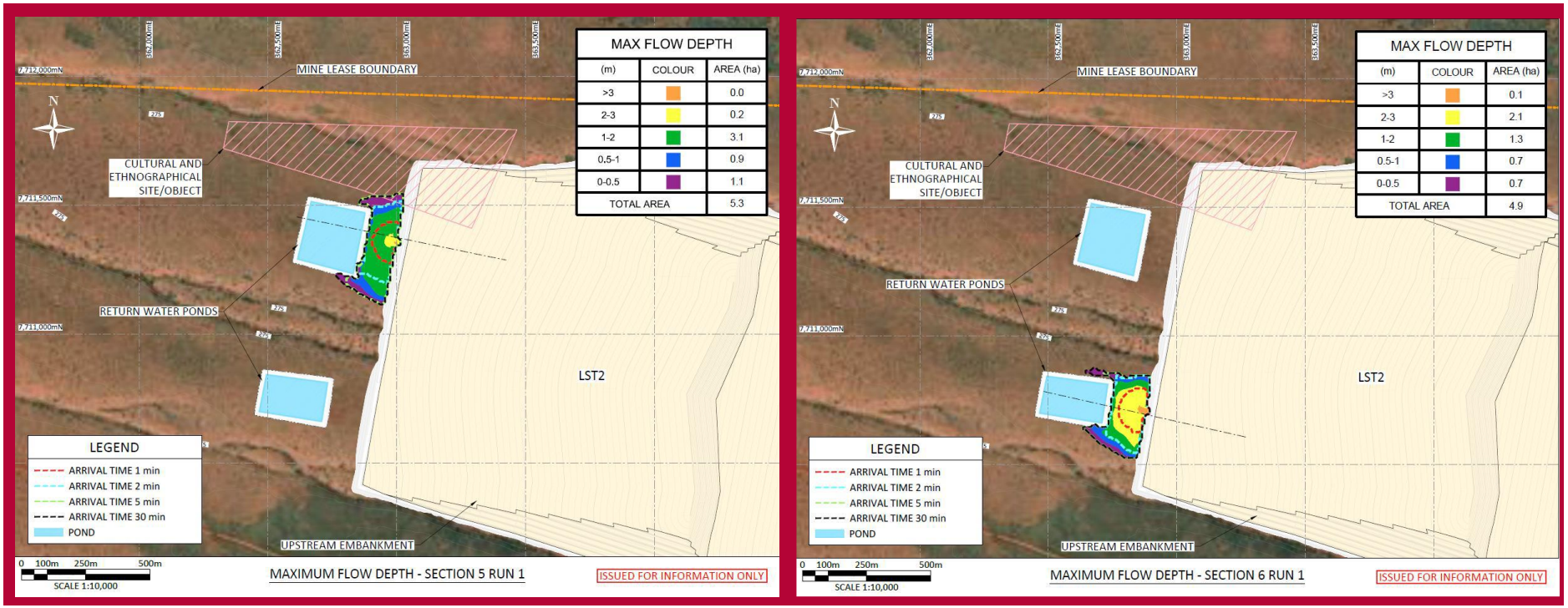

*Source: (WWL 2025a)*

**Figure 11-6: TSF Initial Configuration (HS Cell 1) – Embankment Breach Maximum Modelled Inundation Area (L - 'HS Flow Path 1', R – 'HS Flow Path 2')**




*Source: (WWL 2025a)*

**Figure 11-7: TSF Final Configuration – Embankment Breach Maximum Modelled Inundation Area (L – 'LS 1 Flow Path 3', R – 'LS 1 Flow Path 4' (after stockpiles removed for use as closure borrow)**




*Source: (WWL 2025a)*

**Figure 11-8: TSF Final Configuration – Embankment Breach Maximum Modelled Inundation Area (L - 'LS 2 Flow Path 5', R – 'LS 2 Flow Path 6')**

#### 11.4.1.2 Soil Contamination from TSF Seepage

As discussed in Section 7, the process plant will generate tailings, to be stored within a TSF, with some tailings generated by the Proposal identified as being PAF with the potential to contain elevated concentrations of heavy metals and cyanide. Seepage through the TSF walls or floor has the potential to detrimentally impact soil condition and negatively affect surrounding soil.

A variety of tests on neutral (circum-neutral pH) and saline conditions in the TSF were conducted on both LS and HS tailings, with LS tailings forming the majority (approximately 93%) of total tailings (Section 7.4.2.1). Saline leach tests showed, overall, no obvious trends for constituent release from low sulfur tailings using leachate of varied salinity (Section 7.4.2.1). There were only minor differences for some elements at low concentrations. Iron and manganese oxide content, especially if crystalline, is expected to be unreactive unless conditions become strongly acidic, or strongly reducing. Some tailings have been classified as PAF, and acidic conditions are possible if the material is not managed properly. The low sulfur content of the tailings would suggest that strongly acidic conditions are unlikely. Strongly reducing conditions are not considered likely unless a reducing agent is introduced (e.g. decomposing organic matter). Overall, if the materials are managed to mitigate risk of acid onset, the leaching potential is low.

Other tests and details are available in Appendix G.

#### 11.4.1.3 Soil Contamination from Plant Feed Stockpile Seepage and/or Runoff

The soils surrounding mine stockpiles containing PAF material represent the greatest risk for soil contamination. The seepage through these stockpiles is slow, given the low rainfall environment, small lift height source control construction method and low permeability basal layer. Hence it is the runoff after rainfall that needs to be contained, if it contacts PAF material exposed on the outer batters.

Fifteen kinetic tests have been undertaken on material from the primary sulfide zone (Rio Tinto 2025e). Some tests continue to operate, providing leach data for more than 5 years. This work has demonstrated effective neutralisation potential with the lag time until acidification calculated as between 8 and 148 years (median 29 years, average 47 years). Hence, for PAF primary sulfide mine stockpiles there will be an acidification lag period of eight years or more. The secondary sulfide plant mine stockpiles may acidify more rapidly, possibly less than one year after placement.

#### 11.4.1.4 Soil Contamination from WRL Seepage and/or Runoff

Geochemical characterisation was undertaken on overburden and oxides, secondary sulfides and primary sulfide material to understand the acidity, metalliferous drainage and neutral mine drainage risks (Appendix G).

Although uptake by vegetation on final landform covers is possible in principle, the geochemical evidence shows that NAF wastes contain extremely low concentrations of mobile metals (Rio Tinto 2024b). Under rehabilitated surface conditions, metals remain strongly bound in immobile mineral phases, resulting in negligible bioavailability to vegetation and, consequently, negligible potential for transfer into terrestrial food webs.

The following focuses on molybdenum and tungsten to demonstrate how oxyanionic metals and metalloids becoming bioavailable from NAF wastes has been assessed. NAF waste, used as cover on final landforms, will mostly be associated with oxides/overburden and primary sulfides.

Molybdenum is enriched in 2% of samples from the overburden and 5% of primary sulfides samples (Rio Tinto 2024b) (Rio Tinto 2025f). Enrichment does not necessarily mean that the constituents will mobilise into solution. Plants take up molybdenum predominantly as molybdate from porewater; therefore, low molybdenum in solution equates to low plant uptake. The chemical mobilisation has been assessed through a number of different methods including liquid extracts (1 part solid to 2 part liquid), multi leach tests (wetting the sample multiple times) sequential extractions and kinetic tests.

In the oxide and overburden, the molybdenum concentrations in the liquid extracts were at or close to the detection limit of 0.001 mg/L, with the highest concentrations being 0.047 mg/L. Molybdenum concentrations generally decrease with successive leaching. Sequential extractions found molybdenum to be mostly within recalcitrant oxidisable minerals, residual or within crystalline iron and manganese oxide, i.e. not readily leachable. The iron and manganese oxide minerals, especially if crystalline, are expected to be unreactive unless conditions become either strongly acidic, or strongly reducing.

In the primary sulfide material molybdenum concentrations in the liquid extracts were <0.112 mg/L (average 0.018 mg/L). Kinetic leach tests were undertaken on 15 samples. Molybdenum concentrations were mostly below the detection limit of 0.001 mg/L, with the maximum concentration measured of 0.016 mg/L in sample 10689926 (a PAF-LC sample that would be stored within the interior of the WRL).

These findings collectively show that even in samples where total molybdenum exceeds the “enriched” threshold, the environmentally available fraction is extremely small. Because bioaccumulation is controlled by the soluble fraction, not the total concentration, enrichment alone is not a predictor of ecological risk. Hence, the geochemical test work undertaken (provided in Appendix G) supports a low risk for molybdenum bioaccumulation.

Tungsten is enriched in 76% of samples from the overburden and 51% of primary sulfides samples (Rio Tinto 2024b) (Rio Tinto 2025e). Although tungsten shows substantial total concentration enrichment in many Winu samples relative to crustal abundance, the ecological significance of this depends almost entirely on whether tungsten is chemically mobile and thus biologically available. The leach data indicate that despite high total tungsten in oxides and primary sulfides, dissolved tungsten concentrations are uniformly very low, with most values at or near analytical detection limits. This strongly constrains the potential for uptake into vegetation or transfer into food webs.

Chemical mobilisation has been assessed through a number of different methods including liquid extracts (1 part solid to 2 part liquid), multi leach tests (wetting the sample multiple times) sequential extractions and kinetic tests.

In the oxides and overburden tungsten concentrations in liquid extract tests were at or close to the detection limit of 0.001 mg/L, with the highest concentrations being 0.197 mg/L. Tungsten concentrations generally decrease with successive leaching.

In the primary sulfides tungsten concentrations in liquid extracts were <1.3 mg/L (average 0.056 mg/L). Kinetic leach tests were undertaken on 15 samples. Tungsten concentrations were mostly below the detection limit of 0.001 mg/L, with the maximum concentration measured of 0.35 mg/L in sample 10689921 (a NAF sample). This measurement appears to be an error as most measurements before and after the sample were an order of magnitude lower.

These results collectively demonstrate that tungsten is mostly locked in mineral phases resistant to rapid dissolution.

#### 11.4.1.5 Soil Erosion from Clearing of Native Vegetation and Constructed Landforms

Soil erosion is the process by which water or wind removes soil particles from a soil profile. It is a natural process that is accelerated by human activities. Erosion is especially a risk when soils are disturbed. Excessive soil erosion causes the soil condition to deteriorate through the removal of the nutrient-rich topsoil and soil structure, which can affect the health of the overlying vegetation.

The three soil mapping units within the Development Envelope are generally characterised as sandy; therefore, having little cohesion. Each soil type is susceptible to erosion from wind and water (Landloch 2025). Deeper portions of the Gradational Sands profile have an increased clay content giving it a greater ability to aggregate which makes it slightly less susceptible to wind erosion if exposed.

Clearing of native vegetation for the Proposal has the potential to increase erosion in exposed areas of these soils, as vegetation buffers the erosive effects of wind and water (Landloch 2020b).

Additionally, the placement of the cleared soils into stockpiles and on the slope of the WRL and TSF during rehabilitation has the potential to increase the impact of erosion if not appropriately managed. The potential for wind erosion may be heightened due to the design of the WRL and TSF, with potential for deposition of eroded materials both on the constructed landform and on leeward areas adjacent to that landform. The preference to reduce the disturbance footprint necessitates an increase in height, which in turn increases the potential for wind erosion (Agreenco 2025).

### 11.4.2 Cumulative Impacts

For this assessment, cumulative impacts on TEQ are considered in relation to the potential contamination of soil-landscape systems (DPIRD 2018). Soil-landscape systems have been chosen as a proxy for assessing cumulative impacts on TEQ as detailed soil mapping is unavailable for all third-party projects.

Of the existing and reasonably foreseeable Projects that occur within the same soil-landscape systems as the Proposal, only one has the potential to impact TEQ: Telfer-Havieron Gold Mining Project (Table 11-7).

**Table 11-7: Cumulative Impacts on Soil-Landscape Systems Underling the Proposal**

| Soil Landscape Systems | Proposal | Telfer-Havieron Gold Mining Project |
|---|---|---|
| Little Sandy System | ✓ | ✓ |
| Nita System | ✓ | x |
| AB40 System | ✓ | ✓ |

Based on impact at a soil-landscape systems scale, there is the potential for the Proposal to have a cumulative impact on TEQ. The Telfer-Havieron Gold Mining Project is located 120 km east of the Proposal and will impact some of the same soil-landscape systems as the Project. These cumulative impacts to TEQ are associated with erosion due to clearing. Other potential impacts to TEQ are related to contamination of soil (such as TSF seepage or chemical spills) which will remain localised to the impact location as transportation of contaminants follows the movement of water as it percolates through the profile and thus predominantly occurs vertically rather than horizontally (Hook 1978). The scale of most seepage or spill related contaminations will remain highly localised (discussed further in Section 7). Therefore, given the spatial scale of potential impacts due to these two projects in relation to the extent of the soil-landscape systems in the region, the cumulative impact to TEQ is not considered to be significant and will not be discussed further.

## 11.5 Mitigation

The Proponent is committed to ensuring that the Proposal avoids or minimises, where practicable, impacts on TEQ within the Development Envelope.

During the Proposal design, the mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to mitigate the potential impacts of the Proposal on TEQ as far as practicable. Table 11-8 outlines how the application of the mitigation hierarchy has been applied to TEQ, and the key avoidance and minimisation measures have been summarised in the sections below.

### 11.5.1 Avoidance and Minimisation

#### 11.5.1.1 Soil Contamination from Waste Rock, Plant Feed or Tailings Spillage

Due to the PAF material being associated with the secondary and primary sulfide orebody and waste material at depth, the avoidance of PAF material is not possible. Refer to Section 7.5.2.3 (Inland Waters) for further information on PAF management and mitigation.

To minimise the risk of AMD contaminating soils within the Development Envelope the Proponent has undertaken a comprehensive geochemical characterisation program and the findings from these studies have been incorporated into geological and mining models, which enables the PAF material to be identified and managed in accordance with the AMD S&MP.

The Proponent has designed the TSF system in accordance with the Global Industry Standards on Tailings Management (ICMM 2020). Key elements of the TSF design include:

- Developing TSF plans and design criteria to minimise risk at all phases of the mining lifecycle
- Plan, build and operate the TSF to manage risks at all phases of the mining lifecycle
- Design, implement and operate a monitoring system to manage risk
- Prepare an emergency response and long-term recovery plan in the event of a TSF failure
- Designing the TSF to minimise closure risks.

Triggers will be developed and incorporated into a TSF Trigger Action Response Plan (TARP), as part of the TSF Operating and Maintenance Manual (WWL 2025a). The TARP will describe a minimum set of actions required by the Proponent in response to an exceedance of nominated criteria developed using a tiered system as a function of increasing risk in relation to TSF performance. TARP implementation aims to prevent loss of control to avoid potential TSF failures that could lead to an environmental (or human safety) impact.

Along with routine inspections, monitoring to gauge TSF performance will occur through (WWL 2025a):

- Piezometers, to monitor pore pressure in tailings above the TSF liner; which provides the means to measure saturation (and cover) levels of the HS tailings
- Settlement plates located along the crest of embankments, to measure consolidation settlement of the embankments
- Inclinometers installed on the impounding embankments to monitor possible movement of the embankments with time
- InSAR (Interferometric Synthetic Aperture Radar) satellite-based movement measurement, to monitor embankment movement
- Boreholes down gradient of the TSF, to monitor groundwater levels and quality (refer to Section 7).

TARP triggers will be developed based on the above inspection and monitoring methods.

Further trigger criteria are provided as part of the Emergency Preparedness Plan as part of the TSF Operating and Maintenance Manual (WWL 2025a). Cascading levels of urgency and action are articulated in relation to TSF observations (levels in order: Alert, Limited Damage, Major Damage, Dam Failure).

#### 11.5.1.2 Soil Contamination from TSF Seepage

The TSF system will segregate the HS and LS tailings into different TSF cells (Figure 11-10 and Figure 11-11), with the HS tailings being stored sub-aqueously to reduce the risk for oxidation and AMD generation (Green and Chapman 2022) (Section 11.3.3.2).

The PAF-LC LS tailings will be stored sub-aerially as the potential level of acidification and mineral leaching is significantly less than the HS tailings. During operations, the LS tailings will be placed as a slurry (68% solids by weight). With the liner limiting drain down, and continual placement of tailings, it is expected that the LS tailings will maintain a relatively high degree of saturation during operations. The

TSF system has also been designed to drain internally with two reclaim water ponds available for operational water management and where there is excess water from extreme rainfall events. The TSF will be constructed using materials sourced on site, both in-situ or from mine waste, that will be classified and segregated to ensure they meet the design criteria for different TSF fill zones to provide stable and safe tailings containment (Section 11.3.4.1).

As a part of closure, the LS tailings will undergo drain down, via the TSF underdrains, and a closure cover will be installed (Figure 11-12). While a lower degree of saturation is expected at closure and post-closure, the cover and fine-grained nature of the tailings are expected to maintain a degree of saturation that will limit oxygen ingress for a significantly long time. Nonetheless, some oxidation will occur post closure.

Additional measures will be undertaken to ensure the closure outcomes and post-mining land uses described in the MCP (Appendix A03) can be achieved, including, but not limited to:

- Continued geochemical and physical characterisation of mined waste rock
- Monitoring and characterisation of LS and HS streams to determine potential to generate AMD, plus analysis of HS supernatant water and TSF reclaim water
- Monitoring of the water cover thickness above the HS tailings, to ensure >85% saturation i.e. nominally > 0.5m thick water cover. If the water thickness drops below this threshold, water will be pumped from a suitable source (e.g. neighbouring HS tailings, reclaim water pond or dewatering bores).

#### 11.5.1.3 Soil Contamination from Plant Feed Stockpile Seepage and/or Runoff

The Proponent will further develop, implement and regularly update the SWMP (Appendix C01) and AMD S&MP (Appendix C07). Both documents are used to guide the management of AMD risks associated with the PAF plant feed stockpiles. Key elements include:

- A basal low permeability layer will be laid before placing any PAF mine stockpiles to reduce direct contact with any surface water flows and reduce AMD seepage into the underlying soil
- Bottom up construction, with small lifts to reduce oxygen entry and preferential water movement
- Any AMD runoff from PAF mine stockpiles will be collected in lined perimeter drains and sumps and transported to the concentrator for amelioration during processing.

#### 11.5.1.4 Soil Contamination from WRL Seepage and/or Runoff

The Proponent will further develop, implement and regularly update an AMD S&MP (Appendix C07) to be consistent with leading industry practices and government regulations. Key elements of the AMD S&MP include:

- Upfront and continually during operations, NAF and PAF material will be identified, geochemically and geophysically characterised, segregated and designated to associated disposal locations, based on chemical assays
- PAF material is to be stored within the core of the WRL (Figure 11-9), requiring ongoing waste rock identification and segregation of AMD-generating waste
- A basal clay layer will be laid before placing any PAF material in the WRL or mine stockpile that contain PAF material to reduce direct contact with any surface water flows and reduce AMD seepage into the underlying soil
- The internal slopes of the berms will be reverse sloped to ensure that the WRL drains internally
- Material placement will be reconciled against mine plans to verify compliance to plan.

Independent risk reviews are to be undertaken in accordance with Rio Tinto's E13 Standard (Rio Tinto 2017), to ensure continuous improvement plans of the reactive mineral waste management strategy.

The PAF landform will be built to minimise long term risks using leading practice source control methods such as small dump lifts and traffic compaction (INAP 2024). The mine plan will be reviewed annually

to ensure the same methodology is applied with any increase and the WRL sequence updated to ensure effective encapsulation.

#### 11.5.1.5 Soil Erosion from Clearing of Native Vegetation and Constructed Landforms

Soil erosion during implementation of the Proposal cannot be wholly avoided only minimised; however, any soil erosion that may occur is expected to be confined to the Conceptual Footprint. Minimising soil erosion has been achieved by optimising the Development Envelope and Conceptual Footprint to reduce vegetation clearing and maintain intact and undisturbed soil surfaces as far as practicable.

Soil management procedures are in development and will be outlined in a Soil Management Plan, which will be incorporated into future updates of the MDCP and MCP. As part of these procedures, any cleared soil will be appropriately stockpiled using methods that reduce erosion, such as maintaining low (<2 m) stockpile heights and establishing vegetation.

Landforms will be designed to minimise erosion; and any residual impacts will be mitigated with temporary protective measures, until the landforms stabilise. The HS cell will be encapsulated to the north, south and east by the WRL and west by the LS cells. Retention bunds will be progressively installed during operations along the final tailings surface of the LS cells to control surface water and mitigate erosion. To further promote stability and minimise outer wall erosion, a rock armour external wall will be progressively constructed with competent NAF material. The LS cells will also be covered with an erosion protective cover to limit net infiltration; however, topsoil will be also added to promote a vegetation cover to further minimise erosion.

Dispersive waste material will be suitably encapsulated within the WRL, and areas of increased susceptibility will be armoured with competent NAF material. The outer profile of the WRL will also be modified post closure with an optimised berm-batter design, to promote stability, minimise surface erosion and promote vegetation regrowth.

Dust suppression controls (e.g. use of water carts) will also be implemented to minimise the effects of any wind erosion.

All relevant measures will be incorporated into a Soil Management Plan to be prepared, and undertaken in accordance with the requirements of the MDCP and MCP, to ensure closure objectives and post-mining land uses can be achieved.

### 11.5.2 Mitigation of Risks at Closure

An MCP has been prepared to address closure requirements for the Proposal (Appendix A03) consistent with DEMIRS (now DMPE) Guideline for Preparing Mine Closure Plans (2025b). The MCP will be updated regularly (at intervals not exceeding five years) to ensure its objectives remain relevant and aligned with stakeholder expectations and that its strategies and plan are appropriate to achieve closure outcomes. Final cover trials will be conducted during operations to support closure planning and long-term performance predictions in relation to the WRL and TSF.

To assess whether metal bioaccumulation in vegetation and into terrestrial food-webs after closure needs to be managed, the following investigations will be undertaken:

- Before mining, the Proponent will:
    - Determine the concentrations of a suite of metals in the tissue of key plant species in the MIA, to determine natural background levels of metals in vegetation in the area
    - Determine background levels of metals in the tissue of key lizard and snake species within the MIA, as reptiles are considered to be the most sensitive receptors for metal contamination in the area because of their limited range and their position in local food-webs. This testing will establish natural background levels of metals in these fauna groups for any monitoring that would take place after mine closure

- During LOM, undertake trials of the growth of key rehabilitation species in various mine-waste materials to determine whether the uptake of metals by plants is likely to be a significant environmental issue after mine closure.

The investigations will be incorporated into the regular MCP updates as these progress.

**Table 11-8: Application of the Mitigation Hierarchy for Terrestrial Environmental Quality**

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| Soil contamination from waste rock, plant feed or tailings spillage | **Measure to Minimise** | | | |
| | All waste rock will be characterised to inform the design of the WRL and TSF<br><br>PAF and NAF designations are within the geological and mining models to enable planning and safe storage of the PAF material<br><br>PAF material is to be stored within the core of the WRL, requiring ongoing waste rock identification and segregation of PAF waste<br><br>The WRL will be constructed bottom up to ensure effective PAF encapsulation<br><br>The internal slopes of the berms will be reverse sloped to ensure that the WRL drains internally<br><br>During Operations any AMD from plant feed stockpiles will be collected in perimeter drains and sumps and transported to the concentrator for amelioration during short-term processing<br><br>Visual inspection of the WRL and TSF for degradation of the outer competent material and NAF encapsulation material<br><br>Inspection and monitoring of the WRL perimeter drainage sumps, pumps and groundwater and surface water quality<br><br>The Proponent will prepare and regularly update the AMD S&MP (Appendix C07) consistent with the Leading Practice Sustainability Development Program for the Mining Industry (Australian Government 2016) | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of an MDCP and MCP | The proposed measures are consistent with standard industry practice for the management of AMD including:<br>• Preventing Acid and Metalliferous Drainage: Leading Practice Sustainability Development Program for the mining industry (Australian Government 2016)<br>• Global Acid Rock Drainage (GARD) Guide (INAP 2024)<br>• ARD Test Handbook: Project P387A: Prediction and kinetic control of acid mine drainage (AMIRA 2002)<br>• Treatment and Management of Soil and Water in Acid Sulfate Soil Landscapes (DER 2015b)<br>• Leading Practice Sustainability Development Program for the Mining Industry (Australian Government 2016)<br><br>Guidelines for MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br><br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Mine Stockpile operating procedures will include inspections and monitoring of drainage sumps, pumps, and ground and surface water quality<br><br>Minimisation of spillage risk will be central to TSF design, construction and operation<br><br>Emergency response and long-term recovery plans will be implemented in the event of a TSF failure<br><br>The Proponent will implement a TSF Operating and Maintenance Manual, which will include a:<br>• TARP to prevent loss of control to avoid potential TSF failures that could lead to spillage<br>• Emergency Preparedness Plan to monitor and address potential TSF failures | | | |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement. This will include:<br>• Installation of a store and release cover, constructed of NAF material, on the WRL to limit water ingress<br>• Reducing the overall slope angle of the WRL to 11° to reduce the effects of erosion and the potential to expose PAF Material | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MCP | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025)<br><br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DEMIRS 2025a)<br><br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed | | N/A | |
| | **Measure to Avoid** | | | |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| Soil contamination from TSF seepage | During operations, the HS tailings will be stored sub-aqueously within the TSF to avoid tailings exposure to oxygen and resulting acidification. Upon closure the HS tailings cells will also be progressively covered with low sulfur tailings followed by a thin rock cover | Proposal specific | Yes - DWER works approval and licence required for the construction and operation of a TSF and DMPE approval is required under the Mining Act for the implementation of a MDCP and MCP | A Works Approval will contain legally enforceable conditions to prevent, control, abate or mitigate pollution or environmental harm during the construction and commissioning of the Projects Prescribed Activities (DWER 2019c). An Operational Licence has similar conditions for the Operation of the Projects Prescribed Activities<br>Guidelines for MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025) |
| | **Measure to Minimise** | | | |
| | TSF design includes segregation of HS and LS materials | Proposal specific | Yes - DWER works approval and licence required for the construction and operation of a TSF and DMPE approval is required under the Mining Act | A Works Approval and Operational Licence will contain legally enforceable conditions to prevent, control, abate or mitigate pollution or environmental harm during the construction and commissioning of the TSF (DWER 2019c)<br>Guidelines for MDCPs are available and are consistent with industry-leading practice (DEMIRS 2025; DMPE 2025c)<br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | HS cells will be lined with a HDPE (or equivalent) geomembrane liner and a suitable subgrade layer<br>LS cells will be lined with a HDPE (or equivalent) liner<br>The final liner selection will be based upon liner laboratory testing and further review by industry experts | Proposal specific | | |
| | The TSF will be designed and operated in accordance with Global Industry Standard on Tailings Management (ICMM 2020), Rio Tinto standards and general good international practice | Standard practice | | |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | TSF design includes the WRL abutting and wrapping around the high sulfur storage cell as an increased control preventing failure | Proposal specific | | |
| | The TSF will have internal drainage with the internal slopes of its embankments directing surface water flows into the TSF cells | Standard practice | | |
| | Two reclaim water ponds will be constructed to receive supernatant from the TSF during operations. HS supernatant will only be directed to ponds during periods of excess water; however, since the HS tailings are not expected to oxidise, the pH is expected to be circum-neutral | Proposal specific | | |
| | A Winu Spill Response Management Plan will be developed and implemented during construction and operation<br>Spill kits will be located strategically throughout the MIA, and employees trained in their use | Standard practice | Yes – DWER operational licence will be required for appropriate management of potential emissions from the Proposal and a DMPE Dangerous Goods Licence will be required for the storage and transportation of chemicals including cyanide | A Part V of EP Act works approval, and licence will contain legally enforceable conditions to prevent, control, abate or mitigate pollution or environmental harm during the construction, commissioning and operation of prescribed activities (DWER 2019c)<br>A Dangerous Goods Site Licence will contain conditions pertaining to the storage of all dangerous goods present at the premises. Conditions will usually reflect requirements specified in the relevant Australian Standards |
| | **Measure to Rehabilitate** | | | |
| | At closure, the LS cells will be capped with a 0.5 m layer of NAF metasediment rock and a 0.2 m layer of topsoil. Meanwhile, the HS cells will have a 'tension saturated cover' consisting of 6.0 m LS tailings followed by a 0.5 m NAF metasediment rock capping layer | Proposal specific | Yes – DMPE approval is required under the Mining Act for the implementation of the MCP | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Further details will be provided in the MCP and will be refined through further study prior to mine closure (Appendix A03) | | | land use and closure outcomes (DEMIRS 2025a)<br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | At closure, spillways and retention bunds will be constructed on top of the covered TSF to control water discharge during heavy rainfall events. The spillways will direct water away from the HS cells to the LS cells and will be constructed of durable NAF material and a maximum gradient of 1:10<br>Further details are provided in the Winu TSF Closure Design report (WWL 2025b) noting future amendments are possible as the feasibility studies continue to progress towards the final feasibility stage (Appendix G08) | Standard practice | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement | Standard practice | | |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed | | N/A | |
| Soil contamination from plant feed stockpile seepage and/or runoff | **Measure to Minimise** | | | |
| | During Operations any AMD from mine stockpiles will be collected in perimeter drains and sumps and transported to the concentrator for amelioration during short-term processing<br>A basal clay layer will be laid before the placement of any PAF material in the stockpiles to avoid direct | Standard practice | Yes – DWER operational licence will be required for appropriate management of potential emissions from the Proposal and a DMPE Dangerous Goods Licence will be required | A Part V of EP Act works approval, and licence will contain legally enforceable conditions to prevent, control, abate or mitigate pollution or environmental harm during the construction, commissioning and operation of prescribed activities (DWER 2019c) |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | contact with any surface water flows and reduce AMD seepage volumes into the underlying soil<br><br>The Proponent will prepare and regularly update the AMD S&MP (Appendix C07) consistent with the Leading Practice Sustainability Development Program for the Mining Industry (Australian Government 2016)<br><br>Mine stockpiles containing PAF material will be built in small lifts and have traffic compacted low permeability layers underneath to minimise AMD percolation<br><br>Mine stockpile operating procedures will include inspections and monitoring of drainage sumps, pumps, and ground and surface water quality<br><br>A Winu Spill Response Management Plan will be developed and implemented during construction and operation<br><br>Spill kits will be located strategically throughout the MIA, and employees trained in their use | | for the storage and transportation of chemicals including cyanide | A Dangerous Goods Site Licence will contain conditions pertaining to the storage of all dangerous goods present at the premises. Conditions will usually reflect requirements specified in the relevant Australian Standards |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement. This will include:<br>• Installation of a store and release cover, constructed of NAF material, on the WRL to limit water ingress<br>• Reducing the overall slope angle of the WRL to 11 o to reduce the effects of erosion and the potential to expose PAF material | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MCP | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025)<br><br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DEMIRS 2025a)<br><br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | After mine closure, unprocessed stockpiles will be placed within the WRL. If the stockpile has PAF material, it will be stored in accordance with the AMD S&MP | | | undertaken as part of the Proposal (DEMIRS 2025b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed | | N/A | |
| Soil contamination from WRL seepage and/or runoff | **Measure to Minimise** | | | |
| | PAF material is to be stored within the core of the WRL, requiring ongoing waste rock identification and segregation of PAF waste<br><br>The WRL will be constructed bottom up to ensure effective PAF encapsulation. The movement of Heavy Mobile Equipment on the WRL will form compacted layers that will minimise seepage and restrict some oxygen movement<br><br>The internal slopes of the berms will be reverse sloped to ensure that the WRL drains internally<br><br>A basal clay layer will be laid before the placement of any PAF material in the WRL to avoid direct contact with any surface water flows and reduce AMD seepage volumes into the underlying soil<br><br>Visual inspection of the WRL for degradation of the outer competent material and NAF encapsulation material<br><br>Inspection and monitoring of the WRL perimeter drainage sumps, pumps and groundwater and surface water quality<br><br>The Proponent will prepare and regularly update the AMD S&MP (Appendix C07) consistent with the Leading Practice Sustainability Development | Standard practice | Yes – DWER operational licence will be required for appropriate management of potential emissions from the Proposal and a DMPE Dangerous Goods Licence will be required for the storage and transportation of chemicals including cyanide | A Part V of EP Act works approval, and licence will contain legally enforceable conditions to prevent, control, abate or mitigate pollution or environmental harm during the construction, commissioning and operation of prescribed activities (DWER 2019c)<br><br>A Dangerous Goods Site Licence will contain conditions pertaining to the storage of all dangerous goods present at the premises. Conditions will usually reflect requirements specified in the relevant Australian Standards |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Program for the Mining Industry (Australian Government 2016)<br><br>A Winu Spill Response Management Plan will be developed and implemented during construction and operation<br><br>Spill kits will be located strategically throughout the MIA, and employees trained in their use | | | |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement. This will include:<br>• Installation of a store and release cover, constructed of NAF material, on the WRL to limit water ingress<br>• Reducing the overall slope angle of the WRL to 11° to reduce the effects of erosion and the potential to expose PAF Material | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MCP | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025)<br><br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DEMIRS 2025a)<br><br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed | | N/A | |
| Soil erosion | **Measure to Minimise** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to minimise vegetation clearing where practicable | Standard practice | No | Project optimisation through reducing clearing extents is the most effective control to ensure impacts are as low as reasonability practicable |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Perimeter bunds will be constructed on the upper surface and benches of the WRL to ensure surface water retained within the bunds infiltrates into the WRL or evaporates<br><br>Topsoil stockpiles will not exceed 2 m in height and will be placed in the direction of the natural sand dunes to minimise wind erosion<br><br>Topsoil stockpiles will be vegetated where possible to increase evapotranspiration and minimise soil loss to erosion<br><br>WRL and TSF will be constructed with competent NAF material on the outside to minimise erosion<br><br>Dispersive waste material will be encapsulated within NAF material to control wind erosion and allow vegetation establishment<br><br>Visual inspection of WRL and TSF for degradation of the outer competent material and NAF encapsulation material<br><br>Dust suppression controls will be implemented to minimise the effects of wind erosion | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of an MDCP | Guidelines for MDCPs are available and are consistent with industry-leading practice (DEMIRS 2025; DMPE 2025c)<br><br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | **Measure to Rehabilitate** | | | |

| Potential Impact | Mitigation | Standard Business Practice or Proposal-Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement<br><br>Topsoil (from the two main soil units, Deep Sand and Gradational Sand) will be stockpiled for use in rehabilitation. Subsoils suitable for use in rehabilitation will also be stockpiled where practicable<br><br>Recovery and stockpiling of topsoil is intended for future use as a growth medium in rehabilitation works<br><br>Installation of a WRL store and release cover with topsoil and growth media placed over the top using competent material and final slope surface water runoff controls<br><br>WRL design entails a shallow slope with durable materials used on outer slopes to promote stability and minimise surface erosion | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MDCP and MCP | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br><br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DEMIRS 2025a)<br><br>The MDCP must also detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed | | N/A | |

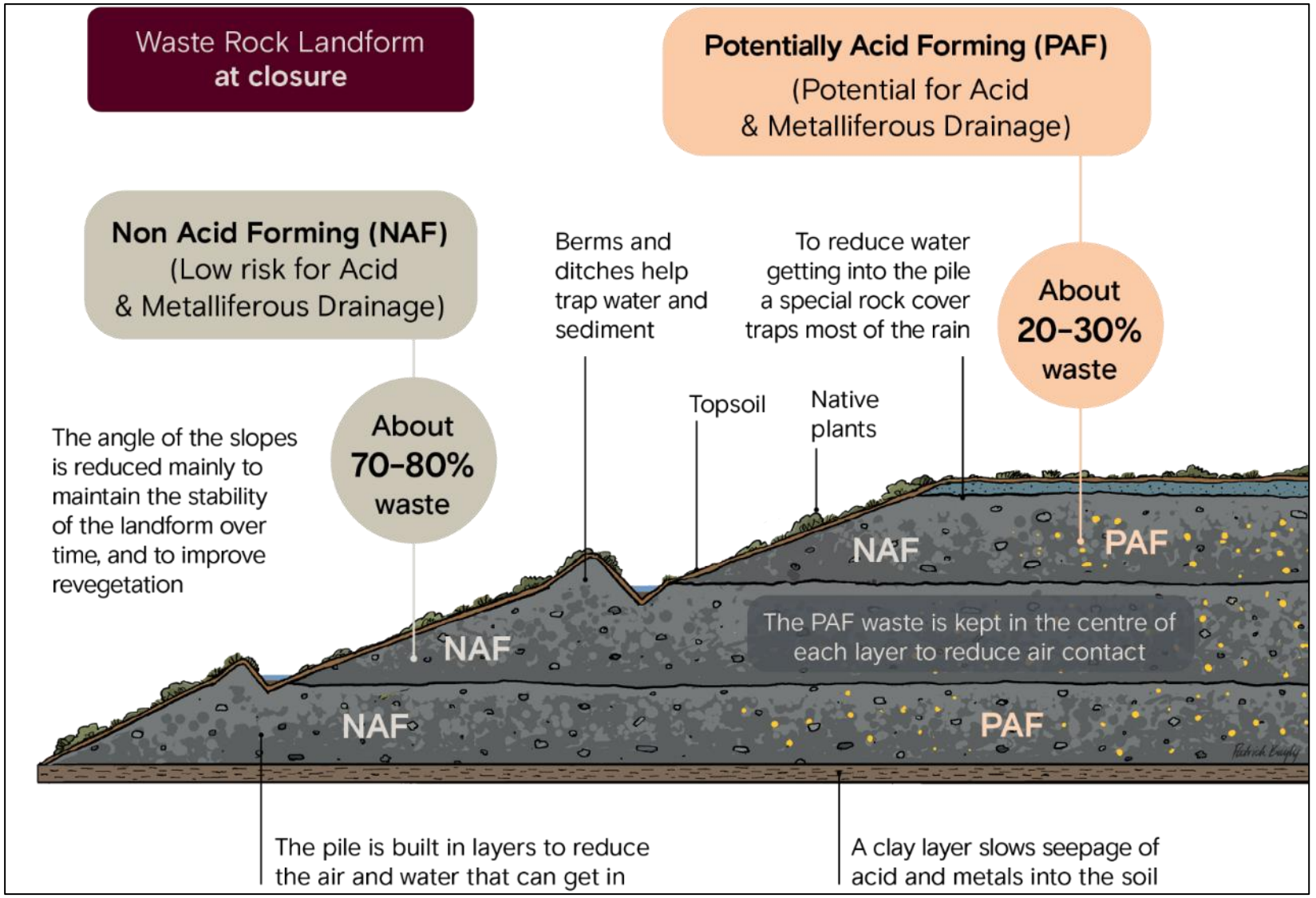



**Figure 11-9: WRL Conceptual Design**

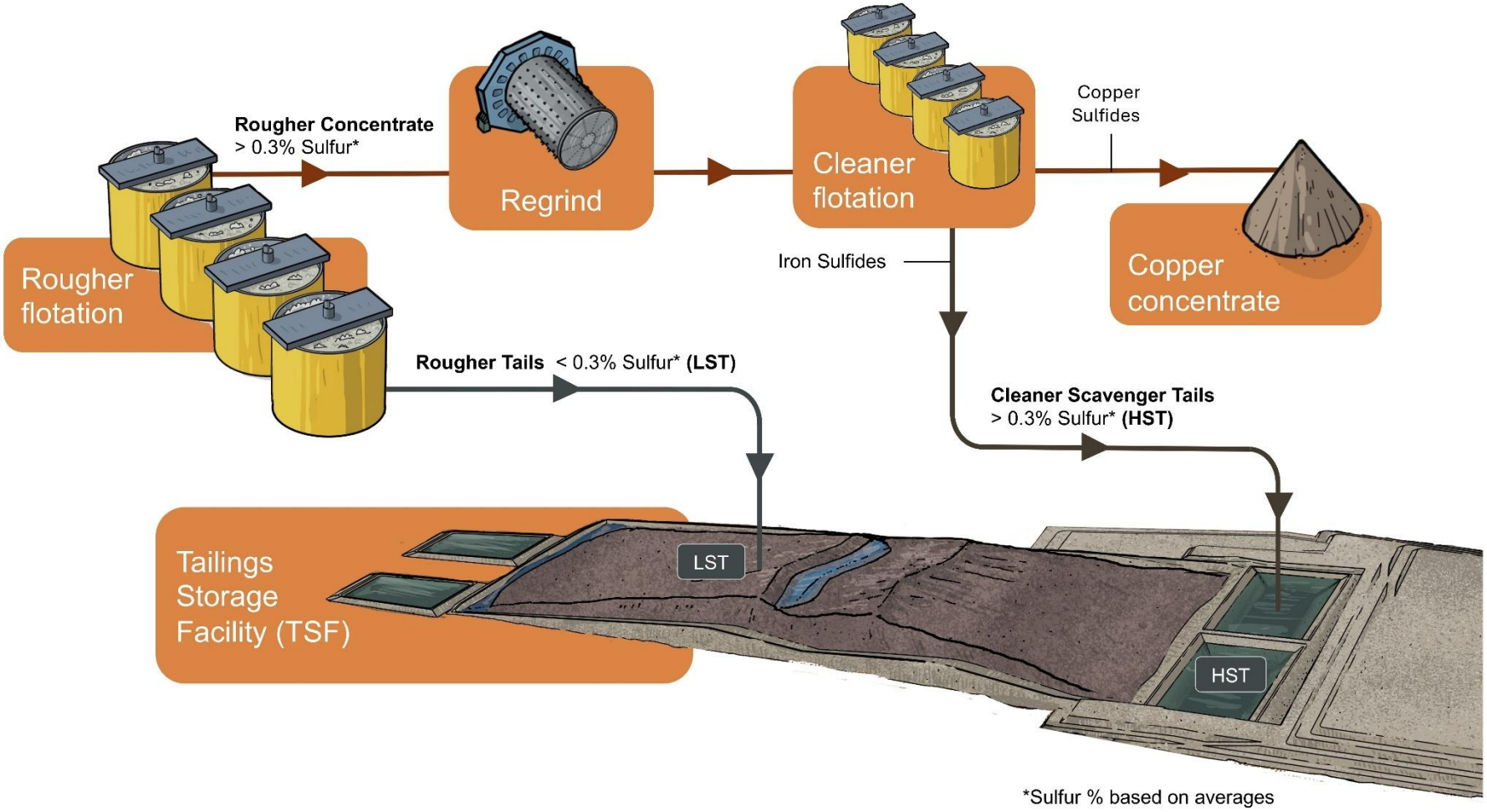



**Figure 11-10: TSF Conceptual Design (During Mining Operations) – High and Low Sulfur Tailings Streams from the Process Plant**

N

**Legend**

- Development Envelope
- Native Title Determinations
- Mining Lease

EMBANKMENT

RETURN WATER PONDS

LST 2

LST 1

HST

WASTE ROCK LANDFORM

EMBANKMENT

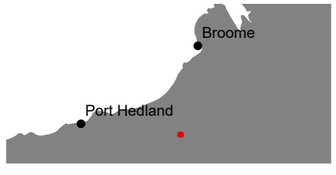
RioTinto

**Fig 11-11: TSF Conceptual Design (LST = Low Sulfur Tailings, HST = High Sulfur Tailings) – Plan View**

**Rio Tinto Copper (RTC)**

**Publisher:** Michael.Rouse
Date Published: Monday, 6 July 2026

**Coordinate System:**
GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter
**Scale:** 1:20,000
Rio Tinto © Copyright




0 1 2 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_InlandWaters.aprx Layout: ERD - Inland Waters - TSF Conceptual Design Plan View

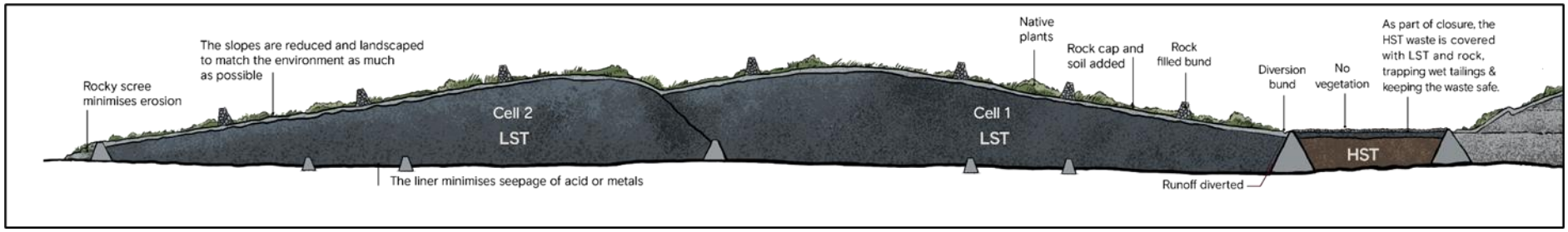



**Figure 11-12: TSF Conceptual Design (After Closure)**

## 11.6 Assessment of Significance of Residual Impacts

### 11.6.1 Assessment of Direct and Indirect Impacts

#### 11.6.1.1 Soil Contamination from Waste Rock, Mine Stockpiles or Tailings Spillage

Mitigation measures and proposed monitoring are discussed in further detail in the AMD S&MP (Appendix C07).

PAF material will be identified in advance using the geology and mining models, with supporting characterisation studies. PAF material will be tracked to be monitored.

