Attachment 3

Prepared for
Rio Tinto Group
ABN: 96 004 458 404

AR-23-18419 - Flora, Vegetation and Fauna Habitat Assessment

Native Vegetation Clearing Permit

14-Jan-2024
Doc No. 60726828_3

aecom.com

Delivering a better world

AR-23-18419 - Flora, Vegetation and Fauna Habitat Assessment

Native Vegetation Clearing Permit

Client: Rio Tinto Group

ABN: 96 004 458 404

Prepared by

AECOM Australia Pty Ltd
Whadjuk Nyoongar Country, Level 15, Alluvion Building, 58 Mounts Bay Road, Perth WA 6000, GPO Box B59, Perth WA 6849, Australia
T +61 1800 868 654 www.aecom.com
ABN 20 093 846 925

14-Jan-2024

Job No.: 60726828

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document	AR-23-18419 - Flora, Vegetation and Fauna Habitat Assessment
Ref	60726828
Date	14-Jan-2024
Originator	Floora de Wit, Gefan Juran
Checker/s	Celia Mitchel, Shannon de Melo
Verifier/s	Jamie Shaw

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
B	27-Aug-2024	Draft for client review	Floora de Wit Associate Director - Natural Resources	
0	11-Nov-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	
1	19-Nov-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	
2	28-Nov-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	
3	14-Jan-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	

Table of Contents

Executive Summary i
1.0 Introduction 1
1.1 Background and Location 1
1.2 Objective and Scope 1
2.0 Conservation Codes 3
2.1 Flora and Fauna 3
2.2 Vegetation Communities 6
2.3 Biosecurity and Agriculture Management Act 2007 7
3.0 Existing Environment 8
3.1 Climate 8
3.2 Interim Biogeographic Region of Australia 8
3.3 Land Systems 9
3.4 Geology 9
3.5 Pre-European Vegetation 9
3.6 Conservation Reserves and Heritage 9
4.0 Methodology 14
4.1 Personnel 14
4.2 Desktop Assessment 14
4.2.1 Database Searches 14
4.2.2 Likelihood Assessment 15
4.3 Flora and Vegetation Assessment 16
4.3.1 Vegetation Mapping 17
4.3.2 Targeted Flora Searches 17
4.4 Fauna Habitat Assessment 17
4.5 Survey Limitations 17
5.0 Desktop Assessment Results 19
5.1 Previous Surveys 19
5.2 Significant Ecological Communities 20
5.3 Significant Flora 20
5.4 Significant Fauna 22
6.0 Field Survey Results 24
6.1 Vegetation 24
6.1.1 Communities 24
6.1.2 Significant Vegetation 24
6.1.3 Condition 24
6.2 Flora 27
6.3 Fauna Habitats 27
7.0 Discussion 29
8.0 Conclusion 30
9.0 References 31

Appendix A
Flora Desktop Results A

Appendix B
Fauna Desktop Results B

Appendix C
Species by Family by Site C

Appendix D
Flora Site Data D

List of Tables

Table 1	Vegetation, flora and fauna survey summary	1
Table 2	Categories of species listed under Schedule 179 of the EPBC Act	3
Table 3	Conservation codes for WA flora and fauna listed under the BC Act (DBCA, 2019)	4
Table 4	Conservation codes for WA flora and fauna species as listed by DBCA and endorsed by the Ministers for Environment	5
Table 5	Categories of TECs that are listed under the EPBC Act	6
Table 6	Conservation codes for state listed Ecological Communities	6
Table 7	Categories for Priority Ecological Communities	6
Table 8	Beard et al. (2013) Vegetation Associations and Present Remaining (Govt. of WA, 2018)	9
Table 9	Nature reserves within the vicinity of the survey area	9
Table 10	Database searches undertaken for the survey area	14
Table 11	Categories of likelihood of occurrence for flora and fauna species present	15
Table 12	Categories of likelihood of occurrence for fauna species	16
Table 13	Survey limitations	18
Table 14	Results of previous surveys conducted in the vicinity of the study area	19
Table 15	Significant Ecological Communities in the vicinity of the survey area	20
Table 16	Significant Flora species considered to have high or moderate likelihood of occurrence	21
Table 17	Significant fauna species considered to have high or moderate likelihood of occurrence	22
Table 18	Condition extent within survey area	24
Table 19	Vegetation communities description, details and photograph	25
Table 20	Fauna habitats of the survey area	27

List of Figures

Figure 1	Survey Area	2
Figure 2	Rainfall and temperature data from Pannawonica and Mardie stations (BoM, 2024)	8
Figure 3	Land Systems	10
Figure 4	Geology	11
Figure 5	Pre-European Vegetation	12
Figure 6	Conservation Estates and Heritage	13
Figure 7	Flora, Fauna and Communities Desktop Results	23
Figure 8	Vegetation Communities, Condition and Survey Effort	26
Figure 9	Fauna Habitats	28

Abbreviation

Abbreviation	Description
AECOM	AECOM Australia Pty Ltd
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation
DoEE	Department of the Environment and Energy
DEWHA	Department of the Environment, Water, Heritage and the Arts
DPLH	Department of Planning, Lands and Heritage
DPIRD	Department of Primary Industries and Regional Development
EPA	Environmental Protection Authority
EP Act	*State Environmental Protection Act 1986*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
GPS	Global Positioning System
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre
MCNP	Millstream Chichester National Park
NVCP	Native Vegetation Clearing Permit
P	Priority
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
Rio Tinto	Rio Tinto Group / Rio Tinto Iron Ore
TEC	Threatened Ecological Community
WA	Western Australia
WAH	Western Australian Herbarium
WoNS	Weed of National Significance

Executive Summary

Rio Tinto Iron Ore (Rio Tinto) engaged AECOM Australia Pty Ltd (AECOM) to undertake a flora, fauna and vegetation assessment for a defined survey area in the Pilbara region. The survey area comprises 9.20 ha and is located along the Rio Tinto rail line approximately 70 km south of Karratha city.

The objective of the survey was to assist Rio Tinto to complete a Native Vegetation Clearing Permit (NVCP) application. The survey area was completed by botanist Celia Mitchell and environmental scientist Nina Sergeev on 5 June 2024.

- Two native vegetation communities were mapped for 8.38 ha. The remaining 0.82 ha was heavily modified (cleared).
- No TECs or PECs were considered likely to occur and none were recorded.
- No Priority flora species were recorded within the survey area, and none were considered likely or to have the potential to occur.
- Two fauna habitats were mapped including a Minor Flowline and Stony Plain.
- The Stony Plain may provide habitat for:
    - Western Pebble-mound Mouse *Pseudomys chapmani* (Priority 4)
    - Northern Short-tailed Mouse *Leggadina lakedownensis* (Priority 4).
- The Minor Flowline may provide habitat for the Grey Falcon *Falco hypoleucos* listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act).
- No Priority fauna species were recorded within the survey area.

1.0 Introduction

1.1 Background and Location

Rio Tinto Iron Ore (Rio Tinto) engaged AECOM Australia Pty Ltd (AECOM) to complete a Native Vegetation Clearing Permit (NVCP) level survey along part of a rail line. The survey targeted Threatened and Priority flora, communities and fauna habitats. The survey results will support an NVCP application and ensure Rio Tinto complies with the NVCP conditions under Section 51A of the *Environmental Protection Act 1986* (EP Act).

The survey area is a 9.20 ha polygon situated between chainage 95 and 96 of the Rio Tinto Tom Price West Mainline, approximately 70 km southeast of Karratha townsite in the Shire of Ashburton (Figure 1).

1.2 Objective and Scope

The objective of the work was to assess the environmental values of the survey area pertaining to flora, vegetation, and fauna to assist Rio Tinto in completing the NVCP application for the Rio Tinto rail line.

The scope of work included:

- A desktop assessment to identify potential flora, fauna and ecological communities within the survey area.
- A flora and vegetation survey and targeted flora survey in accordance with the Environmental Protection Authority (EPA) Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (2016a).
- A fauna habitat assessment in accordance with the EPA Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (2020).

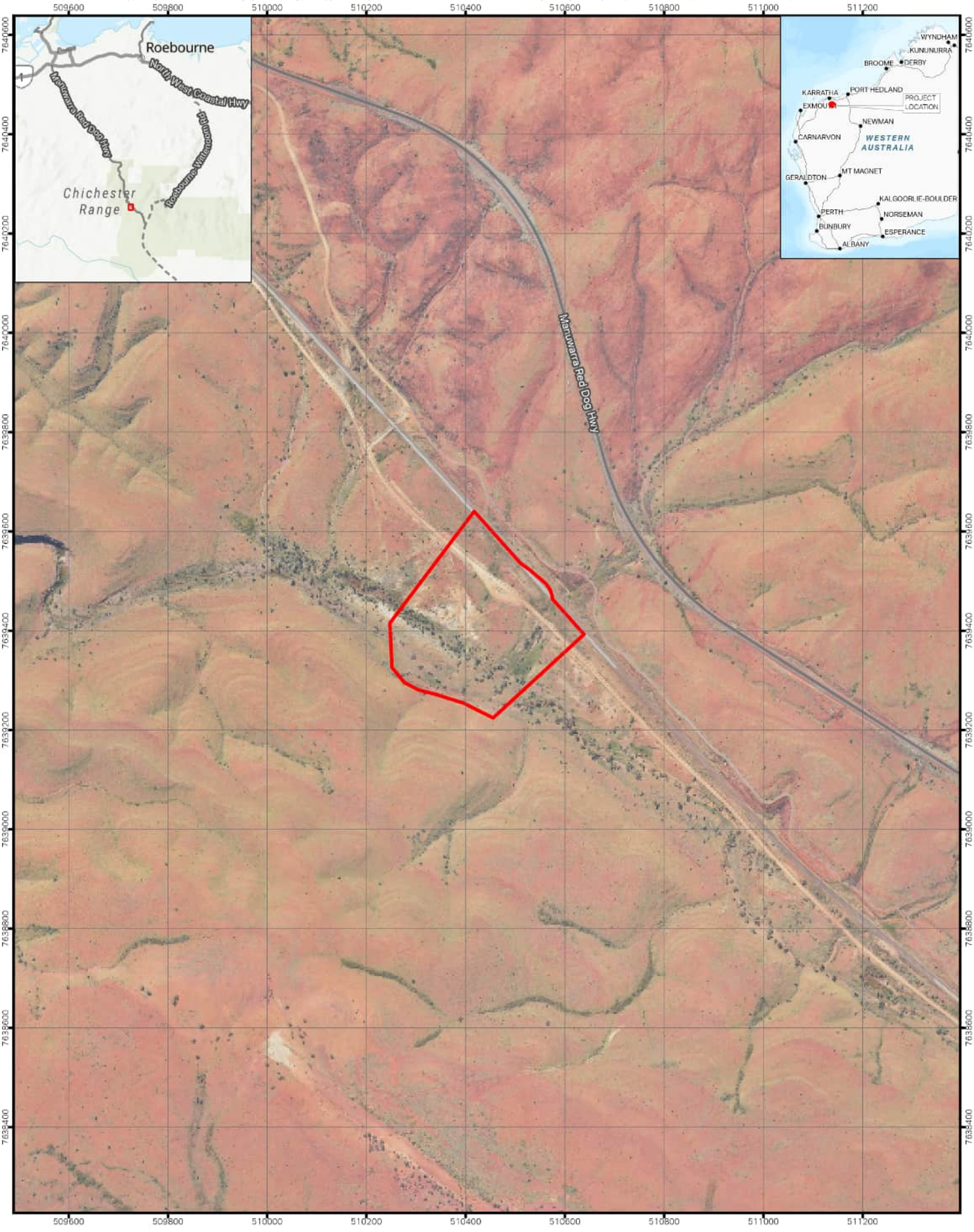
This report is intended as a supporting document for an NVCP application by Rio Tinto and has been prepared based on a review of existing information for the study area, combined with site field surveys.

A summary of the survey specifics and key limitations is shown in Table 1.

Table 1 Vegetation, flora and fauna survey summary

Survey type	Survey Area (ha)	Survey timing	Relevant regulatory standards and guidelines	Survey limitations
Flora, vegetation and fauna habitat survey	9.20	5 June, 2024	• Environmental Protection Authority (EPA) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a) • EPA Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (2020) • EPA Factor Guideline – Flora and Vegetation (2016b) • EPA Factor Guideline – Landforms (2016c) • Rio Tinto Data Standards (2023)	No survey limitations

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	13 AUG 2024
APPROVED BY	F DE WIT

N

1:10,000 (when printed at A4)

0 50 100 150 200 metres

GDA2020 MGA ZONE 50

LEGEND

Survey Area

Survey Area

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure **1**

A4 size

Project: \\na.aecomnet.com\ifs\APAC\Perth~AUPER1\Legacy\Projects\60726828_Rio_Rail_Flora\500_CAD_GIS\920_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig1_NVCP_Trip5_SurveyArea_A4P_v1, Last exported: 13/08/2024 5:15 PM

2.0 Conservation Codes

2.1 Flora and Fauna

Species at risk of extinction are recognised at a Commonwealth level under the EPBC Act and are categorised as outlined in Table 2.

Table 2 Categories of species listed under Schedule 179 of the EPBC Act

Code	Category
Ex	**Extinct Taxa** A species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild Taxa** A species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered Taxa** A species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered Taxa** A species which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable Taxa** A species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria
CD	**Conservation Dependent Taxa** A species which at a particular time if, at that time: the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered the following subparagraphs are satisfied: • the species is a species of fish, • the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised the plan of management is in force under a law of the Commonwealth or of a State or Territory cessation of the plan of management would adversely affect the conservation status of the species.
Mi	**Migratory Taxa** The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including: • Japan Australia Migratory Bird Agreement 1981 (JAMBA) • China Australia Migratory Bird Agreement 1998 (CAMBA) • Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA) • Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals). All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as a MNES under the EPBC Act.
Ma	**Marine Taxa** A species established under s248 of the EPBC Act.

Flora and fauna species that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the *Biodiversity Conservation Act 2016* (BC Act). These categories are defined in Table 3.

Table 3 Conservation codes for WA flora and fauna listed under the BC Act

Code	Category
CR	**Critically Endangered Taxa** 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. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EN	**Endangered Taxa** 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. Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
VU	**Vulnerable Taxa** 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. Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EX	**Extinct Taxa** Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
MI	**Migratory Taxa** 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). 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, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).
OS	**Other specially protected species** 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 List as Priority 1, 2 or 3 by the Western Australian 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 listed as Priority 4. Categories and definitions of Priority Fauna species are provided in Table 4.

Table 4 Conservation codes for WA flora and fauna species as listed by DBCA and endorsed by the Ministers for Environment

Code	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, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
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, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority Three – Poorly Known Species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority Four – Rare, Near Threatened and other species in need of monitoring** Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

2.2 Vegetation 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.

Communities can be classified as TECs under the EPBC Act. Categories of EPBC Act listed TECs are described in Table 5.

Table 5 Categories of TECs that are listed under the EPBC Act

Code	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.

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. TECs are listed under the BC Act in one of four categories defined in Table 5.

The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a database of state listed TECs, which is available for online searches via their website. Possible TECs that do not meet survey criteria or are not adequately defined are listed as Priority Ecological Communities (PECs) under Priorities 1, 2 and 3. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. Conservation dependent communities are classified as Priority 5. PECs are endorsed by the Minister for Environment and are described in Table 6.

DBCA requires that all Priority and Threatened ecological communities are considered during environmental impact assessments and clearing permit applications.

Table 6 Conservation codes for state listed Ecological Communities

Code	Category
PD	Presumed Totally Destroyed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable

Table 7 Categories for Priority Ecological Communities

Code	Category
P1	Poorly-known ecological communities
P2	Poorly-known ecological communities
P3	Poorly-known ecological communities
P4	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.

2.3 Biosecurity and Agriculture Management Act 2007

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the *Biosecurity and Agricultural Management Act 2007* (BAM Act), which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth. Each organism listed under the BAM Act comes with certain legal / import requirements:

- Declared Pest, Prohibited - s12. Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits.
- Permitted - s11. Permitted organisms may be subject to an import permit if they are potential carriers of high-risk organisms.
- Declared Pest - s22(2). Declared pests may be subject to an import permit if they are potential carriers of high-risk organisms and may also be subject to control and keeping requirements once within Western Australia.
- Permitted, Requires Permit - r73. Regulation 73 permitted organisms may only be imported subject to an import permit.
- Declared pests can be assigned to a C1, C2 or C3 control category under the Biosecurity and Agriculture Management Regulations 2013:
    - C1 Exclusion - Organisms which should be excluded from part or all of Western Australia
    - C2 Eradication - Organisms which should be eradicated from part or all of Western Australia
    - C3 Management - Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
- Unassigned - Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the BAM Act.

3.0 Existing Environment

3.1 Climate

The survey area is located in the Pilbara region which experiences hot humid summers and warm winters. In the Pilbara most of the rainfall comes from thunderstorms and cyclonic events, meaning rainfall can be highly variable. Most rainfall occurs between January and March, with the driest months being September and November.

Rainfall data from the Pannawonica Bureau of Meteorology (BoM) station (number 005069) (approximately 86 km south-west of the survey area) from the 12 months preceding the survey was obtained. This was compared against the long-term mean (1972 to 2024). Rainfall at Pannawonica was below average for five months preceding the survey (January to May 2024) with one significant rainfall event (June 2023), shown in Figure 2 (BoM, 2024). The 12 months preceding the survey received 162 mm compared to the long-term annual rainfall of 409 mm. Reduced rainfall may affect flowering period and growth vigour of perennial species and inhibit germination of annual species.

Temperature data from the Mardie BoM station (number 005008) (approximately 102 km north-west of the survey area) was obtained for the 12 months preceding the survey and compared against the long-term mean (1972 to 2024). Temperatures at Mardie were above or near-average for five months preceding the survey (February to May). Temperature variation is unlikely to have an effect on the objective of this survey.

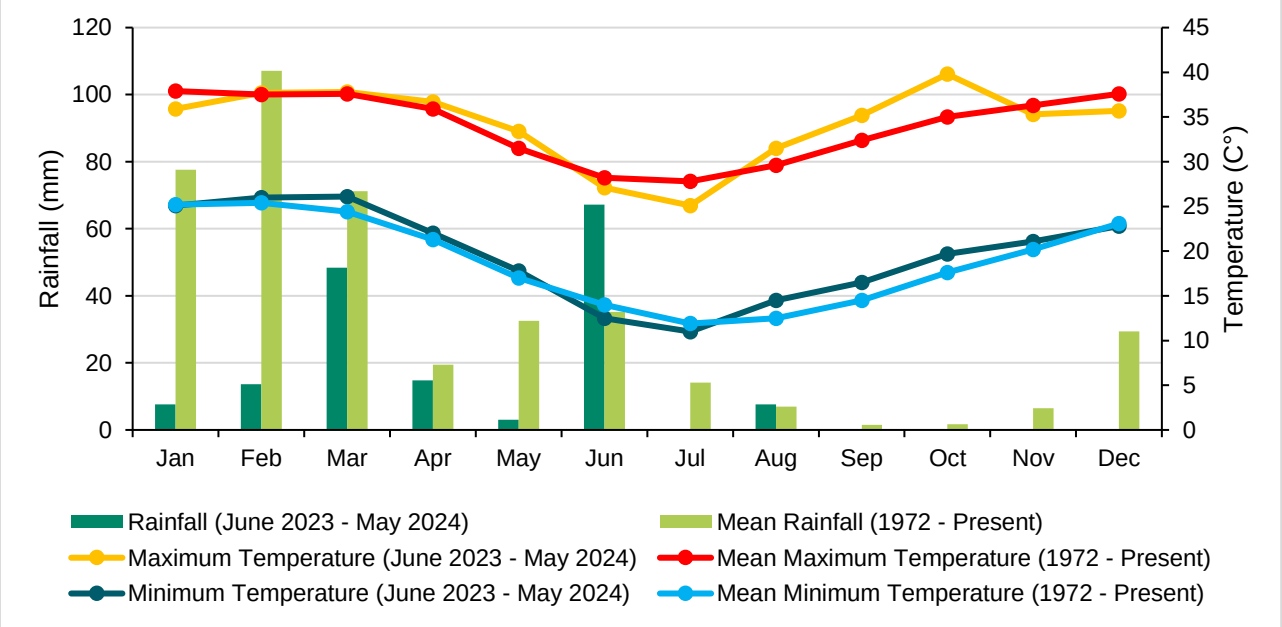


Figure 2 Rainfall and temperature data from Pannawonica and Mardie stations (BoM, 2024)

3.2 Interim Biogeographic Region of Australia

The largest regional vegetation classification scheme recognised by the Environmental Protection Authority (EPA) is the Interim Biogeographical Region of Australia (IBRA). The IBRA regions provide the planning framework for the systematic development of a comprehensive, adequate, and representative (CAR) national reserve system. There are 85 recognised IBRA regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (IBRA7, 2012). The survey area across the Pilbara region.

The survey is located within the Chichester subregion, which is part of the Pilbara Craton. It features ancient granite and basalt plains that support a shrub steppe environment dominated by *Acacia pyrifolia* and *Triodia pungens* hummock grasses. Additionally, Snappy Gum tree steppes can be found in the ranges (IBRA, 2012).

3.3 Land Systems

The Chichester subregion is underlain by the northern section of the Pilbara Craton. Significant areas of basaltic ranges interrupt undulating Archaean granite and basalt plains (Kendrick & McKenzie 2001).

The survey area falls within the Capricorn system (Van Vreeswyk et al., 2004) described as having rugged sandstone hills, ridges, stony footslopes, and interfluves. This landscape supports low Acacia shrublands or hard spinifex grasslands with scattered shrubs (Figure 3).

3.4 Geology

The survey area is on the Tumbiana Formation (Stewart et al., 2008) which is part of the Mount Bruce Supergroup. It is described as Pisolitic tuff, siliceous limestone and dolomite, mudstone, tuffaceous shale, siltstone, sandstone, volcaniclastic sandstone and siltstone, calcareous sandstone, local basalt and basaltic breccia, chert, local conglomerate, shale, jasper.

3.5 Pre-European Vegetation

Beard et al. (2013) mapping is used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent. There is one vegetation association recorded across the survey area, Vegetation Association 587, described as “Chichester Plateau” (WA Govt., 2019). There is 99.99% of this vegetation remaining in WA, 99.9% remaining in the Pilbara Region, and 100% remaining in the Chichester Plateau Subregion (Govt. of WA, 2019).

Pre-European vegetation is detailed in Table 8 and mapped in Figure 5.

Table 8 Beard et al. (2013) Vegetation Associations and Present Remaining (Govt. of WA, 2019)

Vegetation association	Description	Percentage remaining (%)		
		Western Australia	Pilbara	Chichester Plateau
587	Mosaic: Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana* / Hummock grasslands, shrub-steppe; kanji over *Triodia pungens*	99.99%	99.99	100%

3.6 Conservation Reserves and Heritage

The survey area is located on a conservation reserve Millstream Chichester National Park (Reserve number 30071). An Environmentally Sensitive Area falls within the survey area (ID 5531). DBCA legislated land within the vicinity of the project site is described in Table 9.

Table 9 Nature reserves within the vicinity of the survey area

Name	Type	Purpose	Area (ha)	Distance (km)
Millstream Chichester	National Park	Conservation of Flora and Fauna	4.81	Within the survey area

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	WYATTK2
DATE MODIFIED	13 AUG 2024	**APPROVED BY**	F DE WIT

N

1:100,000 (when printed at A4)

0 500 1,000 1,500 2,000 metres

GDA2020 MGA ZONE 50

DATA SOURCES: Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2016). Service Layer Credits: World Imagery: Earthstar Geographics

LEGEND

- Survey Area
- Soil Landscape Mapping - Best Available (DPIRD-027)
- Capricorn system,Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs
- River system,Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex
- Robe system,Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands
- Rocklea system,Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs
- Ruth system,Hills and ridges of volcanic and other rocks supporting shrubby hard spinifex and occasionally soft spinifex grasslands
- Wona system,Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields

Soil Landscape Mapping

RIO TINTO

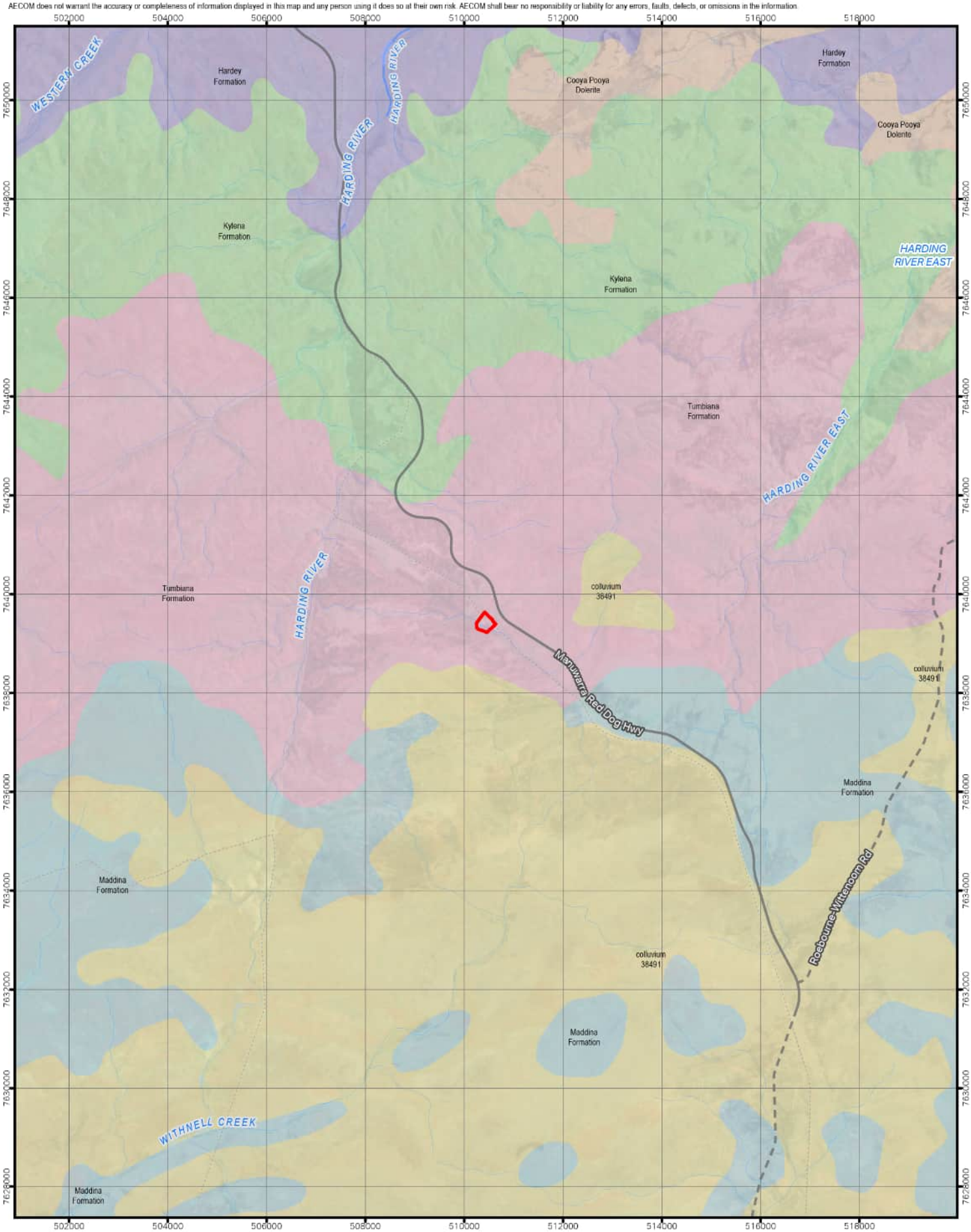
AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 3

Project: \\na.aecomnet.com\ifs\APAC\Perth~AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig3_NVCP_Trip5_SoilLandscapeMapping_A4P_v1, Last exported: 13/08/2024 5:19 PM

A4 size

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	15 AUG 2024
APPROVED BY	F DE WIT

N

1:100,000
(when printed at A4)

0 500 1,000 1,500 2,000
metres

GDA2020 MGA ZONE 50

DATA SOURCES Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2015)
Service Layer Credits: World Imagery: Earthstar Geographics,WMS

LEGEND

- Survey Area
- Geoscience Australia (2012) Surface Geology of Australia, 1:1 000 000 scale, 2012 edition
- Cooya Pooya Dolerite,igneous mafic intrusive
- Hardey Formation,sedimentary, igneous volcanic
- Kylena Formation,igneous felsic volcanic, igneous mafic volcanic, sedimentary
- Maddina Formation,igneous mafic volcanic, igneous felsic volcanic, sedimentary,
- Tumbiana Formation,sedimentary, igneous volcanic
- colluvium 38491,regolith

Geology

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure **4**

A4 size

Project: \\na.aecomnet.com\fs\APAC\Perth~AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig4_NVCP_Trip5_Geology_A4P_v1, Last exported: 15/08/2024 11:24 AM

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	WYATTK2
DATE MODIFIED	13 AUG 2024	**APPROVED BY**	F DE WIT

N

0 0.5 1 1.5 2
km

1:75,000
(when printed at A4)

GDA2020 MGA ZONE 50

DATA SOURCES Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2016)
Service Layer Credits: World Imagery: Earthstar Geographics,WMS

