

# Wonmunna Iron Ore Project: Southern Haul Road

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Clearing Permit Supporting Documentation – Rev 0

L47/1025



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0	12/08/2022	B. How	M. Blacklow	P. de San Miguel	Final revision for submission through to regulator.

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**ATTACHMENTS**

- A Biological Reports (Appendices 1 – 6)
- B Spatial Data
- C Proof of Ownership (Tenement Holder)

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## ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AEP	Annual exceedance probability
AH Act	<i>Aboriginal Heritage Act 1974</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
CID	Channel Iron Deposits
DAFWA	Department of Agriculture and Food of Western Australia
DAWE	Australian Department of Agriculture, Water and the Environment
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DMIRS	Western Australian Department of Mines, Industry Regulation and Safety
DWER	Western Australian Department of Water and Environmental Regulation
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
ESA	Environmentally Sensitive Area
ESP	Exchangeable Sodium Percentage
GIS	Geographic Information Systems
GWL	Ground Water Licence
GWOS	Ground Water Operating Strategy
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre
m	Metre
mBGL	metres below groundwater level
mg/L	Milligrams per litre
Mining Act	<i>Mining Act 1978</i>
MCP	Mine Closure Plan
MNES	Matters of National Environmental Significance
MP	Mining Proposal
MRL	Mineral Resources Limited
MRWA	Mine Roads Western Australia

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NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Community
Proposed Permit Area	Wonmunna Below Water Table Project, Southern Haul Road Option – NVCP Application Area
RIWI Act	<i>Rights in Water and Irrigation Act 1914</i>
SMU	Soil Mapping unit
SRE	Short Range Endemic
TDS	Total dissolved solids
TEC	Threatened Ecological Community
TPFL	Threatened and Priority Flora database
WA	Western Australia
WAH	Western Australian Herbarium
WONS	Weeds of National Significance

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## 1. INTRODUCTION

### 1.1 PROJECT BACKGROUND

Mineral Resources Limited (MRL) operate the Wonmunna Iron Ore Project (WIOP) located approximately 70 km west-northwest of Newman in the Shire of East Pilbara, Western Australia (WA) (Figure 1-1). In 2020, Wonmunna Iron Ore Pty Ltd (WIO), a wholly owned subsidiary of MRL, acquired the WIOP from Australian Aboriginal Mining Corporation Pty Ltd (AAMC).

The WIOP mining operations involves the mining of three main iron ore deposits: North Marra Mamba (NMM), Central Marra Mamba (CMM) and Southern Marra Mamba (SMM). Onsite, ore is processed and hauled via road trains to Port Hedland for overseas export.

MRL commenced developing the project in 2020, starting with mining at NMM-West with the first delivery of iron ore in March 2021.

In 2022, MRL submitted a Mining Proposal (MP) and Mine Closure Plan (MCP) for the WIOP above groundwater table (AWT) expansion under the WA *Mining Act 1978* (Mining Act). The MP and MCP included a consolidation of previously approved WIOP MP's. This latest amalgamation included:

- Expand the AWT mining footprint with the addition of pits at NMM (East)
- Extend the NMM (West) pit to a depth of 660 mRL which is below the pre-mining natural water table elevation of 667 – 668 mRL
- Modify the rehabilitation design of the WRL footprints at NMM (East), NMM (West) and CMM
- Expand the existing ROM pad and develop two (2) additional ROM pad locations
- Introduction of mobile crushing plants at various locations within the Project to support fixed plant crushing operations
- Increase in the annual production rate of the Project to 13.5 Mtpa
- Disposal of used tyres within the CMM WRL
- Use of brine water from the Reverse Osmosis (RO) Plant for dust suppression in disturbed areas
- Development of a landfill facility in the NMM (West) WRL
- Establishment of biofarms.

The MP and MCP was approved by the Department of Mines, Industry Regulation and Safety (DMIRS) in June 2022 under REG ID 103347.

A Native Vegetation Clearing Permit (NVCP) for clearing of up to 555 hectares (ha) was originally approved by DMIRS for the WIOP in 2014, under CPS 6216/1 and 6216/2 (2019), with a subsequent amendment to this permit currently being assessed by DMIRS (CPS 6216/3). This amendment seeks to increase the area of clearing from 555Ha to 850Ha within the purpose permit boundary.

MRL are currently progressing the environmental approvals for the next phase of the WIOP, referred to as the WIOP Below Water Table (BWT) project. The BWT project predominately involves:

- extend AWT mining below the groundwater table in the NMM-East and CMM deposits; and
- addition of a southern haul road to connect the western side of the project with the NMM-E pits.

MRL are currently preparing amendments to the approved AWT MP and MCP for the inclusion of these BWT project elements.

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During ongoing consultation with key stakeholders, MRL were advised that the proposed east-west haul road that connects the NMM mining areas (East and West) was in proximity to a recently re-surveyed and expanded exclusion zone of an Aboriginal Heritage Place (Forgotten Pool; Site ID# 24764), that was lodged under the *Aboriginal Heritage Act 1972* (AH Act).

The Nyiyaparli Traditional Owners (KNAC) are the native title claimants over the eastern portion of the WIOP (NNTT No. WC2013/003; Nyiyaparli #3) and have been regularly consulted regarding operations and proposed expansions of the project. This includes but is not limited to the current south haul road which this application pertains to.

The original Weeli Wolli exclusion zone was established in 2015 by previous project owners, to protect the riparian vegetation and fauna habitat present adjacent to Welli Wolli Creek as well as the forementioned heritage place of significance.

To reduce the likelihood of any potential impacts to the lodged Heritage Place, MRL propose to construct a new haul road as part of the proposed BWT project to connect the NMM mining areas (East and West), referred to herein as the Project. The location of this new alignment has been worked through in line with consultation and survey work with the KNAC group.

## 1.2 PURPOSE

MRL requires a NVCP issued under the *Environmental Protection Act 1986* (EP Act) and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Clearing Regulations) to clear native vegetation to construct the Project. Clearing required for portions of the haul road located within tenement M47/1424 (to the north and east) are already covered under the NVCP for the WIOP Project (CPS 6216/2).

This NVCP application relates to the portion of the southern haul road located within the newly granted tenement L47/1025. This is defined as the Proposed Permit Area.

The purpose of this document is to support the NV-F01 Application for a purpose permit required for the Project (this Application), to seek approval to clear of up 25 hectares (ha) of native vegetation within a 195 ha Proposed Permit Area (Figure 1-2).

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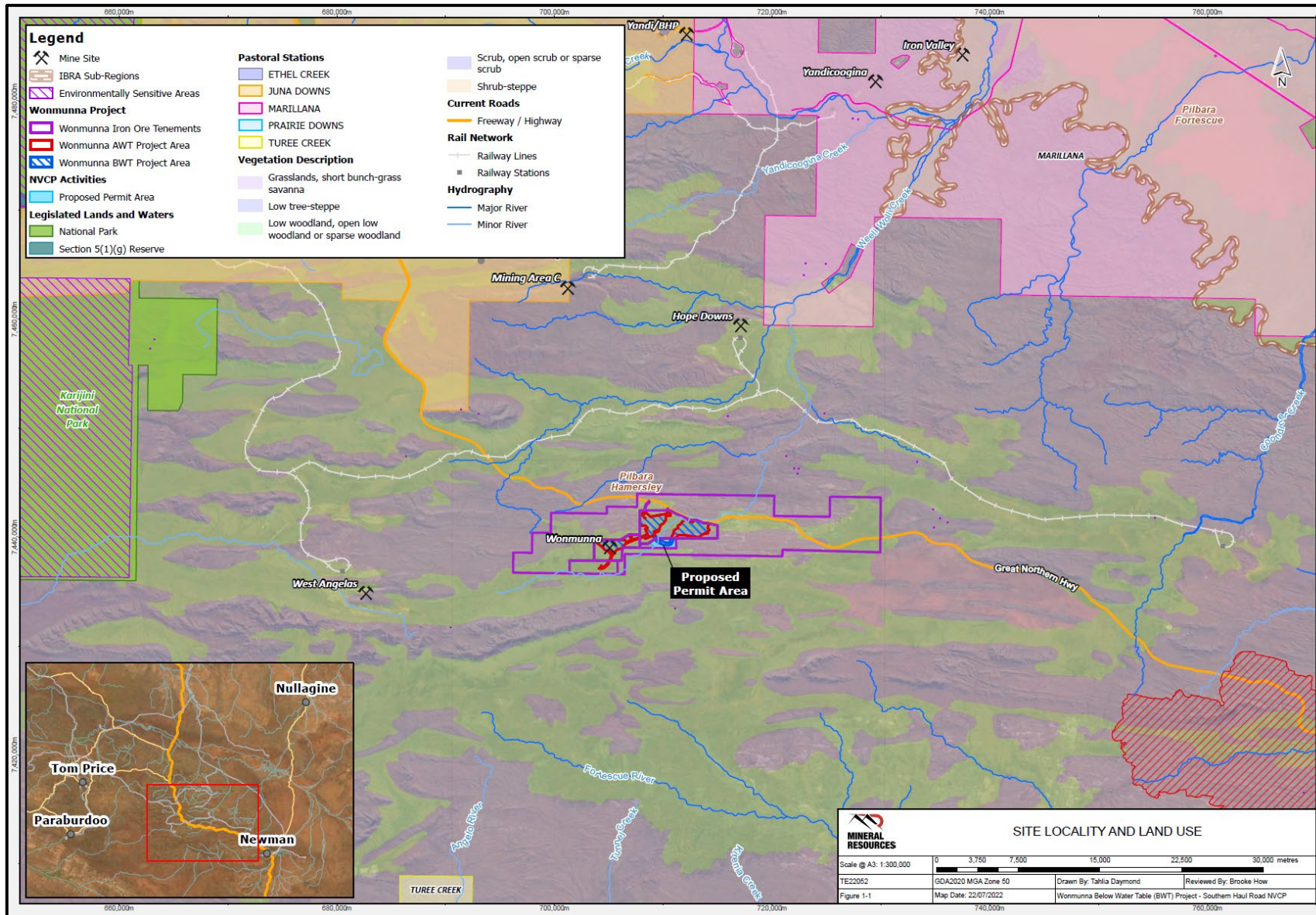


FIGURE 1-1: SITE LOCALITY AND LAND USE

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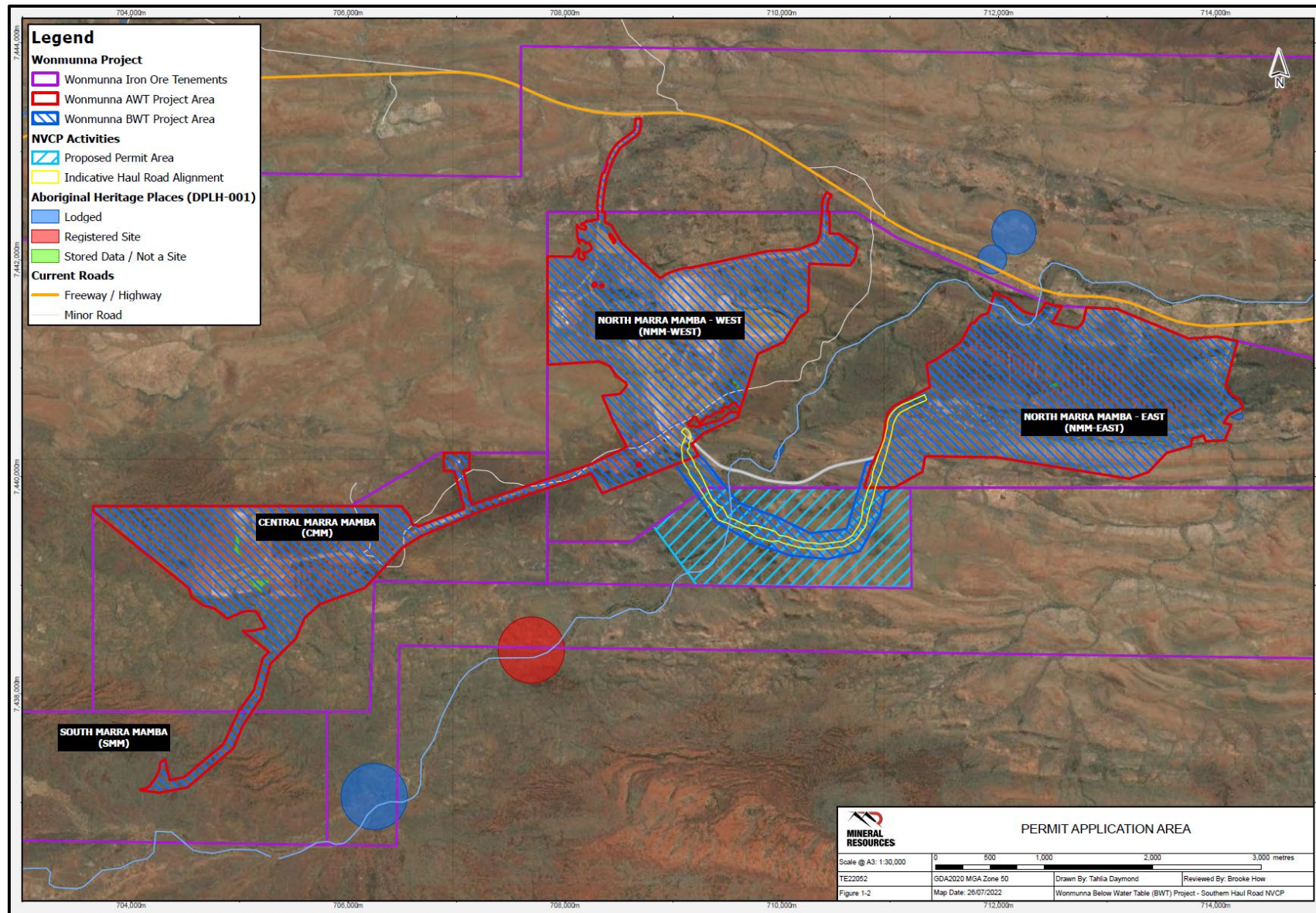


FIGURE 1-2: PERMIT APPLICATION AREA

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### 1.3 APPROVALS

The Project's tenure has been granted by DMIRS under Miscellaneous Licences L47/1025.

An existing east-west haul road was approved under the AWT MP (REG ID 103347) and NVCP (CPS 6216/2). Closure aspects relating to the existing east-west haul road were approved under the AWT MCP, approved as part of the AWT MP submission.

MRL are currently progressing with approvals for the BWT MP and MCP which includes this southern haul road. A BWT MP and MCP will be submitted to DMIRS in accordance with DMIRS (2020a) *Statutory Guidelines for Mining Proposals* and DMIRS (2020b) *Statutory Guidelines for Mine Closure Plans*, for the construction, operation and planned closure of the Project. These submissions will be submitted concurrently with this application.

The Project will require water for construction and dust suppression. All water requirements will be sourced from the existing bores in the WIOP (as detailed in Section 3.1.4). Water abstracted from groundwater supplies at the WIOP will be managed under the approved 5C Licence to Take Water, GWL 204222(2) issued by the Department of Water and Environmental Regulation (DWER) in accordance with the *Rights in Water and Irrigation Act 1914* (RIWI Act).

## 2. PURPOSE PERMIT AREA

### 2.1 BOUNDARY

The boundary for all clearing activities proposed in this Application are within a 195 ha Proposed Permit Area. The boundary of the Purpose Permit Area is shown on Figure 1-2 and geographic information system (GIS) spatial data has been provided as Attachment B.

### 2.2 TENURE AND LAND ACCESS

The activities associated with this Application will be undertaken wholly within one miscellaneous tenement, L47/1025, granted by DMIRS, as listed in Table 2-1 below. This tenement is held by Wonmunna Iron Ore Pty Ltd, a wholly owned subsidiary of MRL. A copy of the tenement holding is provided as Attachment C.

**TABLE 2-1: PROJECT TENEMENTS**

TENEMENT	AREA (HA)	HOLDER	STATUS	EXPIRY
L47/1025	247.51	Wonmunna Iron Ore PTY LTD	Live	19/05/2043

### 3. PROPOSED ACTIVITIES

#### 3.1 DESCRIPTION OF PROPOSED ACTIVITIES

The Project requires clearing of up to 25 ha of native vegetation within the 195 ha Proposed Permit Area, as shown on Figure 1-2.

MRL propose to construct the Southern Haul Road which will extend between the WIOP’s NMM (West) and NMM (East) deposits.

The Project requires clearing for the following activities:

- Haul road
- Topsoil and vegetation stockpiles.

A summary of the proposed clearing required for each of the Project’s activities is provided in Table 3-1.

**TABLE 3-1: SUMMARY OF PROPOSED DISTURBANCE**

ACTIVITY	PROPOSED DISTURBANCE (HA)
Haul Road	20
Stockpiles (Topsoil, subsoils and vegetation)	5
<b>TOTAL</b>	<b>25</b>

##### 3.1.1 Haul Road and Drainage

The Proposed Permit Area has been designed for flexibility in the final road alignment route to allow for variations in site-specific conditions encountered during construction. Within the Proposed Permit Area, the actual haul road disturbance will be approximately 20 ha and includes allowance for a construction road corridor up to a maximum width of 100 m and approximately 2.1 km in length. The final road width will be approximately 50 m. The indicative haul road alignment is shown on Figure 1-2.

The road will require cut to fill techniques to achieve the desired surface gradient of the road. Due to the presence of harder materials in the mesa formations, some drill and blast will be required. It is envisaged that the cut to fill balance will even out, with design cut volume being 505,348 m<sup>3</sup>, and the fill volume being 546,999 m<sup>3</sup>.

The remaining fill requirements will be sourced from waste rock stockpiles from the WIOP AWT project, specifically the NMM-E or CMM deposits. All material has undergone thorough geochemical testing and materials characterisation to ensure its suitability for use as a road construction base and hence, poses a very low contamination risk to the surrounding environment (refer to Section 4.3.3).

The proposed haul road will cross the minor ephemeral Weeli Wolli Creek (WWC). Management measures have been incorporated into the road design, with a particular focus on the crossing to mitigate any impacts to the natural regime or water quality of the creek and its tributaries. MRL have successfully constructed haul roads to the north of the WIOP associated with the Phil’s Creek Mine, approximately 50 km to the north, with minimal impacts to the creek and existing hydrological patterns.

A Surface Water Management Plan (SWMP; AQ2 2022) was developed for the AWT Project, that included management measures for the original AWT east-west haul road construction.

