

Metawandy AR-15- 13649C Native Vegetation Clearing Permit

Flora, Vegetation and Fauna Habitat Survey

11-May-2023
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Metawandy AR-15-13649C Native Vegetation Clearing Permit

Flora, Vegetation and Fauna Habitat Survey

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Prepared by Celia Mitchell

Reviewed by Floora de Wit

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Acronym	Description
AECOM	AECOM Australia Pty Ltd
ALA	Atlas of Living Australia
BC Act	Biodiversity Conservation Act
Biota	Biota Environmental Sciences
BOM	Bureau of Meteorology
CAR	Comprehensive, Adequate and Reserve System
Cons. Status	Conservation Status
DAWE	Department of Agricultural, Water and Environment
DBCAs	Department of Biodiversity Conservation and Attractions
DPaW	Department of Parks and Wildlife
DoEE	Department of Environment and Energy (now known as DAWE)
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act
ESA	Environmentally Sensitive Area
GPS	Global Positioning System
Ha	Hectares
IBRA	Interim Biogeographical Region of Australia
Km	Kilometres
M	Metres
NVCP	Native Vegetation Clearing Permit
NVIS	National Vegetation Information System
NHP	National Heritage Place
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
Rio Tinto	Rio Tinto Group
SRE	Short Range Endemics
sp.	Species
TEC	Threatened Ecological Community
WA	Western Australia
WAH	Western Australian Herbarium

Executive Summary

AECOM Australia Pty Ltd (AECOM) was engaged by Rio Tinto Iron Ore (Rio Tinto) to conduct vegetation, flora and fauna assessments for an area covering 74.8 ha at Metawandy. This survey will inform a native vegetation clearing permit application required for resource evaluation.

The survey was undertaken by two Rio Tinto botanists, one Rio Tinto field technician and one AECOM botanist. The scope of work included a reconnaissance flora and vegetation assessment and a fauna habitat assessment. The entire survey area was traversed on foot using a helicopter to gain access to the survey area.

A summary of the results is presented below:

- no TECs or PECs were anticipated to occur, and none were identified
- seven native vegetation communities were recorded, and their delineation was supported by comparing the floristic data
- Priority species identified and recorded throughout the survey area included:
 - three Priority 3 species *Indigofera rivularis*, *Sida* sp. Hamersley Range and *Triodia pisolitica*
 - one Priority 4 species *Ptilotus mollis*
- six broad fauna habitats were recorded. These habitats are considered suitable for two Threatened species, one Priority species and one Other Specially Protected Fauna Species. None of these significant fauna species are anticipated to rely on this habitat for their survival.

Rainfall was above average in the months leading up to the survey which was evident in the presence of flowering grasses and annual species during the survey. Despite this, two species lacked sufficient material for confident identification.

1.0 Introduction

1.1 Background

Rio Tinto is proposing to undertake geotechnical investigations for exploration at Metawandy. Vegetation clearing will be required to facilitate these activities. Approval for clearing of native vegetation is required by way of a Native Vegetation Clearing Permit (NVCP) under Section 51A of the Environmental Protection Act (EP Act).

Vegetation, flora and fauna habitat assessments were required to assess the environmental values of a defined survey area and use these results to address the 10 Clearing Principles as part of the NVCP application process.

1.2 Location

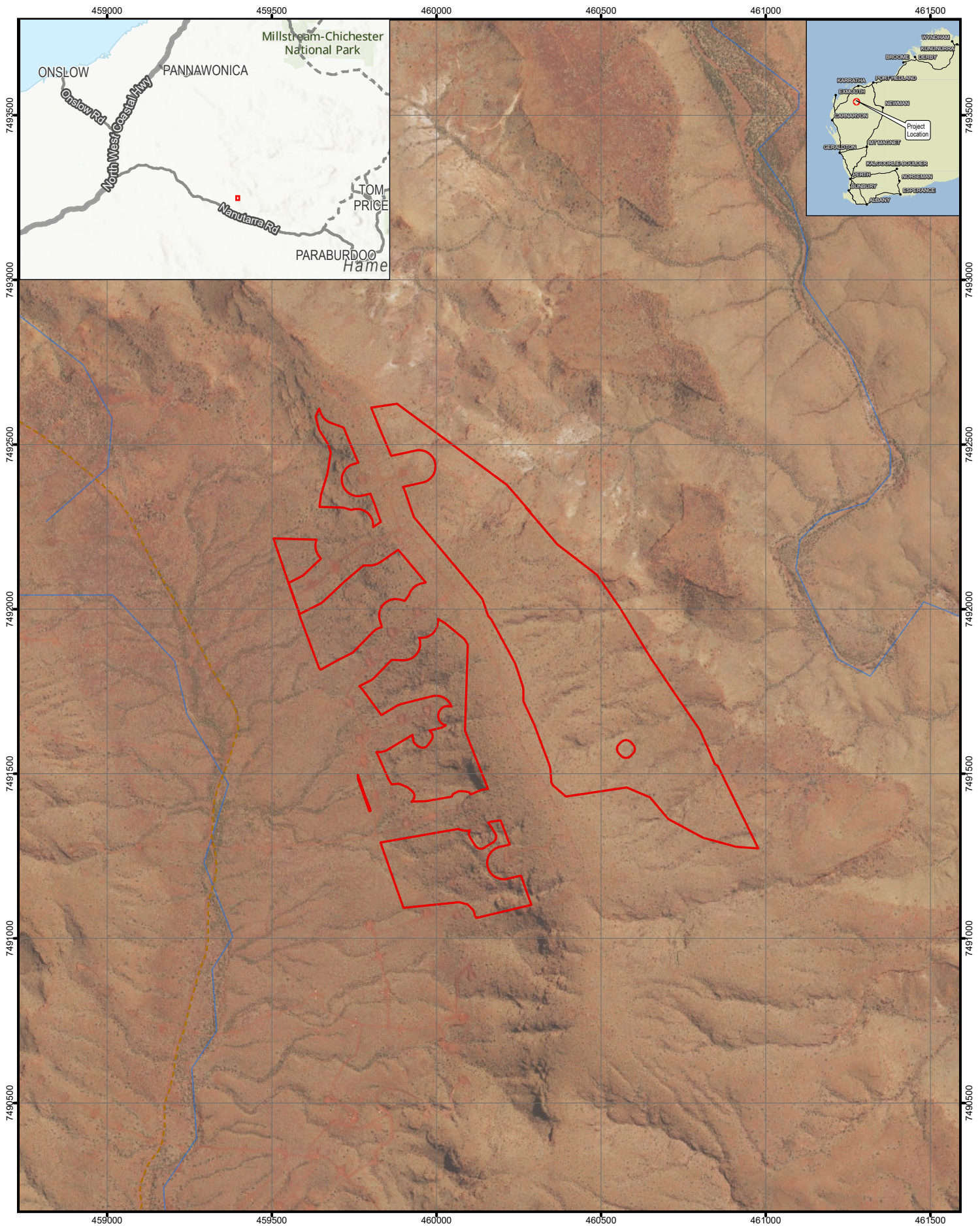
The Metawandy survey area is located 120 km west of Tom Price and 122 km north-west of Paraburdoo within the Pilbara region of Western Australia (Figure 1). The survey area covers 74.8 ha of undisturbed ground and intact native vegetation.

1.3 Objective and Scope

The objective of the work is to assess the ecological values of the defined survey area to support a NVCP application. This was achieved through the implementation of a flora, vegetation and fauna habitat assessment, specifically:

- a reconnaissance flora and vegetation assessment including targeted flora searches and relevés
- fauna habitat assessment
- one report incorporating desktop information and flora and fauna survey results.

Surveys were undertaken in accordance with relevant legislation and EPA guidelines (EPA 2016).



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LEGEND
▭ Survey area

Survey area

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Figure 1

2.0 Existing Environment

2.1 Climate

The survey area is located in the Shire of East Pilbara which experiences a semi-arid climate. The nearest weather station providing long term data is Paraburdoo Aero (station 7185), located 122 km southeast of the survey area. Climate data is presented in Figure 2. The Paraburdoo weather station recorded 308.8 mm of rainfall in the four months preceding the survey between the 1st of February to the 31st of May. This is higher than the long-term average rainfall for Feb-May of 169.7 mm. The higher rainfall was evident in the presence of flowering grasses and annual species during the survey. Very little rain occurred between July 2021 and January 2022, with some rain in January. Total annual rainfall in the 12 months preceding the survey was 319.2 mm, almost equal to the mean annual rainfall of 320.9 mm (BOM 2022).

Temperatures were not far from monthly averages, with milder conditions in March, April and May leading up to the survey.

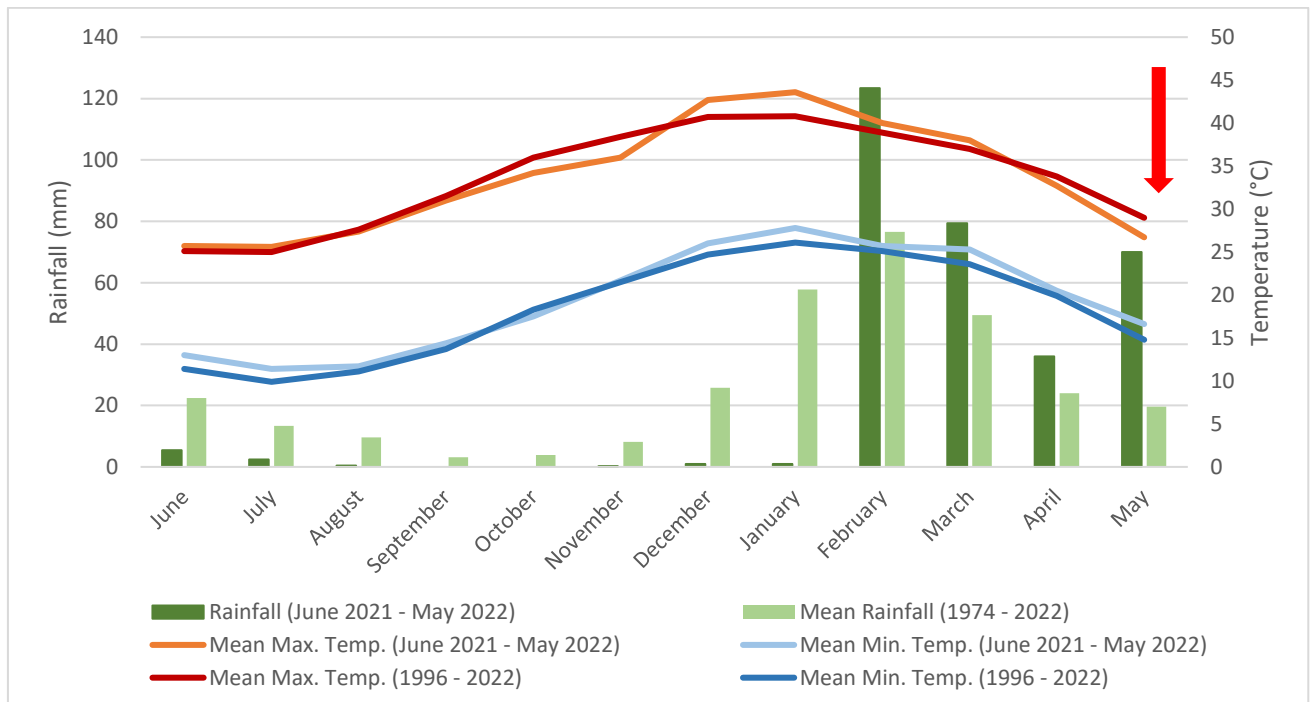


Figure 2 Rainfall Data from Paraburdoo Aero 007185 (BOM 2022). Red arrow indicates time of survey.

2.2 IBRA Region

There are 89 recognised IBRA regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (DoEE 2012; IBRA7). The Pilbara bioregion is further divided into four subregions, with the survey area located in the Hamersley subregion.

The Hamersley subregion, described by Kendrick (2001), is the southern section of the Pilbara Craton and consists of a mountainous area of Proterozoic sedimentary ranges and plateaux dissected by gorges. The vegetation consists of Mulga low woodland over bunch grasses on valley floors with *Eucalyptus leucophloia* over *Triodia* on skeletal soils of ranges. Rare features of the subregion include the Gorges of the Hamersley Range (particularly in Karijini National Park), Palm Spring and Duck Creek, *Themeda* grasslands of the Pilbara, and Red Hill Station Mulga stands in the extreme west of the subregion.

2.3 Land Systems

Two land systems have been mapped within the survey area (van Vreeswyk et al. 2004) (Figure 3):

- Platform System – dissected slopes and raised plains supporting shrubby hard spinifex grasslands
- Newman System – rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.

2.4 Geology and Soils

The survey area lies in the Fortescue Province which is described at a regional level by Tille (2006) as hills and ranges (with stony plains and some alluvial plains and sandplains) on the volcanic granitic and sedimentary rocks of the Pilbara Craton. Soils are stony with red loamy earths and red shallow loams with some red/brown non-cracking clays, red deep sandy duplexes and red deep sands (Tille 2006).

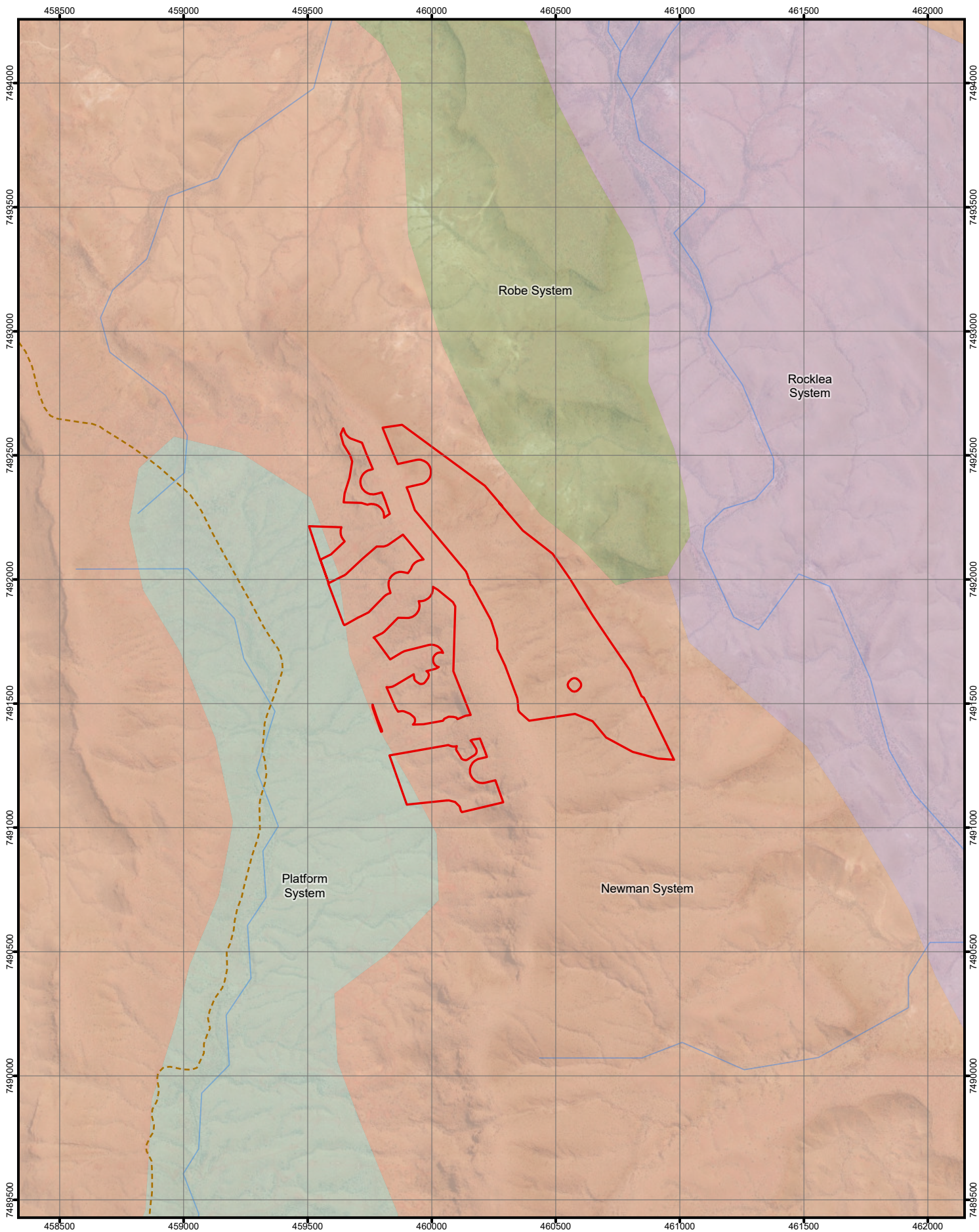
Two geological units and two artificial units intersect with the survey area (Table 1; Figure 4).

Table 1 Geological units that occur within the survey area (Geological Series WA 2001)

Unit Code	Geological Description
Lchk	Banded iron-formation, chert, mudstone and siltstone
Qrc	Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite

The survey area intersects with two soil types (Figure 4):

- 285Pl: stony soil
- 285Ne: stony soil.



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Land Systems

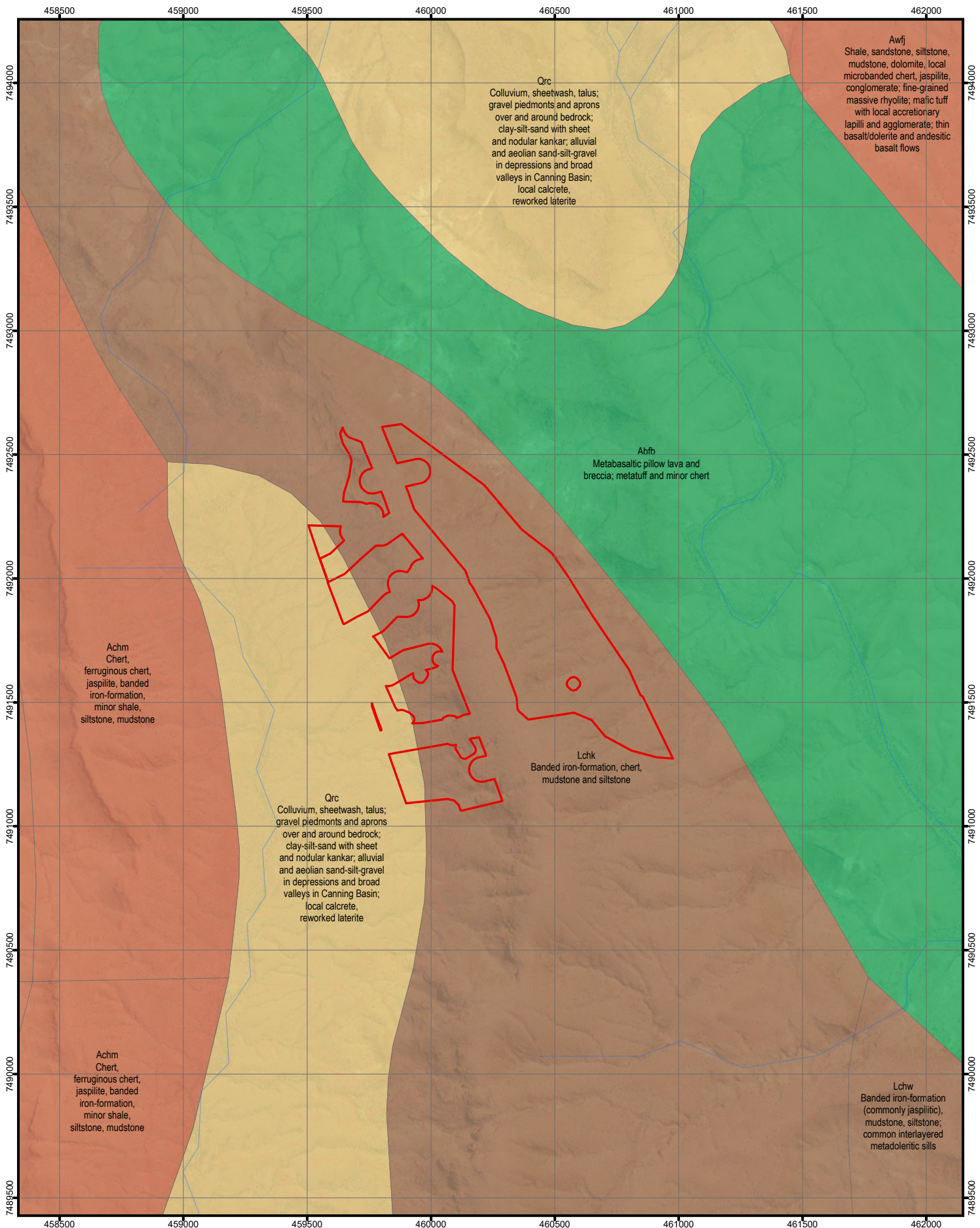
- Newman System
- Platform System
- Robe System
- Rocklea System
- Survey area