LEGEND

- Survey Area
- Full Pre-European Vegetation (DPIRD-006)
- veg_assoc,struct_des,flor_desc
- 173,Shrub-steppe,Hummock grassland with scattered shrubs or mallee *Triodia spp. Acacia spp., Grevillea spp. Eucalyptus spp*
- 175,Grasslands, short bunch-grass savanna,Annual grasses *Enneapogon spp. Aristida spp.* etc on dry plains and salt water grasses *Sporobolus virginicus* on the coast
- 587,Sparse low tree-steppe / Sparse shrub-steppe,

Pre-European Vegetation

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

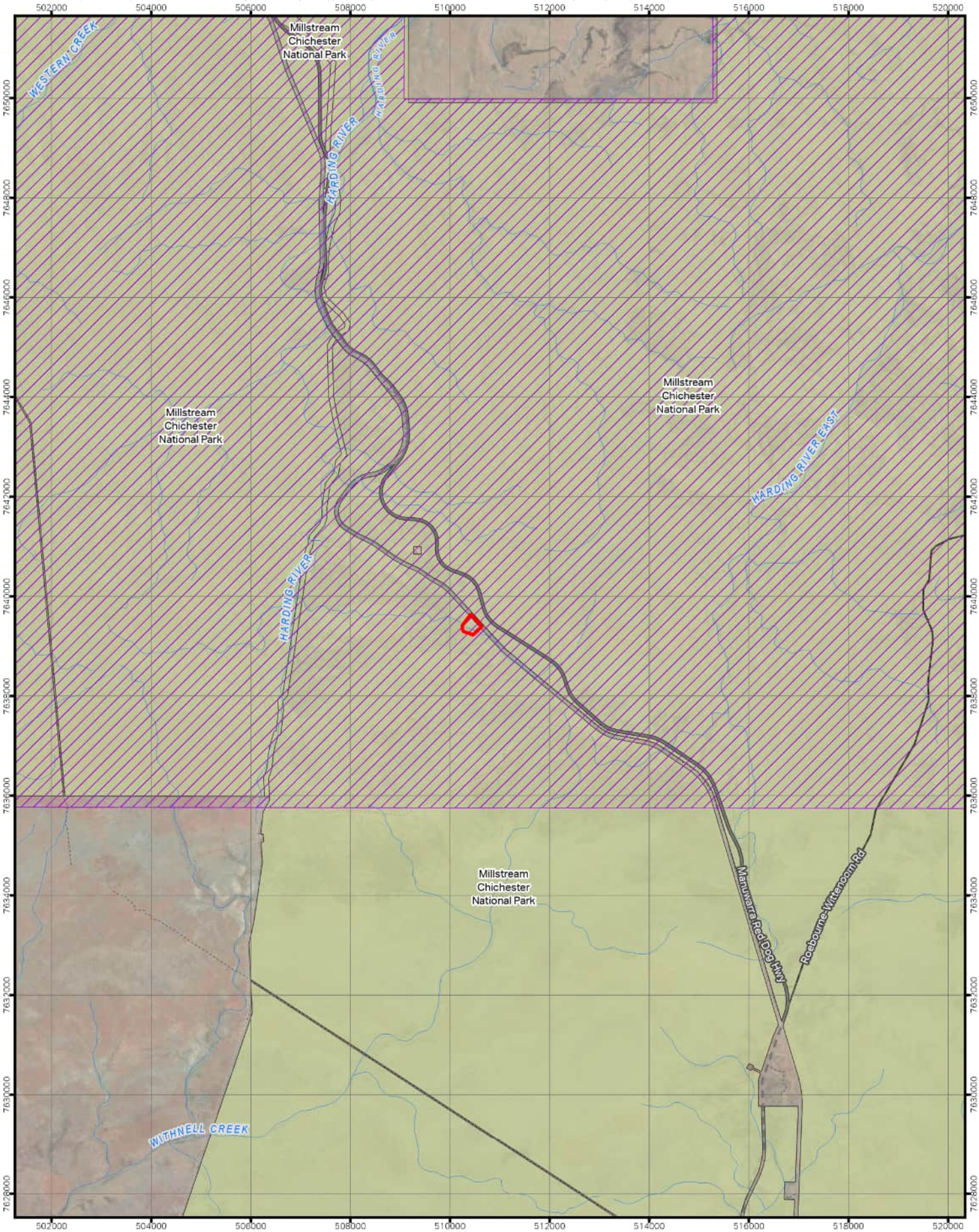
Figure

5

Project: \\na.aecomnet.com\ifs\APAC\Perth~AUPER1\Legacy\Projects\607X\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2),
Layout: 60726828_Fig5_NVCP_Trip5_PreEuropeanVeg_A4P_v1, Last exported: 13/08/2024 5:29 PM

A4 size

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	13 AUG 2024
APPROVED BY	F DE WIT

N

1:100,000
(when printed at A4)

0 500 1,000 1,500 2,000
Metres

GDA2020 MGA ZONE 50

DATA SOURCES: Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2015)
Service Layer Credits: World Imagery: Earthstar Geographics,WMS

LEGEND

- Survey Area
- DBCA - Legislated Lands and Waters (DBCA-011)
  - National Park
- Clearing Regulations - Environmentally Sensitive Areas (DWER-046)
  - 26-0324FL_TPFL
  - 26-0324FL_WAHerb

Conservation Reserves and Environmentally Sensitive Areas

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure **6**

A4 size

Project: \\na.aecomnet.com\ifs\APAC\Perth~AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig6_NVCP_Trip5_ConsReserves_A4P_v1. Last exported: 13/08/2024 5:29 PM

4.0 Methodology

4.1 Personnel

The field survey was undertaken by Celia Mitchell (collection permit FB62000077-2). Celia has completed a Master of Science in Conservation Biology and Botany. She is a Botanist with five years' experience undertaking flora and vegetation surveys across WA, including baseline, monitoring and targeted surveys.

Celia was supported by Nina Sergeev (collection permit FB62000544). Nina has completed a Bachelor of Science in Biology (Zoology). She is an Environmental Scientist with three years' experience undertaking fauna habitat surveys across WA. Nina has been involved in various projects across remote locations including targeted surveys and rehabilitation monitoring in the Shark Bay World Heritage Area, Koolan Island flora, vegetation and targeted surveys, and the Karratha Renewables Program.

4.2 Desktop Assessment

4.2.1 Database Searches

Prior to the field survey a comprehensive desktop assessment was undertaken to identify significant environmental values likely to be present in the survey area including flora, fauna, and vegetation communities. Commonwealth and State database search results that were used in this assessment are shown in Table 10.

Table 10 Database searches undertaken for the survey area

Database	Information	Administering Agency
Threatened and Priority Flora and Fauna Lists (TPFL database)	List of significant flora and fauna species and broad distribution within 50 km	DBCA
Threatened and Priority Flora Database (WAHerb database)	Validated populations of threatened and priority flora species within 50 km	
WA Herbarium Database (FloraBase)	All records of threatened and priority flora from the WA Herbarium collection of specimens, including un-validated historical specimens	
Threatened and Priority Ecological Communities (TEC/PEC) Database	Threatened and Priority ecological communities within 50 km	
Dandjoo	Flora and fauna species, not including threatened species	
Atlas of Living Australia	List of flora and fauna species recorded, including significant species	Atlas of Living Australia
Protected Matters Search Tool	Matters of national significance and matters protected by *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)	DCCEEW
Environmentally Sensitive Areas (ESAs)	Listed ESAs	DWER
Birdata	Bird species lists and distribution maps for an area of interest	BirdLife Australia
Declared Pest (s22) in the WA Organism List	Declared Plants as listed under the *Biosecurity and Agriculture Management Act 2007*	Department of Primary Industries and Regional Development

Database	Information	Administering Agency
National Weeds Lists (Weeds in Australia 2012)	Weed of National Significance	Australian Weeds Committee
Relevant Ecological Surveys	Results from previous surveys undertaken in the vicinity, detailed in Section 5.1.	Various
Rio Tinto database	Records of significant flora, fauna and communities.	Rio Tinto

4.2.2 Likelihood Assessment

Significant flora species' likelihood of occurrence was assessed systematically using a point-based system (Table 11). The assessment considers 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. For the purpose of this assessment, a recent record refers to less than 20 years old.

Table 11 Categories of likelihood of occurrence for flora and fauna species present

Likelihood of Occurrence	Score	Definition
Known	6	Species known to occur in survey area.
High (Likely)	4, 5	Recent record of species in local area and habitat is suitable. Species with a habitat score of 2, have a recent record in the vicinity, AND are known within 20 km OR 5 km
Moderate (Possible)	3, 4	Suitable habitat present (score of 2) and record in region AND/OR recent record. OR Habitat marginal (score of 1) AND record in region AND/OR recent record.
Low (Unlikely)	2, 3	Suitable habitat present (score of 2) NO recent records NO records within 5 km. Habitat marginal (score of 1) NO recent records NO records within 5 km, MAYBE records within 20 km
Negligible (Suitable Habitat not Present)	0, 1, 2, 3	If no suitable habitat is present, the likelihood is automatically zero. This can pertain to a score of 1,2 or 3 (record within proximity OR recent record). Marginal habitat (score of 1) NO recent record NO record within 20 km.

Table 12 Categories of likelihood of occurrence for fauna species

Likelihood of Occurrence	Definition
Known	Species is known to occur in the survey area
High (Likely)	Not known to occur in the survey area but there are records within close proximity of the survey area AND/OR recent records and suitable habitat for the species is known to be, or likely to be, present within the survey area
Moderate (Possible)	Not known to occur within the survey area but there are records in close proximity of the survey area and recent records and suitable habitat for the species is known to be, or likely to be present within the survey area. OR Not known to occur within the survey area but suitable habitat for the species is known to be, or likely to be present within the survey area.
Low (Unlikely)	Not known to occur within the survey area but there are records in close proximity OR recent records and suitable habitat for the species may be present (marginal habitat)
Negligible (Suitable habitat not present)	Despite records in close proximity or recent records, no suitable habitat is present within the survey area, therefore the likelihood of the species occurring there is negligible

4.3 Flora and Vegetation Assessment

Methods outlined in the Flora Survey Technical Guide (EPA, 2016a) method for a single-phase detailed flora and vegetation assessment was implemented. The survey was undertaken on 5 June 2024. Data were collected from three unbounded quadrats of approximately 50 m by 50 m delineated with a GPS. Data collected included 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
- Recorder details
- Location using hand-held GPS (accuracy of 5 m)
- Sample site type and size
- Photograph (north-west corner)
- Soil details (type, colour, moisture)
- Landform
- Species – representative list of vascular plant species present, including weed species.
- Habitat - a broad description of the surrounding landscape based on landform, topography and soil
- Disturbance records - fire history, tracks, weed infestation, and other evidence that may be present
- Locations of Weeds of National Significance (WoNS) or Declared Pests will be recorded. Photographs will be taken of any significant flora and WoNS or Declared Pests recorded.
- Species list including:
    - Estimated height
    - Estimated percentage cover (for trees both percentage within relevé and within community was recorded to enable better description of vegetation community).

Any species unable to be identified in the field were collected for identification in AECOM's in-house herbarium and the specimens and taxonomic references and keys at the Western Australian Herbarium (WAH). Naming of species followed the convention of the WAH (1998-).

4.3.1 Vegetation Mapping

Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation communities were described using a modification of Aplin (1979) at a scale of 1:10,000 based on the Association Level V in accordance with the National Vegetation Information System (NVIS) Framework (DotEE, 2017). Delineation of vegetation communities was supported by analysing floristic data collected within quadrats.

Vegetation condition was determined using the Trudgen (1988) vegetation condition scale as recommended in the Flora Survey Technical Guide (EPA, 2016a).

4.3.2 Targeted Flora Searches

Targeted searches were undertaken for significant flora species that were known or likely to occur, informed by the desktop study. A detailed field guide was produced, which included photographs and description of morphological features that would assist in identifying the species in the survey area.

Where a potential Priority species was encountered, the following was recorded:

- Location (using a hand-held GPS accuracy 5m)
- The number of individuals in the immediate population, or an estimate of the size (number) of the population with an estimated radius of its spatial extent
- Plant height
- Vegetation condition
- Associated dominant species
- Soil type and colour
- Topography
- Additional information relevant to the area including key characteristics and landforms.

4.4 Fauna Habitat Assessment

The fauna habitat assessment was undertaken simultaneously with the flora and vegetation assessment. The survey was undertaken by Nina Sergeev who has over three years' experience undertaking fauna habitat surveys across WA. Nina has completed a Bachelor of Science in Biology (Zoology) and has been involved in various projects across remote locations.

Fauna habitat assessments were conducted throughout the survey area and were used to define the structure, complexity, and continuity of the habitat present, and documented the presence and abundance of habitat features that included but were not limited to presence or absence of large mature trees, water bodies, dense vegetation, hollows, and leaf litter.

The habitat assessment was used to verify the findings in the desktop survey as per the Terrestrial Vertebrate Fauna Surveys Technical Guide (EPA, 2020). Potential usage within the survey area of conservation significant fauna was recorded, using hand-held GPS (accuracy of 5 m).

Whilst the database results obtained from DBCA (DBCA, 2024) included a record of significant invertebrate fauna, the field survey was unable to verify its presence as it was not in accordance with the methods outlined in Sampling of Short Range Endemic Invertebrate Fauna Technical Guide (EPA 2016d).

4.5 Survey Limitations

An evaluation of the potential limitations of this survey is summarised in Table 13. No significant limitations were identified that could affect the flora, fauna, and vegetation surveys.

Table 13 Survey limitations

Limitation	Impact on survey
Availability of contextual information on the region	**Nil** The survey area is situated on the Chichester bioregion within the Millstream Chichester National Park. Contextual information was obtained through DBCA database searches, publicly available datasets, previous surveys undertaken in the area and the Rio Tinto significant values database.
Competency/experience of consultant conducting survey	**Nil** The flora, vegetation and fauna survey was undertaken by Celia Mitchell and Nina Sergeev. Celia has over five years' experience undertaking botanical surveys across WA. This includes annual flora surveys for a nearby operating site in the Pilbara region. Nina has three years' experience undertaking flora, vegetation and fauna surveys and has been involved in various projects across remote locations.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	**Nil** Flora was collected from three quadrats and opportunistic species were recorded while walking linear traverses. The systematic linear traverses and recording all flora species is considered suitable effort for the size and complexity of the vegetation and fauna habitats present. Survey effort is presented in Figure 8. Two flora species were unable to be confidently identified to species level (denoted by a "?", 90% confidence associated with both samples) due to lack of suitable material. This is not considered to represent a significant limitation for this survey.
Completion (is further work needed)	**Nil** No further survey work is recommended. The Flora Survey Technical Guide (EPA, 2016a) suggests that each vegetation community should be represented by a minimum of three quadrats. This was not possible due to the size of the survey area (9.20 ha). Survey effort was considered adequate and the survey was undertaken during the ideal survey period for the Pilbara, thereby maximising detection of significant flora species.
Remoteness and/or access issues	**Nil** The entire survey area was accessible on foot.
Timing, weather, season, cycle	**Minor** The survey was undertaken on June 5 2024. This followed a 12-month period of below average rainfall in the region, with total rainfall 247 mm less than the long-term average of 409 mm (BoM, 2024). This was evident in the field with grasses lacking fruiting material and the absence of most annual species.
Disturbances (e.g. fire, flood, accidental human intervention) which affected results of the survey	**Nil** No recent fire or other disturbance affected the ability to interpret the flora and fauna data.

5.0 Desktop Assessment Results

5.1 Previous Surveys

Several ecological surveys have been conducted previously around the survey area. The results of these surveys are summarised in Table 14.

Table 14 Results of previous surveys conducted in the vicinity of the study area

Survey Author and Title	Survey Area	Significant values
Eco Logical Australia (2022): Ti Tree Rail Targeted flora survey RTIO-0959991	Eight areas totalling 204.5 ha located between Ti Tree rail camp and Galah Siding on the 7 Mile rail line.	**Flora**: two Priority flora (*Ipomoea racemigera* – P3 and *Triodia basitricha* – P3) were recorded. **Communities**: No significant communities recorded.
Rio Tinto (2022) Targeted flora survey RTIO-0970407	The flora survey was conducted across six study areas located on the Tom Price Mainline and Deepdale Mainline: AR-22-17510, AR-22-17442, AR-22-17454, AR-22-17285D, AR-22-17407, AR-22-17285C.	**Flora**: no significant flora recorded. **Communities**: no significant communities recorded.
Astron (2022) Rail Weed Monitoring Program RTIO-0970484	Borrow Pits 74.0 and 78.2, along the railway in the Millstream Chichester National Park.	**Flora**: Declared Pest (permitted) **Rumex vesicarius* recorded.
Eco Logical (2023) Galah Rail Siding reconnaissance and targeted flora survey RTIO-0983630	Galah rail siding on the Tom Price East Main Line 83.5 - 84.75 Chainage.	**Flora**: no significant flora recorded. **Communities**: no significant communities recorded. **Fauna**: potential habitat for: Grey Falcon (*Falco hypoleucos*) (V), Australian Painted Snipe (*Rostratula australis*) (E), Oriental Pratincole (*Glareola maldivarum*) (Mi), Lined soil-crevice skink (*Notoscincus butleri*).
Astron (2023) Rail Native Vegetation Clearing Permit Survey RTIO-1035439	Three project areas: Western Creek 1 (2.9 ha), Western Creek 2 (11.5 ha), and Chichester (32.7 ha). The survey area is located 71 km southeast of Karratha and covers an area of 47.1 ha.	**Flora**: *Pentalepis trichodesmoides* subsp. *hispida* (P2), was recorded. **Communities**: no significant communities recorded. **Fauna**: high post-survey likelihood of occurrence, Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4).

5.2 Significant Ecological Communities

Four significant ecological communities occur within 50 km of the survey area, described in Table 15. None of these overlap with the survey area. One Priority 1 PEC, “Four plant assemblages of the Wona Land System” is mapped 0.21 km from the survey area.

Table 15 Significant Ecological Communities in the vicinity of the survey area

Community	Cons. Code[1]	Distance from Survey area
Four plant assemblages of the Wona Land System. Cracking clays of the Chichester and Mungaroona Range. This shrubless plain of stony gibber community occurs on the tablelands with very little vegetative cover during the dry season, however during the wet a suite of ephemerals/annuals and short-lived perennials emerge, many of which are poorly known and range-end taxa. Annual Sorghum grasslands on self-mulching clays with a moderate-dense overlay of rocks. This community appears very rare and restricted to the Pannawonica-Robe valley end of Chichester Range. Naturally species poor when dry. Threat: weed invasion. Mitchell grass plains (*Astrebela* spp.) on gilgai. Mitchell grass and Roebourne Plain grass (*Eragrostis xerophila*) plain on gilgai. *Astrebla pectinata, A. elymoides, E. xerophila, Aristida latifolia, Eriachne and Sida fibulifera. Typical type, heavily grazed.*	P1	0.21 km
Horseflat Land System of the Roebourne Plains. The Horseflat Land System (Roebourne Plains) land units forming extensive clay plains dominated by tussock grasslands on mostly alluvial, red clay loams gilgaied and non-gilgaied for this community. The community is dominated by perennial tussock grasses include *Eragrostis xerophila* (Roebourne Plains grass), *Chrysopogon falla*x (ribbon grass) and other *Eragrostis* spp. and *Eriachne* spp. The community also supports a suite of annual grasses including *Dichanthium* spp. and *Sorghum* spp. The community extends from Peedamulla to Balla Balla surrounding the towns of Karratha and Roebourne.	P3	20.94 km
Kanjenjie Land System. Stony clay plains supporting snakewood shrublands with tussock grasses. Supports tall shrublands of mulga, snakewood and other acacias with understorey of low shrubs or perennial grasses. Some parts support tussock grasslands of Mitchell grass or Roebourne Plains grass with few shrubs	P3	27.26 km
Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region. The community includes flora with restricted distributions or populations that are highly disjunct or are major range extensions from northern and eastern Australia. These include I*mperata cylindrica, Cladium procerum, Schoenus falcatus* and *Fimbristylis sieberiana* (P3). In the Pilbara these taxa are almost exclusively restricted to the riparian zones of permanent wetlands with high soil moisture maintained by groundwater flows. Occurrences are disjunct with sites typically associated with groundwater discharge in gorge and valley wetlands that are often coupled with significant shading.	P2	23.93 km

1. DBCA P Priority

5.3 Significant Flora

A total of twenty-seven (27) significant flora species were identified in the desktop study as potentially occurring. No species listed as Threatened under the EPBC Act or BC Act were identified as occurring within 50 km of the survey area.

One Priority species identified, *Eragrostis crateriformis*, was delisted by DBCA in August 2024, and is not considered further in this report.

Of the remaining 26 species, two flora species were considered as high likelihood to occur and three flora species were considered as moderate likelihood to occur (Table 16). Another four significant flora species were considered as low likelihood to occur while the remaining seventeen (17) flora species were considered unlikely or have a negligible likelihood due to absence of suitable habitat, age of record, and lack of known records in the vicinity .

The comprehensive flora desktop results are mapped in Figure 7 and habitat, distance, and date of records is presented in Appendix A.

Table 16 Significant Flora species considered to have high or moderate likelihood of occurrence

Species	Con. Code[1] BC Act / DBCA	Habitat
High		
Pentalepis trichodesmoides subsp. *hispida*	P2	Found in *Triodia* hummock grassland, often in the understorey of a shrubland of *Acacia* spp., *Gossypium* spp., *Senna* spp., *Brachychiton* spp. and *Eucalyptus* spp., on summits and slopes of low hills, on basaltic soils, at altitudes to 1150 m (Orchard & Cross, 2012).
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	Drainage lines, clay flats, crabhole flats and dark self-mulching clays (WA Herb, 1998-).
Moderate		
Goodenia obscurata	P3	Occurs on floodplains or low rocky ridges, growing in red-brown sandy clay or lateritic loam over banded ironstone. Associated with low open woodland of *Acacia* over *Triodia*, or open shrubland with a sparse overstorey of *Corymbia hamersleyana* and *Hakea chordophylla* over *Triodia* (DPaW & Rio Tinto, 2015).
Ipomoea racemigera	P2	Sandy soils along watercourses (DPaW & Rio Tinto, 2015).
Trianthema sp. Python Pool (G.R. Guerin & M.E. Trudgen GG 1023)	P2	Occurs in sand, gibber plain on plains (WA Herb, 1998-).

1. DBCA P Priority

5.4 Significant Fauna

A total of twenty-five (25) significant fauna species were identified in the desktop assessment as potentially occurring. Of these, three fauna species were considered high likelihood to occur, three species were considered to have a moderate likelihood to occur, and the remaining 17 species were considered negligible due to lack of suitable habitat (Table 17).

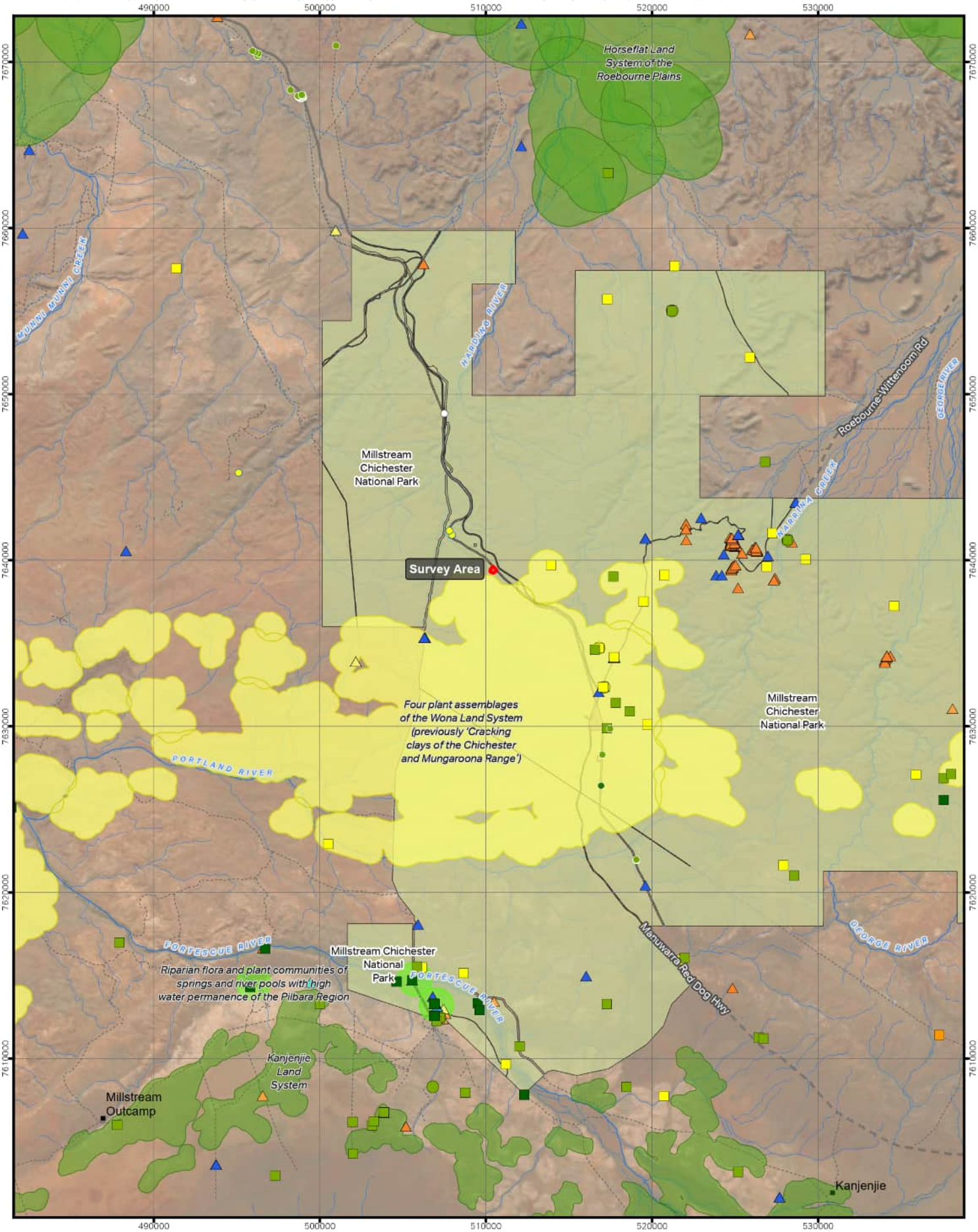
The comprehensive fauna desktop is mapped in Figure 7 and their habitat, number of records, distance, and likelihood assessment is presented in Appendix B.

Table 17 Significant fauna species considered to have high or moderate likelihood of occurrence

Species	Common Name	Cons. Code[1]		Habitat
		BC Act / DBCA	EPBC Act	
High				
Antipodogomphus hodgkini	Pilbara Dragonfly	P3		This species inhabits rivers, streams and pools (Theischinger & Endersby, 2009).
Leggadina lakedownensis	Northern Short-Tailed Mouse	P4		Its natural habitat is dry savanna (Watts, 1976).
Pseudomys chapmani	Western Pebble-mound Mouse	P4		It is associated with eroding sands and can be found in the Pilbara region in areas of rocky hummock grassland with little or no soil and an overstorey of Acacia spp. (Kitchener 1983; Burbidge 2016).
Moderate				
Falco hypoleucos	Grey Falcon	VU	V	Timbered lowland plains, including acacia shrublands particularly with tree-lined watercourses, tussock grassland and open woodland (TSSC, 2020).
Glareola maldivarum	Oriental Pratincole	IA	Mi	Open plains, floodplains or short grassland (including farmland), often occurring near terrestrial wetlands, and occurring along the coast. The species does not breed in Australia (DCCEEW, 2024).
Notoscincus butleri	Lined Soil-Crevice Skink	P4		The preferred natural habitat of *N. butleri* is stony grassland (AoLA, 2021)

1. P Priority IA International Agreement Mi Migratory VU Vulnerable V Vulnerable

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	WYATTK2
DATE MODIFIED	15 AUG 2024	**APPROVED BY**	F DE WIT

N

0 2 4 6 km

1:300,000 (when printed at A4)

GDA2020 MGA ZONE 50

DATA SOURCES Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2019)
Service Layer Credits: World Imagery, Earthstar Geographics, WMS

LEGEND

- Survey Area
- Flora (Rio Tinto)
  - P2
  - P3
  - P4
  - PSI
- WA Herbarium database (WAHERB)
  - P1
  - P2
  - P3
  - P4
- Threatened and Priority Flora database (TPFL)
  - P2
  - P3
- Threatened Fauna database (DBCA)
  - Endangered
  - Vulnerable
  - Migratory Species
  - Priority 1
  - Priority 2
  - Priority 3
  - Priority 4
- TEC / PEC
  - Priority 1
  - Priority 2
  - Priority 3
- DBCA - Legislated Lands and Waters (DBCA-011)
  - National Park

Conservation Significant Flora and Fauna Desktop Results

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 7

A4 size

Project: \\na.aecomnet.com\ifs\APAC\Perth-AUPER1\Legacy\Projects\607X\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig7_NVCP_Trip5_DBCAFloraFauna_A4P_v1, Last exported: 15/08/2024 11:14 AM

6.0 Field Survey Results

6.1 Vegetation

6.1.1 Communities

Two native vegetation communities were described and mapped including:

- ChApTw: Triodia hummock grasslands recorded on lower slopes adjacent to a minor flowline
- EcScCc: Eucalyptus open woodland representing the minor flowline.