Through the implementation of the AMD S&MP, the amount of mis-dumped PAF material is expected to be minimal and hence interaction with surrounding soil limited. and the Proponent therefore expects mineral waste spillage will not result in any significant residual impact on the environment.

The potential for any breach in tailings containment to occur is considered by the Proponent to be very low given the TSF will be:

- Designed and operated in accordance with international guidance, Rio Tinto standards and general good international practice
- Located on a geotechnically stable base (Section 11.3.4) and constructed from suitably competent materials (Section 11.3.3).

Furthermore, the positioning and design of the TSF - in terms of it being bounded by natural dune landforms and the WRL - provide a strong level of containment that will limit any potential for, and extent of, any tailings inundation following a wall breach, in the unlikely event this was to occur. The Proponent also considers that it will not be possible for a breach with potential to release high sulfur tailings to occur once the HS cells are contained by the WRL and the LS cells, approximately 11 years after commencement of TSF operations.

Management and monitoring of the TSF, including application of and responses to appropriate triggers and emergency preparedness, will occur through implementation of a detailed Operating and Maintenance Manual, to ensure the facility is operated in a safe and environmentally sound manner.

Through the management and mitigation measures outlined above the Proponent expects that the Proposal will not result in a significant residual impact on the environment due to TSF spillage.

#### 11.6.1.2 Soil Contamination from TSF Seepage

The Proposal will generate tailings as a copper and gold processing by-product. The TSF is specifically designed to control long term AMD through the segregation of HS and LS tailings (rather than combining the tailings into one process stream). This means that most of the TSF footprint will be LS tailings, with a small fraction comprising HS tailings.

As discussed (Section 7.6.2.1), the HS tailings, with the potential to become highly acidic will be stored sub-aqueously with the HS cell lined with a HDPE (or equivalent) membrane liner and constructed abutting the WRL (Figure 11-11). The LS tailings will be stored sub-aerially as these materials have a lower potential for acidification and thus mineral leaching. The LS cells will also be lined. The whole TSF has been designed to be internally draining. During processing within the process plant, the LS and HS supernatant will be dosed with lime before it is released to the TSF and the reclaim water ponds.

During operations, seepage would be extremely limited due to the use of liners with any seepage only moving a few centimetres into underlying soils over the life of mining (Section 7.6.2.1). Two lined reclaim ponds, to be constructed to the west of the TSF for additional water management, will enhance operational water recovery and reduce hydraulic head on the LS tailings liners, helping minimise seepage. These ponds are part of the closed-loop water recovery system and are not intended to discharge to the environment. The TSF design philosophy emphasises liner integrity and extremely low seepage rates for the water holding structures. After mine closure a cover will be placed over the

saturated HS tailings to limit the upward loss of water due to capillary rise. The cover over the LS tailings will encourage vegetation and aim to limit dust.

Through the management and mitigation measures outlined above the Proponent expects that the Proposal will not result in a significant residual impact on the environment due to TSF seepage.

#### 11.6.1.3 Soil Contamination from Plant Feed Stockpile Seepage and/or Runoff

Some mine stockpiles will result in the formation of AMD, particularly the runoff around secondary sulfide mine stockpiles. PAF primary sulfide mine stockpiles are likely to have an acidification lag greater than eight years.

To minimise the amount of AMD generated, the PAF mine stockpiles will be built on a low permeability pad and built in small lifts to control water flow through and minimise oxidation. The runoff from the secondary sulfide mine stockpiles and others that generate AMD will be collected and sent to the process plant for amendment. Water quality monitoring will occur around the facility to validate the AMD S&MP effectiveness.

After mine closure, the stockpiles will either be processed or placed within the WRL. If the stockpile has PAF material, it will be stored in accordance with the AMD S&MP.

With the implementation of the AMD S&MP controls, the SWMP and monitoring the Proponent expects the Proposal will not result in a significant residual risk to the environment due to soil contamination from plant feed stockpiles seepage and/or runoff.

#### 11.6.1.4 Soil Contamination from WRL Seepage and/or Runoff

The WRL design utilises closure in design concepts. Leading practice guidelines on building WRLs to minimise AMD have been adopted (INAP 2024). The critical design features to note that will limit AMD are (Section 7.6.2.1):

- PAF storage encapsulation within NAF waste to limit exposure to oxygen and water
- A low permeability basal layer to ensure seepage collection at the toe drain, limit infiltration and to raise the PAF material above the original ground level to prevent direct contact with PAF material with any water flowing at the ground/landform interface
- Bottom up construction - small lifts, to limit material segregation and tightly compact the waste dump to reduce oxygen ingress
- Final store and release cover to limit net percolation of rainfall.

Test work is currently underway with the University of Queensland (UQ) (third year of a five year research project), which is studying the relative benefit of compaction and source control methods in WRLs to control AMD seepage (CRC TIME Project 3.10: Improved prediction, remediation and closure of AMD/NMD sites by examination of mine waste behaviour at the meso-scale). Being a greenfield site, the focus of this research has been on drill core and how this material can be used (beyond industry standard applications) to inform WRL design (Zhang, Corzo Remigio, et al. 2025.

Given low concentrations and strong binding of metals in NAF material within the WRL the bioavailability of metals and metalloids will be negligible with no potential for significant uptake of contaminants into vegetation or transfer into food webs.

Modelling results show that infiltration represents only a small fraction of annual rainfall, and the majority is stored temporarily and then lost to evaporation, with negligible seepage (HGL 2024b; Section 7.6.2.1).

At closure, a cover will be placed on the surface of the WRL, reducing infiltration of rainfall from approximately 21% of precipitation to approximately 3 to 6% of precipitation and the progression of a wetting front through the WRL is expected to be negligible after closure (Section 7.6.2.1).

With the implementation of proposed design concepts, the Proposal will not result in a significant residual risk to the environment from WRL seepage and/or runoff.

#### 11.6.1.5 Soil Erosion from Clearing Native Vegetation and Constructed Landforms

The occurrence of soil erosion within the Development Envelope is unavoidable. This is due to the cohesionless and sandy soil units that dominate the surface and near-surface parts of the Development Envelope. However, this will be limited to disturbance areas within the Conceptual Footprint, and the Proponent is committed to implementing mitigation measures in line with best practice industry standards to minimise the extent and severity of any erosion within those areas. These mitigation measures include Conceptual Footprint optimisation, surface water management, topsoil and subsoil stockpile measures, appropriate WRL design and construction, and best practice rehabilitation and closure actions. Through implementing these mitigation measures the occurrence of soil erosion will be confined, with any potential impacts localised and then rehabilitated. With the application of these mitigation measures the Proponent expects that the Proposal will not result in a significant residual impact on the environment due to soil erosion.

## 11.7 Likely Environmental Outcomes

In consideration of the proposed management measures and likely residual impacts associated with the Proposal, the anticipated environmental outcomes that apply to Terrestrial Environmental Quality include:

- Minimise the Proposal's impact on soil conditions, including erosion and contamination, by implementing mitigation measures consistent with leading industry practices and government regulations.

Following the implementation of the mitigation hierarchy, no significant residual impacts were identified. As such, the Proponent considers that the Proposal can be implemented to meet the EPA’s objective for the Terrestrial Environmental Quality factor to maintain the quality of land and soils so that environmental values are protected.

# 12 LANDFORMS

## 12.1 EPA Environmental Factor Objective

The EPA Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) lists the following as its objective for Landforms:

**To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.**

For assessment by the EPA landforms are defined as the distinctive, recognisable physical features of the earth's surface having a characteristic shape produced by natural processes. A landform is defined by the combination of its geology (composition) and morphology (form) (EPA 2018b).

The significance of a landform can be assessed through consideration of the following characteristics (EPA 2018b):

- Variety
- Integrity
- Ecological importance
- Scientific importance
- Rarity
- Social importance.

## 12.2 Relevant Policy and Guidance

Table 12-1 presents the relevant policy and guidance for Landforms.

**Table 12-1: Relevant Policy and Guidance for Landforms**

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| **Environmental Protection Authority** | |
| Instructions on how to prepare an Environmental Review Document (EPA 2024e) | This document forms the basis of the headings and content provided in this ERD |
| Statement of Environmental Principles, Factors, Objectives and Aims for EIA (EPA 2023b) | The EPA objective for Landforms forms the basis of this assessment. This assessment has regard to the aim of EIA and consideration of significance |
| Environmental Factor Guideline: Landforms (EPA 2018b) | The information required for impact assessment has been considered in the scope of this chapter |
| **Other State or Commonwealth** | |
| Guidelines for Mine Closure Plans (DMPE 2025b) | The MCP has been prepared in accordance with the guidance. It addresses matters related to landform rehabilitation (Appendix A03) |
| Guideline for preparing Mining Development and Closure Proposals (DEMIRS 2025) | |
| Mining Development and Closure Proposal and Approvals Statement Framework (DMPE 2025c) | |
| Plan for our Parks (DBCA 2023b) | This plan has been considered for context and relevance in preparation of this ERD |

## 12.3 Receiving Environment

### 12.3.1 Studies

The aim of the key landform study was to assess the significance of the dominant dunal landform within the MIA (Table 12-2) (SLR 2025). The RAC and Rimfire were not considered in the landform assessment as neither involve potentially pronounced, larger-scale physical disturbance or other attributes that could influence landforms at a scale that could be considered significant.

The social importance of dunal landforms has not been considered in this aspect of the assessment as it is addressed under the Social Surroundings environmental factor (Section 6).

**Table 12-2: Summary of Technical Studies for Landforms Environmental Factor**

| Title | Location, Type and Timing | Consistency with Guidance |
|---|---|---|
| Winu Project: Landforms Assessment (SLR 2025)<br><br>(Appendix H01) | **Study Area:** 288,266 ha including the MIA and 20 km buffer; and sites in the Great Sandy Desert and Simpson Desert<br><br>**Type:** Landforms assessment<br><br>**Timing:** January 2025 | Prepared consistent with the EPA Factor Guideline for Landforms (EPA 2018b) |

### 12.3.2 Dominant Landform

An extensive system of linear sand dunes is present within the Great Sandy Desert IBRA bioregion (Section 12.3.3), including within the Development Envelope (SLR 2025). These dunes are the dominant landform within and surrounding the Development Envelope and are the focus of this assessment.

Analysis of the dune ridges did not identify any degradation or movement of the dunes over a 5-year period (SLR 2025). The landforms within the Survey Area are considered to be in good condition, intact and whole, and disturbance within the wider 20K area (the Survey Area plus a 20 km buffer) is limited.

### 12.3.3 Interim Biogeographic Regionalisation of Australia (IBRA)

The Proposal is predominantly situated within the Greater Sandy Desert IBRA bioregion, with a small portion located within the Dampierland bioregion. The Greater Sandy Desert bioregion is divided into six subregions, of which the Mackay and McLarty subregions are relevant to the Proposal. Within the Dampierland bioregion, the Pindanland subregion is relevant to the Proposal. The MIA is within the Mackay subregion.

The Great Sandy Desert bioregion is largely a tree steppe in the north, grading to shrub steppe in the south (SLR 2025). The bioregion is dominated by Quaternary red longitudinal sand dune fields overlying Jurassic and Cretaceous sandstones of the Canning and Armadeus Basins. Vegetation in the bioregion comprises open hummock grasslands of *Triodia pungens* and *T. schinzii* with scattered trees of Desert Walnut and Bloodwoods, and shrubs of *Acacia* spp, *Grevillea wickhamii* and *G. refracta.*

The Mackay subregion is described as the tropical inland ‘red-centre’ desert and includes the Percival and Auld palaeoriver systems (N. L. McKenzie et al. 2003).

### 12.3.4 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by DPIRD, outlining the distribution and provided comprehensive descriptions of biophysical resources, including soil and vegetation condition. The Development Envelope occurs within six land systems:

- Little Sandy - Sandplains with linear and reticulate dunes supporting shrubby spinifex grasslands
- Nita - Sandplains supporting shrubby spinifex grasslands with occasional trees

- Callawa - Highly dissected low hills, mesas and gravelly plains on sandstone and conglomerate supporting spinifex grasslands
- Buckshot - Gravelly sandplains and sporadic sand dunes supporting shrubby hard spinifex grasslands
- AB40 Atlas System - Gently undulating plain and dominated by longitudinal dunes, many exposures of ironstone gravels and some breakaways capped by ironstone
- B30 Atlas System - Largely stable linear dune fields with swales opening locally into sand plains. (Figure 12-1).

A small proportion of the total extent of the Little Sandy System (0.45%) and AB40 Atlas System (0.01%) occur within the MIA (Table 12-3).

**Table 12-3: Land Systems within the MIA**

| Land System | Description | Total Extent (ha) | Extent in MIA | |
|---|---|---|---|---|
| | | | ha | % of Total Extent |
| Little Sandy | Sandplains with linear and reticulate dunes supporting shrubby spinifex grasslands | 2,102,399 | 9,510.85 | 0.45 |
| AB40 Atlas System | Gently undulating plain and dominated by longitudinal dunes, many exposures of ironstone gravels and some breakaways capped by ironstone | 6,059,965 | 670.48 | 0.01 |

### 12.3.5 Local Assessment Units

Local Assessment Units (LAUs) have been defined in accordance with relevant EPA guidelines (EPA 2018b), to provide a basis for the consideration of landform significance and to inform assessment of potential landform changes (SLR 2025). LAUs are defined on a case-by-case basis and configured to include aspects of the environment, such as morphology or geology, to consider landforms within the broader landscape (EPA 2018b).

For the assessment of the dunal landform within the MIA, seven LAUs were defined by SLR (2025) to provide context at a local, regional and national scale (Figure 12-1):

- **Survey Area** (20,407 ha): the MIA and surrounding area (termed the Mine Development Area [MDA] in the study)
- **20K Area** (288,266 ha): the Survey Area plus a 20 km buffer
- Simpson Desert (90,000 ha)
- **Great Sandy Desert comparison sites 1, 2, 3 and 4:** all located outside the 20k Area but a similar size to the Survey Area.

### 12.3.6 Dunal Landforms within the Development Envelope

The Landform Assessment (SLR 2025) assessed dunal landforms within the MIA against the EPA criteria used to determine whether a landform is significant (Table 12-4) (EPA 2018b).

The landforms in the MIA are not significant when considered in a local and regional context according to the EPA criteria (SLR 2025). Nevertheless, given dunal landforms meet one of the five significance criteria, for integrity, for the purposes of this assessment dunal landforms within and surrounding the Development Envelope have been characterised as ‘important’ landforms.

The social importance of dunal landforms has not been considered in this aspect of the assessment as it is addressed under Social Surroundings (Section 6).

**Table 12-4: Assessment of Dunal Landforms within the Development Envelope**

| Criteria | Definition (EPA 2018b) | Assessment* |
|---|---|---|
| Variety | The landform is a particularly good or important example of its type. The landform is not well represented over the local, regional or national scale or differs from other examples at these scales, either naturally or as a result of cumulative impacts from existing and reasonably foreseeable activities, developments and land uses | A majority of the landforms within the Survey Area are part of Little Sandy Land System. Linear and reticulate dunes are well represented and a key feature of this land system<br><br>The Landform Assessment assessed the shape, slope and aspect of the landforms associated with the Survey Area and compared these with the landforms within the 20K Area, and comparison sites in the Great Sandy Desert. The comparison found some variations between the areas. However, when assessed against the significant variations associated with the Simpson Desert landform, it was concluded that although there is variation between the areas within the Great Sandy Desert, no characteristics were identified that indicate that the landforms within the Survey Area are significantly different to those in the 20K Area or more broadly within the Little Sandy Land System<br><br>The assessment determined that landforms within the Survey Area are well-represented locally and nationally. As such, **landforms within the Survey Area are not considered to represent landforms that are a particularly good example or any more important than those elsewhere in the region**<br><br>Landforms within the Survey Area are not considered significant with respect to the EPA's variety criterion |
| Integrity | The landform is intact, being largely complete or whole and in good condition | The Survey Area is located within a remote area with limited historical disturbance. Vegetation across the Survey Area was considered to be in Excellent condition, other than areas of cleared tracks and exploration drill pads (Western Botanical 2026a). The Landform Assessment analysis did not identify degradation or movement of dunes over a 5-year period<br><br>On this basis, **the landforms within the Survey Area are considered intact, whole and in good condition, meeting the EPA's landform criterion for integrity**<br><br>However, the Landform Assessment also indicates that most landforms across the region are likely to meet this criterion, therefore integrity is not considered to be a unique and key defining factor that potentially may have otherwise led to a conclusion that landforms in the Survey Area are significant |
| Ecological Importance | The landform has a distinctive or exclusive role in maintaining ecological and physical processes; for example, by providing a unique microclimate, source of water flow, or shade. The landform supports endemic or highly restricted plants or animals | Variations in slope, aspect, wind protection, moisture and soils may result in microhabitats for flora and fauna species within the landforms in the Survey Area. The Landform Assessment identified that the morphological variations across the landforms within the Survey Area are repeated across the 20K and the Great Sandy Desert comparison sites and are therefore not unique to each dune landform. As such, the microhabitats formed are also not considered to be unique<br><br>Flora, vegetation and fauna recorded within the Survey Area are typical of the region and local area (Western Botanical 2026a; Biota 2026h). No flora or fauna species have been identified that are restricted to any particular dune landform or system within the Survey Area<br><br>Given the microhabitats associated with the landforms in the Survey Area are not considered to be unique, and that no flora or fauna species that have been identified as endemic or restricted to landforms within the Survey Area, **the landforms within the Survey Area are not considered to meet the EPA's landform criteria for ecological importance** |
| Scientific Importance | The landform provides evidence of past ecological processes or is an important | Scientific interest in the landform within the Survey Area is limited to the studies associated with the Proposal<br><br>The dune landforms within the Survey Area may be utilised to evaluate past ecological and geological processes. However, no evidence suggests that |

| Criteria | Definition (EPA 2018b) | Assessment* |
|---|---|---|
| | geomorphological or geological site. The landform is of recognised scientific interest as a reference site or an example of where important natural processes are operating | these landforms are of particular interest or scientific importance compared to those in the 20K Area<br><br>No geoheritage sites have been mapped within the Great Sandy Desert. The nearest geoheritage site is located within the Pilbara bioregion, southwest of the Proposal<br><br>On this basis, **the landforms within the Survey Area are not considered to be of particular importance or scientific interest and; therefore, do not meet the EPA's landform criteria for scientific importance** |
| Rarity | The landform is rare or relatively rare, being one of the few of its type at a national, regional or local level | The Landform Assessment identified that the dune landforms within the Survey Area are numerous and well represented at a local and regional scale and are therefore not considered to be rare, relatively rare, or to be one of a few of its type at any scale<br><br>As such, **the landforms within the Survey Area do not meet the EPA's landform criteria for rarity** |

**Source: (SLR 2025) except where otherwise cited.*

120°30'0"E
121°0'0"E
121°30'0"E
122°0'0"E
122°30'0"E
20°0'0"S
20°30'0"S
21°0'0"S
21°30'0"S

Dampierland (DAL02)

Great Sandy Desert (GSD01)

Great Sandy Desert (GSD02)

Pilbara (PIL01)

Little Sandy Desert (LSD02)

Little Sandy Desert (LSD01)

Comparison Site 1

Comparison Site 2

Comparison Site 3

Comparison Site 4

20k Area

N




## Legend

- Mine Development Area*
- Winu Project Development Envelope
- 20k Area
- Comparison Site 1
- Comparison Site 2
- Comparison Site 3
- Comparison Site 4
- IBRA Subregions

### DPIRD Soil Systems

- AB40 Atlas System
- Little Sandy System

*Mine Development Area defined only for the purposes of the landform assessment, based on a generalised area covering the MIA.

RioTinto

**Figure 12-1: Landscape Assessment Units**

Rio Tinto Copper (RTC)

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:700,000
Rio Tinto © Copyright




0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: Landform Technical Assessment

## 12.4 Potential Environmental Impacts

### 12.4.1 Direct and Indirect Impacts

Potential direct and indirect impacts of the Proposal to Landforms have been identified as:

- Removal of locally important dunal landforms as a result of clearing and infrastructure
- Degradation of environmental values associated with locally important dunal landforms as a result of disruption to sediment flow.

Dunal landforms within the Survey Area (which includes the MIA) do not meet EPA landform criteria for variety, ecological importance, scientific importance or rarity as required to be considered significant landforms (Section 12.1). The landforms are considered to meet the criterion for integrity, however, given the remote location and limited disturbance, most landforms across the region are expected to meet this criterion. The intact nature and integrity of the landforms within the Survey Area is, therefore, not unique and not a key defining factor that would determine them to be significant landforms (SLR 2025). As they meet the integrity criterion, for the purposes of this assessment dunal landforms in the MIA have been characterised as important in a local context.

Within the Development Envelope, the Little Sandy Land System contains the dunal landforms that occur within the region. Within the MIA, 3,918 ha of the Little Sandy system will be disturbed, representing approximately 41% loss within the MIA, and a 0.2% loss against its total extent regionally (Table 12-3). Total disturbance within the Little Sandy land system is summarised within Table 12-5.

Potential related impacts relating to sediment flow and erosion as a result of the Proposal are addressed under the Inland Waters environmental factor (Section 7) and Terrestrial Environmental Quality environmental factor (Section 11).

**Table 12-5: Disturbance of Dunal Landforms**

| Land System | Extent within Conceptual Footprint (MIA) (ha) | Extent within Development Envelope (MIA) (ha) | Total Extent (ha) | Approximate % Loss within Development Envelope (MIA) | Approximate % Loss within Total Extent |
|---|---|---|---|---|---|
| Little Sandy | 3,918.8 | 9,511.9 | 2,102,399 | 41 | 0.2 |

### 12.4.2 Cumulative Impacts

The Proposal will contribute to the following cumulative impact at a regional scale, removal of dunal landforms. For the purposes of assessing potential impacts to Landforms, cumulative impacts have been considered based on any existing or reasonably foreseeable projects that occur within the two Land Systems present in the MIA (Section 12.3.4; Table 12-6).

Of all of the existing and reasonably foreseeable projects within 150 km of the Proposal (Section 2.3.9), only one – Telfer Project, Expansion of Telfer Gold Mine – included Landforms as a key environmental factor as part of its EP Act assessment. Given this, and that other mapping of specific landforms at a regional scale is not available, Land System mapping can be used as a surrogate for assessing the dunal landforms within the Development Envelope in a regional context. Where possible, the assessment has considered impacts based on the expected clearing footprints of each project. Where footprints are not publicly available, the entire development envelope of the project is used, to be conservative.

There is limited existing disturbance near the Proposal. The closest existing and reasonably foreseeable project is located approximately 35 km west of the MIA (AREH). Telfer Project, Expansion of Telfer Gold Mine is located approximately 115 km south-east of the MIA.

**Table 12-6: Cumulative Impacts on Land Systems within the MIA and Pilbara Region**

| Land System | Current Extent (ha) | Impact within MIA (ha) | Cumulative Impact | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Australian Renewable Energy Hub | Gas Pipeline to Nifty Copper Operations | Pardoo Irrigated Agriculture Project – Stage 3 | Telfer Project, Power Supply and Infrastructure Corridor | Telfer Project, Expansion of Telfer Gold Mine | Telfer-Havieron Gold Mining Project | Area (ha) | % of Current Extent |
| Little Sandy | 2,102,399 | 3,918.8 | 9,858.5 | 371.1 | - | 710.3 | 395.1 | 2,990.2 | 18,244.0 | 0.01 |
| AB40 | 6,059,965 | 670.48 | - | - | - | - | 19.7 | 2,856.0 | 3,546.2 | <0.1 |
| **Total** | **8,215,898** | **4,589.3** | **10,754.1** | **371.1** | **-** | **710.3** | **414.8** | **5,846.2** | **21,790.2** | **0.01** |

## 12.5 Mitigation

The Proponent is committed to ensuring that the Proposal avoids or minimises, where practicable, impacts on important landforms within the Development Envelope.

During Proposal design, the mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to mitigate the potential impacts of the Proposal on Landforms as far as practicable. Table 12-7 summarises the application of the mitigation hierarchy.

### 12.5.1 Avoidance and Minimisation

The Development Envelope and Conceptual Footprint was adjusted where possible, in consultation with the Traditional Owners, to avoid or minimise impacts on known significant environmental and ACH values, including with respect to dune landforms. This has included locating as many Proposal elements between dunes as practicable (refer to Section 2 [Figure 2-1 and Figure 2-2]).

Disruption to sediment flows from soil erosion during implementation of the Proposal cannot be wholly avoided only minimised; however, any soil erosion that may occur is expected to be confined to the Conceptual Footprint. Minimising soil erosion has been achieved by optimising the Development Envelope and Conceptual Footprint to reduce vegetation clearing and maintain intact and undisturbed soil surfaces as far as practicable. In order to keep the risk of sediment-laden stormwater runoff from disturbed areas impacting local surface water resources, the Proponent will ensure drainage from at-risk areas includes appropriate erosion and sediment controls. An Operational Surface Water Management Plan (Worley 2024c) (Appendix C01) has been prepared to outline the different stormwater management strategies and infrastructure for handling surface water runoff which will capture and contain sediment laden water flowing off mine infrastructure within drains and bunds, minimising potential uncontrolled sediment laden discharge outside approved disturbance areas. Further detail is provided in Sections 7 and 11.

Soil management procedures are also in development and will be outlined in a Soil Management Plan, to be incorporated into future updates of the MDCP and MCP.

### 12.5.2 Mitigation of Risks at Closure

The MCP has been prepared to address closure requirements for the Proposal (Appendix A03). The MCP will be updated regularly (at intervals not exceeding five years) to ensure its objectives remain relevant and aligned to stakeholder expectations and its strategies and plan are appropriate to achieve closure outcomes.

To meet closure outcomes and manage closure risks, the following strategies that relate to the Landforms environmental factor will be implemented at the Proposal:

- Rehabilitation of ex-pit waste rock landforms (WRLs), with design informed by waste characterisation, to ensure long term stability and minimise the risk of erosion
- Implementation of progressive rehabilitation to promote revegetation and habitat development
- Surface water and groundwater modelling to inform operations, closure planning and design and ensure no unacceptable impacts to sensitive receptors
- Rehabilitation monitoring of progressive rehabilitation to inform closure planning, closure outcomes and completion criteria development and refinement
- Ensure significant ACH values are protected and adequate post-mining land access is facilitated
- Design and placement of closure safety bunding to manage risks associated with inadvertent public access post-closure
- Removal of infrastructure to 1 m below ground level at closure unless otherwise agreed with relevant stakeholders

- Ongoing closure engagement with internal and external stakeholders to ensure technical and stakeholder input is considered and incorporated, where appropriate, into life of mine and closure planning and decision-making processes.

**Table 12-7: Application of the Mitigation Hierarchy for Landforms**

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| Removal of dunal landforms as a result of clearing and infrastructure | **Measure to Minimise** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to minimise impacts to dunal landforms where practicable by:<br>• Relocating infrastructure that avoids dunes wherever possible<br>• Utilising natural breaks in the dunal landforms for linear infrastructure such as roads, pipelines and powerlines | Proposal specific | No | Project optimisation through reducing clearing extents is the most effective control to ensure impacts are as low as reasonability practicable |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement<br>Elements to be considered for Landforms as part of rehabilitation design includes:<br>• Rehabilitation will be undertaken progressively to minimise disturbed areas<br>• Ensuring landforms are safe, stable and non-polluting<br>• Landform compatibility with the agreed post-mining land use<br>• Landforms to be aesthetically compatible with the surrounding landscape<br>• Landforms are appropriately located<br>• Rehabilitation will include using appropriate surface treatments on landforms | A Proposal specific MCP has been developed | Yes – DMPE approval is required under the Mining Act for the implementation of an MDCP and MCP (Appendix A03) | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b)<br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025)<br>Rehabilitation will be required to provide a vegetated and stable landform that is appropriately located and aesthetically compatible with the surrounding landscape |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limit proposed | | N/A | |
| Degradation of environmental values associated with dunal landforms as a result of disruption to sediment flow | **Measure to Minimise** | | | |
| | A network of ponds, drains and flood protection bunds will be installed around the MIA to redirect stormwater from mining operations<br>The Development Envelope and Conceptual Footprint have been modified during the design phase to minimise vegetation clearing where practicable | Standard practice | No | Project optimisation through reducing clearing extents is the most effective control to ensure impacts are as low as reasonability practicable |
| | Perimeter bunds will be constructed on the upper surface and benches of the WRL to ensure surface water retained within the bunds infiltrates into the WRL or evaporates<br>Drains and bunds will be monitored and managed to remove sediments to ensure they meet the designed volume requirements<br>Topsoil stockpiles will not exceed 2 m in height and will be placed in the direction of the natural sand dunes to minimise wind erosion<br>Topsoil stockpiles will be vegetated where possible to increase evapotranspiration and minimise soil loss to erosion<br>WRL will be constructed with competent NAF material on the outside to minimise erosion<br>Dispersive waste material will be encapsulated within NAF material to control wind erosion and allow vegetation establishment | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MDCP and MCP | Guidelines for preparing MCPs and MDCPs are available and are consistent with industry-leading practice (DEMIRS 2025; DMPE 2025b, 2025c)<br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b) |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | Visual inspection of WRL and TSF for degradation of the outer competent material and NAF encapsulation material | | | |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MDCP and MCP | Guidelines for preparing MCPs and MDCPs are available and are consistent with industry-leading practice (DEMIRS 2025; DMPE 2025b, 2025c)<br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limit proposed | | N/A | |

## 12.6 Assessment of Significance of Residual Impacts

### 12.6.1 Assessment of Direct and Indirect Impacts

As the landforms within the MIA are not considered significant according to the EPA's landform criteria (EPA 2018b; SLR 2025), the Proposal will not impact any significant landforms and the EPA's objective for this environmental factor, to maintain the variety, integrity, ecological functions and environmental values of landforms, will be achieved.

For the purposes of this assessment, dunal landforms are however considered important in a local context. Approximately 41% of the dunal landforms within the MIA will be affected by the Proposal, and therefore this impact could be considered potentially significant in a local context. However, this disturbance represents only approximately 0.2% of the dunal landforms surrounding the MIA, as represented by the extent of the Little Sandy Land System and; therefore, not significant in a regional context (Table 12-5).

Furthermore, the potential for degradation of environmental values associated with significant dunal landforms as a result of disruption to sediment flow is very low given these landforms within the MIA and surrounds are not considered significant and given the design and implementation of surface water management, which will minimise potential uncontrolled sediment laden discharge outside approved disturbance areas.

### 12.6.2 Assessment of Cumulative Impacts

The estimated cumulative impacts from this Proposal and reasonably foreseeable projects on Land Systems as relevant to Landforms in the context of the MIA are anticipated to be a total of approximately 21,790.2 ha (0.3% of the current subregional extent) (Table 12-6). The Proposal's contribution is approximately 4,589.3 ha (<0.1% of the current subregional extent and approximately 21% of total cumulative impact).

The maximum cumulative impact of clearing will be to the Little Sandy Land System, with a 0.01% loss of its current extent, with the Proposal contributing to the loss of 0.2% of this Land System (Table 12-6).

On this basis, and given that the dunal landforms within the MIA are taken to be locally important, but not significant according to the EPA's landform criteria (Section 12.1), the Proposal will not contribute to cumulative impacts to any significant landforms. Importantly, the social importance of dunal landforms has not been considered in this aspect of the assessment as it is addressed under the Social Surroundings environmental factor (Section 6).

## 12.7 Likely Environmental Outcomes

The anticipated environmental outcomes that apply to Landforms include:

- Disturbance of locally important dunal landforms, but this is not significant in a regional context
- No direct or indirect impacts to significant dunal landforms as a result of the Proposal.

As such, the Proponent considers that that the Proposal can be implemented to meet the EPA's objective for the Landforms factor to maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.

# 13 AIR QUALITY

## 13.1 EPA Environmental Factor Objective

The EPA Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) lists the following as its objective for Air quality:

**To maintain air quality and minimise emissions so that environmental values are protected**

For the assessment by EPA air quality is defined as the chemical, physical, biological and aesthetic characteristics of air (EPA 2020a).

## 13.2 Relevant Policy and Guidance

Table 13-1 presents the relevant policy and guidance for Air Quality.

**Table 13-1: Relevant Policy and Guidance for Air Quality**

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| **Environmental Protection Authority** | |
| Instructions on how to prepare an Environmental Review Document (EPA 2024e) | This document forms the basis of the headings and content provided in this ERD |
| Statement of Environmental Principles, Factors, Objectives and Aims for EIA (EPA 2023b) | The EPA objective for Air Quality forms the basis of this assessment. This assessment has regard to the aim of EIA and consideration of significance |
| Environmental Factor Guideline: Air Quality (EPA 2020) | The information required for impact assessment has been considered in the scope of this chapter |
| **Other State or Commonwealth** | |
| Guidelines for Mine Closure Plans (DMPE 2025b) | The MCP has been prepared in accordance with the guidance. It addresses matters related to soil management (Appendix A03) |
| Guideline for preparing Mining Development and Closure Proposals (DEMIRS 2025) | |
| Mining Development and Closure Proposal and Approvals Statement Framework (DMPE 2025c) | |
| A framework for developing mine-site completion criteria in Western Australia (Young et al. 2019) | |
| Air Quality Modelling Guidance Notes (DoE 2006) | This document has been considered in the dust impact assessment |
| A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites and remediation and other related activities (DEC 2011) | This document has been considered during the development of dust management measures |
| National Pollutant Inventory: Emissions estimation technique manual for Combustion engines (DEWHA 2008) | The estimates within this inventory have been considered in the scope of this chapter |
| National Environmental Protection Measure (NEPM) for Ambient Air Quality (NEPC 2021) | The triggers for assessment of air emissions have been considered in the scope of this chapter |
| Western Australia Air Emissions Guideline (DWER 2019) | |

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| Western Australia Dust Emissions Guideline (DWER 2021) | |

## 13.3 Receiving Environment

### 13.3.1 Studies

The aim of the dust emission surveys were to first measure the baseline levels of dust within the MIA, then assess the significance of any potential dust emissions resulting from the implementation of mining activities at the MIA on sensitive receptors (Red OHMS Group 2022; EAQ 2026). For the purpose of the study, 'mining activities' included drilling, mine blasting, loading/unloading, stockpiling, haulage/vehicle movements and erosion.

The potential dust emissions relating to the construction and operation of the RAC have not been modelled due to the road being sealed, however any potential impacts as a result of these activities will still be assessed in this chapter.

A benchmarking assessment was also undertaken to characterise and compare the air emissions of the diesel power station, with comparable projects (GHD 2025).

Table 13-2 summarises the types and timing for each of the surveys/studies relevant to the Air Quality environmental factor.

The aim of the dust emission surveys were to first measure the baseline levels of dust within the MIA, then assess the significance of any potential dust emissions resulting from the implementation of mining activities at the MIA on sensitive receptors (Red OHMS Group 2022; EAQ 2026). For the purpose of the study, 'mining activities' included drilling, mine blasting, loading/unloading, stockpiling, haulage/vehicle movements and erosion.

The potential dust emissions relating to the construction and operation of the RAC have not been modelled due to the road being sealed, however any potential impacts as a result of these activities will still be assessed in this chapter.

A benchmarking assessment was also undertaken to characterise and compare the air emissions of the diesel power station, with comparable projects (GHD 2025).

**Table 13-2: Summary of Technical Studies for Air Quality Environmental Factor**

| Title | Location, Type and Timing | Consistency with Guidance |
|---|---|---|
| Dust Impact Assessment of Proposed Mining Operations (EAQ 2026)<br>(Appendix I01) | **Location:** MIA<br>**Type:** Dust Impact Assessment<br>**Timing:** May 2026 | Prepared consistent with:<br>• EPA Guideline for Air Quality (EPA 2020)<br>• National Environmental Protection Measure (NEPM) for Ambient Air Quality (NEPC 2021)<br>• Western Australia Air Emissions Guideline (DWER 2019b)<br>• Air Quality Modelling Guidance Notes (DoE 2006) |
| Air Quality Emissions Comparison Assessment (GHD 2025)<br>(Appendix I02) | **Location:** MIA<br>**Type:** Benchmarking<br>**Timing:** June 2025 | Prepared consistent with:<br>• National Pollutant Inventory: Emissions estimation technique manual for Combustion engines (DEWHA 2008) |
| Rio Tinto Winu Baseline Dust Monitoring Final | **Location:** MIA<br>**Type:** Baseline | Prepared consistent with: |

| Title | Location, Type and Timing | Consistency with Guidance |
|---|---|---|
| Summary Report (Red OHMS Group 2022) | **Timing:** 22 September 2021 – 4 April 2022 | • EPA Guidelines for Air Quality (EPA 2020)<br>• National Environmental Protection Measure (NEPM) for Ambient Air Quality (NEPC 2021)<br>• Western Australia Air Emissions Guideline (DWER 2019b) |

### 13.3.2 Sensitive receptors

Impacts on air quality as a result of the Proposal have the potential to affect local communities' access and enjoyment of the areas surrounding the MIA. To assess the potential impacts of the Proposal on air quality, sensitive receptors in the vicinity have been identified. The identified sensitive receptors include locations where people are residing either on a temporary or permanent basis.

The Proposal is located in a remote location, with no surrounding residential areas or other sensitive receptors (Figure 13-1; Table 13-3). The nearest towns, Marble Bar and Nullagine, are approximately 190 km and 210 km south-west, respectively, from the Development Envelope at the MIA. Bidyadanga is the closest Aboriginal community, approximately 170 km north-east of the Development Envelope at the westernmost end of the RAC. Warrawagine Station is located approximately 100 km from the MIA. These and other sensitive receptors in the vicinity of the Proposal are shown in Table 13-3.

Three discrete receptors were established within the proposed accommodation village site for modelling dust concentrations and deposition resulting from the Proposal. It should be noted that while the village was utilised for modelling purposes, Proponent-operated mining camps are regulated by DMPE and managed under the Mining Act and *Work Health and Safety Act 2020* (WHS Act), and are not required to be assessed as sensitive receptors as part of this ERD.

The potential impacts, with respect to air quality, of the Proposal to ACH sites, are discussed in Section 6.

**Table 13-3: Distance of Sensitive Receptors to Proposal Infrastructure**

| Sensitive Receptor | Approximate Distance from MIA and Rimfire (km) | Approximate Distance from RAC (nearest point) (km) | Potential Impacts Addressed in this Section of the ERD |
|---|---|---|---|
| **Townsites** | | | |
| Marble Bar | 200 | 170 | Yes |
| Nullagine | 210 | 190 | Yes |
| **Residential** | | | |
| Accommodation village | 0 | 0 | No |
| Warrawagine Station | 100 | 70 | Yes |
| Sandfire Roadhouse | 120 | 30 | Yes |
| Mandora Station homestead | 140 | 20 | Yes |
| Wallal Downs homestead | 150 | 8 | Yes |
| Eighty Mile Beach Caravan Park | 150 | 9 | Yes |
| Bidyadanga | 230 | 170 | Yes |
| Punmu | 170 | 170 | Yes |

| Sensitive Receptor | Approximate Distance from MIA and Rimfire (km) | Approximate Distance from RAC (nearest point) (km) | Potential Impacts Addressed in this Section of the ERD |
|---|---|---|---|
| Irrungadji | 210 | 190 | Yes |
| Pardoo Roadhouse | 200 | 90 | Yes |
| **Other** | | | |
| Great Northern Hwy Turnoff | 140 | 0 | Yes |

The Proponent considers that there are no sensitive receptors close enough to the MIA and associated mining operations to be affected. In relation to the RAC, given the road will be sealed there is expected to be no impacts to air quality in the vicinity of any sensitive receptor.

120°0'0"E

122°0'0"E

20°0'0"S

22°0'0"S

N

Bidyadanga

Great Northern Hwy

200km

175km

150km

125km

100km

75km

50km

25km

Eighty Mile Beach
Caravan Park

WALLAL DOWNS

MANDORA

Sandfire Roadhouse
and Airport

Pardoo
Roadhouse

PORT HEDLAND

WARRAWAGINE

MARBLE BAR

Irrungadji

NULLAGINE

Punmu

## Legend

- Aboriginal Communities and Town Reserves (DPLH-002)
- Caravan Park
- Roadhouse
- Townsite
- Station/Homestead
- Great Northern Highway
- Development Envelope
- Pastoral Stations

0 25 50 Kilometres

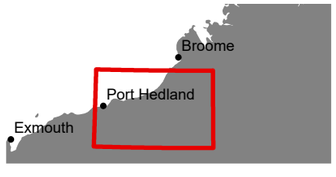
RioTinto

# Figure 13-1: Sensitive Air Quality Receptors (Human)

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter
**Scale:** 1:1,500,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Sensitive Air Quality Receptors

### 13.3.3 Climate

The climate and meteorological characteristics of the region control the dispersion, transformation and removal of pollutants from the atmosphere. The Proposal is located within the Paterson Province which experiences a semi-arid climate with extremely hot summers and warm winters (Section 2).

#### 13.3.3.1 Climate Modelling (TAPM)

The CSIRO's *The Air Pollution Model* (TAPM) for the 2020 annual period was utilised to generate a full prognostic dataset, to assess dust modelling scenarios (EAQ 2026). Climate data from the Pardoo (station number 004028) and Mandora (004019) Automatic Weather Stations (AWS) was used to inform the TAPM, in order to corroborate data from an onsite meteorological station at the MIA, utilised during exploration and siting activities in 2020.

The onsite data recorded similar wind direction patterns compared to the Pardoo and Mandora stations. North and north-westerly winds, and east, south-easterly winds were the dominant patterns recorded at the Winu site (Figure 13-2). The Winu site topography did not significantly affect wind direction (EAQ 2025).

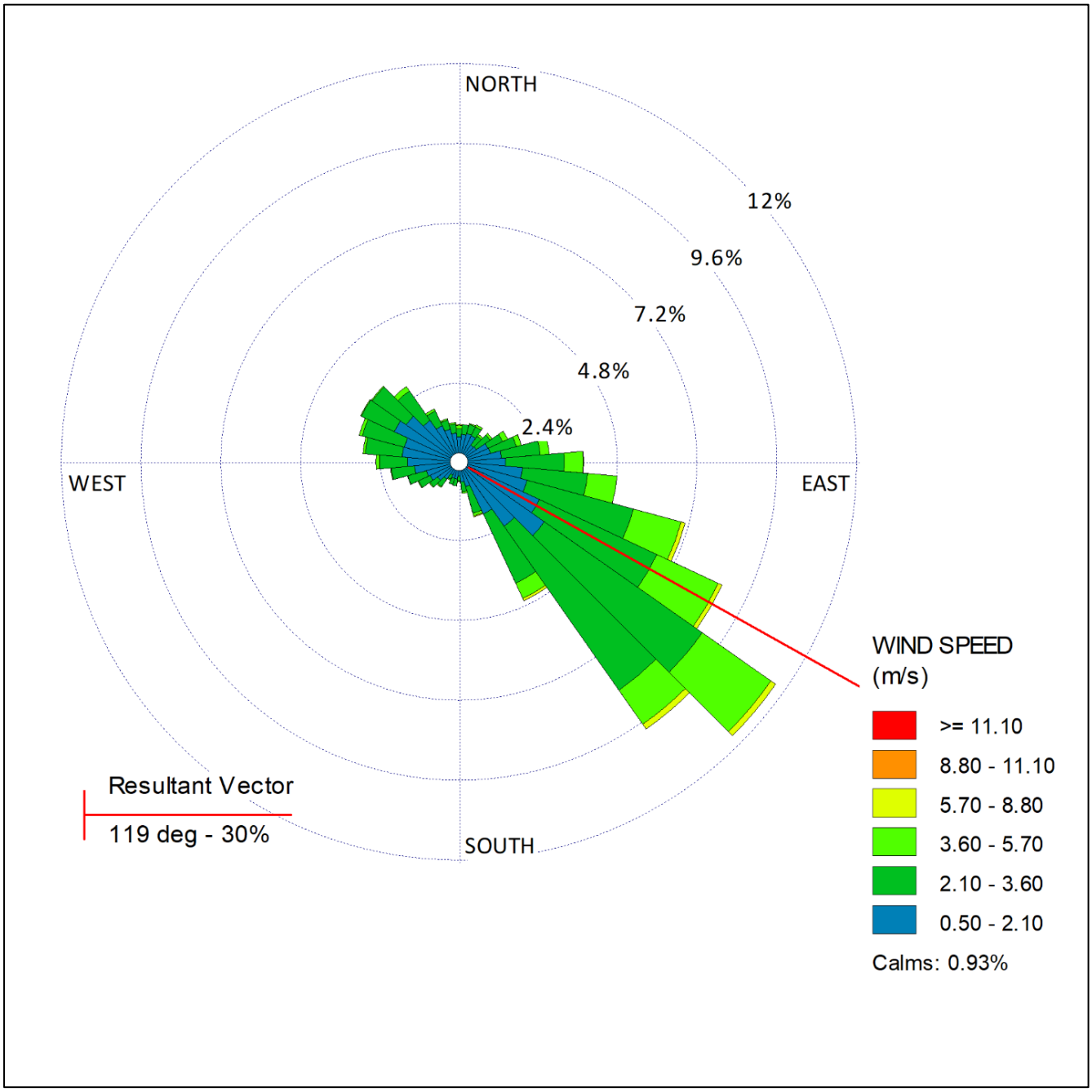
The BoM AWS's recorded slightly different meteorological characteristics to the MIA due to their coastal location. For example, the Pardoo site recorded large persistent rainfall events over monthly periods compared to the MIA, where rainfall tended to be characterised by seasonal 'bursts' of rain (EAQ 2026).