Land Systems

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Figure 3



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Survey area

Surface geology of Australia
 1:1,000,000 scale, Western Australia
 (Geoscience Australia)

QUATERNARY

Qrc

PALEOPROTEROZOIC

Lchk
 Lchw

ARCHEAN

Abfb
 Awfj
 Achm

Geology

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Figure 4

2.5 Vegetation

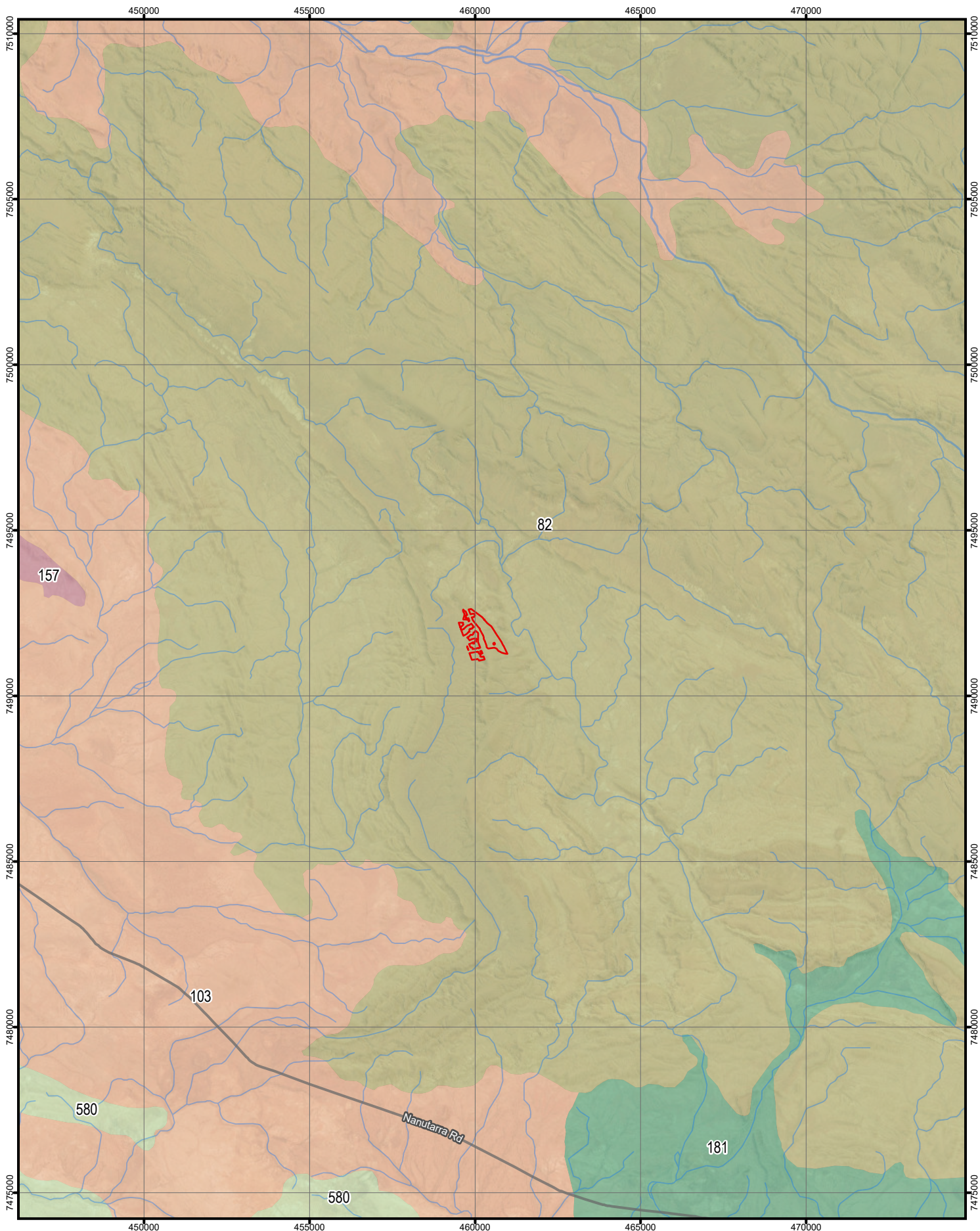
Vegetation mapping undertaken by Beard (1975) was used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent (Table 2; Figure 5). There is one pre-European vegetation association within the survey area, which has more than 99% of pre-European native vegetation remaining.

Table 2 Pre-European vegetation associations (Beard 1975) extent within the survey area (rounded to whole number) including percentage of pre-European extent remaining (Govt. of WA 2018)

Association Description		State	Pilbara IBRA Region	Shire of East Pilbara
82 Hummock grasslands, low tree steppe; snappy gum over <i>Triodia wiseana</i>	Pre-European Extent	2,565,901 ha	2,563,583 ha	927,710 ha
	Current Extent	2,553,206 ha	2,550,888	919,072 ha
	% Remaining	99.51 %	99.50%	99.07%
	Within Survey Area	1.76 ha		

2.6 Conservation Reserves and Environmentally Sensitive Areas

No Threatened Ecological Communities (TEC) have been recorded in the survey area. The survey area is 52 km northwest of Woongara Gorge, listed on the Register of National Estate. One Priority Ecological Community (PEC) is known to occur 25 km north of the survey area, namely, '*Triodia pisoliticola* (previously *Triodia* sp. Robe River) assemblages of mesas of the West Pilbara'. This information is mapped on Figure 6.



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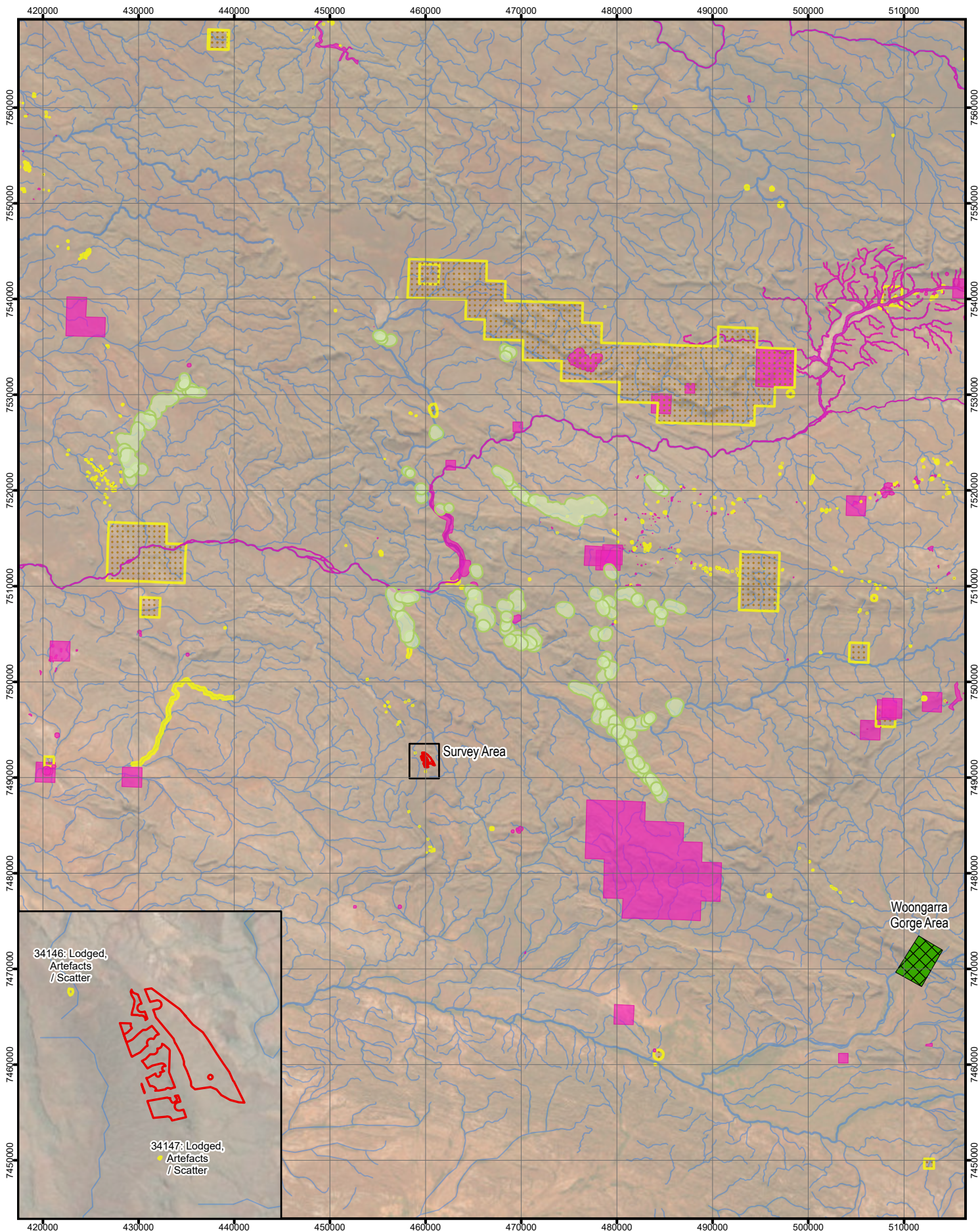
- ▭ Survey area
- ▭ 82: Hummock grassland with scattered bloodwoods snappy gum *Triodia* spp., *Corymbia dichromophloia*, *Eucalyptus leucophloia*
- ▭ 103: Hummock grassland with scattered shrubs or mallee *Triodia* spp. *Acacia* spp., *Grevillea* spp. *Eucalyptus* spp.
- ▭ 157: Hummock grassland *Triodia* spp.
- ▭ 181: Wattle, teatree and other species *Acacia* spp. *Melaleuca* spp.
- ▭ 580: Scrub or very open scrub / Grass-steppe

Pre-European Vegetation

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Figure 5



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- Survey area
- Aboriginal Heritage Places (DPLH-001)
- Registered Site
- Lodged
- Clearing Regulations - Environmentally Sensitive Areas (DWER-046)
- Woongarra Gorge Area
- PEC/TEC
- Triodia pisoliticola* (previously *Triodia* sp. Robe River) assemblages of mesas of the West Pilbara P3

Heritage and Conservation Estates

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Figure 6

3.0 Previous Surveys

Two ecological surveys have been undertaken that are directly relevant to this Project (Table 3). The most significant findings were the four Priority flora recorded in the Rio Tinto (2017) survey. This survey overlaps with the current survey area.

Table 3 Previous Surveys conducted in the vicinity of the survey area

Author	Title and Short Description	Significant Findings
Rio Tinto 2014	Flora and Vegetation Survey at Metawandy and Duck Creek. NVCP level survey.	Vegetation: no TECs or PECs, three vegetation units deemed to be of moderate significance. Flora: five Priority flora recorded. Fauna: no significant habitat.
Rio Tinto 2017	Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086. Targeted survey by Scott Reiffer and Hayden Ajduk in the vicinity of this survey area.	Vegetation: none detected. Flora: four Priority flora recorded. Fauna: no significant habitat.

4.0 Methodology

4.1 Desktop Assessment

A desktop assessment was undertaken to identify significant environmental values that are likely to be present in the survey area including flora, fauna and vegetation communities. Desktop database searches were requested from the following government databases:

- Department of Biodiversity Conservation and Attractions (DBCA) Threatened Species and Communities database including Threatened and Priority flora, fauna and communities with a 50 km buffer
- Western Australian Herbarium (WAH) records
- Protected Matters Search Tool (PMST) with a 50 km buffer (DAWE 2022)
- Atlas of Living Australia (AoLA 2022)
- Rio Tinto Flora and Fauna Database.

Significant flora species likelihood of occurrence was assessed systematically using a point-based system (Table 4). The assessment takes into account proximity of records, date of record, and habitat presence. For the purpose of this assessment flora records are considered to occur locally if they are within 5 km, known regionally if they are within 20 km, and considered a recent record if the record is less than 20 years old. The likelihood of significant ecological communities occurring depends on the presence of suitable landforms, land systems, known occurrences and distance of known occurrences.

The fauna assessment used a similar approach however proximity of records was broadened to 20 km to account for the mobility of fauna species (Table 5). For the purpose of this assessment, a species known in the region is defined as occurring within 25 km from the survey area and a recent record refers to less than 20 years old.

Table 4 Categories of likelihood of occurrence for flora species and communities

Likelihood of Occurrence	Score	Definition
Known	6	Species is known to occur in the survey area.
High (Likely)	4, 5	Suitable habitat present AND recent record in local area or region.
Moderate (Possible)	3, 4	Suitable habitat is present with known records in region (not recent), OR Habitat marginal with recent record in local area or region.
Low (Unlikely)	2, 3	Species is known from region, no recent records, and marginal habitat. OR Recent records, species is not known from region, habitat marginal.
Negligible (Suitable Habitat not Present)	0, 1, 2, 3	Habitat in survey area not suitable.

Table 5 Categories of likelihood of occurrence for fauna species

Likelihood of Occurrence	Score	Definition
Known	5	Species is known to occur in the survey area.
High (Likely)	4	Recent records in region and suitable habitat is present.
Moderate (Possible)	3	Known from recent records in region with habitat somewhat suitable (marginal). OR Known from region, no recent records, habitat suitable. OR Recent records, no records in region, habitat suitable.
Low (Unlikely)	2	Know from region, no recent records, habitat marginal. OR Recent records, not know from region, habitat marginal.
Negligible	0, 1, 2	Habitat in survey area not suitable.

4.2 Flora and Vegetation Assessment

A reconnaissance flora and vegetation assessment was undertaken utilising methods outlined in the EPA (2016) Flora Survey Technical Guide. The field survey was undertaken by Celia Mitchell (collection permit FB62000077-2), Julijanna Hantzis (collection permit FB62000132-1b), Hayden Ajduk (collection permit FB620000910), and assisted by Bianca Connop. Hayden has more than 10 years' experience, Julijanna has more than 4 years' experience and Celia has more than 3 years' experience undertaking field surveys in the Pilbara.

The field survey was undertaken on 1 June 2022. Floristic data was collected from relevés including the presence of plant species, their cover abundance, structural composition of vegetation, physical environment, and presence/absence of disturbance. Each site was given a unique site number, and the following parameters recorded:

- date
- location using hand-held GPS (UTM - accuracy of 5 m)
- sample site type and size
- photograph (northwest corner)
- soil details (type, colour, moisture)
- landform
- vegetation condition using the Trudgen (1988) scale and description of disturbance
- fire history
- species list
 - estimated height
 - estimated percentage cover.

4.2.1 Mapping

Vegetation communities were described and mapped based on changes in dominant species composition and landform, supported by existing mapping from previous surveys. Vegetation community descriptions were based on the National Vegetation Information System (NVIS) framework (DotEE 2018).

Vegetation condition was mapped using the Trudgen (1988) condition scale, including excellent, very good, good, poor, degraded and completely degraded.

4.2.2 Targeted Flora Searches

Targeted searches were undertaken for conservation significant flora species considered likely to occur. This was informed by the desktop assessment and included:

- *Eremophila magnifica* subsp. *magnifica* (P4)
- *Eremophila magnifica* subsp. *velutina* (P3)
- *Indigofera rivularis* (P3)
- *Ptilotus mollis* (P4)
- *Sida* sp. Hamersley Range (K. Newbey 10692) (P3)
- *Triodia pisolitica* (P3).

Prior to commencing the field survey, all species identified as likely and known to occur were reviewed and field guide booklets made. This included photographs, habitat, and identification details of plant, flower and/or fruit.

Significant flora species were marked using a hand-held GPS with a collection made in representative habitats. Individuals were photographed and counted where the location represented more than one individual. Samples were submitted to taxonomist Steve Dillon for formal identification at the WA Herbarium.

4.3 Fauna Habitat Assessment

A fauna habitat survey was undertaken simultaneously with the flora and vegetation survey. A fauna habitat assessment was completed within each of the defined fauna habitats as informed by on-ground observations and vegetation community mapping. The parameters for assessing fauna habitats include defining the structure, complexity and continuity of the habitat present, and documenting the presence and abundance of habitat features (caves, large mature trees, dense vegetation, rocky hills, open plains, incised creeklines).

The assessment focused on confirming habitat suitability for conservation significant fauna species identified during the desktop assessment, predominantly cave systems and significant landforms.

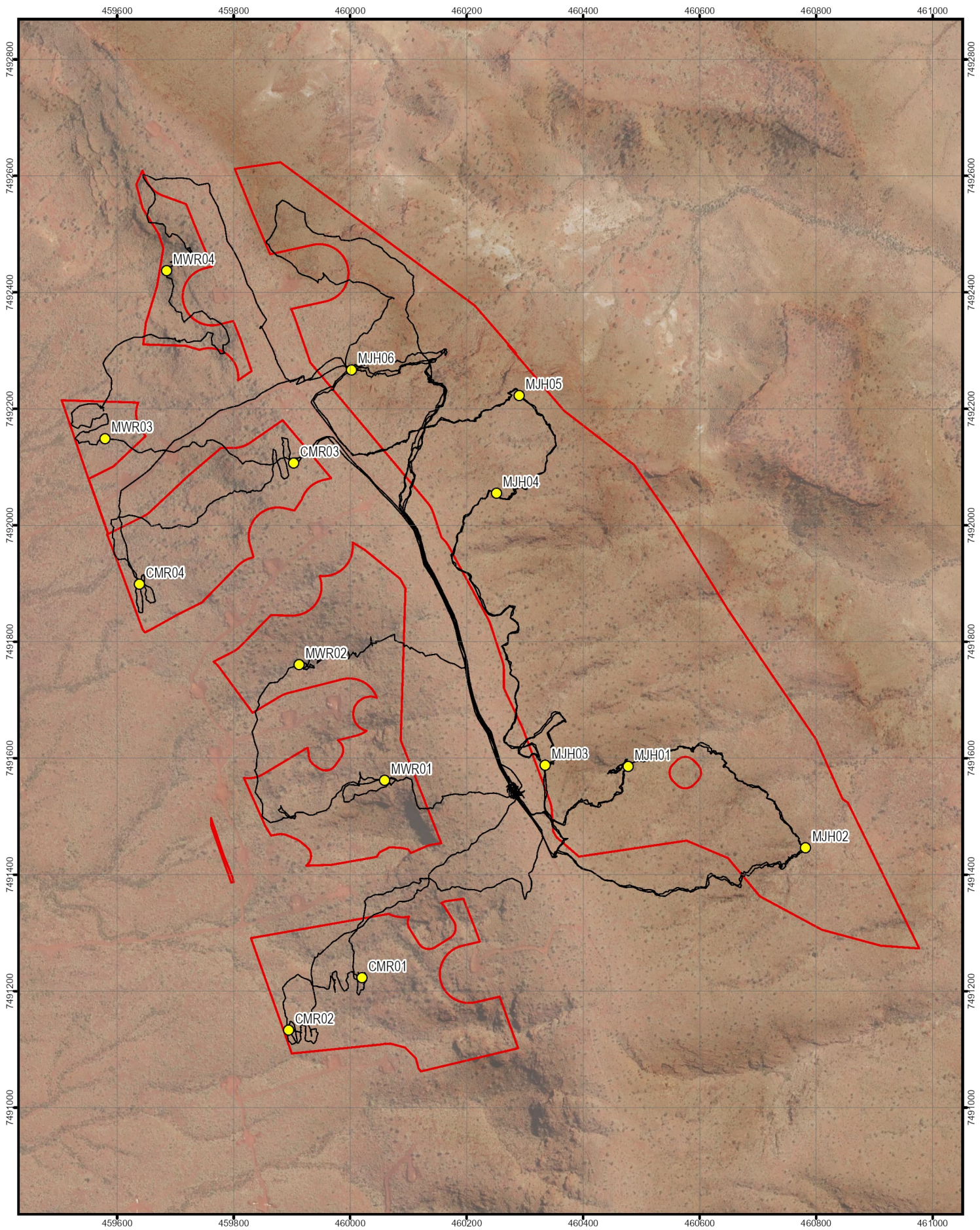
4.4 Limitations

Limitations of the survey are discussed in Table 6.