Additionally, cleared areas were mapped. Vegetation communities are described in Table 19 and mapped in Figure 8.

6.1.2 Significant Vegetation

No TEC or PECs were identified in the survey area. The area does not intersect with the Wona Land System therefore the presence of the Priority 1 PEC has been excluded.

6.1.3 Condition

The vegetation condition of the survey area ranged from Good to Completely Degraded, with the majority of the survey area being mapped as Poor. Disturbance was evident from an old borrow pit, weed invasion and evidence of grazing. One small patch on the west side of the minor channel was considered in Good condition.

Condition extent is described in Table 18 and mapped in Figure 8.

Table 18 Condition extent within survey area

Condition Rating	Extent (ha)	Percent of Survey Area
Good	0.04	<1%
Poor	8.34	91%
Completely Degraded	0.82	8%
Total	9.20	100%

Table 19 Vegetation communities description, details and photograph

Vegetation Unit Code and Description	Survey Effort, Diversity and Extent	Photograph
Code: SA1 Species code: ChApTw Broad floristic type: Triodia tall hummock grassland *Corymbia hamersleyana, Codonocarpus cotinifolius* and *Grevillea pyramidalis* low sparse woodland over *Acacia pyrifolia* var. *pyrifolia, Acacia bivenosa* and *Acacia inaequilatera* tall to mid sparse shrubland over *Triodia wiseana, *Cenchrus ciliaris* and *Enneapogon lindleyanus* tall mixed hummock and tussock grassland. Recorded on lower slopes adjacent to the minor ephemeral drainage on rocky clay loam soils.	Survey effort: GQ03 Diversity: 36 native and one weed species Extent: 3.01 ha Condition: Poor to Good	
Code: MF1 Species code: EcScCc Broad floristic type: Eucalyptus mid open woodland *Eucalyptus camaldulensis, Melaleuca argentea* and *Grevillea pyramidalis* mid open woodland over *Sesbania cannabina, Trichodesma zeylanicum* var. *zeylanicum* and *Acacia trachycarpa* mid to tall sparse shrubland over **Cenchrus ciliaris, *Cenchrus setiger* and *Eriachne mucronata* tall tussock grassland. Represents minor ephemeral drainage with vegetated banks next to a fairly open creek bed.	Survey effort: GQ01 and GQ02 Diversity: 54 native and three weed species Extent: 5.37 ha Condition: Poor	
Highly Modified (HD) Cleared areas devoid of native species	Extent: 0.82 ha	

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	WYATTK2
DATE MODIFIED	15 AUG 2024	**APPROVED BY**	F DE WIT

N

1:4,000 (when printed at A4)

0 20 40 60 80 metres

GDA2020 MGA ZONE 50

DATA SOURCES Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate 2019. Service Layer Credits: World Imagery: Maxar/VMS

LEGEND

- Survey Area
- Vegetation Sample Sites
- Tracklog

Vegetation Communities

- MF1
- SA1
- HD

Vegetation Condition

- 0.1 - Completely Degraded
- 0.4 - Poor
- 0.6 - Good

Vegetation Communities, Condition and Survey Effort

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 8

Project: \\na.aecomnet.com\ifs\APAC\Perth-AUPER1\Legacy\Projects\607X\60726828_Rio_Rail_Flora\300_CAD_GIS\320_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig8_NVCP_Trip5_VegCommCondSEffort_A4P_v1, Last exported: 15/08/2024 12:05 PM

A4 size

6.2 Flora

No species listed under the EPBC Act, BC Act or by DBCA were recorded.

A total of 67 flora species (64 native, three weed species) were recorded representing 54 genera and 26 families. Families best represented included Fabaceae (15 native species) and Poaceae (nine native species). Three weed species were recorded. None of these were listed under the BAM Act or Species of National Environmental Significance.

A species by site by family matrix is presented in Appendix C. Quadrat data is presented in Appendix D.

6.3 Fauna Habitats

Two fauna habitats were mapped in the survey area including Stony Plain and Minor Drainage (see Table 20). The habitats are potentially suitable for:

- Western Pebble-mound Mouse *Pseudomys chapmani* listed as Priority 4 by DBCA
- Northern Short-tailed Mouse *Leggadina lakedownensis* listed as Priority 4 by DBCA
- Grey Falcon *Falco hypoleucos* listed as Vulnerable under the EPBC Act and BC Act.

Fauna habitats are mapped in Figure 9.

Table 20 Fauna habitats of the survey area

Description	Conservation Significant Fauna Habitat
Stony Plain (Extent: 3.01 ha) This habitat is characterised by scattered native shrubs over hummock grasses on lower slopes. Substrate is orange rock with clay loam underneath. Groundcover is moderate. Microhabitats are limited to the hummock grasses. Majority of this fauna habitat is directly adjacent to the rail and the rail access road where weeds are present. This habitat ranged from Good to Poor condition, dependent primarily on the proximity of vegetation to existing infrastructure.	Western Pebble-mound Mouse – rocky hummock grassland present and known from the local region. May forage and move through area, no mounds were observed. Northern Short-tailed Mouse – the Stony Plain represents degraded “dry savannah habitat”. This species may forage and move through the area.
Minor Drainage (Extent: 5.37 ha) This habitat is characterised by native trees (*Eucalyptus camaldulensis* and *Melaleuca argentea*) along a minor bare creek bed. The substrate is predominantly rocky/cobbled with soil and organic matter often washed away in channel. Standing water may be present for a short period after significant rainfall events. Habitat connectivity is considered good along the drainage channel bed and in moderately dense vegetation on the banks. Fauna species are likely to utilise the open terrain as transient habitat to traverse between vegetated habitats. Microhabitats present include tree hollows, potential seasonal inundation and clearings that may support foraging and hunting. This habitat was considered to be in Poor condition with high weed invasion and evidence of grazing.	Grey Falcon – tree-lined watercourse and tussock grassland and open woodland present.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	15 AUG 2024
APPROVED BY	F DE WIT

N

1:2,500
(when printed at A4)

0 10 20 30 40
metres

GDA2020 MGA ZONE 50

DATA SOURCES Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2015)
Service Layer Credits: World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, WA DS

LEGEND

Survey Area

HABITAT

Disturbed

Minor Drainage

Stony Plain

Fauna Habitat

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure **9**

Project: \\na.aecomnet.com\ifs\APAC\Perth~AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig9_NVCP_Trip5_FaunaHab_A4P_V1, Last exported: 15/08/2024 12:12 PM

A4 size

7.0 Discussion

The survey area comprises 9.20 ha and incorporates the Tom Price West Mainline, associated access road, and native vegetation. The area is characterised by a minor ephemeral drainage channel that runs northwest to southeast with Triodia hummock grasslands on lower slopes adjacent.

No significant vegetation (listed TECs or PECs) or flora species were recorded during the survey. The majority of the survey area has been historically disturbed including from fire and an old borrow pit. Minor weed invasion is present along the access track, rail line, and borrow pit. The ephemeral river also provides a vector for weed spread and supports typical weedy Pilbara grasses.

All significant flora species with a moderate or high likelihood of occurring were reduced to a low or negligible likelihood. The river may support standing water after significant rainfall events however none was present at the time of the survey. No crabhole or gilgaied clay plains were present either, thereby reducing the likelihood of numerous significant flora species.

Pentalepis trichodesmoides subsp. *hispida* is a Priority 2 species considered likely to occur with a known occurrence 3.1 km from the survey area recorded in 2023. It grows in Triodia hummock grassland on summits and slopes of hills (DPaW & Rio Tinto, 2015). Habitat for this species was not present and it was not recorded despite being readily identifiable by its unique features. Its likelihood was therefore reduced to negligible.

Themeda sp. Hamersley Station (M.E. Trudgen 11431) is a Priority 3 species known from 7.69 km from the survey area recorded in 2010. This species grows in a variety of habitats including drainage lines, clay flats, crabhole flats and self-mulching clays (DPaW & Rio Tinto, 2015). This species is readily identified in the field. No *Themeda* spp. were recorded, therefore the likelihood that this species is present was reduced to low. Three significant fauna species had a high likelihood and another three had a moderate likelihood of occurring. These species were associated with broad fauna habitats that are common throughout the Pilbara region. Of these six species, three had a post-survey likelihood of moderate based on habitats present, number of records and proximity of these records.

The Grey Falcon *Falco hypoleucos* is associated with timbered lowland plains including Acacia shrublands with tree-lined watercourses. There is one record dated 2012 located 35.62 km from the survey area. As a highly mobile species they could be a transient visitor to the Minor Drainage habitat, but it would be unlikely to rely on this habitat for survival due to the small extent present.

The Northern Short-tailed Mouse *Leggadina lakedownensis* is listed as a Priority 4 species. This species is associated with ‘dry savannah’ habitat. There are 43 records in proximity to the survey area dated 2011 and older. The nearest record is 5.60 km from the survey area. Dry savannah is present as Stony Plain habitat. This species could forage and move through this area given the number of records that are nearby.

The Western Pebble-mound Mouse *Pseudomys chapmani* is listed as Priority 4. It is associated with rocky hummock grasslands with an overstorey of Acacia species. There are 9 records dated 2004 and older with the nearest record 5.60 km from the survey area. The Stony Plain habitat may provide foraging habitat for this species, and it may move through the area. No mounds were observed during the survey.

Vegetation and fauna habitats were homogenous in the local area and in better quality further from the disturbance of the rail and access track. No core habitat is present, and it is unlikely that any fauna species rely on this habitat for survival.

8.0 Conclusion

A baseline flora, vegetation and fauna habitat assessment was undertaken for a 9.20 ha survey area along the Rio Tinto Tom Price West Mainline. The objective was to collect information to a suitable level of detail to support a Native Vegetation Clearing Permit application. To meet this objective, a baseline ecological survey was undertaken in accordance with the relevant EPA technical guides to assess the environmental values that are present.

A desktop assessment identified four TECs that occur within 25 km of the survey area. None of these overlap with the survey area, and none were anticipated to occur based on landforms and land systems present. Twenty-seven significant flora species occur within 50 km of the survey area. Of these, three were considered likely to occur, and three 'may' occur. Twenty-five significant fauna species occur within 50 km of the survey area. Of these, three were considered to have a high likelihood, and three had a moderate likelihood of occurrence in the desktop assessment.

A summary of the field survey results is presented below:

- No TECs or PECs were identified.
- Two native vegetation communities were mapped for 8.38 ha. The remaining 0.82 ha was highly modified (cleared).
- No significant flora species were recorded in the survey area. The post-survey likelihoods of the desktop flora results have been reduced to low or negligible.
- Two fauna habitats were mapped including a Minor Drainage and Stony Plain.
- The Stony Plain may provide habitat for:
    - Western Pebble-mound Mouse *Pseudomys chapmani* (Priority 4)
    - Northern Short-tailed Mouse *Leggadina lakedownensis* (Priority 4)
- The Minor Drainage may provide habitat for the Grey Falcon *Falco hypoleucos* listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act).

The field survey was successfully undertaken with no significant limitations identified. The survey occurred during the ideal detection period of flora species. Two flora species were unable to be confidently identified to species level (denoted by a "?") () due to lack of suitable material. This is not considered to represent a significant limitation for this survey.

9.0 References

Aplin, T. E. H. 1979. The flora. Page in B. J. O'Brien, editor. Environment and Science. University of Western Australia Press, Perth WA.

Astron, 2018. Greater Paraburdoo Detailed Flora and Vegetation Survey April 2018. Prepared for Rio Tinto.

Astron, 2022. Rail Weed Monitoring Program, Borrow Pits 74.0 and 78.2. Prepared for Rio Tinto.

Astron, 2023. Rail Native Vegetation Clearing Permit Survey. Prepared for Rio Tinto.

Atlas of Living Australia (AoLA), 2021. Available at: https://www.ala.org.au/. Accessed August 2024.

Beard JS, Beeston GR, Harvey JM, Hopkins AJM, Shepherd DP, 2013. The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. Conservation Science Western Australia 9, 1 pp.1–152.

BOM, 2024. Climate Statistics for Australian Locations. Bureau of Meteorology. http://www.bom.gov.au/climate. Accessed July 2024.

Braithwaite, R.W. & A.D. Griffiths, 1994. Demographic variation and range contraction in the Northern Quoll, Dasyurus hallucatus (Marsupialia: Dasyuridae). Wildlife Research. 21:203-218.

Burbidge, A.A., 2016. "Pseudomys chapmani". IUCN Red List of Threatened Species. IUCN. 2016:

DBCA, 2024. Flora, Fauna and Ecological Community Data. Supplied by the Department of Biodiversity, Conservation and Attractions.

DCCEEW, 2024. Species Profiles and Threats Database. Online platform: https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl. Accessed July 2024. \

DPaW and Rio Tinto, 2015. Rare and Priority Plants of the Pilbara mobile app edition. Available at:

https://apps.apple.com/au/app/rare-and-priority-plants-of-the-pilbara/id945178469. Accessed on 20

June 2024.

DoE, 2016. Consultation Document on Listing Eligibility and Conservation Actions: Macroderma gigas (Ghost Bat). https://www.dcceew.gov.au/sites/default/files/env/pages/049564f9-5c96-43a0-88c5-ee3dec26c622/files/consultation-document-ghost-bat.pdf

DotEE, 2017. Australian Vegetation Attribute Manual Version 7.0, Department for the Environment and Energy, Canberra

Eco Logical Australia, 2022. Ti Tree Rail Targeted flora survey. Prepared for Rio Tinto.

Eco Logical Australia, 2023. Galah Rail Siding reconnaissance and targeted flora survey. Prepared for Rio Tinto.

EPA, 2016a. Technical Guidance – Terrestrial flora and vegetation Surveys for Environmental Impact Assessment. EPA, Western Australia.

EPA, 2016b. Environmental Factor Guideline – Flora and Vegetation. EPA, Western Australia.

EPA, 2016c. Environmental Factor Guideline – Landforms. EPA, Western Australia.

EPA, 2016d. Technical Guidance – Sampling of short range endemic invertebrate fauna. EPA, Western Australia

EPA, 2020. Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. EPA, Western Australia.

Government of Western Australia (Govt. of WA), 2019. 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth.

Holland AE, & Butcher R, 2016. Vigna triodiophila (Fabaceae: Phascolaea), a new conservation-listed species from the Pilbara, Western Australia.

IBRA7, 2012. Interim Biogeographic Regionalisation for Australia, Version 7. Available at http://www.environment.gov.au/system/files/pages/5b3d2d31-2355-4b60-820c-e370572b2520/files/bioregions-new.pdf.

Kendrick P, & McKenzie N, 2001. Pilbara 1 (PIL1 - Chichester subregion). A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions. Prepared by Peter Kendrick and Norm McKenzie for the Department of Conservation and Land Management.

Kitchener, D.J., 1983. "Pebble-mound Mouse Pseudomys chapmani". In Strahan, Ronald (ed.). Complete book of Australian mammals. Australian Museum: the National Photographic Index of Australian Wildlife. Sydney: Angus and Robertson. pp. 416–17. ISBN 0207144540.

Lindken T, Anderson CV, Ariano-Sánchez D, Barki G, Biggs C, Bowles P, Chaitanya R, Cronin DT, Jähnig SC, Jeschke JM, Kennerley RJ, Lacher TE, Luedtke JA, Liu C, Long B, Mallon D, Martin GM, Meiri S, Pasachnik SA…Evans, T, 2024. What factors influence the rediscovery of lost tetrapod species? Global Change Biology, 30, e17107. https://doi.org/10.1111/gcb.17107

Meiri S, Bauer AM, Allison A, et al., 2017. Extinct, obscure or imaginary: The lizard species with the smallest ranges. Divers Distrib. 2018; 24: 262–273. https://doi.org/10.1111/ddi.12678.

Orchard AE, & Cross EW, 2012. A revision of the Australian endemic genus Pentalepis (Asteraceae: Ecliptinae). Nuytsia 22(6): 371-392.

Pizzey G, & Knight F, 2007. The field guide to the birds of Australia. Harper Collins Publishers: Sydney, Australia.

Rio Tinto, 2023. Flora Data. Rio Tinto Iron Ore. Provided by Rio Tinto dated 12 Mar 2024.

Stewart AJ, Sweet IP, Needham RS, Raymond OL, Whitaker AJ, Liu SF, Phillips D, Retter AJ, Connolly DP, Stewart G, 2008. Surface geology of Australia 1:1,000,000 scale, Western Australia [Digital Dataset] Canberra: The Commonwealth of Australia, Geoscience Australia.

Theischinger G; & Endersby I, 2009. Identification Guide to the Australian Odonata. Department of Environment, Climate Change and Water NSW. p. 191.

Trudgen ME, 1988. A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.

TSSC, 2020. Flaco hypoleucoc (Grey Falcon) Conservation Advice, accessed 2023. Canberra: Department of Agriculture, Water and the Environment.

Van Vreeswyk, A.M.E., A.L. Payne, K.A. Leighton & P. Hennig, 2004. An inventory and condition survey of the Pilbara region, Western Australia. Department of Agriculture Technical Bulletin No. 92.

WAH, 1998-. Florabase: Online Resource. Available at https://florabase.dpaw.wa.gov.au. Accessed August 2023.

Watts CHS, & Aslin HJ, 1981. The rodents of Australia. Angus and Robertson, Sydney.

.

Appendix A

Flora Desktop Results

Appendix A Flora Desktop Results

Taxon	Habitat	Cons. Code	Distance from Survey Area			Date			Likelihood Assessment					Total Score	Likelihood		Comments
			WAHerb	TPFL	Rio	WA Herb	TPFL	Rio	Recorded in survey area	Known occurrence <10km	Known occurrence <20km	Recent Record (<20 years)	Habitat suitability (0,1,2)		Pre-survey	Post-survey	
Cladium procerum	Perennial pools.	P2	24.17	-	-	2008			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)	Cracking clay, basalt. Gently undulating plain with large surface rocks, flat crabholed plain.	P3	7.09	-	-	2004			0	1	1	0	0	2	Negligible	Negligible	No suitable habitat.
Eriochloa fatmensis	Regularly flooded area immediately adjacent to active river levee.	P3	43.83	-	-	1981			0	0	0	0	1	1	Negligible	Negligible	No suitable habitat.
Euphorbia australis var. *glabra*	Sump, low in the landscape on alluvial cracking clay loamy soil, gritty with ironstone fragments, saline flats (Astron, 2018).	P3	34.15	-	-	2004			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Euphorbia inappendiculata var. *inappendiculata*	Cracking clays, associated with tussock grassland.	P2	21.16	-	-	1997			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Euphorbia stevenii	Clay, sandy soils.	P3	24.71	-	-	1997			0	0	0	0	1	1	Negligible	Negligible	No suitable habitat.
Fimbristylis sieberiana	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	P3	27.00	27.00	-	2021	2008		0	0	0	1	1	2	Low	Negligible	No suitable habitat.
Glycine falcata	Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.	P3	47.94	-	-	2011			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Goodenia obscurata	Occurs on floodplains or low rocky ridges, growing in red-brown sandy clay or lateritic loam over banded ironstone. Associated with low open woodland of Acacia over Triodia, or open shrubland with a sparse overstorey of Corymbia hamersleyana and Hakea chordophylla over Triodia	P3	26.92	-	-	2023			0	0	0	1	2	3	Moderate	Low	Habitat marginal (disturbed drainage line). No banded ironstone. No records within 20 km.
Ipomoea racemigera	Sandy soils along watercourses (DPaW & Rio Tinto, 2015)	P2	25.99	25.98	-	2022	2022		0	0	0	1	2	3	Moderate	Low	Habitat present, not recorded during survey.
Livistona alfredii	Watercourses and drainage lines.	P4	25.04	-	-	2003			0	0	0	0	2	2	Low	Negligible	No suitable habitat.
Neptunia longipila	Cracking clay area, very gently sloping. Soil: Red-brown clay with numerous cobbles and some pebbles.	P2	3.34	-	-	2013			0	1	1	0	0	2	Negligible	Negligible	No suitable habitat.
Owenia acidula	Plain with creek and drainage line adjacent. Silty loam.	P3	26.92	31.18	-	1990	1990		0	0	0	0	1	1	Low	Negligible	No suitable habitat.
Paspalidium retiglume	Tropical and subtropical sub-humid woodlands, arid and semi-arid low woodland and tussock grasslands. Often in cracking clays.	P2	7.82	17.46	-	2004	1997		0	1	1	0	0	2	Negligible	Negligible	No suitable habitat.
Pentalepis trichodesmoides subsp. *hispida*	Found in Triodia hummock grassland, often in the understorey of a shrubland of Acacia spp., Gossypium spp., Senna spp., Brachychiton spp. and Eucalyptus spp., on summits and slopes of low hills, on basaltic soils, at altitudes to 1150 m (Orchard & Cross, 2012).	P2	19.09	-	3.10	2013		2023	0	0	1	1	2	4	High	Negligible	No suitable habitat.
Rhynchosia bungarensis	Rock piles, gorges, river beds, alluvial soils in shrubland.	P4	30.34	-	14.41	1997		No date	0	0	0	0	1	1	Low	Negligible	No suitable habitat.
Solanum albostellatum	Cracking clay soils on open floodplains in open scrubland over grasses (DPaW &Rio Tinto, 2015). Associated with other tussock grasses.	P3	26.90	-	30.46	2018		2010	0	0	0	1	0	1	Negligible	Negligible	No suitable habitat.
Swainsona thompsoniana	Inhabits open floodplains on heavy clay soils.	P3	17.46	-	-	2009			0	0	1	0	0	1	Negligible	Negligible	No suitable habitat.
Tephrosia lithosperma	Crest and slopes of a low rise. Soil: Light brown pebbly, gravelly loam.	P1	38.73	-	-	1997			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Terminalia supranitifolia	Volcanic rock piles or near rocky ridges in low hilly country close to coast.	P3	45.19	44.31	-	1986	2001		0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Teucrium pilbaranum	Crabhole plains dominated by E. victrix and calcrete tables dominated by grasses.	P2	24.21	-	-	1996			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	Drainage lines, clay flats, crabhole flats and dark self mulching clays.	P3	7.69	-	11.80	2010		No date	0	1	1	0	2	4	High	Low	Habitat marginal (disturbed drainage line). No deep clays or crabhole flats.
Trianthema sp. Python Pool (G.R. Guerin & M.E. Trudgen GG 1023)	Occurs in sand, gibber plain on plains.	P2	16.33	-	-	2018			0	0	1	1	1	3	Moderate	Negligible	No suitable habitat.
Triodia basitricha	Grows on crests and nearby slopes of rocky hills (DPaW & Rio Tinto, 2015).	P3	25.74	-	19.37	2022		2018	0	0	0	1	0	1	Negligible	Negligible	No suitable habitat.
Triodia pisoliticola	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	24.18	-	-	1994			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Vigna triodiophila	Species only recorded in basalt rockpile habitats in the northwest of the Pilbara bioregion (known from seven populations near Karratha, the Burrup Peninsula and Port Hedland (Holland & Butcher, 2016). Associated vegetation inlcudes open to scattered shrubs, tall shrubs and low treess, with hummock and tussock grasslands (Holland & Butcher, 2016).	P3	34.39	-	-	2009			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.

Appendix B

Fauna Desktop Results

Appendix B Fauna Desktop Results

Type	Taxon	Common Name	Habitat	Cons. Code		Date		Records		Distance		PMST	Likelihood Assessment				Total Score	Pre-survey Likelihood	Post-survey Likelihood	Comments
				BC Act / DBCA	EPBC Act	DBCA	Rio	DBCA	Rio	DBCA	Rio		Recorded in Survey Area	Known Occurrence <20km	Recent Record <20 years	Habitat Suitability (0,1,2)				
Bird	*Actitis hypoleucos*	Common Sandpiper	Wide range of coastal wetlands, around muddy margins or rocky shores, some inland wetlands and rarely on mudflats (DCCEEW, 2024)	IA	MI & MA	2014		4		22.37		Known	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Reptile	*Anilios ganei*	Gane's Blind Snake	Grasslands.	P1		1999		1		26.21			0	0	0	1	1	Negligible	Negligible	No suitable habitat
Invertebrate	*Antipodogomphus hodgkini*	Pilbara Dragonfly	It is endemic to the Pilbara region of Western Australia, where it inhabits rivers, streams and pools (Theischinger & Endersby, 2009).	P3		2007		2		25.81			0	0	1	2	3	High	Low	No suitable habitat
Bird	*Arenaria interpres*	Ruddy Turnstone	Coastal regions with exposed rock coast lines or coral reefs (DCCEEW, 2024).	IA	Mi	2011		1		22.37			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Bird	*Calidris acuminata*	Sharp-tailed Sandpiper	Occurs along muddy edges of shallow fresh or brackish wetlands with inundated or emergent sedges, grass, saltmarsh or other low vegetation (DCCEEW, 2024).	VU	V & MI & MA	2014		1		41.79		May	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Bird	*Calidris ruficollis*	Red-necked Stint	Coastal sheltered areas and exposed or ocean beaches, sometimes on stony or rocky shores, reefs or shoals (DCCEEW, 2024).	IA	Mi	2014		1		41.79			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Dasyurus hallucatus*	Northern Quoll	The Pilbara and further north through to the Kimberley (DSEWPaC, 2011b). The species occupies rocky areas, deserts, eucalypt forests and woodlands, hummock grass (Plechtrachne spp.), basalt hills, mesas, high and low plateaux, lower slopes, occasional tor fields and stony plains supporting spinifex grasslands (Braithwaite & Griffiths 1994; Van Vreeswyk et al. 2004).	EN	E	2022		249		11.61		Known	0	1	1	0	2	Negligible	Negligible	No suitable habitat
Bird	*Falco hypoleucos*	Grey Falcon	Timbered lowland plains, including acacia shrublands particularly with tree-lined watercourses, tussock grassland and open woodland (TSSC, 2020).	VU	V	2012		1		35.62		Known	0	0	1	2	3	Moderate	Moderate	Suitable habitat present, only one record 35 km from survey area. Unlikely to rely on habitat for survival.
Bird	*Gelochelidon nilotica*	Gull-billed Tern	Shallow wetlands, including coastal or inland lakes, swamps and lagoons,sheltered bays and estuaries (DCCEEW, 2024).	IA	Mi	1999		1		36.23			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Bird	*Glareola maldivarum*	Oriental Pratincole	Open plains, floodplains or short grassland (including farmland), often occurring near terrestrial wetlands, and occurring along the coast. The species does not breed in Australia (DCCEEW, 2024).	IA	Mi	2011		2		9.76		May	0	1	1	1	3	Moderate	Low	May occur but unlikely to rely on habitat.
Bird	*Hydroprogne caspia*	Caspian Tern	The Caspian Tern is found in sheltered coastal embayments and those with sandy or muddy margins (DCCEEW, 2024).	IA	Mi	2014		12		36.23			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Leggadina lakedownensis*	Northern Short-Tailed Mouse	Its natural habitat is dry savanna.	P4		2011		43		5.60			0	1	1	2	4	High	Moderate	May occur but unlikely to rely on habitat.
Fish	*Leiopotherapon aheneus*	Fortescue Grunter	Clear freshwater. It is endemic to rivers in Western Australia (AoLA, 2021).	P4		1980		9		25.81			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Reptile	*Lerista quadrivincula*	Four-Lined Slider	Only known from the type locality (Meiri et al. 2017). This is one of the species called 'lost' and 'rediscovered' by Lindken et al. 2024.	P1		1980		2		47.93			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Reptile	*Liasis olivaceus barroni*	Pilbara Olive Python	Deep gorges and water holes in the ranges of the Pilbara region (DEECCW, 2024)	VU	V	2019		4		26.73		Likely	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Macroderma gigas*	Ghost Bat	Northern Australia, inhabiting arid Pilbara to tropical savanna woodlands and rainforests rainforest, monsoon and vine thicket, open woodlands and arid areas and reside in caves, rock crevices and disused mine adits (DoE, 2016).	VU	V	1958		1		26.73		Likely	0	0	0	0	0	Negligible	Negligible	No suitable habitat
Invertebrate	*Nososticta pilbara*	Threadtail Damselfly	It has only been found in the Pilbara region of Western Australia, where it inhabits streams and pools.	P2		2007		6		25.03			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Reptile	*Notoscincus butleri*	Lined Soil-Crevice Skink	The preferred natural habitat of *N. butleri* is stony grassland.	P4		2011		24		14.75			0	1	1	0	2	Moderate	Low	May occur, suitable habitat present and records within 20 km
Bird	*Numenius phaeopus*	Whimbrel	Along the Australian coast, inhabiting estuaries, mangroves, tidal flats, flooded paddocks, and bare grasslands (Pizzey & Knight, 2007)	IA	Mi	1977		1		44.66			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Bird	*Pandion haliaetus*	Osprey	Littoral and coastal habitats, terrestrial wetlands of tropical and temperate Australia, and offshore islands. Atypical habitats incude heath, woodland or forest (DCCEEW, 2024).		Ma	1977		1		44.66		Known	0	0	0	0	0	Negligible	Negligible	No suitable habitat
Bird	*Plegadis falcinellus*	Glossy Ibis	Well vegetated wetlands, wet pastures, floodwaters, brackish wetlands and mudflats (Pizzey & Knight, 2007).	IA	Mi	2013		3		35.62			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Pseudomys chapmani*	Western Pebble-mound Mouse	It is associated with eroding sands and can be found in the Pilbara region in areas of rocky hummock grassland with little or no soil and an overstorey of Acacia spp. (Kitchener 1983; Burbidge 2016).	P4		2004		9		5.60			0	1	1	2	4	High	Moderate	No suitable habitat
Mammal	*Rhinonicteris aurantia* (Pilbara form)	Pilbara Leaf-Nosed Bat	Tropical woodland to semi-arid grasslands.	VU	V	2018		2		25.85		Likely	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Bird	*Rostratula australis*	Australian Painted Snipe	Shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DCCEEW, 2024).	EN	E	2011		2		18.73		May	0	1	1	0	2	Negligible	Negligible	No suitable habitat
Bird	*Tringa glareola*	Wood Sandpiper	Common in Northern Australia, a casual visitor to southern parts, occuping wetland margins, saltmarshes and sewage ponds (Pizzey & Knight, 2007).	IA	Mi	2015		2		40.84			0	0	1	0	1	Negligible	Negligible	No suitable habitat