Monthly averages for rainfall, temperature, as well as wind direction and speed are presented in Table 13-4. Based on the local meteorology data and that of the TAPM prognostic output, EAQ (2026) considered the TAPM dataset reliably comparable to the onsite data collected. As such, a hybrid meteorological dataset was developed to represent the Proposal for modelling applications (EAQ 2026). Figure 13-2 shows the 'hybrid' output from the onsite and TAPM meteorological datasets that was used in the dust dispersion modelling that informs this impact assessment.

**Table 13-4: Rainfall and Temperature Data (2020)**

| Meteorological data | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average Rainfall (mm) (Onsite) | 57.2 | 15.8 | 0.00 | 0.00 | 47.6 | 0.00 | 0.00 | 0.40 | 0.00 | 4.80 | 24.2 | 35.0 |
| Maximum Temperature (°C) (Onsite) | 43.5 | 42.5 | 41.7 | 40.7 | 34.7 | 30.7 | 30.6 | 37.1 | 38.3 | 41.6 | 43.4 | 42.8 |
| Maximum Temperature (°C) (TAPM) | 40.6 | 39.5 | 38.3 | 36.9 | 29.6 | 24.0 | 24.5 | 31.5 | 33.9 | 38.1 | 39.0 | 39.0 |
| Average Wind Speed (m/s) (Onsite) | 2.9 | 2.7 | 1.8 | 2.1 | 2.5 | 2.4 | 2.4 | 1.9 | 2.0 | 2.5 | 2.3 | 2.7 |
| Average Wind Speed (m/s) (TAPM) | 2.4 | 2.3 | 1.9 | 2.2 | 2.8 | 2.5 | 2.7 | 2.2 | 2.3 | 2.2 | 2.2 | 2.3 |
| Average Wind Direction (degrees) (Onsite) | 199 | 220 | 191 | 185 | 126 | 118 | 123 | 183 | 182 | 215 | 222 | 182 |
| Average Wind Direction | 201 | 204 | 171 | 153 | 120 | 124 | 121 | 153 | 162 | 207 | 224 | 180 |

| Meteorological data | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (degrees) (TAPM) | | | | | | | | | | | | |




*Source: (EAQ 2026)*

**Figure 13-2: Hybrid Wind Rose - Meteorological Wind Characteristics 2020 (modelled)**

### 13.3.4 Types and Sources of Air Emissions

#### 13.3.4.1 Particulate Matter

Dust, also known as 'particulate matter (PM)' or 'airborne particulates', comprise various-sized particles ranging in size from less than 10 nanometres to more than 100 micrometres (µm) in diameter. Airborne particles are often categorised by their size as total suspended particles (TSP), inhalable particulates are classified as coarse fraction ($PM_{10}$) and fine fraction $PM_{2.5}$) (DEC 2011). Dust also includes smoke from combustion, pollens, sea salts and liquids (aerosols).

$PM_{10}$ and $PM_{2.5}$ are produced by a wide range of industrial and mineral processing activities as well as bushfires and dust storms. These particles are small enough to enter the body and cause adverse health effects over long periods (Red OHMS Group 2022). Definitions, as outlined by the draft Dust Emissions guidelines (DWER 2021c) are as follows:

- $PM_{2.5}$: Particulate matter with an aerodynamic diameter of less than or equal to 2.5 µm
- $PM_{10}$: Particulate matter with an aerodynamic diameter of less than or equal to 10 µm.

TSP is associated with nuisance impacts such as a reduction in visibility and terrestrial impacts from dust deposition (EAQ 2026). Definitions, as outlined by guidance are as follows (DWER 2021c):

- TSP: All particle sizes suspended in air
- Deposited Dust: Particulate matter that settles out from suspension in the air.

The leading dust emission is expected to be $PM_{10}$ particulates, and sources expected from Proposal include:

- Clearing and construction activities, such as bulk earthworks (MIA and RAC)
- Drilling and blasting (MIA)
- Handling and transfer of mineral resources and waste materials (MIA and RAC)
- Roads and haul road traffic (RAC)
- Wind erosion from stockpiles and open areas (MIA and RAC)

Estimated annual $PM_{10}$ emissions from the Proposal, based on the MIA, are listed in Table 13-5.

**Table 13-5: $PM_{10}$ Emissions (Mining) for 2032 Operations (Mine Only)**

| Activity | $PM_{10}$ (kg/yr) |
|---|---|
| Drilling | 34,598 |
| Blasting | 20,817 |
| Bulldozing | 33,905 |
| Wind Erosion (Topsoil) | 34,671 |
| Wind Erosion (Stockpiles) | 60,929 |
| Unloading (ROM, Waste) | 134,530 |
| Loading (Ore/Waste) | 352,510 |
| On-Mine Wheel Generated Dust | 7,415,801 |

*Source: (EAQ 2026)*

#### 13.3.4.2 Particulate Material Characteristics and Dust Potential

Dust characteristics reflect the physical properties of the material being mined. Materials closer to the surface (particularly sands and weathered sandstones) are less consolidated and generate more dust when disturbed.

As mining progresses deeper into more consolidated geological units, the amount of dust generated from excavation is expected to decrease as mining progresses through the different material types (Table 13-6; Figure 13-3).

The haul road will predominantly be made from the cemented sandstones due to coarseness, and ability to break down into a compacted form when applied to haulage. This is the material encountered early in the mine life and will be used to create the roads.

**Table 13-6: Key Material Types and their Dust Potential**

| Material Type | Description | Dust Potential |
|---|---|---|
| Sands (Quaternary/Aeolian Sands) | Unconsolidated to partially consolidated silty sands with up to 4% clay | Primary contributors to dust due to their loose structure |
| Permian Sandstones | Weathered sandstones with low plasticity | Dust potential decreases with depth due to increasing consolidation |
| Permian Mudstones (Oxidised and Reduced) | Silty to clayey units with low–medium plasticity | Lower dust generation potential compared with sands |
| Leachcap / Weathered Metasediments | Cobbly, coarse material | Coarse material with lower potential of fine dust generation |
| Copper Oxide and Secondary Sulphides | | |
| Fresh Metasediments | More competent rock, producing relatively coarse fragments | Minimal potential for fine dust |

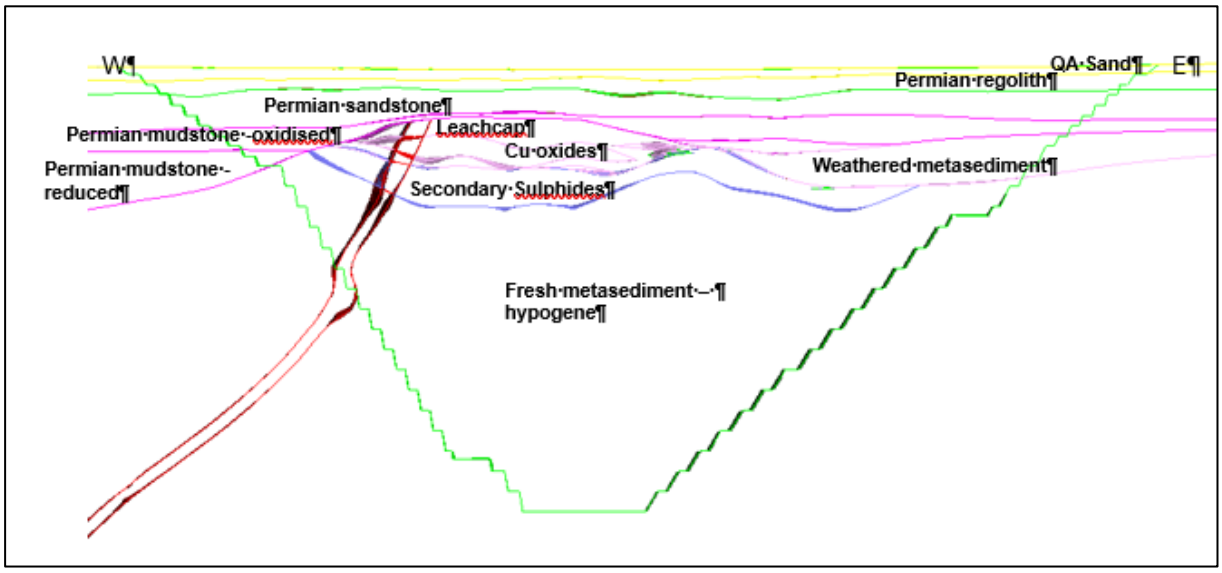



**Figure 13-3: Material Types within the Winu Pit**

#### 13.3.4.3 Gaseous Pollutants

Atmospheric gas emission sources expected from the Proposal include:

- Combustion of diesel fuel
- Extraction of metal from mineral resources
- Discharge of waste products into the air (i.e. from landfill and industrial processes).

The Proposal will result in the emission of gaseous pollutants through electricity generation and combustion of fuels within mining vehicles and equipment. These emissions will likely include (GHD 2025):

- Carbon Monoxide (CO): a gas produced by the incomplete combustion of fuels containing carbon. CO can harm human health, as it is absorbed through the lungs and reduces the blood's oxygen-carrying capacity. Carbon monoxide poisoning can result in death
- Nitrous Oxides ($NO_X$): refers to a mixture of nitrogen oxides, including nitric oxide (NO) and nitrogen dioxide ($NO_2$). They are primarily emitted from fuel burning processes and are significant air pollutants. NOx contributes to the formation of smog, acid rain, tropospheric ozone and can be harmful to human health
- Sulfur Dioxide ($SO_2$): a colourless gas produced from the burning of fossil fuels and in small amounts from extracting metal from minerals. $SO_2$ may react with compounds in the atmosphere and form haze, reducing visibility. It can also harm human health by irritating the lungs
- Volatile Organic Compounds (VOCs): refers to a group of chemicals that have a high vapor pressure at room temperature and readily evaporate into the air. Examples of VOCs include benzene, formaldehyde, toluene and acetone. VOCs are typically released from fuel via combustion or evaporation. Exposure to VOCs can cause respiratory problems and long-term effects such as liver or kidney damage.

These pollutants can potentially reach several kilometres from their source under favourable atmospheric conditions. However, gaseous pollutants typically rapidly disperse as they rise through the atmosphere, particularly, CO, NOx and VOCs. This results in the extent of any potential impact being limited to the vicinity of the release location (Zhou and Levy 2007).

Given the lack of nearby sensitive receptors and limited extent of potential pollutant dispersal, a formal air quality assessment was not undertaken. However, a benchmarking study was conducted by GHD (2025) to characterise and compare the emissions of the diesel power station at 10 Mtpa throughput, with comparable projects. The results of this study are presented in Table 13-7.

**Table 13-7: Average Emissions per Mega Watt hour (MWh) 2021/22-2023/24 (Kg/MWh)**

| Emission Type | Winu Proposal | Angaston | Bairnsdale | Owen springs | Esperance | Norseman |
|---|---|---|---|---|---|---|
| CO | 0.3 | 0.3 | 0.1 | 0.3 | 1.9 | 2.6 |
| $NO_X$ | 0.7 | 1.0 | 0.4 | 1.6 | 14.2 | 12.1 |
| $SO_2$ | >0.001 | 0.002 | 0.003 | 0.004 | 0.003 | >0.001 |
| VOCs | >0.01 | 0.1 | 0.1 | 0.1 | 0.4 | 0.6 |

Based on the benchmarking assessment, the Proposal demonstrates relatively low emissions per MWh of energy produced compared to the other sites, with CO levels similar to Angaston and Owen Springs but much lower than Esperance and Norseman. The Proposal's NOx emissions are modest, higher than Bairnsdale but well below Esperance and Norseman. $SO_2$ emissions are minimal and comparable across all sites, while VOCs emissions are the lowest among the assessed power stations.

The relatively low gaseous emissions can be attributed to the high penetration (approximately 85%) of renewable energy proposed for the Proposal, through the development of a wind farm and solar farm. These initiatives will reduce diesel requirements, and therefore emissions, by approximately 85%.

No impact to sensitive receptors is expected as a result of the Proposal, given:

- The proposed gaseous pollution emissions are relatively low to those of comparable projects
- Any potential impacts are limited to the immediate vicinity of the emissions source
- The nearest sensitive receptors are approximately 100 km or more from the emissions source.

Consideration of gaseous pollutants will; therefore, not be discussed further in this assessment.

### 13.3.5 Air Quality Criteria

Air quality criteria relevant to this assessment were obtained from the following standards:

- National Environmental Protection Measure (NEPM) for Ambient Air Quality (NEPC 2021)
- Western Australia Air Emissions Guideline (DWER 2019b)
- Western Australian Dust Emissions Guidelines (DWER 2021c).

The ambient air quality assessment criteria are based on amenity impacts and the protection of human health. A summary of the criteria applied to this Proposal are presented in Table 13-8.

The 24-hour average criteria and the annual average criteria are utilised to assess potential short-term health impacts and potential long-term health impacts of dust emissions, respectively.

**Table 13-8: Air Quality Assessment Criteria Applicable to the Proposal**

| Substance | Averaging Period | Percentile | Standard - Maximum Ambient Concentration (µg/m3) | Environmental Value | Source |
|---|---|---|---|---|---|
| Particles ($PM_{2.5}$) | 24 hours | $100^{th}$ | 25 | Human Health | (DWER 2019b; NEPC 2021) |
| | Annual | | 8 | | |
| Particles ($PM_{10}$) | 24 hours | | 50 | | |
| | Annual | | 25 | | |
| TSP | 24 hours | | 90 | Human Health & Amenity | (DWER 2019b) |
| Deposited Dust | 4 $g/m^2$/30 days (maximum) | | | Amenity / Nuisance | (DWER 2021c) |
| | 2 $g/m^2$/30 days (above background) | | | | (DWER 2021c) |

### 13.3.6 Baseline Air Quality

On a regional scale, the Pilbara is an inherently dusty environment, with wind-blown dust and wildfires being significant contributors to particulate loading. An aggregated emission inventory was undertaken in 2000, which estimated that approximately 170 kt of particulate material was emitted due to wind erosion in the Pilbara and a further 195 kt due to wildfires (SKM 2003).

Baseline ambient air quality data for the MIA were studied in 2022 (Red OHMS Group 2022). Two *Met One E-sampler units* were placed approximately 2.5 km south-west of the proposed accommodation village to collect $PM_{10}$ and $PM_{2.5}$ data for a period of approximately six months.

No background ambient suspension values (TSP), or ambient deposition values have been recorded for the locality.

The Winu $PM_{10}$ baseline dust results are supported by previous regional background dust measurements undertaken by BHP in 2015, as a part of the BHP Pilbara Strategic Environmental Assessment (EAQ 2026). Although, the 2015 results represent regional dusts within the broader Pilbara

iron ore operational region, they offer a more comprehensive assessment of background dust levels and were incorporated into the modelling of cumulative dust emissions (Section 13.4.1) (EAQ 2026).

The results of both baseline dust assessments are presented in (Table 13-9).

The background dust concentrations in the Pilbara region were identified in 2015, and have been incorporated into the dust modelling report (EAQ 2026).

**Table 13-9: Background Dust Concentrations**

| Particulate Type | MIA | | BHP (24 hr Average ug/$m^3$) |
|---|---|---|---|
| | Typical Range ug/$m^3$ | Peak ug/$m^3$ | |
| $PM_{2.5}$ | 2-10 | 15.8 | 3 |
| $PM_{10}$ | 2-10 | 16.5 | 18 |
| TSP | NA | NA | 33 |

*Source: (Red OHMS Group 2022; EAQ 2026)*

## 13.4 Potential Environmental Impacts

Potential impacts of the Proposal to air quality have been identified as follows and discussed below:

- Increased dust particulates as a result of the construction and operation of the Proposal (MIA and RAC) - affecting human health and amenity at sensitive receptors.

The potential impacts of dust emissions associated with the Proposal with respect to Social Surroundings are discussed in Section 6.

### 13.4.1 Cumulative Impacts

The Proponent will implement dust management measures to reduce dust particulate emissions over the life of mine. The Proposal may result in a minor, temporary increase in localised dust above established background concentrations (Table 13-9).

There is limited existing disturbance in the area surrounding the Proposal, with the closest major projects located approximately 116 km south-west of the MIA (Woodie Woodie) and 120 km south-east of the MIA (Telfer). Given the localised and temporary nature of the dust emissions, the absence of nearby sensitive receptors, the Proposal will not contribute to cumulative impacts to air quality.

## 13.5 Mitigation

The Proponent is committed to ensuring that the Proposal avoids or minimises, where practicable, impacts on air quality.

During Proposal design, the mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to mitigate the potential impacts of the Proposal on air quality as far as practicable. Table 13-10 summarises the application of the mitigation hierarchy.

### 13.5.1 Avoidance and Minimisation

Soil erosion during implementation of the Proposal cannot be wholly avoided only minimised; however, any soil erosion that may occur is expected to be confined to the Conceptual Footprint. Minimising soil erosion has been achieved by optimising the Development Envelope and Conceptual Footprint to reduce vegetation clearing and maintain intact and undisturbed soil surfaces as far as practicable.

Soil management procedures are in development and will be outlined in a Soil Management Plan, which will be incorporated into future updates of the MDCP and MCP. As part of these procedures, any cleared soil will be appropriately stockpiled using methods that reduce erosion, such as maintaining low (<2 m) stockpile heights and establishing vegetation.

Landforms will be designed to minimise erosion; and any residual impacts will be mitigated with temporary protective measures, until the landforms stabilise. The HS cell will be encapsulated to the north, south and east by the WRL and west by the LS cells. Retention bunds will be progressively installed during operations along the final tailings surface of the LS cells to mitigate erosion. To further promote stability and minimise outer wall erosion, a rock armour external wall will be progressively constructed with competent NAF material. The LS cells will also be covered with an erosion protective cover; however, topsoil will be also added to promote a vegetation cover to further minimise erosion.

Dispersive waste material will be suitably encapsulated within the WRL, and areas of increased susceptibility will be armoured with competent NAF material. The outer profile of the WRL will also be modified post closure with an optimised berm-batter design, to promote stability, minimise surface erosion and promote vegetation regrowth.

Dust suppression controls (e.g. use of water carts) will also be implemented to minimise the effects of any wind erosion.

The RAC will be sealed, which will substantially minimise wheel-generated dust from transportation into and out of the MIA. The concentrate product will also be transported in covered containers to ensure dust emissions are negligible during operations

All relevant measures will be incorporated into a Soil Management Plan to be prepared, and undertaken in accordance with the requirements of the MDCP and MCP, to ensure closure objectives and post-mining land uses can be achieved.

### 13.5.2 Mitigation of Risks at Closure

The MCP has been prepared to address closure requirements of the Proposal (Appendix A03). The MCP will be updated regularly (at intervals not exceeding five years) to ensure its objectives remain relevant and aligned to stakeholder expectations and its strategies and plan are appropriate to achieve closure outcomes.

To meet closure outcomes and manage closure risks, the following strategies that relate to the Air Quality environmental factor will be implemented at the Proposal:

- Rehabilitation of ex-pit WRLs, with design informed by waste characterisation, to ensure long term stability and minimise the risk of erosion
- Implementation of progressive rehabilitation to reduce dust emissions
- Ongoing closure engagement with internal and external stakeholders to ensure technical and stakeholder input is considered and incorporated, where appropriate, into life of mine and closure planning and decision-making processes.

**Table 13-10: Application of the Mitigation Hierarchy for Air Quality**

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| Increased dust particulates as a result of the construction and operation of the Proposal, including from power generation (MIA and RAC) - affecting human health and amenity at sensitive receptors | **Measure to Minimise** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to minimise vegetation clearing where practicable | Standard practice | No | Project optimisation through reducing clearing extents is the most effective control to ensure impacts are as low as reasonability practicable |
| | Topsoil stockpiles will not exceed 2 m in height and will be placed in the direction of the natural sand dunes to minimise wind erosion<br>Topsoil stockpiles will be vegetated where possible to increase evapotranspiration and minimise soil loss to erosion<br>The WRL and TSF will be constructed with competent NAF material on the outside to minimise erosion<br>Dispersive waste material will be encapsulated within NAF material to control wind erosion and allow vegetation establishment<br>Visual inspection of WRL and TSF for degradation of the outer competent material and NAF encapsulation material<br>HS tailings will be stored sub-aqueously, limiting the potential for wind erosion<br>Dust emission controls will be implemented to minimise the effects of wind erosion, including the use of dust suppressants on working surfaces and stockpiles as required, speed limits, as well as training and education for staff<br>The RAC will be sealed, which will substantially minimise wheel-generated dust from transportation into and out of the MIA | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of an MDCP | Guidelines for MDCPs are available and are consistent with industry-leading practice (DEMIRS 2025; DMPE 2025c)<br>The MDCP must detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025) |

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| | The concentrate product will be transported in covered containers to ensure dust emissions are negligible during operations | | | |
| | The power solution incorporates approximately 85% renewable energy penetration<br>Key power station pollutants will be limited and controlled under the PPA | Proposal specific | No | Minimising is the second step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) |
| | Ensuring proper maintenance, such as regular servicing, cleaning, and using quality fuel | Yes | No | |
| | **Measure to Rehabilitate** | | | |
| | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP (Appendix A03) consistent with DMPE guidance (DMPE 2025b; DEMIRS 2025) and in accordance with the requirements of the Mining Act Approvals Statement<br>Topsoil (from the two main soil units, Deep Sand and Gradational Sand) will be stockpiled for use in rehabilitation. Subsoils suitable for use in rehabilitation will also be stockpiled where practicable<br>Recovery and stockpiling of topsoil is intended for future use as a growth medium in rehabilitation works<br>Installation of a TSF store and release cover with topsoil and growth media placed over the top using competent material, final slope surface water runoff controls (Section 11)<br>WRL design has been reshaped to reduce slope, with durable materials used outer slopes to promote stability and minimise surface erosion | Standard practice | Yes – DMPE approval is required under the Mining Act for the implementation of the MDCP and MCP | Guidelines for MCPs and MDCPs are available and are consistent with industry-leading practice (DMPE 2025b; DEMIRS 2025; DMPE 2025c)<br>The MCP must detail all legal obligations for rehabilitation and closure that affect post-mining land use and closure outcomes (DMPE 2025b)<br>The MDCP must also detail all mitigation and management actions for all potentially environmentally hazardous mining activities undertaken as part of the Proposal (DEMIRS 2025) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limit proposed | | N/A | |

## 13.6 Assessment of Significance of Residual Impacts

### 13.6.1 Dust Emissions from MIA

For the purposes of determining the risk of dust emissions from mining activities within the MIA on nearby sensitive receptors, an AERMOD (atmospheric dispersion modelling system) assessment was undertaken. The results of this assessment were compared against the Western Australia Air Emissions Guideline modelling criterion for dust (DWER 2021c; EAQ 2026), as shown in Table 13-8.

Based on the modelling undertaken, mining activities within the MIA are expected to generate high concentrations of dusts (EAQ 2026). The impacts to surrounding sensitive receptors have been assessed based on TSP (which indicates nuisance dust and dust deposition), $PM_{10}$ and $PM_{2.5}$ (which indicate impacts relating to human health).

#### 13.6.1.1 TSP Concentrations and Dust Deposition

The 24-hr TSP model results for MIA mining activities were compared to the criterion of 90 µg/m$^3$ (EAQ 2026). The results for the MIA indicate that:

- Dust concentration decay (reduction in dust concentration over time) is 'rapid' when moving north and south across and relatively 'slow' east and west due to the persistence of the east-west winds that carry dust for longer distances over time
- TSP concentrations exceed the 24-hr TSP criterion of 90 µg/m$^3$ at the accommodation village (approximately 10 km west of the MIA)
- Exceedance of this criterion (90 µg/m$^3$) was restricted to an area approximately 10 to 20 km north and south of the MIA and 20 to 40 km east and west of the MIA (Figure 13-4).

Monthly dust deposition was also compared to the maximum criterion of 4 g/m$^2$/30 days (EAQ 2026). The results indicated dust deposition rates are predicted to be low approximately 10 km from MIA mining activities, with approximately 0.16 to 0.26 g/m$^2$ recorded at the accommodation village (EAQ 2026).

Given Warrawagine Station is the closest sensitive receptor (located approximately 100 km from the MIA), it is not considered that TSP or dust deposition associated with mining activities in the MIA is likely to impact nearby townsites, communities or station homesteads.

#### 13.6.1.2 $PM_{10}$ and $PM_{2.5}$

The proposed accommodation village was assessed from three discrete receptors, which were placed within the village area representing the entrance (receptor IDs 1 and 2) and the middle (3) (Table 13-11). The 24-hr concentrations of $PM_{2.5}$ and $PM_{10}$ for MIA mining activities were compared to the latest DWER and subsequent NEPM criteria of 25 µg/m$^3$ and 50 µg/m$^3$ respectively (EAQ 2026) (Table 13-11). The results for the MIA indicate that:

- Predicted 24-hr concentrations of $PM_{2.5}$ and $PM_{10}$ exceed the 24-hr criterion at the accommodation village.
- The number of exceedances of the $PM_{10}$ 24-hr criterion at the accommodation village range between 19-50 hours annually and 14-36 hours annually for $PM_{2.5}$. Modelling shows these exceedances are limited to worst-case meteorological conditions
- Exceedance of this criterion is restricted to an area approximately 10 to 20 km north and south and 20 to 40 km east and west of the MIA, respectively (Figure 13-5 and Figure 13-7)

Annual concentrations of $PM_{2.5}$ and $PM_{10}$ for MIA mining activities were compared to the latest DWER and subsequent NEPM criteria of 8 µg/m$^3$ and 25 µg/m$^3$ respectively, and no exceedances were recorded (Table 13-11; Figure 13-6 and Figure 13-8).

**Table 13-11: Winu Accommodation Village Dust Exceedances Peak Concentrations***

| Representative Receptor I.D | $PM_{2.5}$ (µg/m³) | | | | $PM_{10}$ (µg/m³) | | | |
|---|---|---|---|---|---|---|---|---|
| | 24-Hr Criterion | 24-Hr | Annual Criterion | Annual | 24-Hr Criterion | 24-Hr | Annual Criterion | Annual |
| 1 | 25 | 58.6 | 8 | 4.1 | 50 | 179.5 | 25 | 12.7 |
| 2 | | 48.3 | | 3.7 | | 149.7 | | 11.4 |
| 3 (middle) | | 49.4 | | 3.1 | | 148.1 | | 9.7 |

*Source (EAQ 2026)*

#### 13.6.1.3 Cumulative Impacts $PM_{10}$ and $PM_{2.5}$

The cumulative 24-hr $PM_{2.5}$ and $PM_{10}$ concentrations (which incorporates background concentrations) were compared to the criterion of 25 µg/m³ and 50 µg/m³, respectively, while annual $PM_{2.5}$ and $PM_{10}$ concentrations were also compared to the criterion of 8 µg/m³ and 25 µg/m³, respectively (Table 13-12).

The results indicated that maximum 24-hr $PM_{2.5}$ and $PM_{10}$ concentrations may exceed the relevant criteria at the accommodation receptors under the conservative peak operating scenario. Annual $PM_{2.5}$ concentrations remain below the annual criterion at all assessed camp receptors, while annual $PM_{10}$ concentrations exceed the annual criterion at one location (receptor ID 1; Table 13-12). TSP 24-hr concentrations at the accommodation receptors exceed the criterion; however, modelled monthly dust deposition remains well below both the maximum and above-background deposition criteria (Table 13-12). As mentioned, dust emissions at Proposal accommodation will be managed under the Mining Act and WHS Act.

**Table 13-12: Winu Accommodation Village Cumulative (including Background) Dust Predictions**

| Representative Receptor I.D. | $PM_{2.5}$ (µg/m³) | | | | $PM_{10}$ (µg/m³) | | | |
|---|---|---|---|---|---|---|---|---|
| | 24-Hr Criterion | Cumulative 24-Hr | Annual Criterion | Annual | 24-Hr Criterion | Cumulative 24-Hr | Annual Criterion | Annual |
| 1 | 25 | 44.1 | 8 | 3.3 | 50 | 257.0 | 25 | 31.7 |
| 2 | | 48.0 | | 3.0 | | 228.2 | | 22.4 |
| 3 (middle) | | 39.4 | | 2.9 | | 191.8 | | 15.4 |
| | TSP (µg/m³) | | | | Deposition (g/m²/30 days) | | | |
| | 24-Hr Criterion | | Cumulative 24-Hr | | Criterion | Above-background Criterion | Monthly Max | |
| 1 | 90 | | 349.8 | | 4 | 2 | 0.211 | |
| 2 | | | 307.4 | | | | 0.186 | |
| 3 (middle) | | | 318.6 | | | | 0.142 | |

*Source: (EAQ 2026)*

#### 13.6.1.4 Conclusion

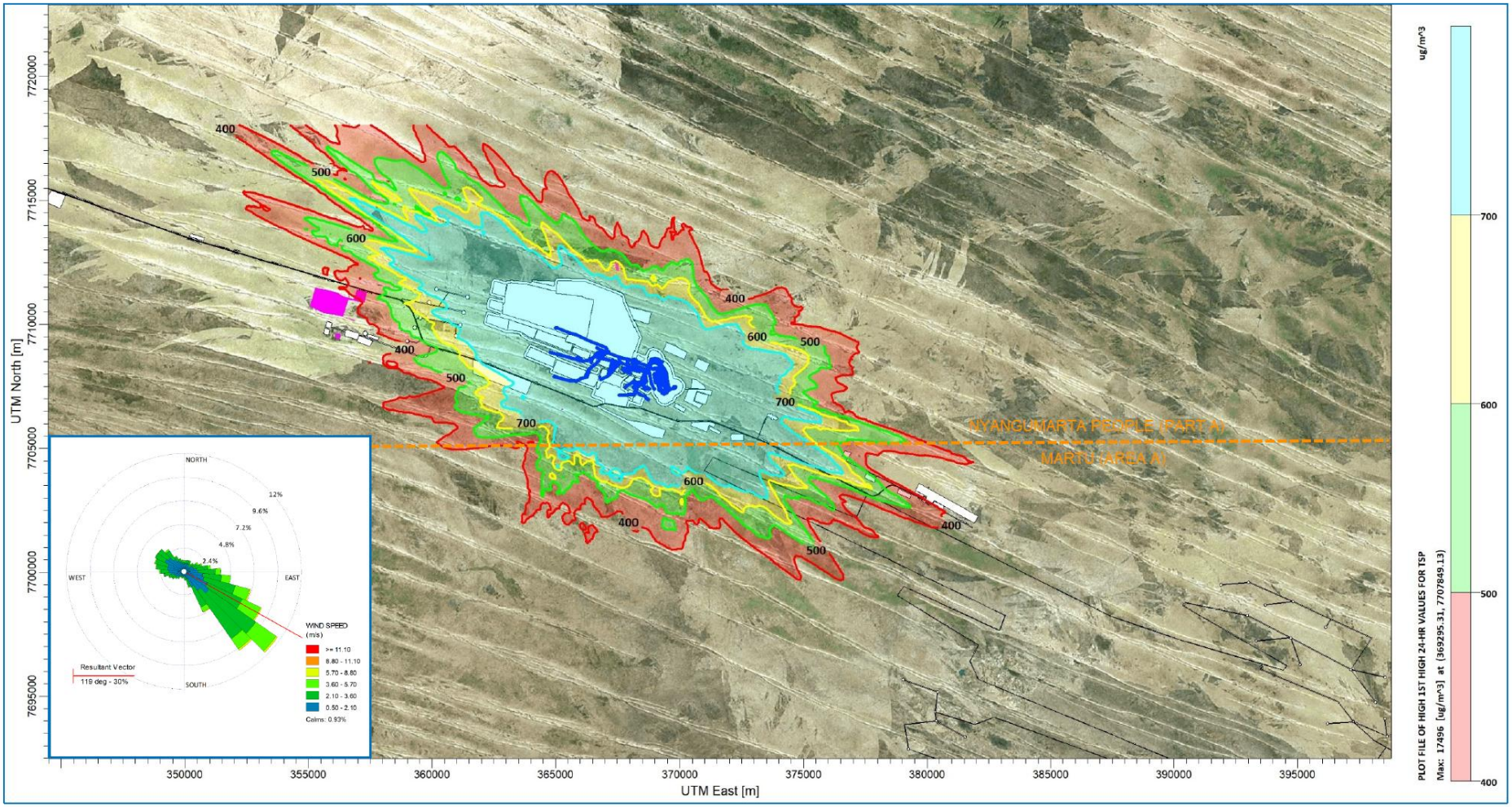
While modelling indicates that short-term particulate concentrations may exceed guideline criteria under conservative, worst-case conditions, these exceedances will be localised and episodic (EAQ 2026). The combination of low to moderate background concentrations, conservative modelling assumptions, directional wind patterns and intermittent receptor use supports the conclusion that overall risk to human health and amenity is limited.

Furthermore, given the considerable distance of the MIA to the nearest sensitive receptor (Warrawagine Station), located approximately 100 km from the MIA, the Proponent considers emissions from the MIA can be appropriately managed through standard dust mitigation and operational controls. As such, human health and amenity will not be impacted at any of the sensitive receptors identified outside the Development Envelope (Table 13-3) due to dust emissions from Proposal mining activities.

### 13.6.2 Dust Emissions from the RAC

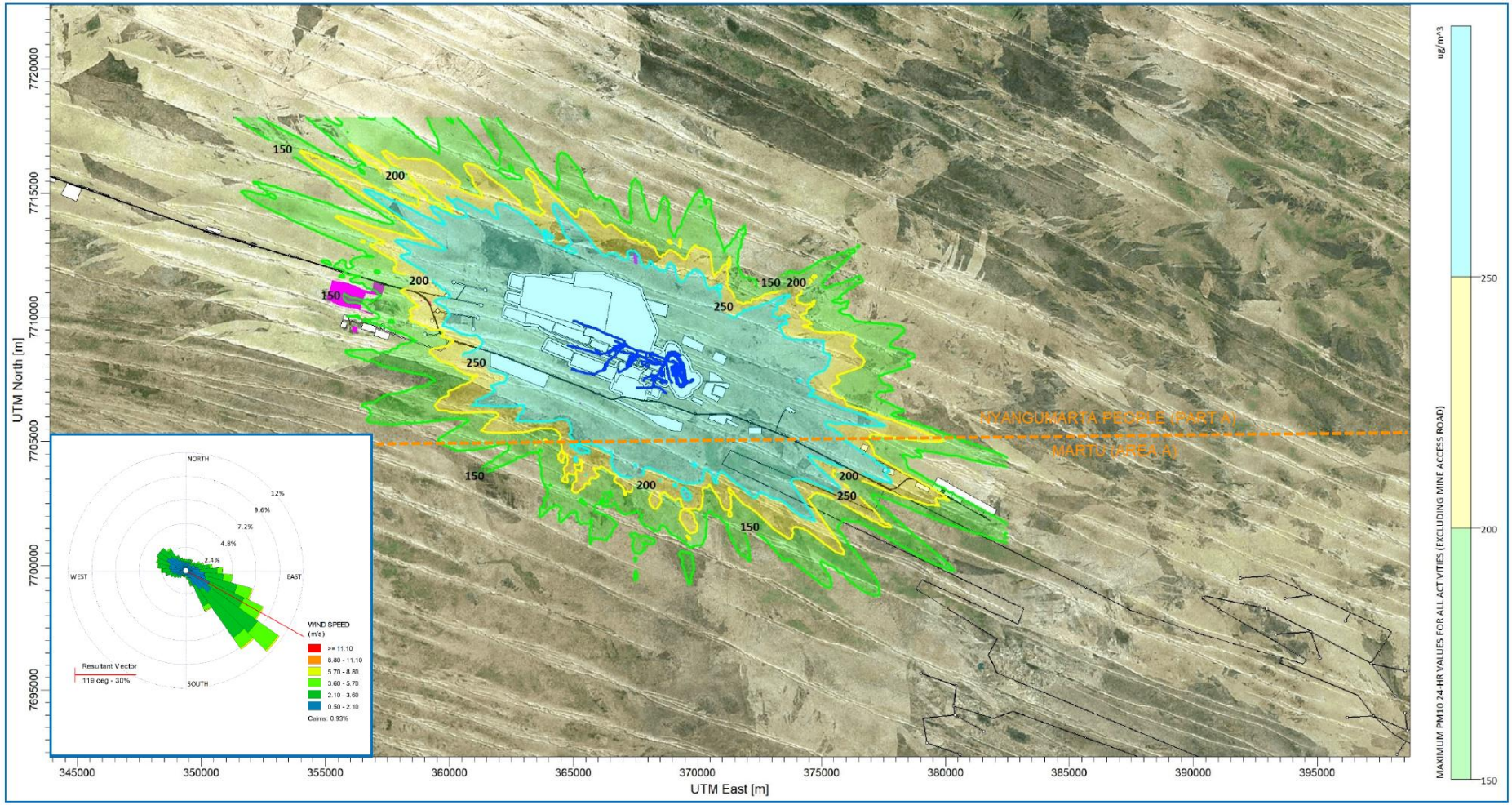
No modelling has been undertaken for the construction of upgrades and operation of the RAC; however, dust emissions from these activities will be temporary in nature and negligible in extent and magnitude given:

- Construction of the road will occur over a short timeframe, with any dust emissions relatively short-lived and concentrated at isolated sections of the road as construction progresses along the 183 km route. Industry standard mitigation measures will be implemented to minimise dust emissions, including the use of dust suppressants on working surfaces and stockpiles as required, speed limits, as well as training and education for staff
- The RAC will be sealed, which will substantially minimise wheel-generated dust from transportation into and out of the MIA. The concentrate product will be transported in covered containers to ensure dust emissions are negligible during operations
- Effective isolation from sensitive receptors. The only sensitive receptors within 10 km of the RAC are the Wallal Downs homestead (8 km), the Great Northern Hwy Turnoff (0 km - intersects RAC) and Eighty Mile Beach Caravan Park (9 km).



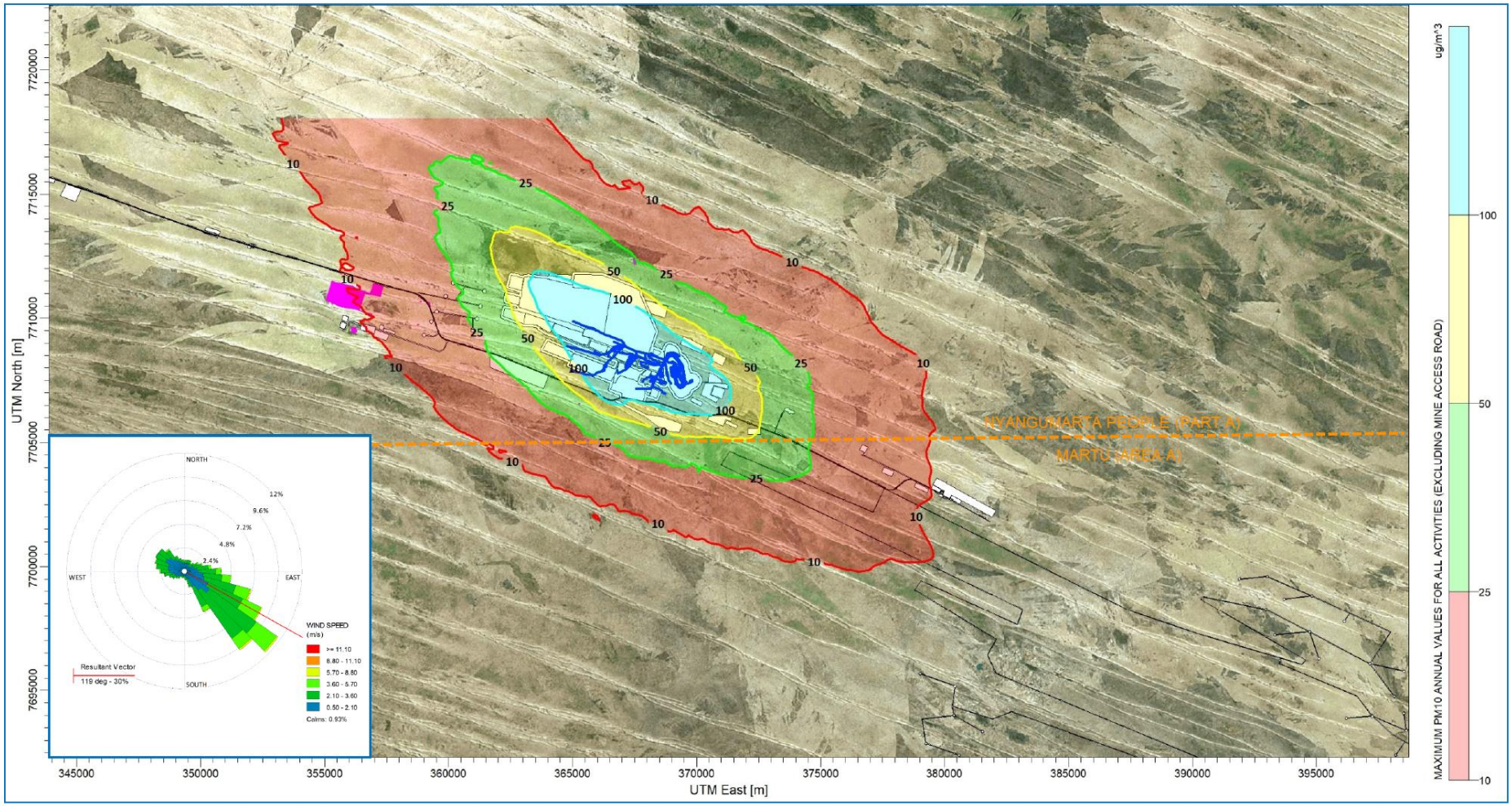

*Source: (EAQ 2026)*

**Figure 13-4: Mine-Only TSP 24-Hr Ground Level Concentrations (µg/m$^3$)**



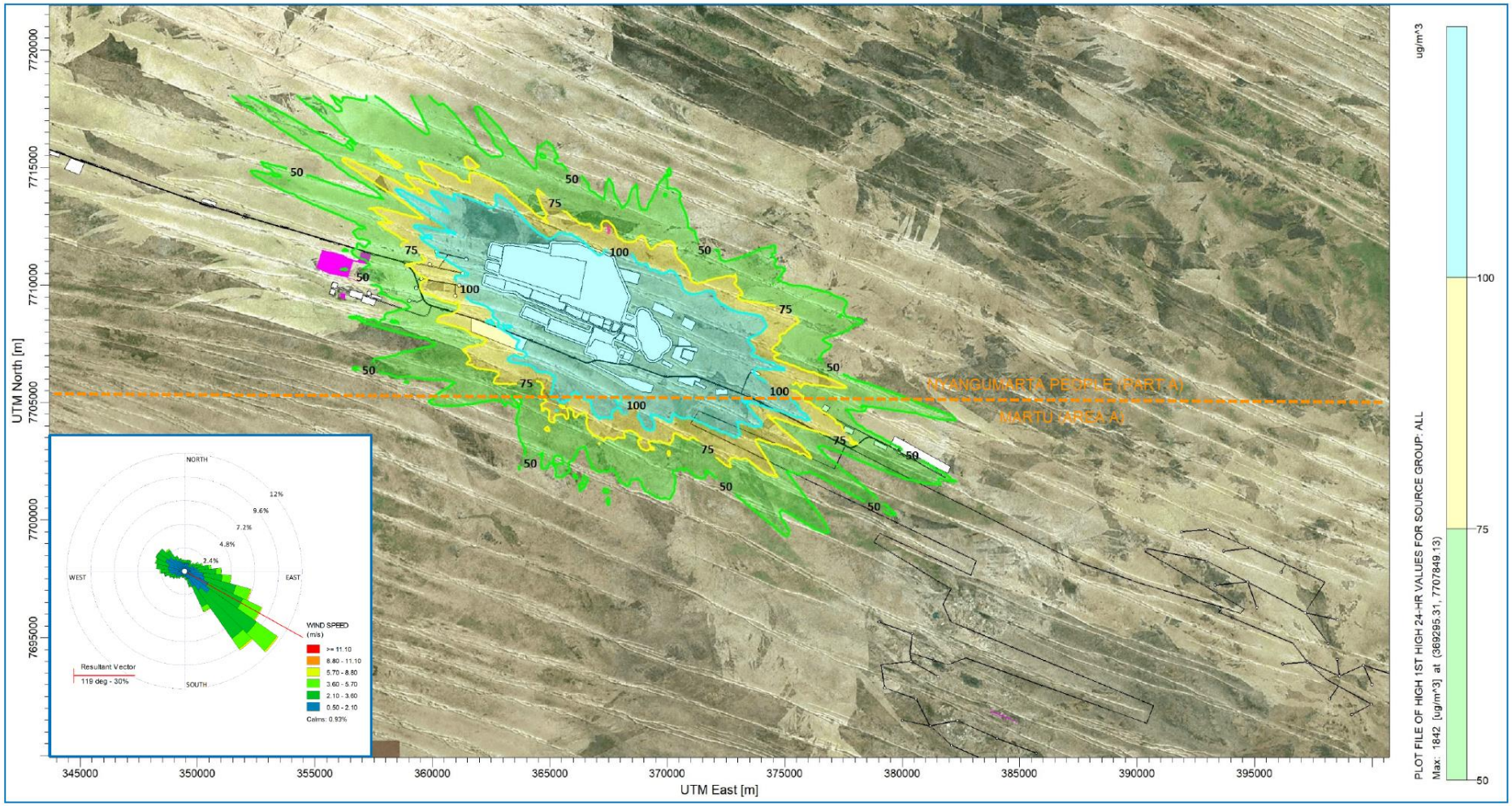

*Source: (EAQ 2026)*

**Figure 13-5: Mine Only $PM_{10}$ 24-Hr Ground Level Concentrations (µg/m$^3$)**



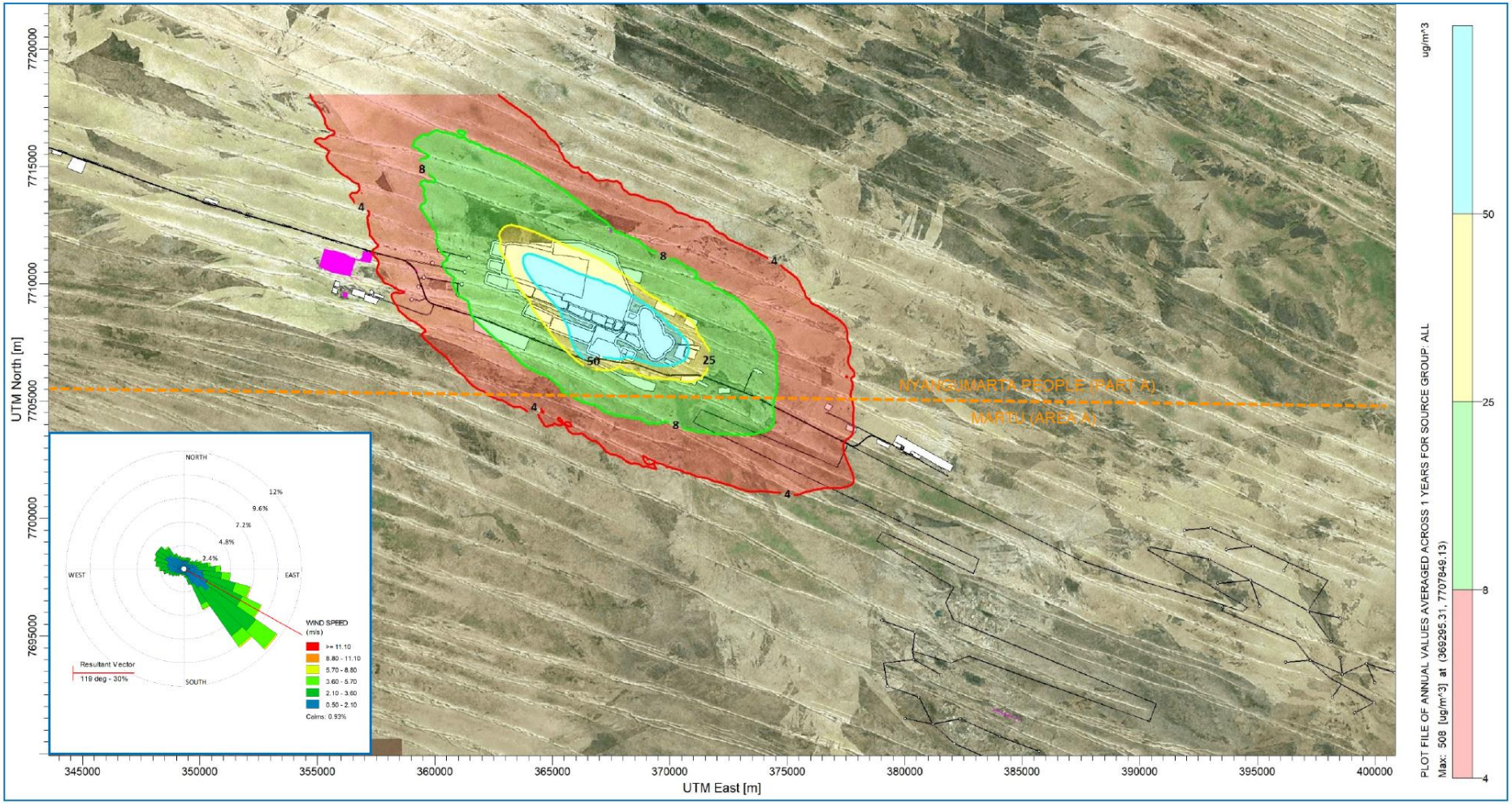

*Source: (EAQ 2026)*

**Figure 13-6: Mine-Only $PM_{10}$ Annual Ground Level Concentrations (µg/m³)**




*Source: (EAQ 2026)*

**Figure 13-7: Mine-Only $PM_{2.5}$ 24-hr Ground Level Concentrations (µg/m$^3$)**




*Source: (EAQ 2026)*

**Figure 13-8: Mine-Only $PM_{2.5}$ Annual Ground Level Concentrations (µg/m$^3$)**

## 13.7 Likely Environmental Outcomes

The anticipated environmental outcomes that apply to air quality include:

- Under worst case conditions criteria for TSP, $PM_{2.5}$ and $PM_{10}$ are highly unlikely to be exceeded more than 25 km from the MIA and will be episodic in nature
- Dust emissions originating from the RAC will be temporary in nature and negligible in extent and magnitude
- Human health and amenity will not be impacted at any of the sensitive receptors (identified in Table 13-3) as a result of dust emissions from mining activities.