Table 6 Limitations of the Ecological Surveys

Limitation	Outcome
Availability of contextual information on the region	Not a limitation. Rio Tinto has undertaken several surveys within and adjacent to the survey area in the last 10 years. DBCA database results, Atlas of Living Australia and the Protected Matters Search Tool was used to define significant species and habitat that may be present.
Competency/experience of consultant conducting survey	Not a limitation. The flora assessment was undertaken by three botanists who have completed surveys of similar scope in the Pilbara. Field team members communicated regularly to ensure a consistent approach was implemented for collecting data. The fauna assessment focussed on identifying unique habitat features and assessing habitat suitability for significant fauna species.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	Not a limitation. The majority of survey area was traversed on foot and all flora species encountered were recorded and/or collected. The species list is considered

Limitation	Outcome
	comprehensive. Survey effort reflects a reconnaissance flora and vegetation assessment as described by EPA (2016).
Completion (is further work needed)	<p>Not a limitation.</p> <p>The field survey did not identify any unusual or surprising results. No Priority flora were recorded that were unexpected. The survey effort is considered adequate to meet the objective of a flora and vegetation assessment and fauna habitat assessment (Figure 7). No fauna observations were recorded during the survey. The survey focussed on habitat assessments and suitability for use by significant fauna species only.</p>
Remoteness and/or access problems	<p>Not a limitation.</p> <p>The entire survey area was accessible with a helicopter.</p>
Timing, weather, season, cycle	<p>Not a limitation.</p> <p>The field survey was undertaken in June 2022 following several rainfall events described in Section 2.1 Climate. Grasses, annual species, and Priority flora were in flower at the time of the survey.</p>
Disturbances (e.g. fire flood, accidental human intervention) which affected results of the survey	<p>Not a limitation.</p> <p>No disturbances occurred that may have influenced the outcome of the flora and fauna assessment.</p>



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LEGEND

- ▭ Survey Area
- Relevé
- Tracklog

Survey Effort

RIO TINTO GROUP

METAWANDY AR-15-13649C NATIVE VEGETATION CLEARING PERMIT

Figure 7

5.0 Desktop Assessment

5.1 Conservation Significant Communities

No Threatened Ecological Communities (TECs) listed under the EPBC Act or BC Act are known to occur within 50 km of the survey area according to the DBCA TEC and PEC database. One Priority 1 PEC is located 25 km north of the survey area, '*Triodia pisolitica* (previously *Triodia* sp. Robe River) assemblages of mesas of the West Pilbara'. This was not considered likely to occur in the survey area and was not recorded.

5.2 Conservation Significant Flora

A total of 63 significant flora species were identified during the desktop assessment, including one species listed as Threatened under the EPBC Act and BC Act and 62 Priority flora. Two species are known to occur based on previous surveys in the area (Rio Tinto 2017) and four species have a high likelihood of occurring based on habitat presence, proximity of previous records, and date of these records. Species known, likely to, or may occur are presented in Table 7.

Nine species have a moderate likelihood of occurring where either they do not occur within 20 km, or the date of record is older than 20 years, and/or habitat suitability is marginal. The remaining 47 species have a low to negligible likelihood of occurring due to absence of suitable habitat, no known records within 20 km, and no recent (<20 years) records.

Significant flora records are presented in Figure 8 and the comprehensive species list of the desktop flora results is presented in Appendix B.

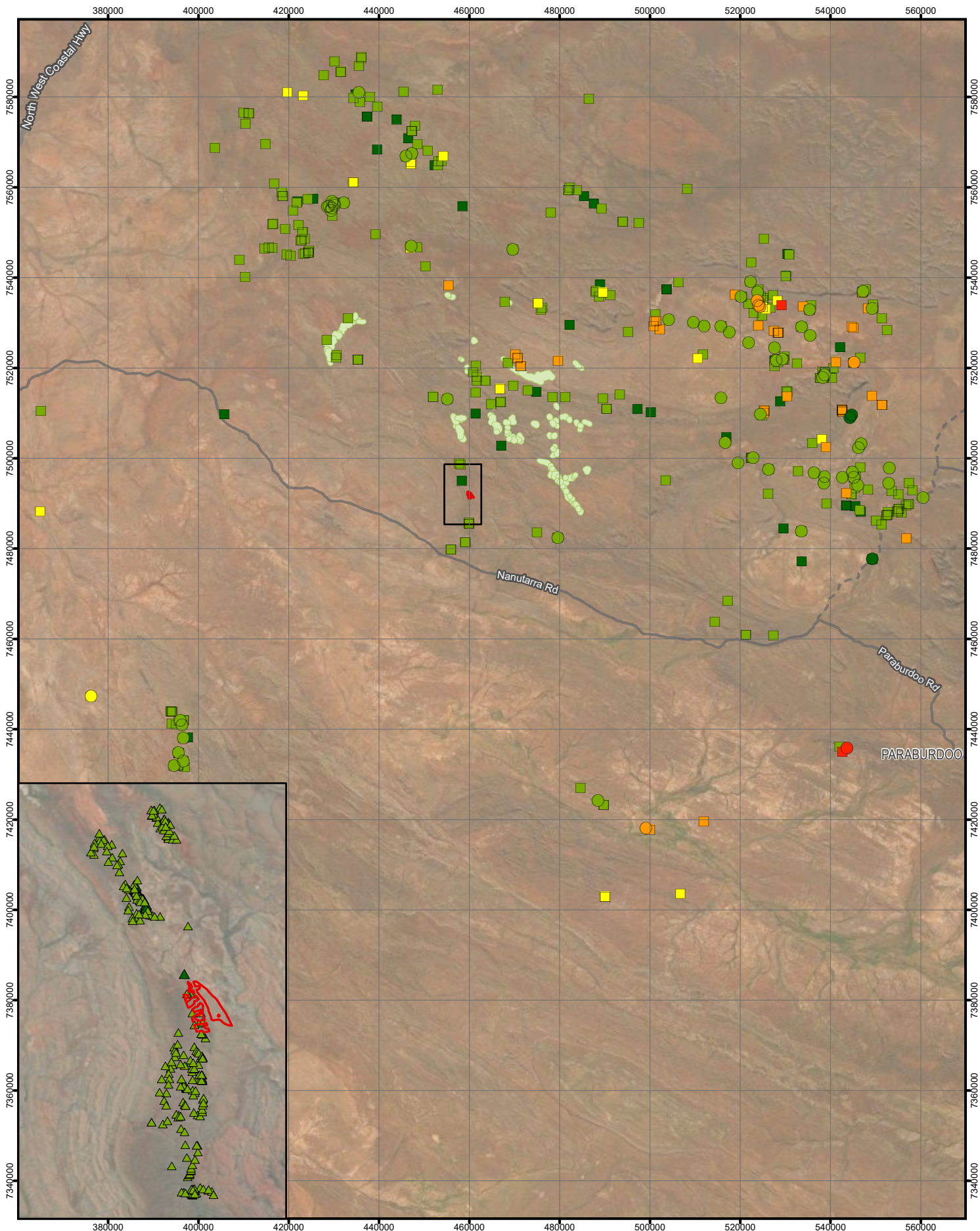
Table 7 Priority flora species that are 'known, 'likely to' or 'may occur'

Species	Cons. Status ¹	Habitat ²
Known		
<i>Ptilotus mollis</i>	P4	Stony hills and screes.
<i>Sida</i> sp. Hamersley Range (K. Newbey 10692)	P3	Low open woodland over hummock grassland of <i>Triodia</i> sp.
Likely		
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	P4	Skeletal soils over ironstone. Rocky screes.
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	P3	Skeletal soils over ironstone. Summits.
<i>Indigofera rivularis</i>	P3	Creek lines or along steep slopes in skeletal soils from the Brockman Ironstone Formation. Used to be known as sp. Bungaroo Creek.
<i>Triodia pisolitica</i>	P3	Skeletal soils on ironstone. Summits and mesas or other hilly areas. Has been found on midslope and valleys. Restricted to Robe Pisolite. Previously known as sp. Robe River.
May		
<i>Acacia bromilowiana</i>	P4	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds.
<i>Cyanthillium gracile</i>	P3	Rocky slopes, ironstone, gullies, summit of hills.
<i>Dampiera anonyma</i>	P3	Skeletal red brown to brown gravelly soil over banded ironstone, basalt, shale, and jaspilite. Hill summits, upper slopes (above 1000m).
<i>Lepidium catapycnon</i>	P4	Skeletal soils. Hill slopes.
<i>Oxalis</i> sp. Pilbara (M.E. Trudgen 12725)	P2	Shaded areas of rock outcrops and gullies.

Species	Cons. Status ¹	Habitat ²
<i>Rhynchosia bungarensis</i>	P4	Rock piles, gorges, riverbeds, alluvial soils in shrubland.
<i>Senna</i> sp. Barlee Range (S. van Leeuwen 1520)	P2	Skeletal soils in rocky areas especially scree slopes and rock piles in small chines and gullies.
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642)	P3	Skeletal red soils pockets. Steep slope.
<i>Triodia basitricha</i>	P3	Occurs on rocky and gravelly slopes of mountains or low hills.

1. Cons. Status: P Priority

2. Habitat derived from Florabase (WAH 1998).



PROJECT ID 60680395
 CREATED BY WYATTK2
 APPROVED BY F. DE WIT
 LAST MODIFIED 11 AUG 2022

AECOM
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Datum: GDA 1994 MGA Zone 50
 1:1,100,000
 (when printed at A4)

Scale: 0 5 10 15 20 km

Data sources:
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010)
 Service Layer Credits: World Imagery, Earthstar Geographics

LEGEND

Survey area

Priority Flora (Rio Tinto, 2011, 2014, 2016)

▲ P3
 ▲ P4

PEC/TEC

Tridodia pisolitcola (previously Tridodia sp. Robe River) assemblages of mesas of the West Pilbara P3

Threatened and Priority Flora database (TPFL)

● Threatened
 ● P1
 ● P2
 ● P3
 ● P4

WA Herbarium database (WAHERB)

■ Threatened
 ■ P1
 ■ P2
 ■ P3
 ■ P4

Conservation Significant Flora Desktop Results

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Figure 8

5.3 Conservation Significant Fauna

The desktop assessment identified 27 conservation significant fauna species, including 17 bird, six mammal, three reptile and one fish species. The likelihood assessment (Table 4) determined that:

- five species have a high likelihood of occurring including three mammal, one reptile and one bird species
- five species have a moderate likelihood of occurring including two mammals, one reptile and two bird species
- seventeen species have a low or negligible likelihood including one mammal, one reptile, one fish and 14 bird species.

Species with a low or negligible likelihood have not been recorded within 50 km of the survey area, and/or no suitable habitat is present.

The species known to occur or considered likely to occur are described in Table 8. Significant fauna records are presented in Figure 9.

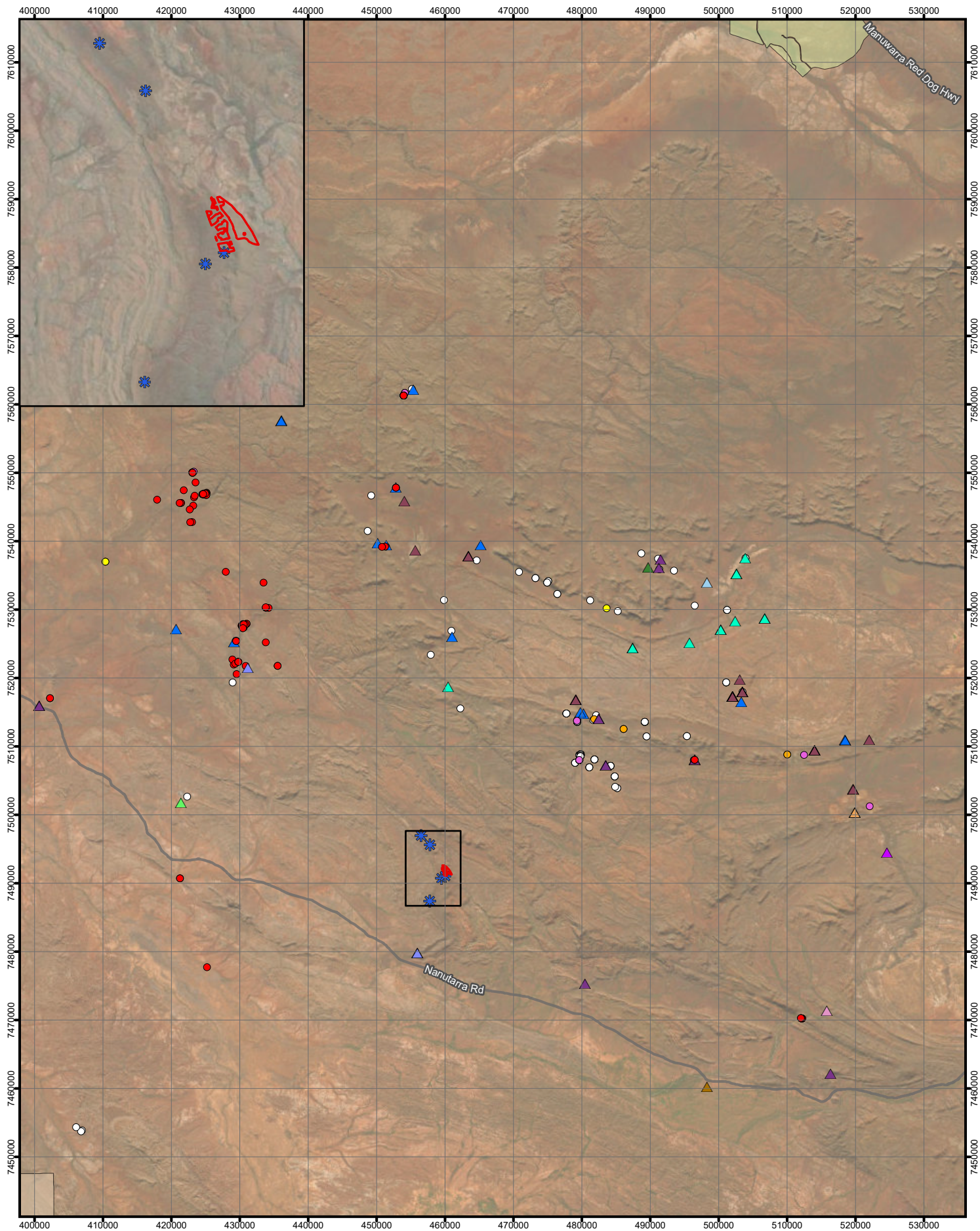
The comprehensive desktop assessment results are presented in Appendix C.

Table 8 Conservation significant fauna species considered likely to occur

Taxon	Common Name	Cons. Status ¹		Habitat ²
		EPBC Act	DBCA / BC Act	
<i>Anilios ganei</i>	Gane's Blind Snake (Pilbara)		P1	Gane's Blind Snake is known from Newman to Pannawonica where it is associated with moist gorges and gullies (Wilson & Swan 2010).
<i>Falco peregrinus</i>	Peregrine Falcon		OS	The Peregrine Falcon is widespread across Australia and inhabits a variety of habitats from rainforests to arid zone, coast to alpine (BirdLife 2022).
<i>Macroderma gigas</i>	Ghost Bat	VU	VU	The Ghost Bat occupies the arid Pilbara landscape where they roost in caves, rock crevices and old mines during the day. Foraging occurs at night, with their diet comprising birds, other bats, reptiles, frogs and large insects (TSSC 2016a).
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse, Ngadji		P4	Colonies occur on the gentler slopes of rocky ranges where the ground is covered by a stony mulch and vegetated by hard spinifex, often with a sparse overstorey of Eucalyptus and scattered shrubs, typically Senna, Acacia and Ptilotus (Van Dyck & Strahan 2008).
<i>Rhinionictis aurantia (Pilbara)</i>	Pilbara Leaf-nosed Bat	VU	VU	The Pilbara Leaf-nosed Bat requires caves or mines with hot humid microclimates for roosting (Van Dyck & Strahan 2008; Churchill 1998).

EPBC Act and BC Act: VU Vulnerable, EN Endangered, OS Other Specially Protected Species

DBCA: P Priority



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Datum: GDA 1994 MGA Zone 50

1:725,000
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Data sources:
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).
 Service Layer Credits: World Imagery, Earthstar Geographics

LEGEND

- ▭ Survey area
- ✳ *Pseudomys chapmani*, Western Pebble-mound Mouse, Ngadjji
- *Dasyurus hallucatus*, EN
- *Falco hypoleucos*, VU
- *Liasis olivaceus barroni*, VU
- *Macroderma gigas*, VU
- *Rhinonictes aurantia* (Pilbara), VU
- ▲ *Actitis hypoleucos*, MI
- ▲ *Apus pacificus*, MI
- ▲ *Charadrius veredus*, MI
- ▲ *Pandion cristatus*, MI
- ▲ *Falco peregrinus*, OS
- ▲ *Aniilos ganei*, P1
- ▲ *Ninox connivens connivens*, P3
- ▲ *Amytornis striatus striatus*, P4
- ▲ *Leggadina lakedownensis*, P4
- ▲ *Leipotherapon athenus*, P4
- ▲ *Notoscincus butleri*, P4
- ▲ *Pseudomys chapmani*, P4
- ▲ *Sminthopsis longicaudata*, P4

Conservation Significant Fauna Desktop Results

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METAWANDY AR-15-13649C NATIVE VEGETATION CLEARING PERMIT

Figure 9

6.0 Field Survey Results

6.1 Vegetation

6.1.1 Condition

Vegetation condition was considered Excellent for the majority of the survey area. One relevé had a condition of Very Good due to presence of an introduced flora species (**Cenchrus ciliaris*). It is not represented on a figure for this report.



6.1.2 Communities



Seven vegetation communities were mapped in the survey area. The vegetation communities sampled in 2022 are described in Table 9 and mapped in Figure 10 at the end of this document. These include:



- two communities of Hills and Slopes
- one community of Undulating Slopes and Low Rises
- one community of Plains
- two communities of Gullies
- one community of Drainage Lines.


These communities represent seven out of twelve vegetation communities previously described and mapped across the survey area by Rio Tinto (2017).

Table 9 Vegetation community descriptions and photographs

Description	Additional Detail	Photograph
<p>Hills and Slopes S2</p> <p>Scattered low trees of <i>Eucalyptus leucophloia</i> with scattered <i>Hakea chordophylla</i> and <i>Acacia pruinocarpa</i> over low open shrubland of <i>Acacia arida</i> over open hummock grassland of <i>Triodia wiseana</i> with scattered <i>Triodia pisoliticola</i>.</p> <p>Recorded from red brown skeletal soils with outcropping and exposed ironstone bedrock from the mid and upper slopes.</p>	<p>Survey effort: three relevés MJH03, MJH04, MJH05</p> <p>Species richness: 24 native species</p>	
<p>Hills and Slopes S3</p> <p>Low open woodland to scattered trees of <i>Eucalyptus leucophloia</i> over scattered tall shrubs of <i>Acacia pruinocarpa</i> over open shrubland of <i>Acacia bivenosa</i> and <i>Acacia maitlandii</i> and <i>Petalostylis labicheoides</i> over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pisoliticola</i>.</p> <p>Recorded from red brown skeletal soils with outcropping and exposed ironstone bedrock from the mid and upper slopes.</p>	<p>Survey effort: three relevés CMR01, CMR03, MWR01</p> <p>Species richness: 33 native species</p>	

Description	Additional Detail	Photograph
<p>Undulating Plains U2</p> <p>Open shrubland of <i>Acacia bivenosa</i>, <i>Acacia kempeana</i> and <i>Acacia ancistrocarpa</i> over open hummock grassland of <i>Triodia wiseana</i>.</p> <p>Recorded from red brown loams with ironstone pebble cover. Associated with low undulating slopes at the base of the range.</p>	<p>Survey effort: one relevés CMR02</p> <p>Species richness: 13 native species</p>	
<p>Plains P1</p> <p>Tall shrubland to tall open shrubland of <i>Acacia kempeana</i> and <i>Acacia bivenosa</i> with scattered <i>Acacia pruinocarpa</i> over open hummock grassland of <i>Triodia wiseana</i>.</p> <p>Recorded from red brown sandy loams with a scattering of ironstone pebble cover. Associated with plains at the base of the range.</p>	<p>Survey effort: two relevés CMR04, MWR03</p> <p>Species richness: 27 native species</p>	

Description	Additional Detail	Photograph
<p>Gullies G1</p> <p>Low open woodland of <i>Corymbia ferritcola</i> with scattered <i>Eucalyptus leucophloia</i> over tall open shrubland of <i>Acacia hamersleyensis</i>, <i>Acacia citrinoviridis</i> and <i>Acacia pruinocarpa</i> over open shrubland of <i>Dodonaea pachyneura</i>, <i>Prostanthera albiflora</i>, <i>Senna glutinosa</i> subsp. <i>glutinosa</i> and <i>Santalum lanceolatum</i> over open hummock grassland of <i>Triodia pisoliticola</i> and <i>Triodia wiseana</i> over scattered tussock grasses of <i>Eriachne mucronata</i> and <i>Cymbopogon ambiguus</i>.</p> <p>Recorded from red brown skeletal loams with exposed ironstone bedrock.</p>	<p>Survey effort: two relevés MWR02, MWR04</p> <p>Species richness: 48 native and one weed species</p>	
<p>Gullies G2</p> <p>Scattered low trees of <i>Eucalyptus leucophloia</i> over open shrubland of <i>Stylobasium spathulatum</i>, <i>Acacia pruinocarpa</i>, <i>Gossypium robinsonii</i>, <i>Petalostylis labicheoides</i>, <i>Acacia bivenosa</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> over open hummock grassland of <i>Triodia wiseana</i> with scattered <i>Triodia pisoliticola</i> over scattered tussock grasses of <i>Eriachne mucronata</i> and <i>Cymbopogon ambiguus</i>.</p> <p>Recorded from red brown skeletal loams with exposed ironstone bedrock.</p>	<p>Survey effort: two relevés MJH01, MJH02</p> <p>Species richness: 44 native species</p>	

Description	Additional Detail	Photograph
<p>Drainage Lines D3</p> <p>Scattered low trees of <i>Eucalyptus leucophloia</i> with scattered <i>Acacia citrinoviridis</i> over tall open scrub to tall open shrubland of <i>Acacia monticola</i>, <i>Acacia maitlandii</i>, <i>Petalostylis labicheoides</i>, <i>Acacia kempeana</i>, <i>Acacia bivenosa</i> and <i>Acacia pruinocarpa</i> over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pisoliticola</i>.</p> <p>Recorded from red brown skeletal loams with cobbles. Represents minor drainage lines and tributaries thereof.</p>	<p>Survey effort: one relevé MJH06</p> <p>Species richness: 31 native species</p>	

6.2 Flora

6.2.1 Conservation Significant Flora

Four Priority flora species were recorded, described in detail below. Locations of these species are shown on the Vegetation Community, Figure 10.