Appendix C

Species by Family by Site

Appendix C Flora Species List

Family	Taxon	GQ01	GQ02	GQ03
Amaranthaceae				
	Achyranthes aspera	x		
	Ptilotus exaltatus	x	x	x
Boraginaceae				
	Trichodesma zeylanicum var. *zeylanicum*	x	x	x
Chenopodiaceae				
	Alysicarpus muelleri	x	x	
	Salsola australis			x
	Sclerolaena cornishiana	x		
Cleomaceae				
	Arivela viscosa	x	x	x
Convolvulaceae				
	Bonamia pilbarensis			x
	Evolvulus alsinoides		x	x
	Ipomoea ?muelleri	x		
	Ipomoea costata			x
	Ipomoea muelleri	x		
Cucurbitaceae				
	Cucumis variabilis	x		
Cyperaceae				
	Cyperus vaginatus		x	
Euphorbiaceae				
	Euphorbia australis var. *subtomentosa*	x	x	x
	Euphorbia coghlanii	x	x	x
	Euphorbia drummondii	x		x
Fabaceae				
	Acacia ancistrocarpa		x	x
	Acacia bivenosa	x	x	x
	Acacia colei var. *ileocarpa*			x
	Acacia inaequilatera			x
	Acacia pyrifolia var. *pyrifolia*	x	x	x
	Acacia trachycarpa	x		
	Crotalaria medicaginea	x	x	
	Indigofera linnaei	x		
	Indigofera monophylla			x
	Rhynchosia minima	x	x	x
	Senna glutinosa		x	x
	Senna notabilis	x	x	x
	Sesbania cannabina	x	x	
	Swainsona formosa	x	x	x
	Tephrosia densa	x		x
Goodeniaceae				
	Goodenia muelleriana		x	x
Gyrostemonaceae				
	Codonocarpus cotinifolius			x
Lauraceae				
	Cassytha filiformis		x	x

Appendix C Flora Species List

Family	Taxon	GQ01	GQ02	GQ03
Malvaceae				
	Abutilon ?otocarpum	x		
	Corchorus incanus subsp. *incanus*		x	x
*	*Malvastrum americanun*		x	
	Sida fibulifera	x	x	
	Triumfetta clementii		x	x
Myrtaceae				
	Corymbia hamersleyana			x
	Eucalyptus camaldulensis	x	x	
	Melaleuca argentea		x	
Nyctaginaceae				
	Boerhavia gardneri	x	x	x
Oleaceae				
	Jasminum didymum subsp. *lineare*		x	x
Orobanchaceae				
	Striga curviflora	x		
Phyllanthaceae				
	Phyllanthus maderaspatensis		x	
Plantaginaceae				
	Stemodia grossa	x	x	
Poaceae				
	Aristida latifolia		x	
*	*Cenchrus ciliaris*	x	x	x
*	*Cenchrus setiger*	x	x	
	Cymbopogon ambiguus	x	x	x
	Dactyloctenium radulans	x		
	Enneapogon lindleyanus		x	x
	Eriachne mucronata	x	x	
	Panicum decompositum		x	
	Paraneurachne muelleri		x	
	Themeda triandra		x	
	Triodia wiseana	x	x	x
Portulacaceae				
	Portulaca oleracea	x		
Proteaceae				
	Grevillea pyramidalis	x		x
	Hakea lorea			x
Rubiacae				
	Dolichocarpa crouchiana	X		
Solanaceae				
	Solanum cleistogamum			x
	Solanum diversiflorum	x	x	x
Violaceae				
	Afrohybanthus aurantiacus		x	
Zygophyllaceae				
	Tribulus hirsutus	x	x	

Appendix D

Flora Site Data

Appendix D Site Data

Site No: GQ01	**Date**: 05/06/2024	**Longitude:** 117.10157180	**Latitude**: -21.34750467

Type: Quadrat
Size: 50m x 50m
Topography: Minor Drainage
Vegetation Type: Eucalypts along minor channel
Fire: 1-2 years
Rock Type: ironstone, calcrete, blue metal

Soil Types: sandy clay loam, calcrete, pale brown
Effort: 1 person
Surface:
Vegetation Condition: good to poor, weed dominated, old ballast from rail, rubbish
Condition Notes: weeds, rubbish

Vegetation Community: *Eucalyptus camaldulensis, Melaleuca argentea* and *Grevillea pyramidalis* mid open woodland over *Sesbania cannabina, Trichodesma zeylanicum* var. *zeylanicum* and *Acacia trachycarpa* mid to tall sparse shrubland over **Cenchrus ciliaris, *Cenchrus setiger* and *Eriachne mucronata* tall tussock grassland.



Cons. Status	*Taxon*	Height (cm)	% Cover	Comment
	Abutilon ?otocarpum	0.3	0.1	CM240605-17
	Acacia bivenosa	0.9	0.1	
	Acacia trachycarpa	3	0.5	CM240605-10
	Acacia pyrifolia var. *pyrifolia*	1.8	0.1	
	Achyranthes aspera	0.6	0.1	CM240605-16

Cons. Status	*Taxon*	Height (cm)	% Cover	Comment
	Alysicarpus muelleri	0.6	0.1	CM240605-08
	Arivela viscosa	0.6	0.1	
	Boerhavia gardneri	0.01	0.1	CM240605-09
*	*Cenchrus ciliaris*	0.8	35	
*	*Cenchrus setiger*	0.8	25	
	Crotalaria medicaginea	0.5	0.1	
	Cucumis variabilis	0	0.1	
	Cymbopogon ambiguus	1.1	0.1	
	Dactyloctenium radulans	0.1	0.1	
	Dolichocarpa crouchiana	0.1	0.1	CM240605-13
	Eriachne mucronata	0.4	0.1	CM240605-12
	Eucalyptus camaldulensis	9	4	CM240605-06
	Euphorbia coghlanii	0.2	0.1	
	Euphorbia drummondii	0.4	0.1	CM240605-07
	Euphorbia coghlanii	0.01	0.1	CM240605-18
	Grevillea pyramidalis	2.3	0.1	
	Indigofera linnaei	0.2	0.1	
	Ipomoea ?muelleri	0	0.1	CM240605-11
	Ipomoea muelleri	0.2	0.1	CM240605-15
	Jasminum didymum subsp. *lineare*	0.4	0.1	CM240605-14
	Portulaca oleracea	0.01	0.1	
	Ptilotus exaltatus	0.4	0.1	
	Rhynchosia minima	0	0.1	
	Sclerolaena cornishiana	0.3	0.1	CM240605-21
	Senna notabilis	0.1	0.1	
	Sesbania cannabina	1.3	1	
	Sida fibulifera	0.2	0.1	
	Solanum diversiflorum	0.4	0.1	
	Stemodia grossa	0.1	0.1	
	Swainsona formosa	0.1	0.1	
	Tephrosia densa	0.4	0.1	
	Tribulus hirsutus	0.01	0.1	CM240605-20
	Trichodesma zeylanicum var. *zeylanicum*	0.2	0.1	
	Triodia wiseana	0.5	0.5	CM240605-19

Site No: GQ02	**Date**: 05/06/2024	**Longitude:** 117.099719440	**Latitude**: -21.346437762

Type: Quadrat
Size: 50m x 50m

Topography: Minor Drainage
Vegetation Type: Eucalypts along drainage and associated floodplain
Fire: 1-2 years
Rock Type: ironstone, calcrete, blue metal

Soil Types: sandy clay loam, calcrete, pale brown
Effort: 1 person

Surface:
Vegetation Condition: good to poor, weed dominated, old ballast from rail, rubbish, weird disturbance area
Condition Notes: weeds, rubbish, borrow pit

Vegetation Community: *Eucalyptus camaldulensis, Melaleuca argentea* and *Grevillea pyramidalis* mid open woodland over *Sesbania cannabina, Trichodesma zeylanicum* var. *zeylanicum* and *Acacia trachycarpa* mid to tall sparse shrubland over **Cenchrus ciliaris, *Cenchrus setiger* and *Eriachne mucronata* tall tussock grassland.



Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Acacia ancistrocarpa	1.5	0.1	
	Acacia bivenosa	0.9	0.1	
	Acacia pyrifolia var. *pyrifolia*	0.6	0.1	
	Afrohybanthus aurantiacus	0.4	0.1	
	Alysicarpus muelleri	0.4	0.1	
	Aristida latifolia	0.5	0.1	CM240605-28
	Arivela viscosa	0.6	0.1	

Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Boerhavia gardneri	0.4	0.1	CM240605-26
	Cassytha filiformis	0	0.1	CM240605-27
*	*Cenchrus ciliaris*	0.5	10	
*	*Cenchrus setiger*	0.6	10	
	Corchorus incanus subsp. *incanus*	1.1	0.1	CM240605-25
	Crotalaria medicaginea	0.2	0.1	
	Cymbopogon ambiguus	0.4	0.1	
	Cyperus vaginatus	0.5	0.1	CM240605-23
	Enneapogon lindleyanus	0.4	0.1	CM240605-24
	Eriachne mucronata	0.4	0.1	
	Eucalyptus camaldulensis	9	6	
	Euphorbia coghlanii	0.3	0.1	
	Euphorbia australis var. *subtomentosa*	0.01	0.1	
	Evolvulus alsinoides	0.1	0.1	
	Goodenia muelleriana	0.3	0.1	
	Jasminum didymum subsp. *lineare*	0.8	0.1	
*	*Malvastrum americanum*	0.2	0.1	
	Melaleuca argentea	5.3	0.5	
	Panicum decompositum	0.7	0.1	CM240605-23
	Paraneurachne muelleri	0.5	0.1	
	Phyllanthus maderaspatensis	0.3	0.1	
	Ptilotus exaltatus	0.05	0.1	
	Rhynchosia minima	0.3	0.1	
	Senna glutinosa	0.8	0.1	
	Senna notabilis	0.2	0.1	
	Sesbania cannabina	0.6	0.1	
	Sida fibulifera	0.2	0.1	
	Solanum diversiflorum	0.01	0.1	
	Stemodia grossa	0.6	0.1	
	Swainsona formosa	0.4	0.1	
	Themeda triandra	0.9	0.1	
	Tribulus hirsutus	0.01	0.1	
	Trichodesma zeylanicum var. *zeylanicum*	1.5	0.5	
	Triodia wiseana	0.3	1	
	Triumfetta clementii	0.3	0.1	CM240605-22

Site No: GQ03	**Date**: 05/06/2024	**Longitude:** 117.101571807	**Latitude**: -21.347504679

Type: Quadrat
Size: 50m x 50m
Topography: Minor Drainage
Vegetation Type:
Fire: 1-2 years
Rock Type: ironstone, calcrete, blue metal

Soil Types: sandy clay loam, calcrete, pale brown
Effort:
Surface:
Vegetation Condition: good to poor, weed dominated, old ballast from rail, rubbish
Condition Notes: weeds, rubbish

Vegetation Community: *Corymbia hamersleyana, Codonocarpus cotinifolius* and *Grevillea pyramidalis* low sparse woodland over *Acacia pyrifolia* var. *pyrifolia, Acacia bivenosa* and *Acacia inaequilatera* tall to mid sparse shrubland over *Triodia wiseana, *Cenchrus ciliaris* and *Enneapogon lindleyanus* tall mixed hummock and tussock grassland.



Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Acacia ancistrocarpa	2.7	0.1	
	Acacia bivenosa	0.8	0.1	
	Acacia inaequilatera	2.8	0.1	
	Acacia pyrifolia var. *pyrifolia*	2.2	1.5	
	Acacia colei var. *ileocarpa*	1.4	0.1	CM240605-30
	Arivela viscosa	0.2	0.1	
	Boerhavia gardneri	0.3	0.1	
	Bonamia pilbarensis	0.01	0.1	CM240605-31

Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Cassytha filiformis	0	0.1	
*	*Cenchrus ciliaris*	0.5	3	
	Codonocarpus cotinifolius	3.6	0.1	
	Corchorus incanus subsp. *incanus*	1.1	0.1	
	Corymbia hamersleyana	4	1	
	Cymbopogon ambiguus	0.7	0.1	
	Enneapogon lindleyanus	0.3	0.5	
	Euphorbia australis var. *subtomentosa*	0.01	0.1	
	Euphorbia coghlanii	0.4	0.1	
	Euphorbia drummondii	0.4	0.1	
	Evolvulus alsinoides	0.01	0.1	
	Evolvulus alsinoides	0.3	0.1	
	Grevillea pyramidalis	3.2	0.1	
	Hakea lorea	0.7	0.1	
	Indigofera monophylla	0.5	0.1	
	Ipomoea costata	1.6	0.5	CM240605-29
	Jasminum didymum subsp. *lineare*	0.7	0.1	
	Ptilotus exaltatus	0.01	0.1	
	Rhynchosia minima	0	0.1	
	Salsola australis	0.4	0.1	
	Senna glutinosa	2.1	0.1	
	Senna notabilis	0.1	0.1	
	Solanum cleistogamum	0.2	0.1	NC
	Solanum diversiflorum	0.4	0.1	
	Swainsona formosa	0.1	0.1	
	Tephrosia densa	0.2	0.1	
	Trichodesma zeylanicum var. *zeylanicum*	0.6	0.1	
	Triodia wiseana	0.6	32	
	Triumfetta clementii	0.3	0.1	

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a Fortune 500 firm and its Professional Services business had revenue of $14.1 billion in fiscal year 2024. See how we are delivering sustainable legacies for generations to come at aecom.com and @AECOM.

aecom.com

© 2024 AECOM. All Rights Reserved.

Attachment 4

AECOM Australia Pty Ltd
Whadjuk Nyoongar Country
Level 15, Alluvion Building
58 Mounts Bay Road
Perth WA 6000
GPO Box B59
Perth WA 6849
Australia
www.aecom.com

+61 1800 868 654 tel

ABN 20 093 846 925

14 January 2025

Candice Le Roux
152-158 St Georges Terrace,
Perth, Western Australia, 6000

Dear Candice

Abstraction from Water Bores along Tom Price rail line - 10 Clearing Principles Assessment

1.0 Introduction

Rio Tinto Iron Ore (Rio Tinto) is proposing to clear up to 0.40 ha of native vegetation from a clearing area of 0.70 ha along the Rio Tinto rail line, approximately 70 km south of Karratha city, Western Australia (Figure 1). The purpose of clearing is to provide access to and facilitate the abstraction from the following water bores, WARP22 (MLWTP 95.8KM) - GWL165810(5) (RTIO-HSE-0111496) (the Project).

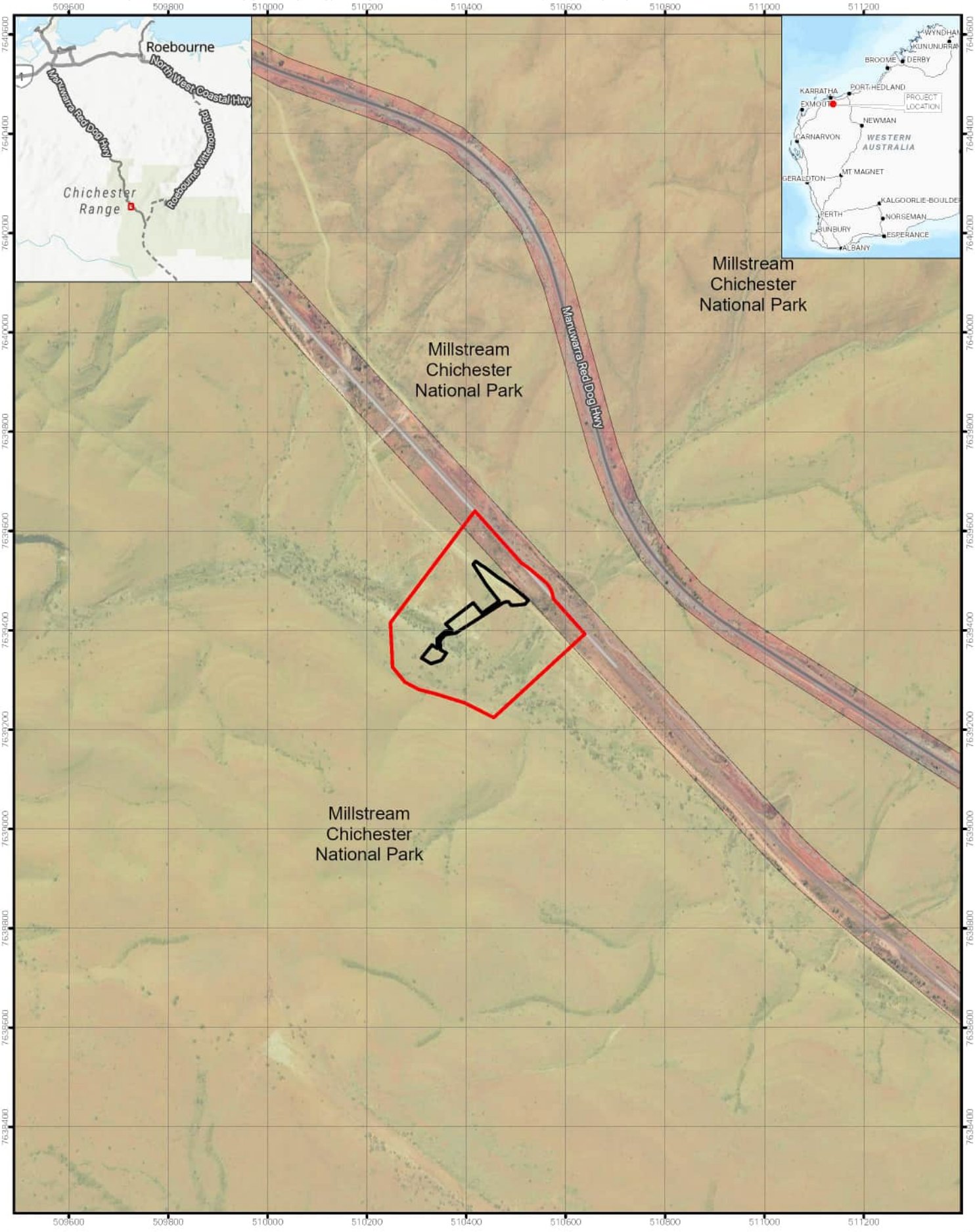
The Project scope includes the following activities:

- Installation of pumps and associated equipment.
- Installation of water storage tanks, which will be placed in previously disturbed areas.
- Installation of a water pipeline.
- Clearing and maintenance of a single-lane track to access the water bores, ensuring minimal disturbance to native vegetation where possible.

All clearing in Western Australia must be completed under an approved Native Vegetation Clearing Permit (NVCP), unless an exemption applies under the Environmental Protection (Clearing of native Vegetation) Regulations 2004. As there are no NVCP exemptions that apply to this proposal, a NVCP is required. The works are proposed to be completed under Clearing Permit System 4442/7 (CPS 4442/7).

Rio Tinto has engaged AECOM Australia Pty Ltd (AECOM) to complete an assessment of the proposed clearing against the 10 Clearing Principles.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	CREATED BY	ROB.MCGREGOR
DATE MODIFIED	17 SEP 2024	APPROVED BY	G.JURAN

N

0 50 100 150 200
metres

1:10,000
(when printed at A4)

GDA2020 MGA ZONE 50

LEGEND

- Clearing Area (AR-23-18419)
- Survey Area
- DBCA - Legislated Lands and Waters (DBCA-011)
- National Park

Survey Area

RIO TINTO

AR-23-18419 - CLEARING PRINCIPLES ASSESSMENT

Figure **1**

A4 size

Project: \\na.aecomnet.com\LPS\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Pipe\900_CAD_GIS\920_GIS\fnp_5102_MXD_APRX\01_CPA_Figures\01_CPA_Figures.aprx lrob.mcgregor
Layout: 60726828_002_CPA_Trip5, Last exported: 13/09/2024 5:15 PM

2.0 Summary of survey results

Rio Tinto commissioned AECOM to undertake a biological assessment of a 9.20 ha survey area, which included the 0.70 ha proposed clearing area (Figure 1). The scope included a detailed flora and vegetation assessment, targeted searches for significant communities and flora, and a basic fauna habitat assessment (AECOM 2024).

Senior Botanist Celia Mitchell (collection permit FB62000077-2), supported by Nina Sergeev, conducted the survey on 5 June 2024 (AECOM 2024). No significant limitations were identified that may impact on the ability to use the data to inform the environmental impact assessments.

The results from the biological survey are summarised below and the report is presented in Attachment A.

2.1.1 Desktop assessment

AECOM (2024) conducted a desktop assessment to determine the likelihood of occurrence for significant communities and species, listed as either Threatened under the *Biodiversity Conservation Act 2016* (BC Act) or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), or classified as Priority by DBCA.

Vegetation and flora

No Threatened Ecological Communities (TECs) listed under the EPBC Act or BC Act were identified in the desktop assessment as occurring within 50 km of the survey area.

Four Priority Ecological Communities (PECs) were identified within 50 km of the survey area in the desktop assessment, listed below:

- Four plant assemblages of the Wona Land System (P1).
- Horseflat Land System of the Roebourne Plains (P3).
- Kanjenjie Land System (P3).
- Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region (P2).

No Threatened flora species listed under the EPBC Act or BC Act were identified in the desktop assessment as occurring within 50 km of the survey area.

Twenty-six (26) Priority flora species were identified through the desktop assessment. Of these, two species had a high likelihood of occurrence, three species had a moderate likelihood of occurrence, four species had a low likelihood of occurrence, and the remaining 17 species had a negligible likelihood of occurrence.

The species with a high likelihood of occurrence are listed below:

- *Pentalepis trichodesmoides subsp. hispida, P2.*
- *Themeda sp. Hamersley Station (M.E. Trudgen 11431), P3.*

Fauna

A total of 24 vertebrate significant fauna species were considered to have the potential to occur in the survey area and search buffer (70 km). Of these, it was determined that two species were likely to occur in the survey area, three species had a moderate likelihood, and the remaining 17 species were considered negligible in the absence of suitable habitat.

The significant fauna species with potential to occur in the survey area are listed below:

- High likelihood of occurrence:
    - Northern Short-tailed Mouse (*Leggadina lakedownensis*) (P4).
    - Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4).

- Moderate likelihood of occurrence:
    - Grey Falcon (*Falco hypoleucos*) (Vulnerable under the EPBC Act and BC Act).
    - Oriental Pratincole (*Glareola maldivarum*) (Migratory under the EPBC Act and BC Act).
    - Lined Soil-Crevice Skink (*Notoscincus butleri*) (P4).

One significant invertebrate, the Pilbara Dragonfly (*Antipodogomphus hodgkini*) (P3) was identified in the desktop assessment as likely to occur. The presence of this species was unable to be verified, as the fauna survey was not undertaken in accordance with the methods outlined in Sampling of Short Range Endemic Invertebrate Fauna Technical Guide (EPA 2016d). Consequently, invertebrates are not included in the Field Survey Results (Section 2.1.2) or Assessment Against the 10 Clearing Principles (Section 4.0).

2.1.2 Field Survey Results

Vegetation and flora

Two vegetation communities were mapped in the clearing area:

- *Triodia* tall hummock grasslands (ChApTw) (SA1): 0.03 ha in Poor condition, recorded on lower slopes adjacent to a minor drainage.
- *Eucalyptus* mid open woodland (EcScCc) (MF1): 0.36 ha in Poor condition, representing the minor drainage.

The remaining area was mapped as Disturbed (0.31 ha). None of the vegetation communities recorded represent TEC/PEC. The vegetation types and condition are mapped in Figure 2.

A total of 65 native flora species were recorded within the survey area. None of the species recorded were significant flora species listed under the EPBC Act, BC Act, or as Priority by DBCA.

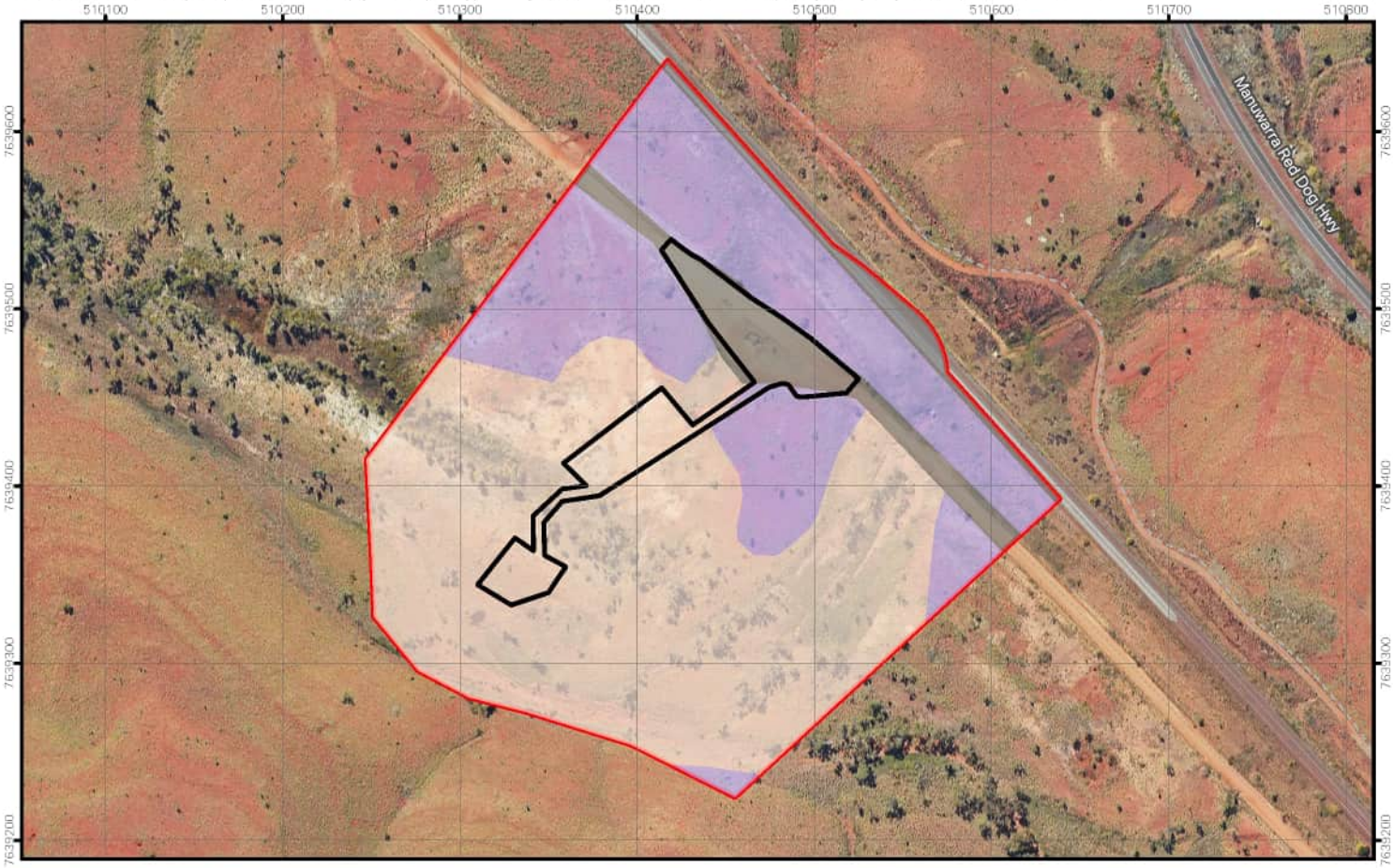
One Priority flora taxon, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3), was considered to have a low likelihood of occurrence in the post-survey assessment. All other significant flora were reduced to a negligible likelihood of occurrence.