No significant residual impacts to air quality were identified as a result of the Proposal due to the absence of sensitive receptors and the implementation of best practice dust mitigation and management measures along with operational controls. As such, the Proponent considers that that the Proposal can be implemented to meet the EPA's objective for the Air Quality factor to maintain air quality and minimise emissions so that environmental values are protected.

# 14 GREENHOUSE GAS EMISSIONS

## 14.1 EPA Environmental Factor Objective

The EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) lists the following as its objective for Greenhouse Gas (GHG) Emissions:

**To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable**

## 14.2 Relevant Policy and Guidance

Table 14-1 presents the relevant policy and guidance for GHG Emissions and demonstrates how they have been considered in the Proposal.

**Table 14-1: Relevant Policy and Guidance for Greenhouse Gas Emissions**

| Policy and Guidance | Explain how the Policy and Guidance have been Considered |
|---|---|
| **Environmental Protection Authority** | |
| Statement of Environmental Principles, Factors, Objectives and Aims for EIA (EPA 2023b) | The EPA objective for Greenhouse Gas Emissions forms the basis of this assessment. This assessment has regard to the aims of EIA, consideration of significance and the application of the mitigation hierarchy |
| Environmental Factor Guideline: Greenhouse Gas Emissions (EPA 2024a) | The triggers for assessment of greenhouse gas emissions have been considered in the scope of this chapter |
| Instructions on how to prepare an Environmental Review Document (EPA 2024e) | This document forms the basis of the headings and content provided in this ERD |
| **Other State or Commonwealth** | |
| Greenhouse Gas Emissions Policy for Major Projects (GoWA 2024b) | The Proponent is committed to contributing towards the State's aspiration of net zero by 2050 |
| Western Australian Climate Policy (GoWA 2020) | The Proposal includes long-term emission reduction targets consistent with the State's net zero aspiration by 2050 |
| *National Greenhouse and Energy Reporting Act 2007* (Cth) (NGER Act) | Relevant GHG emissions associated with the Proposal operations will be reported annually through the NGER scheme, in accordance with the NGER Act |
| National Greenhouse and Energy Reporting (Measurement) Determination 2008 | The GHG emissions for stationary and transport energy sources for the Proposal have been estimated using the methods and criteria from the National Greenhouse and Energy Reporting Measurement Determination |
| National Greenhouse and Energy Reporting Regulations 2008 | |
| Carbon Credits (Carbon Farming Initiative—Plantation Forestry) Methodology Determination 2022 | The GHG emissions associated with vegetation clearing for the Proposal have been estimated using the methods and criteria from the Carbon Credits Methodology Determination |
| FullCAM Guidelines (CER 2022) | |
| National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (DCCEEW 2024c) | Provides the rules that govern how the Safeguard Mechanism operates |

### 14.2.1 Framework for International Cooperation

In 2015 the Paris Agreement was ratified by parties to the United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement establishes a series of targets, including:

- Keeping “global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit temperature increase to 1.5°C”
- Reach global peaking of GHG emissions as soon as possible to achieve a balance between anthropogenic emissions by sources and removals by sinks in the second half of this century.

Under the Paris Agreement rules, countries measure, report and commit to reducing the GHG emissions that occur within their own borders. In this way, countries take responsibility for their own environmental impact while promoting equitable and sustainable development globally.

Australia is a signatory to the agreement and to assist in meeting the agreement's aims, on 16 June 2022, Australia communicated its updated Nationally Determined Contribution (NDC) to the United Nations which included confirmation of Australia’s commitment to achieve net zero emissions by 2050, and a new, increased, 2030 target of 43% below 2005 levels by 2030. To achieve this target, the federal government set targets in legislation via the Climate Change Bill 2022.

Australia is due to submit its next NDC under the Paris Agreement to the UNFCCC in 2025.

### 14.2.2 Commonwealth Policy and Guidance

The legislative framework for Australia’s emissions reporting scheme and reduction policy is set out in the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) (Cth), which is administered by the Clean Energy Regulator (CER).

Under the act, facilities that emit more than 25,000 tonnes of carbon dioxide equivalence (t $CO_{2\text{-}e}$) a year or consume or produce 100 terajoules or more of energy a year, must submit an annual report to CER. The report must detail the organisation's emissions, energy consumption, and energy production for the financial year (CER 2025a).

The Safeguard Mechanism is the key emissions reduction policy that builds on the NGER reporting scheme. The mechanism applies to large facilities that emit over 100,000 t $CO_{2\text{-}e}$ each year, which are primarily facilities in the mining, oil and gas extraction, manufacturing, and waste sectors. Only direct or Scope 1 emissions are included in this threshold: that is, GHG emissions released into the atmosphere as a direct result of an activity undertaken at that facility. These facilities must keep net emissions under a threshold, called a baseline (CER 2025c).

If the baseline is exceeded, or is likely to, emitters can manage excess emissions by (CER 2025b):

- Pursuing activities that reduce emissions of the facility
- Purchase and surrender carbon units (Australian Carbon Credit Units (ACCUs) are the sole currently prescribed units)
- Apply for a multi-year monitoring period
- Apply for an exemption due to exceptional circumstances.

### 14.2.3 Western Australia Policy and Guidance

On 15 October 2024, in response to the Commonwealth Government's 2023 reforms to the Safeguard Mechanism, the WA State Greenhouse Gas Emissions Policy for Major Projects (State GHG Policy) was updated to remove areas of duplication, whilst remaining committed to the achieving net zero greenhouse gas emissions by 2050 (GoWA 2024b). The policy guides decision making relating to greenhouse gas emissions for major projects that are assessed by the EPA.

In recognition of the established link between cumulative sources of GHG emissions and the risk of climate change, the EPA considers GHG emissions as a key environmental factor where Proposals are reasonably likely to exceed:

- 100,000 t $CO_{2\text{-}e}$ of Scope 1 emissions in any year; or
- 100,000 t $CO_{2\text{-}e}$ of Scope 2 emissions in any year.

Further context is provided in Section 14.3.2.

## 14.3 Receiving Environment

GHG emissions contribute to a changing climate on a global scale. The effects of the changing climate are predicted to be significant for Western Australia (EPA 2024a).

### 14.3.1 Studies

A life-of-asset GHG Assessment was prepared for the Project to determine the emissions baseline and determine whether the project triggers the EPA's Environmental Factor Guideline - Greenhouse Gas Emissions (November 2024) threshold of 100,000 t $CO_{2\text{-}e}$ (Table 14-2) (GHD 2026).

The GHG emissions assessment included direct emissions from the Winu Project activities (Scope 1), indirect emissions from purchased electricity (Scope 2) and other indirect contributions not included in Scope 2 along the Winu supply chain (Scope 3). All GHG emissions estimates were based on data provided by the Proponent, with all calculations conducted in accordance with industry recognised or Australian regulatory standards.

**Table 14-2: Summary of Technical Studies for Greenhouse Gas Emissions Environmental Factor**

| Title | Location, Type and Timing | Consistency with Guidance |
|---|---|---|
| Greenhouse Gas Emission Assessment Update (GHD 2026)<br>(Appendix J01) | **Study Area:** Proposal<br>**Type:** Greenhouse gas assessment<br>**Timing:** April 2026 | Prepared consistent with the EPA Environmental Factor Guideline for Greenhouse Gas Emissions (EPA 2024a) |

### 14.3.2 Assessment Context

GHG emissions are a key contributor to climate change, with the effects of a changing climate predicted to be significant in Western Australia (EPA 2024a). In addition to the commitments outlined in the Western Australian Climate Policy (GoWA 2020), the State Government has committed to reducing GHG emissions to 43% below 2005 levels by 2030.

National and international reporting standards define the following set of distinct scopes of GHG emissions, demarcating sources of emissions and associated responsibilities:

- Scope 1: emissions generated as a direct result of an activity e.g. diesel combustion by vehicles or gas
- Scope 2: emissions generated from the consumption of an energy commodity
- Scope 3: indirect emissions, other than Scope 2 emissions, that are generated in the wider community.

Notwithstanding the above, the EPA has identified through the ESD that it considers for the purpose of this assessment that GHG emissions from:

- Electricity generation produced for the Proposal as Scope 1 (not Scope 2) - given this, no Scope 2 emissions will occur as a result of the Proposal
- Haulage of concentrate (from mine to port), regardless of third-party contractual arrangements as Scope 1 (not Scope 3).

GHG emissions are expressed in $CO_{2\text{-}e}$, which is an aggregate of GHG emissions, including carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), sulfur hexafluoride ($SF_6$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and nitrogen trifluoride ($NF_3$) calculated as an equivalent $CO_2$

emission by factoring in the global warming potential (GWP) of each gas. GWP is applied in accordance with National Greenhouse and Energy Reporting (Measurement) Determination 2008.

From 2022 to 2023, Australia's net GHG emissions from all sectors was 453.4 Mt $CO_{2\text{-}e}$. This included the land use, land use change and forestry sector, which was a net sink (DCCEEW 2025b). Western Australia accounted for 89.4 Mt $CO_{2\text{-}e}$, of which, the vast majority (81.4 Mt $CO_{2\text{-}e}$) was from the energy sector (DCCEEW 2025d).

## 14.4 Potential Environmental Impacts

Mining operations generate GHG emissions predominantly through the combustion of diesel fuel for construction, operation and energy production. The major GHG emission types from the Proposal are carbon dioxide ($CO_2$), nitrogen oxide ($N_2O$) and methane ($CH_4$).

Potential GHG emissions attributable to the Proposal over its life have been identified as:

- Direct and indirect emissions associated with land clearing of vegetation during the construction and operational phases of the Proposal (Scope 1 emissions)
- Direct emissions from the combustion of diesel for mobile and stationary energy demands, including transportation directly related to the Project (Scope 1 emissions)
- Burning of diesel for the production of electricity via a PPA. This is Scope 2 emissions under National and international reporting standards. However, as noted (Section 14.3.2) the EPA has identified it considers this as Scope 1 emissions for the purposes of this assessment
- Indirect emissions (other than Scope 2 emissions) as a consequence of the activities of the Proponent's suppliers and customers from sources not owned or controlled by the Proponent's business. In this case, the downstream processing of copper concentrate, purchased goods and services, upstream and downstream transportation and indirect emissions from fuel use (production and supply) (Scope 3 emissions); however, as noted (Section 14.3.2) the EPA has identified it considers downstream transportation in the form of haulage of concentrate (from mine to port) (regardless of third-party contractual arrangements) with Scope 1 emissions for the purpose of this assessment.

Noting that the above definition of Scope 1 emissions does not align with National and International reporting standards with respect of PPA electricity emissions and haulage emissions, this characterisation has been used to calculate Scope 1 emissions estimates in the following sections.

### 14.4.1 GHG Emissions Estimates

A GHG emissions inventory has been calculated for the Proposal using the methods and criteria outlined in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (NGER Determination) and the *Carbon Credits (Carbon Farming Initiative—Plantation Forestry) Methodology Determination 2022*. Calculation methods for all emission sources are presented in Table 14-5.

Proposal GHG emissions estimates, including peak annual operating emissions, is provided below in Table 14-3. During the two-year construction phase, the total estimated Scope 1 emissions of the Proposal is 162,026 t $CO_{2\text{-}e}$, from land clearing and diesel emissions (GHD 2026). During the operations phase of the Proposal, the total Scope 1 emissions are estimated to be 2,607,124 t $CO_{2\text{-}e}$ (GHD 2025). The annualised operational Scope 1 emissions for the Winu Project are detailed in Table 14-4 and presented in Figure 14-1.

Progressive rehabilitation will be implemented over the life of the Proposal to promote revegetation and increase the capacity of carbon sequestration. However, due to the small portion of emissions from land clearing and the inherent uncertainty in re-creating vegetation following mining, the estimates of net GHG emissions outlined in Table 14-3 do not include estimates of carbon sequestration through progressive rehabilitation, as the impact on the total emissions estimate will be negligible.

The EPA considers GHG emissions a significant factor if Scope 1 or Scope 2 emissions are reasonably likely to exceed 100,000 t $CO_{2\text{-}e}$ emissions in any year (EPA 2024a).

Under the EPA's characterisation total Scope 1 emissions over the life of the Proposal are estimated to be 2,769,150 t $CO_{2-e}$, with peak annual Scope 1 emissions of 109,166 t $CO_{2-e}$ in year 2048.

Apart from land clearing, all Scope 1 and 2 GHG emissions associated with the Proposal's operations will be reported annually through the NGER scheme and may be abated in line with emissions reduction baselines under the Safeguard Mechanism, in accordance with the NGER Act.

**Table 14-3: Proposal GHG Emissions Estimates (t $CO_{2-e}$)**

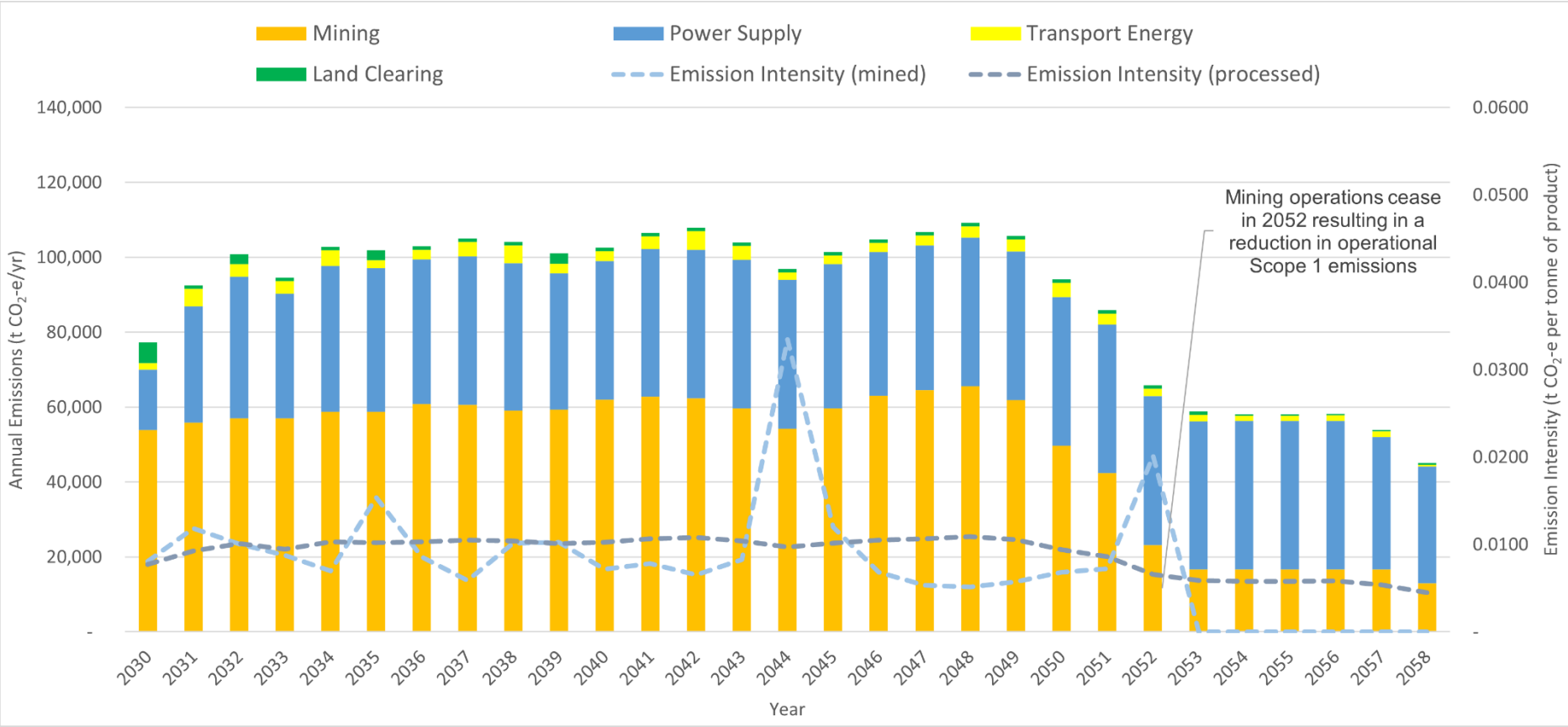
| Activity | Total Construction Emissions* | Annual Average Operational Emissions | Peak Annual Operational Emissions (2048) | Total Operational Emissions | Total Emissions over Life of Proposal |
|---|---|---|---|---|---|
| **Scope 1 emissions** | | | | | |
| Land clearing | 95,642 | 1,175 | 926 | 34,077 | 129,719 |
| Diesel emissions | 66,384 | 48,581 | 65,876# | 1,408,855 | 1,475,239 |
| Diesel power generation | - | 37,382 | 39,669 | 1,084,073 | 1,084,073 |
| Copper concentrate (+ fuel) haulage | - | 2,763 | 2,695 | 80,119 | 80,119 |
| **Total** | **162,026** | **89,901** | **109,166** | **2,607,124** | **2,769,150** |
| **Scope 3 emissions** | | | | | |
| **Total** | **423,626** | **162,662** | **-** | **4,717,206** | **5,140,832** |

**As construction is estimated to take place over a two-year period, only total emissions have been presented above. #The large variation between peak and annual average diesel emissions is due to high mining rates in the first half of the Proposal life followed by ongoing processing of stockpiles leading to lower diesel usage in the later years of the Proposal life.*

**Table 14-4: Annual Operational Scope 1 Emissions Estimates for Winu (in t $CO_{2-6}$)**

| Year | Stationary Energy - Mining | Stationary Energy - Power Supply (Electricity) | Transport Energy | Land Clearing | Winu Emissions Total | Emission Intensity (mined) | Emission Intensity (processed) |
|---|---|---|---|---|---|---|---|
| 2030 | 53,943 | 16,039 | 1,718 | 5,590 | 77,291 | 0.008 | 0.008 |
| 2031 | 55,910 | 31,050 | 4,585 | 926 | 92,471 | 0.012 | 0.009 |
| 2032 | 56,982 | 37,793 | 3,383 | 2,713 | 100,870 | 0.010 | 0.010 |
| 2033 | 57,021 | 33,280 | 3,368 | 926 | 94,595 | 0.009 | 0.009 |
| 2034 | 58,766 | 38,946 | 4,227 | 926 | 102,865 | 0.007 | 0.010 |
| 2035 | 58,753 | 38,402 | 2,069 | 2,713 | 101,936 | 0.015 | 0.010 |
| 2036 | 60,827 | 38,690 | 2,493 | 926 | 102,936 | 0.009 | 0.010 |
| 2037 | 60,642 | 39,650 | 3,845 | 926 | 105,063 | 0.006 | 0.011 |
| 2038 | 59,107 | 39,333 | 4,734 | 926 | 104,101 | 0.010 | 0.010 |
| 2039 | 59,290 | 36,511 | 2,519 | 2,713 | 101,032 | 0.010 | 0.010 |
| 2040 | 62,008 | 36,993 | 2,671 | 926 | 102,598 | 0.007 | 0.010 |
| 2041 | 62,871 | 39,401 | 3,366 | 926 | 106,564 | 0.008 | 0.011 |
| 2042 | 62,419 | 39,652 | 4,897 | 926 | 107,894 | 0.007 | 0.011 |
| 2043 | 59,736 | 39,652 | 3,628 | 926 | 103,942 | 0.008 | 0.010 |
| 2044 | 54,256 | 39,719 | 2,066 | 926 | 96,967 | 0.033 | 0.010 |
| 2045 | 59,698 | 38,436 | 2,410 | 926 | 101,470 | 0.012 | 0.010 |
| 2046 | 63,045 | 38,396 | 2,432 | 926 | 104,800 | 0.007 | 0.010 |
| 2047 | 64,540 | 38,631 | 2,646 | 926 | 106,743 | 0.005 | 0.011 |
| 2048 | 65,613 | 39,669 | 2,957 | 926 | 109,166 | 0.005 | 0.011 |

| Year | Stationary Energy - Mining | Stationary Energy - Power Supply (Electricity) | Transport Energy | Land Clearing | Winu Emissions Total | Emission Intensity (mined) | Emission Intensity (processed) |
|---|---|---|---|---|---|---|---|
| 2049 | 61,885 | 39,652 | 3,274 | 926 | 105,737 | 0.006 | 0.011 |
| 2050 | 49,736 | 39,652 | 3,868 | 926 | 94,181 | 0.007 | 0.009 |
| 2051 | 42,468 | 39,652 | 2,856 | 926 | 85,903 | 0.007 | 0.009 |
| 2052 | 23,180 | 39,719 | 2,045 | 926 | 65,871 | 0.020 | 0.007 |
| 2053 | 16,623 | 39,636 | 1,750 | 926 | 58,936 | - | 0.006 |
| 2054 | 16,623 | 39,652 | 1,400 | 365 | 58,040 | - | 0.006 |
| 2055 | 16,623 | 39,652 | 1,411 | 365 | 58,051 | - | 0.006 |
| 2056 | 16,649 | 39,719 | 1,442 | 365 | 58,176 | - | 0.006 |
| 2057 | 16,623 | 35,403 | 1,496 | 365 | 53,887 | - | 0.005 |
| 2058 | 13,017 | 31,094 | 560 | 365 | 45,037 | - | 0.005 |




*Source: (GHD 2026)*

**Figure 14-1: Operational Scope 1 Emissions Baseline for Winu**

**Table 14-5: Emissions Sources and Calculations Methods**

| Emission Scope | Source | Details | Method of Calculation | Assumptions |
|---|---|---|---|---|
| Scope 1 | Stationary Energy | Diesel combustion of site based, non-road registered equipment and machinery for construction and mining activities | Estimated consumption of diesel and NGER measurement determination Schedule 1 Part 3 | Nominal mineral processing capacity of 10 million tonnes per annum |
| | Transport Energy (excludes haulage of concentrate to port) | Diesel combustion of road registered mobile equipment | Estimated consumption of diesel (post-2004 vehicles) and NGER measurement determination Schedule 1 Part 4 Division 4.2 | Nominal mineral processing capacity of 10 million tonnes per annum |
| | Land Clearing | Lost carbon sequestration potential | Based on the total clearing area, known vegetation classes, estimated potential maximum biomass class and subsequent t $CO_{2-e}$/ha emissions factor (Carbon Credits Methodology) | Approximately 75% of land clearing will occur in the first two years, and then approximately 1% each year for the life of mine |
| Scope 1 for the purposes of this assessment | Purchased Electricity | Diesel combustion for the generation of electricity | Estimated consumption of diesel and NGER measurement determination schedule 1 part 3 | Diesel–fired thermal generation (65 MW), wind turbine, solar panels, and battery storage<br>Approximately 85% renewable energy fraction via solar, wind and battery energy storage system |
| | Category 4 – Upstream Transport and Distribution | Category 4: Transportation and distribution of products (excluding fuel and energy products) purchased or acquired by the reporting company in the reporting year in vehicles and | Calculated based on predicted estimates of fuel consumption, material movements and quantity of concentrate carried | Transportation of concentrate by truck from the MIA via the Great Northern Highway to port for export |
| Scope 3 | Category 1 – Purchased Goods and Services<br>Category 2 – Capital Goods<br>Category 3 – Fuel and Energy (not | Category 1: Extraction, production, and transportation of goods and services purchased or acquired by the reporting company in the reporting year, not otherwise included in Categories 2-8<br>Emissions from use of products purchased, such as fuel combusted for | The GHG emissions related to Scope 3 have been defined in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (GHG Protocol Standard) and GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard<br>Categories of emissions were calculated as follows: | Nominal mineral processing capacity of 10 million tonnes per annum |

| Emission Scope | Source | Details | Method of Calculation | Assumptions |
|---|---|---|---|---|
| | included in scope 1 or 2)<br><br>Category 7 – Employee Commuting<br><br>Category 9 – Downstream Transport and Distribution<br><br>Category 10 – Processing of Sold Products | mining operations, will be accounted for as either a scope 1 or scope 2 emission<br><br>Category 2: Extraction, production, and transportation of capital goods purchased or acquired by the reporting company in the reporting year<br><br>Category 3: Extraction, production, and transportation of fuels and energy purchased or acquired by the reporting company in the reporting year, not already accounted for in scope 1 or scope 2<br><br>Category 7: Transportation of employees between their homes and their worksites during the reporting year (in vehicles not owned or operated by the reporting company)<br><br>Category 9: Transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer (if not paid for by the reporting company)<br><br>Category 10: Processing of intermediate products sold in the reporting year by downstream companies | Category 1 was calculated using estimation for grinding media usage, basting media usage, reagents & operating consumables spend. This also included the spend on general & other mining goods<br><br>Category 2 was calculated using ongoing CAPEX spend<br><br>Category 3 was calculated based on the total stationary and transport fuel not accounted for in Scope 1<br><br>Category 3 was calculated based total stationary and transport fuel required for haulage and the quantity of concentrate estimated to be transported, not accounted for in Scope 1<br><br>Category 7 was calculated based on the estimated number of chartered flights to site<br><br>Category 9 was calculated based on the quantity of concentrated anticipated to be shipped from Port Hedland<br><br>Category 10 was calculated based on the estimated amount copper and gold production that occurs from the out of the Proposal | |

### 14.4.2 Safeguard Emissions

In accordance with EPA guidelines (EPA 2024a), for emissions covered by the Safeguard Mechanism - in this case Scope 1 emissions that don't include land clearing that exceed 100,000 t $CO_2$-e - proponents are required to provide information, including but not limited to the following:

- Information on expected Scope 1 emissions covered by the Safeguard Mechanism, including expected baseline, and how these emissions are anticipated to reduce over the life of the Proposal through compliance with the Safeguard Mechanism (Section 14.4.2.2)
- How best practice measures have been adopted to avoid or reduce a Proposal's Scope 1 emissions (Section 14.5.2)
- Whether carbon offsets are proposed to be surrendered for more than 30% of the Proposal's expected baseline Scope 1 emissions (Section 14.5.4).

The emissions generated from activities that are excluded from NGER reporting and the Safeguard Mechanism are land clearing and Scope 3 emissions, these are described in further detail in Section 14.4.2.

#### 14.4.2.1 Facility Emissions Boundary

For the purposes of this assessment and at the request of the EPA the Winu Mine Facility and Power Generation Facility will be considered as a combined facility. It will be assumed that the Proponent has operational control of the Power Generation Facility and therefore emissions are Scope 1.

The Scope 1 facility boundary includes all Greenhouse Gas generating activities occurring within the Development Envelope and at the request of the EPA has been extended to incorporate emissions associated with road transport of copper concentrate to port, transport beyond this point is not within the facility boundary and is therefore consider Scope 3.

#### 14.4.2.2 Facility Definition

For the purposes of NGER reporting and the Safeguard Mechanism, the facility is defined in accordance with section 9 of the NGER Act, comprising all activities, infrastructure, and emission sources for which the Proponent has operational control, as described in the detailed proposal description (Section 2.1.2). Emissions covered by the Safeguard Mechanism (by exceeding the 100,000 t $CO_2$-e threshold for the Proposal) are presented in Table 14-6 and Figure 14-2.

**Table 14-6: Emissions Covered by Safeguard Mechanism**

| Financial Year | Scope 1 Emissions (t $CO_2$-e) Regulated under the Safeguard Mechanism |
|---|---|
| 2034-35 | 100,582 |
| 2035-36 | 100,617 |
| 2036-37 | 103,074 |
| 2037-38 | 103,656 |
| 2038-39 | 100,748 |
| 2040-41 | 103,656 |
| 2041-42 | 106,304 |
| 2042-43 | 104,992 |
| 2045-46 | 102,209 |
| 2046-47 | 104,846 |

| Financial Year | Scope 1 Emissions (t $CO_2$-e) Regulated under the Safeguard Mechanism |
|---|---|
| 2047-48 | 107,029 |
| 2048-49 | 106,526 |

**Financial years where GHG emissions do not exceed the 100,000 t $CO_2$-e threshold to be regulated under the Safeguard Mechanism have been excluded from this table.*

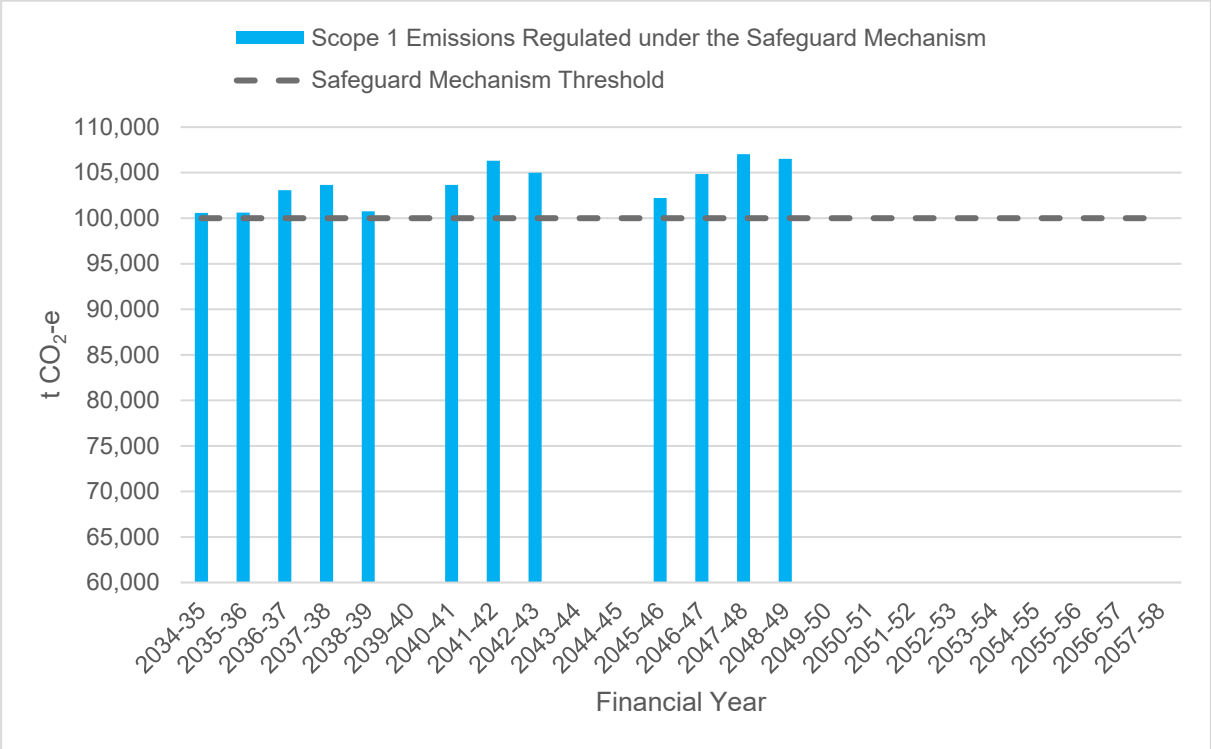



**Figure 14-2: Emissions Covered by the Safeguard Mechanism**

The Proponent is a part of the broader Rio Tinto group of companies and as such will leverage of the broader decarbonisation projects underway in the company to achieve net zero emissions by 2050. These projects include investment in economical, transitional arrangements for diesel whilst technology for large electric mining fleet progresses. Electrification is the ultimate longer-term solution for repowering the mining fleet and we are working with partners to catalyse the development of this technology. Bridging the gap to electrification at scale, and for applications where electrification is not suitable, requires innovative complementary solutions.

### 14.4.3 Non-Safeguard Emissions

In accordance with EPA guidelines (EPA 2024a), for emissions not covered by the Safeguard Mechanism, in this case emissions from land clearing and Scope 3 emissions, proponents are required to provide information, including but not limited to the following:

- A clear pathway for reducing Scope 1 over the life of the proposal (Section 14.5.3)
- Justification for the emissions baseline used and the alternative approaches (Section 14.4.1)
- Emissions intensity of the proposal and benchmarking of Scope 1 emissions intensity against comparable projects and international and Australian best practice (Section 14.4.4)
- How best practice measures have been adopted to avoid or reduce a proposal's Scope 1 emissions at commencement, and throughout the life of the proposal (Section 14.5.2)
- A description of intended GHG emissions offsets, if applicable (Section 14.5.4)

- Other legal and policy instruments that can regulate GHG emissions from the proposal to meet the EPA's objectives (Section 14.2.2)
- Consistency with a global low-carbon transition to net zero by 2050 scenario beyond 2050 (Section 14.5.1).

Calculating emissions intensity data specifically for emissions caused by land clearing is not considered best practice and is therefore not readily available for comparison. Land clearing is also a relatively minor source of emissions for the Proposal and data is not readily available, as such the Proponent has conducted an internal intensity benchmarking assessment of total Scope 1 and 2 emissions of mines with similar annual production within Western Australia. The results of this assessment are provided in Section 14.4.4.

The following subsections of this chapter will assess the above requirements.

#### 14.4.3.1 Emissions Reductions over the LoM

Land clearing is a relatively minor source of emissions for the Project, comprising 4.7% of total Scope 1 emissions (Table 14-3). Emissions from land clearing will peak in the two years of construction, with an estimated 95,642 t $CO_{2\text{-}e}$, based on clearing 3,501 ha across the construction period (GHD 2026). A smaller amount of on-going land clearing will occur during the LoM to achieve the total maximum extent proposed.

Land clearing emissions are expected to reduce dramatically during the operations phase of the Proposal, peaking in in the first year of operations in 2030, with an estimated 5,590 t $CO_{2\text{-}e}$ of emissions. Emissions will then stabilise to approximately 926 t $CO_{2\text{-}e}$ for the majority of the operational phase, with additional peaks of 2,713 t $CO_{2\text{-}e}$ in 2032, 2035 and 2039.

Finally, during the last five years of operations, when mining operations cease and long-term stockpiles are processed, approximately 365 t $CO_{2\text{-}e}$ of emissions are expected year on year. This is graphically represented in Figure 14-3.

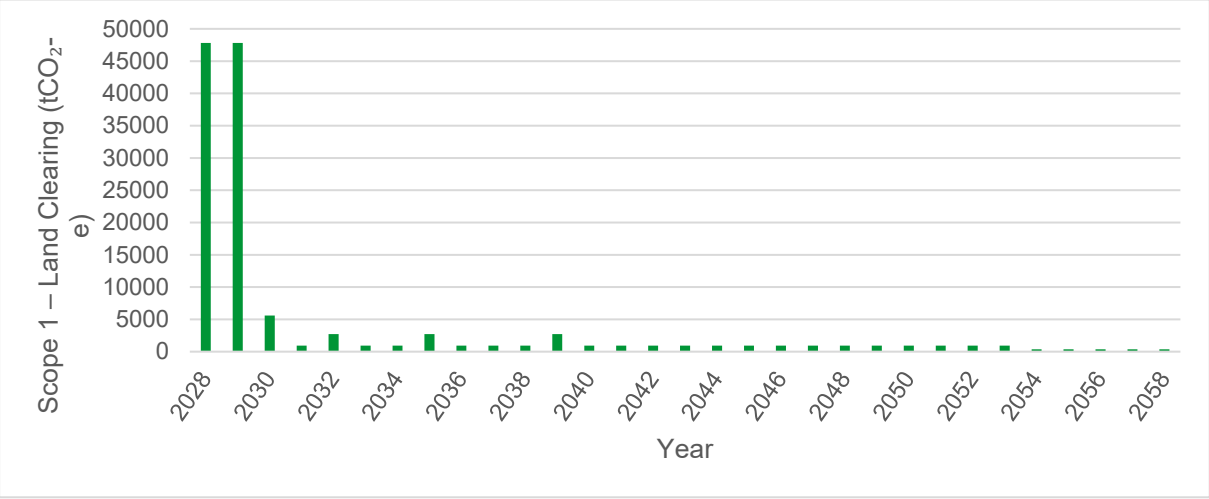



**Figure 14-3: Scope 1 – Land Clearing (t $CO_2$-e) Baseline for Winu**

### 14.4.4 Projected Emissions Intensity Benchmarking

The emission intensity estimate for the Proposal is 0.0092 t $CO_{2\text{-}e}$/tonne ore mined based on average annual Scope 1 emissions estimate of 89,901 t $CO_{2\text{-}e}$ per annum and average annual mined production of 9.72 Mt, across the 29-year operational period. Mining operations for the Winu Project cease in 2053, with only processing activities continuing until the end of the project in 2058.

The Proposal emissions intensity value performs very well against the Australian Government's default Scope 1 emissions intensity specified by the Safeguard Mechanism, being within approximately 14% of the specified value (Table 14-7). The default emission intensity is derived from an industry average,

accounting for all ROM metal ore that contains one or more metals and is produced as part of carrying on the metal ore mining and processing activity at the facility that is not eligible to be considered bauxite, manganese ore, iron ore or lithium ore.

The Proposal emission intensity value is also expected to perform well, in comparison to comparable Western Australian base metal projects. The Proposal most closely resembles the OZ Minerals West Musgrave, as both projects will produce onsite electricity from significant renewables penetration (80-90%), with Scope 1 emission sources (e.g. diesel or gas-fired power stations) providing the remaining generation, including back up generation.

The emissions intensity of the Proposal is compared to mines within Western Australia below in Table 14-7 and Figure 14-4.

**Table 14-7: GHG Benchmarking Assessment**

| Project | Commodity | Average Ore mined (t) per annum | Average Total Scope 1 & 2 emissions (t $CO_{2-e}$) per annum | Emissions Intensity (t $CO_{2-e}$/tonne ore mined) | Source |
|---|---|---|---|---|---|
| Winu | Copper-Gold | 9,721,470 | 89,901 | 0.0092 | From this assessment |
| Newcrest Telfer | Gold-Copper | 20,402,000* | 498,322 | 0.00244 | Newcrest FY 2022 Sustainability Report (Newcrest 2022) |
| OZ Minerals West Musgrave | Copper-Nickel | 10,010,000* | 156,162 | 0.0156 | West Musgrave Copper and Nickel Project – Greenhouse Gas Management Plan (OZ Minerals 2021) |
| IGO Nova Operation | Nickel-Copper-Cobalt | 1,644,752 | 61,255 | 0.0372 | Independence Group (IGO) Sustainability Report (IGO 2022) |
| Safeguard Mechanism Default Emissions Intensity Value AR5 for ROM metal ore | Metal Ore | N/A | N/A | 0.00859 | Safeguard Mechanism: Prescribed production variables and default emissions intensities (DCCEEW 2021) |

**Numbers are approximate*

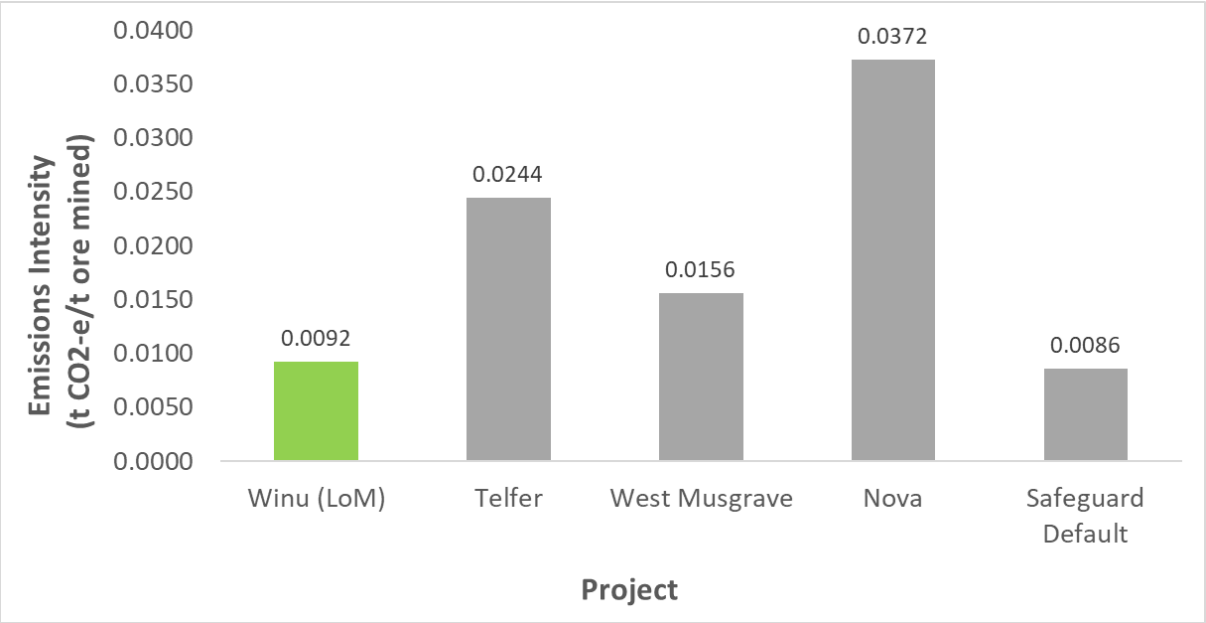



**Figure 14-4: Comparison of Proposal Emissions Intensity against Comparable Projects**

### 14.4.5 Cumulative Impacts

GHG emissions are inherently cumulative in nature. The total annual emissions for the Energy sector (which includes mining, processing, transport, oil and gas) in WA for the latest available year of data (2022) from the national accounts, was 81.73 Mt (DCCEEW 2025d). The Proposal's contribution for all Scope 1 emissions (including Scope 2 emissions redefined as Scope 1 emissions for the purpose of this assessment) as an annual operational average is expected to be approximately 89,901 t $CO_{2\text{-}e}$ (Table 14-3) or approximately 0.11% of the State's annual emissions.