***Indigofera rivularis* (P3)**

Indigofera rivularis is a perennial shrub to 2 m, and is associated with rocky creek lines (WAH 1998). A total of 23 individuals from four locations were recorded (Figure 10). *Indigofera rivularis* was considered likely to occur prior to commencing the field survey.

This species was found on hill slopes in rocky gullies amongst hummock grasses and mixed Acacia shrubland. The morphological features of the leaves and plant habit led to confident identification in the field. Two samples were collected from the survey area (CMOPP01, MJH02-01) and verified by Steve Dillon at the WA Herbarium.

***Ptilotus mollis* (P4)**

Ptilotus mollis is a compact perennial shrub to 50 cm and is associated with stony hills and screes (WAH 1998). A total of 63 individuals from three locations were recorded within the survey area. *Ptilotus mollis* was known to occur prior to commencing the field survey.

This species was found on hill slopes in rocky gullies amongst hummock grasses and mixed Acacia shrubland. The morphological features of the leaves and flowers led to confident identification in the field. Two samples were collected from the survey area (JH-02, JH-04) and verified by Steve Dillon at the WA Herbarium.

***Sida* sp. Hamersley Range (K. Newbey 10692) (P3)**

Sida sp. Hamersley Range (K. Newbey 10692) is a low spreading shrub to 30 cm and is associated with the bases of ironstone cliffs or breakaways in high altitude areas (WAH 1998). This species was known to occur prior to commencing the field survey.

A total of four individuals from one location were recorded within the survey area. The available morphological features led to correct and confident identification in the field and no samples were collected.

***Triodia pisolitica* (P3)**

Triodia pisolitica is a perennial hummock grass to 50 cm, and is associated with mesas and hillslopes (WAH 1998). A total of 4,021 individuals from 16 locations were recorded within the survey area. *Triodia pisolitica* was considered likely to occur prior to commencing the field survey.

This species was widespread throughout the survey area. The morphological features of the leaves and seed heads led to confident identification in the field. Four samples were collected from the survey area (CMR01-01, MWR01.02, MJH01-05, JH-01) and verified by Steve Dillon at the WA Herbarium.

6.2.2 Flora Diversity

A total of 87 native plant species were recorded in the survey area, comprising 51 genera and 27 families. The most abundant families include Fabaceae (18 species), Poaceae (10 species), and Amaranthaceae (10 species).

One weed species was recorded, **Cenchrus ciliaris*. No Declared Pest species or Weeds of National Significance were recorded.

6.3 Fauna Habitat

Six fauna habitats were mapped in the survey area. The fauna habitats sampled in 2022 are described in Table 10 and mapped in Figure 11. These include:



- Rocky slopes
- Undulating slopes and low rises
- Gullies
- Mulga on plains
- Drainage line – minor
- Rocky breakaways and cliffs.



These communities represent six out of twelve fauna habitats previously described and mapped across the survey area by Rio Tinto (2017).



The habitat is suitable for five conservation significant fauna species, all of which were considered 'likely to occur' in the desktop assessment:

- Gane's Blind Snake *Aniliios ganei* (DBCA P1)
- Peregrine Falcon *Falco peregrinus* (BC Act Other specially protected fauna)
- Ghost Bat *Macroderma gigas* (EPBC Act and BC Act Vulnerable)
- Western Pebble-mound Mouse *Pseudomys chapmani* (DBCA P4)
- Pilbara Leaf-nosed Bat *Rhinionicteris aurantia* (EPBC Act and BC Act Vulnerable).

Table 10 Fauna Habitats of the Survey Area

Description	Conservation Significant Fauna Habitat	Photograph
<p>Rocky slopes</p> <p>Low open woodland to scattered low trees of <i>Eucalyptus leucophloia</i> over scattered to open mixed <i>Acacia</i> shrub cover over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pisoliticola</i>. Red brown skeletal loams with ironstone boulders, rocks and outcropping. Leaf litter minimal under Mulga, large <i>Triodia</i> hummocks interspersed with sparse open ground.</p>	<p>Foraging habitat for:</p> <ul style="list-style-type: none"> - Peregrine Falcon 	
<p>Undulating slopes and low rises</p> <p><i>Triodia wiseana</i> grasslands on rocky undulating terrain with sparse litter and open mixed <i>Acacia</i> shrub cover. Minimal to no logs present. Includes areas with calcrete and quartz. Soils are skeletal to clay loam with rocks on surface.</p>	<p>Suitable habitat for:</p> <ul style="list-style-type: none"> - Western Pebble-mound Mouse <p>Foraging habitat for:</p> <ul style="list-style-type: none"> - Peregrine Falcon - Pilbara Leaf-nosed Bat - Ghost Bat 	

Description	Conservation Significant Fauna Habitat	Photograph
<p>Gully</p> <p>Includes <i>Corymbia ferriticola</i> with scattered <i>Eucalyptus leucophloia</i> mature trees and <i>Acacia hamersleyensis</i> tall shrubs in varying densities with some hollows, some logs of moderate size, and minimal density groundcover of <i>Eriachne mucronata</i> and <i>Cymbopogon ambiguus</i> tussock grasses, herbs and shrubs. Soils are red brown skeletal loams with pebbles, rocks and mass exposed ironstone outcropping. Leaf litter is medium to high on banks and beneath trees and tall shrubs, and sparse in the river bed. No caves or water pools present.</p>	<p>Foraging habitat for:</p> <ul style="list-style-type: none"> - Pilbara Leaf-nosed Bat - Peregrine Falcon - Northern Quoll 	
<p>Mulga on plains</p> <p>Red brown loams with rocks and pebbles, with low woodland of <i>Acacia aptaneura</i> and <i>Acacia pruinocarpa</i> over open hummock grassland of <i>Triodia wiseana</i> with open bare ground often with a gravelly surface. Understorey density includes tussock and hummock grasses at varying densities. Leaf litter medium to high under Mulga, interspersed with sparse open ground.</p>	<p>Foraging habitat for:</p> <ul style="list-style-type: none"> - Pilbara Leaf-nosed Bat - Peregrine Falcon - Ghost Bat 	

Description	Conservation Significant Fauna Habitat	Photograph
<p>Drainage line - minor</p> <p>Includes mature trees of <i>Eucalyptus leucophloia</i> in varying densities with some hollows over tall shrubland of mixed <i>Acacia monticola</i>, <i>Acacia maitlandii</i>, <i>Petalostylis labicheoides</i>, <i>Acacia kempeana</i>, <i>Acacia bivenosa</i> and <i>Acacia pruinoarpa</i> over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pisolitica</i>. Leaf litter medium to under Mulga, interspersed with sparse open ground, some logs of moderate size, and moderate density groundcover of tussock grasses, herbs and shrubs. Soils are grey to red and include river stones and pebbles.</p>	<p>Foraging habitat for:</p> <ul style="list-style-type: none"> - Pilbara Leaf-nosed Bat - Peregrine Falcon 	
<p>Rocky breakaways and cliffs</p> <p>Includes scattered low trees of <i>Corymbia ferritcola</i> and <i>Eucalyptus leucophloia</i> over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pisolitica</i> over scattered tussock grasses of <i>Eriachne mucronata</i>. Soils are red brown skeletal loams with pebbles, rocks and exposed ironstone outcropping and cliff faces. Small rocky overhangs were present but no caves were recorded.</p>	<p>Foraging habitat for:</p> <ul style="list-style-type: none"> - Pilbara Leaf-nosed Bat - Peregrine Falcon 	

7.0 Discussion

7.1 Vegetation

Twelve native vegetation communities were previously mapped throughout the survey area (Rio Tinto 2014, 2017). Seven of these communities were encountered across the 2022 linear survey area. These communities have been described as Hills and Slopes (two types), Undulating Slopes and Low Rises, Plains, Gullies (two types), and Drainage Lines. None of the vegetation communities observed represent a TEC or PEC.

The vegetation within the survey area was considered common in the local area and therefore not considered unique.

7.2 Flora

A total of 88 taxa were recorded in the survey area, comprising 51 genera and 27 families. The taxa recorded during this survey is consistent with what was recorded previously in the survey area by Rio Tinto (2017): 88 taxa from 49 genera representing 27 families.

Two species, *Eremophila* sp. and *Sida* sp., lacked sufficient material for confident identification. Based on the appearance of the dried plant material it is unlikely that these specimens represent species new to the inventory of vascular flora previously recorded in the survey area.

The majority of the survey area was traversed on foot and flora species not represented in relevés were recorded opportunistically.

Four Priority flora species were recorded during the survey: *Indigofera rivularis* (P3), *Ptilotus mollis* (P4), *Sida* sp. Hamersley Range (K. Newbey 10692) (P3) and *Triodia pisoliticola* (P3). *Ptilotus mollis* and *Sida* sp. Hamersley Range were known to occur in the area from previous surveys and database records.

Two other species were identified in the desktop assessment to have a high likelihood of occurring due to the proximity of known records, age of record, and habitat suitability. These are discussed briefly below.

Eremophila magnifica subsp. *magnifica* (P4) is known from six DBCA records within 50 km. It is associated with skeletal soils over ironstone and rocky screes (WAH 1998). This is a perennial species that would be anticipated to have been found should it be present. Likelihood has therefore been reduced to low.

Eremophila magnifica subsp. *velutina* (P3) is known from 13 DBCA records within 50 km and one within 10 km. It is associated with skeletal soils over ironstone and summits (WAH 1998). All four survey team members were familiar with this species and was targeted accordingly. As a perennial species it was anticipated to be detectable during the field survey. It has therefore been reduced to low as it was not recorded.

The likelihood assessment was reviewed following field survey completion. These changes are presented in Appendix B.

One weed species was recorded, **Cenchrus ciliaris*. This species is common in the Pilbara and not considered significant. No Declared Pest species or Weeds of National Significance were recorded.

7.3 Fauna

The desktop assessment identified 27 conservation significant fauna species, including 17 bird, six mammal, three reptile and one fish species.

Five conservation significant fauna species were considered 'likely to occur' in the survey area, including two threatened species listed under the EPBC Act and BC Act (Ghost Bat, and Pilbara Leaf-nosed Bat), two Priority species (Gane's Blind Snake and Western Pebble-mound Mouse) and one Other Specially Protected Fauna Species (Peregrine Falcon).

These are discussed briefly below:

Gane's Blind Snake (*Anilius ganei*) is associated with moist gorges and gullies (Wilson & Swan 2010). It's considered to have a high likelihood of occurrence as there are three DBCA records within 20 km of the survey area as recent as 2015. While there are gully habitats within the survey area, none are associated with permanent moisture. Based on this information, Gane's Blind Snake is considered unlikely to utilise habitat present in the survey area.

The Peregrine Falcon (*Falco peregrinus*) is listed as Other Specially Protected fauna. It was considered likely to occur based on the presence of DBCA records as recent as 2017 and within 25 km. The Falcon is widespread and occurs in a variety of habitats. It is unlikely to rely on habitat within the survey area for survival.

The Ghost Bat (*Macroderma gigas*) was considered likely to occur based on DBCA records as recent as 2017 and within 25 km of the survey area. This species may forage opportunistically across all habitat types present in the survey area. However, the gully and breakaway habitats within the survey area do not contain cave supporting geologies or old abandoned mine shafts that the Ghost Bats utilise for roosting. As such the Ghost Bat is unlikely to be reliant upon the fauna habitats in the survey area.

The Western Pebble-mound Mouse (*Pseudomys chapmani*) is a Priority 4 mammal that was considered likely to utilise the undulating slopes and low rises habitat in the survey area. No pebble mounds were recorded during the survey, however given that two Pebble-mound Mouse mounds were previously recorded just outside the bounds of the survey area (Rio Tinto 2017) it is still considered likely to occur.

The Pilbara Leaf-nosed Bat (*Rhinoniceteris aurantia* (Pilbara)) inhabits abandoned mine shafts, granite rock pile terrain of the east Pilbara and caves formed in gorges that dissect sedimentary geology in the west Pilbara (Bat Call WA 2021). It's considered to have a high likelihood of occurrence as there are 158 DBCA as recent as 2017 and within 25 km of the survey area. However, the gully and breakaway habitats within the survey area do not contain cave supporting geologies which the Bat utilises for roosting. It is likely that this species forages in the local area but is unlikely to rely on habitat within the survey area for survival.

8.0 Conclusion

A biological survey was undertaken at Metawandy to support a clearing permit application. The survey included a reconnaissance flora and vegetation assessment, fauna habitat assessment and targeted searches for significant flora.

Three botanists and one field technician assessed the survey area using a helicopter and traversing the survey area on foot. In the months preceding the survey, above average rainfall had occurred in the local area. This was reflected in the abundance of annual species and flowering grasses, although two specimens still lacked suitable material for identification.

A summary of the results is presented below:

- No TECs or PECs were anticipated to occur, and none were identified
- Seven native vegetation communities were recorded, and their delineation was supported by floristic data captured from relevés and mapping completed previously for the area.
- Three Priority 3 species *Indigofera rivularis*, *Sida* sp. Hamersley Range and *Triodia pisolitica* and one Priority 4 species *Ptilotus mollis* were recorded throughout the survey area.
- Six broad fauna habitats were recorded. These habitats are considered suitable for two Threatened species (Ghost Bat, and Pilbara Leaf-nosed Bat), two Priority species (Gane's Blind Snake and Western Pebble-mound Mouse) and one Other Specially Protected Fauna Species (Peregrine Falcon). None of these significant fauna species are anticipated to rely on this habitat for their survival.

Vegetation communities and fauna habitats were considered common in the local area, extending outside the survey area. No significant limitations were identified that would influence the outcome of the survey.

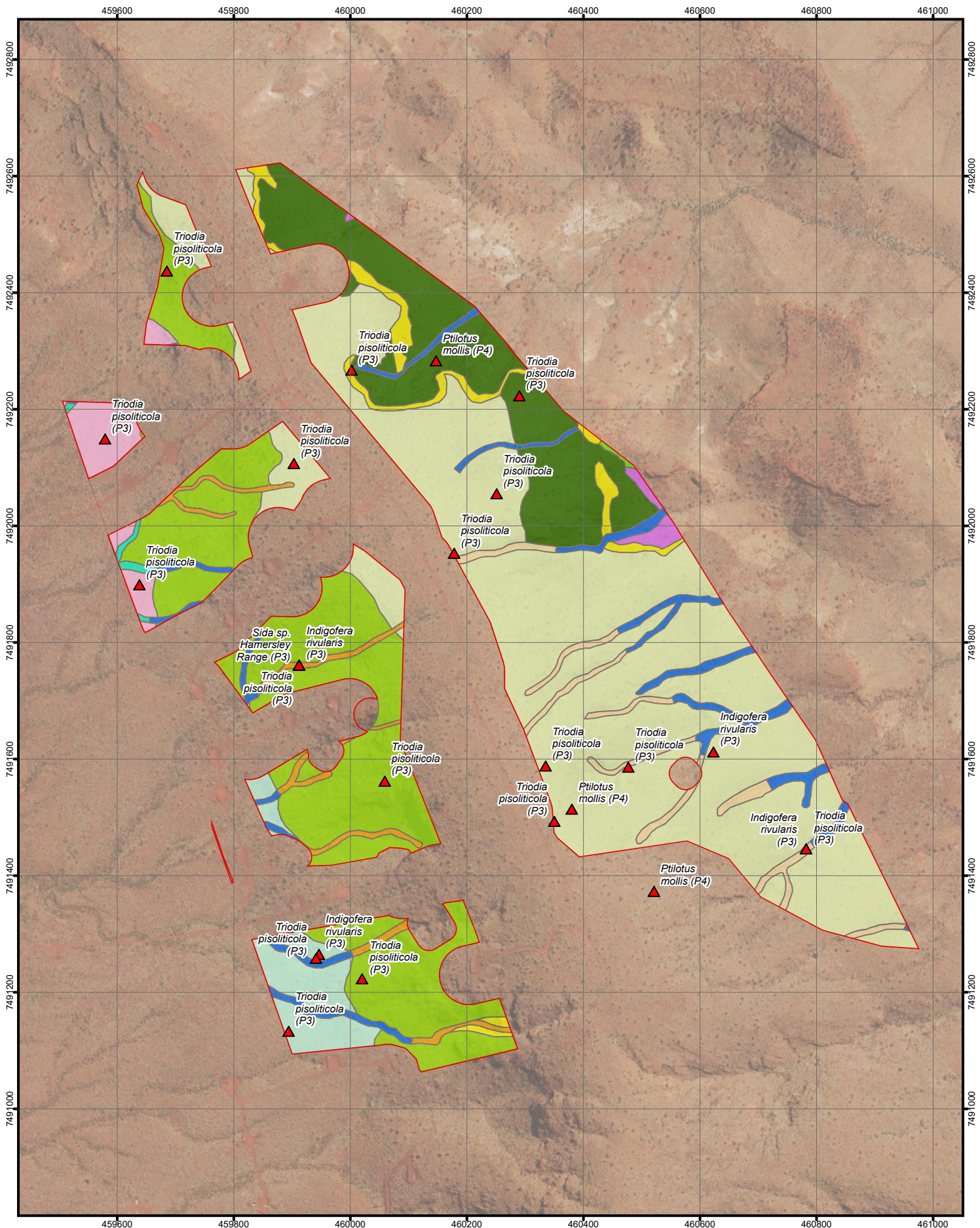
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PROJECT ID 60680395
 CREATED BY WYATTK2
 APPROVED BY MITCHELLC
 LAST MODIFIED 08 MAY 2023

AECOM
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Datum: GDA 1994 MGA Zone 50

1:8,500
 (when printed at A4)

0 50 100 150 metres

Data sources:
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).
 Service Layer Credits: World Hillshade: Esri, Geoscience Australia, NASA, NGA, USGS
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LEGEND