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There will be specific management strategies and detailed engineering designs incorporated for the WWC crossing to ensure that surface water flow and quality are not affected by the crossing nor through any mining related activities. The installation of appropriately sized culverts to ensure sediment load is minimised, and natural water flow upstream to downstream during rainfall events is maintained will be key to this installation. Care shall be taken in selecting material for construction at the crossing, to ensure that coarse fragments are used and fine-grained materials are avoided (as much as practicable) to avoid erosion of the road surface and prevent downstream sedimentation of the creek.

Roads may be constructed with a camber, table drains and regular turnouts to discharge surface runoff into the natural surrounds. This would prevent the accumulation of large, fast surface water flows along the roads, thus limiting flooding and erosion of the road surface. Sediment traps are unlikely to be required at these discharge points, due to the small upstream catchment areas (AQ2 2022).

All floodway's and culverts will be constructed within the road corridor and informed by the outcomes of flood modelling conducted for the AWT Project (refer to Section 4.4.1).

### **3.1.2 Borrow Pits**

There is no requirement for borrow pits for this Project as MRL will be utilising cut and fill material directly from the road corridor, and all remaining fill requirements to be sourced from waste rock from the WIOP AWT's project, as outlined in Section 3.1.1.

### **3.1.3 Topsoil, Subsoil and Vegetation Stockpiles**

Vegetation and topsoil will be removed and stockpiled in accordance with MRL's existing Site Disturbance Permit Procedure (MRL-EN-PRO-0005) during clearing activities for the Project. Stockpiles will be placed at various locations within the Proposed Permit Area alongside construction areas (outside the road corridor). This Application includes an allowance for stockpile areas up to 5 ha within the Proposed Permit Area.

Topsoil will be stockpiled to ensure the integrity of the rehabilitation resource is maintained for future rehabilitation requirements. Stockpiles will be stored at a maximum height of 2 m to ensure their stability and to maintain viability of the seed bank. All stockpiles will be sign-posted and locations recorded via survey as per MRL's environmental management system (EMS) for use in future closure and rehabilitation.

### **3.1.4 Water Requirements**

Water for the Project's road construction and operation dust suppression will be sourced from the existing borefield that supplies water to the AWT mining activities, abstracted under existing 5C groundwater licence GWL 204222(2), issued by DWER.

The management of this water, including potential impacts from leaks or spills will continue to be managed under the existing approvals including the currently approved Groundwater Operating Strategy (GWOS)..

### **3.1.5 Laydown Area**

Temporary equipment laydown areas will not be required for this Project. The Project will utilise existing laydown areas, maintenance facilities and accommodation camps within the approved WIOP AWT mining area.

## **3.2 METHOD OF VEGETATION DISTURBANCE**

Vegetation will be cleared using mechanical methods with any topsoil and vegetation removed prior to clearing of subsoils whenever possible. A soil assessment has been conducted at the WIOP (refer to Section 4.5.2) that is considered representative of the soils expected within the Proposed Permit Area. Expected topsoil depths are likely to vary between 0 – 0.15 m below ground level (mBGL). This information will allow selective removal of topsoils. All salvaged topsoil and vegetation scrub will be stockpiled separately within suitably positioned locations within the Proposed Permit Area for use in rehabilitation activities.

### 3.3 REHABILITATION AND MAINTENANCE

Rehabilitation of the haul road and related activities (i.e. topsoil, subsoil and vegetation stockpiles) will be conducted in accordance with the amended BWT MCP (ENV-TS-RP-0412; currently being drafted) to cover the BWT operations, including this haul road. The amended MCP will be submitted to DMIRS for assessment concurrently with this application.

As previously mentioned, a soils assessment has been conducted at the WIOP (refer to Section 4.5.2) and is considered representative of the soils expected within the Proposed Permit Area. Based on the outcomes of the recent sitewide soils assessment (Landloch 2021a), all topsoil and subsoils are considered suitable for use in rehabilitation and revegetation of native species representative of the surrounding areas and region.

Rehabilitation will typically involve:

- At the completion of construction, removal of all equipment and other temporary infrastructure.
- At the completion of construction, commence progressive rehabilitation of cleared areas no longer required.
- At closure of the haul road, removal of drainage structures and any other remaining infrastructure.
- Assess the presence and extent of any potential hydrocarbon (or other) contamination within the Proposed Permit Area. Where required, excavate contaminated soils, and transport to hydrocarbon bioremediation areas at WIOP or other approved facilities.
- Recontouring of disturbed areas to blend in with local topography and prevent erosion.
- Rip or scarify compacted surfaces.
- Spread stockpiled topsoil and vegetation over recontoured areas to facilitate natural revegetation.

### 3.4 INDICATIVE TIMELINE

Clearing activities are proposed to commence upon approval of this Application, scheduled for late Q4 of 2022 with construction activities concluding by the end of Q2 of 2023.

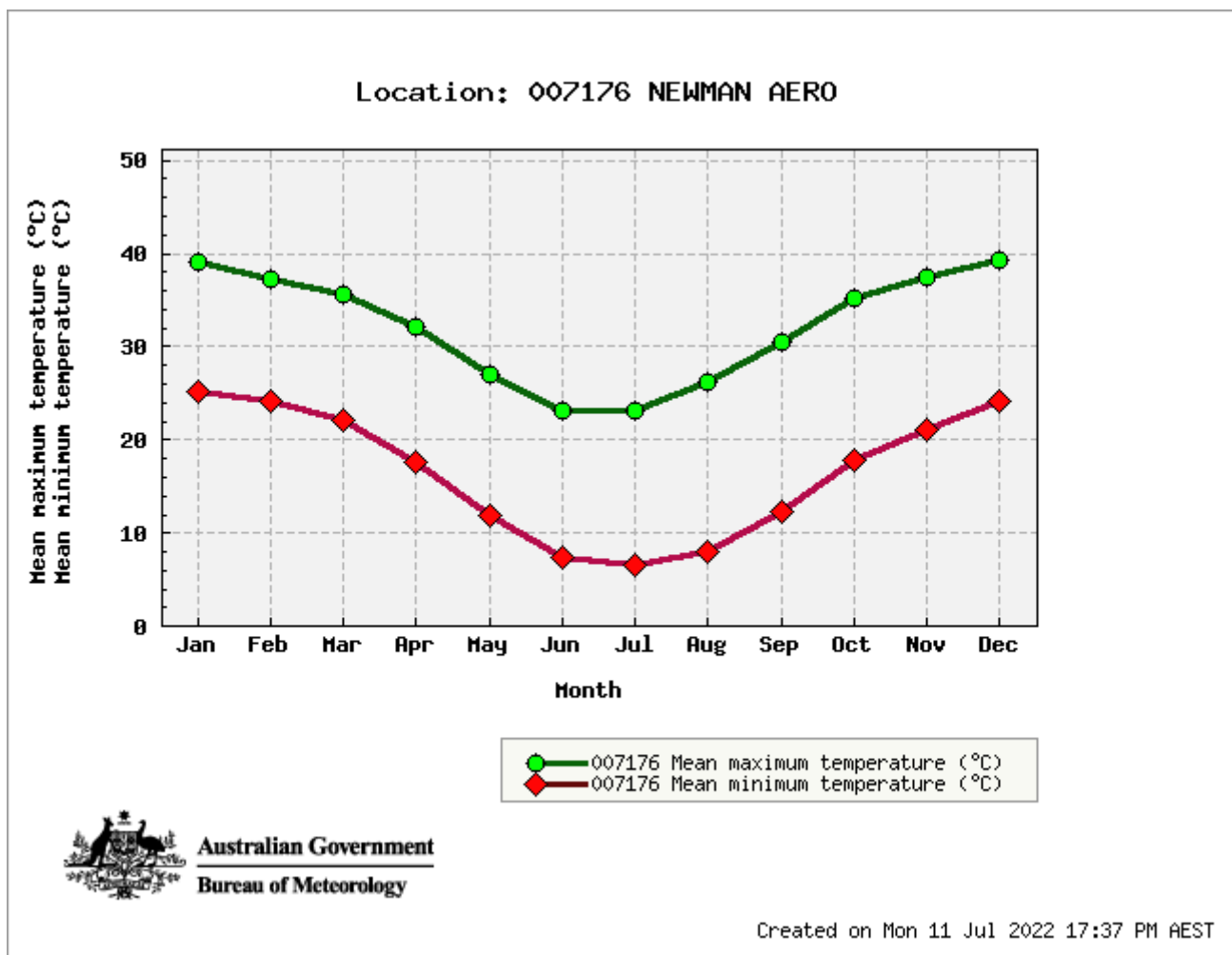


#### 4. RELEVANT ENVIRONMENTAL CHARACTERISTICS

##### 4.1 CLIMATE

The climate of the Project area is described as semi-desert tropical, receiving an average annual rainfall of 300 mm, with the majority of this occurring in summer cyclonic or thunderstorm events (Kendrick, 2001). The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent climate data is Newman Aero (Site 007176; Latitude: 23.42°S Longitude 119.80°E), located approximately 85 km southeast of the WIOP (BOM 2022).

Temperatures recorded by the Newman Aero station indicate a mean monthly maximum temperature of 39.3°C (December) and a mean monthly minimum temperature of 6.6°C in July (BOM 2022).



**FIGURE 4-1: MEAN ANNUAL TEMPERATURE FOR NEWMAN AIRPORT STATION (ID (007176) (1996-2022)**

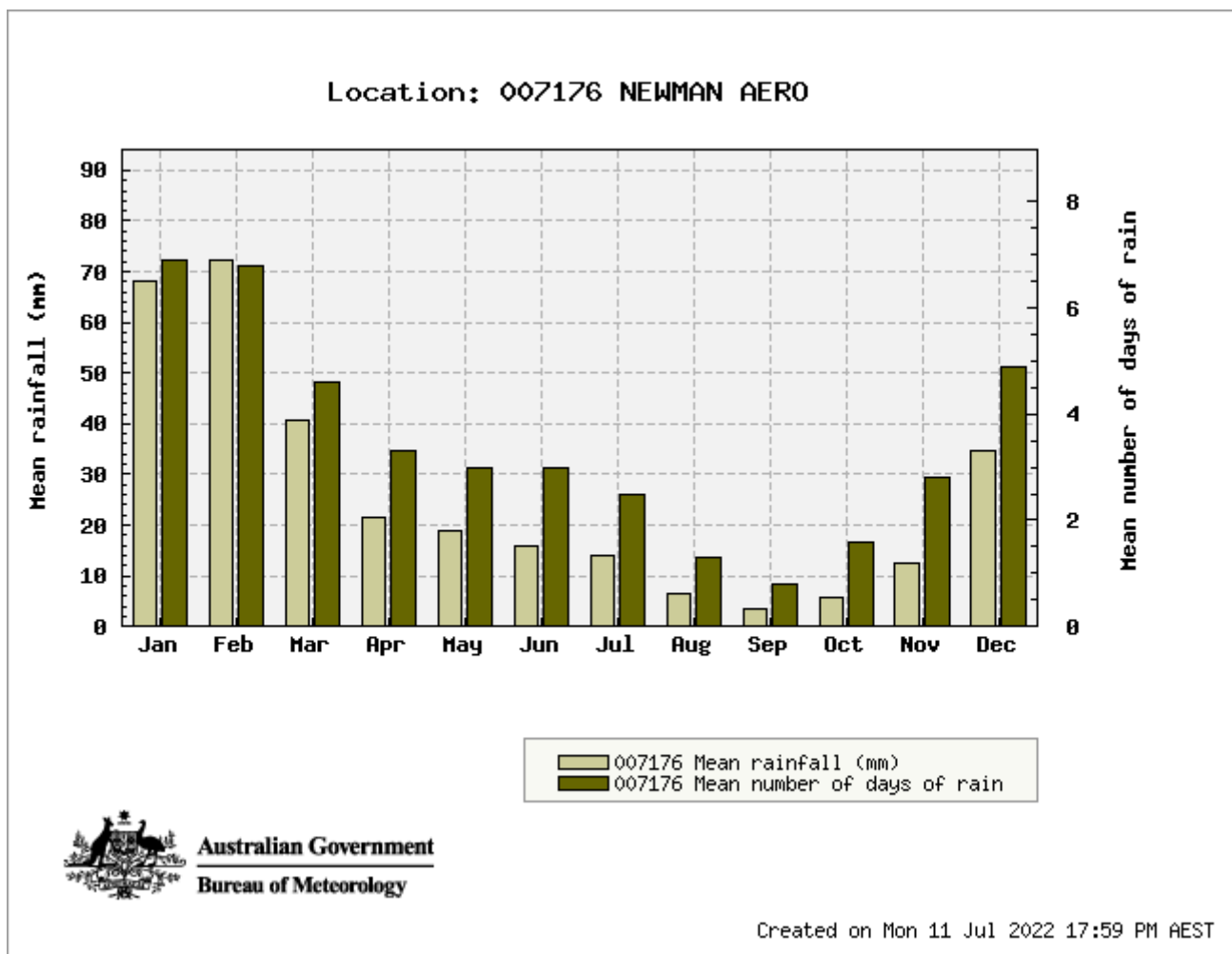
The Pilbara is one of the most cyclone-prone areas of the world. On average, the area receives 2.5 cyclonic events per year, which are typically accompanied by strong to destructive winds and heavy rain (van Vreeswyk *et al.* 2004). The tropical cyclone season extends from November to May, with the most significant cyclones typically occurring in January to March.

The mean annual rainfall recorded by the Newman Aero station for the years 1971 to 2022 is 318.0 mm, with an average of 26.5 mm of rainfall recorded per month. Typically, more than half of the annual rainfall falls in the

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summer months (December – February), with the highest rainfall occurring January and February with monthly averages of 68.2 and 72.3 mm, respectively (Figure 4-2) (BOM 2022). However, rainfall is highly variable and is often influenced by large monsoonal or cyclonic events and tropical storms, and it is common for a month’s volume of rainfall to fall during one event (AQ2 2022a).

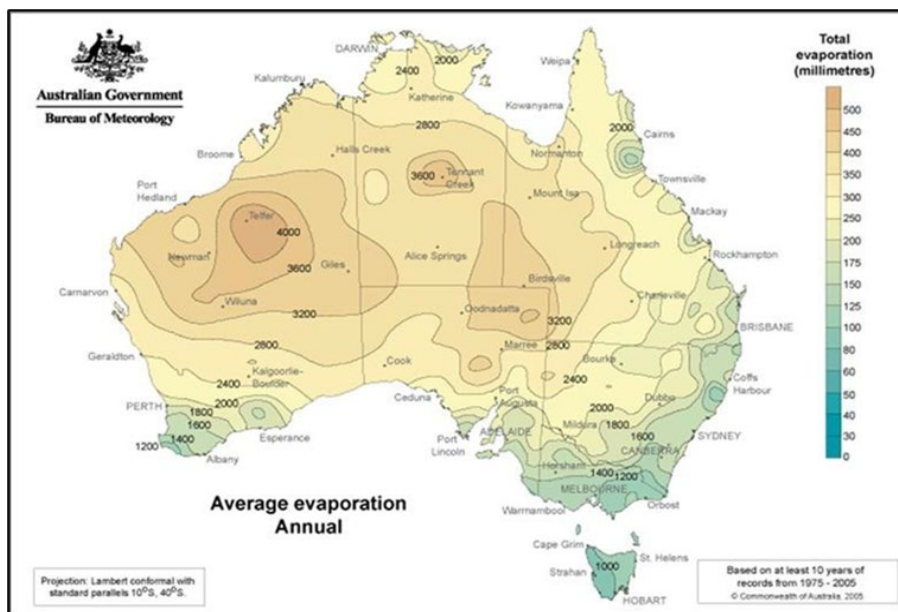
The DWER’s Wonmunna rainfall station (Site 507012) has collected data since 1985 and is located 5 km west of the WIOP. Annual average rainfall at this station is 376 mm.



**FIGURE 4-2: MEAN RAINFALL (MM) NEWMAN AERO (007176) RECORDED BETWEEN 1971-2022 (BOM 2022)**

The Australian average annual evaporation map indicates an annual evaporation of approximately 3,200 mm for the area (Figure 4-3) (BOM, 2022). Based on an average annual rainfall of approximately 300 mm for the Project area, the average annual evaporation rate exceeds rainfall by a factor of ten.

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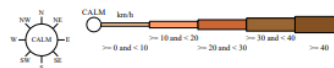
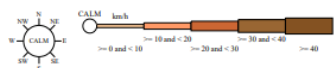


**FIGURE 4-3: AVERAGE ANNUAL EVAPORATION**

The Newman Aero station (Site 007176) has recorded daily wind speed and wind direction for 9 am and 3 pm since 1994. Annual wind speed averages at 9am is 14.8 km/hour and 15.2 km/hour at 3pm, with the strongest winds recorded in the morning of up to 135 km/hour (BOM, 2022). Predominant wind direction is from the east.

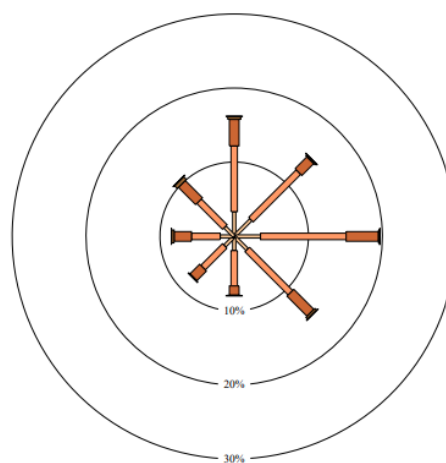
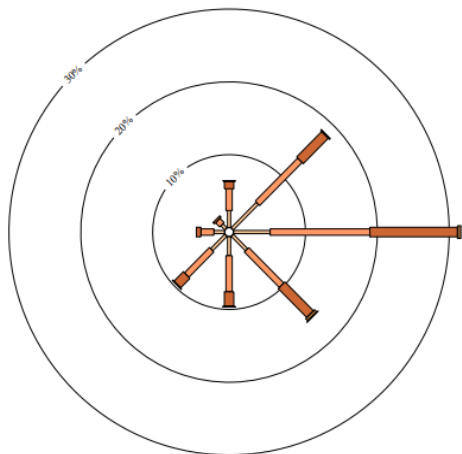
**Rose of Wind direction versus Wind speed in km/h (01 Nov 1994 to 11 Aug 2021)**  
 Custom times selected, refer to attached note for details.  
**NEWMAN AERO**  
 Site No: 007176 • Opened Jan 1971 • Still Open • Latitude: -23.4213° • Longitude: 119.8023° • Elevation 524m  
 An asterisk (\*) indicates that calm is less than 0.5%.  
 Other important info about this analysis is available in the accompanying notes.