## 14.5 Mitigation

### 14.5.1 Corporate Emissions Reduction Targets

The Proponent is part of the Rio Tinto Group (Rio Tinto), which is committed to understanding and managing climate related obligations, risks and opportunities as Rio Tinto operates within an increasingly carbon-constrained climate. Rio Tinto supports the goals of the Paris Climate Agreement and recognises the need to achieve these goals. Rio Tinto' climate change strategies and reporting are guided by international principles, frameworks, best practice, national regulatory compliance requirements and stakeholder engagement (Rio Tinto 2025a).

Relative to a 2018 baseline Rio Tinto's Climate Action Plan outlines its ambition to reach net zero emissions by 2050 across all operations (Rio Tinto 2025a). To support this ambition, medium-term global targets have been introduced for Scope 1 and 2 emissions to:

- Reduce absolute emissions by 15% by 2025
- Reduce absolute emissions by 50% by 2030.

The focus of the decarbonisation strategy is on transitioning away from diesel fuel, developing nature-based solutions and building renewable energy infrastructure (Rio Tinto 2025a).

However, because the Proposal was not operational in 2018, the two interim targets have not been applied. The long-term corporate target of reaching net zero emissions by 2050 has instead been adopted for the Proposal. Annual emissions will be reported in accordance with the NGER.

This aligns with the Rio Tinto's global long term emission reduction target (Rio Tinto 2025a). EPA Factor Guidelines (EPA 2024a) and the State GHG Policy and Guidelines (GoWA 2024b).

### 14.5.2 Best Practice Design

The largest contribution to the Proposal's emissions profile is from the consumption of diesel to run mining operations and is associated with heavy mining equipment, including drills, trucks, dig units, loaders and dozers and ancillary equipment. Globally, Rio Tinto is progressing action to decarbonise these emissions and the modelling of energy sources and systems indicate that the long-term solution to reduce fossil diesel use in mining fleet and equipment is electrification.

The fleet itself is only one part of the infrastructure required to support the large-scale transition to an electric mining fleet. Charging infrastructure must be dynamic and flexible enough to support evolving mine plans and equipment routes which may mean that charging stations cannot remain permanently in one location or must be complemented by mobile solutions. The charging network must also be underpinned by access to renewable energy sources and systems to operate these. The pace of electric vehicle rollout and breakthroughs in mining fleet development assures that this challenge can be met through innovation and collaboration; however, current technology has not yet delivered the energy density required for large mining vehicles.

Rio Tinto is exploring options with suppliers to reduce emissions from larger trucks including the development of 220 tonne zero emissions haul trucks. Trials will be undertaken in the Pilbara with Caterpillar and Komatsu, but Rio Tinto is not expecting mass deployment of battery electric haul trucks throughout its operations, and subsequent significant reduction in haul truck emissions, before 2030.

The challenges and timeframes involved with full deployment mean that the electrification pathway will not result in meaningful emissions reduction in the short term. It is recognised that other technologies will be important. For example, investigation of sustainable biofuels as an interim step as well as working with equipment manufacturers to introduce smaller and more energy-efficiency equipment into mine sites is ongoing. Below is a list of the combined approach to decarbonise Rio Tinto's operations and reduce its emissions:

- Improve fuel efficiency and rapidly deploy partial abatement solutions with shorter timeframes
- Use alternative fuel sources including renewable diesel
- Plan for battery electrification to deliver at-scale benefits after 2030.

### 14.5.3 Scope 1 – Mitigation Measures

As required by EPA guidelines (EPA 2024a), the Proponent is committed to implementing the mitigation hierarchy (avoid, reduce) to reduce Scope 1 emissions. The Proponent is exploring and implementing a range of short, medium and long-term initiatives, having recently increased efforts with the establishment of a dedicated abatement program for diesel reduction/elimination in 2022, which leverages from the work already underway by Rio Tinto at a group level.

The Proponent will review and adopt reasonable and practical measures to avoid and reduce the Proposals Scope 1 emission.

Table 14-9 summarises how the mitigation hierarchy will be applied by the Proponent to reduce Scope 1 Emissions.

#### 14.5.3.1 Clearing of Native Vegetation

The Proponent has refined the Development Envelope and Conceptual Footprint to ensure the Proposal prioritises the avoidance of important vegetation where other options were available.

Key outcomes of the Proposal design refinements have been described in Section 2.2. The key avoidance measure relevant to Flora and Vegetation is the reduction of the Development Envelope from 37,744 ha during early project design stages to 23,649 ha, including removal of the Texas and Wallal borefields from the Development Envelope.

As above, although progressive rehabilitation will be implemented over the life of the Proposal, the Proponent recognises the uncertainty in the re-creation of vegetation following mining. As such, carbon sequestration via progressive rehabilitation has not been considered to reduce emissions.

#### 14.5.3.2 Mine Design

The Proponent is committed to the continued optimisation of the mine plan and design of the Proposal to continue to improve logistical efficiencies. This has included the assessment the following opportunities to reduce carbon emissions from diesel combustion:

- Mining areas, pit exits and water landforms are optimised to reduce haul distances
- Autonomous haulage from pit will be implemented which has shown to be more efficient for diesel consumption
- Material movement to final landform and progressive rehabilitation during operation to avoid rehandling of material post mining
- Haul road layout designed to smooth tuck speeds to minimis stop/ start, improving efficiency.

#### 14.5.3.3 Alternative Fuel and Fleet Electrification

Rio Tinto has completed and continues to assess numerous technologies to transition away from diesel powered mining equipment. Technologies are more progressed for some equipment than others with the emissions reduction/elimination pathway for each equipment type analysed. The mining equipment assessed includes haul trucks, dig units, drill rigs auxiliary vehicles, generators and light vehicles.

The current best practice alternative energy sources to power mining equipment includes (but is not limited to):

- Electric (including trailing cables, overhead catenary and/or batteries)
- Hydrogen fuel cell electric
- Renewable Diesel
- LPG
- Additives
- CNG/LNG
- Biodiesel.

The Proposal is still in early stage development and decisions on the specific equipment to deploy is still to be made; however, the selection criteria that will be used to identify best practice diesel reduction/elimination measures and their effectiveness included a Technology Readiness Level (TRL) and Commercial Readiness Index (CRI) assessment. TRL is a globally accepted benchmarking assessment for tracking technology progress from early-stage research (TRL1) through to actual system demonstration (TRL9).

Following the assignment of TRL and CRI values for each technology available and associated emissions reduction benefits for different equipment types, a multi-criteria assessment will be used to settle on the specific equipment used. The following criteria are likely to be used during this assessment:

- Fleet replacement schedules
- Mine planning requirements
- Site infrastructure
- Power demand/supply
- Maintenance
- Information systems
- Environmental/heritage considerations.

Given the assessments completed to date, battery electrification of mine equipment has been adopted as the preferred long-term pathway; however, assessments continue for all available and future technologies as the diesel reduction/elimination pathway is likely to change and evolve over time.

#### 14.5.3.4 Renewable Energy

The power solution takes into account Rio Tinto's commitments to emissions reduction through the use of significant renewable energy infrastructure. The final power solution consists of solar generation, wind generation, battery storage and diesel firming generation.

The outcome of the strategy is an optimised solution for power supply with approximately 85% renewable energy penetration, calculated over the 29-year life of the generation assets which is considered best practice design. Existing and emerging technologies have been assessed against the project power requirements, resulting in the preliminary selection of renewable energy generation and storage equipment (subject to finalisation of tendering and contractual requirements with independent power station providers) including the following approximate components:

- 98 $MW_p$ Solar Farm
- 64 MW Wind Farm
- 85 MW/ 340 MWh Battery Storage.

This strategy will result in a reduction of Scope 1 emissions by approximately 7,286,927 t $CO_{2\text{-}e}$ over the life of the Proposal. Annual emissions after mitigation through the use of renewable energy sources are presented in Table 14-8 and depicted in Figure 14-5.

Low or no emission solutions for firming power is yet to be achieved and available at scale, however, as this technology becomes available and cost effective, the Proponent is committed to investigating its adoption.

**Table 14-8: Emissions Mitigation from Renewable Energy Sources**

| Operational Year | Total Scope 1 – Renewables ($tCO_2$-e) | Total Scope 1 – No Renewables ($tCO_2$-e) |
|---|---|---|
| 2030 | 77,291 | 247,500 |
| 2031 | 92,471 | 362,925 |
| 2032 | 100,870 | 417,933 |
| 2033 | 94,595 | 379,809 |
| 2034 | 102,865 | 428,456 |
| 2035 | 101,936 | 423,519 |
| 2036 | 102,936 | 427,151 |
| 2037 | 105,063 | 436,845 |
| 2038 | 104,101 | 433,124 |
| 2039 | 101,032 | 411,001 |
| 2040 | 102,598 | 416,865 |
| 2041 | 106,564 | 438,442 |
| 2042 | 107,894 | 442,522 |
| 2043 | 103,942 | 434,619 |
| 2044 | 96,967 | 421,055 |

| Operational Year | Total Scope 1 – Renewables ($tCO_2$-e) | Total Scope 1 – No Renewables ($tCO_2$-e) |
|---|---|---|
| 2045 | 101,470 | 422,789 |
| 2046 | 104,800 | 429,226 |
| 2047 | 106,743 | 434,441 |
| 2048 | 109,166 | 445,174 |
| 2049 | 105,737 | 438,217 |
| 2050 | 94,181 | 415,106 |
| 2051 | 85,903 | 398,549 |
| 2052 | 65,871 | 358,870 |
| 2053 | 58,936 | 344,530 |
| 2054 | 58,040 | 342,826 |
| 2055 | 58,051 | 342,851 |
| 2056 | 58,176 | 343,484 |
| 2057 | 53,887 | 310,446 |
| 2058 | 45,037 | 268,333 |

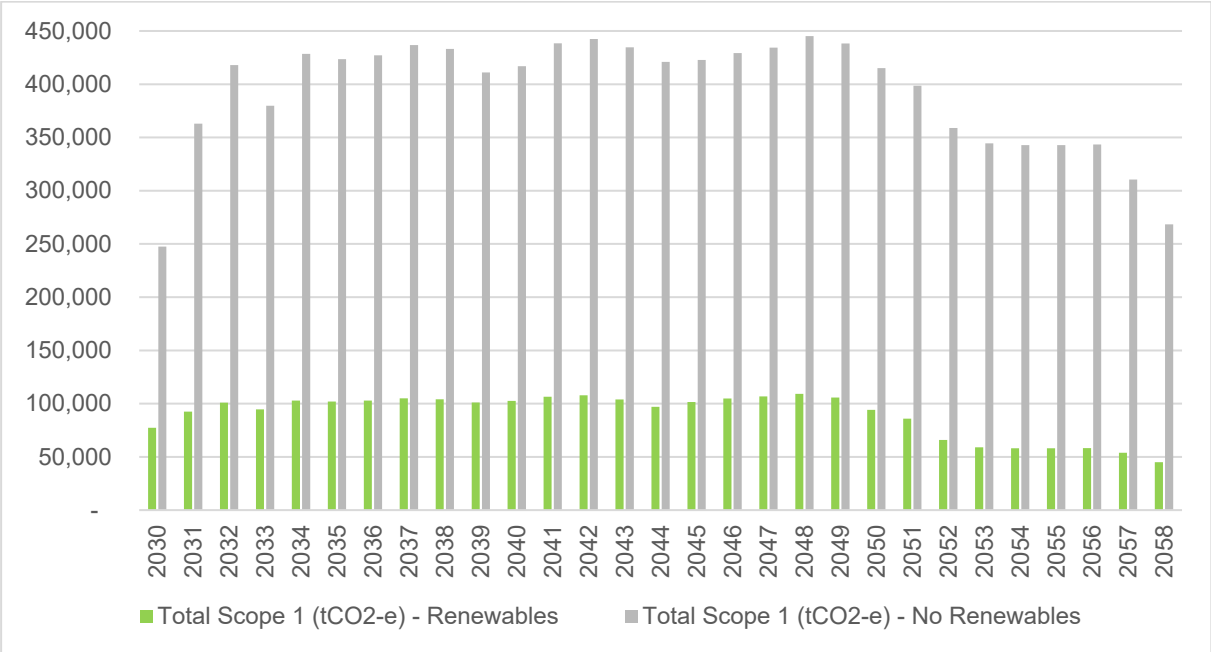



**Figure 14-5: Emissions Mitigation from Renewable Energy Sources**

**Table 14-9: Application of the Mitigation Hierarchy for GHG Emissions**

| Potential Impact | Mitigation | Standard Business Practice or Proposal Specific | Are Other Decision-making Processes Relevant? | Effectiveness of Nominated Control |
|---|---|---|---|---|
| **Direct Impacts** | | | | |
| Emissions as a result of clearing native vegetation | **Measure to Avoid** | | | |
| | The Development Envelope and Conceptual Footprint have been modified during the design phase to avoid direct impacts to native vegetation where possible<br>The total extent of clearing will not exceed 4,878 ha within the 23,649 ha Development Envelope | Proposal specific | No | Avoidance is the first and preferred step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | Upper clearing limit for native vegetation | | Clearing limits to be included as Ministerial Condition | |
| Combustion of diesel for mobile and stationary energy demands | **Measure to Avoid** | | | |
| | Ongoing optimisation of the mine plan and design of the Proposal to continue to improve logistical efficiencies | Proposal specific | No | Avoidance is the first and preferred step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) |
| | **Reduce** | | | |
| | Investigating the adoption of Renewable Diesel for vehicles and machinery that are difficult to electrify | Proposal specific | No | Reduce is the second step in the mitigation hierarchy and therefore is consistent with the EPA's Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA 2023b) |
| | Utilisation of renewable energy infrastructure for power generation | Proposal Specific | No | |
| | Investigating electrification of heavy mobile equipment | Proposal specific | No | |
| | **Proposed Limits on Impact to Ensure Environmental Outcomes** | | **Mechanism for Limit** | |
| | No limits proposed | | N/A | |

### 14.5.4 Offsets

In 2022, Rio Tinto increased investment in the Nature Solutions team in recognition that high quality offsets will play a significant role in its decarbonisation strategy this decade. Rio Tinto is expecting to achieve the long-term target of net zero emissions by 2050 through a combination of avoidance measures and offsets.

Where offsets are required due to company commitments and targets or changes to the Safeguard threshold the Proponent proposes to use Australian Carbon Credit Units (ACCUs), to meet any EPA commitments. ACCUs must be surrendered in the Australia National Registry of Emissions Unit (ANREU) of which the CER is the certifying body. The Proponent is focused on securing high quality 'nature based' ACCUs, with a vintage year from 2018 and onwards, that meet Rio Tinto's high-quality thresholds due to the potential for strong carbon, nature and social benefits. Given this focus, Rio Tinto's GHG offsets investments prioritise the development and sourcing of ACCUs generated by methods including but not limited to:

- Environmental planting
- Savanna burning
- Integrated farm method (as of H2 2024).

The projected Scope 1 emissions will be consistent with a global low-carbon transition to net zero by 2050 scenario. The mitigation measures discussed in this Section will reduce Scope 1 emissions continually past 2050 and offsets will be used for the remaining emissions past 2050.

Prior to 2050, in order to reduce peak emissions to meet the Safeguard Mechanism threshold of 100,000 $tCO_2$-e, the maximum percentage of offsets required would be approximately 9%, as calculated under the EPA assessment methodology of combined Scope 1 and Scope 2 emissions (109,166 $tCO_2$-e [2048]; Table 14-3).

The amount of offsets required may change if technology advances allow the Proponent to reduce Scope 1 emissions further than estimates presented in Section 14.4.1. The Proponent's preference is to reduce emissions through local abatement before relying on offsets to meet emissions targets.

### 14.5.5 Scope 3 Emissions

Reducing Scope 3 emissions will be difficult as the Proponent has limited influence on the supply chain. Whilst acknowledging the difficulty, Rio Tinto is partnering with customers to decarbonise value chains, identifying four areas of focus:

- Steel value chain
- Alumina refining
- Shipping
- Procurement decarbonisation.

For the scope of the Proposal, project shipping and procurement decarbonisation are relevant areas of focus. An outline of the relevant targets for these areas is provided below. For a more detailed description of the four focus areas refer to Rio Tinto's Climate Action Plan (2025a).

Shipping decarbonisation targets include:

- Reach net zero shipping by 2050 across our shipping footprint
- Fulfil First Movers Coalition (FMC) pledge of 10% of time-chartered fleet to be running on low-carbon fuels1 by 2030 and progressing to 100% of time-chartered fleet by 2040
- Having reduced emissions intensity by 40% five years ahead of the target set, Rio Tinto has set a more ambitious target of delivering a 50% intensity reduction by 2030

Procurement decarbonisation targets include:

- Engage with 50 of our highest-emitting suppliers on emissions reduction, focused on driving supplier accountability for setting and delivering against their decarbonisation targets
- Implement decarbonisation evaluation criteria for new sourcing in high-emitting categories.

## 14.6 Assessment of Residual Impacts

In the context of state, national and global GHG emissions, the annual operational average Scope 1 and 2 emissions associated with the Proposal make up a very small percentage of the total (0.11%, 0.02% and 0.00016% respectively DCCEEW 2025b; UNEP 2024).

As discussed in Section 14.4.4, the emissions intensity of the Proposal is not only the lowest in comparison to other copper-gold projects identified in Western Australia but is also within approximately 14% of the Australian Governments default Scope 1 emissions intensity specified by the Safeguard Mechanism. This indicates that the performance measures implemented at the Project are consistent with industry best practice.

UNFCCC provides the framework for international cooperation to reduce global GHG emissions and limit temperature increases. The UNFCCC Paris Agreement entered into force on 4 November 2016, and Australia is currently committed to reducing GHG emissions by 43 per cent below 2005 levels by 2030. Relative to a 2018 baseline Rio Tinto's Climate Action Plan outlines its ambition to reach net zero emissions by 2050 across all operations (Rio Tinto 2025a). To support this ambition, medium-term global targets have been introduced for Scope 1 and 2 (Section 14.5.1). However, because the Proposal was not operational in 2018, the two interim targets have not been applied.

The Proponent is committed to achieving the long-term corporate target of net-zero emissions by 2050, consistent with the Rio Tinto Group Climate Action Plan (Rio Tinto 2025a) and the State GHG Policy and Guidelines (GoWA 2024b). The focus of Rio Tinto's decarbonisation strategy is on transitioning away from diesel fuel, developing nature-based solutions and building renewable energy infrastructure (Rio Tinto 2025a). The Proponent will implement a range of these solutions to achieve emissions reductions, via site-based renewable energy infrastructure, efficiency improvements and electrification of mobile fleet.

After the application of avoidance and minimisation measures, the Proposal is expected to contribute net GHG emissions (Scope 1 and Scope 2 emissions) of approximately 2,769,150 t $CO_{2\text{-}e}$ through the approximate 32 year life of the Proposal.

The GHG emissions associated with the Proposal are not significant in the context of state, national and global emissions, and will not impede the State GHG Policy aspiration of net zero emissions by 2050 given the relatively low emissions and the projected decarbonisation of the Project by 2050.

## 14.7 Likely Environmental Outcomes

The key predicted outcomes for the Greenhouse Gas Emissions values are that Scope 1 and 2 GHG emissions attributable to the Proposal are estimated to be 2,769,150 t $CO_2$-e over the life of the mine.

After the mitigation hierarchy has been applied, the Proponent considers that the Proposal will not have a significant residual impact on GHG Emissions.

The Proponent is committed to achieving net-zero emissions by 2050, consistent with the Rio Tinto Group Climate Action Plan (Rio Tinto 2025a) and the State GHG Policy and Guidelines (GoWA 2024b).

Given the Proposal is subject to Rio Tinto's emissions targets and will be regulated under the NGER Act, no conditions are proposed under this Part IV of the EP Act.

Based on the current understanding of potential impacts and emissions reductions measures, it is considered that the EPA objective "To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change" can be met.

# 15 OFFSETS

This section outlines the offset package proposed to counterbalance the significant residual impacts of the Proposal, identified through the environmental impact assessment described in this ERD.

The process of identifying significant residual impacts and determining appropriate offsets follows the framework provided by the WA Environmental Offsets Policy (GoWA 2011) and the WA Environmental Offsets Guidelines (GoWA 2014a), while ensuring that the type and scale of the offsets proposed for MNES are appropriate and consistent with the EPBC Act Environmental Offsets Policy (DSEWPaC 2012a) in addition to the State's requirements. As the Proposal is being assessed by a separate parallel Commonwealth EPBC Act assessment, it is expected that the State and Commonwealth agencies will work cooperatively to align offsets and avoid duplication as far as practicable. As such, this section addresses both the State and Commonwealth offset requirements.

## 15.1 Objective

Environmental offsets are measures that provide environmental benefits to compensate the significant residual environmental impacts of a proposal or activity. Offsets should only be applied where the residual impacts of a proposal are determined to be significant, once avoidance, minimisation, and rehabilitation have been employed.

To ensure consistency and transparency of whether offsets should be applied to a proposal, the significance of residual impacts is determined by applying the residual impact significance model (RISM) provided in the WA Environmental Offsets Guideline (Table 15-3) (GoWA 2014a). This model outlines how significance is determined and when an offset is likely to be required, or may be required, concerning relevant EPA environmental factors and the clearing principles in Schedule 5 of the EP Act (GoWA 2014a).

The mitigation hierarchy of 'avoid, minimise, rehabilitate and offset' has been considered in the assessment of this Proposal. This will continue to be applied during the implementation phase, as far as reasonably practicable, such that impacts are first avoided, then minimised, rehabilitated and finally offset if significant residual impacts are unavoidable.

## 15.2 Relevant Policy and Guidance

### 15.2.1 EP Act

#### 15.2.1.1 WA Environmental Offsets Policy

Western Australia's Environmental Offsets Policy (the Policy) (GoWA 2011) seeks to protect and conserve environmental and biodiversity values for present and future generations. The policy ensures economic and social development while supporting long-term environmental and conservation values. The Policy aims to ensure that environmental offsets are applied in specified circumstances transparently to create certainty and predictability while acknowledging that some environmental values are not readily replaceable. It serves as an overarching framework to underpin environmental offset assessment and decision-making in Western Australia.

#### 15.2.1.2 WA Environmental Offset Guidelines

Western Australia's Environmental Offset Guidelines (the Guidelines) (GoWA 2014a) complements the Policy by clarifying the determination and application of environmental offsets in Western Australia. The application of the Guidelines is designed to ensure that decisions made on environmental offsets are consistent and accountable under the EP Act.

The Guidelines expand on the Policy to:

- Ensure that the basis for decision-making on environmental offsets is understood by decision-makers, government officers, industry and the community and consistently applied by decision-makers
- Ensure transparency in the determination and application of offsets
- Provide a basis for auditing, compliance and enforcement.

Notably, the Guidelines establish that environmental offsets are designed to address significant residual environmental impacts that remain after on-site avoidance and mitigation measures have been undertaken.

#### 15.2.1.3 WA Draft Procedure for Environmental Offsets Metric Inputs

The Procedure for Environmental Offsets Metric Inputs (Draft) (DWER 2022) was developed to improve the consistency and transparency of offset calculations by assisting users of the Western Australia environmental offsets calculator and guideline (DWER 2021a) understand the ranges of metric inputs and their rationale.

The procedure can be applied to all land-based biodiversity offsets required as a condition of EP Act approvals and in the intensive and extensive land use zones, excluding those proposals which use the Pilbara Environmental Offsets Fund.

Notably, the procedure provides examples and suggested ranges for the “risk of future loss” without an offset, that take into account existing environmental and planning approvals, zoning, permitted land uses as well as examples and ranges for the “risk of future loss” with an offset based on offset tenure and land use zones.

### 15.2.2 EPBC Act

The EPBC Act Environmental Offsets Policy (DSEWPaC 2012a) outlines the Commonwealth Government’s offsetting framework under the EPBC Act. The policy intends to provide a transparent framework and greater certainty for businesses considering undertaking action which may be subject to an offset requirement, while providing robust, positive environmental outcomes and consistency of approach.

The policy is accompanied by the Offsets Assessment Guide (DSEWPaC 2012b), which uses a balance sheet approach to estimate impacts and required offsets for species and ecological communities listed under the EPBC Act.

## 15.3 Summary of Significant Residual Impacts

### 15.3.1 State Environmental Values

Environmental offsets will only be applied where the residual impacts of the Proposal are determined to be significant after avoidance, minimisation, and rehabilitation have been pursued (GoWA 2014a).

These measures have been detailed in the relevant impact assessment chapters (Section 6 to 14).

The outcomes of the impact assessment for each relevant environmental factor are summarised in Table 15-1, demonstrating that the Proposal is expected to result in a significant residual impact to the Terrestrial Fauna Environmental Factor only, for impacts to critical habitat for Greater Bilby, Brush-tailed Mulgara, Northern Marsupial Mole, Western Pebble-mound Mouse, Spectacled Hare-wallaby and Dampierland Plain Slider. The impacts and mitigation for these species are summarised in Table 15-2, while the extent of the quantum of residual impacts is visually depicted in Figure 15-1 (series of four).

To determine whether offsets should be applied to the Proposal, the significance of residual impacts has been determined by applying the residual impact significance model (RISM) provided in the WA Environmental Offsets Guidelines (GoWA 2014a), as summarised in Table 15-3. This model outlines

how significance is determined and when an offset may be required for relevant EPA environmental factors.

**Table 15-1: Summary of Impact Assessment Outcomes**

| Environmental Factor | Mitigation Measures | Significance of Residual Impacts |
|---|---|---|
| Social Surroundings | Section 6.5 | Significant residual impacts to Nyangumarta social surroundings include with respect to:<br>• Visual landscapes in the vicinity of cultural sites<br>• Visual and cultural landscapes resulting from the development of the WRL and TSF and large-scale infrastructure<br>• Culturally significant flora resulting from clearing<br>Significant residual impacts to Martu social surroundings include with respect to perceived:<br>• Potential for a changed occurrence of native flora and fauna through changes to surface water and groundwater flows and emissions (i.e. lighting, dust and noise)<br>• Impacts to the integrity of the cultural landscape resulting from the depletion of groundwater resources.<br>• Indirect impacts to surrounding culturally significant soaks resulting from mine related abstraction activities.<br>• Impacts to regionally significant songlines that are connected to 'water places'<br>It has been acknowledged in discussions with JYAC that concerns regarding these potential impacts can largely be managed through continued consultation with the Martu People throughout the life of the Proposal and through collaboration and information sharing via the proposed Implementation Committee<br>Offsets are not proposed in relation to Nyangumarta People and Martu People social surroundings as these impacts will be managed to meet the EPA's objective "to protect social surroundings from significant harm" through a range of measures developed with Nyangumarta People and Martu People, and management plans will continue to be co-developed and through a process of consultation and engagement in place with application of the mitigation hierarchy, including in relation to ACH sites and places<br>No significant residual impacts in relation to other stakeholders' social surroundings (Section 6.6) |
| Inland Waters | Section 7.5 | No significant residual impacts (Section 7.6) |
| Flora and Vegetation | Section 8.5 | No significant residual impacts (Section 8.6) |
| Terrestrial Fauna | Section 9.5 | Significant residual impact of clearing 4,498 ha of critical habitat for Greater Bilby, 3,700 ha of critical habitat for Brush-tailed Mulgara, Spectacled Hare-wallaby, and Dampierland Plain Slider, 798 ha of critical habitat for Northern Marsupial Mole and 238 ha of critical habitat for Western Pebble-mound Mouse (Section 9.6) |
| Subterranean Fauna | Section 10.5 | No significant residual impacts (Section 10.6) |
| Terrestrial Environmental Quality | Section 11.5 | No significant residual impacts (Section 11.6) |

| Environmental Factor | Mitigation Measures | Significance of Residual Impacts |
|---|---|---|
| Landforms | Section 12.5 | No significant residual impacts (Section 12.6) |
| Air Quality | Section 13.5 | No significant residual impacts (Section 13.6) |
| Greenhouse Gas Emissions | Section 14.5 | After the application of avoidance and reduction measures, the Proposal is expected to contribute net Scope 1 emissions of approximately 2,769,150 t $CO_2$-e through its life, with targets set to progress to net zero by 2050. Although, the Proponent does not consider that this level of emissions will have a significant residual impact, it is possible that carbon offsets (ACCUs) will be required to meet Safeguard Mechanism obligations and/or post 2050 targets (Section 14.5.4 and 14.6) |

**Table 15-2: Quantum of Significant Residual Impact to be Offset**

| Environment Value / Impact | Mitigation | | | Significant Residual Impact |
|---|---|---|---|---|
| | Avoid and Minimise | Rehabilitation Type | Likely Rehabilitation Success | |
| Clearing of Shrub and Spinifex on Sandplain (3,700 ha), Inland Sand Dune (798 ha) and Gravelly Lateritic Rises (238 ha) habitat types which provide critical habitat for the following significant fauna species:<br>• 4,498 ha for Greater Bilby, inclusive of:<br>  ○ 3,700 ha for Brush-tailed Mulgara<br>  ○ 798 ha for Northern Marsupial Mole<br>  ○ 3,700 ha for Spectacled Hare-wallaby<br>  ○ 3,700 ha for Dampierland Plain Slider<br>• 238 ha for Western Pebble-mound Mouse | **Avoid**<br>Clearing and fragmentation of habitat:<br>• The Development Envelope and Conceptual Footprint have been modified during the design phase to avoid direct impacts to fauna habitat where practicable – including avoidance of approximately 14,000 ha of fauna habitat and amendment to the MIA Development Envelope to avoid an active Greater Bilby population<br>• The total extent of clearing will not exceed 4,878 ha within the 23,649 ha Development Envelope<br>Loss of or injury to individuals:<br>• Pre-clearance surveys for Greater Bilby will be undertaken to ascertain no active individuals are present within the clearing footprint<br>• No-go zones will be established around any active Greater Bilby burrows (should they be identified during pre-clearance surveys). No-go zones will remain in place until either:<br>  ○ A fauna specialist has relocated the individual or<br>  ○ The individual has been observed to have moved on from the area to adjoining suitable habitat, or the burrow is observed to no longer be active<br>**Minimise**<br>Clearing and fragmentation of habitat:<br>• The Development Envelope and Conceptual Footprint have been modified during the design phase to minimise direct impacts to Inland Sand Dunes habitat which provides critical habitat for significant fauna species<br>• Known locations of significant fauna habitat will be included in the Proponent's GIS system to ensure impacts to known locations of significant habitat types are minimised and adhere to authorised extents<br>Loss of or injury to individuals:<br>• Clearing will be undertaken progressively to allow fauna to migrate away from clearing activities or machinery movements<br>• Within 14 days prior to clearing, a fauna pre-clearance survey will be undertaken.<br>• Speed limits will be implemented to minimise the risk of fauna injury or mortality from vehicle strike<br>• Vehicle traffic will be confined to defined roads and tracks<br>• Site induction programs will provide information on significant fauna, including their appearance and habitats. Training would also discuss standard operating procedures in the event of fauna interactions<br>• Artificial water sources (ponds, dams and turkey's nests) will have egress points<br>• The length of any open trenches will be minimised and backfilled progressively where possible<br>• Duration of open excavations will be minimised and backfilled immediately following completion of construction<br>• Fauna egress and fauna refuge will be installed in all excavations left open overnight<br>• Trench inspections for fauna and clearance are to be carried out within two hours of sunrise and before sunset unless backfilled, in which case inspection shall precede backfilling, as identified below<br>• Construction crews shall inspect trenches half an hour before backfilling. If trapped fauna are present, a fauna handler will be notified and engaged to assist before backfilling<br>Degradation or alteration of habitat as a result of altered hydrological regimes: | The Proponent will prepare and regularly update, at intervals not exceeding five years, an MCP consistent with DMPE Guidelines for Preparing Mine Closure Plans (DMPE 2025b)<br>Habitat elements to be considered for Terrestrial Fauna as part of rehabilitation design includes:<br>• Vegetation that is known to provide preferred food or shelter preference<br>• Retaining and replacing woody debris<br>Rehabilitation will be undertaken progressively where possible to minimise disturbed areas, reducing fragmentation and barriers to fauna movement<br>Groundwater bores will be decommissioned in accordance with DWER relevant guidelines, once no longer required<br>All disturbed areas that are no longer required will be stabilised and, if appropriate, rehabilitated<br>All surface water diversions remaining after closure are designed and engineered to minimise impacts on local hydrological regimes, ensure long term stability across the realistic range of expected flow events, and do not significantly cause or contribute to water quality impacts | **Can the environmental value(s) be rehabilitated? Evidence?**<br>Rehabilitation methods for mine operations in the Pilbara and Australian semi-arid environments are well established<br>Given the life of the Proposal, additional research/evidence-based information is expected to be available at closure to inform rehabilitation success<br>**Operator experience in undertaking rehabilitation?**<br>Rio Tinto has a dedicated closure team that provides strategic advice, governance, technical support and expertise. Rio Tinto has recent experience in mine closure with active rehabilitation being undertaken at the Argyle Diamonds and Ranger Mines. Rio Tinto also conducts rehabilitation activities progressively at all of its operations in the Pilbara. While these are iron ore mines they share key characteristics with the Proposal, including the semi-arid environment. All rehabilitation will be undertaken as suited for the Proposal as a copper-gold mine in the Great Sandy Desert bioregion<br>**What is the type of vegetation being rehabilitated?**<br>Revegetation will be based on the use of local native species with a focus on rehabilitation of native ecosystems where achievable<br>The Proponent will purchase appropriate provenance seeds from the Traditional Owners or commercial seed suppliers for rehabilitation. Stringent controls on seed quality, provenance and seed storage will be in place. Seed pre-treatments are researched and incorporated for some species to maximise the potential of applied seed to germinate successfully and persist<br>**Time scale**<br>Progressive rehabilitation will be undertaken as areas within the Development Envelope have been determined to no longer be required for current or future operation. Progressive rehabilitation will continue to be undertaken throughout the life of the Proposal where practicable; however, the majority of rehabilitation will be undertaken at closure, due to the singular nature of most engineered landforms<br>**Credibility of the rehabilitation proposed (evidence of demonstrated success)**<br>Rio Tinto has undertaken extensive revisions of mine closure planning for all of its Pilbara operations to ensure, among other things, improved detail is provided on how closure objectives, such as those related to progressive rehabilitation, will be achieved successfully. A rehabilitation research program will be developed and implemented throughout the mine life, such that final rehabilitation will be well informed. This will include opportunities to learn from the rehabilitation of sand dominated landscapes at other mining operations in the Great Sandy Desert (Nifty and Telfer) and broader WA (Eneabba). Learnings will incorporate successful rehabilitation and, where possible, case studies where rehabilitation criteria have not been met. Engagement has commenced and will continue throughout the mine life | Yes<br>Clearing 4,736 ha of critical habitat |

| Environment Value / Impact | Mitigation | | | Significant Residual Impact |
|---|---|---|---|---|
| | Avoid and Minimise | Rehabilitation Type | Likely Rehabilitation Success | |
| | • Perimeter bunds will be constructed on the upper surface and benches of the WRL to ensure surface water retained within the bunds infiltrates into the WRL or evaporates<br>• A network of ponds, drains and flood protection bunds will be installed around the MIA to redirect stormwater from mining operations to be retained on site for re-use or to infiltrate/evaporate in situ.<br>• Waterway crossings will be installed along the RAC to prevent ponding upstream, water shadows downstream and to maintain flows downstream.<br>• Infiltration ponds and MAR bore management of surplus water is designed to minimise the potential for groundwater mounding on surface habitats<br>• Infiltration ponds are designed to minimise the risk of:<br>  ○ Overtopping ponds due to storage capacity exceedance<br>  ○ Forming a surface expression of groundwater or near the surface groundwater table.<br>• Infiltration ponds will be positioned to align with the existing dune, to also minimise disturbance to the local topography<br>Degradation of habitat as a result of increased weeds, dust, introduced fauna and altered fire regimes:<br>• The RAC will be sealed to minimise dust emissions<br>• Artificial water sources will be kept to the minimum level required for operations. Leaking water sources will be repaired and minimised<br>• Fixed plant dust suppression will be included in the design<br>• Appropriate dust controls (including but not limited to water carts, non-toxic stabilisers, speed limits, and progressive rehabilitation) to be implemented throughout construction and operations as required (noting the RAC will be sealed and dust control requirements along it will be minimal during operations)<br>• Vehicles will be required to travel at designated operating speeds on all roads and will be restricted from accessing rehabilitated surfaces except for management purposes<br>• The EMP will be implemented to prevent the introduction and spread of weeds and introduced fauna within the Development Envelope<br>• Implement a Fire Management Plan<br>Disturbance and displacement from increased light, noise and/or vibration:<br>• Lighting will be designed and managed in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW 2023b)<br>• No permanent lighting will be installed along the RAC. Limited temporary lighting may be used during construction of the road to support safe operations<br>• No permanent lighting will be installed along pipeline corridors or at the production or monitoring bores. Limited temporary lighting may be used occasionally if required to support safe operations<br>• Lighting at Rimfire collection tanks will be limited to that required for safe operations noting that the borefield will be remotely operated so light usage will be minimal<br>• Permanent lighting will only be installed where required, mainly at operational areas<br>• Permanent lighting and temporary lighting will be shielded and directed to active mine areas to minimise light spill<br>• Ensure all vehicles and machinery are serviced and maintained to minimise machinery noise<br>• Equipment design will be specified to be within Australia standard noise limits and/or fitted with noise mufflers in accordance with manufacturing specifications | | | |

121°0'0"E

Great Northern Hwy

NYANGUMARTA PEOPLE (PART A)

20°0'0"S

## Legend

- Gravelly lateritic rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

RioTinto

# Figure 15-1: Fauna habitat to be Offset due to Significant Residual Impact

## Sheet 1 of 4




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000
Rio Tinto © Copyright

0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Offsets - Significant Residual Impact to be Offset (MS Series)

121°0'0"E

121°30'0"E

N

NYANGUMARTA
PEOPLE
(PART A)

## Legend

- Bilby Populations
- Gravelly lateritic rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

RioTinto

# Figure 15-1: Fauna habitat to be Offset due to Significant Residual Impact

## Sheet 2 of 4




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000
Rio Tinto © Copyright

0 10 20 Kilometres

Path: \\per1.shared.riotinto.com\Data\GIS\Jobs\2021\W21_012_ERD Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: 15-1 - Offsets - Significant Residual Impact to be Offset (MapSeries)

121°30'0"E

121°30'0"E

20°30'0"S

N

NYANGUMARTA
PEOPLE
(PART A)

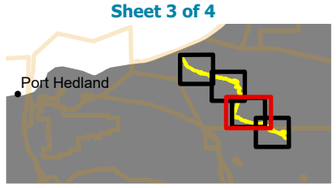
## Legend

- Gravelly lateritic rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

RioTinto

# Figure 15-1: Fauna habitat to be Offset due to Significant Residual Impact

Sheet 3 of 4




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000
Rio Tinto © Copyright

0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Offsets - Significant Residual Impact to be Offset (MapSeries)

121°30'0"E

122°0'0"E

N

NYANGUMARTA PEOPLE (PART A)

MARTU (AREA A)

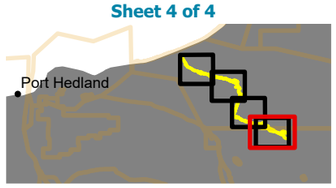
## Legend

- Bilby Populations
- Gravelly lateritic rises
- Inland Sand Dune
- Shrub and Spinifex on Sandplain
- Development Envelope
- Native Title Determinations
- Conceptual Footprint

RioTinto

# Figure 15-1: Fauna habitat to be Offset due to Significant Residual Impact

Sheet 4 of 4




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:160,000
Rio Tinto © Copyright

0 10 20 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Offsets - Significant Residual Impact to be Offset (MapSeries)

122°0'0"E

**Table 15-3: Residual Impact Significance Model (RISM)**

| Part IV Environmental Factors | Flora and Vegetation | | | Terrestrial Fauna | | Subterranean Fauna | |
|---|---|---|---|---|---|---|---|
| **Part V Clearing Principles** | **Threatened Flora** | **Threatened Ecological Communities** | **Remnant Vegetation** | **Wetlands and Waterways** | **Conservation Areas** | **High Biological Diversity** | **Habitat for Fauna** |
| The residual impact is environmentally unacceptable and cannot be offset | None identified | None identified | None identified | None identified | None identified | None identified | None identified |
| Significant residual impact that will require an offset | None identified | None identified | None identified | None identified | None identified | None identified | Clearing up to 4,736 ha of critical habitat for significant fauna species, including:<br>• 4,499 ha of Greater Bilby critical habitat<br>• 3,700 ha of Brush-tailed Mulgara critical habitat<br>• 798 ha of Northern Marsupial Mole critical habitat<br>• 238 ha of Western Pebble-mound Mouse critical habitat<br>• 3,700 ha of Spectacled Hare-wallaby critical habitat<br>• 3,700 ha of Dampierland Plain Slider critical habitat |
| Significant residual impacts that may require an offset | None identified | None identified | None identified | None identified | None identified | None identified | None identified |
| Residual impacts that are not significant | No Threatened flora species listed under the BC Act or EPBC Act have been recorded within the Development Envelope<br><br>Clearing of Priority flora individuals is not expected to result in significant impacts to any species, given the widespread nature of all species both within and outside of the Development Envelope | No TECs listed under the BC Act or EPBC Act have been recorded within the Development Envelope | Although the Proposal will result in the clearing of up to 4,878 ha of Excellent condition native vegetation, this is not considered unique to the Development Envelope | The Proposal does not intersect any major surface water features | There are no conservation reserves or ESAs near the Development Envelope, with the nearest, Walyarta Conservation Park, located approximately 40 km north of the RAC at its nearest point. The nearest Ramsar Wetland to the Proposal is Eighty Mile Beach. The Development Envelope is nearest to the Ramsar site where the RAC intersects the existing Great Northern Highway, 9 km southeast of the coastal portion of Eighty Mile Beach. The MIA and Rimfire are approximately 145 km and 180 km from the coastal portion of the Ramsar Wetland, respectively. The Mandora Marsh (Walyarta) portion of the Ramsar Wetland is approximately 85 km from the MIA and 95 km from Rimfire | The Development Envelope is not considered a biodiversity hotspot<br><br>Although the Development Envelope contains Excellent vegetation and conservation significant flora and fauna species, this is not considered unique to the Development Envelope | The Proposal is not expected to significantly impact Night Parrot, Black-footed Rock Wallaby, Grey Falcon, Princess Parrot, Northern Quoll, Peregrine Falcon, Short-tailed Mouse or any Migratory bird species. No critical habitat for these species will be impacted. Habitat for these species will remain available within the Development Envelope and is widespread throughout the broader region<br><br>The Proposal is not expected to significantly impact subterranean fauna. Sufficient habitat for stygofauna is expected to remain available outside the area of influence of groundwater drawdown |

### 15.3.2 Commonwealth Environmental Values

The Proposal has considered significant residual impacts for environmental values recognised under the Commonwealth policy.

Eleven species[4] listed under the EPBC Act have been recorded (Greater Bilby, Grey Falcon, Pacific Swift, Little Curlew, Oriental Plover and Oriental Pratincole), are considered likely to occur (Black-footed Rock Wallaby, Northern Quoll and Night Parrot) or may occur (Princess Parrot and Barn Swallow) within the Development Envelope. The Proposal has been designed to avoid and minimise potential impacts to these species as far as practicable.

Following the application of the mitigation hierarchy, the Proposal is expected to result in a significant residual impact to the Greater Bilby due to the clearing of 4,498 ha of critical habitat for the species.