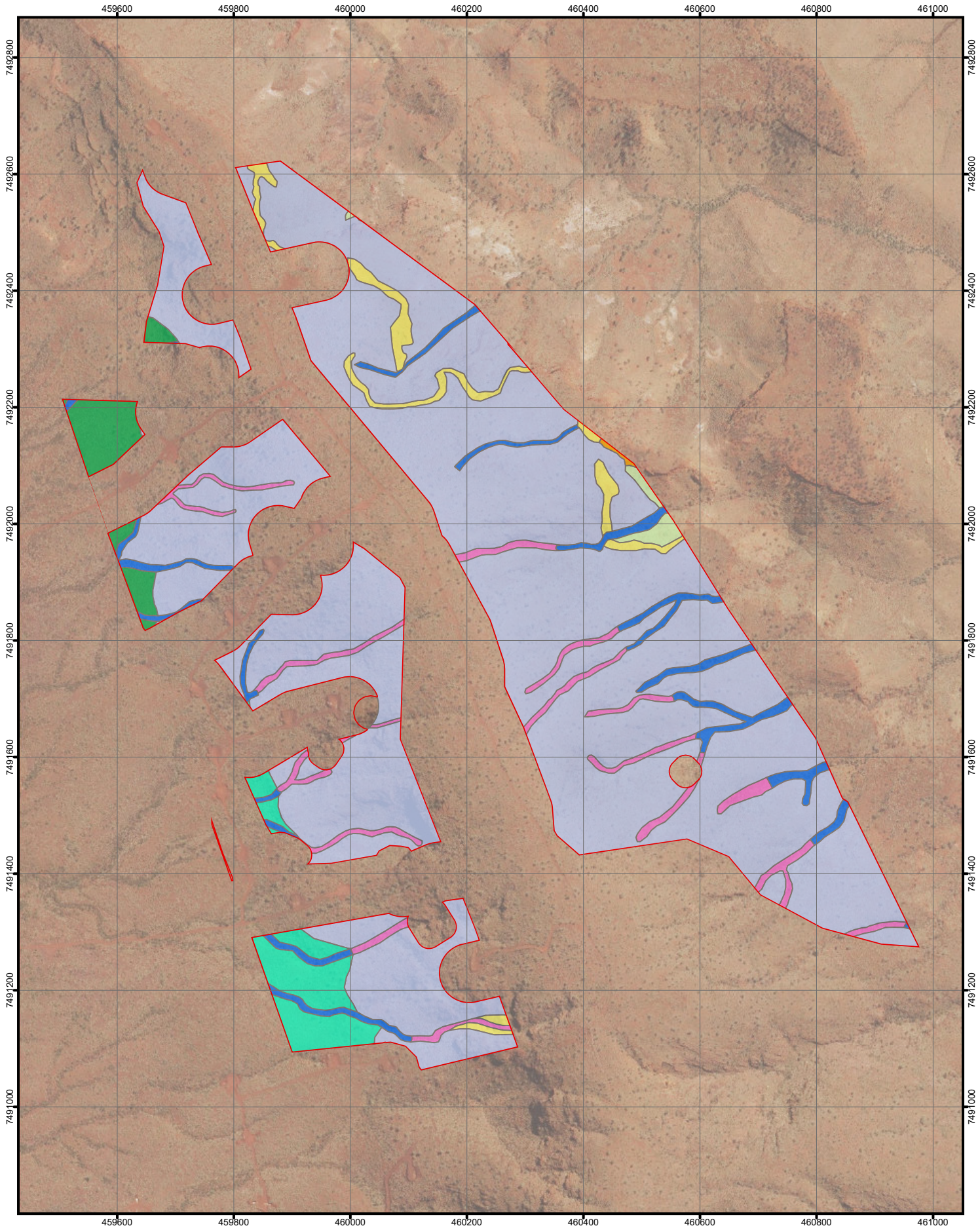
- Survey Area
- ▲ Priority Flora
- Vegetation of Hills and Slopes**
 - S2
 - S3
 - S5
 - S10
- Vegetation of undulating slopes and low rises**
 - U2
- Vegetation of plains**
 - P1
- P5
- R1
- Vegetation of gullies**
 - G1
 - G2
- Vegetation of drainage lines**
 - D3
 - D4

Vegetation Communities

RIO TINTO GROUP

METAWANDY AR-15-13649C NATIVE VEGETATION CLEARING PERMIT

Figure 10



PROJECT ID 60680395
 CREATED BY LEIJ
 APPROVED BY MITCHELLC
 LAST MODIFIED 12 SEP 2022

AECOM
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1:8,500
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0 50 100 150 metres

Data sources:
 Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2010).
 Service Layer Credits: World Hillshade: Esri, Geoscience Australia, NASA, NGA, USGS
 WMS:

LEGEND

Survey area

Fauna Habitat

- Drainage line - minor
- Gully
- Hummock grasslands on loamy lower slopes
- Mulga on plain
- Mulga on slopes
- Rocky breakaways and cliffs
- Rocky slopes
- Undulating slopes and low rises

Fauna Habitat

RIO TINTO

METAWANDY AR-15-13649C NATIVE VEGETATION CLEARING PERMIT

Figure 11

Appendix A

Federal and State Legislation

1.0 Appendix A Federal and State Legislation

1.1 Commonwealth

The EPBC Act is the main piece of Federal legislation protecting biodiversity in Australia. Flora species at risk of extinction are recognised at a Commonwealth level and are categorised in one of six categories as outlined in Table 1.

Table 1 Categories of species listed under Schedule 179 of the EPBC Act

Code	Conservation Category
Ex	Extinct Taxa
ExW	Extinct in the Wild
CE	Critically Endangered
E	Endangered
V	Vulnerable
CD	Conservation Dependent

Communities can be classified as Threatened Ecological Communities (TECs) under the EPBC Act. The EPBC Act protects Australia's ecological communities by providing for:

- identification and listing of ecological communities as threatened
- development of conservation advice and recovery plans for listed ecological communities
- recognition of key threatening processes
- reduction of the impact of these processes through threat abatement plans.

Categories of federally listed TECs are described in Table 2.

Table 2 Categories of TECs that are listed under the EPBC Act

Code	Conservation Category
CE	Critically Endangered If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
E	Endangered If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
V	Vulnerable If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

1.2 Western Australia

1.2.1 Flora and Fauna Species

The *Biodiversity Conservation Act 2016* (BC ACT) Provides for the conservation and protection of Western Australia's biodiversity and biodiversity components. Conservation codes and explanations are derived from DBCA (2019).

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below. It includes species listed as Threatened (Table 3), extinct (Table 4) or specially protected (Table 5)

Table 3 Categories for Threatened Flora and Fauna Species (Jan 2019)

Code	Conservation Category
CR	Critically Endangered Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".
EN	Endangered Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".
VU	Vulnerable Threatened species considered to be "facing a high risk of extinction in the wild in the medium term future, as determined in accordance with criteria set out in the ministerial guidelines".

Table 4 Categories for Extinct Flora and Fauna Species (Jan 2019)

Code	Conservation Category
EX	Extinct Species Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
EW	Extinct in the Wild Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Table 5 Categories for Other Protected Species (Jan 2019)

Code	Conservation Category
MI	Migratory Species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Code	Conservation Category
	Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
OS	Other specially protected fauna Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Species that have not yet been adequately surveyed to warrant being listed under the BC Act, or are otherwise data deficient, are added to a Priority Lists under Priorities 1, 2 or 3 by the State Minister for Environment. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. Categories and definitions of Priority flora species are summarised in Table 6.

Table 6 Conservation codes for WA flora and fauna

Code	Conservation Category
P1	Priority One – Poorly Known Species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation.
P2	Priority Two – Poorly Known Species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation.
P3	Priority Three – Poorly Known Species Species that are known from several locations, and the species does not appear to be under imminent threat.
P4	Priority Four – Rare, Near Threatened and other species in need of monitoring Includes rare species and near threatened species.

1.2.2 Ecological Communities

Threatened Ecological Communities (TECs) are naturally occurring biological assemblages that occur in a particular type of habitat and that may be subject to processes that threaten to destroy or significantly modify the assemblage across its range. TECs are listed by both state and commonwealth legislation.

Vegetation communities in Western Australia are described as TECs if they have been endorsed by the Western Australian Minister for Environment following recommendations made by the Threatened Species Scientific Committee. A TEC is one which is found to fit into one of four categories, summarised in Table 7 (DEC, 2013).

Table 7 Conservation codes for State listed ecological communities

Conservation Code	Category
PD	Presumed Totally Destroyed Adequately searched for but no representative occurrence have been located.
CR	Critically Endangered Adequately surveyed, subject to major contraction, in danger of significant modification in the immediate future.
EN	Endangered Adequately surveyed, subject to major contraction, in danger of significant modification in the near future.
VU	Vulnerable Adequately surveyed, declining in distribution and/or condition, security not yet assured and may move into a category of higher threat in near future.

Possible TECs that do not meet survey criteria or are not adequately defined are listed as Priority Ecological Communities (PECs) and listed in one of five categories, summarised in Table 8.

Table 8 Conservation categories for Priority Ecological Communities

Code	Conservation Category
P1	Priority One: poorly-known ecological communities
P2	Priority Two: poorly-known ecological communities
P3	Priority Three: poorly known ecological communities
P4	Priority Four: ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list.
P5	Priority Five: conservation dependent ecological communities

Appendix B

Conservation Significant Flora Desktop Results

Appendix B Significant Flora Desktop Assessment

Taxon	Habitat (WAH, 1998) unless otherwise referenced	Cons. Code		Distance from Survey Area (km)			Date				PMST	Scoring System					Likelihood		Justification		
		EPBC Act	BC Act/W A	WA Herb	TPFL	Rio Data	WA Herb	TPFL	RIO	Recorded in Survey Area		Known occurrence (<5km)	Known occurrence (20km)	Recent Record (<20 years)	Habitat Suitability (0, 1, 2)	Total Score	Pre-Survey	Post-Survey			
<i>Acacia bromilowiana</i>	Red skeletal stony loam, orange-brown pebbly, gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds.		P4	40			2015						0	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Aluta quadrata</i>	Edge of creek beds, base of cliffs, rocky crevices, near crest of ridge.		EN	100	100		1985	2012					0	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Amaranthus centralis</i>	Red sand in ephemeral watercourses, sandy to clayey loam on river banks and edges of permanent pools.		P3	80		<5			Yes				0	1	1	0	0	2	Negligible	Negligible	No suitable habitat
<i>Ampelopteris prolifera</i>	Near water or in wet ground.		P3	80			2002						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	Hardpan plains.		P3	75			2014						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Aristida polyclados</i>	Limestone gorges.		P1	50			2021						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Astrebula lappacea</i>	Associated with gilgais, depressions on cracking clay soils and crabholed plains in tussock grassland or snakewood shrubland over tussock grassland.		P3	75	95		2018	1996					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Cyanthillium gracile</i>	Rocky slopes, ironstone, gullies, summit of hills.		P3	20			2017						0	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Dampiera anonyma</i>	Skeletal red-brown to brown gravelly soil over banded ironstone, basalt, shale and jaspilite. Hill summits, upper slopes (above 1000m).		P3	80			2008						0	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	Nearest record 80 km from survey area
<i>Dicladantha glabra</i>	Alluvium. Along watercourses, near rock pools.		P2	23			2017						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Dolichocarpa</i> sp. <i>Hammersley Station</i> (A.A. Mitchell PRP 1479)	Cracking clay, basalt. Gently undulating plain with large surface rocks, flat crabholed plain.		P3	71			2011						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Eragrostis crateriformis</i>	Clayey loam or clay. Creek banks, depressions.		P3	94			2005						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Eragrostis surreyana</i>	Seasonally wet areas, grey alluvial soils over rock, deep fine alluvial sands of creeks.		P3	82			2009						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Eremophila coacta</i>	Laterite, shale soils. Ironstone hills, creeklines.		P3	68	77		1986						0	0	0	0	1	1	Low (Unlikely)	Negligible	This species is a perennial and would have been detected if present.
<i>Eremophila magnifica</i> subsp. <i>magnifica</i>	Skeletal soils over ironstone. Rocky screes.		P4	44		<5	2015		Yes				0	1	1	1	1	4	Moderate (Possible)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Eremophila magnifica</i> subsp. <i>velutina</i>	Skeletal soils over ironstone. Summits.		P3	7	66		2013	2007					0	0	1	1	1	3	Moderate (Possible)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Euphorbia australis</i> var. <i>glabra</i>	Sump, low in the landscape on alluvial cracking clay loamy soil, gritty with ironstone fragments, saline flats (Greater Paraburdoo – Detailed Flora and Vegetation Survey, April 2018).		P3	77			2017						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Euphorbia inappendiculata</i> var. <i>inappendiculata</i>	Cracking clays, associated with tussock grassland.		P2	58			2016						0	0	0	1	0	1	Negligible	Negligible	No suitable habitat

Appendix B Significant Flora Desktop Assessment

Taxon	Habitat (WAH, 1998) unless otherwise referenced	Cons. Code		Distance from Survey Area (km)			Date				PMST	Scoring System					Likelihood		Justification	
		EPBC Act	BC Act/W A	WA Herb	TPFL	Rio Data	WA Herb	TPFL	RIO	Recorded in Survey Area		Known occurrence (<5km)	Known occurrence (20km)	Recent Record (<20 years)	Habitat Suitability (0, 1, 2)	Total Score	Pre-Survey	Post-Survey		
<i>Euphorbia inappendiculata</i> var. <i>queenslandica</i>	Clay soils on plains (plantnet.rbg Syd.nsw.gov.au).		P2	76			2015					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Fimbristylis sieberiana</i>	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.		P3	57			2018					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Glycine falcata</i>	Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.		P3	60	55		2017	2008				0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Gompholobium karjini</i>	Occurs in open <i>Triodia</i> hummock grassland with scattered shrubs and trees on ironstone gravel (Nuytsia).		P2	53			2012					0	0	0	1	1	2	Low (Unlikely)	Negligible	This species is a perennial and would have been detected if present.
<i>Goodenia berrinbinensis</i>	Grows in red sandy loam soils often associated with creek beds and ephemeral wetlands.		P4	70			2011					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Goodenia nuda</i>	Open shrubland of <i>Acacia anuera</i> , open low woodland. Slight slope well away from hills at one site, another site valley floor between hills.		P4	56			2014					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Goodenia</i> sp. <i>East Pilbara</i> (A.A. Mitchell PRP 727)	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains.		P3	72			2018					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Grevillea saxicola</i>	Orange-brown to red-brown loam soils on the upper scree/breakway slopes and crests often associated with banded iron formation outcropping. Often found growing in Mulga woodland (Nuytsia).		P3	60			2019					0	0	0	1	1	2	Low (Unlikely)	Negligible	This species is a perennial and would have been detected if present.
<i>Gymnanthera cunninghamii</i>	Sandy soils.		P3	40	77		2019	1998				0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Helichrysum oligochaetum</i>	Depressions and floodplains in clay soils.		P1	96	81		2006	1991				0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Hibiscus</i> sp. <i>Mt Brockman</i> (E. Thoma ET 1354)	Rocky drainage lines below cliff-lines or rocky gorges.		P1	67			2015					0	0	0	1	1	2	Low (Unlikely)	Negligible	This species is a perennial and would have been detected if present.
<i>Indigofera rivularis</i>	Creek lines or along steep slopes in skeletal soils from the Brockman Ironstone Formation. Used to be known as sp. Bungaroo Creek.		P3	5		<5	2015		Yes			0	1	1	1	2	5	High (Likely)	Known	Known. Recorded within survey area
<i>Iotasperma sessilifolium</i>	Cracking clay, black loam. Edges of waterholes, plains.		P3	77			2007					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Lepidium catapycnon</i>	Skeletal soils. Hill slopes.		P4		86			1991				0	0	0	0	2	2	Moderate (Possible)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Livistona alfredii</i>	Watercourses and drainage lines.		P4	62			1998					0	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Owenia acidula</i>	Known only from Millstream and Mardie Station.		P3	72			2008					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Oxalis</i> sp. <i>Pilbara</i> (M.E. Trudgen 12725)	Shaded areas of rock outcrops and gullies.		P2	43			2015					0	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	Not recorded during survey
<i>Paspalidium retiglume</i>	Tropical and subtropical sub-humid woodlands, arid and semi-arid low woodland and tussock grasslands. Often in cracking clays.		P2	55			2012					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Pentalepis trichodesmoides</i> subsp. <i>hispidula</i>	Found in <i>Triodia</i> hummock grassland, often in the understorey of a shrubland of <i>Acacia</i> spp., <i>Gossypium</i> spp., <i>Senna</i> spp., <i>Brachychiton</i> spp. and <i>Eucalyptus</i> spp., on summits and slopes of low hills, on basaltic soils, at altitudes to 1150 m (Nuytsia).		P2	93			1958					0	0	0	0	1	1	Low (Unlikely)	Low (Unlikely)	Old records more than 90 km from survey area.

Appendix B Significant Flora Desktop Assessment

Taxon	Habitat (WAH, 1998) unless otherwise referenced	Cons. Code		Distance from Survey Area (km)			Date				PMST	Scoring System					Likelihood		Justification
		EPBC Act	BC Act/W A	WA Herb	TPFL	Rio Data	WA Herb	TPFL	RIO	Recorded in Survey Area		Known occurrence (<5km)	Known occurrence (20km)	Recent Record (<20 years)	Habitat Suitability (0, 1, 2)	Total Score	Pre-Survey	Post-Survey	
<i>Ptilotus mollis</i>	Stony hills and screes.		P4	3		0	2013		yes		1	1	1	1	2	6	Known	Known	Recorded within survey area
<i>Ptilotus subspinescens</i>	Hummock grasslands between mesas of ironstone on rocky and scree slopes.		P3	63	57		2011	2007			0	0	0	1	1	2	Low (Unlikely)	Low (Unlikely)	Suitable habitat, not recorded during survey.
<i>Ptilotus trichocephalus</i>	Clay flats, sandy colluvial soils and gibber plains. Often with Mulga.		P4	70	90		2009	2006			0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Rhagodia sp. Hamersley (M. Trudgen 17794)</i>	Commonly recorded from hardpan plains dominated by mulga shrubs and trees with the understorey consisting of scattered <i>Eremophila</i> spp., <i>Ptilotus</i> spp., <i>Senna</i> spp. shrubs over annual and perennial grasses. Individuals have been recorded from low hillslopes, stony plains, gullies, low hills, floodplains and claypans.		P3	88			2011				0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Rhodanthe frenchii</i>	Stony hills, rocky riverbanks and outcrops.		P2	100			1968				0	0	0	0	1	1	Low (Unlikely)	Negligible	Old records 100 km from survey area.
<i>Rhynchosia bungarensis</i>	Rock piles, gorges, river beds, alluvial soils in shrubland.		P4	11			2015				0	0	1	1	1	3	Moderate (Possible)	Low (Unlikely)	Not recorded during survey however suitable habitat is present and was traversed. The conditions preceding the survey were favourable, this species would have been detected if present.
<i>Rostellularia adscendens var. latifolia</i>	Ironstone soils. Near creeks, rocky hills.		P3	65			2012				0	0	0	1	1	2	Low (Unlikely)	Low (Unlikely)	
<i>Senna sp. Barlee Range (S. van Leeuwen 1520)</i>	Skeletal soils in rocky areas especially scree slopes and rock piles in small chines and gullies.		P2	95	94		1993	1993			0	0	0	0	2	2	Moderate (Possible)	Low (Unlikely)	Old records more than 90 km from survey area. This species is a perennial and would have been detected if present.
<i>Seringia exastia</i>	Pindan (red soil) heathland. One subpopulation occupies a north-facing dune slope. Remaining six subpopulations occur on almost flat land (SPRAT). Low open woodland.	CR	CR	79			1965				0	0	0	0	0	0	Negligible	Negligible	No suitable habitat