**Rose of Wind direction versus Wind speed in km/h (01 Nov 1994 to 11 Aug 2021)**  
 Custom times selected, refer to attached note for details.  
**NEWMAN AERO**  
 Site No: 007176 • Opened Jan 1971 • Still Open • Latitude: -23.4213° • Longitude: 119.8023° • Elevation 524m  
 An asterisk (\*) indicates that calm is less than 0.5%.  
 Other important info about this analysis is available in the accompanying notes.



9 am  
 9370 Total Observations  
 Calm 3%

3 pm  
 9364 Total Observations  
 Calm \*



**FIGURE 4-4: WIND SPEED AND DIRECTION (NEWMAN AERO STATION - SITE 007176)**

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## 4.2 REGIONAL SETTING AND LAND USE

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into large 'bioregions' and 'subregions' based on climate, geology, landform, and native vegetation and species information. The Project occurs within the Hamersley subregion (PIL03) of the Pilbara bioregion (DAWE 2012) (Figure 1-1), which is described by Kendrick (2001) as:

- Being a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite).
- Having a semi-desert tropical climate with an average of 300 mm rainfall per annum usually in summer cyclonic or thunderstorm events, but winter rain is not uncommon.
- Having drainage into either the Fortescue River (to the north), the Ashburton River to the south or the Robe River to the west.
- Being used for grazing, Unallocated Crown Land (UCL) and Crown reserves, conservation and mining.
- Supporting mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal soils of the ranges. Dominant genera include *Acacia*, *Triodia*, *Ptilotus*, *Corymbia* and *Sida* within the Hamersley Range.
- Supporting stygofaunal crustacean fauna within calcrete environments. Poorly known, but indications for a significantly diverse fauna.

## 4.3 GEOLOGY

### 4.3.1 Regional Geology

The Project lies within the Neoproterozoic - Paleoproterozoic Hamersley Basin and forms part of the West Pilbara Mineral Field (Trendall 1990). The geology of the Hamersley Province of the northern western region of WA is well documented. It extends approximately 550 km east-west and 400 km north-south and covers an area of about 100,000 km<sup>2</sup>. Its axis is aligned more or less west-north-west through to east-south-east. The rocks belong to the Mt Bruce Supergroup that is made up of the Fortescue, Hamersley and Turee Creek Groups. The Hamersley Group is characterised by Banded Iron Formations (BIF), including the Marra Mamba and Brockman Iron Formations, which host a significant portion of economic iron mineralisation of the region (Trendall 1990).

The stratigraphy of the Fortescue Group (Trendall 1990) in the WIOP area consists of (from oldest to youngest):

- The Jeerinah Formation, which is made up of the Woodiana Sandstone (60 m thick)
- The Warrie Member (80 m thick) consisting of shale, a ferruginous chert and dolomite
- The Roy Hill Shale (30 m thick), which consists of carbonaceous shale and mafic volcanics.

Intrusive dolerite has intruded the Jeerinah Formation to form large sills, which dominate the rock type in the WIOP area.

The Hamersley Group contains five major BIF units, of which two, the Marra Mamba Iron Formation (MMIF) and the Brockman Iron Formation, host iron mineralisation, including most of the exploited iron ore deposits in the Pilbara Mineral Province (MRL 2022).

Surface laterite, which is probably the remnant of the original Hamersley Surface, is well developed in the south-west of the WIOP area. The ferruginous duricrust, consisting of transported and residual ferruginous gravel and nodular lateritic materials, caps the basement geology. Partial erosion of the regolith has formed mesas with breakaways, exposing the underlying geology (MRL 2022).

### 4.3.2 Local Geology

The WIOP and Proposed Permit Area is located on the Newman 1:250,000 geological map sheet. The WIOP's tenements cover a large-scale anticlinal structure in the Hamersley Basin exposing rocks of the Fortescue Group.

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Fold keels of the Hamersley Group outcrop in the WIOP area within the fold structure. These folds expose BIF of the Nammuldi Formation, which host iron ore mineralisation (Trendall 1990).

The WIOP lies within the Hamersley Province covering an exposure of Jeerinah Formation (Fortescue Group) with fold keels of the overlying Nammuldi Formation sub cropping in the area. The area is covered by exposure of regolith (Hamersley Surface), a sub horizontal regolith surface, which is partly made up of poorly developed channel iron pisolite beds, ferruginous iron rich gravels, possibly canga, and ferruginous tertiary sediments. The regolith forms a ferruginous crust on the basement geology, which when eroded forms breakaways exposing the underlying geology. In the WIOP area, the Roy Hill shale, dolerite of the Jeerinah Formation and rare outcrops of the Nammuldi Formation are exposed along the breakaways (MRL 2022).

The stratigraphy of the Fortescue and Hamersley Group in the Project area consists of the Jeerinah Formation, which is made up of the Woodiana Sandstone (~60 m thick), overlain by the Warrie Member (~80 m thick) consisting of shale, a ferruginous chert and dolomite. The Warrie Member is overlain by the Roy Hill shale (~30 m thick), a carbonaceous shale. Intrusive dolerite has intruded the Jeerinah Formation to form large sills, which dominate the rock type in the WIOP area (MRL 2022).

The Nammuldi Formation is the basal BIF of the MMIF of the Hamersley Group, which appears to conformably overlie the Jeerinah Formation in the WIOP area. At the unconformity, a goethite chert outcrops at the base of the Nammuldi Formation. The BIF of the Nammuldi Formation has been mineralised to goethite, with the silica bands in the BIF being replaced by goethite and limonite (Trendall 1990).

#### 4.3.3 Waste Rock

No mining is proposed under this Application and therefore no mine waste will be generated by the Project.

To minimise the overall disturbance requirements of this Project, the proposed haul road will utilise approximately 505,348 m<sup>3</sup> of cut and fill material produced by the road construction activities. The Project is estimated to require a total of 546,999 m<sup>3</sup> of fill material. The remaining fill requirements will therefore be sourced locally from the AWT projects WRL's.

Comprehensive geochemical analysis and materials characterisation has been undertaken on the WIOP AWT waste rock material to describe its physical and geochemical characteristics. This information has been used to assess its suitability for road construction purposes. The preferred waste rock material will be sourced from the NNM (East) deposit, however, waste rock may also be sourced from CMM, if required. The information provided below specifically relates to waste material from the NNM and CMM areas.

Mine waste characterisation was initially undertaken in 2012 (Landloch 2012) which indicated a potential for acid production to be low as the waste was largely oxidised. Rock types with potential to create dispersive waste is also in low quantity (as a proportion of total waste) and would not require specific management practices. The potentially dispersive clays and shales were visually distinctive (being white or pale in colour), allowing problematic material to be easily identified to ensure isolation and appropriate management of material.

Landloch completed a further assessment of the WIOP AWT mine waste in 2021 involving a desktop review and a waste sampling program to assess for acid, metalliferous and saline drainage potential (AMD), metals/metalloids, structural stability (dispersion potential), Naturally Occurring Radioactive Materials (NORMs) and fibrous materials.

Landloch (2021b) concluded that waste rock material is highly expected to be Shale (SSH), Mineralised BIF (SBM), Chert (SCH) or Iron Formation (SIF), and all the materials are expected to be weathered (oxidised). Table 4-1 below summarises the extract of the material types expected to be encountered for each of the WIOP deposits which the haul road construction material will be sourced from.

**TABLE 4-1: ESTIMATED PROPORTION OF WASTE ROCK MATERIAL TYPES (MRL 2022)**

DEPOSIT	LITHOLOGY	PROPORTION OF DEPOSIT (%)
NMM (East)	Mineralised BIF	39
	Shale	19
	Undifferentiated mafic extrusive	14
	Chert	8
	Hardpan	6
CMM	Shale	32
	Chert	23
	Mineralised BIF	21
	BIF	6

From the results of the test work by Landloch (2021b), the geochemical characteristics of the waste rock material were described as follows:

- All waste materials exhibit pH and EC<sub>1.5</sub> values considered to be suitable for vegetation establishment.
- All waste materials are considered to pose low risk of AMD. Waste samples tested from NMM (East) and CMM were classed as non-acid forming (NAF).
- All waste materials from NMM (East) and CMM are considered to pose a low risk of metalliferous drainage. Multi-element analysis of solid samples indicated that waste materials were typically enriched with arsenic, antimony, selenium, tellurium, chromium, copper, iron, nickel and zinc. Analysis of elemental concentrations in deionised water leachates indicated low dissolution of these metals/metalloids under field conditions.
- No waste material tested was found to contain respirable asbestiform fibres.
- No waste material tested was found to give rise to enhanced exposures of NORM.

Physical characterisation of samples completed by Landloch (2021b) shows that material is likely to be prone to structural decline due to the high content of clay or high combine sand, silt and clay content and elevated levels of exchangeable sodium percentage (ESP). However, material with appreciable coarse fractions and unstable fine fractions will likely remain structurally stable.

There is a potential that surficial rock material exists (e.g. rocky soils, rock outcrop), as well as all erosion resistant materials for the use in the rehabilitation and closure of the WIOP. This will be assessed further in the MCP amendment (ENV-TS-RP-014). Structurally competent materials will be identified and set aside during mining operations for the purposes of rock armouring and acting as a rehabilitation medium for closure activities.

Overall, the waste rock materials were considered to pose a low risk of acid and metalliferous drainage, were not found to contain respirable asbestiform or give risk to enhanced exposures of NORM. Ongoing validation test work will continue to be completed during mining operations to confirm the most appropriate materials for rehabilitation and rock armouring.

A full copy of this waste characterisation study is provided as Appendix 1 in Attachment A.

## 4.4 WATER

### 4.4.1 Surface Water

The Proposed Permit Area is located within the Upper Fortescue River surface water catchment, which encompasses an area of approximately 41,880 km<sup>2</sup>, and is generally internally draining with all surface water directed toward the Fortescue Marsh. Surface water flows in the Upper Fortescue River catchment (and the Pilbara region in general) are typically ephemeral, being directly related to intense rainfall events and often associated with cyclonic activity or localised thunderstorms. Flows decay rapidly once rainfall has ceased (MRL 2022).

The majority of the drainage system upstream of the Fortescue Marsh has negligible base flow, with stream flows infiltrating the watercourses and recharging the alluvial aquifers during flow events. During rare extreme rainfall events, surface water may overflow the Upper Fortescue River catchment into the Lower Fortescue River catchment through a narrow valley located at the north-eastern end of the catchment (MRL 2022).

The Fortescue Marsh is listed in the Australian Directory of Important Wetlands as a Nationally Important Wetland as it is a unique wetland landform in WA, consisting of a vast and rarely visited wetland, set between rugged ranges (MRL 2022).

The Weeli Wolli Creek comprises a sub-catchment within the Upper Fortescue Marsh Catchment, and is located south of the Fortescue Marshes, draining the Hamersley and Hancock Ranges, and including the Proposed Permit Area. The creek has a catchment area of approximately 4,000 km<sup>2</sup>, with an approximate mainstream length of 112 km from the upper catchment to its outlet in the Fortescue Marsh. It is the second largest contributor to the Fortescue Marsh, and it is estimated that it contributes approximately 10% of total inflows to the marsh (RPS 2014b cited in MRL 2022).

RPS (2014b) defined the local hydrology as consisting of low-lying mesas with steep sides, cut by well-defined drainage paths feeding into the Weeli Wolli Creek. Surface flows are ephemeral, and the numerous, well-defined flow channels do not contain any water for the majority of the year, only filling during (or shortly after) significant rainfall events and typically flow northwards (MRL 2022).

The Proposed Permit Area is located outside of a 1 km wide Exclusion Zone along the Weeli Wolli Creek between NNM (east) and NMM (west) deposits, referred to as the Weeli Wolli Creek Exclusion Zone, with this zone established due to environmentally significant vegetation and habitat associated with surface water dependent riparian ecosystems present in the area (MRL 2022).

Large sheet flow areas are also prevalent in the area, particularly on mesa tops and in the lower-lying gently sloping valley floors. Overall, surface water drainage is toward the Fortescue Marsh, but is locally highly variable, reflecting the orientation of the dissected terrain. A detailed description of the local drainage conditions at WIOP was assessed by RPS (2014b cited in MRL 2022) and used to provide recommendations for surface water management. It should be noted that this information was recommended for the AWT Project, however, it is considered applicable to the Proposed Permit Area and has been considered during the design of the proposed Southern Haul Road as part of this Application.

Recommendations relating to surface water management at WIOP included the use of drainage diversions, where required, to divert surface water run-off around infrastructure and ensure areas remain free-draining and avoid ponding. Other management measures include the installation of rock drains, piping or constructed culverts (MRL 2022). Major surface water diversions will not be required for the road construction, however, the installation of the other management structures (culverts, rock drains or piping) will be required at the main WWC crossing and at various points to avoid alterations to natural sheetwater flow patterns within the Proposed Permit Area and maintain upstream, downstream flow.

#### 4.4.1.1 Flooding Potential

As part of the AWT Project, a Surface Water Management Plan (SWMP; AQ2 2022b) was developed to support the AWT MP submission. Baseline mapping of flooding characteristics was assessed to identify surface water mitigation measures for the AWT project and to identify how the project may impact local hydrology. The 1% Annual

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Exceedance Probability (AEP) and Probable Maximum Flood (PMF) events were used to assess potential environmental impacts. Roads proposed to be constructed as part of the AWT Project were identified as areas having the potential to flood (AQ2 2022b).

For the AWT Project, haul roads were designed to utilise higher ground associated with mesa formations where possible, to interrupt fewer defined surface water flow channels. Broad sheet flow areas were unavoidable in some sections however, resulting the potential for trapping and concentration of these flows. The original east-west haul road also had a requirement to cross the Weeli Wolli Creek, and it was recommended to be designed to act as a low-pass floodway to limit interaction with creek flows and banking up of water at the crossing location. Specific management was also recommended to prevent significant erosion and flooding damage to the haul road (once constructed) at the creek crossing during times of higher flow (AQ 2022b).

The proposed Southern Haul Road as part of this Application will implement mitigation measures as the proposed AWT east-west haul road, as outlined in the SWMP (AQ 2022b), however will be suitably more engineered to achieve the two critical outcomes: a) minimal sedimentation downstream of the crossing and b) maintaining the natural surface upstream, downstream water regime. There will be specific management strategies and detailed engineering designs incorporated for the WWC crossing to ensure that surface water quantity and quality are not affected by the crossing nor through any mining related activities. The installation of appropriately sized culverts to ensure sediment load is minimised, and natural water flow upstream to downstream during rainfall events is maintained will be key to this installation.

Care will be taken in selecting suitable material for construction at the crossing, to ensure that only competent materials are used and less competent, more dispersive materials are avoided to minimise downstream sedimentation of the creek.

Access and haulage roads will be constructed with a camber, table drains and regular turnouts to discharge surface runoff into the natural surrounds. This will prevent the accumulation of large, fast surface water flows along the roads, and will thus limit flooding and erosion of the road surface. Generally, no sediment traps are required at these discharge points due to the small upstream catchment areas.

Through the implementation of the WIOP SWMP and the additional specific management and mitigation measures proposed for the construction and operation of haul roads, it is considered unlikely that significant impacts to the natural regimes and water quality of the Weeli Wolli Creek system will occur. The haul road's design as a low-pass floodway limits the potential for interaction with creek flows and banking up of water at the crossing location. Further, roads constructed within the WIOP area, including the Proposed Permit Area, will be relatively flat and well compacted to minimise potential for erosion. Whilst riparian vegetation is considered to be well represented beyond the extent of the WIOP and Proposed Permit Area (refer to Section 4.6.8), disturbances to this vegetation type will be limited as much as practicable.

A copy of this SWMP is provided as Appendix 2 in in Attachment A.

#### **4.4.1.2 Surface Water Management Areas**

The Project area is within a proclaimed surface water area under the RIWI Act. The water resources are managed in accordance with the DWER Pilbara Regional Water Plan (DoW 2010). The surface water management area is the Upper Fortescue, with the Fortescue Marsh as a Sub-area in the Fortescue Marsh resource.

Through the implementation of the proposed hydrological management and mitigation measures (refer to Section 4.4.1.1), the impacts to the local hydrological regime are considered to be low. It is therefore highly unlikely that these surface water management areas will be impacted by the Project.

#### **4.4.1.3 Water Quality**

Eleven surface water monitoring sites have been established in the broader WIOP area. Due to the sporadic flow in creek and drainage lines sampling of water quality occurs on an opportunistic basis (MRL 2022).



Water quality results for surface water suggests good water quality after rainfall events with EC values mostly below 1000  $\mu\text{S}/\text{cm}$  (indicating fresh water) and a pH range between 6.7 to 7.6 recorded on two sampling occasions in 2021. Dissolved metal values in general were below the ANZECC/ARCANZ 2000 guidelines trigger values for 95% protection of freshwater ecosystems (MRL 2022).

Another water quality assessment was conducted by WRM (2022) to support the BWT environmental impact assessment to assess the quality of the Weeli Wolli Creek. The surface water collected within the WIOP area reported fresh water (EC <500  $\mu\text{S}/\text{cm}$ ) and slightly acidic to slightly alkaline pH (6.5 – 7.97), similar to the results reported from the existing 11 monitoring sites. Background nutrient levels (nitrogen and phosphorus) and heavy metals, with the exception of copper, were reported below guideline levels (WRM 2022).

Water quality of the Weeli Wolli Creek system has the potential to be impacted by the Project in the event that the Project's activities increase sedimentation of surface water flows or result in contamination of local soils into surface water runoff. Through the implementation of surface water management, as outlined in the WIOP SWMP (refer to Section 4.4.1.1) and procedures for hydrocarbon and chemical storage and management (refer to Table 7-1), the water quality of the Weeli Wolli Creek system is unlikely to be impacted by the Project.

#### 4.4.2 Groundwater

The major regional aquifer systems surrounding the WIOP area are encountered within the following main hydro-stratigraphic units (MRL 2022):

- Young valley-fill successions (alluvium material, colluvials, calcretes and tertiary detritals)
- Mineralised, fractured and weathered zones in the Marra Mamba Formation (BIF)
- Fractured and weathered and fractured zones in the Jeerinah Formation.