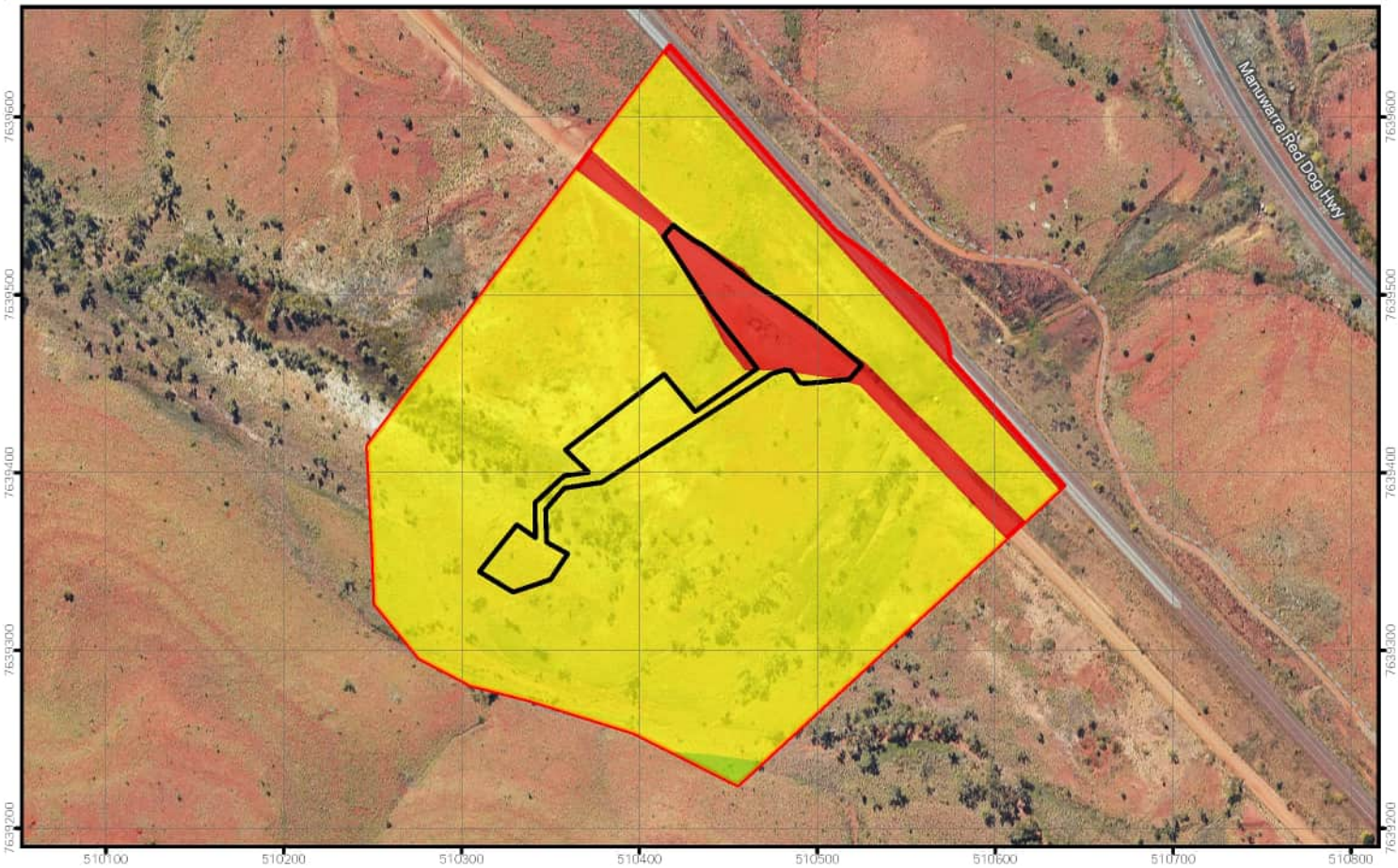
Fauna

Two fauna habitats were mapped within the clearing area, Minor Drainage and Stony Plain (Figure 3). Three significant fauna species were considered to have potential to use or pass through these habitats, listed below:

- Western Pebble-mound Mouse – The Stony Plain fauna habitat in the survey area is characterised by rocky hummock grassland. This habitat is considered suitable for foraging and traversing. No mounds were observed within the survey area.
- Northern Short-tailed Mouse – The Stony Plain fauna habitat in the survey area represents degraded “dry savannah habitat”. This is considered suitable foraging habitat for the Northern Short-tailed Mouse.
- Grey Falcon – The Minor Drainage fauna habitat in the survey area provides suitable foraging and hunting habitats for the Grey Falcon. However, this habitat is not considered critical for the species' survival as it was considered to be in Poor condition with high weed invasion and evidence of grazing.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.





AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	ROB.MCGREGOR
DATE MODIFIED	17 SEP 2024	**APPROVED BY**	G.JURAN

N

0 20 40 60 80
metres

1:4,000
(when printed at A4)

GDA2020 MGA ZONE 50

LEGEND

- Clearing Area (AR-23-18419)
- Survey Area

Vegetation Code

- HD
- MF1
- SA1

Vegetation Condition

- 0.1 - Completely Degraded
- 0.4 - Poor
- 0.6 - Good

Vegetation Type and Condition

CLIENT

AR-23-18419 - CLEARING PRINCIPLES ASSESSMENT

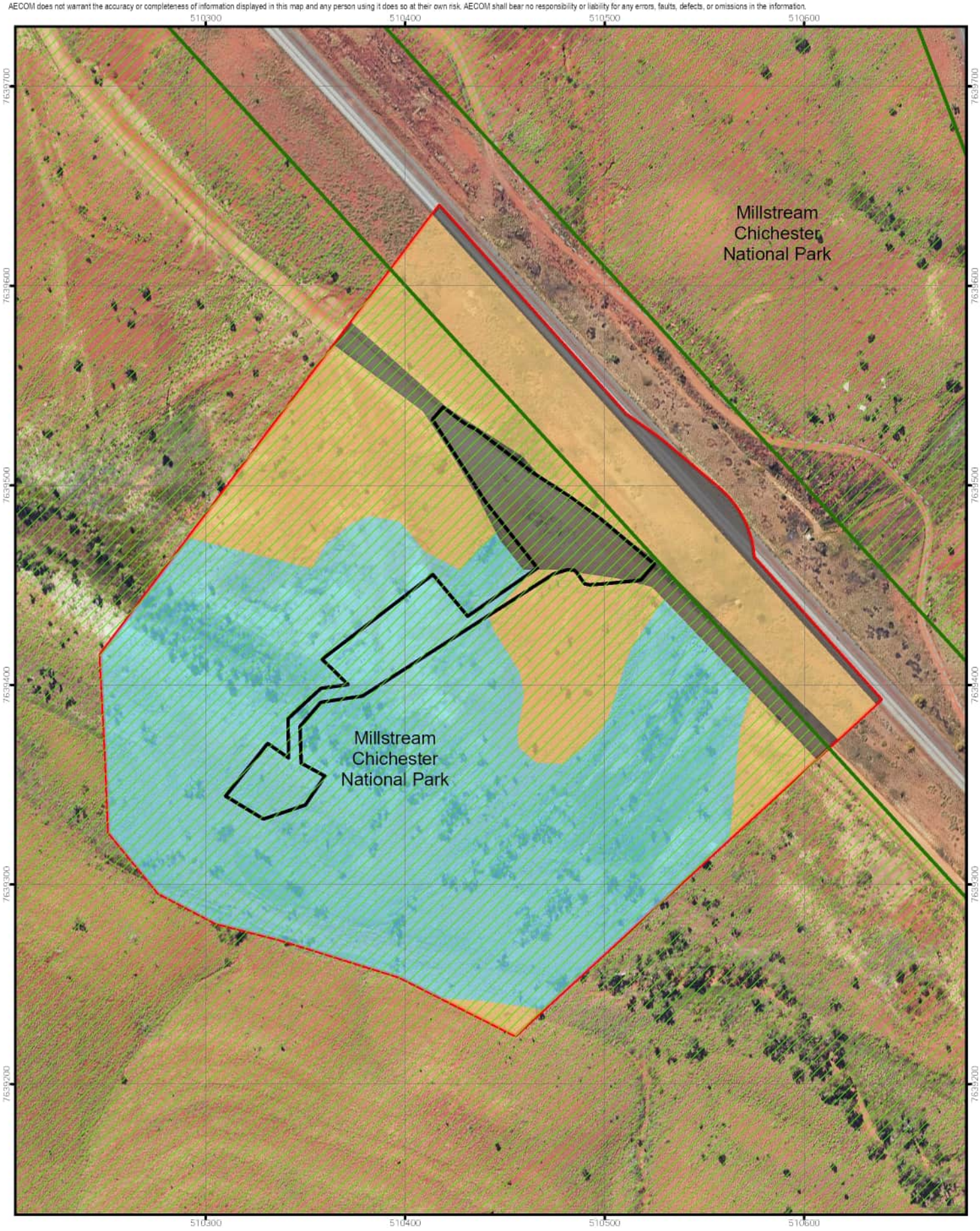
Figure

3

A4 size

Project: \\na.aecomnet.com\LPS\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Pilbara\900_CAD_GIS\920_GIS\Inp_510_MXD_APRX\01_CPA_Figures\01_CPA_Figures.aprx lrob.mcgregor\
Layout: 60726828_003_CPA_Trip5, Last exported: 15/08/2024 12:12 PM

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	ROB.MCGREGOR
DATE MODIFIED	17 SEP 2024
APPROVED BY	G.JURAN

N

1:2,500
(when printed at A4)

0 10 20 30 40
metres

GDA2020 MGA ZONE 50

LEGEND

- Clearing Area (AR-23-18419)
- Survey Area
- DBCA - Legislated Lands and Waters (DBCA-011)
- National Park

Habitat

- Disturbed
- Minor Drainage
- Stony Plain

Fauna Habitat

CLIENT

AR-23-18419 - CLEARING PRINCIPLES ASSESSMENT

Figure

2

A4 size

Project: \\na.aecomnet.com\LPS\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Pipe\900_CAD_GIS\920_GIS\1np_5102_MXD_APRX\01_CPA_Figures\01_CPA_Figures.aprx lrob.mcgregor\
Layout: 60726828_001_CPA_Trip5, Last exported: 15/09/2024 12:12 PM

3.0 Actions to avoid and minimise clearing

The Project requires clearing of 0.40 ha of native vegetation from a clearing area of 0.70 ha. The Project's location is in an area that does not contain any significant flora or communities and is unlikely to provide habitat that is critical for the survival of significant fauna. The vegetation within the clearing area is considered common to the region and does not contain any unique landforms.

The Project is located in previously cleared areas where possible, avoiding large trees and minimising clearing in the Minor Drainage (EcScCc) vegetation type.

Access will be along existing tracks where possible to minimise new disturbance.

4.0 Assessment against the 10 Clearing Principles

Rio Tinto is proposing to clear up to 0.40 ha of native vegetation along the Rio Tinto rail line, approximately 70 km south of Karratha city, Western Australia. An assessment of clearing impacts against the 10 Clearing Principles is presented in Tables 1 to 10. The assessment was completed in accordance with the DER (2014) guidelines.

Table 1 Assessment against principle (a)

a) Native vegetation should not be cleared if it comprises a high level of biological diversity.
Not at variance
Rio Tinto commissioned AECOM to conduct a biological survey of the proposed clearing area (0.70 ha) and a buffer (9.20 ha total). This included a comprehensive desktop assessment, detailed flora and vegetation survey and basic fauna assessment. **Flora** Through the desktop assessment, AECOM (2024) identified 26 Priority flora species potentially occurring within 50 km of the survey area. No species identified were listed as Threatened under the EPBC Act or BC Act. AECOM (2024) determined that three species had a high likelihood of occurrence, three species had a moderate likelihood of occurrence, four species had a low likelihood of occurrence, and the remaining 17 species had a negligible likelihood of occurrence. No significant flora species were recorded in the survey area. One Priority flora taxon, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3), was considered to have a low likelihood of occurrence in the post-survey assessment. All other significant flora were reduced to a negligible likelihood of occurrence. **Fauna** AECOM (2024) identified 24 Threatened, Priority, and Migratory fauna species with potential to occur within 70 km of the survey area through the desktop assessment. It should be noted that invertebrates were excluded from the this report. Two species had a high likelihood of occurrence in the survey area, as listed below: • Northern Short-tailed Mouse (*Leggadina lakedownensis*) (P4). • Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4). AECOM (2024) mapped two habitat types within the clearing area, Stony Plain and Minor Drainage. The rest of the clearing area is Disturbed. In their post-survey assessment, AECOM (2024) determined that three significant fauna have potential to use the clearing area habitats, including: • Grey Falcon (*Falco hypoleucos*) (Vulnerable) • Northern Short-tailed Mouse (*Leggadina lakedownensis*) (P4). • Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4). None of the recorded habitat were considered critical for the species' survival. **Vegetation** Through the desktop assessment, four PECs were identified as occurring within 50km of the survey area. AECOM (2024) mapped two vegetation types within the clearing area: 0.03 ha of *Triodia* tall hummock grasslands in Poor condition and 0.36 ha of *Eucalyptus* mid open woodland in Poor condition. The remaining area was mapped as Disturbed (0.31 ha). None of the vegetation recorded represent TEC/PEC.

a) Native vegetation should not be cleared if it comprises a high level of biological diversity.
The vegetation within the survey area was considered common throughout the region and did not include any unique landforms (AECOM 2024). Although three significant fauna species have potential to use the clearing area, none were observed during the survey, and none are likely to depend on this habitat for their survival. Based on the above information, the proposed clearing is not at variance to this principle.
Evidence: AECOM (2024)

Table 2 Assessment against principle (b)

b) Native vegetation should not be cleared if it comprises whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.
Not at variance
AECOM (2024) identified 24 Threatened, Priority, and Migratory fauna species with potential to occur within the survey area and search buffer. In the desktop assessment, AECOM (2024) determined that two species had a high likelihood of occurrence in the survey area, three species had a moderate likelihood of occurrence and the remaining 17 species were considered negligible in the absence of suitable habitat. It should be noted that invertebrates were excluded from the desktop assessment. The significant fauna species with a high likelihood of occurrence: • Northern Short-tailed Mouse (*Leggadina lakedownensis*) (P4). • Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4). The significant fauna species with a moderaite likelihood of occurrence: • Grey Falcon (*Falco hypoleucos*) (Vulnerable under the EPBC Act and BC Act). • Oriental Pratincole (*Glareola maldivarum*) (Migratory under the EPBC Act and BC Act). • Lined Soil-Crevice Skink (*Notoscincus butleri*) (P4). No significant fauna species were directly or indirectly observed during the field survey. AECOM (2024) identified two habitat types within the clearing area during their field survey: Stony Plain (0.03 ha) and Minor Drainage (0.36 ha). The remaining area is Disturbed (0.31 ha). In the post-survey assessment, AECOM (2024) determined three significant species, the Grey Falcon, Western Pebble-mound Mouse, and Northern Short-tailed Mouse may potentially use or pass through habitat within the clearing area. However, none of the recorded habitats were deemed critical for the survival of these species. The proposed clearing is not at variance to this principle.
Evidence: AECOM (2024)

Table 3 Assessment against principle (c)

c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.
Not at variance
No Threatened flora species were identified in the desktop assessment conducted by AECOM (2024). No Threatened flora species were recorded in the field survey and none were considered likely to occur post-survey (AECOM 2024). The proposed clearing is not at variance to this principle.
Evidence: AECOM (2024)

Table 4 Assessment against principle (d)

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.
Not at variance
AECOM (2024) did not anticipate the occurrence of any TEC during their survey as no TECs are known to the survey area or search buffer (50 km). AECOM (2024) recorded two native vegetation types within the clearing area, neither of which were considered to represent any TEC. The proposed clearing is not at variance with this principle.
Evidence: AECOM (2024)

Table 5 Assessment against principle (e)

e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.
Not at variance
The clearing area occurs in the Chichester bioregion, which is part of the Pilbara Craton IBRA region. AECOM (2014) mapped one pre-European vegetation association across the survey area, the Mosaic system, vegetation association 587. This vegetation type is described as Hummock grasslands with an open low tree-steppe, featuring snappy gum over *Triodia wiseana* and Hummock grasslands with a shrub-steppe, and Kanji over *Triodia pungens*. The Department of Environmental Regulation (DER) (2014) guidelines state that the retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. The extent remaining of vegetation association 587 exceeds this threshold, with over 99% remaining at the state, bioregion and local government levels.

Vegetation Association	Description	Percentage Remaining (%)			
		Western Australia	Pilbara IBRA Region	Chichester Plateau	Shire of Ashburton
587	Mosaic: Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana* / Hummock grasslands, shrub-steppe; kanji over *Triodia pungens*	99.99%	99.99	100%	100%

During the field survey, AECOM recorded two native vegetation types within the clearing area. This included 0.03 ha of *Triodia* tall hummock grasslands and 0.36 ha of *Eucalyptus* mid open woodland.

None of the vegetation communities recorded represent TEC/PEC. In addition, the vegetation recorded in the field survey was considered common to the Pilbara bioregion, with no significant communities or unique landforms identified.

The proposed clearing is not at variance with this principle.

Evidence: AECOM (2024), Govt. of Western Australia (2018), IBRA7 (2012)

Table 6 Assessment against principle (f)

f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.
May be at variance
No mapped DBCA wetlands, Ramsar wetlands or nationally important wetlands occur within or adjacent to the clearing area. The clearing area is located within the Capricorn land system, characterised by rugged sandstone hills, ridges, stony footslopes, and interfluves. This terrain supports low *Acacia* shrublands or hard *Spinifex* grasslands interspersed with scattered shrubs. AECOM (2024) recorded two fauna habitats in the clearing area, Minor Drainage (0.36 ha) and Stony Plain (0.03 ha). The remaining area was mapped as Disturbed (0.31 ha). The Minor Drainage habitat is characterised by native trees (*Eucalyptus camaldulensis* and *Melaleuca argentea*) along a minor bare creek bed. The substrate is predominantly rocky or cobbled with soil and organic matter often washed away in channel. Standing water may be present for a short period after significant rainfall events. The proposed clearing of 0.40 ha will be sited to avoid Minor Drainage habitat and large trees where possible. However, as the clearing includes vegetation growing in association with a watercourse, the proposed clearing may be at variance with this principle.
Evidence: AECOM (2024), DBCA (2017), DBCA (2024), van Vreeswyk at al. (2004)

Table 7 Assessment against principle (g)

g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.
Not at variance
AECOM (2024) recorded two vegetation types within the clearing area, 0.03 ha of *Triodia* tall hummock grasslands and 0.36 ha of *Eucalyptus* mid open woodland. These were associated with the Capricorn land system, characterised by rugged sandstone hills, ridges, stony footslopes, interfluves and stony soil. The stoniness of the Capricorn land system confers resistance to erosion (Van Vreeswyk et al., 2004). The proposed clearing area is relatively minor (0.40 ha) and is unlikely to result in appreciable land degradation. The proposed clearing is not at variance to this principle.
Evidence: AECOM (2024), CALM (2012), van Vreeswyk at al. (2004)

Table 8 Assessment against principle (h)

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.
At variance
The proposed clearing area intersects with the Millstream Chichester National Park conservation area (R_30071), which is protected under the *CALM Act 1984* - Section 5(1) (Figure 3). According to Clearing Permit number CPS 4442/7, Rio Tinto Iron Ore (Rio Tinto) is not authorised to clear native vegetation for project activities within Millstream Chichester National Park. The proposed clearing is at variance with this principle.
Evidence: AECOM (2024), DBCA (2024)

Table 9 Assessment against principle (i)

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.
Not likely to be at variance
The clearing area (0.70 ha) is within a Public Drinking Water Source Area (PDWSA) Harding Dam Catchment Area (P1). This water source is protected under the Harding Dam water source protection plan, May 1999. A P1 source protection area is to avoid unnecessary water quality contamination risks. The proposed clearing of up to 0.40 ha within a 0.70 ha clearing area is relatively minor. Additionally, the proposed clearing will avoid clearing within the Minor Drainage vegetation and avoid large trees, where possible. Given this, the proposed clearing is not likely to be at variance with this principle.
Evidence: AECOM (2014), DWER (2023)

Table 10 Assessment against principle (j)

j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.
Not at variance
The clearing area is located in in the Pilbara region, which experiences semi-arid climate. Rainfall for the 12 months preceding the AECOM survey (2024) was 162 mm, with an annual average of 409.5 mm (BoM 2024). AECOM (2024) mapped 0.36 ha of minor drainage community within the clearing area. The proposed clearing will avoid clearing within the Minor Drainage vegetation and avoid large trees, where possible. The proposed clearing is not likely to cause or exacerbate the incidence or intensity of flooding. The proposed clearing is not at variance with this principle.
Evidence: AECOM (2024), BoM (2024)

5.0 Conclusion

Rio Tinto proposes to clear 0.40 ha of native vegetation from a 0.70 ha clearing area to provide access to and facilitate the abstraction from water bores. An assessment against the 10 clearing principles indicates that the proposed clearing is not or not likely to be at variance with eight of the 10 principles.

The Project is at variance with principle (h) which concerns potential impact on the environmental values of a conservation area. The clearing area intersects with the Millstream Chichester National Park, and according to CPS 4442/7, Rio Tinto is not authorised to clear native vegetation within the National Park.

Additionally, the proposed clearing may be at variance with principle (f) which concerns clearing vegetation associated with a watercourse or wetland. The clearing area intersects with a Minor Drainage (Flowline) habitat, characterised by native trees along a minor bare creek bed. However, the proposed clearing is minor and not likely to have a significant impact on any associated watercourse.

Kind regards



Jamie Shaw
Technical Director - Impact Assessment and Permitting
jamie.shaw@aecom.com

Direct Dial: +61 8 6208 0199
Direct Fax: +61 8 6208 0999

6.0 References

AECOM Australia Pty Ltd. (2024). *Paraburdoo AR-24-18597 Flora, Vegetation and Fauna Assessment*. Unpublished report prepared for Rio Tinto.

BOM. (2024). *Climate Statistics for Australian Bureau of Meteorology*. Retrieved from http://www.bom.gov.au/climate

IBRA7. (2012). *Interim Biogeographic Regionalisation for Australia, Version 7*. Retrieved from http://www.environment.gov.au/system/files/pages/5b3d2d31-2355-4b60-820c-e370572b2520/files/bioregions-new.pdf

CALM. (2002). *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia*. Perth, Western Australia. Retrieved from https://docslib.org/doc/11362383/bioregional-summary-of-the-2002-biodiversity-audit-for-western-australia

DBCA. (2017). *DBCA-010: Ramsar Sites Data*. Perth, Western Australia

DBCA. (2023). *DBCA-026: Regional Parks Data.* Perth, Western Australia

DBCA. (2024). *DBCA-011: Legislated Lands and Waters Data,* Perth, Western Australia

DER. (2014). *A guide to the Assessment of Applications to clear native vegetation – under Part V Division of the Environmental Protection Act 1986.* Perth, Western Australia. Retrieved from https://www.der.wa.gov.au/images/documents/your-environment/native-vegetation/Guidelines/Guide2_assessment_native_veg.pdf

DWER. (2023). *DWER-033: Public Drinking Water Source Areas Data.* Perth, Western Australia

EPA, 2016d. Technical Guidance – Sampling of short range endemic invertebrate fauna. EPA, Western Australia

Govt. of Western Australia. (2019). *2018 Statewide Vegetation Statistics (formerly the CAR Reserve Analysis) - Full report*. Perth, Western Australia. Retrieved from https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics/resource/0fc225fa-b06b-4da4-b5ed-62a146842389

Van Vreeswyk, A.M.E., A.L. Payne, K.A. Leighton & P. Hennig, 2004. *An inventory and condition survey of the Pilbara region, Western Australia*. Department of Agriculture Technical Bulletin No. 92.

Attachment A

Native Vegetation Clearing Permit

Prepared for
Rio Tinto Group
ABN: 96 004 458 404

AR-23-18419 - Flora, Vegetation and Fauna Habitat Assessment

Native Vegetation Clearing Permit

14-Jan-2024
Doc No. 60726828_3

aecom.com

Delivering a better world

AR-23-18419 - Flora, Vegetation and Fauna Habitat Assessment

Native Vegetation Clearing Permit

Client: Rio Tinto Group

ABN: 96 004 458 404

Prepared by

AECOM Australia Pty Ltd
Whadjuk Nyoongar Country, Level 15, Alluvion Building, 58 Mounts Bay Road, Perth WA 6000, GPO Box B59, Perth WA 6849, Australia
T +61 1800 868 654 www.aecom.com
ABN 20 093 846 925

14-Jan-2024

Job No.: 60726828

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document	AR-23-18419 - Flora, Vegetation and Fauna Habitat Assessment
Ref	60726828
Date	14-Jan-2024
Originator	Floora de Wit, Gefan Juran
Checker/s	Celia Mitchel, Shannon de Melo
Verifier/s	Jamie Shaw

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
B	27-Aug-2024	Draft for client review	Floora de Wit Associate Director - Natural Resources	
0	11-Nov-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	
1	19-Nov-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	
2	28-Nov-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	
3	14-Jan-2024	Final Submission	Floora de Wit Associate Director - Natural Resources	

Table of Contents

Executive Summary i
1.0 Introduction 1
1.1 Background and Location 1
1.2 Objective and Scope 1
2.0 Conservation Codes 3
2.1 Flora and Fauna 3
2.2 Vegetation Communities 6
2.3 Biosecurity and Agriculture Management Act 2007 7
3.0 Existing Environment 8
3.1 Climate 8
3.2 Interim Biogeographic Region of Australia 8
3.3 Land Systems 9
3.4 Geology 9
3.5 Pre-European Vegetation 9
3.6 Conservation Reserves and Heritage 9
4.0 Methodology 14
4.1 Personnel 14
4.2 Desktop Assessment 14
4.2.1 Database Searches 14
4.2.2 Likelihood Assessment 15
4.3 Flora and Vegetation Assessment 16
4.3.1 Vegetation Mapping 17
4.3.2 Targeted Flora Searches 17
4.4 Fauna Habitat Assessment 17
4.5 Survey Limitations 17
5.0 Desktop Assessment Results 19
5.1 Previous Surveys 19
5.2 Significant Ecological Communities 20
5.3 Significant Flora 20
5.4 Significant Fauna 22
6.0 Field Survey Results 24
6.1 Vegetation 24
6.1.1 Communities 24
6.1.2 Significant Vegetation 24
6.1.3 Condition 24
6.2 Flora 27
6.3 Fauna Habitats 27
7.0 Discussion 29
8.0 Conclusion 30
9.0 References 31

Appendix A
Flora Desktop Results A

Appendix B
Fauna Desktop Results B

Appendix C
Species by Family by Site C

Appendix D
Flora Site Data D

List of Tables

Table 1	Vegetation, flora and fauna survey summary	1
Table 2	Categories of species listed under Schedule 179 of the EPBC Act	3
Table 3	Conservation codes for WA flora and fauna listed under the BC Act (DBCA, 2019)	4
Table 4	Conservation codes for WA flora and fauna species as listed by DBCA and endorsed by the Ministers for Environment	5
Table 5	Categories of TECs that are listed under the EPBC Act	6
Table 6	Conservation codes for state listed Ecological Communities	6
Table 7	Categories for Priority Ecological Communities	6
Table 8	Beard et al. (2013) Vegetation Associations and Present Remaining (Govt. of WA, 2018)	9
Table 9	Nature reserves within the vicinity of the survey area	9
Table 10	Database searches undertaken for the survey area	14
Table 11	Categories of likelihood of occurrence for flora and fauna species present	15
Table 12	Categories of likelihood of occurrence for fauna species	16
Table 13	Survey limitations	18
Table 14	Results of previous surveys conducted in the vicinity of the study area	19
Table 15	Significant Ecological Communities in the vicinity of the survey area	20
Table 16	Significant Flora species considered to have high or moderate likelihood of occurrence	21
Table 17	Significant fauna species considered to have high or moderate likelihood of occurrence	22
Table 18	Condition extent within survey area	24
Table 19	Vegetation communities description, details and photograph	25
Table 20	Fauna habitats of the survey area	27

List of Figures

Figure 1	Survey Area	2
Figure 2	Rainfall and temperature data from Pannawonica and Mardie stations (BoM, 2024)	8
Figure 3	Land Systems	10
Figure 4	Geology	11
Figure 5	Pre-European Vegetation	12
Figure 6	Conservation Estates and Heritage	13
Figure 7	Flora, Fauna and Communities Desktop Results	23
Figure 8	Vegetation Communities, Condition and Survey Effort	26
Figure 9	Fauna Habitats	28

Abbreviation

Abbreviation	Description
AECOM	AECOM Australia Pty Ltd
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation
DoEE	Department of the Environment and Energy
DEWHA	Department of the Environment, Water, Heritage and the Arts
DPLH	Department of Planning, Lands and Heritage
DPIRD	Department of Primary Industries and Regional Development
EPA	Environmental Protection Authority
EP Act	*State Environmental Protection Act 1986*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
GPS	Global Positioning System
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre
MCNP	Millstream Chichester National Park
NVCP	Native Vegetation Clearing Permit
P	Priority
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
Rio Tinto	Rio Tinto Group / Rio Tinto Iron Ore
TEC	Threatened Ecological Community
WA	Western Australia
WAH	Western Australian Herbarium
WoNS	Weed of National Significance

Executive Summary

Rio Tinto Iron Ore (Rio Tinto) engaged AECOM Australia Pty Ltd (AECOM) to undertake a flora, fauna and vegetation assessment for a defined survey area in the Pilbara region. The survey area comprises 9.20 ha and is located along the Rio Tinto rail line approximately 70 km south of Karratha city.

The objective of the survey was to assist Rio Tinto to complete a Native Vegetation Clearing Permit (NVCP) application. The survey area was completed by botanist Celia Mitchell and environmental scientist Nina Sergeev on 5 June 2024.

- Two native vegetation communities were mapped for 8.38 ha. The remaining 0.82 ha was heavily modified (cleared).
- No TECs or PECs were considered likely to occur and none were recorded.
- No Priority flora species were recorded within the survey area, and none were considered likely or to have the potential to occur.
- Two fauna habitats were mapped including a Minor Flowline and Stony Plain.
- The Stony Plain may provide habitat for:
    - Western Pebble-mound Mouse *Pseudomys chapmani* (Priority 4)
    - Northern Short-tailed Mouse *Leggadina lakedownensis* (Priority 4).
- The Minor Flowline may provide habitat for the Grey Falcon *Falco hypoleucos* listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act).
- No Priority fauna species were recorded within the survey area.