Appendix B Significant Flora Desktop Assessment

Taxon	Habitat (WAH, 1998) unless otherwise referenced	Cons. Code		Distance from Survey Area (km)			Date				PMST	Scoring System					Likelihood		Justification	
		EPBC Act	BC Act/W A	WA Herb	TPFL	Rio Data	WA Herb	TPFL	RIO	Recorded in Survey Area		Known occurrence (<5km)	Known occurrence (20km)	Recent Record (<20 years)	Habitat Suitability (0, 1, 2)	Total Score	Pre-Survey	Post-Survey		
<i>Sida sp. Barlee Range (S. van Leeuwen 1642)</i>	Skeletal red soils pockets. Steep slope.		P3	60	69		2015	2015				0	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Sida sp. Hamersley Range (K. Newbey 10692)</i>	Low open woodland over hummock grassland of <i>Triodia sp.</i>		P3	5	21	0	2015	2009	yes			1	1	1	1	2	6	Known	Known	Recorded within survey area
<i>Solanum kentrocaule</i>	Endemic to WA, has been found only in the Hamersley Range between 700m to 1250m altitude. Inhabits hillsides and mountaintops, or occasionally creek-beds, in skeletal red-brown soil over ironstone or on basalt scree.		P3	43			2012					0	0	0	1	1	2	Low (Unlikely)	Negligible	This species is a perennial and would have been detected if present.
<i>Solanum octona</i>	Gorge tops, red sandy soils with <i>Triodia</i> and skeletal soils. Also recorded in riverine area with gritty sand.		P2	94			1961					0	0	0	0	1	1	Low (Unlikely)	Negligible	Old records more than 90 km from survey area. This species is a perennial and would have been detected if present.
<i>Solanum sp. Red Hill (S. van Leeuwen et al. PBS 5415)</i>	Shale hill, colluvial footslopes, gorges, stony upper footslopes.		P3	47			2018					0	0	0	1	1	2	Low (Unlikely)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Stylidium weeliwoilli</i>	Gritty sand soil, sandy clay. Edge of watercourses.		P3	86	86		2002	1995				0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Swainsona thompsoniana</i>	Open flood plains on heavy clay soils. Occurs in Hamersley Range.		P3	76			2009					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Terminalia supranitifolia</i>	Volcanic rock piles or near rocky ridges in low hilly country close to coast.		P3	25	91		2017	1995				0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Tetradlea butcheriana</i>	Growing out of NE facing cliff faces and breakaways. Fire age of area < 5 years. Derived from DBCA database.		P1	84			2015					0	0	0	1	1	2	Low (Unlikely)	Negligible	Old records more than 80 km from survey area. This species is a perennial and would have been detected if present.
<i>Teucrium pilbaranum</i>	Crabhole plains dominated by <i>E. victrix</i> and calcrete tables dominated by grasses.		P2	76			2015					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Themeda sp. Hamersley Station (M.E. Trudgen 11431)</i>	Drainage lines, clay flats, crabhole flats and dark self mulching clays.		P3	76			2020					0	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Triodia basitricha</i>	Occurs on rocky and gravelly slopes of mountains or low hills (keys.lucidcentral.org).		P3	50			2018					0	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Triodia pisolitica</i>	Skeletal soils on ironstone. Summits and mesas or other hilly areas. Has been found on midslope and valleys. Restricted to Robe Pisolite. Previously known as sp. Robe River.		P3	12		<5	2019		yes			0	1	1	1	2	5	High (Likely)	Known	Known. Recorded within survey area
<i>Triodia sp. Silvergrass (P.-L. de Kock BES 00808)</i>	Steep slope and shale hills, rocky ironstone hills.		P1	30			2019					0	0	0	1	1	2	Low (Unlikely)	Low (Unlikely)	This species is a perennial and would have been detected if present.
<i>Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)</i>	Clay-loams, clays, cracking clays and gilgai.		P1	86	75		1998	2019				0	0	0	0	0	0	Negligible	Negligible	No suitable habitat

Appendix B Significant Flora Desktop Assessment

Taxon	Habitat (WAH, 1998) unless otherwise referenced	Cons. Code		Distance from Survey Area (km)			Date			PMST	Scoring System					Likelihood		Justification	
		EPBC Act	BC Act/W A	WA Herb	TPFL	Rio Data	WA Herb	TPFL	RIO		Recorded in Survey Area	Known occurrence (<5km)	Known occurrence (20km)	Recent Record (<20 years)	Habitat Suitability (0, 1, 2)	Total Score	Pre-Survey		Post-Survey
<i>Wurmbea saccata</i>	Red gritty or silty damp soils with pebbles. Creek beds & margins of rock pools.		P3	80			2002				0	0	0	1	0	1	Negligible	Negligible	No suitable habitat

Appendix C

Conservation Significant Fauna Desktop Results

Appendix C Conservation Significant Fauna Desktop Assessment

Taxon	Common Name	Habitat	Cons. Code		Distance from Survey		No. of Records		Date of Record		PMST	Likelihood Assessment					Likelihood		Justification
			EPBC Act	BC Act/WA	DBCA	Rio Tinto	DBCA	Rio Tinto	DBCA	Rio Tinto		Recorded in survey area	Known occurrence <25km	Recent Record (<20 years)	Habitat Suitability	Total Score	Pre-Survey	Post-Survey	
<i>Actitis hypoleucos</i>	Common Sandpiper	The Common Sandpiper utilises a wide range of coastal wetlands and some inland wetlands and is mostly found around muddy margins or rocky shores and rarely on mudflats.	MI	MI	60		1		2015		May	0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Amytornis striatus striatus</i>	Striated Grasswren	The Striated Grasswren is strongly associated with sandplains, dunes and stony hills dominated by Triodia, with or without an overstorey of tall shrubs (DAWE, 2022).		P4	60		2		2005			0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	No evidence recorded during survey. No records nearby.
<i>Anilius ganei</i>	Gane's Blind Snake (Pilbara)	Gane's Blind Snake is known from Newman to Pannawonica where it is associated with moist gorges and gullies (Wilson & Swan, 2010).		P1	12		3		2015			0	1	1	2	4	High (Likely)	Low (Unlikely)	Unlikely to depend on habitat in survey area.
<i>Apus pacificus</i>	Fork-Tailed Swift	The Fork-tailed Swift is almost exclusively aerial, and a non-breeding visitor to Australia. They are rarely seen roosting on land.	MI	MI	40		1		2012		Likely	0	0	1	0	1	Low (Unlikely)	Negligible	No suitable habitat
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Prefers muddy edges of shallow fresh or brackish wetlands with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	MI	MI							May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Calidris ferruginea</i>	Curlew Sandpiper	Curlew Sandpipers occur on intertidal mudflats in sheltered coastal areas such as estuaries, bays, inlets and lagoons. They are sometimes recorded inland around ephemeral and permanent lakes, dams, waterholes and bore drains with bare sandy/muddy edges.	CR	CE, MI							May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Calidris melanotos</i>	Pectoral Sandpiper	The Pectoral Sandpiper occupies shallow, fresh waters often containing low grass or other small herbs. It is also observed in swamp margins, flooded pastures and saltmarshes. Rarely recorded in Western Australia (DAWE, 2022).	MI	MI							May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Charadrius veredus</i>	Oriental Plover, Oriental Dotterel	The Oriental Plover occurs in coastal and northern inland Australia, this species can venture far from water and has been observed frequenting ploughed land, bare claypans, margins of coastal margins and open plains (Pizzey & Knight, 2007).	MI	MI	48		1		2015		May	0	0	1	0	1	Low (Unlikely)	Negligible	No suitable habitat
<i>Dasyurus hallucatus</i>	Northern Quoll	The Northern Quoll occupies a wide range of habitats including, rocky areas, deserts, eucalypt forests and woodlands, hummock grass (Plectrachne spp.), basalt hills, mesas, high and low plateaux, lower slopes, occasional tor fields and stony plains supporting either hard or soft spinifex grasslands (Braithwaite & Griffiths 1994; van Vreeswyk et al. 2004).	E	E	36		94		2017		Known	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	No evidence recorded during survey. No records nearby.
<i>Falco hypoleucos</i>	Grey Falcon	The Grey Falcon inhabits inland plains, gibber deserts, pastoral lands and timbered watercourses (Pizzey & Knight, 2007).		V	44		3		2015		Known	0	0	1	1	2	Moderate (Possible)	Low (Unlikely)	No suitable habitat
<i>Falco peregrinus</i>	Peregrine Falcon	The Peregrine Falcon is widespread across Australia and inhabits a variety of habitats from rainforests to arid zone, coast to alpine (BirdLife, 2022).		OS	25		12		2017			0	1	1	2	4	High (Likely)	High (Likely)	Likely to forage within survey area, however unlikely to specifically depend on habitat within survey area for survival
<i>Glareola maldivarum</i>	Oriental Pratincole	Inhabits open plains, floodplains or short grassland, often with extensive bare areas.	MI								May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Hirundo rustica</i>	Barn Swallow	The Barn Swallow is recorded in open country in coastal lowlands, often near water, towns and cities. Birds are often sighted perched on overhead wires (Pizzey 1980; Blakers et al. 1984), freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub thickets and tussock grassland (Schodde & Mason 1999).	MI	MI							May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Leggadina lakedownensis</i>	Northern Short-tailed Mouse, Lakeland Downs Mouse, Kerakenga	The Lakeland Down's short-tailed mouse occurs on sandy soils and cracking clays in Western Australia.		P4	63		1		2009			0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Leiopotherapon aheneus</i>	Fortescue Grunter	The Fortescue Grunter is known from Ashburton River and Fortescue River where it inhabits slow to fast flowing clear freshwater streams and pools over sandy and rocky bottoms.		P4	25		12		2018			0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	The Olive Python prefers rocky gorges with permanent water, or along well vegetated watercourses, although it has also been observed in locations distant from water. These include granite outcrops, elevated mesas and spinifex plains on stony ground (Bush & Maryan, 2011).	V	V	30		5		2013		Likely	0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	Unlikely to depend on habitat in survey area.

Appendix C Conservation Significant Fauna Desktop Assessment

Taxon	Common Name	Habitat	Cons. Code		Distance from Survey		No. of Records		Date of Record		PMST	Likelihood Assessment					Likelihood		Justification
			EPBC Act	BC Act/WA	DBCA	Rio Tinto	DBCA	Rio Tinto	DBCA	Rio Tinto		Recorded in survey area	Known occurrence <25km	Recent Record (<20 years)	Habitat Suitability	Total Score	Pre-Survey	Post-Survey	
<i>Macroderma gigas</i>	Ghost Bat	The Ghost Bat occupy arid Pilbara landscape where they roost in caves, rock crevices and old mines during the day. Foraging occurs at night, with their diet comprising birds, other bats, reptiles, frogs and large insects (TSSC ,2016a).	V	V	25		9		2017		Known	0	1	1	2	4	High (Likely)	High (Likely)	Likely to forage within survey area, however unlikely to specifically depend on habitat within survey area for survival
<i>Motacilla cinerea</i>	Grey Wagtail	The Grey Wagtail is most commonly associated with water and are found across a wide variety of wetlands, watercourses and on the banks of lakes and marshes (DotE, 2015)	MI	MI							May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Motacilla flava</i>	Yellow Wagtail	The Yellow Wagtail inhabits open country near water, such as wet meadows.	MI	MI							May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Ninox connivens connivens</i>	Barking Owl	Open woodlands and edges of forests, often adjacent to farmland (BirdLife, 2022). Usually found in habitats dominated by Eucalypts, preferring woodlands with a high density of large trees, and trees with hollows. Roost sites are near waterways or wetlands (BirdLife, 2022).		P3	55		1		1981			0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Notoscopus butleri</i>	Lined Soil-crevice Skink	Arid, rocky, near coastal areas in the Pilbara associated with hummock grasslands near creeks and river margins.		P4	30		26		2017			0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Pandion cristatus</i>	Osprey, Eastern Osprey	The Osprey inhabits littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. Found mostly in coastal areas but can travel inland along major rivers.	MI	MI	52		1		2012			0	0	1	0	1	Negligible	Negligible	No suitable habitat
<i>Pezoporus occidentalis</i>	Night Parrot	Night Parrots are essentially birds of the arid zone and apparently require dense, low vegetation, under or in which they hide during the day (DBCA, 2017). This includes hummock grasslands and samphire shrublands, often near water holes (Blyth, 1996).	E	CE							May	0	0	0	2	2	Low (Unlikely)	Low (Unlikely)	Suitable habitat present. No records in study area.
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse, Ngadji	Colonies occur on the gentler slopes of rocky ranges where the ground is covered by a stony mulch and vegetated by hard spinifex, often with a sparse overstorey of eucalyptus and scattered shrubs, typically Senna, Acacia and Ptilotus (Van Dyck & Strahan 2008).		P4	29	0	16	5	2017	2014		1	1	1	2	5	Known	High (Likely)	Mounds present outside survey area
<i>Rhinonicteris aurantia (Pilbara)</i>	Pilbara Leaf-nosed Bat	The Pilbara Leaf-nosed Bat requires caves or mines with hot humid microclimates for roosting. They can sometimes roost in trees.	V	V	23		158		2017		Known	0	1	1	2	4	High (Likely)	High (Likely)	Likely to forage within survey area, however unlikely to specifically depend on habitat within survey area for survival
<i>Rostratula australis</i>	Australian Painted Snipe	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DAWE, 2022).	E	E							May	0	0	0	0	0	Negligible	Negligible	No suitable habitat
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart	The Long-tailed Dunnart inhabits exposed rock and stony soils with hummock grasses and shrubs including flat-topped hills, lateritic plateaus, sandstone ranges and breakaways with sparse Mulga (WA Museum Collections, 2022).		P4	49		2		2017			0	0	1	2	3	Moderate (Possible)	Low (Unlikely)	No evidence recorded during survey. No records nearby.

Appendix D

Flora Species by Community Matrix

Appendix D Flora by Family by Community Matrix

Family	Taxon	S2			S3			U2	P1		G1		G2		D3	Oppo
		MJH03	MJH04	MJH05	CMR01	CMR03	MWR01	CMR02	CMR04	MWR03	MWR02	MWR04	MJH01	MJH02	MJH06	
Amaranthaceae																
	<i>Amaranthus undulatus</i>										X					
	<i>Gomphrena cunninghamii</i>											X				
	<i>Ptilotus calostachyus</i>	X			X		X	X	X	X		X		X		
	<i>Ptilotus exaltatus</i>									X						
	<i>Ptilotus fusiformis</i>											X				
	<i>Ptilotus gaudichaudii</i>													X		
	<i>Ptilotus gomphrenoides</i>												X	X		
	<i>Ptilotus mollis</i> (P4)														X	
	<i>Ptilotus obovatus</i>									X						
	<i>Ptilotus polystachyus</i>											X				
Araliaceae																
	<i>Astrotricha hamptonii</i>									X	X	X	X	X		
	<i>Trachymene oleraceae</i> subsp. <i>oleracea</i>									X	X	X	X	X		
Boraginaceae																
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>				X					X				X		
Caryophyllaceae																
	<i>Polycarpha longiflora</i>								X	X	X			X		
Cleomaceae																
	<i>Arivela viscosa</i>												X			
Convolvulaceae																
	<i>Duperreya commixta</i>									X						
Cucurbitaceae																
	<i>Cucumis variabilis</i>								X	X						
Cyperaceae																
	<i>Bulbostylis barbata</i>									X	X			X		
	<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>										X	X	X			
Euphorbiaceae																
	<i>Euphorbia careyi</i>										X	X	X	X		
	<i>Euphorbia coghlanii</i>									X						
Fabaceae																
	<i>Acacia aneura</i>											X				
	<i>Acacia arida</i>	X	X	X	X	X	X	X	X	X		X	X			
	<i>Acacia bivenosa</i>	X	X		X	X	X	X	X	X	X					
	<i>Acacia citrinoviridis</i>								X							
	<i>Acacia coriacea</i> subsp. <i>pendens</i>		X													
	<i>Acacia hamersleyensis</i>				X	X	X	X	X		X					
	<i>Acacia inaequilatera</i>	X														
	<i>Acacia kempeana</i>	X	X			X	X		X	X	X					
	<i>Acacia maitlandii</i>					X										
	<i>Acacia pruinocarpa</i>	X	X	X	X	X	X	X	X	X	X	X	X	X		
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>				X	X	X		X		X	X	X			
	<i>Acacia synchronicia</i>	X		X		X							X			
	<i>Acacia tetragonophylla</i>					X			X	X	X					
	<i>Indigofera monophylla</i>						X	X	X							
	<i>Indigofera rivularis</i> (P3)									X			X		X	
	<i>Petalostylis labicheoides</i>				X		X				X			X		
	<i>Senna artemisioides</i> subsp. <i>helmsii</i>								X							
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>									X						
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	X		X	X	X	X	X	X	X	X	X	X	X		
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>			X		X				X						
	<i>Senna glutinosa</i> subsp. <i>xleurssenii</i>							X	X							
Goodeniaceae																
	<i>Dampiera candidans</i>	X					X									
	<i>Goodenia stobbsiana</i>	X		X	X	X	X	X	X			X				
	<i>Scaevola acacioides</i>			X		X			X	X	X					

Family	Taxon	S2			S3			U2	P1		G1		G2		D3	Oppo
		MJH03	MJH04	MJH05	CMR01	CMR03	MWR01	CMR02	CMR04	MWR03	MWR02	MWR04	MJH01	MJH02	MJH06	
Lamiaceae	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>											x	x	x		
Malvaceae	<i>Abutilon</i> sp. <i>Dioicum</i>				x						x	x	x	x		
	<i>Corchorus crozophorifolius</i>				x						x		x	x	x	
	<i>Gossypium robinsonii</i>												x			
	<i>Hibiscus coatesii</i>											x			x	
	<i>Melhania oblongifolia</i>										x					
	<i>Sida rohlena</i> subsp. <i>rohlena</i>												x			
	<i>Sida</i> sp. <i>Excedentifolia</i>										x					
	<i>Sida</i> sp.								x							
	<i>Sida</i> sp. <i>Hamersley Range</i> (P3)										x					
	<i>Triumfetta clementii</i>	x									x		x	x	x	
Myrtaceae	<i>Corymbia ferritcola</i>										x		x		x	
	<i>Corymbia hamersleyana</i>														x	
	<i>Eucalyptus leucophloia</i>	x	x	x	x	x	x		x	x	x	x	x	x	x	
Nyctaginaceae	<i>Boerhavia gardneri</i>											x				
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>				x		x		x		x	x	x	x	x	
Phyllanthaceae	<i>Nellica maderaspatensis</i>												x			
Poaceae	<i>Aristida contorta</i>				x							x				
	* <i>Cenchrus ciliaris</i>											x				
	<i>Cymbopogon ambiguus</i>	x			x		x		x		x	x	x	x	x	
	<i>Eriachne mucronata</i>	x	x				x				x	x	x	x	x	
	<i>Eriachne pulchella</i>					x		x	x				x		x	
	<i>Paspalidium clementii</i>										x	x				
	<i>Sporobolus australasicus</i>												x			
	<i>Triodia pisoliticola</i> (P3)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
	<i>Triodia wiseana</i>	x	x	x	x	x	x	x	x	x	x	x	x	x		
Proteaceae	<i>Grevillea berryana</i>											x	x	x		
	<i>Hakea chordophylla</i>	x			x				x				x			
	<i>Hakea lorea</i> subsp. <i>lorea</i>															
Pteridaceae	<i>Cheilanthes brownii</i>										x		x			
	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>															
Rubiaceae	<i>Dolichocarpa crouchiana</i>												x	x		
	<i>Psydrax latifolia</i>										x	x			x	
Sapindaceae	<i>Dodonaea pachyneura</i>				x		x				x	x	x		x	
Scrophulariaceae	<i>Eremophila latrobei</i> subsp. <i>glabra</i>						x						x			
	<i>Eremophila platycalyx</i>	x														
	<i>Eremophila</i> sp.										x					
	<i>Eremophila tietkensis</i>		x			x						x			x	
Solanaceae	<i>Solanum cleistogamum</i>		x	x									x	x	x	
	<i>Solanum horridum</i>											x				
	<i>Solanum phlomoides</i>						x	x			x					
Surianaceae	<i>Stylobasium spathulatum</i>												x	x		
Violaceae	<i>Afrohybanthus aurantiacus</i>													x	x	
Zygophyllaceae	<i>Tribulus suberosus</i>											x				