Groundwater beneath the Weeli Wolli Creek within the WIOP area was reported to be approximately 32 mBGL. Regional groundwater flows in a north-easterly direction towards the Fortescue Marsh. Locally, the flow regime is influenced by topography, geological structures and surface water features. Water quality is typically fresh (0 – 1,500 mg/L total dissolved solids (TDS)) to brackish (1,500 – 10,000 mg/L TDS). The salinity of groundwater typically varies between seasons and is dependent on the overall water balance within the local catchment (MRL 2022).

There are no groundwater dependent ecosystems (GDEs) identified within the WIOP area. The Weeli Wolli Creek system and associated rock pools in the Weeli Wolli Creek exclusion zone are the closest potential receptors with environmental values (e.g. riparian vegetation, permanent pools) (MRL 2022).

Comparison between groundwater levels monitored in the WIOP area and survey levels undertaken in the lowest levels of the Weeli Wolli Creek bed have shown that these features are not in direct hydraulic connection. When plotting the highest recorded groundwater levels against the lowest surveyed creek bed levels, the minimum distance between the two (2) elevations was measured at around 18 m (AQ2 2022). The Weeli Wolli Creek system and the associated rock pools are therefore solely dependent on surface water flows and not groundwater (AQ2 2022, MRL 2022).

Weeli Wolli Creek is considered to be “losing stream”, i.e. one that loses water as it flows downstream, with the water infiltrating into the ground and recharging the local groundwater. For the Weeli Wolli Creek, losses from the creek into the groundwater (with the water table occurring well below the base of the creek) occur where weathered or fractured bedrock is intercepted (AQ2 2022). As the activities within this Application only occur at the ground surface, disturbance to weathered or fractured bedrock and subsequently, groundwater aquifers are not expected.

## 4.5 LAND SYSTEMS AND SOILS

### 4.5.1 Land Systems

Land system mapping for WA defines areas with recurring patterns of landforms, soils, vegetation and drainage (Schoknecht and Payne 2011; van Vreeswyk et al. 2004). The Project area overlies three land systems, the Newman, Rocklea and Egerton land systems. All three land systems are also represented within the Karijini National Park (G&G Environmental 2011 cited in MRL 2022). The descriptions and occurrence of the land systems within the Proposed Permit Area are summarised in Table 4-2 and locations shown on Figure 4-5.

**TABLE 4-2: LAND SYSTEM ASSOCIATIONS**

LAND SYSTEM	DESCRIPTION	MAPPED EXTENT		
		TOTAL MAPPED EXTENT (HA)	OCCURRING WITHIN PROPOSED PERMIT AREA (HA)	(%) OF TOTAL MAPPED AREA OCCURRING WITHIN PROPOSED PERMIT AREA
Newman	Rugged high mountains, ridges and plateaux with near vertical escarpments of jaspilite, chert and shales supporting hard spinifex grasslands.  Newman was the second largest land system recorded by van Vreeswyk et al. (2004). Soils in the Newman land system are characterised by stony soils, red shallow loams, and red loamy earths.	1,458,000	93.96	<0.01
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex (and occasionally soft spinifex) grasslands, with relief up to 110 m. This was the largest land system recorded by van Vreeswyk et al. (2004) and widespread throughout the Pilbara.  Soils in the Rocklea land system are characterised by stony soils, red shallow loams and calcareous shallow loams. Sandy duplex soils, sandy earths and non-cracking clays may also be present.	22,993,000	177.91	<0.01
Egerton	Dissected hardpan plains supporting Mulga shrublands and hard spinifex hummock grasslands.  Soils in the Egerton land system are characterised by red shallow loams and red shallow sands, as well as red loamy earths.	46,600	17.40	0.04

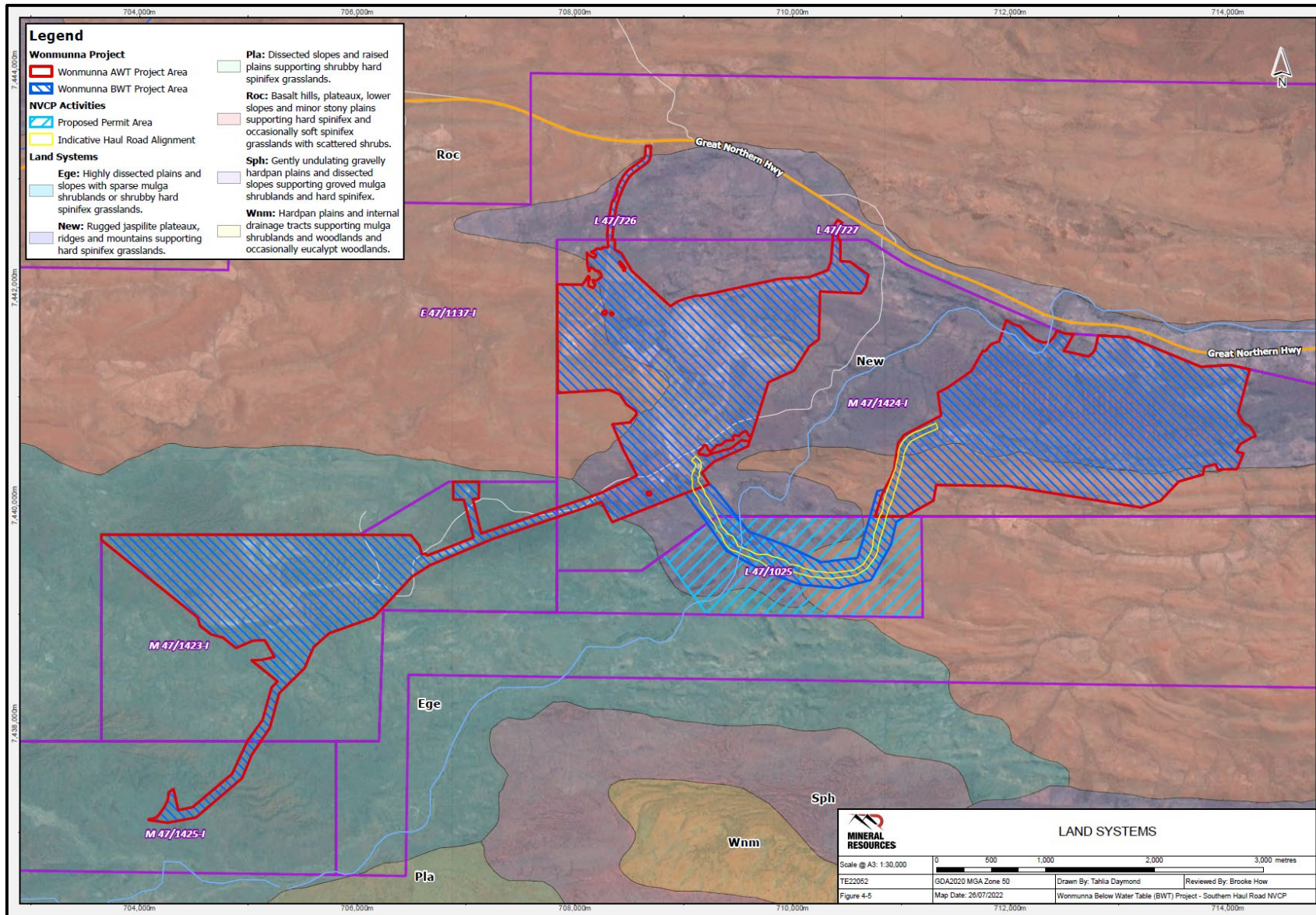


FIGURE 4-5: LAND SYSTEMS

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#### 4.5.2 Soil Characteristics

Soil mapping units (SMU) for the AWT project were determined by Landloch (2021a) based on the review of Australian Soil Classifications (ASC) (NCST 2016) and Soil Groups of WA (SGWA) (Schoknecht and Pathan 2013). For AWT mining areas, field observations were also considered. Soil characteristics were described for the original AWT haul road connecting the NMM (East) and NMM (West) deposits, located less than 500 m to the north of the Proposed Permit Area in tenement M47/1424. It is expected these SMU's extend into the Proposed Permit Area and therefore have been described below.

The SGWA (Schoknecht and Pathan 2013) underlying the AWT Project were identified as either Loamy Earth soils (uniform loam and loam grading to clay loam or clay) or the Rocky or Stony Soils group (rocky, stony or coarse gravelly (by >50%, >20 mm) throughout) (Landloch 2021a). As part of this Application, the SGWA reviewed for the Proposed Permit Area has been identified as the Stony Soils group, as shown on Figure 4-6. Given the proximity of the AWT project to the Proposed Permit Area, and similarity of the mapped SGWA's across both areas, it is therefore considered that information reported by Landloch (2021a) regarding the Rocky or Stony Soils SMU within the AWT project is applicable to understanding the soils expected to be encountered within the Proposed Permit Area.

Two SMU's were broadly described for the AWT project, however it is likely based on assessment of the SGWA that the SMU within the Proposed Permit Area is SMU2, described as Shallow Rocky Loams. A description of the SMU is provided below (Landloch 2021a):

##### **SMU 2 (Shallow Rocky Loams):**

- Soils have shallow soil profiles (<~300mm) with topsoil depths between 0-150 mm, and grade in texture from sandy loam at the surface to clay loam to light clay at depth, with an abundance of rock and/or gravel, overlying a rigid rocky or cemented C horizon.
- Key defining attribute is their shallow profile depth and abundance of coarse fragments throughout the profile.
- Generally located in the high gradient areas or mid and upper slope areas of the survey area and are expected to have formed from pedogenic processes.
- The Shallow Rocky Loams are considered to be the preferred rehabilitation resource on site.
- Comprise a fine fraction that is prone to structural decline. However, their high abundance of coarse fragments will act to limit the impact that structural decline of the fine fraction would have on the structure of the soil as a whole. As such, these materials are unlikely to be prone to tunnel erosion, but they may be susceptible to low permeability, reduced water holding capacity, and hard setting surfaces.
- Comprise relatively high capacity to hold water and nutrients due to their elevated clay content and are not susceptible to wind erosion.
- Typically found to be non-saline, with pH values within acceptable bounds for soils of the region and on site.
- Surface soils were all non-sodic and the subsoils were found to be variably sodic. Topsoils should therefore be stockpiled separately to avoid mixing with sodic soils.

Topsoils depths were assumed to have a depth of 150 mm and were recommended to be stockpiled separately from underlying subsoils due to their sodic content.

A copy of this soil characterisation study is provided as Appendix 3 in Attachment A.

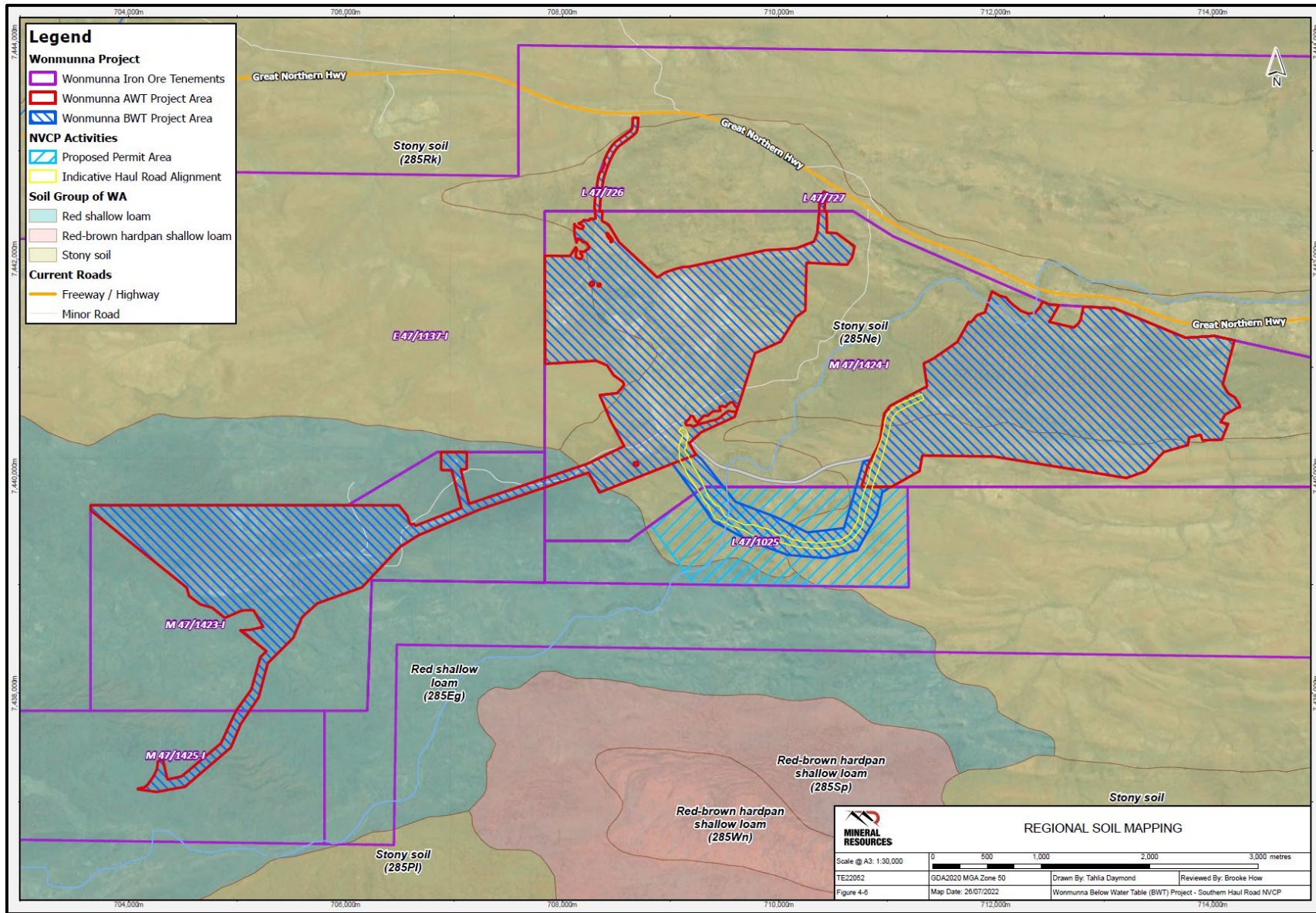


FIGURE 4-6: REGIONAL SOIL MAPPING

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### 4.5.3 Land Degradation Summary

Vegetation condition of the Proposed Permit Area was assessed during a 2022 survey (Phoenix 2022a). No vegetation was considered degraded within the Proposed Permit Area. The majority of vegetation (88%) was rated as Excellent condition and 9% as Very Good. Three sites inspected during the survey were reported to be in either Poor or Good condition. These sites were all located along the major drainage line and their condition was considered a result of impacts from feral animal activity, livestock and presence of weeds (Phoenix, 2022a).

## 4.6 FLORA AND VEGETATION

Level 2 flora and vegetation surveys were conducted over the WIOP in 2011 and 2014 (G&G Environmental 2011; 2014), however this assessment did not collect flora data from within the Proposed Permit Area. In 2021, a desktop assessment and targeted survey conducted by Phoenix (2021b and 2021c cited in Phoenix 2022) identified a number of new significant flora species in the vicinity of the WIOP area that were not considered during earlier 2011 and 2014 surveys. As such, MRL commissioned a flora and vegetation and significant species assessment for the whole tenement L47/1025 in which the Proposed Permit Area lies within, in accordance with the EPA's *Technical Guidance: Flora and vegetation surveys for Environmental Impact Assessment* (EPA. 2016c).

Phoenix (2022) conducted a desktop assessment and a field survey which aimed to:

- Update existing vegetation types and condition
- Undertake a general quadrat survey and targeted conservation significant species search
- Undertake a detailed transect search of the Indicative Haul Road Alignment within the Proposed Permit Area.

The desktop assessment conducted for the Proposed Permit Area utilised a number of databases and previous survey reports to identify flora and vegetation that may occur within the surveyed area. Table 4-3 summarises the sources of information used for this assessment.

**TABLE 4-3: INFORMATION SOURCES USED IN THE DESKTOP ASSESSMENT (PHOENIX, 2022A)**

BIOLOGICAL DATABASES		
DATABASE	TARGET GROUP/S	SEARCH COORDINATES AND EXTENT
Protected Matters Search Tool	EPBC Act Threatened flora and ecological communities	Approximate centre point of survey area (-23.1398°S, 119.0514°E) with 40 km buffer
Department of Biodiversity and Conservation (DBCAs) Threatened and Priority flora Database	Threatened and Priority flora	
DBCAs NatureMap Database	Flora records	
WA Herbarium Database	Flora records	
Phoenix Environmental Sciences – biological database	Flora records	Survey area plus a 5 km buffer
DBCAs Threatened and Priority Ecological Communities Database	Threatened and Priority Ecological Communities	Survey area plus a 10 km buffer
PREVIOUS SURVEY REPORTS		
CONSULTANT	DESCRIPTION	LOCATION
G&G Environmental 2011 G&G Environmental 2014	Level 2 - Flora and vegetation survey	Greater WIOP area
Phoenix Environmental Sciences 2021b	Desktop Review – Flora and Fauna	WIOP – Ancillary Infrastructure Project
Phoenix Environmental Sciences 2021c	Significant Flora Targeted Survey	Greater WIOP area

The field survey was conducted in March 2022, within the primary survey period for the Eremaean botanical province, being six to eight weeks post wet season (March - June).

The survey area was traversed to ground truth previous vegetation mapping boundaries, whilst undertaking quadrat surveys as required to delineate the vegetation types. Targeted searches were conducted in suitable habitat for species identified from the desktop assessment and the Indicative Haul Road Alignment was traversed by foot to further identify any significant flora.

Vegetation mapping was then conducted at a scale of 1:10,000 using NVIS sub-association level for structural descriptions (ESCAVI 2003 cited in Phoenix 2022). Vegetation boundaries were mapped using spatial imagery and data collected during the field survey. To support the delineation of vegetation types at a local scale, a cluster analysis was conducted based on species present within each quadrat (Phoenix 2022a).

In addition, a baseline riparian and groundwater dependent (GDV) survey was conducted in March 2021 by Phoenix (2022b) to assess the potential impacts to these vegetation types from the WIOP mine dewatering and discharge. In 2022, Phoenix expanded on this baseline information, by undertaking an additional two-season (June and November) quadrat based and targeted survey to assess impacts posed by the proposed BWT project activities (Phoenix 2022b).