1.0 Introduction

1.1 Background and Location

Rio Tinto Iron Ore (Rio Tinto) engaged AECOM Australia Pty Ltd (AECOM) to complete a Native Vegetation Clearing Permit (NVCP) level survey along part of a rail line. The survey targeted Threatened and Priority flora, communities and fauna habitats. The survey results will support an NVCP application and ensure Rio Tinto complies with the NVCP conditions under Section 51A of the *Environmental Protection Act 1986* (EP Act).

The survey area is a 9.20 ha polygon situated between chainage 95 and 96 of the Rio Tinto Tom Price West Mainline, approximately 70 km southeast of Karratha townsite in the Shire of Ashburton (Figure 1).

1.2 Objective and Scope

The objective of the work was to assess the environmental values of the survey area pertaining to flora, vegetation, and fauna to assist Rio Tinto in completing the NVCP application for the Rio Tinto rail line.

The scope of work included:

- A desktop assessment to identify potential flora, fauna and ecological communities within the survey area.
- A flora and vegetation survey and targeted flora survey in accordance with the Environmental Protection Authority (EPA) Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (2016a).
- A fauna habitat assessment in accordance with the EPA Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (2020).

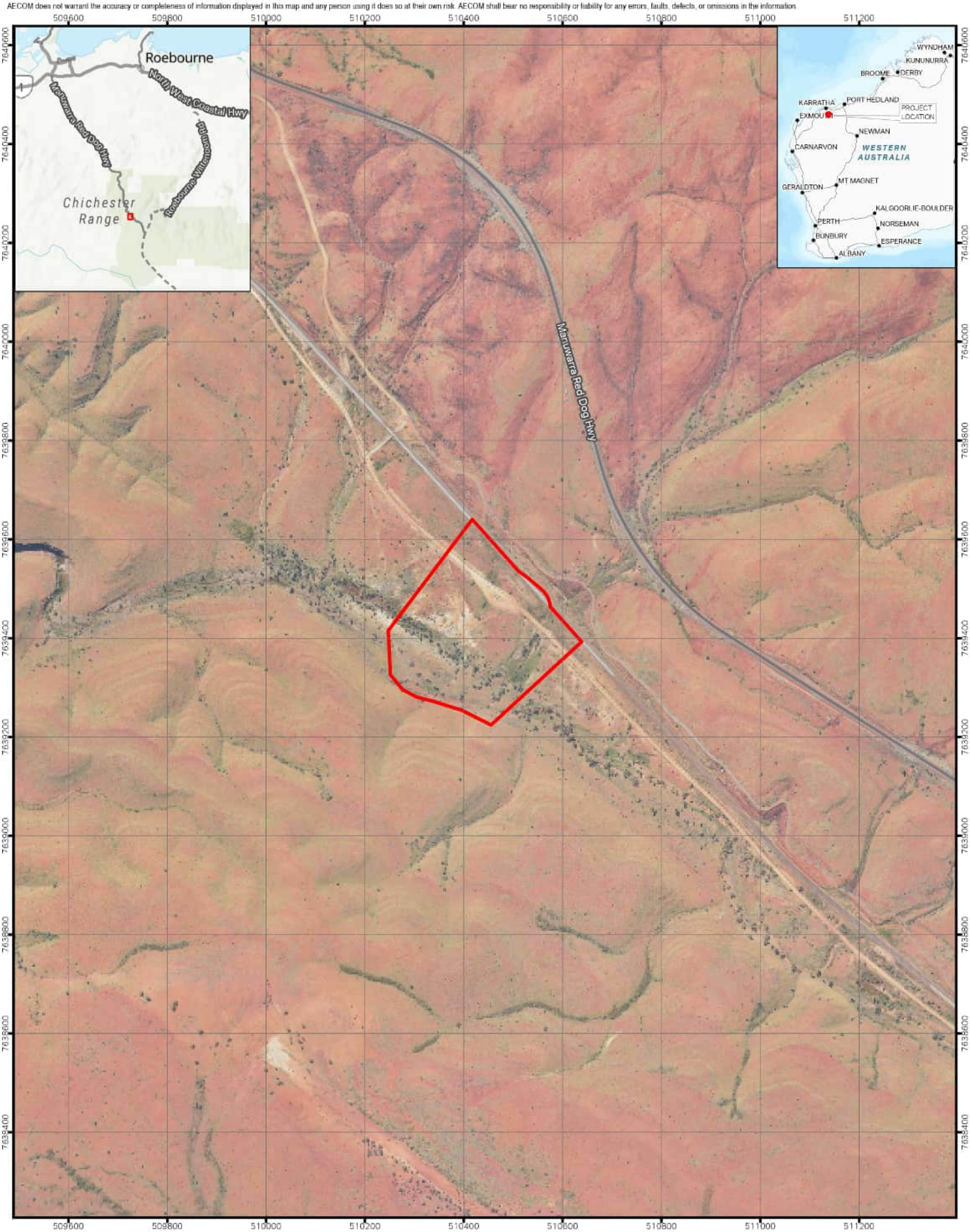
This report is intended as a supporting document for an NVCP application by Rio Tinto and has been prepared based on a review of existing information for the study area, combined with site field surveys.

A summary of the survey specifics and key limitations is shown in Table 1.

Table 1 Vegetation, flora and fauna survey summary

Survey type	Survey Area (ha)	Survey timing	Relevant regulatory standards and guidelines	Survey limitations
Flora, vegetation and fauna habitat survey	9.20	5 June, 2024	• Environmental Protection Authority (EPA) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016a) • EPA Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (2020) • EPA Factor Guideline – Flora and Vegetation (2016b) • EPA Factor Guideline – Landforms (2016c) • Rio Tinto Data Standards (2023)	No survey limitations

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	13 AUG 2024
APPROVED BY	F DE WIT

N

1:10,000 (when printed at A4)

0 50 100 150 200 metres

GDA2020 MGA ZONE 50

LEGEND

Survey Area

Survey Area

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 1

A4 size

Project: \\na.aecomnet.com\ifs\APAC\Perth~AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\600_CAD_GIS\620_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig1_NVCP_Trip5_SurveyArea_A4P_v1, Last exported: 13/08/2024 5:15 PM

2.0 Conservation Codes

2.1 Flora and Fauna

Species at risk of extinction are recognised at a Commonwealth level under the EPBC Act and are categorised as outlined in Table 2.

Table 2 Categories of species listed under Schedule 179 of the EPBC Act

Code	Category
Ex	**Extinct Taxa** A species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild Taxa** A species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered Taxa** A species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered Taxa** A species which is not critically endangered, and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable Taxa** A species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria
CD	**Conservation Dependent Taxa** A species which at a particular time if, at that time: the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered the following subparagraphs are satisfied: • the species is a species of fish, • the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised the plan of management is in force under a law of the Commonwealth or of a State or Territory cessation of the plan of management would adversely affect the conservation status of the species.
Mi	**Migratory Taxa** The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including: • Japan Australia Migratory Bird Agreement 1981 (JAMBA) • China Australia Migratory Bird Agreement 1998 (CAMBA) • Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA) • Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals). All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as a MNES under the EPBC Act.
Ma	**Marine Taxa** A species established under s248 of the EPBC Act.

Flora and fauna species that are considered Threatened and need to be specially protected because they are under identifiable threat of extinction are listed under the *Biodiversity Conservation Act 2016* (BC Act). These categories are defined in Table 3.

Table 3 Conservation codes for WA flora and fauna listed under the BC Act

Code	Category
CR	**Critically Endangered Taxa** 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. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EN	**Endangered Taxa** 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. Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
VU	**Vulnerable Taxa** 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. Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EX	**Extinct Taxa** Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
MI	**Migratory Taxa** 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). 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, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).
OS	**Other specially protected species** 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 List as Priority 1, 2 or 3 by the Western Australian 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 listed as Priority 4. Categories and definitions of Priority Fauna species are provided in Table 4.

Table 4 Conservation codes for WA flora and fauna species as listed by DBCA and endorsed by the Ministers for Environment

Code	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, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
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, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority Three – Poorly Known Species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority Four – Rare, Near Threatened and other species in need of monitoring** Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

2.2 Vegetation 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.

Communities can be classified as TECs under the EPBC Act. Categories of EPBC Act listed TECs are described in Table 5.

Table 5 Categories of TECs that are listed under the EPBC Act

Code	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.

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. TECs are listed under the BC Act in one of four categories defined in Table 5.

The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a database of state listed TECs, which is available for online searches via their website. Possible TECs that do not meet survey criteria or are not adequately defined are listed as Priority Ecological Communities (PECs) under Priorities 1, 2 and 3. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. Conservation dependent communities are classified as Priority 5. PECs are endorsed by the Minister for Environment and are described in Table 6.

DBCA requires that all Priority and Threatened ecological communities are considered during environmental impact assessments and clearing permit applications.

Table 6 Conservation codes for state listed Ecological Communities

Code	Category
PD	Presumed Totally Destroyed
CR	Critically Endangered
EN	Endangered
VU	Vulnerable

Table 7 Categories for Priority Ecological Communities

Code	Category
P1	Poorly-known ecological communities
P2	Poorly-known ecological communities
P3	Poorly-known ecological communities
P4	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.

2.3 Biosecurity and Agriculture Management Act 2007

Biosecurity is the management of the risk of animal and plant pests and diseases entering, emerging, establishing or spreading in WA to protect the economy, environment and community. Biosecurity is managed under the *Biosecurity and Agricultural Management Act 2007* (BAM Act), which came into effect 1 May 2013. Exotic animals and plants can become an invasive species if they can establish in new areas where local conditions are favourable for their growth. Each organism listed under the BAM Act comes with certain legal / import requirements:

- Declared Pest, Prohibited - s12. Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits.
- Permitted - s11. Permitted organisms may be subject to an import permit if they are potential carriers of high-risk organisms.
- Declared Pest - s22(2). Declared pests may be subject to an import permit if they are potential carriers of high-risk organisms and may also be subject to control and keeping requirements once within Western Australia.
- Permitted, Requires Permit - r73. Regulation 73 permitted organisms may only be imported subject to an import permit.
- Declared pests can be assigned to a C1, C2 or C3 control category under the Biosecurity and Agriculture Management Regulations 2013:
    - C1 Exclusion - Organisms which should be excluded from part or all of Western Australia
    - C2 Eradication - Organisms which should be eradicated from part or all of Western Australia
    - C3 Management - Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
- Unassigned - Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the BAM Act.

3.0 Existing Environment

3.1 Climate

The survey area is located in the Pilbara region which experiences hot humid summers and warm winters. In the Pilbara most of the rainfall comes from thunderstorms and cyclonic events, meaning rainfall can be highly variable. Most rainfall occurs between January and March, with the driest months being September and November.

Rainfall data from the Pannawonica Bureau of Meteorology (BoM) station (number 005069) (approximately 86 km south-west of the survey area) from the 12 months preceding the survey was obtained. This was compared against the long-term mean (1972 to 2024). Rainfall at Pannawonica was below average for five months preceding the survey (January to May 2024) with one significant rainfall event (June 2023), shown in Figure 2 (BoM, 2024). The 12 months preceding the survey received 162 mm compared to the long-term annual rainfall of 409 mm. Reduced rainfall may affect flowering period and growth vigour of perennial species and inhibit germination of annual species.

Temperature data from the Mardie BoM station (number 005008) (approximately 102 km north-west of the survey area) was obtained for the 12 months preceding the survey and compared against the long-term mean (1972 to 2024). Temperatures at Mardie were above or near-average for five months preceding the survey (February to May). Temperature variation is unlikely to have an effect on the objective of this survey.

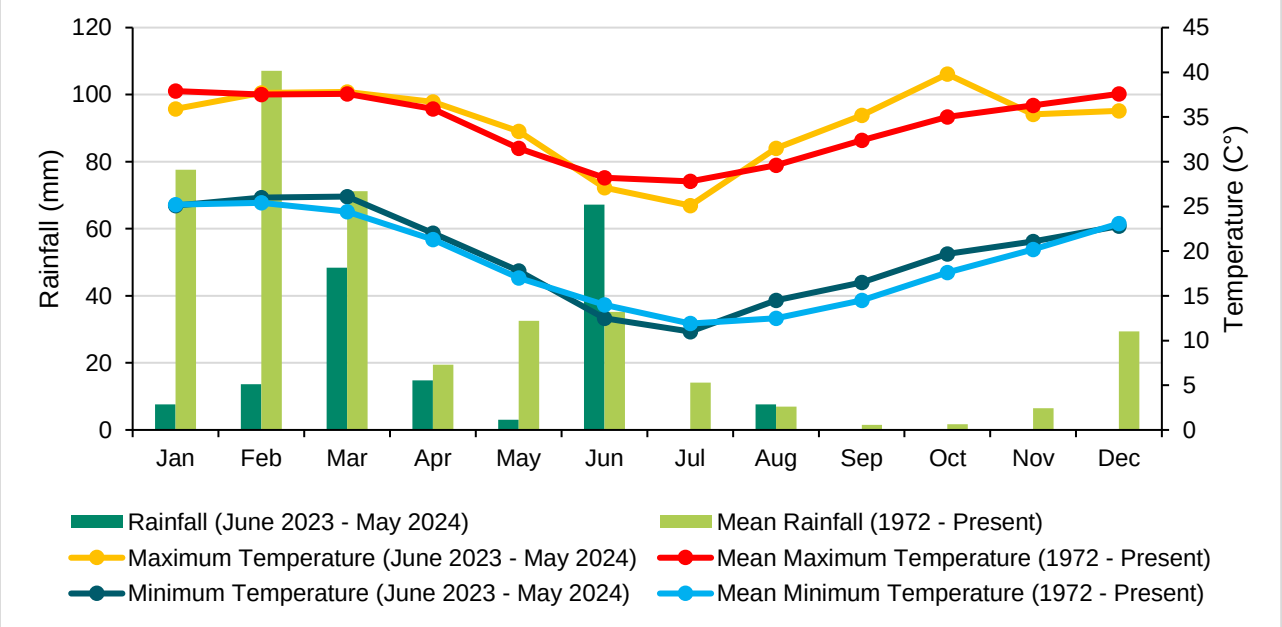


Figure 2 Rainfall and temperature data from Pannawonica and Mardie stations (BoM, 2024)

3.2 Interim Biogeographic Region of Australia

The largest regional vegetation classification scheme recognised by the Environmental Protection Authority (EPA) is the Interim Biogeographical Region of Australia (IBRA). The IBRA regions provide the planning framework for the systematic development of a comprehensive, adequate, and representative (CAR) national reserve system. There are 85 recognised IBRA regions across Australia that have been defined based on climate, geology, landforms and characteristic vegetation and fauna (IBRA7, 2012). The survey area across the Pilbara region.

The survey is located within the Chichester subregion, which is part of the Pilbara Craton. It features ancient granite and basalt plains that support a shrub steppe environment dominated by *Acacia pyrifolia* and *Triodia pungens* hummock grasses. Additionally, Snappy Gum tree steppes can be found in the ranges (IBRA, 2012).

3.3 Land Systems

The Chichester subregion is underlain by the northern section of the Pilbara Craton. Significant areas of basaltic ranges interrupt undulating Archaean granite and basalt plains (Kendrick & McKenzie 2001).

The survey area falls within the Capricorn system (Van Vreeswyk et al., 2004) described as having rugged sandstone hills, ridges, stony footslopes, and interfluves. This landscape supports low Acacia shrublands or hard spinifex grasslands with scattered shrubs (Figure 3).

3.4 Geology

The survey area is on the Tumbiana Formation (Stewart et al., 2008) which is part of the Mount Bruce Supergroup. It is described as Pisolitic tuff, siliceous limestone and dolomite, mudstone, tuffaceous shale, siltstone, sandstone, volcaniclastic sandstone and siltstone, calcareous sandstone, local basalt and basaltic breccia, chert, local conglomerate, shale, jasper.

3.5 Pre-European Vegetation

Beard et al. (2013) mapping is used to determine the current extent of remnant vegetation remaining when compared to pre-European vegetation extent. There is one vegetation association recorded across the survey area, Vegetation Association 587, described as “Chichester Plateau” (WA Govt., 2019). There is 99.99% of this vegetation remaining in WA, 99.9% remaining in the Pilbara Region, and 100% remaining in the Chichester Plateau Subregion (Govt. of WA, 2019).

Pre-European vegetation is detailed in Table 8 and mapped in Figure 5.

Table 8 Beard et al. (2013) Vegetation Associations and Present Remaining (Govt. of WA, 2019)

Vegetation association	Description	Percentage remaining (%)		
		Western Australia	Pilbara	Chichester Plateau
587	Mosaic: Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana* / Hummock grasslands, shrub-steppe; kanji over *Triodia pungens*	99.99%	99.99	100%

3.6 Conservation Reserves and Heritage

The survey area is located on a conservation reserve Millstream Chichester National Park (Reserve number 30071). An Environmentally Sensitive Area falls within the survey area (ID 5531). DBCA legislated land within the vicinity of the project site is described in Table 9.

Table 9 Nature reserves within the vicinity of the survey area

Name	Type	Purpose	Area (ha)	Distance (km)
Millstream Chichester	National Park	Conservation of Flora and Fauna	4.81	Within the survey area

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	WYATTK2
DATE MODIFIED	13 AUG 2024	**APPROVED BY**	F DE WIT

N

0 500 1,000 1,500 2,000
metres

1:100,000
(when printed at A4)

GDA2020 MGA ZONE 50

DATA SOURCES: Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2019)
Service Layer Credits: World Imagery: Earthstar Geographics

LEGEND

- Survey Area
- Soil Landscape Mapping - Best Available (DPIRD-027)
- Capricorn system,Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs
- River system,Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex
- Robe system,Low plateaux, mesas and buttes of limonite supporting soft spinifex and occasionally hard spinifex grasslands
- Rocklea system,Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs
- Ruth system,Hills and ridges of volcanic and other rocks supporting shrubby hard spinifex and occasionally soft spinifex grasslands
- Wona system,Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields

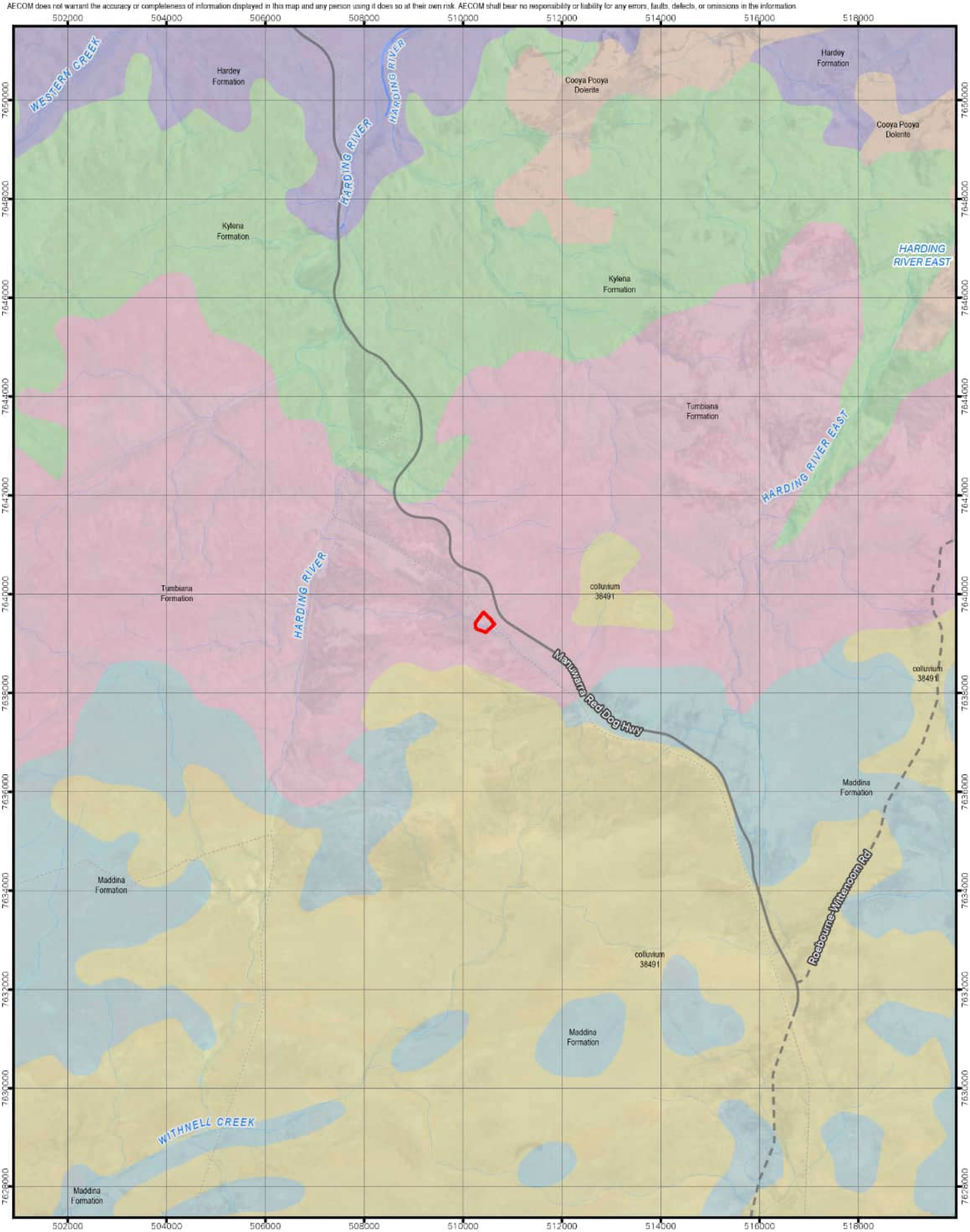
Soil Landscape Mapping

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 3

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	15 AUG 2024
APPROVED BY	F DE WIT

N

0 500 1,000 1,500 2,000
metres

1:100,000
(when printed at A4)

GDA2020 MGA ZONE 50

DATA SOURCES Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate 2015
Service Layer Credits: World Imagery: Earthstar Geographics SIO

LEGEND

- Survey Area
- Geoscience Australia (2012) Surface Geology of Australia, 1:1 000 000 scale, 2012 edition
- Cooya Pooya Dolerite,igneous mafic intrusive
- Hardey Formation,sedimentary, igneous volcanic
- Kylena Formation,igneous felsic volcanic, igneous mafic volcanic, sedimentary
- Maddina Formation,igneous mafic volcanic, igneous felsic volcanic, sedimentary,
- Tumbiana Formation,sedimentary, igneous volcanic
- colluvium 38491,regolith

Geology

RIO TINTO

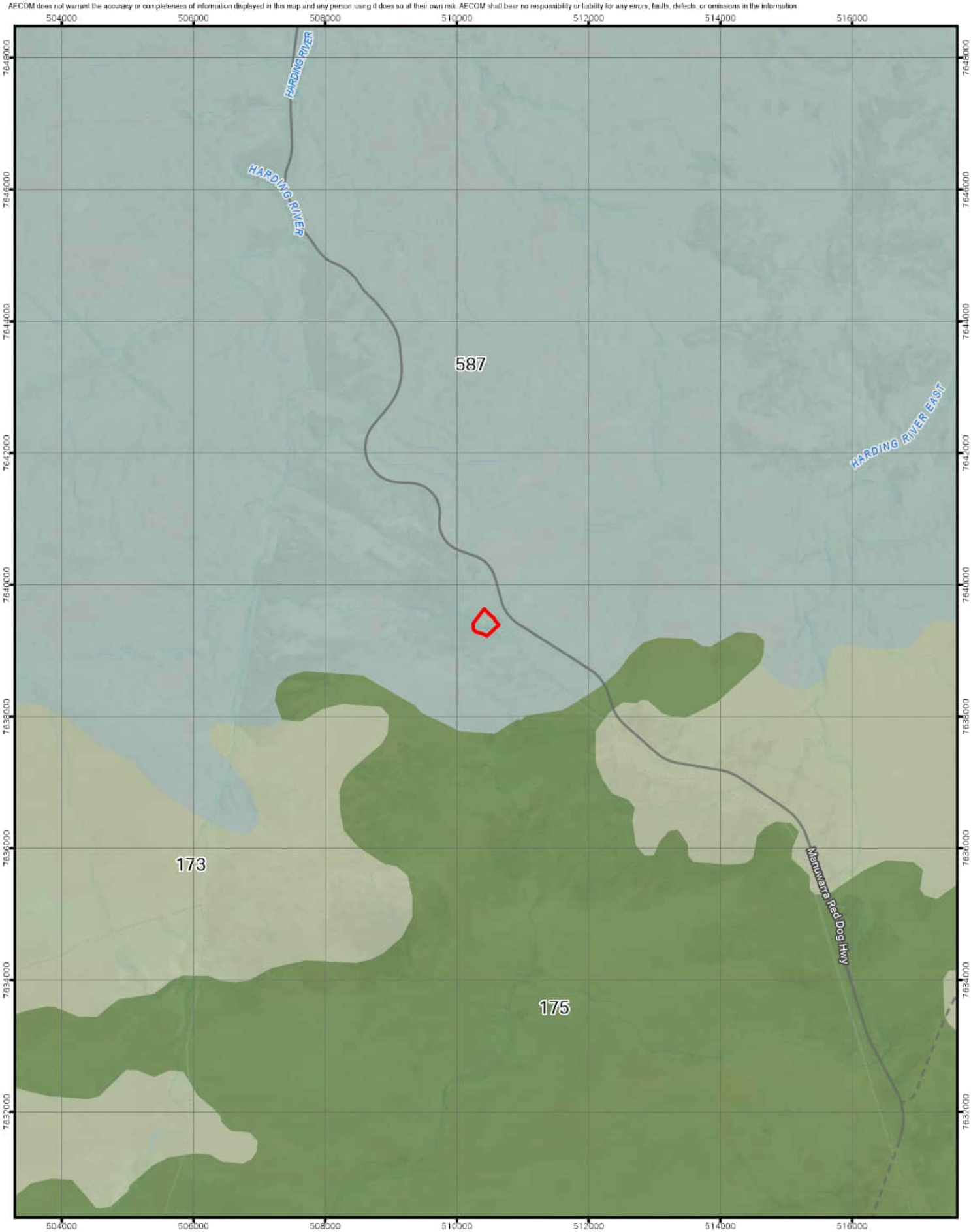
AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 4

Project: \\na.aecomnet.com\fs\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\300_CAD_GIS\320_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2),
Layout: 60726828_Fig4_NVCP_Trip5_Geology_A4P_v1, Last exported: 15/08/2024 11:24 AM

A4 size

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	WYATTK2
DATE MODIFIED	13 AUG 2024	**APPROVED BY**	F DE WIT

N

0 0.5 1 1.5 2
km

1:75,000
(when printed at A4)

GDA2020 MGA ZONE 50

DATA SOURCES: Base Data: © Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate (2015)
Service Layer Credits: World Imagery: Earthstar Geographics SIO

LEGEND

- Survey Area
- Full Pre-European Vegetation (DPIRD-006)

veg_assoc,struct_des,flor_desc

- 173,Shrub-steppe,Hummock grassland with scattered shrubs or mallee *Triodia spp. Acacia spp., Grevillea spp. Eucalyptus spp*
- 175,Grasslands, short bunch-grass savanna,Annual grasses *Enneapogon spp. Aristida spp.* etc on dry plains and salt water grasses *Sporobolus virginicus* on the coast
- 587,Sparse low tree-steppe / Sparse shrub-steppe,

Pre-European Vegetation

RIO TINTO

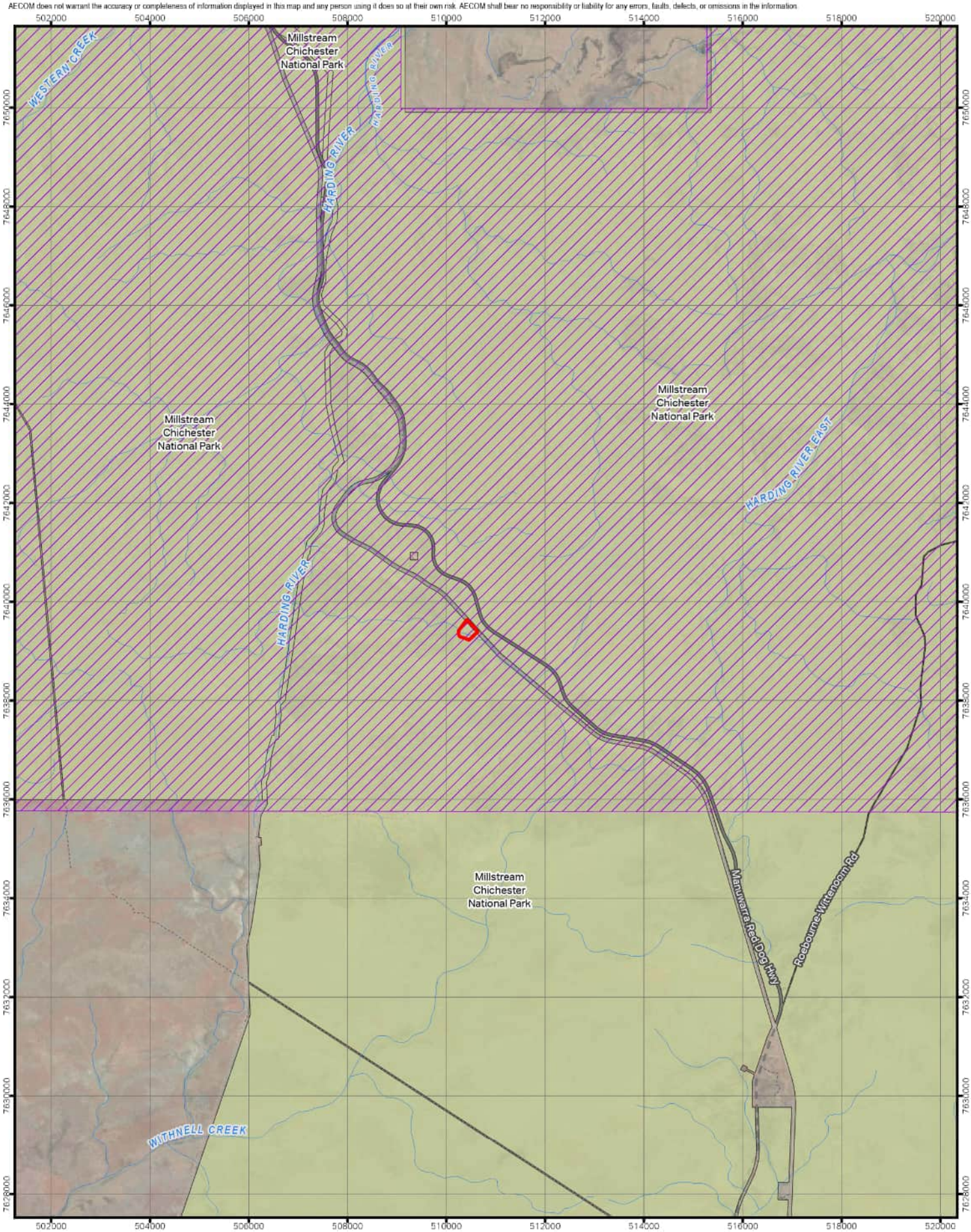
AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 5

Project: \\na.aecomnet.com\ifs\APAC\Perth~AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig5_NVCP_Trip5_PreEuropeanVeg_A4P_v1, Last exported: 13/08/2024 5:29 PM

A4 size

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	13 AUG 2024
APPROVED BY	F DE WIT

N

0 500 1,000 1,500 2,000
Metres

1:100,000
(when printed at A4)

GDA2020 MGA ZONE 50

LEGEND

- Survey Area
- DBCA - Legislated Lands and Waters (DBCA-011)
  - National Park
- Clearing Regulations - Environmentally Sensitive Areas (DWER-046)
  - 26-0324FL_TPFL
  - 26-0324FL_WAHerb

Conservation Reserves and Environmentally Sensitive Areas

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure **6**

A4 size

Project: \\na.aecomnet.com\ifs\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\500_CAD_GIS\520_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig6_NVCP_Trip5_ConsReserves_A4P_v1. Last exported: 13/08/2024 5:29 PM

4.0 Methodology

4.1 Personnel

The field survey was undertaken by Celia Mitchell (collection permit FB62000077-2). Celia has completed a Master of Science in Conservation Biology and Botany. She is a Botanist with five years' experience undertaking flora and vegetation surveys across WA, including baseline, monitoring and targeted surveys.