No significant residual impacts are predicted for the 10 other species listed under the EPBC Act, as the Proposal is not expected to result in habitat loss or impacts to individuals to the extent that species' populations are likely to decline at a local or regional scale. A detailed assessment of the impacts for each species is discussed in Section 9.

#### 15.3.2.1 Greater Bilby

Secondary evidence of the Greater Bilby has been recorded throughout the Development Envelope and wider region. Surveys undertaken within the Development Envelope recorded evidence such as recent diggings, scats, tracks and active burrows (Biota 2026h, 2026a).

While a known population of Bilbies has been surveyed south of the MIA, compared to the estimated Greater Bilby populations in the Pilbara, this population south of the Development Envelope does not represent a large, regionally significant source population for breeding or dispersal within the Great Sandy Desert bioregion (Biota 2026a). The largest Greater Bilby population recorded to date has been at Anna Plains within the Dampierland bioregion, with approximately 44 individuals recorded (Biota 2026a). This population is likely to be an important key source population within the Dampierland bioregion. The population within the Development Envelope, along with other low abundance populations in the Pilbara, Gibson Desert and Dampierland, is likely an important population for maintaining genetic diversity within the bioregion.

The Shrub and Spinifex on Sandplain and Inland Sand Dune habitat types within the Development Envelope are considered to be critical habitat for the Greater Bilby (Biota 2026h).

Following application of the mitigation hierarchy, the residual impact of clearing 4,499 ha of critical habitat for the Greater Bilby is considered significant and is proposed to be offset.

## 15.4 Proposed Offsets

### 15.4.1 Biodiversity Offsets

An Offset Strategy has been developed which provides the proposed framework to deliver the offsets required for the Proposal (E2M 2026) (Appendix K01). The proposed framework includes the key actions, stakeholders, timetable, indicative budget and outcomes for the relevant environmental values, in accordance with the WA and Commonwealth offset policies (Section 15.2).

Traditional land-based offsets are not considered suitable for this Proposal, as the Development Envelope is located within WA's Extensive Land-use Zone with land use tenure issues. As such, the

[4] Refer to Section 9 regarding records of the Australian Tern (*Gelochelidon [nilotica] macrotarsa*) – not considered applicable to this assessment

Proponent proposes a strategic approach to offsets, in line with Principle 6 of the WA Environmental Offsets Policy (2011) and the Commonwealth Environmental Offsets Policy (DSEWPaC 2012a), involving the establishment of a managed offset fund model within the bioregion to counterbalance the residual impacts of the Proposal.

The managed fund model will enable funding for a third party to undertake the agreed offset actions. The proposed offset actions (herein Offset Projects) will be implemented as 100% direct offsets through targeted on-ground conservation management efforts. The Proponent will establish a Winu Mine Managed Offset Fund (Offset Fund) which will be governed by a formal agreement developed in consultation with regulatory agencies, Indigenous Ranger groups and other key stakeholders. The Offset Fund will serve as the long-term financial foundation to support the implementation of conservation measures.

Offset Projects will be collaboratively designed and implemented alongside the Traditional Owners and Ranger groups. The implementation of these Offset Projects will have the following benefits:

- Direct engagement of Nyangumarta People and Martu People and advancement of values and management objectives for both IPAs
- Meaningful conservation outcomes for Greater Bilby, Brush-tailed Mulgara, Northern Marsupial Mole, Dampierland Plain Slider, Spectacled Hare-wallaby and the Western Pebble-mound Mouse populations and habitat
- Other native fauna indirectly benefiting through the implementation of the proposed offset actions, where management and reduction of threatening processes overlap and which are recognised as key threats for the landscape in which the Project and Offset Projects are located (such as feral fauna and altered fire regimes).

The approved Offset Strategy will inform the development of an Offset Management Plan (OMP). The OMP will detail the objectives, targets, monitoring, performance criteria and adaptive contingency measures for implementation of the Offset Projects.

#### 15.4.1.1 Proposed Greater Offset Area

The Offset Projects are proposed to be undertaken across two areas: the Nyangumarta Warrarn IPA and the Martu IPA (herein the Proposed Greater Offset Area; Figure 15-2). These areas are identified as having conservation value in the Great Sandy Desert and are known to provide habitat for Greater Bilby and expected to provide habitat for the five Priority species (Commonwealth of Australia 2023; JYAC 2022; NWAC and YMAC 2022; Biota 2026h).

IPAs are recognised by the Australian Government as a key aspect of the National Reserve System as areas of Country managed by Traditional Owners to deliver biodiversity conservation outcomes. For instance, the Martu IPA and Nyangumarta Warrarn IPA have added over 2.1 million and 2.6 million additional hectares to the National Reserve System since June 2022 and April 2015 respectively (DCCEEW 2025c).

The proposed Offset Projects will build on the existing conservation programs being implemented within the Great Sandy Desert, strengthening the potential for greater outcomes within the area. The Proponent considers that the proposed Offset Strategy would support both the Nyangumarta IPA and Martu IPA.

#### 15.4.1.2 Nyangumarta Warrarn IPA

The Nyangumarta Warrarn IPA extends over an area of approximately 2.8 million ha, the majority of which is located in the Great Sandy Desert and Dampierland IBRA subregions.

The *Nyangumarta Warrarn IPA Management Plan 2022-2023* (NWAC and YMAC 2022) includes strategies and actions for conserving Greater Bilby and other fauna species within the IPA, including:

- Continue to monitor for and develop a Feral Cat eradication program for Nyangumarta Warrarn Country

- Continue to work with partners (e.g. Parks and Wildlife [now DBCA] and the 10 Deserts Project) for the management of Camels and Cattle
- Monitor and eradicate weeds at key locations
- Develop a 5-year fire management operational plan to guide annual fire burning and to build operational capacity
- Develop and implement annual fire management plan working cooperatively with partners
- Continue to work with partners to build knowledge of Threatened species and ecological communities over time to ascertain health of Country and impact of management regime (e.g. long-term biodiversity sites).

#### 15.4.1.3 Martu IPA

The Martu IPA extends over an area of approximately 2.2 million ha, occurring across the Gibson Desert, Great Sandy Desert and Little Sandy Desert IBRA subregions.

The *Martu Indigenous Protected Area Plan of Management 2022-2027* (JYAC 2022) has identified the following eight key targets which need to be healthy in order for the Martu IPA to be healthy:

- Ngurraku ninti (knowledge of ngurra [Country])
- Kalyu (permanent waterholes, springs and soaks)
- Mirrka (plants for food and medicine)
- Martu livelihood
- Warla (lakes)
- Small animals (including Greater Bilby and Marsupial Mole)
- Important Martu places
- Kuwiyi (bush meat).

The management plan has identified the following management objectives to address these targets:

- Feral herbivore management
- Tourist visitation
- Weed management
- Unplanned development
- Climate change
- Feral predator management
- Risk of knowledge not being passed from older to younger generations
- Appropriate fire regimes.

120°0'0"E
122°0'0"E
124°0'0"E
126°0'0"E
20°0'0"S
22°0'0"S
24°0'0"S

N

Nyangumarta Warrarn IPA
Nyangumarta Warrarn IPA
NYANGUMARTA PEOPLE (PART A)
MARTU (AREA A)
Martu IPA
Martu IPA
MARTU (AREA A)
MARTU (PART B)
Birriliburu IPA
Warlu Jilajaa Ju

Rudall River National Park
Rudall River National Park

Port Hedland
Wittenoom
Newman
Lake Disappointment

101 m
277 m
599 m
555 m
395 m
802 m
520 m
477 m
911 m

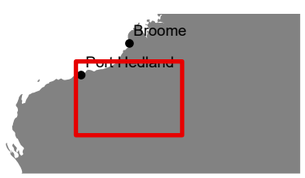
G R E A
G I B S O N D E S E R T

## Legend

- Indigenous Protected Areas
- Native Title Determinations
- Winu Development Envelope

RioTinto

# Figure 15-2: Proposed Greater Offset Area




**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:2,250,000
Rio Tinto © Copyright

0 50 100 Kilometres

Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_IPA_for_DBCA\W21_012_IPA_for_DBCA.aprx Layout: IPA for DBCA Meeting

#### 15.4.1.4 Proposed Offset Quantum

##### 15.4.1.4.1 Offset Funding Quantum

The proposed funding for the Offset Projects has been calculated based on Consumer Price Index (CPI) adjusted rates referenced in the approval documentation for the Thunderbird Mineral Sands Project, WA (EPBC 2016/7648) (DoEE 2018). These rates have been used as a proxy, given there is no established offset fund in the Great Sandy Desert. This project is considered a suitable proxy given its location within the broader Pilbara-Kimberley region and its potential impacts on similar significant species to those relevant to the Proposal, particularly regarding the Greater Bilby (E2M 2026).

The proposed offset is considered suitable to compensate for impacts to all six offset species because they occur within the same landscape and utilise, to varying extents, the same or closely associated habitats and micro habitat features within and around the Development Envelope. These species occupy similar spatial extents, are subject to broadly comparable threats, and those threats have been identified as landscape wide pressures in the area in which the offset is proposed.(E2M 2026).

In the absence of species-specific offset benchmarks for the western pebble-mound mouse, Greater Bilby-based offset rates have been applied to this species. The use of greater bilby population and habitat improvement benchmarks as the basis for the proposed offset is considered a conservative and appropriate approach for the western pebble mound mouse and the remaining four WA priority listed species.(E2M 2026).

The funding is intended to be split between the Nyangumarta IPA and Martu IPA based on the percentage of disturbance occurring within each IPA. As such, 93% of funding will be directed to Nyangumarta IPA and 7% will be directed to Martu IPA.

A summary of the proposed funding model is shown in Table 15-4.

**Table 15-4: Offset Funding Summary**

| Environmental Value | Impact Area | Offset Rate per Hectare* | Offset Funding Total |
|---|---|---|---|
| Clearing of Shrub and Spinifex on Sandplain (3,683 ha), Inland Sand Dune (815 ha) and Gravelly Lateritic Rises (238 ha) habitat types which provide critical habitat for:<br>• Greater Bilby (4,498 ha), inclusive of:<br>  ○ Brush-tailed Mulgara (3,683 ha)<br>  ○ Northern Marsupial Mole (798 ha)<br>  ○ Spectacled Hare-wallaby (3,700 ha)<br>  ○ Dampierland Plain Slider (3,700 ha)<br>• Western Pebble-mound Mouse (238 ha) | 4,736 ha | $3,127 | $14,809,472 |

**Annual payments will be adjusted in accordance with the relevant CPI for Western Australia, with adjustments calculated from the date of approval and applied at the time of each annual instalment.*

##### 15.4.1.4.2 Offset Area Quantum

The Offset Strategy has been developed in line with the Commonwealth Offset Assessment Guide calculator (DSEWPaC 2012b) and DWER environmental offsets calculator (DWER 2021a) where possible. These calculators allow for calculating the offset area required to compensate for significant residual impacts. The calculators consider the area being impacted that requires offsetting, as well as the condition of the impact area.

For the purposes of offset quantum calculation, two distinct habitat loss figures have been applied in alignment with the respective offset calculators: 4,736 ha for the DWER Environmental Offsets Calculator (EOC) as per the requirement to offset the WA priority-listed species, and 4,498 ha for the

Offset Assessment Guide (OAG) calculator for the greater bilby habitat. These figures form the basis for determining the Offset Area required under each framework.

The condition ratings of habitat for all six species within the Conceptual Footprint and Proposed Offset Area were determined in accordance with the *Draft Procedure for Environmental Offsets Metric Inputs* (DWER 2022). This metric scale calculates the condition rating of Threatened fauna habitat based on three characteristics:

- Site condition (used the Trudgen vegetation condition scale for the Extensive Land-use Zone)
- Site context
- Habitat attributes.

Using the Commonwealth calculator, it is estimated that the required offset area is 25,970 ha. The calculations and justification are provided in Appendix A of the Offset Strategy (E2M 2026) (Appendix K01). Using the DWER calculator, the required offset area is estimated to be 23,900 ha. The calculations and justification are provided in Appendix B of the Offset Strategy (E2M 2026) (Appendix K01). Given the significance of critical habitat being offset, the larger area (i.e. 25,960 ha) will be used.

The total area of both IPAs is 5,013,929 ha of which 3,180,788 ha has been identified to locate offset activities, including 2,822,659 ha within the Nyangumarta Warran IPA and 358,129 ha within the Martu IPA. The Proponent considers that these areas are large enough to support a Proposed Offset Area of up to 25,970 ha.

It is noted that species-specific on-ground management is dependent on the nature, condition and extent of suitable habitat for the six species within the IPAs. This will be determined as part of the OMP.

#### 15.4.1.5 Proposed Offset Projects

Due to the absence of species-specific recovery plans for the Brush-tailed Mulgara, Northern Marsupial Mole, Dampierland Plain Slider, Spectacled Hare-Wallaby and Western Pebble-mound Mouse, the Greater Bilby Recovery Plan (Commonwealth of Australia 2023) has been adopted as a guiding framework for conservation actions and on-ground management across all target species within the Offset Area. Although the Western Pebble-mound Mouse does not co-occur with the Greater Bilby, the objectives of the Recovery Plan remain broadly applicable as threats to survival are shared between each of these species and within the landscape in which the Project and Offset Area is proposed. Therefore, this approach provides a consistent foundation for conservation planning for all six species, considering that the co-location of most of these species with the Greater Bilby enables integrated land management strategies to address shared threats and habitat requirements (E2M 2026). The key objectives of the Greater Bilby Recovery Plan relevant to the Offset Strategy are:

- **Objective 1:** The size of the population has grown
- **Objective 2:** The extent of occurrence and area of occupancy has been maintained or increased
- **Objective 4:** Indigenous organisations, communities and individuals have a greater role in conservation.

It is expected that over time, the outcomes of the Offset Projects will also contribute towards **Objective 3**: Maintaining the genetic diversity of each species' population, preserving their capacity for evolutionary adaptation and resilience.

##### 15.4.1.5.1 Priorities for On-ground Management Actions

The following priority management actions, have been identified in the supporting strategies in the National Recovery Plan for the Greater Bilby (DCCEEW 2023) and IPA management plans, as being most relevant to not only the greater bilby but also the five priority-listed fauna and therefore will be the focus of Offset Projects:

- **Priority 1:** Baseline Surveys

- **Priority 2:** Manage and monitor predators
- **Priority 3:** Fire management and prevention
- **Priority 4:** Manage and monitor habitat degradation
- **Priority 5:** Community and indigenous engagement.

The timeframes outlined below will be refined through development of the OMP and individual offset projects and management actions. These timeframes will be informed by baseline survey data and refined iteratively based on monitoring outcomes.

For the purpose of setting indicative temporal expectations for each priority offset project at this early stage of offset planning, the following timeframes are applied to the performance criteria:

- Short term = 1 to 5 years
- Medium term = 6 to 15 years
- Long-term = >15 years.

The Offset Strategy will focus on delivering measurable outcomes aligned with the three priorities listed above, with specific actions and performance criteria to support the recovery of the Greater Bilby, as outlined in Table 15-5 below.

**Table 15-5: Priorities for On-ground Managements Actions**

| On-ground Management Priority (E2M 2026) | Objective | Focus | Performance Criteria |
|---|---|---|---|
| Priority 1: Baseline Surveys | Undertake surveys for each of the threatened offset species within the offset area to establish a baseline for population/s size, distribution, habitat characteristics and preferences, recruitment and threats | • Establish baseline information about presence, distribution, population and habitats for each of the six threatened species which are being offset<br>• Collect meaningful seasonal baseline information to inform the priority Offset management actions, including through tracking and tag and release programs<br>• Survey methods are useful and repeatable as part of essential monitoring activities for priority Offset management actions 2, 3 and 4<br>• Data capture provides detailed threat information, including nature and extent of disturbance, presence and abundance of predators, impacts of disturbance and introduced species on vegetation and habitats | • Baseline data is collected biannually (seasonally) each year for at least the first two years of establishment of the Offset and including a greater bilby tracking program<br>• Baseline mapping is to be completed within three years of establishment of the offset, for vegetation assemblages, habitat (micro-habitat features, e.g. burrows) and population distribution, categorisation and distribution of threats and target areas for development of priority management actions |
| Priority 2: Manage and monitor | Reduce predation pressure from feral species, particularly Red Foxes and Feral Cats, which significantly impact ground-dwelling mammal and reptile populations | • Establish target areas or control events through initial baseline surveys and consultation with relevant stakeholders and specialists<br>• Control and monitoring of predator populations through baiting, trapping and shooting programs, i.e. >2 years for any given control and monitoring event, and in consideration of seasonal and baseline data and breeding cycles<br>• Use of non-toxic techniques and best practices to minimise impact on non-target species<br>• Monitor predator activity via camera traps and track surveys to assess success | • A demonstrable reduction in introduced predator activity, measured using trace plots, tracking and camera monitoring data in the short -to-medium term, with reductions maintained over the long term<br>• A reduction in predator-related mortality of each target species, with regular reporting on non-target species interactions and impacts in the short term, and sustained reductions demonstrated over the long term<br>• Monitoring is undertaken at least triennially to demonstrate that performance criteria are being met over the medium and long term |

| On-ground Management Priority (E2M 2026) | Objective | Focus | Performance Criteria |
|---|---|---|---|
| Priority 3: Fire Management and Prevention | To reduce habitat alteration caused by frequent, hot, large and uncontrolled fires, which modify nesting and foraging resources for the relevant species | • Understand the baseline fire history of the offset area, using a combination of surveys, fire scar analysis and vegetation mapping<br>• Develop and implement strategic and culturally informed burn regimes in line with IPA management plans and greater bilby recovery plan and considering baseline data for each of the six offset species<br>• Use planned small, and seasonal burns of varying intensity to create habitat mosaics of varying seral ages that enhance relevant shelter and foraging conditions and provide a range of conditions required for differing needs of the greater bilby, e.g. foraging, shelter, breeding | • A reduction in the frequency and spatial extent (patch size) of unplanned high-intensity fires caused by lightning strike in the medium to long term<br>• Improved post-fire vegetation recovery and habitat quality, tracked by vegetation surveys and remote sensing, including increased typical species richness and abundance and reduction in richness, abundance and cover of successional species in each vegetation type and following both planned and unplanned fires in the medium to long term<br>• Annual monitoring to demonstrate fire management is having a positive effect on greater bilby population and distribution and is not having a negative impact on populations and distribution of the five priority listed offset species<br>• Demonstrated inclusion of traditional owner input to fire management planning and involvement in on-ground management activities in the short term and maintained over the long term |
| Priority 5: Community and Indigenous Engagement | Foster local community involvement and integrate traditional ecological knowledge into conservation efforts for each relevant species | • Collaborate with Traditional Owners and Indigenous Ranger groups in the management of habitats<br>• Encourage the inclusion of Indigenous land management practices in the development and implementation of conservation actions | • Inclusion of traditional ecological knowledge in land management plans and practices<br>• Increase in number of full-time or part-time employment opportunities created for Indigenous community members in land management and conservation projects<br>• Establishment of formal, long-term agreements or partnerships with Indigenous communities regarding land management and conservation |

#### 15.4.1.5.2 Integration with Existing Regional Programs

The design and implementation of the Offset Projects will build upon existing (but limited) successful regional programs, planning frameworks and research initiatives. This includes (but is not limited to):

- **Indigenous Ranger Programs:** Collaboration with established Nyangumarta and Martu Ranger programs, leveraging their deep cultural knowledge, land management expertise and ongoing conservation activities within the region
- **The Recovery Plan for the Greater Bilby:** Alignment with a contribution to the national recovery efforts outlined in the Recovery Plan (Commonwealth of Australia 2023), ensuring offset activities directly support species-wide conservation objectives
- **Pilbara Bilby Research Program:** Incorporation of scientific findings, monitoring methodologies and conservation approaches developed through this regional research initiative
- **Existing Environmental Offset Projects:** Coordination with and learning from offset projects implemented by other mining companies in the region, promoting complementary actions and avoiding duplication of efforts
- **Government Programs:** Integration with State government initiatives led by the DBCA and DPIRD, focused on fire management, weed control and feral fauna management.

Offset Projects will be designed to build upon these established programs and frameworks to enhance conservation coherence, maximise cost-effectiveness through shared resources and knowledge, and contribute to landscape-scale outcomes that benefit State- and Commonwealth-listed conservation-significant species, as well as other protected species populations occurring in the landscape, beyond the boundaries of the Proposed Offset Area.

#### 15.4.1.5.3 Funding Criteria

Offset Projects funded under the OMP must demonstrate:

- A measurable conservation benefit for relevant State and Commonwealth-listed conservation-significant species
- The capability of the applicant to execute the Offset Project successfully, including proposed budget, use of local resources, and compliance with relevant research, regulatory or other standards including the relevant IPA management plans
- A suitable project timeline, including clearly defined milestones and deliverables.

#### 15.4.1.5.4 Timeframes

Each Offset Project will have specific and measurable objectives, defined across multiple timeframes to ensure both immediate actions and long-term conservation gains. These will include:

- **Annual Objectives:** Short-term targets that measure immediate progress of management interventions, enabling adaptive management approaches and early identification of implementation challenges
- **Five-yearly Objectives:** Medium-term milestones that assess ecological responses and management effectiveness allowing for strategic adjustments to the offset program
- **Ten-year Outcomes:** Long-term conservation goals focused on demonstrating real change at a landscape scale. These extended timeframes recognise that conservation and restoration projects in highly variable, spatially heterogenous and episodic environments like the Great Sandy Desert often require multiple years to measure meaningful improvements in ecosystem health and species populations.

### 15.4.1.6 Offset Management Plan

An OMP will be developed following approval of the Offset Strategy (E2M 2026) (Appendix K01). The OMP will provide the framework for the implementation, delivery and reporting of all Offset Projects. It will be an adaptive document, with regular review and update required to reflect Offset Project progress, changes in regulatory requirements and stakeholder feedback. The OMP will be submitted to the relevant DMAs for review and approval as required and will be made publicly available.

The OMP will include the following key components:

- **Integration of Approved Offset Project Proposals:** Each Offset Project Proposal, once approved, will be incorporated into the OMP. This will ensure that all Offset Project-specific objectives, implementation schedules, budgets, and monitoring frameworks are centrally managed and aligned with the overarching Offset Strategy and accounted for in the Offset Fund
- **Stakeholder Engagement:** The development of the OMP will be undertaken in close consultation with relevant stakeholders, including Traditional Owners, land managers, government agencies, and conservation partners. This engagement will ensure that the OMP reflects shared priorities, incorporates local knowledge, and supports long-term stewardship of the Proposed Offset Areas
- **Governance and Oversight:** The OMP will define governance structures, including roles and responsibilities for the Proponent in the planning, implementation and review of Offset Projects. This will include mechanisms for decision-making, risk management, fund management and adaptive management
- **Monitoring and Evaluation Framework:** The OMP will establish a consistent framework for monitoring Offset Project performance against defined objectives, milestones and targets. This will include methodologies for data collection, analysis and reporting, as well as provisions for auditing and independent reviews where appropriate
- **Reporting and Review Schedule:** The OMP will outline the schedule and format for annual reporting, as required under the EPBC Act and EP Act conditions. It will also include provisions for periodic review and revision of the OMP to ensure it remains current and effective
- **Endurance and Legacy Planning:** The OMP will identify strategies to ensure the long-term sustainability of Offset Projects beyond the life of individual funding cycles. This may include the establishment of conservation agreements, capacity-building initiatives and partnerships that support enduring outcomes for the Greater Bilby, Brush-tailed Mulgara, Northern Marsupial Mole, Dampierland Plain Slider, Spectacled Hare-wallaby, Western Pebble-mound Mouse and other conservation significant fauna.

### 15.4.2 GHG Emissions Offsets

In 2022, Rio Tinto increased investment in the Nature Solutions team in recognition that high quality offsets will play a significant role in its decarbonisation strategy this decade. Rio Tinto is expecting to achieve the long-term target of net zero emissions by 2050 through a combination of avoidance measures and offsets.

Where offsets are required, the Proponent proposes to use ACCUs, to meet any commitments. ACCUs must be surrendered in the ANREU of which the CER is the certifying body. The Proponent is focused on securing high quality ‘nature based’ ACCUs, with a vintage year from 2018 and onwards, that meet Rio Tinto’s high-quality thresholds due to the potential for strong carbon, nature and social benefits. Given this focus, Rio Tinto’s GHG offsets investments prioritise the development and sourcing of ACCUs generated by methods including, but not limited to:

- Environmental planting
- Savanna burning
- Integrated farm method (as of H2 2024).

The projected Scope 1 emissions will be consistent with a global low-carbon transition to net zero by 2050 scenario. The mitigation measures discussed in this section will reduce Scope 1 emissions continually past 2050 and offsets will be used for the remaining emissions past 2050.

The amount of offsets required may change if technology advances allowing Rio Tinto to reduce Scope 1 emissions further than estimates presented in Chapter 14.

## 15.5 Consistency with Offset Policies

The approach to offsetting the significant residual impacts associated with the Proposal is consistent with the six principles outlined in the WA Environmental Offsets Policy (GoWA 2011), and the eight requirements outlined in the EPBC Act 1999 Environmental Offsets Policy (DSEWPaC 2012a). Table

15-6 and Table 15-7 summarises how these principles have been considered during the development of the offsets approach.

**Table 15-6: Consideration of the Principles of the WA Offset Policy**

| Principle | Response (E2M 2026) |
|---|---|
| Environmental offsets will only be considered after avoidance and mitigation options have been pursued | The Proposal has been designed to avoid and minimise environmental impacts to the greatest extent possible, however, the mine layout is dependent on the underlying geology and operational processing requirements. Avoidance and mitigation measures were considered as part of the impact assessment and identification of significant residual impacts<br><br>Environmental offsets have only been considered after avoidance and minimisation options have been pursued |
| Environmental offsets are not appropriate for all projects | The Proponent acknowledges that environmental offsets are not suitable for all types of impacts, particularly where the impact is irreversible or an environmental value is Critically Endangered. For the Proposal, residual impacts to the Greater Bilby (and the five other State-listed species) have been assessed as capable of being offset through well-designed, evidence-based conservation actions that align with the Greater Bilby Recovery Plan (Commonwealth of Australia 2023) (Section 15.4.1.5). The proposed offsets are proportionate, feasible and targeted at key threats, ensuring that they can deliver measurable and enduring conservation outcomes |
| Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted | To ensure the proposed offset is cost effective as well as relevant and proportionate to the significance of the environmental value being impacted, the Proposed Offset Area value has been calculated using the WA and Commonwealth offset calculators. The contribution amount to be paid towards the Offset Projects is a proxy value determined based on the CPI-adjusted rates referenced in the Thunderbird Mineral Sands Project (Section 15.4.1.4) |
| Environmental offsets will be based on sound environmental information and knowledge | The Offset Projects will build on existing conservation and management programs as well as recovery plans already being implemented in the Great Sandy Desert for Greater Bilby, to sustain the conservation gains already achieved. Combined, this will effectively strengthen the potential for greater outcomes for the other State-listed species and will not result in a diluted effort to accommodate a broader area |
| Environmental offsets will be applied within a framework of adaptive management | The Offset Strategy (E2M 2026) (Appendix K01) and OMP will adopt an adaptive implementation approach to respond to new information and opportunities over time. Lessons learned from implementing Offset Projects, and from regional conservation projects, may be addressed in new Offset Projects |
| Environmental offsets will be focused on longer term strategic outcomes | The Offset Strategy (E2M 2026) (Appendix K01) has been designed to deliver long-term strategic conservation outcomes for all State-listed species by aligning offset actions with the Greater Bilby Recovery Plan objectives (Commonwealth of Australia 2023) (Section 15.4.1.5). Objectives within the recovery Plan are expected to benefit each of the other five State-listed species that largely occupy the same habitats or in nearby landscapes (i.e. in the case of the Western Pebble-mound Mouse). Through a multi-tiered objective framework, the OMP will ensure that short-term actions contribute to enduring ecological benefits, such as improved habitat quality, population resilience and landscape-scale threat mitigation. The ten-year evaluation cycle further reinforces the commitment to achieving measurable, lasting improvements in the viability of the species and their habitats |

**Table 15-7: Consideration of the Principles of the Commonwealth Offset Policy**

| Principle | Response (E2M 2026) |
|---|---|
| Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter | The Proponent will deliver measurable conservation outcomes by implementing targeted, landscape-scale actions, such as predator control, fire management, and habitat restoration, that address key threats to the Greater Bilby in alignment with the Recovery Plan objectives (Commonwealth of Australia 2023). These actions, supported by Indigenous-led land management and guided by a structured monitoring and review framework (Section 15.4.1.5), are designed to maintain or improve the species' viability over time |
| Suitable offsets must be built around direct offsets but may include other compensatory measures | The Offset Area will be located within Nyangumarta Warrarn and Martu IPAs on extensive land use zone of the State where the land is almost exclusively Crown land overlain by pastoral leases and mining interests, therefore there is almost no opportunity for land acquisition to occur<br><br>The purchase of the nearest available land is not considered comparable habitat and is located hundreds of kilometres away from the Project locality. As such, it is unlikely to provide the local on-ground benefits to the Greater Bilby in the Project region<br><br>Instead, this Offset Strategy has focused on addressing current key threats to the Greater Bilby through direct offset via on-ground management. Rio Tinto believes this proactive approach has the potential for the most positive long-term environmental and social outcomes for the Greater Bilby within the Project region |
| Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter | The proposed on-ground conservation activities will enable further protection of the Greater Bilby populations on the Nyangumarta Warrarn and Martu IPAs<br><br>The Proponent will meet the requirement that offsets be proportionate to the level of statutory protection by delivering landscape-scale conservation actions that reflect the Greater Bilby's status as a vulnerable species under the EPBC Act (Section 15.4.1.5). These actions are aligned with the Recovery Plan objectives (Commonwealth of Australia 2023) and supported by a robust monitoring framework, which is designed to achieve conservation outcomes commensurate with the species' national significance and legal protection (Section 15.4.1.5).<br><br>The conservation status of the impacted protected matters (i.e. vulnerable) is also incorporated by the Commonwealth Offset Assessment Guide calculator (DSEWPaC 2012b) in calculating the area of the offset to be provided |
| Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter | To ensure the offset proposed is of a suitable size and scale, an indicative Offset Area value has been calculated using the Commonwealth Offset Assessment Guide calculator (DSEWPaC 2012b). The contribution amount to be paid towards the Offset Projects (Section 15.4.1.4) is a proxy value determined based on the CPI-adjusted rates referenced in the Approval: Thunderbird Mineral Sands Project, WA (EPBC 2016/7648) (DoEE 2018). This is considered proportionate to the scale of the residual impacts on the Greater Bilby, ensuring that the offset delivers conservation outcomes commensurate with the significance of the impact and the ecological requirements of the species |
| Suitable offsets must effectively account for and manage the risks of the offset not succeeding | To effectively manage the risk of offset failure, the Offset Strategy incorporates a multi-tiered monitoring and review framework (Section 15.4.1.5), enabling adaptive management and early intervention if outcomes deviate from expectations. Offset Projects will be selected based on demonstrated feasibility, clear performance criteria (Section 15.4.1.5), and the capability of proponents to deliver results (Section 15.4.1.5). Annual reporting, five-yearly reviews, and ten-year evaluations will ensure ongoing oversight, while the use of proven land management techniques and engagement with experienced Indigenous Ranger groups further reduces implementation risk. This structured approach ensures that risks are identified, mitigated, and managed throughout the life of the offset |

| Principle | Response (E2M 2026) |
|---|---|
| Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs | The Proposed Greater Offset Area is currently managed under existing management plans for the Nyangumarta Warrarn and Martu IPAs. As identified in Section 15.4.1.2 and 15.4.1.3, Offset Projects within the Proposed Greater Offset Area will be in addition to the existing management measures currently employed within these areas. Specific details on how the proposed Offset Projects (i.e. on-ground management) will be 'in addition to' existing management plans, will be developed during engagement with relevant stakeholders (i.e. IPA Rangers, Government agencies) and provided in the finalised OMP |
| Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable | Proposed on-ground conservation/management actions will build upon existing Recovery Plans, as well as IPA management plans for the Nyangumarta Warrarn and Martu IPA Rangers. The Proponent will adopt an adaptive implementation approach to respond to new information and opportunities over time to ensure a gain in conservation values for the Greater Bilby. Lessons learned from implementing Offset Projects, and from regional conservation projects, can be addressed in new Offset Projects |
| Suitable offsets must have transparent governance arrangements, including being readily measured, monitored, audited, and enforced | The OMP has transparent governance arrangements to ensure accountability and enforceability. All Offset Projects will be subject to clearly defined performance criteria (Section 15.4.1.5), with progress tracked through annual reporting, five-yearly reviews, and ten-year evaluations (Section 15.4.1.5). These reports will be submitted to relevant regulatory authorities and made available for audit. The OMP Governance Committee will oversee implementation, review project outcomes, and ensure compliance with regulatory and contractual obligations. This structured and transparent framework enables consistent monitoring, independent verification, and enforcement of offset commitments |

## 15.6 Stakeholder Consultation Regarding Offsets

The Proponent has had preliminary discussions with both the EPA and DCCEEW regarding the provision of offsets for significant residual impacts as part of pre-referral and ongoing meetings to support the Proposal assessment. These consultations are expected to continue throughout the assessment process.

Consultation is being undertaken with Nyangumarta and Martu Traditional Owners with presentation of the Offset Strategy context and structure at technical meetings and relevant Board of Director meetings.

In addition, each group was provided with a draft of the ERD (including this Offsets chapter) and the Offset Strategy (E2M 2026) (Appendix K01), with NWAC's and JYAC's feedback incorporated into both documents prior to finalisation and submission.

## 15.7 Conclusion

The Proponent considers that the proposed Offset Strategy sufficiently compensates for the significant residual impacts as a result of the Proposal.

# 16 HOLISTIC IMPACT ASSESSMENT

This ERD provides a detailed assessment of the potential environmental impacts associated with the Proposal and the application of the mitigation hierarchy to each environmental factor. However, the environment is a complex dynamic of connections and interactions, and while an effect on a particular factor(s) may be minor in isolation, its impact across these interconnections may result in a significant impact which requires assessment.

Holistic impact assessment considers “connections and interactions between impacts, and the overall impact of a proposal on the environment as a whole" (EPA 2023b).

The Proponent has sought to understand the environment as a whole, using information derived from technical surveys and investigations on the environment, and the views and concerns raised through consultation with relevant stakeholders, including the Nyangumarta People and Martu People. Elements of the assessment of the Social Surroundings factor are inherently holistic in nature with respect to the cultural traditions of the Traditional Owners, and their inputs and perspectives continue to be vital in growing this understanding of the whole environment and the balance between its many interconnected elements.

## 16.1 Connections and Interactions between Environmental Factors

The environmental surveys and studies undertaken for the Proposal, further informed by stakeholder consultation, have considered and assessed potential local and regional impacts. The results of these surveys have informed the Proposal impact assessment and mitigation measures. While the Proposal’s predicted outcomes have been considered independently in relation to the environmental principles and the EPA’s environmental objectives for each preliminary environmental factor, the Proponent recognises the complex linkages between Social Surroundings, Inland Waters, Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna, Terrestrial Environmental Quality, Air Quality and Landforms as illustrated in Figure 16-1.

When viewed at the timescale of the life of mine, greenhouse gas emissions from the Proposal are expected to have limited interaction with the other factors given the limited scale of emissions proposed. The impacts of the Proposal on this factor are assessed in detail in the individual chapter (Section 16) and require no further holistic considerations.

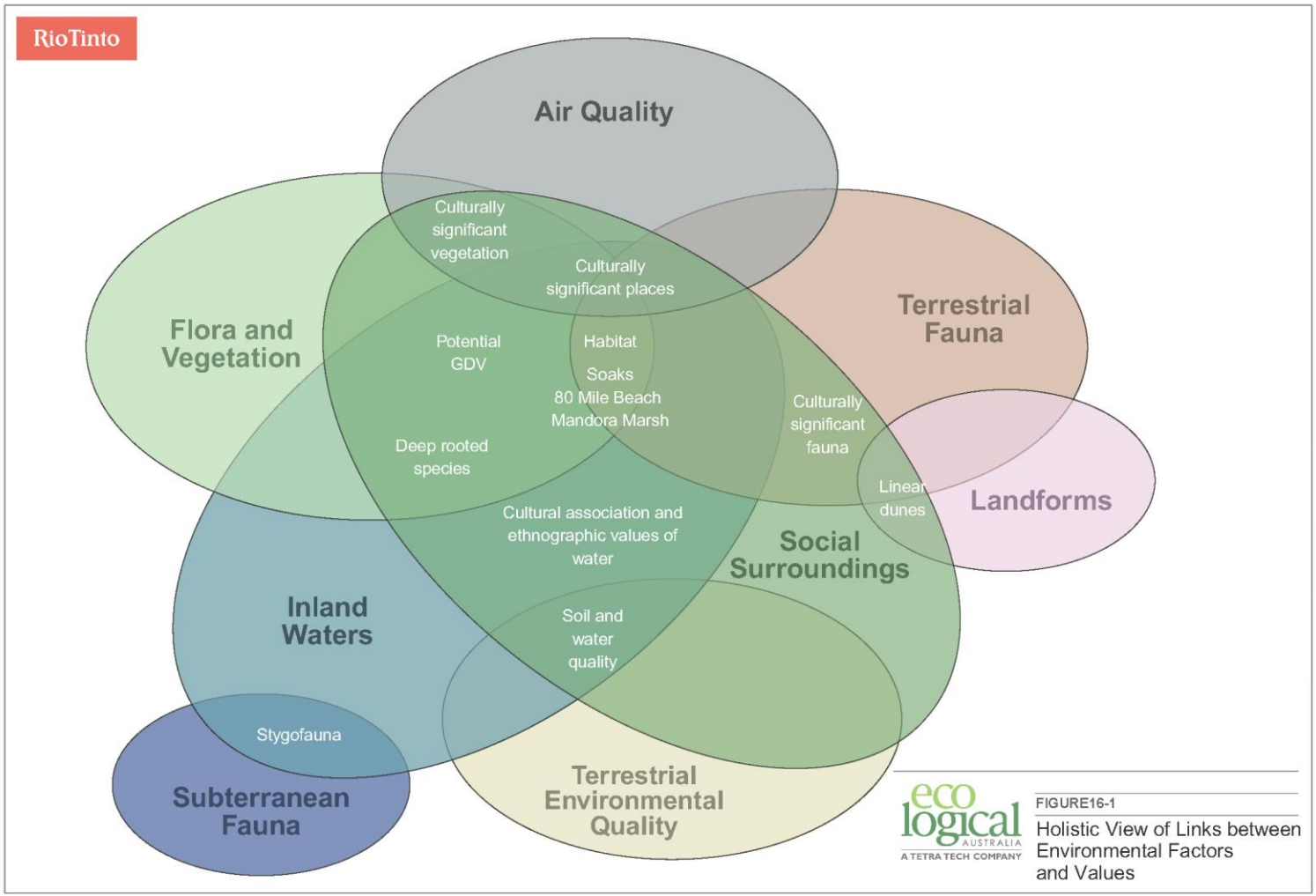



**Figure 16-1: Holistic View of Links between Environmental Factors and Values**

## 16.2 Consideration of Holistic Effects

This section provides information on the Proposal's effects on the environment as a whole to determine whether any additional considerations for assessment arise. For this holistic assessment, the following considerations have been applied:

- Where an impact(s) has been completely avoided, it will not contribute to holistic environmental effects and does not require consideration
- Where an impact is already considered potentially significant and the mitigation hierarchy applied in relation to one factor, additional mitigation measures to address combined environmental effects are unlikely to be required
- Where an impact(s) has been considered to likely result in a significant impact across two or more factors, and the mitigation hierarchy has been applied in isolation per factor, consideration will be given if further measures are required to mitigate this combined impact
- Where there are multiple overlapping minor impacts, or a minor impact affects multiple values and has been assessed as insignificant in the context of an individual factor, these may require further holistic consideration
- The environmental principles of intergenerational equity, and conservation of biological diversity and ecological integrity are considered the most relevant and have been a foundation when considering potential significance of the holistic effect of the Proposal.

Where holistic effects on the environment have been identified, their potential impacts to the environment as a whole have been considered in accordance with Section 4.1 of *the Environmental Impact Assessment Procedures Manual* (EPA 2024c). The following section outlines and discusses these holistic effects as it relates to the implementation of the Proposal.

### 16.2.1 Land Clearing

The Proposal will result in the direct disturbance of 4,878 ha of land, most of which contains Excellent condition native vegetation and the remaining is previously disturbed. The combined impacts associated with this land clearing include:

- Loss of Priority flora and habitat
- Loss of conservation significant fauna habitat
- Potential direct fauna mortality
- Increase in the potential pathways for invasive species (i.e. weeds and feral fauna)
- Localised loss in ecological diversity and values of cultural significance (including culturally significant plants and animals)
- Degradation of soil and surface water quality
- Contribute to reduced air quality in the region due to dust.

While the above effects will result in localised impacts, these impacts can also influence the dynamics of the environment in a regional context, when considered against other similar activities. It has been demonstrated that cumulatively, the Proposal will not result in a significant increase in the combined impacts within the regional area (Section 17). The clearing of vegetation, when assessed at a regional scale, will not lead to compounding impacts, resulting in significant effects on the identified environmental values and their connections, including the provision of habitat for conservation and culturally significant flora and fauna species.

Although there will be permanent effects of disturbance, particularly with respect to the pit void and permanent landforms, many of the longer-term effects of the Proposal to the identified environmental values will be largely counterbalanced through progressive and post-mining rehabilitation works (including revegetating the TSF and WRL), which will seek to restore environmental values impacted through the implementation of the Proposal. Subject to the completion of successful rehabilitation, the Proposal will not result in a significant long-term effect on the identified environmental values of the local area.

While noting the above, mitigation measures proposed across each relevant environmental factor also work together to reduce the combined impact of the holistic effects. These measures include:

- Reduction in the Development Envelope to minimise potential impacts to native vegetation, Priority flora, conservation significant fauna, particularly Night Parrot habitat, which has been completely excluded from the Development Envelope, and cultural heritage values as well as the removal of the Texas Borefield from the Development Envelope and the realignment of the ore stockpile, which resulted in the avoidance of a large population of *Cynodon anisocarpus* (P1) and *Dasymalla chorisepala* (P3) respectively
- Clearing of locally significant vegetation types will be restricted through authorised maximum extents
- The implementation of three Management Areas to manage any increase in abundance or introduction of pest species (feral/invasive fauna and weeds) across the Development Envelope attributable to the Proposal.

In consideration of the scale of the Proposal, the broader distribution of biological values across the local area and surrounds, the application of the mitigation hierarchy to minimise effects, and the established framework of EMPs and environmental offsets, when the separate environmental factors for the Proposal are considered together, the effects of the Proposal to biological values are not considered to be environmentally significant nor inconsistent with the EPA's objectives.

### 16.2.2 Dust and Noise Emissions

Dust and noise emissions will increase slightly due to the Proposal; however, the overall impact is predicted to be minor. Dust and noise emissions from mining and vehicle movements have been assessed in relation to the following environmental factors: Social Surroundings, Flora and Vegetation (dust only) and Terrestrial Fauna.

There are six specific ACH (ethnographic/archaeological) sites within the MIA plus established tree stand, Winu Soak approximately 20 km from the MIA, alongside culturally significant sand dunes and dune slopes - ubiquitous within and around the Proposal area - with potential to be impacted by dust and noise emissions. Furthermore, the broader cultural landscape of the Development Envelope and surrounds includes a myriad of interconnected tangible and intangible features and elements, including amenity and ethnobotanical values, that have inherent significance for Nyangumarta People and Martu People and could be affected by dust and noise. Based on this holistic perspective, concerns have been raised by Nyangumarta People and Martu People about the potential impact of dust and noise to not only specific sites but also more broadly.

No other sensitive receptors occur within approximately 100 km of the MIA and only three occur within 10 km of the RAC. Furthermore, given the RAC will be sealed, emissions from constructing and operating the RAC are expected to be temporary and negligible in extent and magnitude.

Minor impacts may occur in relation to habitat value and visual amenity. Studies have found no evidence to support the perception that dust accumulation on plants causes negative effects (Matsuki et al. 2016). Visual amenity will be affected in terms of airborne dust and settled dust on vegetation, but this will be limited to areas close to MIA. Some negligible effects on visual amenity may occur during the temporary construction period of the RAC, with dust suppression anticipated to minimise any impact, and then no impact is expected during operations given the road will be sealed. Noise emissions are not expected to affect fauna.

Given proposed dust and noise management and mitigation, the small scale of the Proposal in the context of the broader landscape, and the remote and isolated nature of the Proposal no significant impacts associated with dust and noise emissions have been identified on a factor or holistic scale.

### 16.2.3 Social Surroundings

The activities associated with the Proposal lie within the traditional lands of the Nyangumarta People and Martu People. The Proponent understands that through their connection to Country, the link between the Nyangumarta People and Martu People and the environment is highly valued.

It is also recognised that the interconnections between the flora and vegetation, terrestrial fauna, inland waters, terrestrial environmental quality, landforms and air quality have importance to the Nyangumarta People and Martu People. Accordingly, there is potential that the Proposal may result in impacts to social surroundings values of importance to both Traditional Owner groups through:

- Ongoing ground disturbance, construction activities and human activities
- Groundwater abstraction, pit dewatering and potentially contaminating activities
- Disturbance of ethnobotanical values including culturally important flora and fauna
- Increased dust and noise levels as a result of mining and associated activities
- Changes to visual amenity, visual landscapes and local landforms through the creation of a pit void, WRL and TSF and installation of industrial infrastructure such as wind turbines
- Altered access to Country.