It should be noted that this riparian survey covered areas associated with the proposed BWT project areas, but not specifically over the proposed BWT Southern Haul Road and Proposed Permit Area. However, based on the proximity of the riparian survey area to the Proposed Permit Area, and that the surveyed riparian zones are part of

the same Weeli Wolli Creek system, the results of this survey are considered applicable in assessing the riparian vegetation of the Proposed Permit Area.

Information from all available surveys has been used to characterise the flora and vegetation values of the Proposed Permit Area and is summarised in the following sections. Copies of the recent Phoenix reports (2022a; 2022b) are provided as Appendix 4 and Appendix 5 in Attachment A.

#### 4.6.1 Pre-European Vegetation

Mapping of pre-European broad vegetation within WA was completed on a broad scale (1:1,000,000) by Beard (1976). These vegetation types were later re-assessed by Shepherd *et al.* (2002), resulting in 819 vegetation associations within WA (Shepherd, 2002).

The Proposed Permit Area falls within Vegetation Association 29, Fortescue Valley. This area is characterised by low open to sparse woodland of mulga (*Acacia aneura*) and associated species. Approximately 877,889 ha Fortescue Valley has been mapped within Australia, with 99.98% of the vegetation association consider to be remaining undisturbed. Given the Project only proposes to impact on 25 ha, and it has over 99% of its original extent remaining, it would be considered 'least concern' (DER, 2014a).

#### 4.6.2 Conservation Significant Flora

The 2020 desktop search identified 55 significant species occurring within 40 km of the WIOP area, including two Threatened flora and 53 Priority (P) flora listed under the EPBC Act and/or BC Act. Only one known record of a P3 species (*Gymnanthera cunninghamii*) has been recorded within the WIOP survey area (Phoenix 2022a). Phoenix identified suitable habitat for 16 significant species occurred within the WIOP and this information was used to inform a targeted field survey. The 2021 field survey resulted in the identification of three additional species within WIOP area, including the Threatened species *Seringia exastia*<sup>1</sup>, P2 species *Oxalis* sp. Pilbara and P3 *Acacia subtiliformis*.

Based on a review of all desktop information, Phoenix identified suitable habitat within the L47/1025 survey area for up to 41 significant species (Phoenix 2022a), of which were targeted during the recent field survey conducted over tenement L47/1025.

During the field survey, no Threatened flora were recorded (Phoenix 2022a).

One Priority flora, *Aristida lazaridis* (P2), was recorded in the Proposed Permit Area as shown on Figure 4-7. Subsequent surveys conducted for riparian vegetation (Phoenix 2022b) also recorded another two locations of the species in the WIOP area. *Aristida lazaridis*, a P2 species listed under the BC Act, occurs in the Pilbara IBRA Region and Hamersley subregion. There are currently 22 records of this species in the WA Herbarium's FloraBase. It generally occurs on plains and floodplains, in sand to loam soils, in *Acacia* woodlands and hummock grasslands. Within the L47/1025 survey area and consistent with other known records, it was recorded within a major drainage channel. There is a high likelihood the population extends further along the creek; however, the population was not delineated in the field due to difficulties in obtaining field-based identification (Phoenix 2022a). Given the Proposed Permit Area intersects the creek system, it is possible the species may extend into the Proposed Permit Area. This individual record is located outside the Indicative Haul Road Alignment; however, this indicative alignment may be slightly altered during construction to accommodate site specific conditions. Where possible, locations of this P2 species will be avoided.

The likelihood status of potentially occurring significant species was revised by Phoenix following the recent field survey, and the number of species with suitable habitat occurring in tenement L47/1025 was reduced down from 41 to 26 species. Although these significant species (with the exception of *Aristida Lazaridis*) were not recorded during the field survey, as suitable habitat occurs within the survey area, their presence cannot be ruled out. The

<sup>1</sup> *Seringia exastia* is currently considered to be Threatened Flora, but Phoenix DBCA indicates that this species is due to have its conservation status removed as a result of a recent taxonomic study. Following completion of taxonomic revision, this species is expected to be considered common and widespread throughout the Pilbara and beyond and be delisted.



habitats within the WIOP, including the Proposed Permit Area, in which these species occupy are not considered critical or restricted to the survey areas, therefore the Project is unlikely to have any impacts on populations that may occur within the Permit Area.

#### 4.6.3 Introduced Flora

The desktop review identified 15 introduced species within 40 km of the Proposed Permit Area, none of which are a Declared Pest or Weed of National Significance (WoNS) (DPIRD 2022). Previously, G&G Environmental (2014) recorded nine introduced species. This has recently been revised to eight, as *Portulaca oleracea* is now considered to have a mixed naturalised state within WA (Phoenix, 2022a). The recorded introduced species include:

- *Alternanthera pungens* (Khaki Weed)
- *Bidens bipinnata* (Bipinnate Beggartick)
- *Cenchrus setiger* (Birdwood Grass)
- *Cenchrus ciliaris* (Buffel Grass)
- *Malvastrum americanum* (Spiked Malvastrum)
- *Sigesbeckia orientalis* (Indian Weed)
- *Sonchus oleraceus* (Common Sowthistle)
- *Vachellia farnesiana* (Mimosa Bush).

During the field survey, Phoenix (2022a) did not identify any Declared Pests or WoNS. Three introduced species were recorded, *Cynodon dactylon*, *Bidens bipinnata* and *Malvastrum Americanum*, the latter two also being recorded in the greater WIOP area (G&G Environmental (2014). With the exception of *Cynodon dactylon* found at a single location within the *AaAtTp* vegetation type, all other records of introduced flora were found along the major drainage line of the survey area. *Bidens bipinnata* was found to be a dominant species along all three major drainage sites, whereas *Malvastrum americanum* only had a presence at one site (Phoenix, 2022a).

Introduced weed species were identified as being the main threat to riparian vegetation within the Proposed Permit Area (Phoenix 2022b). MRL will implement key management controls for mitigating the risk of invasive weed species within the whole WIOP area, including the Proposed Permit Area, which include:

- Undertaking weed hygiene practices (dry or wet clean down) and inspections when entering WIOP sites, moving between sites or after carrying out high weed risk activities such as clearing or topsoil stockpiling
- Completion of Weed Hygiene Certificates to ensure vehicles and equipment are free of any seeds, plant material or mud that could contain seeds and placing stickers on vehicles that have passed weed and seed inspections
- Controlling soil material movement from areas considered to be weed risk areas (such as riparian vegetation)
- Undertake targeted weed surveys and opportunistic observations and maintain a weed register
- Implementing targeted weed spraying programs or physical removal of individual plants
- Training and awareness for all employees.

Due to the generally low occurrence of weeds within the Proposed Permit Area and the wider WIOP area, the risk of significant harm to the environment through the spread and/or introduction of weed species due to the WIOP activities is considered low.

#### 4.6.4 Unidentified Flora

One specimen, *Indigofera* aff. *boviparda* collected during the recent field survey could not be identified to species level due to insufficient taxonomic characters, as the specimens were sterile (lacking reproductive structures). Whilst this species was unable to be completely identified, it should be noted that based on field observations, it

did not closely resemble the P3 *Indigofera gilesii* species that was identified as possibly occurring in the desktop assessment (Phoenix, 2022a) and therefore it is unlikely this unidentified flora represents a significant species.

#### 4.6.5 Conservation Significant Vegetation

A search of the DBCA's Threatened and Priority Ecological Communities (TEC-PEC) database was conducted within 40 km of the Proposed Permit Area. No Threatened Ecological Communities (TECs) were recorded. Six Priority Ecological Communities (PEC) were identified, although none of the PECs intersect the Proposed Permit Area, and include (Phoenix, 2022a):

- Brockman Iron cracking clay communities of the Hamersley Range (Priority 1)
- Coolibah, Lignum Flats, sub-type 2 (Priority 1)
- Weeli Wolli Spring Community (Priority 1)
- West Angelas Cracking Clays (Priority 1)
- Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region (Priority 2)
- Coolibah, Lignum Flats, sub-type 1 (Priority 3)
- Kumina Land System (Priority 3).

Based on the desktop assessment by Phoenix (2022a), the closest PEC to the Proposed Permit Area is the Weeli Wolli Spring Community PEC (P1), being approximately 7 km north-east of the Proposed Permit Area. This PEC is dominated by a fringing forest, tall woodland of *Melaleuca argentea* (Silver paperbark) and *Eucalyptus camaldulensis* (River Red gum) over trees of *Eucalyptus victrix* (Coolibah) and a dense shrub layer dominated by an assortment of wattles, in particular *Acacia citrinoviridis* (Pilbara Jam) (Phoenix, 2022a).

None of the vegetation recorded during the recent survey were considered to represent any known TECs or PECs (Phoenix 2022a).

The Proposed Permit Area does not occur within or in proximity of any other known Environmentally Sensitive Areas (ESA) as listed under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. The closest ESA to the Proposed Permit Area is the Karijini National Park located approximately 43 km to the west (Figure 1-1).

No vegetation types recorded in the Proposed Permit Area are of local significance.

Groundwater dependent vegetation and riparian communities are discussed separately in Section 4.6.8.

#### 4.6.6 Vegetation




Vegetation mapping was previously completed by G&G Environmental (2014), with one shrubland, one *Eucalyptus* woodland, two *Acacia* woodlands, two *spinifex* steppe communities, four *Eucalyptus* mallee woodlands and six riparian communities mapped. The survey area comprised of six of these vegetation communities. These vegetation communities include M2, M3 and M4, described generally as *Eucalyptus* mallee woodlands, SS1 a single *spinifex* steppe community, C1 and C3, described as a riparian vegetation dominated by a *Eucalyptus camaldulensis* woodland. These communities formed 74.26% of the total vegetation structure of the greater WIOMP (Phoenix, 2022a). The vegetation types are described by G&G Environmental (2014) as:

- **M2** - Isolated low *Acacia spp.*, *Corymbia hamersleyana* and *Eucalyptus leucophloia* trees over isolated low *E. repullulans* mallee to low mallee woodland over isolated mixed low shrubs to low open shrubland with *Corchorus lasiocarpus subsp. lasiocarpus*, *Indigofera monophylla*, *Ptilotus spp.* and *Goodenia spp.* prominent in a low open *Triodia brizoides* hummock grassland with a low *Eucalyptus repullulans* woodland over a mid open *Acacia bivenosa* shrubland over a *Triodia longiceps* and *T. pungens* hummock grassland in drainage lines. Vegetation recovering from fire.



- **M3** - Isolated low *Acacia aptaneura*, *A. pruinocarpa* and *A. synchronicia* trees or tall shrubs over isolated low mixed *Eucalyptus gamophylla*, *E. repullulans* and *E. socialis* mallee to low open mallee woodland over a low to mid *Triodia brizoides* and *T. wiseana* hummock grassland.
- **M4** - Isolated low *Eucalyptus leucophloia* trees and *E. gamophylla* mallee to low open woodland over isolated tall mixed *Acacia spp.* and *Petalostylis labicheoides* shrubs to open shrubland over isolated low mixed shrubs to low open shrubland with *Gompholobium polyzygum*, *Dampiera candidans* and *Goodenia scaevolina* common over a *Triodia pungens* and *T. wiseana* hummock grassland with pockets of a low *Acacia distans* and *Eucalyptus leucophloia* woodland over isolated tall mixed shrubs and isolated clumps of *Triodia pungens* hummocks on steep rocky slopes near the crest of plateaus and isolated mid *Eucalyptus leucophloia* trees over a low *E. repullulans* mallee and tall *Petalostylis labicheoides* shrubland over *Triodia longiceps* and *T. pungens* mid hummock grassland in drainage lines.
- **SS1** - Isolated low trees, frequently *Corymbia hamersleyana* and *Acacia inaequilatera* over isolated low to tall mixed shrubs with *Acacia spp.*, *Grevillea wickhamii* and *Hakea chordophylla* common over isolated low *Indigofera rugosa* shrubs in a low *Triodia brizoides* hummock grassland with isolated clumps of *Themeda triandra* in drainage foci.
- **C1** - Isolated mid *Eucalyptus camaldulensis* trees to mid *E. camaldulensis* woodland over isolated low trees to low *Acacia citrinoviridis* and *Eucalyptus xerothermica* woodland over isolated mixed tall shrubs to tall shrubland frequently with *Gossypium sturtianum* and *Petalostylis labicheoides* shrubs over a mixed low to mid grassland of *Eulalia aurea*, *Themeda triandra* and *Triodia spp.*
- **C3** - A low *Eucalyptus xerothermica* and *E. socialis* woodland, occasionally with *E. repullulans* mallee over a mid to tall *Gossypium sturtianum*, *Petalostylis labicheoides* and *Acacia spp.* shrubland over a low to mid mixed grassland of *Themeda triandra* and *Triodia spp.*

During the recent survey, Phoenix (2022a) described five vegetation types within tenement L47/1025. The vegetation types present within tenement L47/1025, including their description, associated landform and mapped extent, likely disturbance footprints and photographs are provided below in Table 4-4 and locations shown in Figure 4-7.

**TABLE 4-4: VEGETATION TYPES (PHOENIX, 2022A)**

UNIT ID	UNIT DESCRIPTION	MAPPED SURVEY EXTENT (HA) / (%)	EXTENT WITHIN PROPOSED PERMIT AREA (HA)	PROPOSED DISTURBANCE (HA) / (%)	REPRESENTATIVE PHOTOGRAPH
EvAcTs	Mid open woodland of <i>Eucalyptus victrix</i> and occasionally <i>E. camaldulensis</i> var. <i>obtusa</i> , over tall open shrubland of <i>Acacia citrinoviridis</i> , <i>Petalostylis labicheoides</i> , and <i>A. maitlandii</i> , over mid sparse shrubland of <i>Acacia pyrifolia</i> var. <i>pyrifolia</i> , <i>A. bivenosa</i> , and <i>Senna artemisioides</i> subsp. <i>filifolia</i> , over low mid tussock grassland of <i>Themeda</i> sp. <i>Mt Barricade</i> (M.E. Trudgen, 1988, 2471), <i>Eulalia aurea</i> , with <i>Triodia angusta</i> .	4.67 (2%)	4.67	0.33 (7%)	
ElAsppTw	Low isolated trees of <i>Eucalyptus leucophloia</i> and/or <i>Corymbia hamersleyana</i> , over mid isolated shrubs or clumps of shrubs of mixed <i>Acacia</i> spp. ( <i>A. pachyacra</i> , <i>A. synchronicia</i> , <i>A. arida</i> , and others), over low to mid open hummock grassland to hummock grassland of <i>Triodia wiseana</i> .	146.33 (73%)	141.59	17.51 (12%)	
EsppAmTa	Low open woodland variably of <i>Eucalyptus socialis</i> subsp. <i>eucentrica</i> , <i>E. xerothermica</i> , or <i>E. repullulans</i> , over tall sparse to open shrubland of <i>Acacia maitlandii</i> , <i>Petalostylis labicheoides</i> , and <i>A. bivenosa</i> , over low to mid open hummock grassland of <i>Triodia angusta</i> , with <i>Themeda</i> sp. <i>Mt Barricade</i> (M.E. Trudgen, 1988, 2471), and <i>Enteropogon ramosus</i> .	3.42 (2%)	3.42	0.0 (0%)	

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UNIT ID	UNIT DESCRIPTION	MAPPED SURVEY EXTENT (HA) / (%)	EXTENT WITHIN PROPOSED PERMIT AREA (HA)	PROPOSED DISTURBANCE (HA) / (%)	REPRESENTATIVE PHOTOGRAPH
EIAaTb	Low isolated trees to open woodland of <i>Eucalyptus leucophloia</i> or <i>E. gamophylla</i> , over mid to tall sparse to open shrubland of <i>Acacia atkinsiana</i> , <i>A. pruinocarpa</i> , and <i>Senna glutinosa subsp. glutinosa</i> , over low to mid open hummock grassland to hummock grassland of <i>Triodia brizoides</i> and <i>T. pungens</i> , with <i>Aristida holathera</i> var. <i>holathera</i> .	39.75 (20%)	39.74	3.2 (8%)	
AaAtTp	Low woodland to open forest of <i>Acacia aptaneura</i> , <i>A. catenulata subsp. occidentalis</i> , and <i>Eucalyptus leucophloia</i> , over mid to tall sparse shrubland of <i>Acacia tetragonophylla</i> , <i>Eremophila latrobei subsp. latrobei</i> , and <i>Senna glutinosa subsp. filifolia</i> , over low to mid sparse to open hummock grassland of <i>Triodia pungens</i> , variably with <i>T. wiseana</i> or <i>T. angusta</i> .	5.8 (3%)	5.8	0.0 (0%)	

Phoenix reviewed the 2014 (G&G Environmental) vegetation types against the most recent types to show comparison between surveys, as summarised in Table 4-5.

**TABLE 4-5: COMPARISON OF VEGETATION TYPES (PHOENIX, 2022A)**

2014 VEGETATION TYPES (G&G ENVIRONMENTAL 2014)	2021 VEGETATION TYPES (PHOENIX 2022A)	COMMENTS
C1	<i>EvActS</i>	Representative
C3	<i>EsppAmTa</i>	Representative
M3	<i>AaAtTp</i>	Representative
M2, M4, SS1	<i>EIAsppTW</i>	Contains elements of
M2	<i>EIAaTb</i>	Contains elements of

Vegetation type *EIAsppTw* is the most dominant within the tenement, covering 73% of the mapped extent, followed by vegetation type *EIAaTb*, covering 20% of the survey area. The remaining three vegetation types mapped comprise the remaining 6.94% of the survey area. These vegetation types include *EvActS* (2%), *EsppAmTa* (2%) and *AaAtTp* (3%). No vegetation types occupy less than 1% the total survey area and therefore are not considered to be locally significant due to scarcity (Phoenix, 2022a).

Vegetation type *EvACTs* comprises habitat for the P2 species *Aristida lazaridis* and may be considered locally significant as a refuge for this species (Phoenix 2022a). This vegetation type is also considered representative of the riparian vegetation types *EcAcEa* and C1, as described by Phoenix (2022b) and G&G Environmental (2014), respectively. Disturbance to this vegetation may be potentially at variance to the native vegetation clearing principles F, as it requires clearing of native vegetation that is in association with a water course or wetland. However, only 0.33 ha is proposed to be disturbed as part of this Application, predominately for the proposed haul roads creek crossing. This equates to only 7% of the mapped extent of the vegetation type within the Proposed Permit Area, and it is also known to extend well beyond the boundaries of the Proposed Permit Area, including areas mapped as C1 and *EcAcEa* in the WIOP areas. Along with proposed mitigation and management controls (refer to Section 3.1.1 and Section 4.4.1.1) that will prevent significant impacts to the Weeli Wolli Creek and its natural hydrological regime, and subsequently the condition of the riparian vegetation in which it is associated, it is unlikely the Project will pose any significant risk to local riparian vegetation.