Celia was supported by Nina Sergeev (collection permit FB62000544). Nina has completed a Bachelor of Science in Biology (Zoology). She is an Environmental Scientist with three years' experience undertaking fauna habitat surveys across WA. Nina has been involved in various projects across remote locations including targeted surveys and rehabilitation monitoring in the Shark Bay World Heritage Area, Koolan Island flora, vegetation and targeted surveys, and the Karratha Renewables Program.

4.2 Desktop Assessment

4.2.1 Database Searches

Prior to the field survey a comprehensive desktop assessment was undertaken to identify significant environmental values likely to be present in the survey area including flora, fauna, and vegetation communities. Commonwealth and State database search results that were used in this assessment are shown in Table 10.

Table 10 Database searches undertaken for the survey area

Database	Information	Administering Agency
Threatened and Priority Flora and Fauna Lists (TPFL database)	List of significant flora and fauna species and broad distribution within 50 km	DBCA
Threatened and Priority Flora Database (WAHerb database)	Validated populations of threatened and priority flora species within 50 km	
WA Herbarium Database (FloraBase)	All records of threatened and priority flora from the WA Herbarium collection of specimens, including un-validated historical specimens	
Threatened and Priority Ecological Communities (TEC/PEC) Database	Threatened and Priority ecological communities within 50 km	
Dandjoo	Flora and fauna species, not including threatened species	
Atlas of Living Australia	List of flora and fauna species recorded, including significant species	Atlas of Living Australia
Protected Matters Search Tool	Matters of national significance and matters protected by *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)	DCCEEW
Environmentally Sensitive Areas (ESAs)	Listed ESAs	DWER
Birdata	Bird species lists and distribution maps for an area of interest	BirdLife Australia
Declared Pest (s22) in the WA Organism List	Declared Plants as listed under the *Biosecurity and Agriculture Management Act 2007*	Department of Primary Industries and Regional Development

Database	Information	Administering Agency
National Weeds Lists (Weeds in Australia 2012)	Weed of National Significance	Australian Weeds Committee
Relevant Ecological Surveys	Results from previous surveys undertaken in the vicinity, detailed in Section 5.1.	Various
Rio Tinto database	Records of significant flora, fauna and communities.	Rio Tinto

4.2.2 Likelihood Assessment

Significant flora species' likelihood of occurrence was assessed systematically using a point-based system (Table 11). The assessment considers 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. For the purpose of this assessment, a recent record refers to less than 20 years old.

Table 11 Categories of likelihood of occurrence for flora and fauna species present

Likelihood of Occurrence	Score	Definition
Known	6	Species known to occur in survey area.
High (Likely)	4, 5	Recent record of species in local area and habitat is suitable. Species with a habitat score of 2, have a recent record in the vicinity, AND are known within 20 km OR 5 km
Moderate (Possible)	3, 4	Suitable habitat present (score of 2) and record in region AND/OR recent record. OR Habitat marginal (score of 1) AND record in region AND/OR recent record.
Low (Unlikely)	2, 3	Suitable habitat present (score of 2) NO recent records NO records within 5 km. Habitat marginal (score of 1) NO recent records NO records within 5 km, MAYBE records within 20 km
Negligible (Suitable Habitat not Present)	0, 1, 2, 3	If no suitable habitat is present, the likelihood is automatically zero. This can pertain to a score of 1,2 or 3 (record within proximity OR recent record). Marginal habitat (score of 1) NO recent record NO record within 20 km.

Table 12 Categories of likelihood of occurrence for fauna species

Likelihood of Occurrence	Definition
Known	Species is known to occur in the survey area
High (Likely)	Not known to occur in the survey area but there are records within close proximity of the survey area AND/OR recent records and suitable habitat for the species is known to be, or likely to be, present within the survey area
Moderate (Possible)	Not known to occur within the survey area but there are records in close proximity of the survey area and recent records and suitable habitat for the species is known to be, or likely to be present within the survey area. OR Not known to occur within the survey area but suitable habitat for the species is known to be, or likely to be present within the survey area.
Low (Unlikely)	Not known to occur within the survey area but there are records in close proximity OR recent records and suitable habitat for the species may be present (marginal habitat)
Negligible (Suitable habitat not present)	Despite records in close proximity or recent records, no suitable habitat is present within the survey area, therefore the likelihood of the species occurring there is negligible

4.3 Flora and Vegetation Assessment

Methods outlined in the Flora Survey Technical Guide (EPA, 2016a) method for a single-phase detailed flora and vegetation assessment was implemented. The survey was undertaken on 5 June 2024. Data were collected from three unbounded quadrats of approximately 50 m by 50 m delineated with a GPS. Data collected included 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
- Recorder details
- Location using hand-held GPS (accuracy of 5 m)
- Sample site type and size
- Photograph (north-west corner)
- Soil details (type, colour, moisture)
- Landform
- Species – representative list of vascular plant species present, including weed species.
- Habitat - a broad description of the surrounding landscape based on landform, topography and soil
- Disturbance records - fire history, tracks, weed infestation, and other evidence that may be present
- Locations of Weeds of National Significance (WoNS) or Declared Pests will be recorded. Photographs will be taken of any significant flora and WoNS or Declared Pests recorded.
- Species list including:
    - Estimated height
    - Estimated percentage cover (for trees both percentage within relevé and within community was recorded to enable better description of vegetation community).

Any species unable to be identified in the field were collected for identification in AECOM's in-house herbarium and the specimens and taxonomic references and keys at the Western Australian Herbarium (WAH). Naming of species followed the convention of the WAH (1998-).

4.3.1 Vegetation Mapping

Vegetation communities were described and mapped based on changes in dominant species composition and landform. Vegetation communities were described using a modification of Aplin (1979) at a scale of 1:10,000 based on the Association Level V in accordance with the National Vegetation Information System (NVIS) Framework (DotEE, 2017). Delineation of vegetation communities was supported by analysing floristic data collected within quadrats.

Vegetation condition was determined using the Trudgen (1988) vegetation condition scale as recommended in the Flora Survey Technical Guide (EPA, 2016a).

4.3.2 Targeted Flora Searches

Targeted searches were undertaken for significant flora species that were known or likely to occur, informed by the desktop study. A detailed field guide was produced, which included photographs and description of morphological features that would assist in identifying the species in the survey area.

Where a potential Priority species was encountered, the following was recorded:

- Location (using a hand-held GPS accuracy 5m)
- The number of individuals in the immediate population, or an estimate of the size (number) of the population with an estimated radius of its spatial extent
- Plant height
- Vegetation condition
- Associated dominant species
- Soil type and colour
- Topography
- Additional information relevant to the area including key characteristics and landforms.

4.4 Fauna Habitat Assessment

The fauna habitat assessment was undertaken simultaneously with the flora and vegetation assessment. The survey was undertaken by Nina Sergeev who has over three years' experience undertaking fauna habitat surveys across WA. Nina has completed a Bachelor of Science in Biology (Zoology) and has been involved in various projects across remote locations.

Fauna habitat assessments were conducted throughout the survey area and were used to define the structure, complexity, and continuity of the habitat present, and documented the presence and abundance of habitat features that included but were not limited to presence or absence of large mature trees, water bodies, dense vegetation, hollows, and leaf litter.

The habitat assessment was used to verify the findings in the desktop survey as per the Terrestrial Vertebrate Fauna Surveys Technical Guide (EPA, 2020). Potential usage within the survey area of conservation significant fauna was recorded, using hand-held GPS (accuracy of 5 m).

Whilst the database results obtained from DBCA (DBCA, 2024) included a record of significant invertebrate fauna, the field survey was unable to verify its presence as it was not in accordance with the methods outlined in Sampling of Short Range Endemic Invertebrate Fauna Technical Guide (EPA 2016d).

4.5 Survey Limitations

An evaluation of the potential limitations of this survey is summarised in Table 13. No significant limitations were identified that could affect the flora, fauna, and vegetation surveys.

Table 13 Survey limitations

Limitation	Impact on survey
Availability of contextual information on the region	**Nil** The survey area is situated on the Chichester bioregion within the Millstream Chichester National Park. Contextual information was obtained through DBCA database searches, publicly available datasets, previous surveys undertaken in the area and the Rio Tinto significant values database.
Competency/experience of consultant conducting survey	**Nil** The flora, vegetation and fauna survey was undertaken by Celia Mitchell and Nina Sergeev. Celia has over five years' experience undertaking botanical surveys across WA. This includes annual flora surveys for a nearby operating site in the Pilbara region. Nina has three years' experience undertaking flora, vegetation and fauna surveys and has been involved in various projects across remote locations.
Proportion of flora/fauna identified, recorded and/or collected (based on sampling, timing and intensity)	**Nil** Flora was collected from three quadrats and opportunistic species were recorded while walking linear traverses. The systematic linear traverses and recording all flora species is considered suitable effort for the size and complexity of the vegetation and fauna habitats present. Survey effort is presented in Figure 8. Two flora species were unable to be confidently identified to species level (denoted by a "?", 90% confidence associated with both samples) due to lack of suitable material. This is not considered to represent a significant limitation for this survey.
Completion (is further work needed)	**Nil** No further survey work is recommended. The Flora Survey Technical Guide (EPA, 2016a) suggests that each vegetation community should be represented by a minimum of three quadrats. This was not possible due to the size of the survey area (9.20 ha). Survey effort was considered adequate and the survey was undertaken during the ideal survey period for the Pilbara, thereby maximising detection of significant flora species.
Remoteness and/or access issues	**Nil** The entire survey area was accessible on foot.
Timing, weather, season, cycle	**Minor** The survey was undertaken on June 5 2024. This followed a 12-month period of below average rainfall in the region, with total rainfall 247 mm less than the long-term average of 409 mm (BoM, 2024). This was evident in the field with grasses lacking fruiting material and the absence of most annual species.
Disturbances (e.g. fire, flood, accidental human intervention) which affected results of the survey	**Nil** No recent fire or other disturbance affected the ability to interpret the flora and fauna data.

5.0 Desktop Assessment Results

5.1 Previous Surveys

Several ecological surveys have been conducted previously around the survey area. The results of these surveys are summarised in Table 14.

Table 14 Results of previous surveys conducted in the vicinity of the study area

Survey Author and Title	Survey Area	Significant values
Eco Logical Australia (2022): Ti Tree Rail Targeted flora survey RTIO-0959991	Eight areas totalling 204.5 ha located between Ti Tree rail camp and Galah Siding on the 7 Mile rail line.	**Flora**: two Priority flora (*Ipomoea racemigera* – P3 and *Triodia basitricha* – P3) were recorded. **Communities**: No significant communities recorded.
Rio Tinto (2022) Targeted flora survey RTIO-0970407	The flora survey was conducted across six study areas located on the Tom Price Mainline and Deepdale Mainline: AR-22-17510, AR-22-17442, AR-22-17454, AR-22-17285D, AR-22-17407, AR-22-17285C.	**Flora**: no significant flora recorded. **Communities**: no significant communities recorded.
Astron (2022) Rail Weed Monitoring Program RTIO-0970484	Borrow Pits 74.0 and 78.2, along the railway in the Millstream Chichester National Park.	**Flora**: Declared Pest (permitted) **Rumex vesicarius* recorded.
Eco Logical (2023) Galah Rail Siding reconnaissance and targeted flora survey RTIO-0983630	Galah rail siding on the Tom Price East Main Line 83.5 - 84.75 Chainage.	**Flora**: no significant flora recorded. **Communities**: no significant communities recorded. **Fauna**: potential habitat for: Grey Falcon (*Falco hypoleucos*) (V), Australian Painted Snipe (*Rostratula australis*) (E), Oriental Pratincole (*Glareola maldivarum*) (Mi), Lined soil-crevice skink (*Notoscincus butleri*).
Astron (2023) Rail Native Vegetation Clearing Permit Survey RTIO-1035439	Three project areas: Western Creek 1 (2.9 ha), Western Creek 2 (11.5 ha), and Chichester (32.7 ha). The survey area is located 71 km southeast of Karratha and covers an area of 47.1 ha.	**Flora**: *Pentalepis trichodesmoides* subsp. *hispida* (P2), was recorded. **Communities**: no significant communities recorded. **Fauna**: high post-survey likelihood of occurrence, Western Pebble-mound Mouse (*Pseudomys chapmani*) (P4).

5.2 Significant Ecological Communities

Four significant ecological communities occur within 50 km of the survey area, described in Table 15. None of these overlap with the survey area. One Priority 1 PEC, “Four plant assemblages of the Wona Land System” is mapped 0.21 km from the survey area.

Table 15 Significant Ecological Communities in the vicinity of the survey area

Community	Cons. Code[1]	Distance from Survey area
Four plant assemblages of the Wona Land System. Cracking clays of the Chichester and Mungaroona Range. This shrubless plain of stony gibber community occurs on the tablelands with very little vegetative cover during the dry season, however during the wet a suite of ephemerals/annuals and short-lived perennials emerge, many of which are poorly known and range-end taxa. Annual Sorghum grasslands on self-mulching clays with a moderate-dense overlay of rocks. This community appears very rare and restricted to the Pannawonica-Robe valley end of Chichester Range. Naturally species poor when dry. Threat: weed invasion. Mitchell grass plains (*Astrebela* spp.) on gilgai. Mitchell grass and Roebourne Plain grass (*Eragrostis xerophila*) plain on gilgai. *Astrebla pectinata, A. elymoides, E. xerophila, Aristida latifolia, Eriachne and Sida fibulifera. Typical type, heavily grazed.*	P1	0.21 km
Horseflat Land System of the Roebourne Plains. The Horseflat Land System (Roebourne Plains) land units forming extensive clay plains dominated by tussock grasslands on mostly alluvial, red clay loams gilgaied and non-gilgaied for this community. The community is dominated by perennial tussock grasses include *Eragrostis xerophila* (Roebourne Plains grass), *Chrysopogon falla*x (ribbon grass) and other *Eragrostis* spp. and *Eriachne* spp. The community also supports a suite of annual grasses including *Dichanthium* spp. and *Sorghum* spp. The community extends from Peedamulla to Balla Balla surrounding the towns of Karratha and Roebourne.	P3	20.94 km
Kanjenjie Land System. Stony clay plains supporting snakewood shrublands with tussock grasses. Supports tall shrublands of mulga, snakewood and other acacias with understorey of low shrubs or perennial grasses. Some parts support tussock grasslands of Mitchell grass or Roebourne Plains grass with few shrubs	P3	27.26 km
Riparian flora and plant communities of springs and river pools with high water permanence of the Pilbara Region. The community includes flora with restricted distributions or populations that are highly disjunct or are major range extensions from northern and eastern Australia. These include I*mperata cylindrica, Cladium procerum, Schoenus falcatus* and *Fimbristylis sieberiana* (P3). In the Pilbara these taxa are almost exclusively restricted to the riparian zones of permanent wetlands with high soil moisture maintained by groundwater flows. Occurrences are disjunct with sites typically associated with groundwater discharge in gorge and valley wetlands that are often coupled with significant shading.	P2	23.93 km

1. DBCA P Priority

5.3 Significant Flora

A total of twenty-seven (27) significant flora species were identified in the desktop study as potentially occurring. No species listed as Threatened under the EPBC Act or BC Act were identified as occurring within 50 km of the survey area.

One Priority species identified, *Eragrostis crateriformis*, was delisted by DBCA in August 2024, and is not considered further in this report.

Of the remaining 26 species, two flora species were considered as high likelihood to occur and three flora species were considered as moderate likelihood to occur (Table 16). Another four significant flora species were considered as low likelihood to occur while the remaining seventeen (17) flora species were considered unlikely or have a negligible likelihood due to absence of suitable habitat, age of record, and lack of known records in the vicinity .

The comprehensive flora desktop results are mapped in Figure 7 and habitat, distance, and date of records is presented in Appendix A.

Table 16 Significant Flora species considered to have high or moderate likelihood of occurrence

Species	Con. Code[1] BC Act / DBCA	Habitat
High		
Pentalepis trichodesmoides subsp. *hispida*	P2	Found in *Triodia* hummock grassland, often in the understorey of a shrubland of *Acacia* spp., *Gossypium* spp., *Senna* spp., *Brachychiton* spp. and *Eucalyptus* spp., on summits and slopes of low hills, on basaltic soils, at altitudes to 1150 m (Orchard & Cross, 2012).
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	Drainage lines, clay flats, crabhole flats and dark self-mulching clays (WA Herb, 1998-).
Moderate		
Goodenia obscurata	P3	Occurs on floodplains or low rocky ridges, growing in red-brown sandy clay or lateritic loam over banded ironstone. Associated with low open woodland of *Acacia* over *Triodia*, or open shrubland with a sparse overstorey of *Corymbia hamersleyana* and *Hakea chordophylla* over *Triodia* (DPaW & Rio Tinto, 2015).
Ipomoea racemigera	P2	Sandy soils along watercourses (DPaW & Rio Tinto, 2015).
Trianthema sp. Python Pool (G.R. Guerin & M.E. Trudgen GG 1023)	P2	Occurs in sand, gibber plain on plains (WA Herb, 1998-).

1. DBCA P Priority

5.4 Significant Fauna

A total of twenty-five (25) significant fauna species were identified in the desktop assessment as potentially occurring. Of these, three fauna species were considered high likelihood to occur, three species were considered to have a moderate likelihood to occur, and the remaining 17 species were considered negligible due to lack of suitable habitat (Table 17).

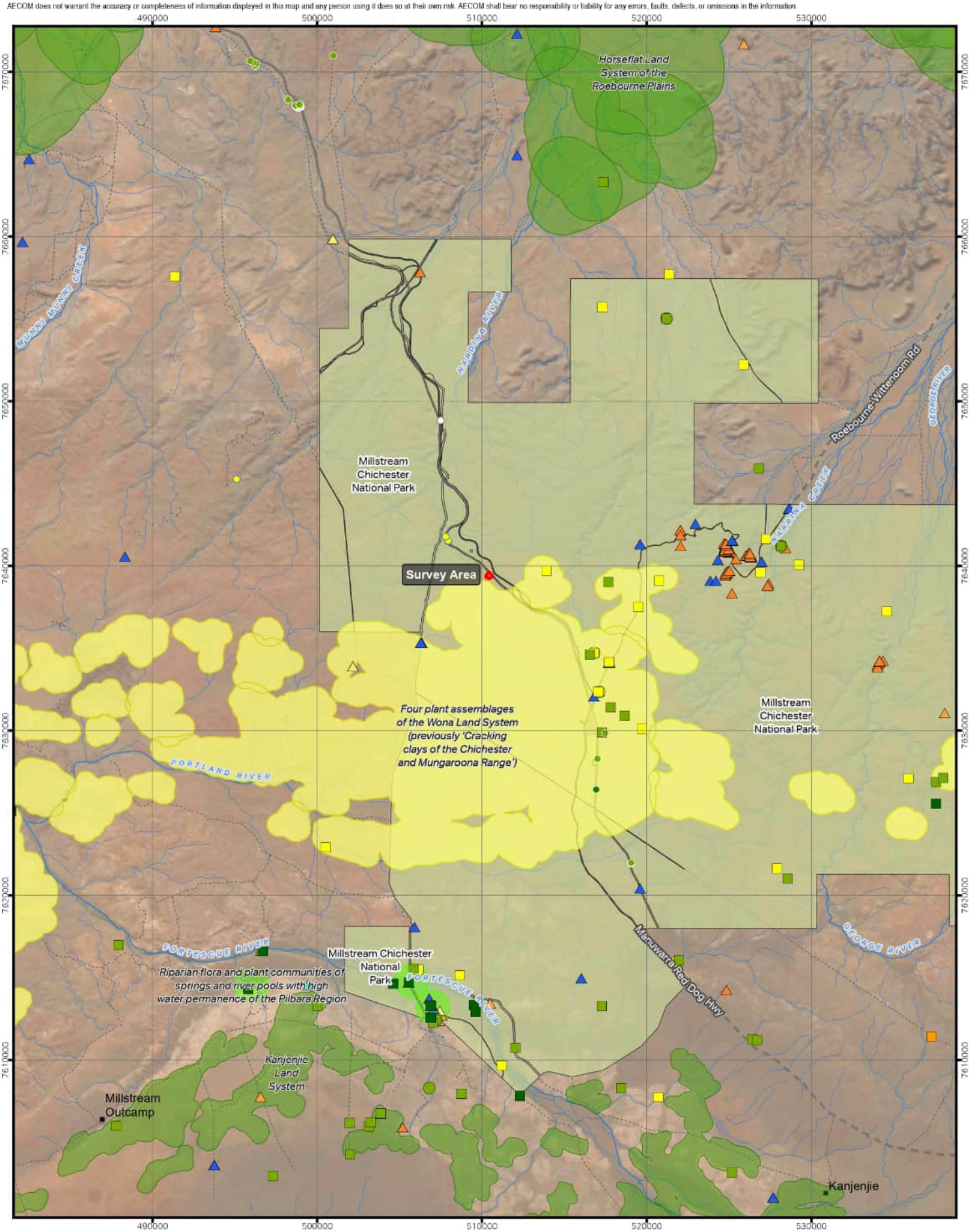
The comprehensive fauna desktop is mapped in Figure 7 and their habitat, number of records, distance, and likelihood assessment is presented in Appendix B.

Table 17 Significant fauna species considered to have high or moderate likelihood of occurrence

Species	Common Name	Cons. Code[1]		Habitat
		BC Act / DBCA	EPBC Act	
High				
Antipodogomphus hodgkini	Pilbara Dragonfly	P3		This species inhabits rivers, streams and pools (Theischinger & Endersby, 2009).
Leggadina lakedownensis	Northern Short-Tailed Mouse	P4		Its natural habitat is dry savanna (Watts, 1976).
Pseudomys chapmani	Western Pebble-mound Mouse	P4		It is associated with eroding sands and can be found in the Pilbara region in areas of rocky hummock grassland with little or no soil and an overstorey of Acacia spp. (Kitchener 1983; Burbidge 2016).
Moderate				
Falco hypoleucos	Grey Falcon	VU	V	Timbered lowland plains, including acacia shrublands particularly with tree-lined watercourses, tussock grassland and open woodland (TSSC, 2020).
Glareola maldivarum	Oriental Pratincole	IA	Mi	Open plains, floodplains or short grassland (including farmland), often occurring near terrestrial wetlands, and occurring along the coast. The species does not breed in Australia (DCCEEW, 2024).
Notoscincus butleri	Lined Soil-Crevice Skink	P4		The preferred natural habitat of *N. butleri* is stony grassland (AoLA, 2021)

1. P Priority IA International Agreement Mi Migratory VU Vulnerable V Vulnerable

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	15 AUG 2024
APPROVED BY	F DE WIT

N

0 2 4 6 km

1:300,000 (when printed at A4)

GDA2020 MGA ZONE 50

LEGEND

- Survey Area
- Flora (Rio Tinto)
  - P2
  - P3
  - P4
  - PSI
- WA Herbarium database (WAHERB)
  - P1
  - P2
  - P3
  - P4
- Threatened and Priority Flora database (TPFL)
  - P2
  - P3
- Threatened Fauna database (DBCA)
  - Endangered
  - Vulnerable
  - Migratory Species
  - Priority 1
  - Priority 2
  - Priority 3
  - Priority 4
- TEC / PEC
  - Priority 1
  - Priority 2
  - Priority 3
- DBCA - Legislated Lands and Waters (DBCA-011)
  - National Park

Conservation Significant Flora and Fauna Desktop Results

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure **7**

A4 size

Project: \\na.aecomnet.com\ifs\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\600_CAD_GIS\620_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig7_NVCP_Trip5_DBCAFloraFauna_A4P_v1, Last exported: 15/08/2024 11:14 AM

6.0 Field Survey Results

6.1 Vegetation

6.1.1 Communities

Two native vegetation communities were described and mapped including:

- ChApTw: Triodia hummock grasslands recorded on lower slopes adjacent to a minor flowline
- EcScCc: Eucalyptus open woodland representing the minor flowline.

Additionally, cleared areas were mapped. Vegetation communities are described in Table 19 and mapped in Figure 8.

6.1.2 Significant Vegetation

No TEC or PECs were identified in the survey area. The area does not intersect with the Wona Land System therefore the presence of the Priority 1 PEC has been excluded.

6.1.3 Condition

The vegetation condition of the survey area ranged from Good to Completely Degraded, with the majority of the survey area being mapped as Poor. Disturbance was evident from an old borrow pit, weed invasion and evidence of grazing. One small patch on the west side of the minor channel was considered in Good condition.

Condition extent is described in Table 18 and mapped in Figure 8.