As outlined in Section 6, impacts to ACH sites and values within and adjacent to the Proposal have been and will be mitigated through:

- Avoidance measures through removal or redesign of some Proposal elements and adjustments in its spatial footprint
- Implementation of a range minimisation measures such as, and not limited to, exclusions zones, RAC road-sealing, waterway crossing designs, noise, dust and visual impact mitigation
- Ongoing co-design, consultation and collaboration with the Nyangumarta People and Martu People on relevant aspects of mine operation, planning, revegetation and closure planning including in relation to undertaking monitoring
- Ensuring permanent access to the Nyangumarta Highway remains unimpeded
- Measures developed in consultation with Traditional Owners to safely and respectfully maintain access to ACH sites and Country.

The Proponent also recognises the potential for interconnected impacts on flora and vegetation, terrestrial fauna, inland waters, terrestrial environmental quality, landforms and air quality to other stakeholders such as pastoralists and road users.

In considering the above and noting the outcomes presented in Section 6, following the implementation of management and mitigation measures, the combined effects of the Proposal as a whole are no greater than the effects on individual factors when considered on a holistic basis.

### 16.2.4 Groundwater Aquifers

The hydrological regimes of groundwater aquifers will likely be altered as a result of:

- Dewatering for pit development (to be used in processing)
- Extraction from Rimfire during periods of additional water needs
- The infiltration and MAR of excess dewatering water and extraction from RAC bores during the temporary road construction works.

Impact from the dewatering, extraction and reinjection from and to groundwater aquifers has been assessed in relation to the following environmental factors: Inland Waters, Social Surroundings, Flora and Vegetation and Subterranean Fauna.

The potential combined impacts associated with dewatering, extraction and excess water management include:

- Impacts on hydrological regimes
- Potential for altered groundwater quality

- Loss of or change to stygofauna habitat
- Drawdown impacting potential GDV
- Potential impacts to social, cultural heritage sites and values.

While the above effects will result in localised impacts, some of these impacts may also influence the regional hydrology when considered against other similar activities. However, it is considered that ground water drawdown, when assessed at a regional scale, will not lead to compounding impacts resulting in significant effects on the identified environmental values and their connections.

As outlined in Section 7, only five groundwater licences overlap with the Development Envelope. Given the low allocation limits associated with these licences and the confined nature of the metasediments, it is considered the Proposal is unlikely to contribute to existing groundwater drawdown related effects on the regional Canning-Wallal aquifer and its values.

Post closure, the pit will continue to act as groundwater sink due to evaporation, resulting in continued propagation of the drawdown away from the pit. This will limit any potential movement of solutes and contaminants through groundwater from seepages or spillages from the TSF. As such, widespread impacts to Social Surroundings values, potential GDEs and stygofauna are considered unlikely as a result of altered groundwater quality.

Given the presence of stygofauna records within the area of influence of Rimfire, loss of individual stygofauna is expected to be unavoidable; however, suitable connected aquifer habitat is expected to extend outside the groundwater drawdown cone of depression. Furthermore, the worst-case scenario (Project licensing case) has been utilised for this assessment and the extent of drawdown is expected to be much reduced with respect to the more realistic Project demand case. As outlined in Section 10, these impacts are not considered to be environmentally significant with the application of appropriate mitigation and management. The risk of drawdown significantly impacting GDV within the Percival Palaeovalley is expected to be negligible, as outlined in Section 8. No other environmental or currently known ACH values that may be potentially sensitive to groundwater drawdown have been identified within the zone of influence of the cone of depression.

While noting the above, mitigation measures proposed across each relevant environmental factor also work together to reduce the combined impact of the holistic effects. These measures include:

- The Wallal Borefield was removed from the Proposal after investigation into the potential impacts of groundwater abstraction from this borefield on GDEs (Eighty Mile Beach and Mandora Marsh)
- The Texas Borefield was removed from the Proposal which has reduced the area in which groundwater abstraction is proposed to occur
- The Proposal will utilise a CWD in the first instance and only infiltration areas and MAR bores will be used, when required, to manage excess mine dewater to avoid discharge to the environment
- Infiltration ponds and MAR have been designed to minimise the risk of:
    - Overtopping of the ponds due to storage capacity
    - Recirculation of infiltrated water back into the mine pit
    - Forming a surface expression of groundwater or near surface groundwater table.
- Clearing of locally significant vegetation types will be restricted through authorised maximum extents (no more than 24%)
- Removal of two potential aquifer reinjection (managed aquifer recharge) areas from the Development Envelope to minimise the impacts from groundwater mounding
- In the long-term the pit is predicted to act as an evaporative hydraulic sink, with no expected discharge to the environment
- The Proposal will use mine water to meet most operational water demand avoiding the need for large quantities of additional non-potable water supplied from borefields (other than Rimfire)
- Groundwater levels shall be monitored at bores, with triggers for management actions applied as per the Rimfire Groundwater Operating Strategy (Appendix C19).

The application of the mitigation hierarchy and implementation of the EMP will minimise the impacts of the Proposal on environmental and cultural values associated with groundwater aquifers within and surrounding the Development Envelope.

## 16.3 Holistic Impact Outcomes

There are no additional significant residual impacts or additional mitigation required when the Proposal is considered on holistic basis. The combined effects of the Proposal on biological and social values holistically are not considered greater than any impacts to individual environmental factors.

# 17 CUMULATIVE ENVIRONMENTAL IMPACT ASSESSMENT

Cumulative environmental impacts are the successive, incremental, and interactive impacts on the environment of a proposal with one or more past, present and reasonably foreseeable future activities (EPA 2024c).

The EPA (2024c) defines reasonably foreseeable future activities as "*Third party (or proponent) activities that are already approved, are in a government approvals process, or are otherwise reasonably likely to proceed:*

- for proposals assessed at the level of environmental review – at the time an Environmental Review Document for a proposal is accepted; or
- for proposals assessed at the level of assessment on referral information - at the time the final referral or required additional information is accepted; and
- existing activities that are reasonably expected to be ongoing."

## 17.1 Existing and Reasonably Foreseeable Projects

The cumulative impact assessment undertaken for the Proposal has considered a number of existing or reasonably foreseeable projects that occur within the Mackay, McLarty and Pindanland subregions of the Great Sandy Desert and Dampierland bioregions, respectively. The cumulative impact assessment for each key environmental factor considered projects relevant to the environmental values being impacted. The relevant projects used to assess cumulative impacts to each key environmental factor are outlined in Table 17-1 and shown in Figure 17-1.

**Table 17-1: Environmental Factors with Potential to be Cumulatively Impacted by the Proposal and Nearby Projects**

| Existing or Reasonably Foreseeable Project | Approximate Distance to MIA (km) | Approximate Nearest Distance to Development Envelope (km) | Relevant Key Environmental Factor | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Social Surroundings | Inland Waters | Flora and Vegetation | Terrestrial Fauna | Subterranean Fauna | Terrestrial Environmental Quality |
| AREH | 35 | 0<br>Intersects the Proposal within the RAC | ✓ | ✓ | ✓ | ✓ | | |
| Gas Pipeline to Nifty Copper Operations / Nifty Copper Operations | 85 | 70 from Rimfire | ✓ | | ✓ | ✓ | ✓ | |
| Goldsworthy Iron Ore Mines Extension Project | 145 | 80 from RAC | ✓ | ✓ | | | | |
| Kintyre Uranium Project | 175 | 160 from Rimfire | | | ✓ | | | |
| Pardoo Irrigated Agriculture Project – Stage 3 | 190 | 70 from RAC | ✓ | ✓ | ✓ | ✓ | | |
| Telfer Project, Power Supply and Infrastructure Corridor | 55 | 40 from RAC | ✓ | | ✓ | ✓ | | |
| Telfer Project, Expansion of Telfer Gold Mine | 115 | 92 from Rimfire | ✓ | | ✓ | ✓ | ✓ | |

| Existing or Reasonably Foreseeable Project | Approximate Distance to MIA (km) | Approximate Nearest Distance to Development Envelope (km) | Relevant Key Environmental Factor | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Social Surroundings | Inland Waters | Flora and Vegetation | Terrestrial Fauna | Subterranean Fauna | Terrestrial Environmental Quality |
| Telfer-Havieron Gold Mining Project | 120 | 95 from Rimfire | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Woodie Woodie Continued Operations Project | 105 | 105 from MIA | | ✓ | | | | |

120°0'0"E

122°0'0"E

20°0'0"S

22°0'0"S

## Legend

- Project Locations
- Gas Pipeline to Nifty Copper Operations
- Goldsworthy Iron Ore Mines Extension Project (indicative)
- Pardoo Irrigated Agriculture Project – Stage 3 (indicative)
- Telfer Project, Power Supply and Infrastructure Corridor (indicative)
- Australian Renewable Energy Hub (File Notation Areas - DEMIRS)
- 150km Buffer from MIA
- Development Envelope
- Native Title Determinations

N

Port Hedland

Goldsworthy

Woodie Woodie Continued Operations Project

Nifty

Telfer Project, Expansion of Telfer Gold Mine

Telfer-Havieron Gold Mining Project

Kintyre Uranium Project

Nullagine

Great Northern Hwy

GREAT SANDY DESERT

RIPON HILLS

THE DYKE RANGE

KARAJARRI PEOPLE (AREA B)

KARAJARRI PEOPLE (AREA A)

NYIKINA MANGALA

NYANGUMARTA PEOPLE (PART A)

NYAMAL PEOPLE #10

NYAMAL PEOPLE #1

KARIYARRA PEOPLE

NYAMAL PALYKU PROCEEDINGS

NGARLUMA / YINDJIBARNDI

MARTU (AREA A)

KULYAKARTU & KULYAKARTU 2 PART A

NYIYAPARLI PEOPLE

Rudall River National Park

128 m
232 m
111 m
155 m
327 m
319 m
325 m
353 m
255 m
364 m
336 m
599 m
555 m
481 m

0 25 50 Kilometres

RioTinto

**Figure 17-1: Existing and Reasonably Foreseeable Projects Relevant to Assessment of Cumulative Impacts**

**Rio Tinto Copper (RTC)**

**Publisher:** B.Gardiner
Date Published: Friday, 5 June 2026

**Coordinate System:**
GCS GDA 1994
Datum: GDA 1994
Units: Degree
**Scale:** 1:1,500,000
Rio Tinto © Copyright




Path: \\pe1-shared\Winu\TechData\GIS\Jobs\2021\W21_012\02_Processing\20250211_ERD_Figures_and_Calcs\W21_012_ERD_Figures_and_Calcs.aprx Layout: ERD - Existing and Foreseeable Projects (Cumulative Impacts)

## 17.2 Summary of Cumulative Impact Assessment of Key Environmental Factors

Cumulative environmental impacts have been assessed for each key environmental factor relevant to the Proposal. A summary of the cumulative impacts is provided below.

### 17.2.1 Social Surroundings

The Proposal has potential to result in cumulative impacts to Nyangumarta People and Martu People Social Surroundings, including effects upon amenity, traffic, and cultural values. There are a number of existing and reasonably foreseeable projects in the region, albeit most outside the AREH are located approximately 100 km away or more from the Development Envelope.

Nyangumarta People cumulative impact concerns related to regional observations of declines in populations of native fauna due to mining. Nyangumarta People have emphasised the need to avoid similar declines and assess the risks to these species to ensure their protection and the continued ecological integrity of the region. Related to individual species, the pristine nature of the vast majority of the Nyangumarta IPA also serves to creates a stark contrast between pristine and impacted areas. This highlights the potential impact and heightening concerns related to the broader cumulative impacts to country associated with industrialisation.

Nyangumarta People also expressed concerns with regard to cumulative impacts to water including a need to develop a determination-wide water management plan that minimises cumulative impacts to Nyangumarta Country and cultural values related to increased water usage. In order to better understand cumulative impacts, Nyangumarta People have requested support for future studies to develop a regional mining/exploration impact analysis which can consider the long-term cumulative impacts of all resource development activities on Nyangumarta Country. Engagement with Wallal Downs pastoral station noted similar concerns around cumulative impacts to groundwater resources.

During Martu engagement, concerns were raised regarding potential impacts to fauna associated with an increase in truck movements from the Proposal.

The cumulative impact assessment concludes that the Proposal is not expected to result in significant cumulative impacts to any key environmental factor. The combination of limited spatial overlap with other projects, localised nature of potential impacts, and the resilience of regional environmental systems supports this conclusion.

### 17.2.2 Inland Waters

The Proposal is expected to result in the following cumulative impacts to Inland Water environmental values:

- Reduction of the Great Sandy Desert Lake Dora catchment
- Alteration of groundwater levels.

Cumulative impacts to Inland Waters have been considered based on any existing or reasonably foreseeable projects that occur within the same surface water catchment area or groundwater drawdown area as the Proposal.

#### 17.2.2.1 Cumulative Impacts to the Great Sandy Desert Lake Dora Catchment Area

In the context of surface water, a review of potential cumulative impacts is based on catchment area reduction. The Proposal occurs within the Great Sandy Desert Lake Dora catchment, an area of approximately 290,000 $km^2$. The total cumulative area of the Great Sandy Desert Lake Dora catchment impacted by the Proposal and existing or reasonably foreseeable projects is anticipated to be approximately 581 $km^2$, representing a less than 1% reduction of the Great Sandy Desert Lake Dora catchment (Table 7-9).

It is important to note that a reduction in catchment area is not a direct link to reduced surface water flow or volume. Regardless, no significant reductions in surface water flow and volume are expected during mining operations given little to no surface water runoff due to the dominance of dunal landforms and aeolian sand cover, with no clearly defined surface water courses in the region and within the Development Envelope (Section 7).

The Proposal does not substantially contribute to cumulative reduction of the Great Sandy Desert Lake Dora catchment.

#### 17.2.2.2 Cumulative Impacts to Groundwater Levels

No obvious spatial or temporal cumulative effects to the local groundwater aquifers and associated values are expected in relation to the interaction of mine pit dewatering and Rimfire (Section 7).

The confined metasediment aquifer will be the main aquifer requiring dewatering to facilitate BWT mining. Drawdown from BWT within the metasediment aquifer will be largely contained within the Thorny Devil Fault and the Mafic sill as these features act as flow barriers (Worley 2025b). Therefore, drawdown from BWT mining within this aquifer is unlikely to contribute to existing groundwater drawdown related effects on the regional Canning-Wallal aquifer and its values.

The unconfined sandstone aquifer will not be actively dewatered due to the small saturated thickness, but will have some passive drainage once the low permeability Permian mudstone is removed during mining. This is expected to have a localised impact on the unconfined sandstone aquifer and not impact the regional scale aquifer. No response to rainfall recharge has been observed to date in bores screened in the unconfined sandstone aquifer at Winu, which indicated this is not a recharge area for the aquifer. The metasediment aquifer associated with Rimfire is not considered part of the regional Canning-Wallal aquifer.

Five groundwater licences overlap the Development Envelope (Table 7-10). Four of these are issued to Rio Tino Exploration Pty Ltd, one of which is associated with Winu (Worley 2025b). Given the low annual allocation limits of these licences, they are unlikely to have any discernible impact on groundwater levels within the Development Envelope.

The Proposal is not expected to contribute to existing groundwater drawdown related effects on the Canning-Wallal aquifer and its value.

### 17.2.3 Flora and Vegetation

The Proposal is expected to result in the following cumulative impacts to Flora and Vegetation at a subregional scale:

- Clearing of native vegetation
- Clearing of significant flora species.

Cumulative impacts to Flora and Vegetation have been considered based on any existing or reasonably foreseeable projects that occur within the three relevant subregions (Mackay, McLarty and Pindanland).

#### 17.2.3.1 Cumulative Impacts to Native Vegetation

The Proposal will result in the clearing of up to 4,878 ha of native vegetation, all of which is in Excellent condition. Vegetation to be cleared comprises five Beard (1975) vegetation associations: Great Sandy Desert 134, Mandora East 80, Mandora East 101, Madora East 117 and Pindan 32. Clearing for the Proposal represents <0.1% of the current extent of each vegetation association within the three subregions.

The proposed clearing footprint for the AREH project was used to determine the approximate impact to each of the relevant vegetation associations. Approvals documentation for the remaining existing or reasonably foreseeable projects did not present exact clearing extents of vegetation associations relevant to the Proposal. The cumulative impact assessment conservatively assessed the total extent

of each vegetation within the development envelope of each project. The potential cumulative impacts on vegetation associations within the three subregions are presented in Table 8-16.

The total estimated cumulative impacts from this Proposal, existing and reasonably foreseeable projects within the region on native vegetation associations are anticipated to be a total of 59,540 ha (0.4% of the current extent). The Proposal's contribution is 4,878 ha (<0.1% of the current extent).

Australia's Strategy for Nature 2024-2030 includes a target to protect and conserve at least 30% of Australia's terrestrial (and other) areas by 2030 (DCCEEW 2024a). One measure consistent with this strategy is to avoid clearance of existing vegetation with a pre-European extent of below 30.0%. The cumulative impact assessment shows that the Proposal will result in negligible cumulative impacts to vegetation associations within the subregions, with more than 96% of the pre-European extents remaining within the subregions following implementation of the Proposal and existing and reasonably foreseeable projects. The maximum cumulative impact of clearing will be associated with the Mandora East 80 vegetation association at 1.7% of the pre-European and current subregional extent, with the Proposal contributing to <0.1% of this impact.

Clearing of native vegetation is not considered a significant impact, given the remaining extent of vegetation associations and negligible cumulative impacts of the Proposal.

#### 17.2.3.2 Cumulative Impacts to Significant Flora

Six flora species of conservation significance have the potential to be cumulatively impacted by clearing for the Proposal and existing or foreseeable projects within the Mackay, McLarty and Pindanland subregions: *Goodenia hartiana* (P2)*, Bonamia oblongifolia* (P3)*, Corynotheca asperata* (P3)*, Indigofera ammobia* (P3), *Tribulopis marliesiae* (P3) and *Terminalia kumpaja* (P3). None of the other significant flora species recorded within the Development Envelope, including *Cynodon anisocarpus* (P1), were identified as potentially impacted by clearing from the relevant existing or foreseeable projects. Clearing footprints for the six relevant projects were not publicly available and as such, the assessment conservatively assumed all flora individuals present within the development envelopes would be cleared. Where quantitative data on the number of flora individuals to be impacted was unavailable, cumulative impacts have been described based on presence or absence.

The Woodie Woodie Continued Operations Project and Goldsworthy Iron Ore Mines Extension Project did not record any impacts to the to the relevant Priority flora species.

For project flexibility, the Proposal may clear up to 20.0% of known records of *Goodenia hartiana* (P2) records within the Flora Survey Area. This species was recorded within the mine site and borefield of the Telfer Goldmine Expansion and Infrastructure Project, as well as along the corridor of the Telfer Power Supply and Infrastructure Corridor Project. The species was also considered Likely to occur within the AREH development envelope due to the presence of suitable habitat. A total of 335,702 records of this species are known to occur within the Flora Survey Area outside of the Development Envelope, along with a further 64,153 records from the State Threatened and Priority Flora database. Considering the extensive number of individuals recorded within the Flora Survey Area and the limited targeted survey effort within the surrounding area, it is considered that the species likely occurs across the Great Sandy Desert in greater abundances and is a common but under-surveyed species (Western Botanical 2026a). On this basis, although the species may be cumulatively impacted by the Proposal and existing projects, impacts are not expected to be significant.

The Proposal will clear up to 0.4% of the known *Bonamia oblongifolia* (P3) records within the Flora Survey Area. This species was recorded at a 0.1-1% cover at 13 locations within the AREH development envelope. The species was also recorded within the Stage 3 Pardoo Irrigated Agriculture Project, with a cumulative loss of 158 individuals of this species from this project. A total of approximately 1,200,000 individuals have been recorded in the surrounding area from populations at Mandora Station, Wallal Downs Station, Pardoo Station and Anna Plains Station (EnviroWorks 2017 as cited in Western Botanical 2026a). This species is not considered regionally restricted and on this basis, cumulative impacts from the Proposal and existing projects are not expected to be significant.

The Proposal will result in the clearing of up to 10.0% of the *Corynotheca asperata* (P3) records known to occur within the Flora Survey Area. The species has not been recorded from any of the relevant existing or reasonably foreseeable projects within the subregions, although it was considered likely to occur within the AREH development envelope due to the presence of suitable habitat. A total of 5,961 individuals have been recorded within the Flora Survey Area, outside of the Development Envelope, as well as another 10,275 records from the State Threatened and Priority Flora database. Combined with the State records (noting each record may denote multiple individuals), the proposed clearing may impact up to (at most) approximately 8% of known individuals of the species. On this basis, the species is not expected to be significantly impacted as a result of cumulative impacts from the Proposal and the AREH project.

The Proposal may clear up to 15.0% of the known *Indigofera ammobia* (P3) records within the Flora Survey Area. The species was recorded within the AREH development envelope at seven locations, each with 0.1% species cover. An additional 19,442 individuals have been recorded within the Flora Survey Area, outside of the Development Envelope, as well as another 271 records from the State Threatened and Priority Flora database. As such, any cumulative impacts to this species from the Proposal and the AREH project are not expected to significantly impact the conservation status of the species.

Clearing for the Proposal may result in the loss of up to 20.0% of the *Tribulopis marliesiae* (P3) records known to occur within the Flora Survey Area. The AREH recorded at least 176 individuals within its development envelope. An additional 1,206 individuals have been recorded within the Flora Survey Area, outside of the Development Envelope, as well as another 98 records from the State Threatened and Priority Flora database. The species is cryptic and only detectable during its flowering period; therefore, it is considered likely that subsequent survey effort would yield higher abundances of this species (Western Botanical 2026a). On this basis, cumulative impacts to *Tribulopis marliesiae* as a result of the Proposal and AREH are not considered significant.

Clearing for the Proposal may result in the loss of up to 1.0% of the *Terminalia kumpaja records* known to occur within the Flora Survey Area. The AREH recorded at least 68 individuals within its development envelope. An additional 83 individuals have been recorded within the Flora Survey Area, outside of the Development Envelope, as well as another 234 records from the State Threatened and Priority Flora database. As such, any cumulative impacts to this species from the Proposal and the AREH project are not expected to significantly impact the conservation status of the species.

Considering the above, the Proposal is not expected to contribute to significant cumulative impacts to any significant flora species.

### 17.2.4 Terrestrial Fauna

The Proposal is expected to result in the cumulative regional loss of fauna habitat and associated impact to fauna species present within the Development Envelope.

For the purposes of assessing potential impacts to Terrestrial Fauna, cumulative impacts have been considered based on any existing or reasonably foreseeable projects that occur within the six Land Systems that have been identified as being representative of the fauna habitat within the Development Envelope. Detailed habitat mapping is not available at a regional scale, and Land System mapping can be used as a surrogate for assessing fauna habitat within the Development Envelope in a regional context.

The estimated cumulative impacts from the Proposal and existing or reasonably foreseeable projects within the subregions on fauna habitat and Land Systems are anticipated to be a total of 48,808 ha (0.6% of the current subregional extent) (Table 9-39). This is largely based on the development envelopes of existing and foreseeable projects rather than clearing footprints (with the exception of the AREH project), therefore overestimating the actual cumulative impact on Land Systems. The Proposal's contribution is 4,878 ha (<0.1% of the current subregional extent and 7.8% of total cumulative impact).

The maximum cumulative impact of clearing will be to the Buckshot Land System, with a 10.4% loss of its current extent, with the Proposal contributing to the loss of 0.2% of this Land System (Table 9-39). All other Land Systems will be impacted by less than 3% of their current extent. The most extensive and significant disturbance from the Proposal on conservation significant ground-dwelling vertebrates will be with respect to Greater Bilby, with 4.498 ha of critical habitat affected. The cumulative disturbance of Greater Bilby habitat from other existing or reasonably foreseeable projects, based on disturbance of land systems equates to approximately 45,951 ha of 8,109,521 ha, or 0.6% of the land systems considered to represent suitable bilby habitat (Nita, Little Sandy, AB40 and B30; Table 9-39).

The estimated cumulative impacts to aerial habitat from the development of windfarms in the region from the Proposal and existing or reasonably foreseeable projects within the subregions on fauna habitat and Land Systems are anticipated to be a total of 1,754 wind turbines; of which the Proposal only contributes 11 (0.9%), with the remainder contributed by the AREH project.

Given that the majority of the Land Systems and associated fauna habitat will remain undisturbed within the subregions, the cumulative impacts to fauna species are not expected to be significant at a local or regional scale.

### 17.2.5 Subterranean Fauna

The Proposal has potential to contribute to cumulative degradation or loss of subterranean fauna (stygofauna) habitat due to impacts on groundwater aquifers. Cumulative impacts to stygofauna represent the combination of the maximum direct impacts resulting from groundwater extraction as a result of the Proposal and any existing operations and reasonably foreseeable projects within 100 km of Rimfire. Pit dewatering for BWT mining at the MIA is not expected to impact stygofauna habitat (as discussed in Section 10; Biota 2022c).

Three reasonably foreseeable projects that dewater groundwater aquifers are within 100 km of Rimfire, Telfer Goldmine Expansion and Infrastructure Project, Telfer-Havieron Gold Mining Project, and Nifty Copper Operations.

Limited publicly available information exists for Nifty Copper; however, one source indicated a subterranean fauna study was conducted which found no stygofauna, concluding the orebody and surrounding lithology represented poor stygofauna habitat (Listcorp 2024). An assessment for the Telfer-Havieron proposal, which also considered studies from the existing Telfer mine indicated the affected aquifers are of different lithologies to that found at Rimfire.

Given the isolation of the Proposal from other existing and reasonably foreseeable projects, the difference in aquifer characteristics from those projects and the limited extent of drawdown in Stygofauna habitat at Rimfire, the Proposal is not expected to contribute to cumulative impacts to stygofauna.

### 17.2.6 Terrestrial Environmental Quality

The Proposal has potential to have a cumulative impact on TEQ associated with contamination of soil-landscape systems (DPIRD 2018). Soil-landscape systems have been used as a proxy for assessing cumulative impacts on TEQ as detailed soil mapping is not available for existing or reasonably foreseeable projects relevant to the Proposal.

Of the existing and reasonably foreseeable projects that occur within the same soil-landscape systems as the Proposal (Little Sandy System, Nita System, Callawa System, Buckshot System, AB40 System and B30 System), only the Telfer-Havieron Gold Mining Project has the potential to impact TEQ. This project has the potential to result in cumulative impacts associated with erosion due to clearing. Other potential impacts to TEQ are related to contamination of soil (such as TSF seepage or chemical spills). Such impacts will remain highly localised to the impact location, as transportation of contaminants predominantly occurs vertically, rather than horizontally, following the movement of water as it percolates through the profile (Hook 1978).

Given the spatial scale of potential impacts resulting from the Proposal and the Telfer-Havieron Gold Mining Project in relation to the extent of the soil-landscape systems in the region, the cumulative impact to TEQ is not considered to be significant.

### 17.2.7 Landforms

The Proposal is expected to result in the cumulative regional loss of dunal landforms as a result of clearing and infrastructure.

For the purposes of assessing potential impacts to Landforms, cumulative impacts have been considered based on any existing or reasonably foreseeable projects that occur within the two Land Systems present in the MIA. Mapping of specific landforms at a regional scale is not available, and Land System mapping can be sued as a surrogate for assessing the dunal landforms within the Development Envelope in a regional context.

The estimated impact from the Proposal and other existing or reasonably foreseeable projects within the subregions on Land Systems are anticipated to be a total of 21,790.2 ha (0.01% of the current subregional extent) (Table 12-6). This is largely based on the development envelopes of existing and foreseeable projects rather than clearing footprints (with the exception of the AREH project), therefore overestimating the actual cumulative impact on Land Systems. The Proposal's contribution is approximately 4,589.3 ha (<0.1% of the current subregional extent and approximately 21% of total cumulative impact).

The maximum cumulative impact of clearing will be to the Little sandy Land System, with a 0.01% loss of its current extent, with the Proposal contributing to the loss of 0.2% of this Land System (Table 12-6). The AB04 Land System will be impacted by less than 0.1% of its current extent.

Given that the dunal landforms within the MIA are not significant according to the EPA's landform criteria (Section 12.1), the Proposal will not contribute to cumulative impacts to any significant landforms.

### 17.2.8 Air Quality

The Proposal may result in a minor, temporary increase in localised dust above established background concentration as a result of the construction and operation of the Proposal that has the potential to affect human health and amenity at sensitive receptors.

There is limited existing disturbance in the area surrounding the Proposal, with the closest major projects located approximately 116 km south-west of the MIA (Woodie Woodie) and 120 km south-east of the MIA (Telfer). Given the localised and temporary nature of the dust emissions and the absence of nearby sensitive receptors, the Proposal will not contribute to cumulative impacts to air quality.

### 17.2.9 Greenhouse Gas Emissions

GHG emissions are inherently cumulative in nature. The total annual emissions for the Energy sector (which includes mining, processing, transport, oil and gas) in WA for the latest available year of data (2022) from the national accounts, was 81.73 Mt (DCCEEW 2025d). The Proposal's contribution for all Scope 1 emissions (including Scope 2 emissions redefined as Scope 1 emissions for the purpose of this assessment) as an annual operational average is expected to be approximately 89,901 t $CO_{2\text{-}e}$ (Table 14-3) or approximately 0.11% of the State's annual emissions.

## 17.3 Predicted Cumulative Outcomes

Based on the above cumulative impact assessment, the Proponent does not consider that the Proposal will result in a significant current or proposed cumulative impact to any key environmental factor.

# 18 REFERENCES


ABS. 2023. ‘Region Summary: East Pilbara’. https://dbr.abs.gov.au/region.html?lyr=lga&rgn=53220.

Advisian. 2023a. *Wallal H3 Assessment: Conceptual and Numerical Model Update*. Prepared for Rio Tinto Copper.

Advisian. 2023b. *Winu Gold and Copper Project: Infiltration Pond Study*.

Advisian. 2024. *Solute Transport Modelling (Groundwater), Quarry and Pond Options*.

Agreenco. 2025. *Wind Erosion Study to Inform Rehabilitation Viability at Rio Tinto’s Winu Project Site, Western Australia.* Prepared for Rio Tinto Winu.

ALA. 2026a. ‘Anilios Endoterus (Waite, 1918)’. Atlas of Living Australia. https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/252b385c-6260-4f31-b5b5-a741fb2610e3.

ALA. 2026b. ‘Antaresia Childreni (Gray, 1842)’. Atlas of Living Australia. https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/d1f64ac1-0fa7-4549-b68e-c6ad41423902.

ALA. 2026c. ‘Black-Necked Whipsnake’. Atlas of Living Australia. https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/8d5cf804-3391-40f5-aa29-58617bee1e05.

ALA. 2026d. ‘Demansia Rufescens Storr, 1978’. Atlas of Living Australia. https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/6ef3f067-2013-49a9-bb3b-a0b16940d692.

ALA. 2026e. ‘Diporiphora Vescus Doughty, Kealley & Melville, 2012’. Atlas of Living Australia. https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/608a07a8-34f3-43e2-9e6f-500347fb8a35.

ALA. 2026f. ‘Planigale Kendricki Aplin, Cooper, Travouillon & Umbrello, 2023’. Atlas of Living Australia. https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/09f46642-3dea-4fca-aff9-e6dcb7acb3f7.

ALA. 2026g. ‘Varanus Giganteus (Gray, 1845)’. Atlas of Living Australia. https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/8fd73969-1e98-4d1f-9ff5-ce87ea618827.

AMIRA. 2002. *ARD Test Handbook: Project P387A Prediction & Kinetic Control of Acid Mine Drainage*.

ANZECC & ARMCANZ. 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Commonwealth of Australia.

ANZG. 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. https://www.waterquality.gov.au/guidelines/anz-fresh-marine.

APVMA. 2026. ‘APVMA Certifies That Second Generation Anticoagulant Rodenticides Should Be Restricted Chemical Products’. March 10. https://www.apvma.gov.au/news-and-publications/news/apvma-certifies-second-generation-anticoagulant-rodenticides-should-be-restricted-chemical-products.

AQ2. 2025a. *Rimfire Water Supply - Peer Review. Memo Prepared for Rio Tinto Copper*.

AQ2. 2025b. *Winu H3 Peer Review. Memo Prepared for Rio Tinto Copper*.

AQ2. 2026. *Environmental Review Document (ERD) Submission Peer Review*. No. 005a.

Astron. 2018. *Paterson Flora, Vegetation and Fauna Habitat Assessment Summary*. Prepared for Rio Tinto Exploration.

Astron. 2019. *Paterson Road Corridor Reconnaissance Flora and Vegetation and Level 1 Fauna Survey*.

ATCW. 2025a. *Peer Review of the Mine Site and Access Road SWMPs and TUFLOW Models. Memorandum Prepared for Rio Tinto.*

ATCW. 2025b. *Winu Site-Wide Water Balance Peer Review. Memorandum Prepared for Rio Tinto*.

Australian Geographic. 2020. *Night Parrot Found in Martu Country, WA*. August 21. https://www.australiangeographic.com.au/nature-wildlife/2020/08/night-parrot-found-in-salt-lake-country-of-wa/.

Australian Government. 2016. *Preventing Acid and Metalliferous Drainage: Leading Practice Sustainable Development Program for the Mining Industry*.

Australian Government. 2019. *Australian Rainfall and Runoff: A Guide to Flood Estimation*. Version 4.2. Commonwealth of Australia. https://www.arr-software.org/pdfs/ARR_190514_V4.2.pdf.

Australian Government. 2025. 'Eighty Mile Beach Marine Park'. Australian Marine Parks. https://australianmarineparks.gov.au/parks/north-west-marine-parks-network/eighty-mile-beach-marine-park/.

Beard, J. S. 1975. *Vegetation Survey of Western Australia. Western Australia 1: 1,000,000 Vegetation Series. Explanatory Notes to Sheet 5*. University of Western Australia Press.

Biologic. 2021. *Brockman Syncline Proposal (Revised Operations) Baseline Groundwater Dependent Ecosystem Exposure Assessment for the Greater Brockman Operations*. Prepared for Rio Tinto. https://www.epa.wa.gov.au/proposals/brockman-syncline-proposal.

Biota. 2018a. *Asian Renewable Energy Hub and Detailed Flora and Vegetation Survey*. Prepared for NW Interconnected Power.

Biota. 2018b. *Asian Renewable Energy Hub Migratory Shorebirds and Waterbirds Survey*. Prepared for NW Interconnected Power.

Biota. 2018c. *Asian Renewable Energy Hub Terrestrial Fauna and SRE Fauna Survey*. Prepared for Interconnected Power. https://www.epa.wa.gov.au/sites/default/files/PER_documentation2/Appendix%207%20-%20Terrestrial%20Fauna%20Desktop%20Review%20and%20Level%202%20Survey%20Part%201.pdf.

Biota. 2020a. *Winu Project - Bilby Abundance Study*. Prepared for Rio Tinto Pty Ltd.

Biota. 2020b. *Winu Project Fauna Assessment*. Prepared for Rio Tinto Winu Pty Limited.

Biota. 2021. *Winu Project Detailed Flora and Vegetation Survey*. Prepared for Rio Tinto Winu Pty Limited.

Biota. 2022a. *Winu Production Bores Stygofauna Desktop Study*. Prepared for Rio Tinto Copper.

Biota. 2022b. *Winu Project Area Extension Targeted Fauna Survey*. Prepared for Rio Tinto Winu Pty Limited.

Biota. 2022c. *Winu Project Subterranean Fauna Desktop Study and Basic Survey*.

Biota. 2023a. *Winu Project Wallal Borefield Stygofauna Assessment*. Prepared for Rio Tinto Winu Pty Limited.

Biota. 2023b. *Winu Project Water Borefield Targeted Fauna Survey DRAFT*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2023c. *Winu Terrestrial Fauna Interim Consolidation Report*. Prepared for Rio Tinto Winu Pty Limited.

Biota. 2023d. *Winu Texas Stygofauna Desktop Study*. Prepared for Rio Tinto Copper.

Biota. 2024. *Winu Project Bilby Population Abundance Study*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2025a. *Winu Project Infiltration Pond Impact Assessment*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2025b. *Winu Project Night Parrot Impact Assessment*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2025c. *Winu Project Noise and Vibration Impact Assessment*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2025d. *Winu Project SRE Invertebrate Fauna Assessment*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2025e. *Winu Project Texas Borefield Stygofauna Assessment*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2026a. *Winu Project Bilby Abundance Study 2025*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2026b. *Winu Project Bilby Habitat Assessment*. Prepared for Rio Tinto Winu Pty Ltd No. 2034.

Biota. 2026c. *Winu Project Migratory Bird Review*. Prepared for Rio Tinto Winu Pty Ltd No. 1716E.

Biota. 2026d. *Winu Project MNES Fauna Supporting Information*. Prepared for Rio Tinto Winu Pty Ltd Draft (Rev B).

Biota. 2026e. *Winu Project Percival Paleovalley Tributary and MNES Fauna*. Prepared for Rio Tinto Winu Pty Ltd No. 1919.

Biota. 2026f. *Winu Project Rimfire Borefield Stygofauna Assessment 2026*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2026g. *Winu Project Targeted Night Parrot Survey*. Prepared for Rio Tinto Winu Pty Ltd Rev 1.

Biota. 2026h. *Winu Project Vertebrate Fauna Consolidation Report*. Prepared for Rio Tinto Winu Pty Ltd.

Biota. 2026i. *Winu Project Wind Turbine Avifauna and Bat Risk Assessment*. Prepared for Rio Tinto Winu Pty Ltd.

BoM. 2023. ‘Climate Data Online’. http://www.bom.gov.au/climate/data/.

Brim Box et al. 2022. ‘Mapping Terrestrial Groundwater-Dependent Ecosystems in Arid Australia Using Landsat-8 Time-Series Data and Singular Value Decomposition’. *Remote Sensing in Ecology and Conservation* 8 (4): 464–76.

Bullen, R. D. 2021. *A Review of Ghost Bat Ecology, Threats and Survey Requirements*. Prepared for Department of Agriculture, Water and Environment. Bat Call WA. https://www.dcceew.gov.au/sites/default/files/documents/review-ghostbat-ecology-threats.pdf.

Butler, R. 2009. 'Vulnerability of Plant Functional Types to Dust Deposition in the Pilbara, NW Australia'. Honours thesis presented for the degree of Bachelor of Science (Environmental Science) (Honours), University of Western Australia, School of Plant Biology.

CER. 2022. *FullCAM Guidelines Requirements for Use of the Full Carbon Accounting Model (FullCAM) with the Emissions Reduction Fund (ERF) Methodology Determination: Carbon Credits (Carbon Farming Initiative—Plantation Forestry) Methodology Determination 2022*. Australian Government.

CER. 2025a. 'Assess Your Obligations'. https://cer.gov.au/schemes/national-greenhouse-and-energy-reporting-scheme/assess-your-obligations.

CER. 2025b. 'Managing Excess Emissions'. Regulator. April 15. https://cer.gov.au/schemes/safeguard-mechanism/managing-excess-emissions.

CER. 2025c. 'Safeguard Baselines'. https://cer.gov.au/schemes/safeguard-mechanism/safeguard-baselines.

Commonwealth of Australia. 2001. *National Objectives and Targets for Biodiversity Conservation 2001-2005*. Canberra.

Commonwealth of Australia. 2023. *Recovery Plan for the Greater Bilby (Macrotis Lagotis)*. Canberra. https://www.dcceew.gov.au/environment/biodiversity/threatened/publications/recovery/greater-bilby-2023.

Cross, A., S. Jaireth, R. Rapp, and R. Armstrong. 2011. 'Reconnaissance-Style EPMA Chemical U–Th–Pb Dating of Uraninite'. *Australian Journal of Earth Sciences* 58 (6): 675–83. https://doi.org/10.1080/08120099.2011.598190.

Czarnota, K., D. C. Champion, B. Goscombe, et al. 2010. 'Geodynamics of the Eastern Yilgarn Craton'. *Precambrian Research* 183 (2): 175–202.

Dale, Allan P., and Marcus B. Lane. 1994. 'Strategic Perspectives Analysis: A Procedure for Participatory and Political Social Impact Assessment'. *Society & Natural Resources* 7 (3): 253–67. https://doi.org/10.1080/08941929409380863.

Davy, John L., Kym Burgemeister, and David Hillman. 2018. 'Wind Turbine Sound Limits: Current Status and Recommendations Based on Mitigating Noise Annoyance'. *Applied Acoustics* 140 (November): 288–95. https://doi.org/10.1016/j.apacoust.2018.06.009.

DAWR. 2017. *Australian Weeds Strategy 2017-2027 - Invasive Plants and Animals Committee*. Commonwealth of Australia. https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/pests-diseases-weeds/consultation/aws-final.pdf.

DBCA. 2017a. *Guidelines for Surveys to Detect the Presence of Bilbies and Assess the Importance of Habitat in Western Australia*. Western Australia.

DBCA. 2017b. *Guidelines for Surveys to Detect the Presence of Bilbies, and Assess the Important of Habitat in Western Australia*. https://library.dbca.wa.gov.au/FullTextFiles/072208.pdf.

DBCA. 2019. *Parks and Reserves of the South-West Kimberley and North-West Pilbara Joint Management Plan 2019 - Management Plan 91*. Conservation and Parks Commission. https://www.dbca.wa.gov.au/management/plans/parks-and-reserves-south-west-kimberley-and-north-west-pilbara#:~:text=This%20management%20plan%20provides%20direction%20for%20the%20joint,Conservation%20Park%20and%20Kurriji%20Pa%20Yajula%20Nature%20Reserve.

DBCA. 2023a. 'Pilbara Region - Weed Impact and Invasiveness Ratings'. https://www.dbca.wa.gov.au/management/threat-management/weeds.

DBCA. 2023b. ‘Plan for Our Parks’. https://www.dbca.wa.gov.au/management/parks/plan-for-our-parks.

DBCA. 2024. ‘Guidelines for Determining the Likely Presence and Habitat Usage of Night Parrot (Pezoporus Occidentalis) in Western Australia’. March.

DCCEEW. 2021. ‘Australia’s Bioregions (IBRA)’. https://www.dcceew.gov.au/environment/land/nrs/science/ibra.

DCCEEW. 2022. ‘Independent Scientific Committee on Wind Turbines’. November. https://www.dcceew.gov.au/energy/renewable/independent-scientific-committee-wind-turbines.

DCCEEW. 2023a. *Interim Engaging with First Nations People and Communities on Assessments and Approvals under Environment Protection and Biodiversity Conservation Act 1999*. Australian Government.

DCCEEW. 2023b. *National Light Pollution Guidelines for Wildlife*. Australian Government. https://www.dcceew.gov.au/sites/default/files/documents/national-light-pollution-guidelines-wildlife.pdf.

DCCEEW. 2024a. *Australia’s Strategy for Nature 2024-2030*. https://www.dcceew.gov.au/environment/biodiversity/conservation/publications/australias-strategy-for-nature.

DCCEEW. 2024b. *Environmental Management Plan Guidelines*. Australian Government.

DCCEEW. 2024c. ‘National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015’. https://www.legislation.gov.au/F2015L01637/latest/text.

DCCEEW. 2025a. *Conservation Advice for Pezoporus Occidentalis (Night Parrot)*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/59350-conservation-advice-05092025.pdf.

DCCEEW. 2025b. *National Inventory Report 2023: The Australian Government Submission to the United Nations Framework Convention on Climate Change - Australian National Greenhouse Accounts*. https://www.dcceew.gov.au/sites/default/files/documents/national-inventory-report-2023-volume-1.pdf.

DCCEEW. 2025c. ‘National Reserve System’. https://www.dcceew.gov.au/environment/land/nrs.

DCCEEW. 2025d. ‘State and Territory Greenhouse Gas Inventories: 2023 Emissions’. May. https://www.dcceew.gov.au/climate-change/publications/national-greenhouse-accounts-2023/state-and-territory-greenhouse-gas-inventories-2023-emissions.

DCCEEW. 2026. ‘Species Profile and Threats Database’. http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

DCCEEW. n.d. *Great Sandy Desert Bioregion*. https://www.dcceew.gov.au/sites/default/files/env/resources/a8015c25-4aa2-4833-ad9c-e98d09e2ab52/files/bioregion-great-sandy-desert.pdf.

DEC. 2011. *A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities*.

DEMIRS. 2023a. *Mine Closure Plan Guidance - How to Prepare in Accordance with Part 1 of the Statutory Guidelines for Mine Closure Plans, Version 4.0*. Government of Western Australia.

DEMIRS. 2023b. *Statutory Guidelines for Mining Proposals, Version 4.0*. Government of Western Australia.

DEMIRS. 2025. *Guideline for Preparing Mining Development and Closure Proposals*. https://www.wa.gov.au/system/files/2025-05/mdcp_guideline.pdf.

DER. 2015a. *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes*. Western Australia.