Appendix E

Relevé Data

Appendix E – Flora Site Data

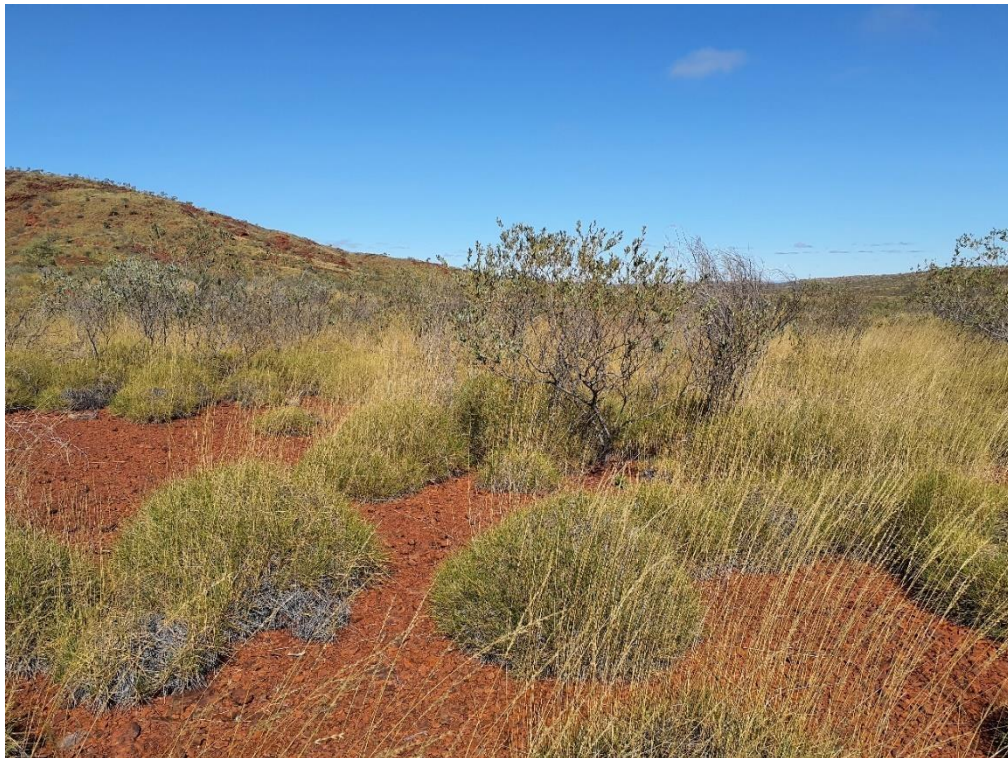
Site No: CMR01	Date: 01/06/2022	Longitude: 0460020	Latitude: 7491223
Type: Relevé		Soil Types: Sandy clay loam	
Topography: Mid-hill slope		Soil Colour: Reddish brown	
Vegetation Condition: Excellent		Condition Notes: None	
Fire: 8-12 yrs			
Vegetation Type: S3			
<p>Low open woodland to scattered trees of <i>Eucalyptus leucophloia</i> over scattered tall shrubs of <i>Acacia pruinocarpa</i> over open shrubland of <i>Acacia bivenosa</i> and <i>Acacia maitlandii</i> and <i>Petalostylis labicheoides</i> over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pisoliticola</i></p>			



Coll.	Taxon	Height (m)	Cover (%)	Comments
CMR01-05	<i>Acacia arida</i>	1.8	0.1	
	<i>Acacia bivenosa</i>	1.5	0.1	
CMR01-04	<i>Acacia hamersleyensis</i>	2.3	0.5	
	<i>Acacia pruinocarpa</i>	3	0.1	
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.4	1	
	<i>Aristida contorta</i>	0.3	0.1	
CMR01-02	<i>Corchorus crozophorifolius</i>	0.7	0.1	
	<i>Cymbopogon ambiguus</i>	0.4	0.1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
CMR01-03	<i>Dodonaea pachyneura</i>	1.8	0.1	
	<i>Eucalyptus leucophloia</i>	5	0.1	
	<i>Goodenia stobbsiana</i>	0.2	1	
	<i>Hakea chordophylla</i>	2.5	0.1	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	1.2	0.1	
	<i>Petalostylis labicheoides</i>	2	0.1	
	<i>Ptilotus calostachyus</i>	1.6	0.5	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.4	0.1	
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.8	0.1	
CMR01-01	<i>Triodia pisoliticola</i>	0.6	0.1	
CMR01-05	<i>Triodia wiseana</i>	0.5	5	

Site No: CMR02	Date: 01/06/2022	Longitude: 0460020	Latitude: 7491223
Type: Relevé	Soil Types: Sandy clay loam		
Topography: Footslope	Soil Colour: Red brown		
Vegetation Condition: Excellent	Condition Notes: None		
Fire: 8-12 yrs			
Vegetation Type: U2			
Open shrubland of <i>Acacia bivenosa</i> , <i>Acacia kempeana</i> and <i>Acacia ancistrocarpa</i> over open hummock grassland of <i>Triodia wiseana</i> .			



Coll.	Taxon	Height (m)	Cover (%)	Comments
CMR01-05	<i>Acacia arida</i>	1	2.1	
	<i>Acacia bivenosa</i>	3	2.3	
CMR01-04	<i>Acacia hamersleyensis</i>	0.1	1.8	
	<i>Acacia pruinocarpa</i>	0.1	2.2	
	<i>Dampiera candidans</i>	0.1	0.5	
	<i>Eriachne pulchella</i>	0.1	0.1	
	<i>Goodenia stobbsiana</i>	0.1	0.1	
	<i>Hakea chordophylla</i>	0.1	2.3	
	<i>Indigofera monophylla</i>	0.1	0.2	
	<i>Ptilotus calostachyus</i>	0.1	0.3	
	<i>Solanum phlomoides</i>	0.1	0.3	

Coll.	Taxon	Height (m)	Cover (%)	Comments
CMR01-01	<i>Triodia pisolitica</i>	0.5	0.4	
	<i>Triodia wiseana</i>	12	0.6	

Site No: CMR03	Date: 01/06/2022	Longitude: 0459903	Latitude: 7492107
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Type: Relevé
Topography: Hill crest/hillslope
Vegetation Condition: Excellent
Fire: 8-12 yrs
Vegetation Type: S3

Soil Types: Sandy clay loam
Soil Colour: Red Brown
Condition Notes: None

Low open woodland to scattered trees of *Eucalyptus leucophloia* over scattered tall shrubs of *Acacia pruinocarpa* over open shrubland of *Acacia bivenosa* and *Acacia maitlandii* and *Petalostylis labicheoides* over open hummock grassland of *Triodia wiseana* and *Triodia pisoliticola*.



Coll.	Taxon	Height (m)	Cover (%)	Comments
CMR01-05	<i>Acacia arida</i>	2.4	0.5	
	<i>Acacia bivenosa</i>	1	2.1	
CMR01-04	<i>Acacia hamersleyensis</i>	0.1	1.1	
	<i>Acacia kempeana</i>	2	2.8	
	<i>Acacia maitlandii</i>	0.1	3.2	
	<i>Acacia pruinocarpa</i>	0.1	1.9	
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	0.1	2.5	
	<i>Acacia tetragonophylla</i>	0.1	1.7	
NC	<i>Eremophila tietkensis</i>	0.1	0.7	
	<i>Eriachne pulchella</i>	0.1	0.1	
	<i>Eucalyptus leucophloia</i>	1.5	6	

Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Goodenia stobbsiana</i>	0.1	0.2	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	0.1	2.8	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	0.1	1.8	
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	0.1	2.1	
CMR01-01	<i>Triodia pisoliticola</i>	2	0.5	
	<i>Triodia wiseana</i>	12	0.6	

Site No: CMR04	Date: 01/06/2022	Longitude: 0459638	Latitude: 7491899
Type: Relevé	Soil Types: Sandy clay loam		
Topography: Footslope	Soil Colour: Reddish brown		
Vegetation Condition: Excellent	Condition Notes: None		
Fire: 8-12 yrs			
Vegetation Type: P1			
Tall shrubland to tall open shrubland of <i>Acacia kempeana</i> and <i>Acacia bivenosa</i> with scattered <i>Acacia pruinocarpa</i> over open hummock grassland of <i>Triodia wiseana</i>			



Coll.	Taxon	Height (m)	Cover (%)	Comments
CMR01-05	<i>Acacia arida</i>	2.4	2	
	<i>Acacia bivenosa</i>	2.1	1	
CMR01-04	<i>Acacia hamersleyensis</i>	1.1	0.1	
	<i>Acacia kempeana</i>	2.5	0.1	
	<i>Acacia pruinocarpa</i>	1.9	0.1	
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	4.2	0.1	
	<i>Acacia tetragonophylla</i>	2.1	0.1	
	<i>Cucumis variabilis</i>	0.5	0.1	
	<i>Cymbopogon ambiguus</i>	0.4	0.1	
	<i>Eriachne pulchella</i>	0.1	0.1	
	<i>Eucalyptus leucophloia</i>	6	1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Goodenia stobbsiana</i>	0.2	0.1	
	<i>Indigofera monophylla</i>	0.3	0.1	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	2.8	0.1	
	<i>Polycarpaea longiflora</i>	0.1	0.1	
	<i>Ptilotus calostachyus</i>	0.3	0.1	
	<i>Senna glutinosa</i> subsp. <i>xluerssenii</i>	0.4	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.8	0.1	
CMR01-01	<i>Triodia pisolitica</i>	0.1	0.1	
	<i>Triodia wiseana</i>	0.6	14	

Site No: MWR01	Date: 01/06/2022	Longitude: 0460059	Latitude: 7491562
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Type: Relevé
Topography: Mid-hill slope
Vegetation Condition: Excellent
Fire: 8-12 yrs
Vegetation Type: S3

Soil Types: Sandy clay loam
Soil Colour: Red brown
Condition Notes: None

Low open woodland to scattered trees of *Eucalyptus leucophloia* over scattered tall shrubs of *Acacia pruinocarpa* over open shrubland of *Acacia bivenosa* and *Acacia maitlandii* and *Petalostylis labicheoides* over open hummock grassland of *Triodia wiseana* and *Triodia pisoliticola*



Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Acacia arida</i>	1.5	1	
	<i>Acacia bivenosa</i>	1.5	0.1	
	<i>Acacia hamersleyensis</i>	2	2	
MWR01.04	<i>Acacia kempeana</i>	2.1	0.1	
	<i>Acacia pruinocarpa</i>	1.8	0.1	
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	1.8	0.1	
	<i>Acacia synchronicia</i>	1.8	0.1	
	<i>Cymbopogon ambiguus</i>	1	0.1	
MWR01.03	<i>Dodonaea pachyneura</i>	1	0.1	
MWR01.06	<i>Eremophila latrobei</i> subsp. <i>glabra</i>	1.3	0.1	
	<i>Eriachne mucronata</i>	0.25	0.1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Eucalyptus leucophloia</i>	5	1	
	<i>Goodenia stobbsiana</i>	0.1	0.1	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	0	0.1	
	<i>Petalostylis labicheoides</i>	2.1	0.1	
	<i>Ptilotus obovatus</i>	0.3	0.1	
	<i>Ptilotus calostachyus</i>	0.1	0.1	
	<i>Scaevola acacioides</i>	1.1	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.5	0.1	
	<i>Solanum phlomoides</i>	0.1	0.1	
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.1	
MWR01.02	<i>Triodia pisolitica</i>	0.5	3	
MWR01.01	<i>Triodia wiseana</i>	0.5	20	
MWR01.05	<i>Triumfetta clementii</i>	0.4	0.1	

Site No: MWR02	Date: 01/06/2022	Longitude: 0459412	Latitude: 7491761
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Type: Relevé
Topography: Rocky gully
Vegetation Condition: Excellent
Fire: 8-12 yrs
Vegetation Type: G1

Soil Types: Sandy clay loam
Soil Colour: reddish brown
Condition Notes: None

Low open woodland of *Corymbia ferritcola* with scattered *Eucalyptus leucophloia* over tall open shrubland of *Acacia hamersleyensis*, *Acacia citrinoviridis* and *Acacia pruinocarpa* over open shrubland of *Dodonaea pachyneura*, *Prostanthera albiflora*, *Senna glutinosa* subsp. *glutinosa* and *Santalum lanceolatum* over open hummock grassland of *Triodia pisolitica* and *Triodia wiseana* over scattered tussock grasses of *Eriachne mucronata* and *Cymbopogon ambiguus*.



Coll.	Taxon	Height (m)	Cover (%)	Comments
MWR02.01	<i>Abutilon</i> sp. Dioicum	1.5	0.1	
	<i>Acacia bivenosa</i>	2.1	0.1	
	<i>Acacia hamersleyensis</i>	2	3	
MWR02.06	<i>Acacia kempeana</i>	3.5	0.1	
	<i>Astrotricha hamptonii</i>	1.2	0.1	
MWR02.04	<i>Bulbostylis barbata</i>	0.1	0.1	
MWR02.05	<i>Cheilanthes brownii</i>	0.1	0.1	
MWR02.03	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	1	0.1	
MWR02.09	<i>Corchorus crozophorifolius</i>	1	0.1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Corymbia ferritcola</i>	3	1	
	<i>Cucumis variabilis</i>	0	0.1	
	<i>Cymbopogon ambiguus</i>	0.6	0.1	
MWR01.03	<i>Dodonaea pachyneura</i>	1.8	3	
	<i>Duperreya commixta</i>	0	0.1	
NC	<i>Eremophila</i> sp.	1.6	1	
	<i>Eriachne mucronata</i>	0.3	0.1	
	<i>Eucalyptus leucophloia</i>	4.5	0.1	
MWR02.02	<i>Euphorbia coghlanii</i>	0.05	0.1	
NC	<i>Indigofera rivularis</i>	1	0.1	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	0	0.1	
	<i>Melhaniania oblongifolia</i>	0.4	0.1	
MWR02.10	<i>Paspalidium clementii</i>	0.15	0.1	
	<i>Polycarpaea longiflora</i>	0.15	0.1	
	<i>Psydrax latifolia</i>	3	0.1	
	<i>Scaevola acacioides</i>	1	0.1	
	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	0.4	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.2	0.1	
NC	<i>Sida</i> sp. Hamersley Range	0.3	0.1	
	<i>Solanum phlomoides</i>	0.5	0.1	
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.05	0.1	
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.1	0.1	
MWR01.02	<i>Triodia pisoliticola</i>	0.4	20	
MWR01.01	<i>Triodia wiseana</i>	0.4	2	
MWR01.05	<i>Triumfetta clementii</i>	0.3	0.1	

Site No: MWR03	Date: 01/06/2022	Longitude: 0459579	Latitude: 7492149
Type: Relevé	Soil Types: Sandy loam		
Topography: Plain, Footslope	Soil Colour: reddish brown		
Vegetation Condition: Excellent	Condition Notes: None		
Fire: 8-12 yrs			
Vegetation Type: P1			
Tall shrubland to tall open shrubland of <i>Acacia kempeana</i> and <i>Acacia bivenosa</i> with scattered <i>Acacia pruinocarpa</i> over open hummock grassland of <i>Triodia wiseana</i> .			



Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Acacia arida</i>	1.9	2	
	<i>Acacia bivenosa</i>	2	3	
	<i>Acacia citrinoviridis</i>	2.1	0.1	
MWR03.02	<i>Acacia kempeana</i>	2.2	0.1	
	<i>Acacia pruinocarpa</i>	2	0.1	
	<i>Acacia tetragonophylla</i>	2	0.1	
	<i>Eriachne pulchella</i>	0.05	0.1	
	<i>Eucalyptus leucophloia</i>	5	0.1	
	<i>Goodenia stobbsiana</i>	0.1	0.1	
	<i>Hakea chordophylla</i>	2.5	0.1	
	<i>Indigofera monophylla</i>	0.5	0.1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Ptilotus exaltatus</i>	0.05	0.1	
	<i>Ptilotus calostachyus</i>	0.5	0.1	
	<i>Scaevola acacioides</i>	1.5	0.1	
	<i>Senna artemisioides</i> subsp. <i>helmsii</i>	0.5	0.1	
	<i>Senna glutinosa</i> subsp. <i>xluerssenii</i>	1.8	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.8	0.1	
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	1	0.1	
MWR03.01	<i>Sida</i> sp.	0.4	0.1	Sterile
MWR01.02	<i>Triodia pisoliticola</i>	0.4	0.1	
	<i>Triodia wiseana</i>	0.6	20	

Site No: MRW04	Date: 01/06/2022	Longitude: 0459685	Latitude: 7492437
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Type: Relevé**Soil Types:** Sandy clay loam**Topography:** Rocky Outcrop**Soil Colour:** reddish brown**Vegetation Condition:** Very Good**Condition Notes:** Buffel grass scattered**Fire:** 8-12 yrs**Vegetation Type:** G1

Low open woodland of *Corymbia ferritcola* with scattered *Eucalyptus leucophloia* over tall open shrubland of *Acacia hamersleyensis*, *Acacia citrinoviridis* and *Acacia pruinocarpa* over open shrubland of *Dodonaea pachyneura*, *Prostanthera albiflora*, *Senna glutinosa* subsp. *glutinosa* and *Santalum lanceolatum* over open hummock grassland of *Triodia pisolitica* and *Triodia wiseana* over scattered tussock grasses of *Eriachne mucronata* and *Cymbopogon ambiguus*.



Coll.	Taxon	Height (m)	Cover (%)	Comments
MWR02.01	<i>Abutilon</i> sp. Dioicum	1.5	0.1	
	<i>Acacia bivenosa</i>	2	2	
	<i>Acacia pruinocarpa</i>	2	0.1	
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>	2	0.1	
	<i>Acacia tetragonophylla</i>	2	0.1	
HAOP04	<i>Amaranthus undulatus</i>	0.1	0.1	
	<i>Aristida contorta</i>	0.2	0.1	
	<i>Astrotricha hamptonii</i>	1	0.1	
MWR04.02	<i>Boerhavia gardneri</i>	0.1	0.1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
MWR02.04	<i>Bulbostylis barbata</i>	0.05	0.1	
	* <i>Cenchrus ciliaris</i>	0.3	0.1	
	<i>Cymbopogon ambiguus</i>	0.8	0.1	
MWR04.03	<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.2	0.1	
MWR01.03	<i>Dodonaea pachyneura</i>	2	5	
NC	<i>Eremophila tietkensis</i>	1.5	0.1	
	<i>Eriachne mucronata</i>	0.3	0.1	
	<i>Eucalyptus leucophloia</i>	3.5	1	
MWR04.04	<i>Euphorbia careyi</i>	0.1	0.1	
	<i>Grevillea berryana</i>	3	0.1	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	0	0.1	
MWR02.10	<i>Paspalidium clementii</i>	0.1	0.1	
	<i>Petalostylis labicheoides</i>	2	0.1	
	<i>Polycarpaea longiflora</i>	0.1	0.1	
	<i>Psydrax latifolia</i>	2	0.1	
	<i>Scaevola acacioides</i>	1	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.5	0.1	
MWR04.01	<i>Sida sp. Excedentifolia</i>	0.2	0.1	
	<i>Solanum horridum</i>	0.3	0.1	
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.1	
	<i>Tribulus suberosus</i>	0.8	0.1	
MWR01.02	<i>Triodia pisolitica</i>	1.5	15	
MWR01.01	<i>Triodia wiseana</i>	0.4	5	
MWR01.05	<i>Triumfetta clementii</i>	0.4	0.1	

*denotes weed species

Site No: MJH01	Date: 01/06/2022	Longitude: 0460477	Latitude: 7491586
Type: Relevé		Soil Types: Sandy clay loam	
Topography: Gorge/gully		Soil Colour: Red	
Vegetation Condition: Excellent		Condition Notes: None	
Fire: 8-12 yrs			
Vegetation Type: G2			
Scattered low trees of <i>Eucalyptus leucophloia</i> over open shrubland of <i>Stylobasium spathulatum</i> , <i>Acacia pruinocarpa</i> , <i>Gossypium robinsonii</i> , <i>Petalostylis labicheoides</i> , <i>Acacia bivenosa</i> and <i>Senna glutinosa</i> subsp. <i>glutinosa</i> over open hummock grassland of <i>Triodia wiseana</i> with scattered <i>Triodia pisoliticola</i> over scattered tussock grasses of <i>Eriachne mucronata</i> and <i>Cymbopogon ambiguus</i> .			



Coll.	Taxon	Height (m)	Cover (%)	Comments
MJH01-18	<i>Abutilon</i> sp. Dioicum	1.2	0.1	
	<i>Acacia aneura</i>	3.6	0.1	
MJH01-12	<i>Acacia arida</i>	1.2	0.3	
	<i>Acacia pruinocarpa</i>	1.3	0.5	
	<i>Acacia pyrifolia</i>	2.2	0.3	
	<i>Astrotricha hamptonii</i>	1.2	0.5	
MJH01-08	<i>Cheilanthes brownii</i>	0.15	0.1	
MJH01-15	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	1.9	0.1	
MJH01-04	<i>Corchorus crozophorifolius</i>	0.5	0.5	
	<i>Corymbia ferriticola</i>	2.3	1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Cymbopogon ambiguus</i>	0.45	0.3	
MJH01-01	<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.3	0.1	
MJH01-13	<i>Dodonaea pachyneura</i>	1.6	0.1	
MWR01.06	<i>Eremophila latrobei</i> subsp. <i>glabra</i>	1.4	1.5	
	<i>Eriachne mucronata</i>	0.3	0.1	
	<i>Eucalyptus leucophloia</i>	4.5	2	
MJH01-03	<i>Euphorbia careyi</i>	0.05	0.1	
MJH01-02	<i>Gomphrena cunninghamii</i>	0.1	0.1	
	<i>Goodenia stobbsiana</i>	0.2	0.1	
	<i>Grevillea berryana</i>	1.6	0.3	
MJH01-14	<i>Hibiscus coatesii</i>	0.45	0.1	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	Cr	0.1	
	<i>Ptilotus calostachyus</i>	0.5	0.1	
MJH01-16	<i>Ptilotus fusiformis</i>	0.2	0.1	
	<i>Ptilotus polystachyus</i>	0.35	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.4	0.5	
MJH01-10	<i>Solanum cleistogamum</i>	0.2	0.1	
	<i>Sporobolus australasicus</i>	0.2	0.1	
	<i>Stylobasium spathulatum</i>	1.2	0.1	
MJH01-07	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.15	0.1	
MJH01-05	<i>Triodia pisolitica</i>	0.5	12	
MJH01-06	<i>Triodia wiseana</i>	0.35	11	
MJH01-09	<i>Triumfetta clementii</i>	0.2	0.1	

Site No: MJH02	Date: 01/06/2022	Longitude: 0460782	Latitude: 7491446
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Type: Relevé
Topography: Gorge/gully
Vegetation Condition: Excellent
Fire: 8-12 yrs
Vegetation Type: G2

Soil Types: Sand clay loam
Soil Colour: reddish brown
Condition Notes: None

Scattered low trees of *Eucalyptus leucophloia* over open shrubland of *Stylobasium spathulatum*, *Acacia pruinocarpa*, *Gossypium robinsonii*, *Petalostylis labicheoides*, *Acacia bivenosa* and *Senna glutinosa* subsp. *glutinosa* over open hummock grassland of *Triodia wiseana* with scattered *Triodia pisoliticola* over scattered tussock grasses of *Eriachne mucronata* and *Cymbopogon ambiguus*.