**4.6.7 Vegetation Condition**

According to Phoenix (2022a) remnant vegetation varies from Poor to Excellent condition with majority being in excellent condition (88.48%). Excellent condition is described as pristine vegetation with nearly no signs of damage that are caused by human activities since European settlement, and very good condition is characterised with slight signs of damage by human activities.

Vegetation conditions relating to vegetation types in the survey area are described in the Table 4-6. It should be noted that some vegetation types recorded more than one condition rating.

**TABLE 4-6: VEGETATION CONDITION – EXTENT OF EACH CONDITION RATING IN SURVEY AREA(PHOENIX, 2022A)**

CONDITION RATING	AREA (HA)	% OF SURVEY AREA	VEGETATION TYPES
Excellent	176.94	88.48	<i>AaAtTp, ElAsppTw, EspAmTa, ElAaTb, ElAaTb</i>
Very Good	18.37	9.19	<i>ElAsppTw</i>
Good	2.9	1.45	<i>EvAcTs</i>
Poor	1.76	1.76	<i>EvAcTs</i>
Degraded	-	-	-
Completely Degraded	-	-	-
Cleared	-	-	-

The overall rating for tenement L47/1025 was predominately Excellent, with no signs of damage caused by human activities since European settlement. Areas with lower condition rankings were a result of damage caused by vehicles, grazing by livestock, feral animal activity and weed infestation.

**4.6.8 Riparian and Groundwater Dependent Vegetation**

The riparian and GDV survey was conducted for the BWT potential discharge points, all located within BWT Project area, but outside the Proposed Permit Area (Phoenix 2022b). However, the Proposed Permit Area is part of the same Weeli Wolli Creek system and the outcomes of the survey are considered representative of the Proposed Permit Area.

The riparian and GDV survey identified three vegetation types within the creek systems surveyed, with each type more broadly comprised of *Eucalyptus* woodlands over mixed mid to tall shrublands with *Acacia* spp., *Petalostylis labicheoides* and *Androcalva luteiflora* prominent over missed grasslands with *Eulalia aurea*, *Themeda triandra* and *Triodia lanigera* prominent. The primary disturbance to these areas was the presence of introduced species (Phoenix 2022b).

The riparian vegetation descriptions were compared to the previously described vegetation types (G&G Environmental 2014 and Phoenix 2022a). It was identified a number of existing vegetation types are representative of existing ones described. The riparian communities described by Phoenix (2022b) and how they compare to previously described vegetation types are summarised in Table 4-7.

**TABLE 4-7: RIPARIAN VEGETATION TYPES (PHOENIX, 2022B)**

UNIT ID	UNIT DESCRIPTION	COMPARISON WITH VEGETATION TYPES FROM EXISTING SURVEYS
<i>EcAcEa</i>	Isolated mid <i>Eucalyptus camaldulensis</i> trees to mid <i>E. camaldulensis</i> woodland over isolated low trees to low <i>Acacia citrinoviridis</i> and <i>Eucalyptus xerothematica</i> woodland over isolated mixed tall shrubs to tall shrubland frequently with <i>Gossypium sturtianum</i> and <i>Petalostylis labicheoides</i> shrubs over a mixed low to mid grassland of <i>Eulalia aurea</i> , <i>Themeda triandra</i> and <i>Triodia</i> spp.	C1 (G&G Environmental 2014) EvAcTs (Phoenix 2022a)
<i>EvAmTI</i>	Isolated mid <i>Eucalyptus victrix</i> trees over isolated low <i>Corymbia hamersleyana</i> trees over a mid to tall <i>Melaleuca glomerata</i> shrubland over a mid to tall <i>Triodia longiceps</i> and <i>Cenchrus ciliaris</i> grassland.	C2 (G&G Environmental 2014)
<i>ExpITH</i>	Low <i>Eucalyptus xerothematica</i> and <i>E. socialis</i> woodland, occasionally with <i>E. repullulans</i> mallee over a mid to tall <i>Gossypium sturtianum</i> , <i>Petalostylis labicheoides</i> and <i>Acacia</i> spp. shrubland over a low to mid mixed grassland of <i>Themeda triandra</i> and <i>Triodia</i> spp.	C3 (G&G Environmental 2014) EspAmTa (Phoenix 2022a)

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In 2014, the C1 and C2 vegetation types were identified as potentially being locally significant due to C1's diversity and novel suite of species and C2's habitat supporting significant P3 species *Gymnanthera cunninghamii*. Both these vegetation types are represented by the Phoenix (2022b) communities *EcAcEa* and *EvAmTI*, respectively (Phoenix 2022b). The *EcAcEa* community also provides habitat for the P2 *Aristida lazardis* species. All three communities are considered to represent vegetation of greater species diversity than vegetation recorded in the surrounding landscapes. The main risk to the riparian communities in the WIOP area was reported to be the presence of introduced species (Phoenix 2022b).

Disturbances to the *EcAcEa* riparian community is also discussed in Section 4.6.6.

Along the Weeli Wolli Creek, the only GDV species recorded were *Eucalyptus camaldulensis* and/or *E. victrix*, it was not possible to distinguish these species as they were sterile during the survey. Trees of these species were recorded throughout the surveyed area and extend well beyond, both up and down-stream in the riparian vegetation of the Weeli Wolli Creek (Phoenix 2022b).



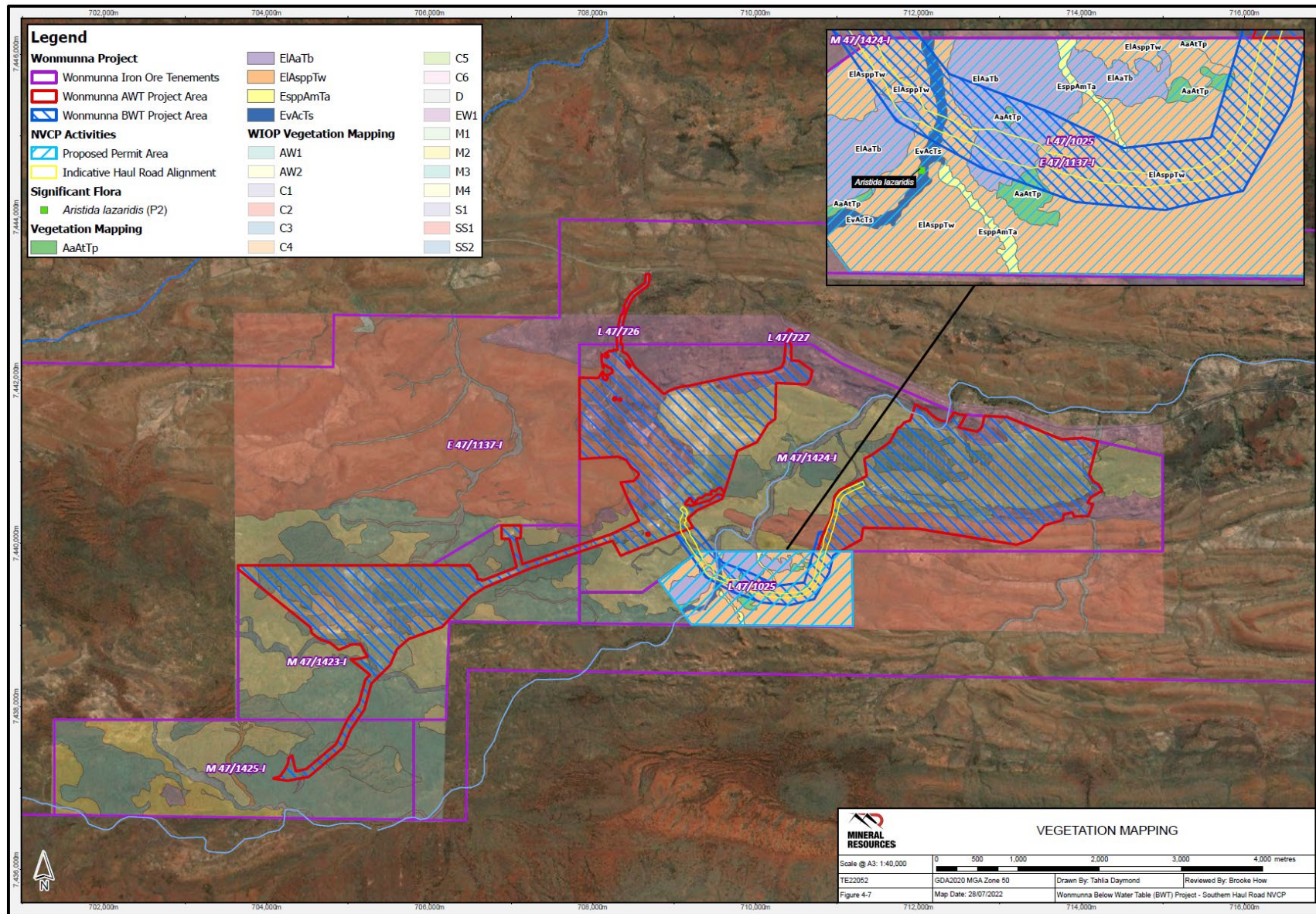


FIGURE 4-7: VEGETATION MAPPING

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#### 4.7 FAUNA

In 2021, a desktop assessment and a targeted significant fauna survey was conducted by Phoenix (2021b cited in Phoenix 2022). The outcomes of the desktop assessment was used to identify significant fauna likely to occur in the area and informed the targeted search.

The desktop assessment conducted for the Proposed Permit Area utilised a number of biological databases and previous survey reports to identify significant fauna that may occur within the surveyed area. Table 4-8 summarises the sources of information used for this assessment.

**TABLE 4-8: INFORMATION SOURCES USED IN THE DESKTOP ASSESSMENT (PHOENIX, 2022A)**

BIOLOGICAL DATABASES		
DATABASE	TARGET GROUP/S	SEARCH COORDINATES AND EXTENT
Protected Matters Search Tool	EPBC Act Threatened fauna	Approximate centre point of survey area (-23.1398°S, 119.0514°E) with 40 km buffer
DBCA Threatened and Priority fauna Database	Threatened and Priority fauna	
DBCA NatureMap Database	Fauna records	
Phoenix Environmental Sciences – biological database	Fauna records	Survey area plus a 5 km buffer
WA Museum Arachnid and Myriapod Database, Mollusca Database	Arachnid, myriapod and mollusc SREs	100 km <sup>2</sup> search area encompassing the survey area between -22.2468°S, 118.0688°E (NW corner) and -24.0266°S, 120.0488°E (SE corner)
PREVIOUS SURVEY REPORTS		
CONSULTANT	DESCRIPTION	LOCATION
Phoenix Environmental Sciences 2014	Update to 2011 Level 2 short-range endemic invertebrate fauna survey	Greater WIOP area
Phoenix Environmental Sciences 2021b	Desktop Review – Flora and Fauna	WIOP – Ancillary Infrastructure Project

The significant fauna species search was conducted in March 2022 for the Proposed Permit Area and in accordance with the EPA’s *Technical Guidance: Terrestrial Fauna Surveys* (EPA 2016). The survey involved 20 sampling sites, including foraging sites, and included a combination of active search, avifauna search, bat echolocation recording, camera trapping, Short Range Endemic (SRE) invertebrate sampling and targeted searches for the Western Pebble-mound Mouse and Northern Quoll.

An aquatic fauna survey was also conducted over the WIOP to assess potential impacts of the BWT projects mine dewatering requirements on aquatic fauna of the Weeli Wolli Creek. Whilst survey sites are outside of the Proposed Permit Area, the results of this survey provide contextualise assessment of potential impacts posed to aquatic fauna of the Weeli Wolli Creek by the proposed haul road in the Proposed Permit Area.

Information from all available surveys has been used to characterise the fauna values of the Proposed Permit Area and the results are summarised in the following sections. The location of survey areas is shown on Figure 4-8. Copies of these reports are provided as Appendix 4 in in Attachment A.

**4.7.1 Fauna Habitat**

Five broad fauna habitats were identified in the Proposed Permit Area in 2022. The habitats recorded and their mapped extent are summarised below in Table 4-9 and locations shown on Figure 4-8.

**TABLE 4-9: FAUNA HABITATS WITHIN PROPOSED HAUL ROAD AREA**

HABITAT TYPE	MAPPED SURVEY EXTENT	PROPOSED DISTURBANCE*
	HA (%)	
Creek line	4.67 (2.3%)	0.33 (7%)
Drainage line	3.42 (1.7%)	0.00 (0%)
Open woodland over shrubland	39.75 (19.9%)	3.20 (8%)
Spinifex grassland	146.33 (73.2%)	17.51 (12%)
Woodland	5.8 (2.9%)	0.00 (0%)

\* proposed disturbance based on the Indicative Haul Road Alignment

The Spinifex grassland habitat was the most common habitat within the Proposed Permit Area, that includes some isolated trees of *Eucalyptus* and some isolated shrubs (spinifex grassland) as well as some rocky slopes. This habitat covers the majority of the Proposed Permit Area (73.2%) and it not considered suitable habitat for any significant fauna species (Phoenix 2022a). Up to 12% of this habitat may be disturbed by the Project.

The second most common habitat was the Open woodland over shrubland, mainly consisting of *Eucalyptus* woodland over mid to tall sparse to open *Acacia* shrubland, over spinifex grassland. This habitat also contains some rocky break aways and hilltops, identified as suitable habitat for the Western Pebble-mound Mouse and Northern Quoll, respectively (Phoenix 2022a). Approximately 12% of this habitat may be disturbed by the Project.

The Woodland habitat occurs in small clumps throughout the Proposed Permit Area (2.9%) and consists of *Acacia* and *Eucalyptus* trees, *Acacia* shrubland and spinifex grassland. The caves and clifftops within this habitat may provide suitable habitat for bats, of which some may be of conservation significance (Phoenix 2022a). This habitat is unlikely to be disturbed by the Project.

The Creek line habitat covers 2.3% of the Proposed Permit Area and comprised the dry Weeli Wolli Creek line. It represents suitable foraging habitat for the Northern Quoll, Pilbara Leaf-nosed Bat and the Ghost Bat. Approximately 7% of this habitat is proposed to be disturbed as a result of this Project.

The Drainage line was the smallest habitat recorded, comprising only 1.7% of the Proposed Permit Area, and branches off from the Creek line habitat. It is two drainage lines consisting of scattered *Eucalyptus* trees, *Acacia* shrubland and spinifex grassland, with rocky surface and clay-loams throughout. It was not identified as comprising suitable habitat for any significant species (Phoenix 2022a). This habitat is unlikely to be disturbed by the Project.

No fauna habitats were identified as being of significance to any significant fauna (Phoenix, 2022a).

#### 4.7.2 Conservation Significant Fauna

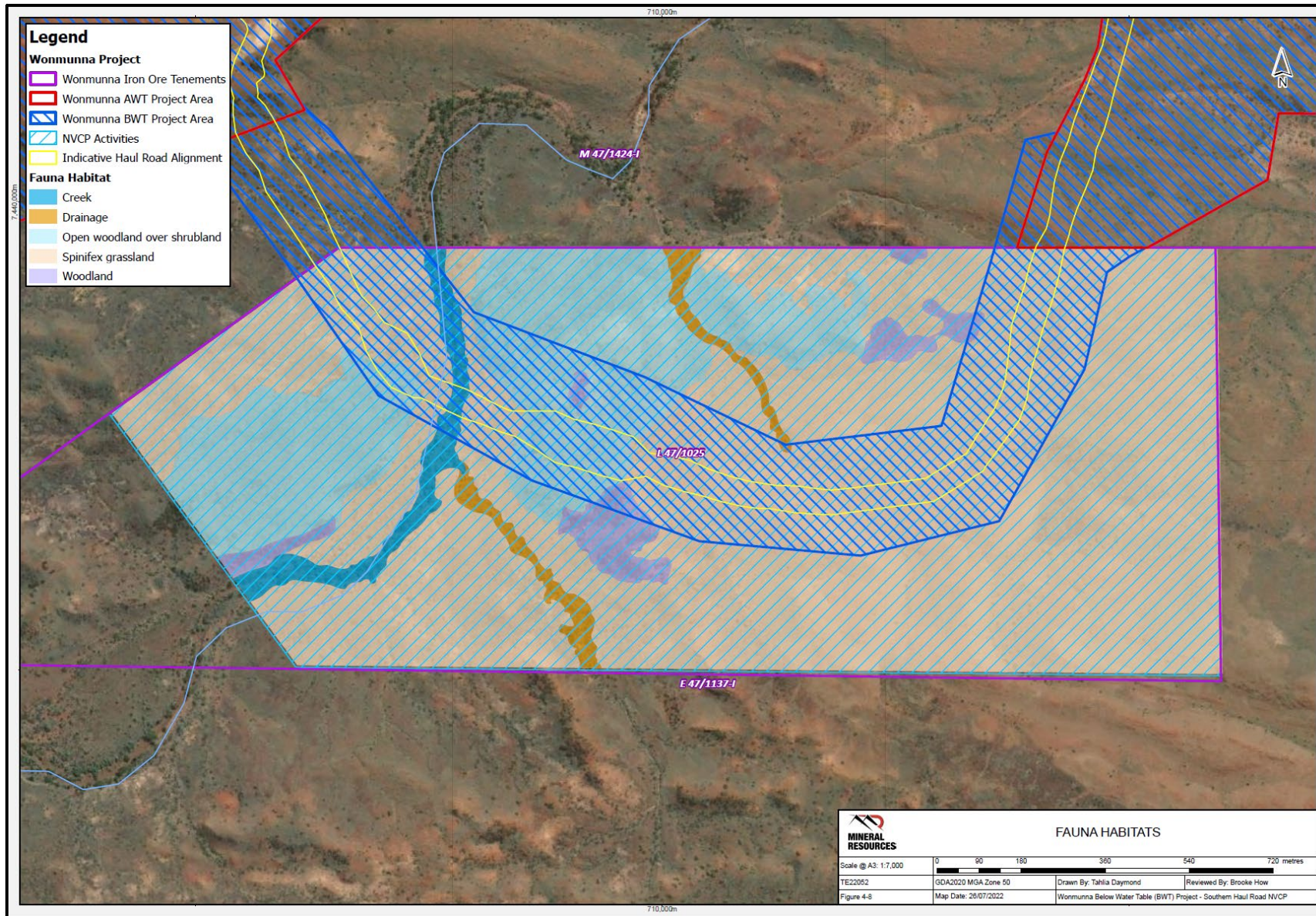
Based on a review of available information, few significant species were considered likely to occur within the Proposed Permit Area however may include:

- Northern Quoll (*Dasyurus hallucatus*) – Endangered
- Pilbara Leaf-nosed bat (*Rhinoicterus aurantia*) – Vulnerable
- Ghost bat (*Macroderma gigas*) – Vulnerable
- Unpatterned Robust Slider (Robertson Range) (*Lerista macropistthopus remota*) – P2
- Western pebble-mound mouse (*Pseudomys chapmani*) – P4.