DER. 2015b. *Treatment and Management of Soil and Water in Acid Sulfate Soil Landscapes*. https://www.wa.gov.au/system/files/2023-04/Treatment-and-management-of-soil-and-water-in-acid-ss-landscapes.pdf.

DEWHA. 2008. *Emission Estimation Technique Manual for Combustion Engines Version 3.0*. https://www.dcceew.gov.au/sites/default/files/documents/combustion-engines_1.pdf.

DEWHA. 2010a. *Survey Guidelines for Australia's Threatened Bats*. Australian Government.

DEWHA. 2010b. *Survey Guidelines for Australia's Threatened Birds*. Australian Government.

DEWHA. 2010c. *Survey Guidelines for Australia's Threatened Frogs*. Australian Government.

DMP. 2013. *Code of Practice: Tailings Storage Facilities in Western Australia*. Western Australia.

DMP. 2015a. *Guide to Departmental Requirements for the Management and Closure of Tailings Storage Facilities (TSFs)*. Government of Western Australia.

DMP. 2015b. *Guideline: Management of Fibrous Minerals in Western Australian Mining Operations*. Second Edition. Resources Safety.

DMP. 2016. 'Draft Guidance - Materials Characterisation Baseline Data Requirements for Mining Proposals'. The Chamber of Minerals and Energy of Western Australia, May.

DMPE. 2025a. *Environmental Objectives Policy for Mining*. https://www.wa.gov.au/system/files/2025-09/2510121_environmentalobjectivespolicyformining_web.pdf.

DMPE. 2025b. *Guideline for Preparing Mine Closure Plans*. https://www.wa.gov.au/system/files/2025-11/preparing_mine_closure_plans.pdf.

DMPE. 2025c. *Mining Development and Closure Proposal and Approvals Statement Framework*. https://www.wa.gov.au/system/files/2025-02/mdcp_framework_document.pdf.

DoE. 2006. *Air Quality Modelling Guidance Notes*. Perth, WA. https://www.wa.gov.au/system/files/2023-03/Air-quality-modelling-guidance-notes-2006.pdf.

DoE. 2013. *Matters of National Environmental Significance: Significant Impact Guidelines 1.1*. Australian Government.

DoE. 2015a. *Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act*. https://www.dcceew.gov.au/sites/default/files/documents/migratory-birds-draft-referral-guideline.pdf.

DoE. 2015b. *Wildlife Conservation Plan for Migratory Shorebirds*. https://www.dcceew.gov.au/sites/default/files/documents/widlife-conservation-plan-migratory-shorebirds.pdf.

DoE. 2016. *EPBC Act Referral Guideline for the Endangered Northern Quoll Dasyurus Hallucatus*. Australian Government.

DoE. 2017. *EPBC Act Policy Statement 3.21 – Industry Guidelines for Avoiding, Assessing and Mitigating Impacts on EPBC Act Listed Migratory Shorebird Species*. https://www.dcceew.gov.au/sites/default/files/documents/bio4190517-shorebirds-guidelines.pdf.

DoEE. 2018. ‘Approval: Thunderbird Mineral Sands Project, WA (EPBC2019/7648)’.

DoW. 2009. *Operational Policy No. 5.12 - Hydrogeological Reporting Associated with a Groundwater Well Licence*. Western Australia.

DoW. 2013. *Western Australia Water in Mining Guideline*. No. 12. Western Australia.

DoW. 2020. *Policy: Use of Mine Dewatering Surplus*. Formerly Strategic Policy 2.09. Government of Western Australia. https://www.wa.gov.au/system/files/2022-11/Policy-use-of-mine-dewatering-surplus.pdf.

DPaW. 2017. *Interim Guideline for Preliminary Surveys of Night Parrot (Pezoporus Occidentalis) in Western Australia*.

DPHI. 2026. *Social Impact Assessment Guideline: For State Significant Projects*. NSW Government.

DPIRD. 2018. ‘Soil Landscape Mapping - Systems (DPIRD-064)’. https://catalogue.data.wa.gov.au/dataset/soil-landscape-mapping-systems.

DPIRD. 2025. ‘NRInfo (Natural Resource Information) for Western Australia.’ https://www.dpird.wa.gov.au/environment-and-sustainability/nrinfo-for-western-australia/#:~:text=NRInfo%20(natural%20%20resource%20information)%20provides,areas%20needing%20more%20intensive%20assessment.

DPLH. 2025. ‘Wallal Downs Station Group’. Heritage Council. https://inherit.dplh.wa.gov.au/public/inventory/details/8337d2bb-01b1-45d9-9a79-a243237e28b0.

DSEWPaC. 2011a. *Survey Guidelines for Australia’s Threatened Mammals*. Australian Government.

DSEWPaC. 2011b. *Survey Guidelines for Australia’s Threatened Reptiles*. Australian Government.

DSEWPaC. 2011c. *Update of Dust Storm Index (DSI) Maps for 2005 to 2010 and Re-Analysis and Mapping of DSI for 1992-2005, 1992-2008 and 1992-2010.* Report prepared for the Australian Collaborative Rangeland Information System (ACRIS).

DSEWPaC. 2012a. *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. Australian Government.

DSEWPaC. 2012b. *EPBC Act Offsets Assessment Guide*. https://www.dcceew.gov.au/environment/epbc/publications/epbc-act-environmental-offsets-policy.

DWER. 2019a. *Climate Change in Western Australia*. Issues paper. Government of Western Australia. https://consult.dwer.wa.gov.au/climatechange/issues-paper/user_uploads/climate-change-in-wa_2019.pdf.

DWER. 2019b. *Guideline: Air Emissions (Draft)*. Western Australia.

DWER. 2019c. *Guideline: Industry Regulation Guide to Licensing*. Government of Western Australia.

DWER. 2020. *Policy: Use of Operating Strategies in the Water Licensing Process (Formerly Operational Policy 5.08)*. Western Australia.

DWER. 2021a. ‘DWER WA Environmental Offsets Calculator’. November. https://www.wa.gov.au/government/publications/dwer-wa-environmental-offsets-calculator.

DWER. 2021b. *Guideline: Assessment of Environmental Noise Emissions*. Draft for Consultation. Department of Water and Environmental Regulation. https://www.wa.gov.au/system/files/2022-03/Draft%20Guideline%20Assessment%20of%20environmental%20noise%20emissions.pdf.

DWER. 2021c. *Guideline: Dust Emissions (Draft)*. Western Australia.

DWER. 2021d. *Noise Regulations fact sheet: Regulation 11: Blasting Operations*. https://www.wa.gov.au/system/files/2023-01/Noise-regulations-fact-sheet-Regulation-11-blasting-operations.pdf.

DWER. 2022. *DRAFT Procedure for Environmental Offsets Metric Inputs*. Government of Western Australia.

DWER. 2023. *Climate Adaptation Strategy: Building WA's Climate Resilient Future*. Government of Western Australia. https://www.wa.gov.au/government/publications/climate-adaptation-strategy.

DWER. 2024a. *Guide to Future Climate Projections for Water Management in Western Australia*. Government of Western Australia. https://www.wa.gov.au/government/publications/guide-future-climate-projections-water-management-western-australia.

DWER. 2024b. 'Hydrographic Catchments - Catchments (DWER-028)'. https://catalogue.data.wa.gov.au/dataset/hydrographic-catchments-catchments.

DWER. 2024c. 'Water Register'. https://maps.water.wa.gov.au/#/webmap/register.

DWER. 2025. 'Contaminated Sites Database (DWER-059)'. https://catalogue.data.wa.gov.au/dataset/contaminated-reported-sites-dwer-059.

E2M. 2026. *Winu Copper and Gold Mine (Winu Project) Offsets Strategy*. Prepared for Rio Tinto Winu Pty Ltd.

EAQ. 2026. *Dust Impact Assessment of the Proposed Mining Operations: Rio Tinto Winu Copper-Gold Project*. Prepared for Rio Tinto Winu.

Ecoscape. 2025. *Winu Project Visual Impact Assessment*. Prepared for Rio Tinto Nos 5107-23-R_Final_rev1.

ELA. 2024. *Cyanide Management Plan*. Prepared for Rio Tinto Winu Version 5.

EPA. 2006. *Guidance for the Assessment of Environmental Factors (in Accordance with the Environmental Protection Act 1986) Rehabilitation of Terrestrial Ecosystems*. No. 6. Western Australia.

EPA. 2014. *Cumulative Environmental Impacts of Development in the Pilbara Region. Advice of the Environmental Protection Authority to the Minister for Environment under Section 16(e) of the Environmental Protection Act 1986*. Western Australia.

EPA. 2016a. 'Environmental Factor Guideline: Flora and Vegetation'. Perth, Western Australia, December.

EPA. 2016b. *Environmental Factor Guideline: Human Health*. Perth, WA. https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Guideline-Human-Health-131216_2.pdf.

EPA. 2016c. *Environmental Factor Guideline: Subterranean Fauna*. Western Australia.

EPA. 2016d. *Environmental Factor Guideline: Terrestrial Environmental Quality*. Western Australia.

EPA. 2016e. *Environmental Factor Guideline: Terrestrial Fauna*. Western Australia.

EPA. 2016f. *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment*. Western Australia.

EPA. 2016g. ‘Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna’.

EPA. 2016h. *Technical Guidance: Sampling of Short Range Endemic Invertebrate Fauna*. Western Australia.

EPA. 2016i. *Technical Guidance: Terrestrial Fauna Surveys*. Government of Western Australia. https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Tech%20guidance-%20Terrestrial%20Fauna%20Surveys-Dec-2016.pdf.

EPA. 2018a. *Environmental Factor Guideline: Inland Waters*. Western Australia.

EPA. 2018b. *Environmental Factor Guideline: Landforms*. Western Australia.

EPA. 2019. ‘Environmental Factor Guideline: Greenhouse Gas Emissions’.

EPA. 2020a. *Environmental Factor Guideline: Air Quality*. Western Australia.

EPA. 2020b. ‘Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment’. Joondalup, Western Australia, June.

EPA. 2021a. *DRAFT Technical Guidance: Subterranean Fauna Surveys for Environmental Impact Assessment*. Government of Western Australia.

EPA. 2021b. *Environmental Outcomes and Outcomes-Based Conditions Interim Guidance*. Western Australia.

EPA. 2021c. *Instructions for the Preparation of Data Packages for the Index of Biodiversity Surveys for Assessments (IBSA)*. Environmental Protection Authority.

EPA. 2021d. *Interim Guidance: Taking Decision Making Processes into Account in EIA*. Western Australia.

EPA. 2021e. ‘Technical Guidance: Subterranean Fauna Surveys for Environmental Impact Assessment’. Joondalup, Western Australia, December.

EPA. 2021f. ‘Template for Environmental Protection Act 1986 Part IV Impact Reconciliation Procedure’. March.

EPA. 2023a. *Environmental Factor Guideline: Social Surroundings*.

EPA. 2023b. *Statement of Environmental Principles, Factors, Objectives and Aims of EIA*.

EPA. 2023c. ‘Statement of Environmental Principles, Factors, Objectives and Aims of EIA’. Joondalup, Western Australia, April.

EPA. 2023d. ‘Technical Guidance: Environmental Impact Assessment of Social Surroundings - Aboriginal Cultural Heritage’. Joondalup, Western Australia, November.

EPA. 2024a. *Environmental Factor Guideline: Greenhouse Gas Emissions*. Western Australia.

EPA. 2024b. *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures*. Western Australia.

EPA. 2024c. *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual*. Western Australia.

EPA. 2024d. *Instructions and Template: How to Identify the Content of a Proposal*. Western Australia.

EPA. 2024e. *Instructions: How to Prepare an Environmental Review Document*. Western Australia.

EPA. 2024f. *Instructions: How to Prepare Environmental Protection Act 1986 Part IV Environmental Management Plans*. Western Australia.

EPA. 2024g. *Instructions on How to Prepare Environmental Protection Act 1986 Part IV Impact Reconciliation Procedures and Impact Reconciliation Reports*. Western Australia.

EPA. 2024h. *Public Advice: Considering Environmental Offsets at a Regional Scale*. Western Australia. https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Public%20Advice%20Considering%20Environmental%20Offsets%20at%20a%20Regional%20Scale.pdf.

ETA. 2021. *West Angelas Revised Proposal Air Quality Assessment*. Prepared for Rio Tinto.

Fitzpatrick, Rob, Bernie Powell, and Steve Marvanek. 2011. 'Atlas of Australian Acid Sulfate Soils'. CSIRO. 590.24 MB. https://doi.org/10.4225/08/512E79A0BC589.

Fortin. 2025. *Winu Rimfire Pre-Feasibility Study Report*. Prepared for Rio Tinto.

Garnett, S., J. Szabo, and G. Dutson. 2014. *The Action Plan for Australian Birds 2010*. CSIRO Publishing.

Geoscience Australia. 2014. 'Palaeovalleys'. https://www.ga.gov.au/scientific-topics/water/groundwater/groundwater-in-australia/palaeovalleys.

Gerson, A. R., P. Weber, R. St. C. Smart, G. Levay, M. Hutton-Ashkenny, and R. Green. 2021. 'The Application of Thermal Decomposition for Determination of Carbonate Acid-Neutralising Capacity for Improved Acid Mine Drainage Prediction'. *Minerals* 11 (11): 1181. https://doi.org/10.3390/min11111181.

GHD. 2025. *Air Quality Emissions Comparison Assessment. Technical Memorandum Prepared for Rio Tinto Winu*.

GHD. 2026. *Greenhouse Gas Emission Assessment Update: Winu Project*. Prepared for Rio Tinto Winu.

Golder. 2020a. *Winu Final Study: Updated Flood Risk Assessment - Access Route*.

Golder. 2020b. *Winu Water Studies Conceptual Hydrogeology*. Prepared for Rio Tinto.

Golder. 2022a. *2020 Geotechnical Studies: Winu Project Final Study*. Prepared for Rio Tino.

Golder. 2022b. *H3 Hydrogeological Assessment of the Winu Project*. Prepared for Rio Tinto Copper.

Government of Western Australia. 2019. *2018 Statewide Vegetation Statistics Incorporating the CAR Reserve Analysis (Full Report)*. Department of Biodiversity, Conservation and Attractions.

GoWA. 2011. *WA Environmental Offsets Policy*.

GoWA. 2014a. *WA Environmental Offsets Guidelines*.

GoWA. 2014b. 'WA Environmental Offsets Template'. https://www.epa.wa.gov.au/policies-guidance/wa-environmental-offsets-policy-framework.

GoWA. 2018. *Pilbara Conservation Strategy*. Department of Biodiversity, Conservation and Attractions. https://www.dbca.wa.gov.au/management/pilbara.

GoWA. 2019. *2018 Statewide Vegetation Statistics Incorporating CAR Reserve Analysis (Full Report)*. Department of Biodiversity, Conservation and Attractions. DBCA Statewide Vegetation Statistics - Datasets - data.wa.gov.au.

GoWA. 2020. *Western Australian Climate Policy*. Government of Western Australia. https://www.wa.gov.au/government/publications/western-australian-climate-policy.

GoWA. 2021. *Western Australia Climate Projections: Summary*. https://www.wa.gov.au/system/files/2022-01/Western_Australian_Climate_Projections_Summary.pdf.

GoWA. 2024a. 'Bold Bid to Stop Southward Advance of Cane Toads to the Pilbara'. https://www.wa.gov.au/government/media-statements/Cook-Labor-Government/Bold-bid-to-stop-southward-advance-of-cane-toads-to-the-Pilbara-20240717.

GoWA. 2024b. *Greenhouse Gas Emissions Policy for Major Projects*. Government of Western Australia. https://www.wa.gov.au/system/files/2024-10/greenhouse-gas-emissions-policy-major-projects.pdf.

Graham, G. 2001a. *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002. Dampierland 2 (DL2 - Pindaland Subregion)*. Dept. of Conservation & Land Management.

Graham, G. 2001b. *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002. Great Sandy Desert 1 (GSD1 - McLarty Subregion)*. Dept. of Conservation & Land Management.

Green, C., and J. Chapman. 2022. *Critical Decisions for AMD Management*. International Mine Water Association Conference.

Griffiths, A. D., and B. W. Brook. 2014. 'Effect of Fire on Small Mammals: A Systematic Review'. *International Journal of Wildland Fire* 23 (7): 1034–43.

Hale, M. 2012. *Kurlumarniny: We Come from the Desert*. Aboriginal Studies Press. https://aiatsis.gov.au/publication/35259.

Harvey, M. S. 2002. 'Short-Range Endemism among the Australian Fauna: Some Examples from Non-Marine Environments'. *Invertebrate Systematics* 16 (4): 555–70.

HGL. 2024a. *Winu Pit Lake Model*. Prepared for Rio Tinto Winu Pty Ltd.

HGL. 2024b. *Winu Project - Evaluation of Waste Rock Landform (WRL) Seepage Potential*.

Hickman, A. H., and L. Bagas. 1999. *Geological Evolution of the Palaeoproterozoic Talbot Terrane, and Adjacent Meso- and Neoproterozoic Successions, Paterson Orogen, Western Australia*. With Geological Survey of Western Australia. Report / Geological Survey of Western Australia 71. Perth.

Higgins, P. J. 1999. *Handbook of Australian, New Zealand and Antarctic Birds, Volume 4 (Parrots to Dollarbird)*. Vol. 4. Oxford University Press.

Hill, B., and S. Ward. 2010. *National Recovery Plan for the Northern Quoll Dasyurus Hallucatus*. Prepared for the Northern Territory Department of Natural Resources, Environment, The Arts and Sport. Palmerston, Northern Territory. https://www.dcceew.gov.au/sites/default/files/documents/northern-quoll.pdf.

Hook, R. I. V. 1978. 'Transport and Transportation Pathways of Hazardous Chemicals from Solid Waste Disposal'. *Environmental Health Perspectives* 27 (December): 295. https://doi.org/10.2307/3428891.

Hunter v State of Western Australia, No. 654 (FCA 2009). https://www.nntt.gov.au/News-and-Publications/hotspots/Documents/Hot%20Spots%2031/Hunter%20v%20WA%20%5b2009%5d%20FCA%20654%20HS31.pdf.

Huston, D. L., K. Czarnota, S. Jaireth, and N. C. Williams. 2010. 'Mineral Systems of the Paterson Region'. *Geoscience Australia*, January, 155–218.

ICMI. 2023. 'The Cyanide Code'. https://cyanidecode.org/.

ICMM. 2019. *Integrated Mine Closure: Good Practice Guide*. 2nd Edition.

ICMM. 2020. *Global Industry Standard on Tailings Management*. https://globaltailingsreview.org/wp-content/uploads/2020/08/global-industry-standard_EN.pdf.

ICOMOS. 2013. *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*. https://australia.icomos.org/publications/burra-charter-practice-notes/.

INAP. 2024. *Global Acid Rock Drainage (GARD) Guide*.

Isbell, R. F. and NCST. 2025. *The Australian Soil Classification*. 3rd edn. CSIRO Publishing.

James on Behalf of the Martu People v Western Australia, No. 1208 (FCA 2002).

Johnstone, R. E., and G. M. Storr. 1998. *Handbook of Western Australian Birds*. Western Australian Museum.

Jupp, Tony, James Fitzsimons, Ben Carr, and Peter See. 2015. 'New Partnerships for Managing Large Desert Landscapes: Experiences from the Martu Living Deserts Project'. *The Rangeland Journal* 37 (6): 571. https://doi.org/10.1071/RJ15047.

JYAC. 2022. *Martu Indigenous Protected Area Plan of Management 2022-2027*.

Kendrick, P. 2001. *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002. Great Sandy Desert 2 (GSD2 - Mackay Subregion)*. Dept. of Conservation & Land Management.

Landloch. 2020a. *SIBERIA Landform Evolution Modelling: Winu Project*.

Landloch. 2020b. *Winu Soil Characterisation Report*.

Landloch. 2025. *Winu Project: Soil Characterisation*. Prepared for Rio Tinto Winu Pty Ltd.

Leeuwen, S. van. 2002. *Biological Survey of the South-Western Little Sandy Desert: National Reserve System Project N706*. Final Report. Department of Conservation and Land Management.

Leseberg, N. 2025a. *Peer Review of Biota Environmental Sciences' Winu Project Night Parrot Impact Assessment*. Prepared for Rio Tinto Winu Ltd.

Leseberg, N. 2025b. *Peer Review of Biota Environmental Sciences' Winu Project Targeted Night Parrot Survey*. Prepared for Rio Tinto Winu Pty Ltd. Adaptive NRM.

Listcorp. 2024. *Nifty Copper Complex - Pre-Feasibility Study*. https://www.listcorp.com/asx/cym/cyprium-metals-limited/news/nifty-copper-complex-pre-feasibility-study-3122303.html.

Lloyd George Acoustics. 2025a. *Ambient Noise Monitoring - Winu Copper-Gold Project, WA*. Prepared for: Rio Tinto Winu Pty Ltd Nos 24129774-03 Ambient.

Lloyd George Acoustics. 2025b. *Environmental Noise Assessment Winu Project, WA*. Report Prepared for Rio Tinto Winu Pty Ltd Nos 24129774-02A.

Lloyd George Acoustics. 2025c. *Winu Project: Aircraft Noise Assessment*. Memo Report Prepared for: Rio Tinto Winu Pty Ltd.

Lloyd George Acoustics. 2025d. *Winu Project: Rimfire Bore Field Noise Assessment*. Memo Report Prepared for: Rio Tinto Winu Pty Ltd Nos 24129771-04 Memo Rimfire.

Lohr, M., C. Lohr, J. Dunlop, et al. 2025. 'Widespread Detection of Second Generation Anticoagulant Rodenticides in Australian Native Marsupial Carnivores'. *The Science of the Total Environment* 967. https://doi.org/10.1016/j.scitotenv.2025.178832.

Lynnes, H., and S. Calderwood. 2025. *Rio Tinto Winu Borefields and Cultural Mapping Project*.

Main Roads WA. 2023. 'Trafficmap'. https://trafficmap.mainroads.wa.gov.au/map.

Matsuki, M., M. R. Gardener, A. Smith, R. K. Howard, and A. Gove. 2016. 'Impacts of Dust on Plant Health, Survivorship and Plant Communities in Semi-arid Environments'. *Austral Ecology* 41 (4): 417–27. https://doi.org/10.1111/aec.12328.

MCA. 2021. *ESG: Change for the Better*. https://minerals.org.au/wp-content/uploads/2022/12/ESG-Change-for-the-better.pdf.

McKenzie, N. J., R. Webster, and A. J. Ringrose-Voase. 2008. 'Guidelines for Surveying Soil and Land Resources'. In *Australian Soil and Land Survey Handbook Series*, 2nd edn, vol. 2. CSIRO Publishing.

McKenzie, N. L., J. E. May, and Western Australia, eds. 2003. *A Biodiversity Audit of Western Australia's Biogeographical Subregions in 2002*. Dept. of Conservation & Land Management.

MEND Program. 1991. *Acid Rock Drainage Prediction Manual*.

Mine Lakes Consulting. 2024. *Rio Tinto, Winu Mine - Review of Water Balance and Quality Modelling by Hydrogeologica. Memorandum Prepared for Rio Tinto*.

Mine Lakes Consulting. 2025. *Winu Mine Pit Lake Environmental Risk Assessment (ERA) - 2024 Update*. Prepared for Rio Tinto. Perth, Australia.

Morris, K., J. Woinarski, and K. Aplin. 2008. *Leggadina Lakedownensis*. http://www.iucnredlist.org/apps/redlist/details/11384/0.

Murphy, S. and Night Parrot recovery Team. 2015. 'Shining a Light: The Research Unlocking the Secrets of the Mysterious Night Parrot'. *Australian Birdlife* 4 (3): 30–35.

MWH. 2015. *Appendix A: Development of Pilbara Landscape Ecohydrological Units*. Prepared for BHP Billiton Iron Ore Pty Ltd.

NEPC. 2021. 'National Environment Protection (Ambient Air Quality) Measure (as Amended)'.

Newport, J., D. J. Shorthouse, and A. D. Manning. 2014. 'The Effects of Light and Noise from Urban Development on Biodiversity: Implications for Protected Areas in Australia'. *Ecological Management & Restoration* 15 (3): 204–14. https://doi.org/10.1111/emr.12120.

Ngururrpa Rangers, C. Sunfly, A. Schubert, et al. 2024. 'Potential Threats and Habitat of the Night Parrot on the Ngururrpa Indigenous Protected Area'. *Wildlife Research* 51 (10). https://doi.org/10.1071/WR24083.

NWAC. 2016. *Traditional Ecological Knowledge of Nyangumarta Warrarn Indigenous Protected Area*. https://www.ymac.org.au/wp-content/uploads/2013/05/899-Ethno-booklet.pdf.

NWAC. 2025. 'People and Country'. https://www.nwac.org.au/about-us.

NWAC and YMAC. 2022. *Nyangumarta Warrarn Indigenous Protected Area Management Plan 2022-2032*. Nyangumarta Warrarn Aboriginal Corporation and Yamatji Marlpa Aboriginal Corporation.

Oderman, G. 1957. *Property in Northwest Australia*. Vol. 21. Annali Lateranensi.

Okane. 2020. *Winu Copper Project - Conceptual Cover System Modelling*. Nos 0662-049–001.

Okane. 2024. *Winu Tailings Storage Facility High Sulfur Tailings Cover System Numerical Modelling*. Prepared for Rio Tinto.

Pearson, D. J. 2013. *Recovery Plan for Five Species of Rock Wallabies: Black-Footed Rock Wallaby (Petrogale Lateralis), Rothschild Rock Wallaby (Petrogale Rothschildi), Short-Eared Rock Wallaby (Petrogale Brachyotis), Monjon (Petrogale Burbidgei) and Narbarlek (Petrogale Concinna) 2012-2022*. Department of Parks and Wildlife. https://www.dcceew.gov.au/sites/default/files/documents/rock-wallabies-recovery-plan.pdf.

RAC. 2025. 'Spotlight on WA's Riskiest Roads with Survey Results Now in'. Media Releases. RAC. https://rac.com.au/about-rac/media/media-releases/february-2025/spotlight-on-was-riskiest-roads-with-survey-results-now-in.

Red Earth Engineering. 2024. *J24050-Winu ASS Desktop Rev1. Technical Memorandum Prepared Fro Rio Tinto Copper*.

Red OHMS Group. 2022. *Rio Tinto Winu Baseline Dust Monitoring Final Summary Report*.

Reid, K., and G. B. Baker. 2025. *Impacts on Birds and Bats from Onshore Windfarms in Australia: An Ecological Risk Assessment*. Department of Climate Change, Energy, the Environment, and Water.

Richardson Consulting. 2026. *Winu Ecohydrology Assessment - Initial Findings*. Memo Report Prepared for: Winu Services Pty Ltd.

Rio Tinto. 2017. *Environmental Performance Standard E13: Chemically Reactive Mineral Waste Control Standard*.

Rio Tinto. 2019. *D3 - Management of Slope Geotechnical Hazards*. HSE-B-024.

Rio Tinto. 2020. *Group Standard: D5 – Management of Tailings and Water Storage Facilities*.

Rio Tinto. 2021. *Communities and Social Performance Commitments Disclosure Interim Report*.

Rio Tinto. 2022. *Communities and Social Performance Standard*. https://www.riotinto.com/-/media/Content/Documents/Sustainability/Corporate-policies/RT-Communities-social-performance-standard.pdf.

Rio Tinto. 2023. *Winu Closure Planning: Waste Rock Closure Use Assessment*. Unpublished report.

Rio Tinto. 2024a. *Winu Waste Characterisation - Secondary Sulfide (Enriched) Zone*.

Rio Tinto. 2024b. *Winu Waste Characterisation - Upper (Oxidised and Overburden) Zone*.

Rio Tinto. 2025a. *2025 Climate Action Plan*.

Rio Tinto. 2025b. *Waste Rock Landform (WRL): Winu Project - Mine Planning*.

Rio Tinto. 2025c. *Winu - Acid and Metalliferous Drainage Strategy and Management Plan*.

Rio Tinto. 2025d. *Winu Ground Disturbance & Rehabilitation Work Practice*.

Rio Tinto. 2025e. *Winu Waste Characterisation - Primary Sulfide (Hypogene) Zone*.

Rio Tinto. 2025f. *Winu Waste Characterisation - Tailings*.

Rio Tinto. 2026. *Winu Exploration Rehabilitation Report*.

Schoknecht, N., and S. Pathan. 2013. *Soil Groups of Western Australia*. Resource Management Technical Report 380 4th edn. Unpublished. https://www.researchgate.net/doi/10.13140/RG.2.1.3428.9128.

Shepherd, D. P., G. R. Beeston, and A. J. M. Hopkins. 2002. *Native Vegetation in Western Australia: Extent, Type and Status*. Resource Management Technical Report No. 249. Department of Primary Industries and Regional Development.

Shire of East Pilbara. 2023. 'Our Towns'. https://www.eastpilbara.wa.gov.au/our-region/our-towns#:~:text=There%20are%20numerous%20cultural%20and%20heritage%20attractions%2C%20such,square%20kilometres%3B%20larger%20than%20the%20state%20of%20Victoria.

SKM. 2003. *Aggregated Emissions Inventory for the Pilbara Airshed.* Revision 2.

Slootweg, Roel, Frank Vanclay, and Marlies Van Schooten. 2003. 'Integrating Environmental and Social Impact Assessment'. In *The International Handbook of Social Impact Assessment*, edited by Henk A. Becker and Frank Vanclay. Edward Elgar Publishing. https://doi.org/10.4337/9781843768616.00016.

SLR. 2025. *Landforms Assessment: Winu Project*. Prepared for Rio Tinto Winu Pty Ltd.

Southgate, R., M. A. Dziminski, R. Paltridge, A. Schubert, and G. Gaikhorst. 2019. 'Verifying Bilby Presence and the Systematic Sampling of Wild Populations Using Sign-Based Protocols – with Notes on Aerial and Ground Survey Techniques and Asserting Absence'. *Australian Mammalogy* 41 (1): 27. https://doi.org/10.1071/AM17028.

Southgate, R., R. Paltridge, P. Masters, and S. Carthew. 2007. 'Bilby Distribution and Fire: A Test of Alternative Models of Habitat Suitability in the Tanami Desert, Australia'. *Ecography* 30 (6): 759–76. https://doi.org/10.1111/j.2007.0906-7590.04956.x.

SRK. 2025. *Tailings Storage Facility Seepage Modelling: Winu TSF Seepage Modelling, Pilbara Region, WA, Australia.* Prepared for Rio Tinto.

Sullivan, L., N. Ward, N. Toppler, and G. Lancaster. 2018. *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual*. CC BY 4.0. Department of Agriculture and Water Resources.

Swinderen, L. van, B. D. Hansen, R. A. Fuller, et al. 2025. *Revision of the East Asian-Australasian Flyway Population Estimates for 37 Listed Migratory Shorebird Species*. Prepared for the Department of Climate Change, Energy, the Environment and Water. BirdLife Australia. https://www.dcceew.gov.au/sites/default/files/documents/revision-east-asian-australasian-flyway-population-estimates-2025.pdf.

Talis Consultants. 2024. *Telfer - Havieron Gold Mining Project. Section 38 Environmental Protection Act 1986 Referral Supporting Document V6 Inclusive of Ministerial Statements 605, 606 and 650 30. Prepared for Newcrest Mining Limited.*

Trindale, N. B. 1974. *Aboriginal Tribes of Australia: Their Terrain, Enironmental Controls, Distribution, Limits, and Proper Names*. University of California Press.

Trotter, L., and A. Cross. 2022. *Ensemble Modelling for Ground Water Dependent Vegetation Detection*. Curtin University.

Trudgen, M. E. 1988. *A Report on the Flora and Vegetation of the Port Kennedy Area*. Unpublished report prepared for Bowman Bishaw and Associates. West Perth.

TSSC. 2005. 'Commonwealth Listing Advice on Northern Quoll (Dasyurus Hallucatus)'. http://www.environment.gov.au/biodiversity/threatened/species/dasyurus-hallucatus.html.

TSSC. 2016a. *Conservation Advice Macrotis Lagotis Greater Bilby*. https://www.environment.gov.au/biodiversity/threatened/species/pubs/282-conservation-advice-15072016.pdf.

TSSC. 2016b. *Conservation Advice: Petrogale Lateralis Lateralis Black-Flanked Rock-Wallaby*. https://environment.gov.au/biodiversity/threatened/species/pubs/66647-conservation-advice-07122016.pdf.

TSSC. 2018. *Conservation Advice: Polytelis Alexandrae Princess Parrot*. Department of the Environment and Energy.

TSSC. 2020. *Conservation Advice: Falco Hypoleucos Grey Falcon*. Department of Agriculture, Water and the Environment. https://environment.gov.au/biodiversity/threatened/species/pubs/929-conservation-advice-09072020.pdf.

Umwelt. 2024. *Winu Copper Gold Project Socio-Economic Baseline*.

Umwelt. 2025. *Socio-Economic Impact Assessment*.

UNEP. 2024. *Emissions Gap Report 2024: Broken Record*. https://www.unep.org/resources/emissions-gap-report-2024.

V & C Semeniuk Research Group. 2000. *Wetlands of the Northwestern Great Sandy Desert in the LaGrange Hydrological Sub-Basin*. Report to Water & Rivers Commission. Western Australia.

Van Etten, E. J. B. 2020. 'The Gibson, Great Sandy, and Little Sandy Deserts of Australia'. In *Encyclopedia of the World's Biomes*. Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.11967-0.

Vanclay, F., A. M. Esteves, I. Aucamp, and D. M. Franks. 2015. *Social Impact Assessment: Guidance for Assessing and Managing the Social Impacts of Projects*. International Association for Impact Assessment. https://iaia.org/wp-content/uploads/2025/03/Social-Impact-Assessment-Guidance-for-Assessing-and-Managing-the-Social-Impacts-of-Projects.pdf.

Vaughan, A. 2025. *A Report Detailing the Outcomes of the Winu Social Surroundings Assessment, Winu Copper and Gold Project, Western Australia*. Prepared for Rio Tinto 2023_01 Winu Nyangumarta Social Surroundings Assessment. NWAC.

Vreeswyk, A. M. E. van, K. A. Leighton, A. L. Payne, and P. Henning. 2004. 'An Inventory and Condition Survey of the Pilbara Region, Western Australia'. Department of Agriculture, Western Australia. https://library.dpird.wa.gov.au/tech_bull/7.

Walsh, F. 2008. 'To Hunt and to Hold: Martu Aboriginal People's Uses and Knowledge of Their Country, with Implications for Co-Management in Karlamilyi (Rudall River) National Park and the Great Sandy Desert, Western Australia'. Doctoral Thesis, University of Western Australia. https://research-repository.uwa.edu.au/en/publications/to-hunt-and-to-hold-martu-aboriginal-peoples-uses-and-knowledge-o#:~:text=%5BTruncated%20abstract%5D%20This%20ethnoecological%20study%20examines%20land%20uses,and%20Kunawarritji%E2%80%94in%20the%20Great%20and%20Little%20Sandy%20Deserts.

WAM. n.d. 'Desert Spadefoot Notaden Nichollsi Parker 1940'. https://museum.wa.gov.au/explore/frogwatch/frogs/desert-spadefoot.

WAPC. 2004. 'Guidelines for Wind Farm Development'. *Planning Bulletin* (Western Australia), May. 67th edn.

Warburton, P. E. 1981. *Journey Across the Western Interior of Australia*. Hesperian Press.

Western Botanical. 2023. *Flora of Ethno-Botanical Significance: Winu-Copper - Gold Project, September 2023 V2*. Prepared for Rio Tinto Winu Pty Limited No. WB1016.

Western Botanical. 2025a. *Melaleuca Vegetation Mapping for the Winu Project. Ref WB107*.

Western Botanical. 2025b. *Memo Summary of Findings from April 2025 Targeted Weed Survey of the Winu and Magnum Camps and Surrounding Infrastructure. Ref WB1068*.

Western Botanical. 2025c. *Memo Summary of Findings from Regional Targeted Priority Flora Assessment of the Winu Project, May-June 2025. Prepared for Rio Tinto Copper Winu*.

Western Botanical. 2025d. *Significant Vegetation of the Winu Project, June 2025. Ref WB1069. Prepared for Rio Tinto Copper Winu*.

Western Botanical. 2025e. *Statewide Flora Records for Priority Flora of the Winu Project*.

Western Botanical. 2026a. *Consolidated Detailed Flora and Vegetation Assessment of the Winu Project, June 2026*. Prepared for Rio Tinto Winu Pty Limited.

Western Botanical. 2026b. *Memo on Portulaca Sp. Nyangumarta (B. Eckermann BE Opp 01).*

Wildlife Health Australia. 2022. 'Wildlife Health Australia Submission: Chemical Review of Anticoagulant Rodenticides'. Submissions to Australian pesticides and Veterinary Medicines Authority (APVMA). Chemical Review. February 2.

Wildlife Health Australia. 2023. 'Rodenticide Toxicity in Australian Wildlife'. Fact Sheet. February.

Worley. 2024a. *Winu Closure: Surface Water Management Plan Update 2023*. Prepared for Rio Tino.

Worley. 2024b. *Winu Mine Access Road Surface Water Management Plan Update 2024: Winu Copper Gold Project*. Prepared for Rio Tinto Winu Pty Ltd.

Worley. 2024c. *Winu Operational Surface Water Management Plan Update 2023: Winu Copper Gold Project*. Prepared for Rio Tinto Winu Pty Ltd.

Worley. 2024d. *Winu Surface Water Heritage Assessment 2024 Memorandum*.

Worley. 2025a. *Further Information Required for Preliminary Documentation for Winu Copper and Gold Mine (Winu Project), Great Northern Highway, Broome, 6725 WA*.

Worley. 2025b. *H3 Hydrogeological Assessment: Winu Project Area*. Prepared for Rio Tinto Copper.

Worley. 2025c. *Rimfire H3 Assessment: 2025 Update*. Prepared for Rio Tinto Copper RTC.

Worley. 2025d. *Surplus Water Management PFS: Winu Copper Gold Project*. Prepared for Rio Tinto Winu Pty Ltd.

Worley. 2025e. *Water Balance: Winu Copper Gold Project*. Prepared for Rio Tinto Winu Pty Ltd.

Worley. 2025f. *Winu Access Road H2 Assessment: H2 Report*. Prepared for Rio Tinto Copper Pty Ltd.

Worley. 2025g. *Winu Baseline Groundwater Monitoring Plan: Baseline Assessment - 2025 Update*. REP-HG-037.

Worley. 2025h. *Winu H3 Hydrogeological Assessment – Recovery Model Update. Memorandum Prepared for Rio Tinto Copper Pty Ltd*.

Worley. 2025i. *Winu Project: Percival Palaeovalley Assessment*. Prepared for Rio Tinto Copper Pty Ltd.

Worley. 2026. *Impact Assessment of Winu Mining Activities on the Wallal Aquifer and Environmental Receptors*. Memo Report Prepared for: Winu Services Pty Ltd Nos 311012-01475-HG-TM-048. Winu Project.

WWL. 2025a. *Winu HDTSF 5H 10 Mtpa Pre-Feasibility Design Report*. Prepared for Rio Tinto Nos 127-032–1.

WWL. 2025b. *Winu TSF Closure Design: 10 Mtpa*. Prepared for Winu Nos 127–029.

Young, R., A. Manero, B. Miller, M. Kragt, R. Standish, and G. Boggs. 2019. *A Framework for Developing Mine-Site Completion Criteria in Western Australia*. The Western Australian Biodiversity Science Institute. https://www.wa.gov.au/system/files/2025-03/framework_developing_mine-site_completion_criteria_wa.pdf.

Zhang, W., A. Corzo Remigio, R. Green, and M. Edraki. 2025. 'Improved Predictions of Acid and Metalliferous Drainage for Greenfield Project'. Paper presented at Life of Mine and Mine Waste & Tailings.

Zhou, Y., and J. I. Levy. 2007. 'Factors Influencing the Spatial Extent of Mobile Source Air Pollution Impacts: A Meta-Analysis'. *BMC Public Health* 7 (1): 89. https://doi.org/10.1186/1471-2458-7-89.

## APPENDIX A CHAPTER 1-5 INTRODUCTION

A01 Winu Proposal Content Document

A02 Winu Environmental Scoping Document

A03 Winu Draft Mine Closure Plan

A04 Winu Stakeholder Consultation Register

A05 Winu Draft Environmental Management Plan

A06 ISA Submissions

## APPENDIX B SOCIAL SURROUNDINGS

B01 Winu Nyangumarta Social Surroundings Assessment - confidential

B02 Rio Tinto Winu Borefields and Cultural Mapping Project - confidential

B03 Winu Summary of Archaeological and Ethnographic Surveys

B04 Nyangumarta Survey Sites and Culturally Significant Sites - confidential

B05 Winu Project Visual Impact Assessment

## APPENDIX C INLAND WATERS

C01 Winu Operational Surface Water Management Plan

C02 Winu Mine Access Road Surface Water Management Plan Update 2024 / Peer review of the mine site and access road SWMPs and TUFLOW models

C03 Winu Closure Surface Water Management Plan Update 2023 Memorandum

C04 Winu Water Balance / Winu Water Balance - peer review

C05 Winu Baseline Groundwater Monitoring Plan

C06 Winu Surplus Water Management Report

C07 Winu AMD Strategy and Management Plan

C08 Winu Final Study: Updated Flood Risk Assessment - Access Route

C09 H3 Hydrogeological Assessment Winu Project Area / Winu H3 Peer Review / MIA H3 Hydrogeological Assessment - recovery model update

C10 Cyanide Management Plan

C11 Winu Mine Pit Lake Environmental Risk Assessment (ERA) - 2024 Update

C12 Rimfire Hydrogeological H3 Report / Rimfire H3 Assessment - peer review

C13 Winu Access Road H2 Assessment

C14 Winu Pit Lake Model Report

C15 Winu Project - Percival Palaeovalley Assessment

C16 Winu Mine - review of water balance and quality modelling by Hydrogeologica

C17 Solute Transport Modelling (Groundwater); Quarry and Pond Options

C18 Winu Gold and Copper Project - Infiltration Pond Study

C19 Rimfire Draft Groundwater Operating Strategy

C20 Winu Hydrogeological Impact Assessment – Wallal Aquifer

C21 Peer Review of Winu Hydrogeological Impact Assessment – Wallal Aquifer

## APPENDIX D FLORA AND VEGETATION

D01 Consolidated Detailed Flora and Vegetation Assessment of the Winu Project

D02 Regional and Targeted Priority Flora Assessment of the Winu Project

D03 Significant Vegetation of the Winu Project

D04 Melaleuca Vegetation Mapping - Winu Project

D05 Winu Project Infiltration Pond Impact Assessment

D06 Winu Project Flora of Ethno-Botanical Significance

D07 Winu Ecohydrology Assessment

## APPENDIX E TERRESTRIAL FAUNA

E01 Winu Project Vertebrate Fauna Consolidation Report

E02 Winu Project SRE Invertebrate Fauna Assessment

E03 Winu Project Targeted Night Parrot Survey Report / Winu Project Targeted Night Parrot Survey Report - peer review

E04 Winu Night Parrot Impact Assessment Report / Winu Night Parrot Impact Assessment Report - peer review

E05 Winu Project Bilby Population Abundance Study

E06 Winu Project Noise and Vibration Impact Assessment

E07 Wind Project Wind Turbine Avifauna and Bat Risk Assessment

E08 Winu Project Rimfire Bore Field Noise Assessment

E09 Ambient Noise Monitoring - Winu Copper-Gold Project WA

E10 Winu Project Bilby Habitat Assessment

E11 Winu Project Migratory Bird Review

E12 Winu Project MNES Fauna supporting Information

E13 Winu Project Percival Palaeovalley Tributary and MNES Fauna

E14 Environmental Noise Assessment Winu Project, WA

E15 Winu Project: Aircraft Noise Assessment

## APPENDIX F SUBTERRANEAN FAUNA

F01 Winu Project Subterranean Fauna Desktop Study and Basic Survey Report

F02 Winu Project Rimfire Borefield Stygofauna Assessment Report

## APPENDIX G TERRESTRIAL ENVIRONMENTAL QUALITY

G01 Winu Waste Rock Characterisation Report - Primary Sulfide Zone

G02 Winu Waste Rock Characterisation Report - Secondary Sulfide Zone

G03 Winu Waste Rock Characterisation Report - Upper Oxide Zone

G04 Winu Tailings Characterisation Report

G05 Winu Soil Characterisation Report

G06 Winu HDTSF 5H 10 MTPA Pre-Feasibility ERD Design Report

G07 Winu TSF High Sulfur Cover System Numerical Modelling

G08 Winu HDTSF 5H 10 Mtpa Pre-Feasibility Closure Report

G09 Acid Sulfate Soils Desktop Study

G10 Winu Waste Rock Landform - Winu Project Mine Planning

G11 Tailings Storage Facility Seepage Modelling

G12 Winu Copper Project – Conceptual Cover System Modelling

## APPENDIX H LANDFORMS

H01 Winu Project Landforms Assessment

## APPENDIX I AIR QUALITY

I01 Dust Impact Assessment of Proposed Mining Operations

I02 Air Quality Emissions Comparison Assessment

## APPENDIX J GREENHOUSE GASES

J01 Greenhouse Gas Emission Assessment Update

## APPENDIX K OFFSETS

K01 Winu Offset Strategy