Coll.	Taxon	Height (m)	Cover (%)	Comments
MJH01-18	<i>Abutilon</i> sp. Dioicum	0.8	0.1	
MJH01-12	<i>Acacia arida</i>	2.1	0.5	
	<i>Acacia pruinocarpa</i>	2.6	0.5	
	<i>Acacia pyrifolia</i>	1.8	1.5	
	<i>Acacia synchronicia</i>	2.3	0.5	
	<i>Afrohybanthus aurantiacus</i>	0.3	0.1	
	<i>Arivela viscosa</i>	0.45	0.1	
	<i>Astrotricha hamptonii</i>	1.4	0.7	
MJH01-04	<i>Corchorus crozophorifolius</i>	0.6	0.1	
	<i>Cymbopogon ambiguus</i>	0.75	0.5	

Coll.	Taxon	Height (m)	Cover (%)	Comments
MJH01-01	<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>	0.4	0.1	
MJH02-02	<i>Dodonaea pachyneura</i>	1.4	1.5	
MJH02-04	<i>Dolichocarpa crouchiana</i>	0.1	0.1	
MWR01.06	<i>Eremophila latrobei</i> subsp. <i>glabra</i>	1.2	15	
	<i>Eriachne mucronata</i>	0.3	0.1	
	<i>Eriachne pulchella</i>	0.1	0.5	
	<i>Eucalyptus leucophloia</i>	4.3	1	
MJH01-03	<i>Euphorbia careyi</i>	0.1	0.1	
	<i>Gossypium robinsonii</i>	1.4	0.1	
	<i>Grevillea berryana</i>	2.2	1	
	<i>Hakea lorea</i>	1.6	0.1	
MJH02-01	<i>Indigofera rivularis</i>	1.2	1	
MJH02-09	<i>Jasminum didymum</i> subsp. <i>lineare</i>	Cr	0.1	
MJH02-03	<i>Nellica maderaspatensis</i>	0.1	0.1	
MJH02-05	<i>Ptilotus gomphrenoides</i>	0.1	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.4	1	
MJH02-08	<i>Sida rohlenae</i> subsp. <i>rohlenae</i>	0.55	0.1	
MJH02-06	<i>Solanum cleistogamum</i>	0.2	0.1	
	<i>Stylobasium spathulatum</i>	1.9	0.3	
MJH01-07	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.2	0.1	
MJH01-05	<i>Triodia pisoliticola</i>	0.55	14	
MJH01-06	<i>Triodia wiseana</i>	0.4	8	

Site No: MJH03	Date: 01/06/2022	Longitude: 0460335	Latitude: 7491588
Type: Relevé	Soil Types: Sand clay loam		
Topography: Scree slope	Soil Colour: Reddish brown		
Vegetation Condition: Excellent	Condition Notes: None		
Fire: 8-12 yrs			
Vegetation Type: S2			
Scattered low trees of <i>Eucalyptus leucophloia</i> with scattered <i>Hakea chordophylla</i> and <i>Acacia pruinocarpa</i> over low open shrubland of <i>Acacia arida</i> over open hummock grassland of <i>Triodia wiseana</i> with scattered <i>Triodia pisoliticola</i> .			



Coll.	Taxon	Height (m)	Cover (%)	Comments
MJH03-02	<i>Acacia arida</i>	1.6	3	
	<i>Acacia bivenosa</i>	1.6	0.5	
	<i>Acacia inaequilatera</i>	1.4	0.1	
MJH03-01	<i>Acacia kempeana</i>	1.9	15	
	<i>Acacia pruinocarpa</i>	2.3	2	
	<i>Acacia synchronicia</i>	1.9	0.1	
	<i>Cymbopogon ambiguus</i>	0.6	0.1	
	<i>Dampiera candidans</i>	0.4	0.1	
	<i>Eremophila platycalyx</i>	1.3	0.1	
	<i>Eriachne mucronata</i>	0.2	0.1	
	<i>Eucalyptus leucophloia</i>	4.1	4	
	<i>Goodenia stobsiana</i>	0.4	0.1	
	<i>Hakea chordophylla</i>	1.4	0.3	
	<i>Ptilotus calostachyus</i>	0.4	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.2	0.5	

Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.1	0.1	
MJH01-05	<i>Triodia pisolitica</i>	0.3	4	
MJH01-06	<i>Triodia wiseana</i>	0.35	18	
MJH01-09	<i>Triumfetta clementii</i>	0.3	0.1	

Site No: MJH04 **Date:** 01/06/2022 **Longitude:** 0460251 **Latitude:** 7492055

Type: Relevé

Soil Types: Sand clay loam

Topography: Spur

Soil Colour: Red

Vegetation Condition: Excellent

Condition Notes: None

Fire: 8-12 yrs

Vegetation Type: S2

Scattered low trees of *Eucalyptus leucophloia* with scattered *Hakea chordophylla* and *Acacia pruinocarpa* over low open shrubland of *Acacia arida* over open hummock grassland of *Triodia wiseana* with scattered *Triodia pisolitica*.



Coll.	Taxon	Height (m)	Cover (%)	Comments
MJH04-02	<i>Acacia arida</i>	2.1	1	
MJH03-02	<i>Acacia bivenosa</i>	0.9	0.3	
	<i>Acacia coriacea</i> subsp. <i>pendens</i>	1.3	0.1	
MJH03-01	<i>Acacia kempeana</i>	2.1	0.1	
	<i>Acacia pruinocarpa</i>	2.3	2	
MJH04-01	<i>Eremophila tietkensis</i>	0.9	0.1	
	<i>Eriachne mucronata</i>	0.2	0.5	
	<i>Eucalyptus leucophloia</i>	4.1	2	
MJH01-10	<i>Solanum cleistogamum</i>	0.3	0.1	
MJH01-05	<i>Triodia pisolitica</i>	0.5	14	
MJH01-06	<i>Triodia wiseana</i>	0.4	15	

Site No: MJH05	Date: 01/06/2022	Longitude: 0460290	Latitude: 7492223
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Type: Relevé

Soil Types: Clay loam

Topography: Scree slope

Soil Colour: reddish brown

Vegetation Condition: Excellent

Condition Notes:

Fire: 8-12 yrs

Vegetation Type: S2

Scattered low trees of *Eucalyptus leucophloia* with scattered *Hakea chordophylla* and *Acacia pruinocarpa* over low open shrubland of *Acacia arida* over open hummock grassland of *Triodia wiseana* with scattered *Triodia pisoliticola*.



Coll.	Taxon	Height (m)	Cover (%)	Comments
MJH03-02	<i>Acacia arida</i>	2.1	2	
	<i>Acacia pruinocarpa</i>	2.3	2	
	<i>Acacia synchronicia</i>	1.6	0.1	
	<i>Eucalyptus leucophloia</i>	4.5	2	
	<i>Goodenia stobbsiana</i>	0.3	0.1	
	<i>Scaevola acacioides</i>	1	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.2	0.1	
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	1.2	0.1	
MJH01-10	<i>Solanum cleistogamum</i>	0.45	0.1	
MJH01-05	<i>Triodia pisoliticola</i>	0.5	12	
MJH05-01	<i>Triodia wiseana</i>	0.3	10	

Site No: MJH06	Date: 01/06/2022	Longitude: 0460002	Latitude: 7492267
Type: Relevé	Soil Types: Sandy clay loam		
Topography: Gully	Soil Colour: Red		
Vegetation Condition: Excellent	Condition Notes:		
Fire: 8-12 yrs			
Vegetation Type: D3			
<p>Scattered low trees of <i>Eucalyptus leucophloia</i> with scattered <i>Acacia citrinoviridis</i> over tall open scrub to tall open shrubland of <i>Acacia monticola</i>, <i>Acacia maitlandii</i>, <i>Petalostylis labicheoides</i>, <i>Acacia kempeana</i>, <i>Acacia bivenosa</i> and <i>Acacia pruinocarpa</i> over open hummock grassland of <i>Triodia wiseana</i> and <i>Triodia pisoliticola</i>.</p>			



Coll.	Taxon	Height (m)	Cover (%)	Comments
	<i>Acacia pruinocarpa</i>	1.7	0.3	
	<i>Afrohybanthus aurantiacus</i>	0.2	0.1	
	<i>Astrotricha hamptonii</i>	1.1	0.3	
MJH06-02	<i>Bulbostylis barbata</i>	0.1	0.1	
MJH01-15	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	0.8	0.1	
MJH01-04	<i>Corchorus crozophorifolius</i>	0.4	0.1	
	<i>Corymbia ferritcola</i>	2.5	0.5	
	<i>Corymbia hamersleyana</i>	2.7	0.1	
	<i>Cymbopogon ambiguus</i>	0.4	0.1	
CMR01-03	<i>Dodonaea pachyneura</i>	1.2	0.2	
MJH06-01	<i>Dolichocarpa crouchiana</i>	0.1	0.1	
MJH04-01	<i>Eremophila tietkensis</i>	0.8	2	
	<i>Eriachne mucronata</i>	0.2	0.1	
	<i>Eriachne pulchella</i>	0.1	0.1	
	<i>Eucalyptus leucophloia</i>	3.6	0.1	

Coll.	Taxon	Height (m)	Cover (%)	Comments
MJH01-03	<i>Euphorbia careyi</i>	0.1	0.1	
	<i>Hibiscus coatesii</i>	0.4	0.1	
	<i>Jasminum didymum</i> subsp. <i>lineare</i>	0	0.1	
	<i>Petalostylis labicheoides</i>	1.2	0.1	
	<i>Polycarpaea longiflora</i>	0.1	0.1	
	<i>Psyrax latifolia</i>	0.8	0.1	
	<i>Ptilotus calostachyus</i>	0.4	0.1	
	<i>Ptilotus gaudichaudii</i>	0.4	0.1	
MJH02-05	<i>Ptilotus gomphrenoides</i>	0.1	0.1	
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1.2	0.1	
MJH02-06	<i>Solanum cleistogamum</i>	0.3	0.1	
	<i>Solanum cleistogamum</i>	0.3	0.1	
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>	0.3	0.1	
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	0.6	0.1	
MJH01-05	<i>Triodia pisoliticola</i>	0.4	3	
MJH01-06	<i>Triodia wiseana</i>	0.3	5	
MJH01-09	<i>Triumfetta clementii</i>	0.3	0.1	

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11 May 2023

Julijanna Hantzis
 Rio Tinto
 Central Park, Level 12,
 152 - 158 St Georges Terrace, Perth, 6000, Western Australia
 Julijanna.Hantzis@riotinto.com

Dear Julijanna

60680395 : Metawandy NVCP - Statement Addressing the 10 Clearing Principles

Rio Tinto proposes to undertake mineral exploration and geotechnical investigation activities within the Metawandy survey area in the Pilbara. The area to be cleared is comprised of 15 ha of native vegetation. To support this clearing, an assessment against the Ten Clearing Principles is required.

Based on specialist assessment of the survey area and discussion below, it is deemed that the Proposal is unlikely to be at variance with any of the Ten Clearing Principles under Schedule 5 of the Environmental Protection Act 1986.

Assessment	Source & Tools for Assessment	Outcome
Principle (a) - Native vegetation should not be cleared if it comprises a high level of biological diversity		
<p>The survey area occurs within the Hamersley sub-region of the Pilbara bioregion. The Hamersley sub-region is described as: 'Mountainous area of Proterozoic sedimentary ranges and plateaux, supporting Mulga (<i>Acacia aneura</i>) low woodland over bunch grasses on fine textured soils, and <i>Eucalyptus leucophloia</i> woodlands over <i>Triodia brizoides</i> hummock grasslands on skeletal sandy soils' (Kendrick 2001).</p> <p>No Threatened Ecological Communities (TEC) listed under the EPBC Act or BC Act are known to occur within 50 km of the survey area according to the DBCA TEC and Priority Ecological Communities (PEC) database. One Priority 1 PEC is located 25 km north of the survey area, '<i>Triodia pisolitica</i> (previously <i>Triodia</i> sp. Robe River) assemblages of mesas of the West Pilbara'. Due to the distance from the survey area, it is not expected to be impacted by the Proposal.</p> <p>Twelve vegetation communities were previously described and mapped across the survey area by Rio Tinto (2017). During the 2022 survey, seven of those twelve vegetation communities were sampled and confirmed. Two vegetation communities were described from hills and slopes, one community from undulating slopes and low rises, one community from plains, two communities from gullies, and one community from drainage lines. None of the vegetation communities were determined to represent a TEC or PEC.</p> <p>The twelve vegetation communities defined within the survey area are considered to be of low conservation value and are widely distributed both locally and throughout the Hamersley subregion.</p>	<p>AECOM biological survey (2022)</p> <p>Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086</p> <p>Kendrick, P. (2001) Pilbara 3 (PIL3 – Hamersley Subregion). In A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002 (eds J.E. May & N.L. McKenzie). Department of Conservation and Land Management, W.A.</p>	<p><i>The proposal is not likely to be at variance with this clearing principle</i></p>

Assessment	Source & Tools for Assessment	Outcome
<p>A total of 88 native plant species were recorded in the 2022 survey area, comprising 51 genera and 27 families. The number of taxa recorded during this survey appears to be consistent with what has been recorded in the area previously (Rio Tinto 2017). The majority of the survey area was traversed on foot and species not represented in relevés were recorded opportunistically.</p> <p>Four Priority flora species were recorded during the 2022 survey: <i>Indigofera rivularis</i> (P3), <i>Ptilotus mollis</i> (P4), <i>Sida</i> sp. Hamersley Range (K. Newbey 10692) (P3), and <i>Triodia pisoliticola</i> (P3). <i>Ptilotus mollis</i> and <i>Sida</i> sp. Hamersley Range were known to occur in the area from previous surveys and database records.</p> <p>Eight fauna habitats were previously described and mapped across the survey area by Rio Tinto (2017). During the 2022 survey, six of those eight fauna habitats were sampled and confirmed: 'Rocky slopes', 'Undulating slopes and low rises', 'Gullies', 'Mulga on plains', 'Drainage line – minor', and 'Rocky breakaways and cliffs'. These eight fauna habitats are not considered to be restricted at a local or regional level.</p> <p>In summary, the vegetation does not appear to have a biodiversity higher than the surrounding area and consequently the area is not considered to comprise a high level of biological diversity.</p>		
<p>Principle (b) - Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia</p>		
<p>No conservation significant fauna were recorded within the survey area. Five conservation significant fauna species were considered 'likely to occur' within the habitats available in the survey area. These species were: Gane's Blind Snake (<i>Anilius ganei</i>); Ghost Bat (<i>Macroderma gigas</i>); Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>); Pilbara Leaf-nosed Bat (<i>Rhinoniceteris aurantia</i> (Pilbara)); and Peregrine Falcon (<i>Falco peregrinus</i>). Of these, three are listed as Threatened under the EPBC Act and BC Act and two are listed by DBCA as Priority species.</p> <p>Of these seven conservation significant species, none would be likely to be dependent on the habitats within the survey area. The habitats present may provide foraging habitat for fauna; however, the proposed clearing is not expected to impact the conservation status or core habitat for any conservation significant species.</p>	<p>AECOM biological survey (2022)</p> <p>Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086</p>	<p>The proposal is not likely to be at variance with this clearing principle</p>

Assessment	Source & Tools for Assessment	Outcome
<i>Principle (c) - Native vegetation should not be cleared if it includes or is necessary for the continued existence of, rare flora</i>		
No Declared Rare / Threatened flora species were recorded, nor were any EPBC Act listed Threatened flora observed. It is considered unlikely that any Threatened Flora species would have been overlooked.	AECOM biological survey (2022) Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086	<i>The proposal is not likely to be at variance with this clearing principle</i>
<i>Principle (d) - Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a Threatened Ecological Community</i>		
No Threatened Ecological Communities listed under the EPBC Act or BC Act are known to occur within the survey area according to the DBCA TEC database. The vegetation is consequently not a part of or necessary for the maintenance of a Threatened Ecological Community.	AECOM biological survey (2022) Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086	<i>The proposal is not likely to be at variance with this clearing principle</i>
<i>Principle (e) - Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been significantly cleared</i>		
The survey area lies within one of Beard’s mapping communities - Hamersley 82 (e16Lr t3Hi). The current extent of the Beard (1975) mapping unit Hamersley 82 (e16Lr t3Hi) has been estimated to be over 99% of its’ pre-European extent remaining. The vegetation types within the survey area would not therefore represent remnant stands of significantly cleared vegetation.	AECOM biological survey (2022) Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086 Beard JS, 1975. Pilbara, 1:1,000,000 vegetation series: explanatory notes to sheet 5: the vegetation of the Pilbara area Nedlands, W.A. : University of Western Australia Press	<i>The proposal is not likely to be at variance with this clearing principle</i>
<i>Principle (f) - Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or a wetland</i>		
The survey area lies within the Newman, Platform and Robe Land Systems. Minor ephemeral creek lines that flow after significant rainfall events transect the survey area. These flow lines are not considered to be	AECOM biological survey (2022) Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at	<i>The proposal is not likely to be at variance with this clearing principle</i>

Assessment	Source & Tools for Assessment	Outcome
<p>significant watercourses or wetlands due to the infrequent nature of their flows.</p>	<p>Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086</p> <p>DBCA-019 Geomorphic Wetlands, SCP (2021)</p>	
<p><i>Principle (g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation</i></p>		
<p>The survey area lies within the Newman, Platform and Robe Land Systems. These Land Systems are generally not prone to degradation and not susceptible to erosion. The proposed clearing will consequently not cause appreciable land degradation.</p>	<p>AECOM biological survey (2022)</p> <p>Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086</p>	<p><i>The proposal is not likely to be at variance with this clearing principle</i></p>
<p><i>Principle (h) - Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area</i></p>		
<p>There are no conservation areas within 50 km of the clearing area and as a result the clearing will not impact on the environmental values of any conservation areas.</p>	<p>AECOM biological survey (2022)</p> <p>Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086</p> <p>DWER-046 Clearing Regulations ESAs (2021)</p>	<p><i>The proposal is not likely to be at variance with this clearing principle</i></p>
<p><i>Principle (i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water</i></p>		
<p>No permanent or semi-permanent water features occur in or adjacent to the survey area. Given the small scale of Proposal, there is no reason to expect that the Proposal would affect groundwater quality in the region. The Bungaroo Creek Water Reserve is the nearest Public Drinking Water Source area. This reserve is 58 km to the north of the survey area and will not be impacted. The Proposal is not considered to be at variance with this Principle.</p>	<p>AECOM biological survey (2022)</p> <p>Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086</p>	<p><i>The proposal is not likely to be at variance with this clearing principle</i></p>

Assessment	Source & Tools for Assessment	Outcome
<i>Principle (j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause or exacerbate the incidence or intensity of flooding</i>		
Local flooding occurs seasonally in the Pilbara region as a result of cyclonic activity and sporadic thunderstorm activity. The small scale of cleared proposed is not expected to exacerbate the incidence or intensity of flooding in the area.	AECOM biological survey (2022) Rio Tinto (2017), Flora, Vegetation and Fauna Habitat Assessment at Metawandy, Native Vegetation Clearing Permit – Supporting Report, RTIO-HSE-0298086	<i>The proposal is not likely to be at variance with this clearing principle</i>

Yours sincerely



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Attachment 6 and Attachment 7 have been uploaded separately