Based on the outcomes of the desktop assessment, the recent fauna survey targeted the five species listed above. Suitable habitat was considered present within the Proposed Permit Area for the Pilbara Leaf-nosed bat, the Ghost Bat and the Western Pebble-mound Mouse. Whilst there was suitable denning/shelter habitat in the broader WIOP area for the Northern Quoll, there was no suitable habitat or evidence of occurrence in the Proposed Permit Area. No suitable habitat for the Unpatterned Robust Slider was observed (Phoenix 2022a).

None of these species, or any other significant species, were recorded during the survey (Phoenix 2022a).

The targeted fauna survey report is provided as Appendix 4 in Attachment A.



**FIGURE 4-8: FAUNA HABITATS**

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#### 4.7.3 Short Range Endemics

A total of 184 SRE or significant invertebrate taxa from eight invertebrate fauna groups were recorded in the desktop review by Phoenix (2022a). Mygalomorph spiders comprised 41% of these species identified. The remaining 59% represent the seven other invertebrate groups (Phoenix 2022a).

Five SRE habitats were observed within the Proposed Permit Area, including the following:

- Woodland
- Creek line
- Drainage line
- Open woodland over shrubland
- Spinifex grassland.

The Phoenix field survey conducted in 2022 over the Proposed Permit Area yielded a low number of SRE invertebrates. These consisted of three potential SRE species, including two pseudoscorpions (*Euryolpium* 'HD7' and *Indolpium* 'Wo02') and one millipede (*Austrostrophus* 'Wonmunna'). None of the recorded species matched those identified within the desktop assessment (Phoenix, 2022a) or noted to be of conservation significance.

Both the pseudoscorpions were recorded within woodland habitat that extends well beyond the Proposed Permit Area. The millipede species was recorded in the creek line habitat that extends both north and south of the Proposed Permit Area. It is therefore considered unlikely the proposed WIOP, including development of the Southern Haul Road, will impact on these species.

A full copy of this report is provided as Appendix 4 in Attachment A.

#### 4.7.4 Aquatic Fauna

Aquatic fauna of the Weeli Wolli Creek was assessed to document the current ecological condition of the creek and determine the potential impacts to significant aquatic fauna habitat resulting from the BWT project should dewatering discharge be required. This survey was conducted up-gradient of the Proposed Permit Area and provides valuable context to any potential impacts to aquatic fauna habitat that may be impacted by this Application (Wetland Research & Management (WRM) 2022).

A total of 36 microinvertebrate, 55 hyporheic and 129 macroinvertebrate taxa and 433 individual fish were recorded across the whole survey area, which included reference sites and sites within the general WIOP area (WRM 2022).

No microinvertebrate, hyporheic or fish species recorded within the WIOP areas were considered of significance. Two macroinvertebrate species, the Pilbara endemic diving beetles *Tiporus lachlani* and *Sternopriscus pilbarensis*, were recorded within the WIOP. Both endemic species all have broad distributions across the Pilbara and therefore unlikely to be significantly impacted by the Project (WRM 2022). Most aquatic fauna and (by association) aquatic ecosystem functioning, is considered at low risk from hydrological changes.

Altered flow regimes may result in short-term changes to benthic invertebrate and zooplankton species assemblage composition in Weeli Wolli Creek, where activities result in still water (lentic) species being replaced by flowing-water (lotic) species, when activities such as dewatering discharge occur (WRM 2022). Such changes are unlikely to occur a result of the construction of the haul road proposed under this Application.

The main risks to local aquatic fauna populations by the WIOP were considered related to potential erosion, run-off and siltation of the Weeli Wolli Creek (WRM 2022). The proposed haul road will be constructed to retain and or minimise any impacts to the natural flow regime of the Weeli Wolli Creek and avoid any significant changes to aquatic fauna populations.

A full copy of the aquatic fauna assessment is provided as Appendix 6 in Attachment A.

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## 5. STAKEHOLDER CONSULTATION

MRL recognises the value of building positive relationships with key stakeholders and the communities in which we are active. We seek to build sustainable partnerships with business partners, governments, non-government organisations, host communities and other stakeholders to support mutually beneficial outcomes. MRL strives to engage early, openly, honestly and regularly with the communities impacted by our operations and consider their views in our decision-making with respect to key planning, operational and closure aspects.

MRL is committed to continued engagement with stakeholders through all development phases of projects and operations, a Stakeholder Engagement Plan is maintained which outlines all communications and requirements with relevant stakeholders.

Outcomes of these activities are recorded in a Stakeholder Consultation Register, which is a live document that interconnects with the Stakeholder Engagement Plan. This plan encompasses all MRL activities associated with this Project, including:

- Wonmunna Iron Ore Mine AWT expansion
- Wonmunna Iron Ore Mine BWT activities (proposed).

MRL intend to include engagement activities specific to this Application in this Stakeholder Engagement Plan.

Key stakeholders associated with this Application include the following:

### Non-Government Stakeholders

- Traditional Landowners: Karlka Nyiyaparli and Ngarlawangga Aboriginal Corporation (KNAC and NAC)
- Wildflower Society of WA
- Tourism Operators
- Greening Australia
- Conservation Council of WA
- Other mining companies including Hancock Prospecting, Rio Tinto, BHP and FMG.

### Local and State Government:

- DMIRS
- DWER
- Department of Primary Industries and Regional Development (DPIRD)
- DBCA
- Department of Planning, Lands and Heritage (DPLH)
- Main Roads Western Australia (MRWA)
- Town of Port Hedland
- Shire of East Pilbara
- Pilbara Development Commission
- Newman Chamber of Commerce and Industry
- Pilbara Ports Authority.

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## 6. AVOIDANCE AND MITIGATION MEASURES

MRL has applied mitigation hierarchy (avoid, minimise and rehabilitate) to reduce the potential impacts to flora and vegetation. Areas of land clearing will be progressively rehabilitated to agreed post mining land use outcomes. These outcomes will be documented in the Project’s MCP (ENV-TS-RP-0412), which has been submitted to DMIRS concurrently with this Application.

The objectives of environmental management for this Application are:

- To identify all likely environmental impacts arising from the clearing activities and to determine significant impacts requiring the implementation of special management procedures
- To develop and declare the environmental management commitments necessary to minimise, control, ameliorate and rehabilitate significant impacts.

An amended MP (ENV-TS-RP-0411) is being prepared to support the approval of the BWT Project, including the activities within this Application, by DMIRS under the *Mining Act 1978*. Management measures from the amended MP will be implemented for clearing activities described within this Application.

Proposed mitigation measures relating directly to the clearing activities proposed within this Application are detailed in Table 7-1 in Section 7.

Table 6-1 below addresses an assessment of the requirements under Section 5.6 of the Clearing Permit Application Form.

**TABLE 6-1: SITE SELECTION – AVOIDANCE AND MITIGATION**

DMIRS QUESTIONNAIRE	MRL SITE SELECTION
Why did you select this location and amount of clearing?	<p>The Proposed Permit Area was selected to avoid and/or minimise impacts to areas of environmental and/or heritage significance. This area was chosen as it lies outside of all known areas of heritage significance and will not impact on any significant species, communities or habitats critical to the survival of any significant species. The proposed alignment also aims to traverse the most common vegetation types (<i>EIA<sub>sppTw</sub></i> and <i>EIA<sub>aTb</sub></i>), as much as practical.</p> <p>The amount of clearing proposed in this Application includes the minimum disturbance required to construct the road alignment and topsoil, subsoil and vegetation stockpiles. Additional clearing requirements for borrow pits, turkey’s nests and groundwater bores are not required, as the Application is able to utilise existing material and infrastructure from the greater WIOP area.</p>
What alternatives to clearing – e.g. engineering solutions – did you consider	<p>There are no existing haul roads that connect the WIOP’s NMM (West) and NMM (East) deposits and therefore, there are no alternatives to clearing to gain access to NMM (East).</p> <p>An original east-west haul road was included in the existing NVCP for the WIOP (CPS 6216/2), of which some portions will still be constructed, where they are required to connect the BWT Southern Haul Road Option to AWT deposits. Much of the original haul road approved under CPS 6216/2 has been re-aligned into the BWT Southern Haul Road, as per this Application, in order to ensure any impacts to areas of heritage significance are minimised.</p>
What changes, if any, did you make to the location or amount of clearing to reduce the impacts of the clearing?	<p>A significant reduction in the proposed clearing footprint was achieved by proposing the use of the WIOP waste rock material and cut to fill as the road construction base, in place of constructing new borrow pits.</p> <p>Water required for dust suppression and construction activities will also be sourced from the WIOP, eliminating the requirement for additional clearing for turkey’s nest(s) and groundwater bores within the Proposed Permit Area.</p> <p>The indicative haul road alignment is located to avoid areas of environmental and/or heritage significance, as outlined in item 1 of this table.</p>

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## 7. TEN CLEARING PRINCIPLES

The proposed vegetation clearing has been assessed against the ten clearing principles described within *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER, 2014a) under *Part V Division 2 of the EP Act* (WA). The results of flora, vegetation and fauna surveys described in Section 4 have been used in the assessment of the ten clearing principles, summarised in Table 7-1 below.

**TABLE 7-1: ASSESSMENT OF PROPOSED VEGETATION CLEARING AGAINST THE TEN CLEARING PRINCIPLES, AVIODANCE AND MITGATION MEASURES**

RELEVANT INFORMATION	ASSESSMENT OF POTENTIAL IMPACTS	PROPOSED MITIGATION MEASURES	ASSESSMENT OF VARIANCE WITH CLEARING PRINCIPLE
<b>A. NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT COMPRISES A HIGH LEVEL OF BIOLOGICAL DIVERSITY</b>			
<p>The Purpose Permit Area does not lie within any ESAs, TEC’s or PEC’s that are considered to represent a high level of biodiversity.</p> <p>General vegetation types recorded within the Purpose Permit Area have not been described as highly diverse. None of the communities described were identified as being of conservation significance.</p> <p>The riparian vegetation communities (<i>EcAcEa</i> and <i>EvAmTI</i> and <i>ExpITH</i>) were described as having a greater species diversity than the vegetation recorded in the surrounding landscapes and is likely a result of their association with the Weeli Wolli Creek system.</p> <p>The <i>EcAcE</i> vegetation type was also deemed representative of the <i>EvAcTs</i> vegetation community, that has been mapped within the Proposed Permit Area. Approximately 0.33 ha of this vegetation type is proposed to be disturbed as part of this Application, predominately to construct the haul road creek crossing.</p> <p>All vegetation types, including the riparian vegetation, are considered to extend well beyond the boundaries of the Purpose Permit Area and are known to be well represented within the region.</p> <p>The Indicative Haul Road Alignment predominately utilises the most common vegetation types, <i>ElAaTb</i> and <i>ElAsppTw</i>, representing 20% and 73% of the mapped extent.</p> <p>Two of the least common vegetation types, <i>EsppAmTa</i> and <i>AaAtTp</i> are outside the Indicative Haul Road Alignment and are unlikely to be impacted by the Project. The other least common vegetation type, riparian <i>EvAcTs</i>, will be disturbed (~0.33 ha, 7% of mapped extent). Disturbance to this vegetation community was unavoidable as it is associated with the Weeli Wolli Creek that intersects the entire Proposed Permit Area and extends the length between the BWT NNME (east) and NMM (West) deposits.</p>	<p>The clearing proposed within this Application will require the removal of up to 25 ha of native vegetation which will result in minor loss of native vegetation within the Purpose Permit Area, being approximately 25% of the mapped extent during the recent 2021 survey.</p> <p>Only 7% (0.33 ha) of the riparian vegetation, <i>EvAcTs</i> is proposed to be disturbed during the Project. The remaining 93% of the community within the Proposed Permit Area will be undisturbed, as well as the extensions of this community that is considered highly likely to occur more locally up and down stream along the Weeli Wolli Creek system.</p> <p>The Indicative Haul Road Alignment limits clearing of less common vegetation types, where possible. This includes the avoidance of two of the least common types, <i>EsppAmTa</i> and <i>AaAtTp</i>, and minimises disturbance to riparian <i>EvAcTs</i> to only 7% of the mapped extent within the Proposed Permit Area.</p> <p>Given the low clearing requirements for the Application, and vegetation within the Proposed Permit Area does not represent a high level of biodiversity, this Application is not considered to impact on the overall biodiversity of the Proposed Permit Area.</p>	<ul style="list-style-type: none"> <li>All clearing activities will be managed in accordance with the MRL Site Disturbance Permit System (ENV-EN-PRO-0005).</li> <li>Clearing within riparian vegetation types will be minimised as much as possible (i.e. locating all non-essential road infrastructure such as topsoil, subsoil or vegetation stockpiles, in more common vegetation types).</li> <li>The final haul road alignment will be designed to minimise clearing of native vegetation as much as practicable (i.e. utilise previously cleared or degraded areas, if possible).</li> <li>Clearing boundaries will be flagged/demarcated in the field and spotters used when clearing in proximity to the boundary of the Proposed Permit Area to ensure clearing remains within approved areas, particularly when in proximity to riparian vegetation.</li> <li>Cleared areas are to be progressively rehabilitated, when they are no longer required (i.e. during operation of the haul road).</li> </ul>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle A.</p>
<b>B. NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT COMPRISES THE WHOLE, OR PART OF, OR IS NECESSARY FOR THE MAINTENANCE OF, A SIGNIFICANT HABITAT FOR FAUNA INDIGENOUS TO WA</b>			
<p>Five broad habitats were described in the Proposed Permit Area.</p> <p>The Creek Line habitat was found to provide potential foraging habitat for the Northern Quoll, Pilbara Leaf – Nosed Bat and Ghost Bat. The Woodland habitat is potentially suitable for bats, some of which may be of conservation significance and the Open Woodland over Shrubland habitat may be suitable for the Western Pebble-mound Mouse and the Northern Quoll.</p> <p>Despite the potential for suitable habitat, no evidence of these significant fauna was recorded during the site survey.</p> <p>None of the fauna habitats described are considered significant to these significant species, or any other native fauna known to occur in the Proposed Permit Area.</p>	<p>None of the habitats described within the Proposed Permit Area are considered significant habitat for any native significant fauna.</p> <p>All habitats were considered representative of those in the surrounding region and are broadly distributed throughout the Pilbara and are unlikely to be significantly impacted by the clearing activities proposed in this Application.</p>	<ul style="list-style-type: none"> <li>All clearing activities will be managed in accordance with the MRL Site Disturbance Permit System (ENV-EN-PRO-0005).</li> <li>The final haul road alignment will be designed to minimise clearing of native vegetation as much as practicable (i.e. utilise previously cleared or degraded areas, where possible).</li> <li>Fauna refuges such as large trees and tree hollows, will be pushed to the side of cleared areas and retained where practicable. These can provide ongoing refuge for fauna during construction and operation and help re-establish habitat during rehabilitation.</li> <li>Cleared areas will be rehabilitated if not required during operation of the haul road (i.e. lay down areas).</li> </ul>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle B.</p>

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RELEVANT INFORMATION	ASSESSMENT OF POTENTIAL IMPACTS	PROPOSED MITIGATION MEASURES	ASSESSMENT OF VARIANCE WITH CLEARING PRINCIPLE
<p><b>C. NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT INCLUDES, OR IS NECESSARY FOR THE CONTINUED EXISTENCE OF, RARE FLORA</b></p>			
<p>No Declared Rare or Threatened flora species have been recorded within the Proposed Permit Area.</p> <p>One Priority flora species have been recorded within the Proposed Permit Area. The P2 <i>Aristida lazardis</i> was recorded to the south of the Indicative Haul Road Alignment, as shown on Figure 4-7. The species was recorded along the creek line of the Weeli Wollie Creek and it's possible it may extend further along the creek. At least 22 other records of the species exist at other sites in the Pilbara.</p> <p>A total of 26 other significant species were identified as having the potential to occur in the Proposed Permit Area but were not recorded during the field surveys.</p>	<p>No Declared Rare or Threatened flora will be impacted by the clearing activities within this Application.</p> <p>One P2 species, <i>Aristida lazardis</i> was recorded within the Proposed Permit Area and may occur further along the creek line. However, the habitat in which it occurs extends well beyond the Proposed Permit Area and is not considered restricted to the Project area.</p> <p>It is therefore unlikely the Project will result in significant impacts to the <i>Aristida lazardis</i> (P2) species or its local population.</p>	<ul style="list-style-type: none"> <li>All clearing activities will be managed in accordance with the MRL Site Disturbance Permit System (ENV-EN-PRO-0005).</li> <li>A Flora Register will be maintained for the Proposed Permit Area.</li> <li>Disturbance to <i>Aristida lazardis</i> individuals will be avoided, wherever possible.</li> <li>Disturbance to the creek line / riparian vegetation (<i>EvAcTs</i>) will be minimised where possible (i.e. locating all non-essential road infrastructure such as topsoil, subsoil or vegetation stockpiles, in more common vegetation types).</li> </ul>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle C.</p>
<p><b>D. NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT COMPRISES THE WHOLE OR PART OF, OR IS NECESSARY FOR THE MAINTENANCE OF, A THREATENED ECOLOGICAL COMMUNITY</b></p>			
<p>No TECs or PECs have been recorded within the Proposed Permit Area.</p>	<p>No TECs occur within the Proposed Permit Area and therefore will not be impacted by the clearing activities within this Application.</p>	<ul style="list-style-type: none"> <li>All clearing activities will be managed in accordance with the MRL Site Disturbance Permit System (ENV-EN-PRO-0005).</li> </ul>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle D.</p>
<p><b>E. NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT IS SIGNIFICANT AS A REMNANT OF NATIVE VEGETATION IN AN AREA THAT HAS BEEN EXTENSIVELY CLEARED</b></p>			
<p>The entire Proposed Permit Area is considered remnant, and ranges from Poor to Excellent condition, with more than 97% of the surveyed area considered either Very Good or Excellent.</p> <p>Minimal clearing has occurred in the Proposed Permit Area, with that being limited to light vehicle disturbance and livestock tracks.</p> <p>The Proposed Permit Area has not been extensively cleared. The main disturbances surrounding the Proposed Permit Area are related to implementation of the approved WIOP.</p>	<p>The clearing activities proposed within this Application will impact up to 25 ha, being 25% of the surveyed area.</p> <p>The general overall condition of the vegetation within the Proposed Permit Area is considered Very Good to Excellent and remains uncleared. The same can be expected of most of the vegetation surrounding the Proposed Permit Area, as there is no other developments in close proximity, other than the WIOP.</p> <p>Overall, the area has not been extensively cleared and the Proposed Permit Area is not considered to be a significant remnant of native vegetation.</p>	<ul style="list-style-type: none"> <li>All clearing activities will be managed in accordance with the MRL Site Disturbance Permit System (ENV-EN-PRO-0005).</li> <li>Final haul road alignment will be designed to minimise clearing of native vegetation as much as practicable (i.e. utilise previously cleared or degraded areas, where possible).</li> <li>Cleared areas are to be rehabilitated once they are no longer required for the operation of the haul road.</li> </ul>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle E.</p>
<p><b>F. NATIVE VEGETATION SHOULD NOT BE CLEARED IF IT IS GROWING IN, OR IN ASSOCIATION WITH, AN ENVIRONMENT ASSOCIATED WITH A WATERCOURSE OR WETLAND</b></p>			
<p>No Ramsar Wetlands, Nationally Important Wetlands or DBCA managed waters occur within the Proposed Permit Area.</p> <p>The Proposed Permit Area is located within a proclaimed surface water area in accordance with the DWER Pilbara Regional Water Plan. The surface water management area is the Upper Fortescue, with the Fortescue Marsh as a Sub-area in the Fortescue Marsh resource.</p> <p>The Weeli Wollie Creek intersects the Proposed Permit Area in one location. It is an ephemeral creek, with flows directly related to intense rainfall events and often associated with cyclonic activity or localised thunderstorms. Water quality within flows, when present, is known to be of good quality and support aquatic fauna.</p>	<p>The Application will require the construction of a creek crossing at one location within the Proposed Permit Area. This is unavoidable, as the creek extends the entire length (south to south) of the Proposed Permit Area and beyond. This crossing replaces a previously approved crossing further north that was relocated due to TO engagement.</p> <p>The clearing activities proposed within this Application may result in temporary impacts to the natural flow regime and water quality within the Weeli Wollie Creek. These impacts are only expected to occur during construction activities (less than six months period).</p> <p>Through implementation of the proposed mitigation measures, including designing suitable drainage infrastructure at creek crossings, any potential impacts to the creek and associated riparian vegetation or aquatic faunal</p>	<ul style="list-style-type: none"> <li>All clearing activities will be managed in accordance with the MRL Site Disturbance Permit System (ENV-EN-PRO-0005).</li> <li>Minimise clearing to riparian vegetation types, wherever possible.</li> <li>Implement Surface Water Management Procedures (MRL-EN-PRO-0003).</li> <li>Flood modelling will be reviewed to inform final road design to minimise potential for significant alterations in hydrological flow (i.e. culverts and drains).</li> <li>Clearing, movement and disturbance around creek lines and pooled water will be limited where possible to minimise disruption to the natural hydrological regimes.</li> <li>Conduct clearing and construction activities during the dry season, where possible, particularly within riparian vegetation. Where that is not possible, avoid clearing activities and constructions earthworks during periods of short-duration and high-</li> </ul>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle F.</p>

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RELEVANT INFORMATION	ASSESSMENT OF POTENTIAL IMPACTS	PROPOSED MITIGATION MEASURES	ASSESSMENT OF VARIANCE WITH CLEARING PRINCIPLE
<p>Three riparian vegetation types are associated with the local Weeli Wolli Creek system. Although the riparian communities were described as having a greater species diversity than those around them, all communities were representative of those recorded during previous surveys at the WIOP area and considered to extend up and downstream along the Weeli Wolli Creek.</p> <p>At least one of these vegetation types were located within the Proposed Permit Area, <i>EcAcE / EvAcTs</i> vegetation type. This community is known to occur in other areas within the WIOP area and likely to continue up and down the Weeli Wolli Creek system.</p> <p>The Indicative Haul Road Alignment predominately utilises the most common non-riparian vegetation types, <i>EIAaTb</i> and <i>EIAsspTw</i>, wherever possible to minimise impacts to riparian vegetation and interactions with the Creek system. No more than 7% of <i>EvAcTs</i> community (as mapped within the Proposed Permit Area) will be disturbed as part of this Application. Disturbance to the <i>EvAcTs</i> riparian community and Weeli Wolli Creek was unavoidable, as it intersects the entire length (north to south) of the Proposed Permit Area, as well as the length between the BWT NMM (east) and NMM (West) deposits, in which the haul road seeks to connect.</p> <p>The main threat to riparian vegetation within the Proposed Permit Area was considered the prevalence of introduced species.</p>	<p>community are considered minimal and short-term. Natural hydrological regimes are expected to return to pre-existing conditions once the road has been constructed.</p> <p>The natural hydrological regime of the Weeli Wolli Creek system is unlikely to be significantly impacted by the Application.</p> <p>Some riparian vegetation will be removed in order to construct the haul road creek crossing, however, clearing of this vegetation will be kept to a minimum. Overall disturbance is proposed to be approximately 7% of the mapped extent within the Proposed Permit Area, but this vegetation community is known to occur more broadly within other riparian zones as part of the Weeli Wolli Creek system. Therefore, overall impacts to this community are not expected to be significant.</p>	<p>intensity rainfall (i.e. cyclones) to minimise short-term impacts to water quality and sheet flow.</p> <ul style="list-style-type: none"> <li>• During road construction, consider additional temporary stabilisation measures, if necessary to prevent significant erosion of cleared areas (i.e. during forecasted heavy rainfall events).</li> <li>• Install erosion control measures around vegetation and topsoil stockpiles, to prevent the loss and erosion of stockpiled material, and potential sedimentation of drainage lines.</li> <li>• Conduct regular site inspections during construction, and following high-intensity, short-duration rainfall events during operation and apply adaptive erosion or water management controls, if required (i.e. maintenance or repairs to road construction or surface water infrastructure).</li> <li>• Continue to implement the surface water monitoring program (as part of the AWT Project) to monitor the Weeli Wolli Creek surface water quality and quantity.</li> <li>• Implement a Weed Control Program conducted annually to control the presence of introduced flora (weed) species within riparian communities.</li> <li>• Cleared areas are to be rehabilitated once not required for the operation of the haul road.</li> </ul>	
<p><b>G. NATIVE VEGETATION SHOULD NOT BE CLEARED IF THE CLEARING OF THE VEGETATION IS LIKELY TO CAUSE APPRECIABLE LAND DEGRADATION</b></p>			
<p>The majority of the Proposed Permit Area was observed to be Poor to Excellent condition with the majority (&gt;97%) in Very Good to Excellent condition.</p> <p>Contributing factors to Poor areas was based on the presence of weeds, vehicle tracks and livestock tracks.</p> <p>Soil assessments indicate soils within the Proposed Permit Area are generally suitable for road construction and may require some further assessment if required for rock armouring purposes. However, significant erosion of road surfaces is not expected.</p> <p>Flood modelling conducted for the AWT Project identified the construction of the original AWT east-west haul road was unlikely to impact on the natural flow regime of the Weeli Wolli Creek, provided the proposed mitigation measures were implemented. The activities as part of this Application will utilise similar management measures.</p>	<p>The Proposed Permit Area is surrounded by large amounts of continuous areas of undisturbed native vegetation.</p> <p>A weed control program will be implemented in order to manage and control the existing populations of introduced flora within the Proposed Permit Area.</p> <p>Based on the outcomes of flood modelling conducted for the AWT Project, the natural flow regime of the Weeli Wolli Creek is not expected to be impacted by the Application.</p> <p>Whilst minor, local soil erosion may occur during clearing and construction activities, however, the use of erosion prevention controls, surface water management and progressive rehabilitation of cleared lands further reduces this risk.</p> <p>Through the implementation of proposed mitigation measures, and the retention of natural flow regimes, the potential for significant land degradation is considered low.</p>	<p><i>Proposed measures are as per Principle F.</i></p>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle G.</p>
<p><b>H. NATIVE VEGETATION SHOULD NOT BE CLEARED IF THE CLEARING OF THE VEGETATION IS LIKELY TO HAVE AN IMPACT ON THE ENVIRONMENTAL VALUES OF ANY ADJACENT OR NEARBY CONSERVATION AREA</b></p>			

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RELEVANT INFORMATION	ASSESSMENT OF POTENTIAL IMPACTS	PROPOSED MITIGATION MEASURES	ASSESSMENT OF VARIANCE WITH CLEARING PRINCIPLE
<p>The Proposed Permit Area is not located within any known conservation areas, Conservation or National Parks and Reserves, Ramsar Wetlands, Nationally Important Wetlands or other DBCA managed waters or land.</p> <p>The closest PEC area is the Weeli Wolli Spring Community PEC (P1), located approximately 7 km to the north-east.</p> <p>The Fortescue Marsh (P1), is located approximately 80 km to the north of the Proposed Permit Area.</p> <p>The Karijini National Park is located approximately 43 km to the west of the Proposed Permit Area.</p>	<p>Given the distance of the Proposed Permit Area to the nearest conservation areas, the clearing activities within this Application are not considered to impact on the environmental values of any conservation or environmentally significant areas.</p>	<p>None required.</p>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle H.</p>
<p><b>I. NATIVE VEGETATION SHOULD NOT BE CLEARED IF THE CLEARING IS LIKELY TO CAUSE DETERIORATION IN THE QUALITY OF SURFACE OR UNDERGROUND WATER</b></p>			
<p>A tributary of the Weeli Wolli Creek intersects the Proposed Permit Area in one location. It is an ephemeral creek, with flows directly related to intense rainfall events and often associated with cyclonic activity or localised thunderstorms. Water quality within flows when present is known to be of good quality and support an aquatic faunal community and riparian vegetation.</p> <p>Groundwater below the Weeli Wolli Creek has been reported at approximately 32 mBGL. Groundwater and surface water systems are not considered in direct hydraulic connection with each other. Therefore, any potential impacts to the Weeli Wolli Creek system will not impact on underlying groundwater.</p> <p>The activities associated with the construction of haul road has the potential to cause flooding, potentially resulting in the trapping and concentration of surface water flows. Through specific management and mitigation controls, however, the natural flow regime of the Weeli Wolli Creek will be maintained.</p>	<p>The clearing activities proposed within this Application may result in temporary impacts to the natural flow regime of the Weeli Wolli Creek and create minor levels of soil erosion which could adversely impact on the water quality within the creek system. These impacts are only expected to occur during construction activities (less than six months period).</p> <p>Through implementation of the proposed mitigation measures, including designing suitable drainage infrastructure at creek crossings (i.e. rock drains, culverts and pipelines), erosion control measures around stockpiled material and avoiding clearing during heavy rainfall events, any potential impacts to the creek are considered to be short-term and water quality within the Weeli Wolli Creek system is unlikely to be significantly impacted.</p> <p>Other potential impacts to surface quality may result from minor hydrocarbon spills, which may occur as a result of leaks from vehicles and machinery during clearing or construction activities or due to storage of minor volumes within laydown areas. Any potential contamination observed will be removed and remediated from the Proposed Permit Area to prevent any significant impacts to the water quality of the Weeli Wolli Creek system.</p> <p>In regard to groundwater quality, the clearing proposed under this Application is for the purposes of haul road construction above ground and does not require any below-ground activities. Due to the depth of groundwater expected below the site and the lack of interaction between surface water and groundwater, the surface activities proposed within this Application are not considered to impact on groundwater.</p> <p>Any groundwater abstracted for use in road construction and dust suppression for the activities within this Application is managed separately under the existing groundwater licences and GWOS issued for the AWT Project and regulated by the DWER.</p>	<ul style="list-style-type: none"> <li>• Refer to Proposed measures are as per <i>Principle F</i>.</li> <li>• Continue to implement the surface water monitoring program (as part of the AWT Project) to monitor the Weeli Wolli Creek surface water quality and quantity.</li> <li>• All waste to be removed from the Proposed Permit Area and disposed of at the existing AWT Wonmunna Mine or offsite.</li> <li>• No storage of hydrocarbons and chemicals within the Proposed Permit Area.</li> <li>• No refuelling, maintenance or washing of vehicles within the Proposed Permit Area.</li> <li>• All equipment, vehicles and machinery to be regularly inspected and serviced (at WIOP area) to reduce potential for accidental leaks and spills.</li> <li>• Equipment and machinery to be equipped with spill response kits.</li> <li>• All spills to be managed in accordance with the Chemical Management Procedure (MRL-HS-PRO-0009), including containment, removal and disposal offsite.</li> <li>• Training in the handling of hydrocarbons, chemicals and waste management, as well as emergency spill response to be undertaken by all employees during site inductions.</li> <li>• Implement a surface water monitoring program to identify any significant reduction in water quality as a result of activities conducted within this Application, as part of existing WIOP monitoring programs.</li> <li>• Groundwater abstracted for use in road construction and clearing activities will be managed separately by the AWT project, in accordance with their existing 5C Licences and GWOS.</li> </ul>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle I.</p>
<p><b>J. NATIVE VEGETATION SHOULD NOT BE CLEARED IF THE CLEARING IS LIKELY TO CAUSE, OR EXACERBATE, THE INCIDENCE OR INTENSITY OF FLOODING</b></p>			

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RELEVANT INFORMATION	ASSESSMENT OF POTENTIAL IMPACTS	PROPOSED MITIGATION MEASURES	ASSESSMENT OF VARIANCE WITH CLEARING PRINCIPLE
<p>The climate of the region is semi-desert tropical, characterised by hot summers and cool winters. The average rainfall is approximately 300 millimetres per year, with the majority of rainfall received during the summer months as a result of tropical cycles. Flooding of the Weeli Wolli Creek, located within the Proposed Permit Area is common during short, intense seasonal rainfall events. Evaporation rates are significantly higher than annual rainfall.</p> <p>Flood modelling has been conducted for the AWT Project, with consideration of the existing topography and drainage lines and the proposed road design elements, such as drainage infrastructure at creek crossings. This information informed the development of a SWMP for the WIOP.</p> <p>Proposed management and mitigation controls incorporated into haul road design, will ensure the haul road crossing acts as a floodway, mimicking the natural flow patterns, and will therefore have minimal impact on the local flooding regime of the Weeli Wolli Creek.</p>	<p>The clearing proposed within this Application, together with the road design informed by AWT Project flood modelling and informed SWMP, will not result in the damming or retention of surface water within or surrounding the Proposed Permit Area.</p> <p>There may be minor changes to localised surface drainage through the clearing of vegetation, particularly during construction activities, however, there is not expected to be any significant or long-term impacts to the natural flooding regime of the Weeli Wolli Creek.</p> <p>The clearing proposed within this Application may cause localised, short-term disturbance but will not exacerbate the incidence or intensity of flooding.</p>	<p><i>Proposed measures are as per Principle F.</i></p>	<p>The proposed vegetation clearing is not expected to be at variance with Clearing Principle J.</p>

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## 8. SUMMARY AND CONCLUSIONS

Vegetation clearing detailed within this Application is required for the construction of the BWT Project's Southern Haul Road to allow access for mining fleet between the project's NNM (east) and NMM (West) deposits.

This Clearing Permit Application seeks approval for clearing of up to 25 ha of native vegetation within a 195 ha Proposed Permit Area.

The assessment against the ten clearing principles described within *A Guide to the Assessment of Applications to Clear Native Vegetation* (DER, 2014) under Part V Division 2 of the EP Act was based on information derived from all relevant desktop information and detailed surveys conducted over the Proposed Permit Area. The recent flora, vegetation and riparian surveys, and terrestrial fauna & SRE assessments (Phoenix 2022a) were all used for vegetation and habitat mapping, disturbance calculations and assessments of risks to relevant environmental factors.

All vegetation described within the Proposed Permit Area is representative of the region and the small area of proposed clearing (25 ha) is unlikely to have a significant impact on environmental values of the region. There are no TECs, PECs, Threatened flora or fauna, or any habitat critical to the survival of any native fauna recorded within the Proposed Permit Area. One P2 flora (*Aristida Lazaridis*) and three riparian vegetation types have been recorded in the Proposed Permit Area. Both the P2 flora and the riparian vegetation types are expected to occur well beyond the extent of the Proposed Permit Area, along the associated Weeli Wollli Creek. Where possible, disturbance to this P2 species and riparian vegetation communities will be avoided and/or minimised as much as possible.

The activities proposed within this Application form an integral part of MRL's WIOP development in the vicinity of the Proposal Permit Area. Through the implementation of the management strategies to minimise the impact of land clearing the proposed clearing is not expected to be at variance with any of the ten clearing principles (Table 7-1).

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## 10. APPENDIX LIST

(All appendices provided as Attachment A)

**APPENDIX 1: WIOP WASTE CHARACTERISATION STUDY (LANDLOCH 2021B)**

**APPENDIX 2: WIOP SURFACE WATER MANAGEMENT PLAN (AQ2 2022B)**

**APPENDIX 3: WIOP BASELINE SOIL CHARACTERISATION SURVEY (LANDLOCH 2021A)**

**APPENDIX 4: MEMO: DESKTOP ASSESSMENT AND FIELD VALIDATION RECONNAISSANCE SURVEY FOR ADDITIONAL TENEMENT AT WIOP (PHOENIX 2022A)**

**APPENDIX 5: MEMO: WIOP RIPARIAN VEGETATION AND GROUNDWATER DEPENDENT VEGETATION SURVEY (PHOENIX 2022B)**

**APPENDIX 6: WIOP AQUATIC FAUNA ASSESSMENT (WRM 2022)**