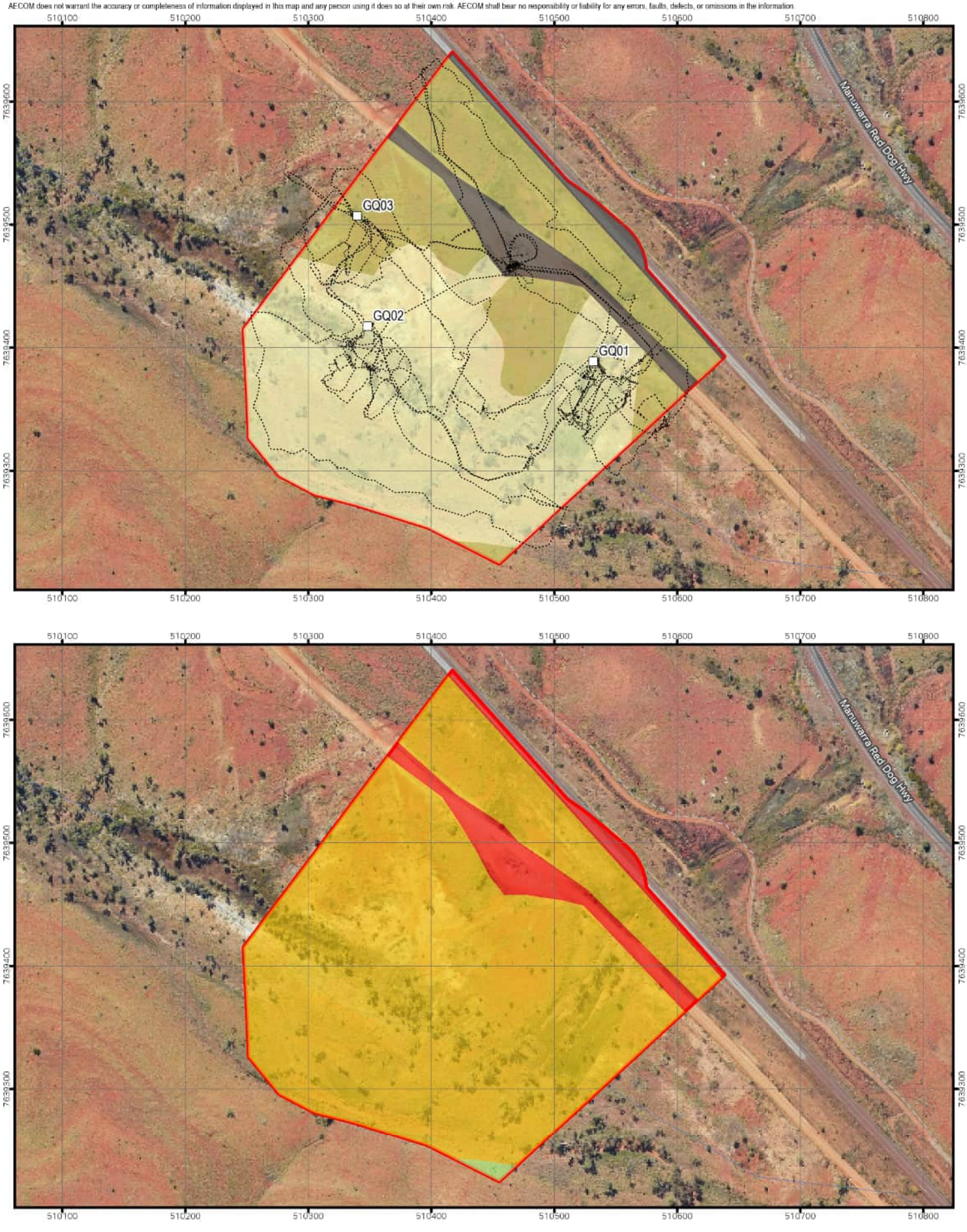
Table 18 Condition extent within survey area

Condition Rating	Extent (ha)	Percent of Survey Area
Good	0.04	<1%
Poor	8.34	91%
Completely Degraded	0.82	8%
Total	9.20	100%

Table 19 Vegetation communities description, details and photograph

Vegetation Unit Code and Description	Survey Effort, Diversity and Extent	Photograph
Code: SA1 Species code: ChApTw Broad floristic type: Triodia tall hummock grassland *Corymbia hamersleyana, Codonocarpus cotinifolius* and *Grevillea pyramidalis* low sparse woodland over *Acacia pyrifolia* var. *pyrifolia, Acacia bivenosa* and *Acacia inaequilatera* tall to mid sparse shrubland over *Triodia wiseana, *Cenchrus ciliaris* and *Enneapogon lindleyanus* tall mixed hummock and tussock grassland. Recorded on lower slopes adjacent to the minor ephemeral drainage on rocky clay loam soils.	Survey effort: GQ03 Diversity: 36 native and one weed species Extent: 3.01 ha Condition: Poor to Good	
Code: MF1 Species code: EcScCc Broad floristic type: Eucalyptus mid open woodland *Eucalyptus camaldulensis, Melaleuca argentea* and *Grevillea pyramidalis* mid open woodland over *Sesbania cannabina, Trichodesma zeylanicum* var. *zeylanicum* and *Acacia trachycarpa* mid to tall sparse shrubland over **Cenchrus ciliaris, *Cenchrus setiger* and *Eriachne mucronata* tall tussock grassland. Represents minor ephemeral drainage with vegetated banks next to a fairly open creek bed.	Survey effort: GQ01 and GQ02 Diversity: 54 native and three weed species Extent: 5.37 ha Condition: Poor	
Highly Modified (HD) Cleared areas devoid of native species	Extent: 0.82 ha	

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828	**CREATED BY**	WYATTK2
DATE MODIFIED	15 AUG 2024	**APPROVED BY**	F DE WIT

N

1:4,000
(when printed at A4)

0 20 40 60 80
metres

GDA2020 MGA ZONE 50

DATA SOURCES: Base Data: (c) Based on information provided by and with the permission of the Western Australian Land Information Authority trading as Landgate 2019.
Service Layer Credits: World Imagery: Maxar, VMS

LEGEND

- Survey Area
- Vegetation Sample Sites
- Tracklog

Vegetation Communities
- MF1
- SA1
- HD

Vegetation Condition
- 0.1 - Completely Degraded
- 0.4 - Poor
- 0.6 - Good

Vegetation Communities, Condition and Survey Effort

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 8

Project: \\na.aecomnet.com\ifs\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\600_CAD_GIS\620_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2),
Layout: 60726828_Fig8_NVCP_Trip5_VegCommCondSEffort_A4P_v1. Last exported: 15/08/2024 12:05 PM

A4 size

6.2 Flora

No species listed under the EPBC Act, BC Act or by DBCA were recorded.

A total of 67 flora species (64 native, three weed species) were recorded representing 54 genera and 26 families. Families best represented included Fabaceae (15 native species) and Poaceae (nine native species). Three weed species were recorded. None of these were listed under the BAM Act or Species of National Environmental Significance.

A species by site by family matrix is presented in Appendix C. Quadrat data is presented in Appendix D.

6.3 Fauna Habitats

Two fauna habitats were mapped in the survey area including Stony Plain and Minor Drainage (see Table 20). The habitats are potentially suitable for:

- Western Pebble-mound Mouse *Pseudomys chapmani* listed as Priority 4 by DBCA
- Northern Short-tailed Mouse *Leggadina lakedownensis* listed as Priority 4 by DBCA
- Grey Falcon *Falco hypoleucos* listed as Vulnerable under the EPBC Act and BC Act.

Fauna habitats are mapped in Figure 9.

Table 20 Fauna habitats of the survey area

Description	Conservation Significant Fauna Habitat
Stony Plain (Extent: 3.01 ha) This habitat is characterised by scattered native shrubs over hummock grasses on lower slopes. Substrate is orange rock with clay loam underneath. Groundcover is moderate. Microhabitats are limited to the hummock grasses. Majority of this fauna habitat is directly adjacent to the rail and the rail access road where weeds are present. This habitat ranged from Good to Poor condition, dependent primarily on the proximity of vegetation to existing infrastructure.	Western Pebble-mound Mouse – rocky hummock grassland present and known from the local region. May forage and move through area, no mounds were observed. Northern Short-tailed Mouse – the Stony Plain represents degraded “dry savannah habitat”. This species may forage and move through the area.
Minor Drainage (Extent: 5.37 ha) This habitat is characterised by native trees (*Eucalyptus camaldulensis* and *Melaleuca argentea*) along a minor bare creek bed. The substrate is predominantly rocky/cobbled with soil and organic matter often washed away in channel. Standing water may be present for a short period after significant rainfall events. Habitat connectivity is considered good along the drainage channel bed and in moderately dense vegetation on the banks. Fauna species are likely to utilise the open terrain as transient habitat to traverse between vegetated habitats. Microhabitats present include tree hollows, potential seasonal inundation and clearings that may support foraging and hunting. This habitat was considered to be in Poor condition with high weed invasion and evidence of grazing.	Grey Falcon – tree-lined watercourse and tussock grassland and open woodland present.

AECOM does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. AECOM shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.



AECOM Delivering a better world

PROJECT ID	60726828
CREATED BY	WYATTK2
DATE MODIFIED	15 AUG 2024
APPROVED BY	F DE WIT

N

1:2,500
(when printed at A4)

0 10 20 30 40
metres

GDA2020 MGA ZONE 50

LEGEND

Survey Area

HABITAT

Disturbed

Minor Drainage

Stony Plain

Fauna Habitat

RIO TINTO

AR-23-18419 - FLORA, VEGETATION AND FAUNA HABITAT ASSESSMENT

Figure 9

A4 size

Project: \\na.aecomnet.com\ifa\APAC\Perth-AUPER1\Legacy\Projects\607x\60726828_Rio_Rail_Flora\600_CAD_GIS\620_GIS\Trip_5\02_MXD_APRX\60726828_RioTinto_Trip5_NVCP_ReportFigures.aprx (wyattk2), Layout: 60726828_Fig9_NVCP_Trip5_FaunaHab_A4P_V1. Last exported: 15/08/2024 12:12 PM

7.0 Discussion

The survey area comprises 9.20 ha and incorporates the Tom Price West Mainline, associated access road, and native vegetation. The area is characterised by a minor ephemeral drainage channel that runs northwest to southeast with Triodia hummock grasslands on lower slopes adjacent.

No significant vegetation (listed TECs or PECs) or flora species were recorded during the survey. The majority of the survey area has been historically disturbed including from fire and an old borrow pit. Minor weed invasion is present along the access track, rail line, and borrow pit. The ephemeral river also provides a vector for weed spread and supports typical weedy Pilbara grasses.

All significant flora species with a moderate or high likelihood of occurring were reduced to a low or negligible likelihood. The river may support standing water after significant rainfall events however none was present at the time of the survey. No crabhole or gilgaied clay plains were present either, thereby reducing the likelihood of numerous significant flora species.

Pentalepis trichodesmoides subsp. *hispida* is a Priority 2 species considered likely to occur with a known occurrence 3.1 km from the survey area recorded in 2023. It grows in Triodia hummock grassland on summits and slopes of hills (DPaW & Rio Tinto, 2015). Habitat for this species was not present and it was not recorded despite being readily identifiable by its unique features. Its likelihood was therefore reduced to negligible.

Themeda sp. Hamersley Station (M.E. Trudgen 11431) is a Priority 3 species known from 7.69 km from the survey area recorded in 2010. This species grows in a variety of habitats including drainage lines, clay flats, crabhole flats and self-mulching clays (DPaW & Rio Tinto, 2015). This species is readily identified in the field. No *Themeda* spp. were recorded, therefore the likelihood that this species is present was reduced to low. Three significant fauna species had a high likelihood and another three had a moderate likelihood of occurring. These species were associated with broad fauna habitats that are common throughout the Pilbara region. Of these six species, three had a post-survey likelihood of moderate based on habitats present, number of records and proximity of these records.

The Grey Falcon *Falco hypoleucos* is associated with timbered lowland plains including Acacia shrublands with tree-lined watercourses. There is one record dated 2012 located 35.62 km from the survey area. As a highly mobile species they could be a transient visitor to the Minor Drainage habitat, but it would be unlikely to rely on this habitat for survival due to the small extent present.

The Northern Short-tailed Mouse *Leggadina lakedownensis* is listed as a Priority 4 species. This species is associated with ‘dry savannah’ habitat. There are 43 records in proximity to the survey area dated 2011 and older. The nearest record is 5.60 km from the survey area. Dry savannah is present as Stony Plain habitat. This species could forage and move through this area given the number of records that are nearby.

The Western Pebble-mound Mouse *Pseudomys chapmani* is listed as Priority 4. It is associated with rocky hummock grasslands with an overstorey of Acacia species. There are 9 records dated 2004 and older with the nearest record 5.60 km from the survey area. The Stony Plain habitat may provide foraging habitat for this species, and it may move through the area. No mounds were observed during the survey.

Vegetation and fauna habitats were homogenous in the local area and in better quality further from the disturbance of the rail and access track. No core habitat is present, and it is unlikely that any fauna species rely on this habitat for survival.

8.0 Conclusion

A baseline flora, vegetation and fauna habitat assessment was undertaken for a 9.20 ha survey area along the Rio Tinto Tom Price West Mainline. The objective was to collect information to a suitable level of detail to support a Native Vegetation Clearing Permit application. To meet this objective, a baseline ecological survey was undertaken in accordance with the relevant EPA technical guides to assess the environmental values that are present.

A desktop assessment identified four TECs that occur within 25 km of the survey area. None of these overlap with the survey area, and none were anticipated to occur based on landforms and land systems present. Twenty-seven significant flora species occur within 50 km of the survey area. Of these, three were considered likely to occur, and three 'may' occur. Twenty-five significant fauna species occur within 50 km of the survey area. Of these, three were considered to have a high likelihood, and three had a moderate likelihood of occurrence in the desktop assessment.

A summary of the field survey results is presented below:

- No TECs or PECs were identified.
- Two native vegetation communities were mapped for 8.38 ha. The remaining 0.82 ha was highly modified (cleared).
- No significant flora species were recorded in the survey area. The post-survey likelihoods of the desktop flora results have been reduced to low or negligible.
- Two fauna habitats were mapped including a Minor Drainage and Stony Plain.
- The Stony Plain may provide habitat for:
    - Western Pebble-mound Mouse *Pseudomys chapmani* (Priority 4)
    - Northern Short-tailed Mouse *Leggadina lakedownensis* (Priority 4)
- The Minor Drainage may provide habitat for the Grey Falcon *Falco hypoleucos* listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act).

The field survey was successfully undertaken with no significant limitations identified. The survey occurred during the ideal detection period of flora species. Two flora species were unable to be confidently identified to species level (denoted by a "?") () due to lack of suitable material. This is not considered to represent a significant limitation for this survey.

9.0 References

Aplin, T. E. H. 1979. The flora. Page in B. J. O'Brien, editor. Environment and Science. University of Western Australia Press, Perth WA.

Astron, 2018. Greater Paraburdoo Detailed Flora and Vegetation Survey April 2018. Prepared for Rio Tinto.

Astron, 2022. Rail Weed Monitoring Program, Borrow Pits 74.0 and 78.2. Prepared for Rio Tinto.

Astron, 2023. Rail Native Vegetation Clearing Permit Survey. Prepared for Rio Tinto.

Atlas of Living Australia (AoLA), 2021. Available at: https://www.ala.org.au/. Accessed August 2024.

Beard JS, Beeston GR, Harvey JM, Hopkins AJM, Shepherd DP, 2013. The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. Conservation Science Western Australia 9, 1 pp.1–152.

BOM, 2024. Climate Statistics for Australian Locations. Bureau of Meteorology. http://www.bom.gov.au/climate. Accessed July 2024.

Braithwaite, R.W. & A.D. Griffiths, 1994. Demographic variation and range contraction in the Northern Quoll, Dasyurus hallucatus (Marsupialia: Dasyuridae). Wildlife Research. 21:203-218.

Burbidge, A.A., 2016. "Pseudomys chapmani". IUCN Red List of Threatened Species. IUCN. 2016:

DBCA, 2024. Flora, Fauna and Ecological Community Data. Supplied by the Department of Biodiversity, Conservation and Attractions.

DCCEEW, 2024. Species Profiles and Threats Database. Online platform: https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl. Accessed July 2024. \

DPaW and Rio Tinto, 2015. Rare and Priority Plants of the Pilbara mobile app edition. Available at:

https://apps.apple.com/au/app/rare-and-priority-plants-of-the-pilbara/id945178469. Accessed on 20

June 2024.

DoE, 2016. Consultation Document on Listing Eligibility and Conservation Actions: Macroderma gigas (Ghost Bat). https://www.dcceew.gov.au/sites/default/files/env/pages/049564f9-5c96-43a0-88c5-ee3dec26c622/files/consultation-document-ghost-bat.pdf

DotEE, 2017. Australian Vegetation Attribute Manual Version 7.0, Department for the Environment and Energy, Canberra

Eco Logical Australia, 2022. Ti Tree Rail Targeted flora survey. Prepared for Rio Tinto.

Eco Logical Australia, 2023. Galah Rail Siding reconnaissance and targeted flora survey. Prepared for Rio Tinto.

EPA, 2016a. Technical Guidance – Terrestrial flora and vegetation Surveys for Environmental Impact Assessment. EPA, Western Australia.

EPA, 2016b. Environmental Factor Guideline – Flora and Vegetation. EPA, Western Australia.

EPA, 2016c. Environmental Factor Guideline – Landforms. EPA, Western Australia.

EPA, 2016d. Technical Guidance – Sampling of short range endemic invertebrate fauna. EPA, Western Australia

EPA, 2020. Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. EPA, Western Australia.

Government of Western Australia (Govt. of WA), 2019. 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth.

Holland AE, & Butcher R, 2016. Vigna triodiophila (Fabaceae: Phascolaea), a new conservation-listed species from the Pilbara, Western Australia.

IBRA7, 2012. Interim Biogeographic Regionalisation for Australia, Version 7. Available at http://www.environment.gov.au/system/files/pages/5b3d2d31-2355-4b60-820c-e370572b2520/files/bioregions-new.pdf.

Kendrick P, & McKenzie N, 2001. Pilbara 1 (PIL1 - Chichester subregion). A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions. Prepared by Peter Kendrick and Norm McKenzie for the Department of Conservation and Land Management.

Kitchener, D.J., 1983. "Pebble-mound Mouse Pseudomys chapmani". In Strahan, Ronald (ed.). Complete book of Australian mammals. Australian Museum: the National Photographic Index of Australian Wildlife. Sydney: Angus and Robertson. pp. 416–17. ISBN 0207144540.

Lindken T, Anderson CV, Ariano-Sánchez D, Barki G, Biggs C, Bowles P, Chaitanya R, Cronin DT, Jähnig SC, Jeschke JM, Kennerley RJ, Lacher TE, Luedtke JA, Liu C, Long B, Mallon D, Martin GM, Meiri S, Pasachnik SA…Evans, T, 2024. What factors influence the rediscovery of lost tetrapod species? Global Change Biology, 30, e17107. https://doi.org/10.1111/gcb.17107

Meiri S, Bauer AM, Allison A, et al., 2017. Extinct, obscure or imaginary: The lizard species with the smallest ranges. Divers Distrib. 2018; 24: 262–273. https://doi.org/10.1111/ddi.12678.

Orchard AE, & Cross EW, 2012. A revision of the Australian endemic genus Pentalepis (Asteraceae: Ecliptinae). Nuytsia 22(6): 371-392.

Pizzey G, & Knight F, 2007. The field guide to the birds of Australia. Harper Collins Publishers: Sydney, Australia.

Rio Tinto, 2023. Flora Data. Rio Tinto Iron Ore. Provided by Rio Tinto dated 12 Mar 2024.

Stewart AJ, Sweet IP, Needham RS, Raymond OL, Whitaker AJ, Liu SF, Phillips D, Retter AJ, Connolly DP, Stewart G, 2008. Surface geology of Australia 1:1,000,000 scale, Western Australia [Digital Dataset] Canberra: The Commonwealth of Australia, Geoscience Australia.

Theischinger G; & Endersby I, 2009. Identification Guide to the Australian Odonata. Department of Environment, Climate Change and Water NSW. p. 191.

Trudgen ME, 1988. A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished report prepared for Bowman Bishaw and Associates, West Perth.

TSSC, 2020. Flaco hypoleucoc (Grey Falcon) Conservation Advice, accessed 2023. Canberra: Department of Agriculture, Water and the Environment.

Van Vreeswyk, A.M.E., A.L. Payne, K.A. Leighton & P. Hennig, 2004. An inventory and condition survey of the Pilbara region, Western Australia. Department of Agriculture Technical Bulletin No. 92.

WAH, 1998-. Florabase: Online Resource. Available at https://florabase.dpaw.wa.gov.au. Accessed August 2023.

Watts CHS, & Aslin HJ, 1981. The rodents of Australia. Angus and Robertson, Sydney.

.

Appendix A

Flora Desktop Results

Appendix A Flora Desktop Results

Taxon	Habitat	Cons. Code	Distance from Survey Area			Date			Likelihood Assessment					Total Score	Likelihood		Comments
			WAHerb	TPFL	Rio	WA Herb	TPFL	Rio	Recorded in survey area	Known occurrence <10km	Known occurrence <20km	Recent Record (<20 years)	Habitat suitability (0,1,2)		Pre-survey	Post-survey	
Cladium procerum	Perennial pools.	P2	24.17	-	-	2008			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)	Cracking clay, basalt. Gently undulating plain with large surface rocks, flat crabholed plain.	P3	7.09	-	-	2004			0	1	1	0	0	2	Negligible	Negligible	No suitable habitat.
Eriochloa fatmensis	Regularly flooded area immediately adjacent to active river levee.	P3	43.83	-	-	1981			0	0	0	0	1	1	Negligible	Negligible	No suitable habitat.
Euphorbia australis var. *glabra*	Sump, low in the landscape on alluvial cracking clay loamy soil, gritty with ironstone fragments, saline flats (Astron, 2018).	P3	34.15	-	-	2004			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Euphorbia inappendiculata var. *inappendiculata*	Cracking clays, associated with tussock grassland.	P2	21.16	-	-	1997			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Euphorbia stevenii	Clay, sandy soils.	P3	24.71	-	-	1997			0	0	0	0	1	1	Negligible	Negligible	No suitable habitat.
Fimbristylis sieberiana	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	P3	27.00	27.00	-	2021	2008		0	0	0	1	1	2	Low	Negligible	No suitable habitat.
Glycine falcata	Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.	P3	47.94	-	-	2011			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Goodenia obscurata	Occurs on floodplains or low rocky ridges, growing in red-brown sandy clay or lateritic loam over banded ironstone. Associated with low open woodland of Acacia over Triodia, or open shrubland with a sparse overstorey of Corymbia hamersleyana and Hakea chordophylla over Triodia	P3	26.92	-	-	2023			0	0	0	1	2	3	Moderate	Low	Habitat marginal (disturbed drainage line). No banded ironstone. No records within 20 km.
Ipomoea racemigera	Sandy soils along watercourses (DPaW & Rio Tinto, 2015)	P2	25.99	25.98	-	2022	2022		0	0	0	1	2	3	Moderate	Low	Habitat present, not recorded during survey.
Livistona alfredii	Watercourses and drainage lines.	P4	25.04	-	-	2003			0	0	0	0	2	2	Low	Negligible	No suitable habitat.
Neptunia longipila	Cracking clay area, very gently sloping. Soil: Red-brown clay with numerous cobbles and some pebbles.	P2	3.34	-	-	2013			0	1	1	0	0	2	Negligible	Negligible	No suitable habitat.
Owenia acidula	Plain with creek and drainage line adjacent. Silty loam.	P3	26.92	31.18	-	1990	1990		0	0	0	0	1	1	Low	Negligible	No suitable habitat.
Paspalidium retiglume	Tropical and subtropical sub-humid woodlands, arid and semi-arid low woodland and tussock grasslands. Often in cracking clays.	P2	7.82	17.46	-	2004	1997		0	1	1	0	0	2	Negligible	Negligible	No suitable habitat.
Pentalepis trichodesmoides subsp. *hispida*	Found in Triodia hummock grassland, often in the understorey of a shrubland of Acacia spp., Gossypium spp., Senna spp., Brachychiton spp. and Eucalyptus spp., on summits and slopes of low hills, on basaltic soils, at altitudes to 1150 m (Orchard & Cross, 2012).	P2	19.09	-	3.10	2013		2023	0	0	1	1	2	4	High	Negligible	No suitable habitat.
Rhynchosia bungarensis	Rock piles, gorges, river beds, alluvial soils in shrubland.	P4	30.34	-	14.41	1997		No date	0	0	0	0	1	1	Low	Negligible	No suitable habitat.
Solanum albostellatum	Cracking clay soils on open floodplains in open scrubland over grasses (DPaW &Rio Tinto, 2015). Associated with other tussock grasses.	P3	26.90	-	30.46	2018		2010	0	0	0	1	0	1	Negligible	Negligible	No suitable habitat.
Swainsona thompsoniana	Inhabits open floodplains on heavy clay soils.	P3	17.46	-	-	2009			0	0	1	0	0	1	Negligible	Negligible	No suitable habitat.
Tephrosia lithosperma	Crest and slopes of a low rise. Soil: Light brown pebbly, gravelly loam.	P1	38.73	-	-	1997			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Terminalia supranitifolia	Volcanic rock piles or near rocky ridges in low hilly country close to coast.	P3	45.19	44.31	-	1986	2001		0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Teucrium pilbaranum	Crabhole plains dominated by E. victrix and calcrete tables dominated by grasses.	P2	24.21	-	-	1996			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	Drainage lines, clay flats, crabhole flats and dark self mulching clays.	P3	7.69	-	11.80	2010		No date	0	1	1	0	2	4	High	Low	Habitat marginal (disturbed drainage line). No deep clays or crabhole flats.
Trianthema sp. Python Pool (G.R. Guerin & M.E. Trudgen GG 1023)	Occurs in sand, gibber plain on plains.	P2	16.33	-	-	2018			0	0	1	1	1	3	Moderate	Negligible	No suitable habitat.
Triodia basitricha	Grows on crests and nearby slopes of rocky hills (DPaW & Rio Tinto, 2015).	P3	25.74	-	19.37	2022		2018	0	0	0	1	0	1	Negligible	Negligible	No suitable habitat.
Triodia pisoliticola	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	24.18	-	-	1994			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.
Vigna triodiophila	Species only recorded in basalt rockpile habitats in the northwest of the Pilbara bioregion (known from seven populations near Karratha, the Burrup Peninsula and Port Hedland (Holland & Butcher, 2016). Associated vegetation inlcudes open to scattered shrubs, tall shrubs and low treess, with hummock and tussock grasslands (Holland & Butcher, 2016).	P3	34.39	-	-	2009			0	0	0	0	0	0	Negligible	Negligible	No suitable habitat.

Appendix B

Fauna Desktop Results

Appendix B Fauna Desktop Results

Type	Taxon	Common Name	Habitat	Cons. Code		Date		Records		Distance		PMST	Likelihood Assessment				Total Score	Pre-survey Likelihood	Post-survey Likelihood	Comments
				BC Act / DBCA	EPBC Act	DBCA	Rio	DBCA	Rio	DBCA	Rio		Recorded in Survey Area	Known Occurrence <20km	Recent Record <20 years	Habitat Suitability (0,1,2)				
Bird	*Actitis hypoleucos*	Common Sandpiper	Wide range of coastal wetlands, around muddy margins or rocky shores, some inland wetlands and rarely on mudflats (DCCEEW, 2024)	IA	MI & MA	2014		4		22.37		Known	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Reptile	*Anilios ganei*	Gane's Blind Snake	Grasslands.	P1		1999		1		26.21			0	0	0	1	1	Negligible	Negligible	No suitable habitat
Invertebrate	*Antipodogomphus hodgkini*	Pilbara Dragonfly	It is endemic to the Pilbara region of Western Australia, where it inhabits rivers, streams and pools (Theischinger & Endersby, 2009).	P3		2007		2		25.81			0	0	1	2	3	High	Low	No suitable habitat
Bird	*Arenaria interpres*	Ruddy Turnstone	Coastal regions with exposed rock coast lines or coral reefs (DCCEEW, 2024).	IA	Mi	2011		1		22.37			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Bird	*Calidris acuminata*	Sharp-tailed Sandpiper	Occurs along muddy edges of shallow fresh or brackish wetlands with inundated or emergent sedges, grass, saltmarsh or other low vegetation (DCCEEW, 2024).	VU	V & MI & MA	2014		1		41.79		May	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Bird	*Calidris ruficollis*	Red-necked Stint	Coastal sheltered areas and exposed or ocean beaches, sometimes on stony or rocky shores, reefs or shoals (DCCEEW, 2024).	IA	Mi	2014		1		41.79			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Dasyurus hallucatus*	Northern Quoll	The Pilbara and further north through to the Kimberley (DSEWPaC, 2011b). The species occupies rocky areas, deserts, eucalypt forests and woodlands, hummock grass (Plechtrachne spp.), basalt hills, mesas, high and low plateaux, lower slopes, occasional tor fields and stony plains supporting spinifex grasslands (Braithwaite & Griffiths 1994; Van Vreeswyk et al. 2004).	EN	E	2022		249		11.61		Known	0	1	1	0	2	Negligible	Negligible	No suitable habitat
Bird	*Falco hypoleucos*	Grey Falcon	Timbered lowland plains, including acacia shrublands particularly with tree-lined watercourses, tussock grassland and open woodland (TSSC, 2020).	VU	V	2012		1		35.62		Known	0	0	1	2	3	Moderate	Moderate	Suitable habitat present, only one record 35 km from survey area. Unlikely to rely on habitat for survival.
Bird	*Gelochelidon nilotica*	Gull-billed Tern	Shallow wetlands, including coastal or inland lakes, swamps and lagoons,sheltered bays and estuaries (DCCEEW, 2024).	IA	Mi	1999		1		36.23			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Bird	*Glareola maldivarum*	Oriental Pratincole	Open plains, floodplains or short grassland (including farmland), often occurring near terrestrial wetlands, and occurring along the coast. The species does not breed in Australia (DCCEEW, 2024).	IA	Mi	2011		2		9.76		May	0	1	1	1	3	Moderate	Low	May occur but unlikely to rely on habitat.
Bird	*Hydroprogne caspia*	Caspian Tern	The Caspian Tern is found in sheltered coastal embayments and those with sandy or muddy margins (DCCEEW, 2024).	IA	Mi	2014		12		36.23			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Leggadina lakedownensis*	Northern Short-Tailed Mouse	Its natural habitat is dry savanna.	P4		2011		43		5.60			0	1	1	2	4	High	Moderate	May occur but unlikely to rely on habitat.
Fish	*Leiopotherapon aheneus*	Fortescue Grunter	Clear freshwater. It is endemic to rivers in Western Australia (AoLA, 2021).	P4		1980		9		25.81			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Reptile	*Lerista quadrivincula*	Four-Lined Slider	Only known from the type locality (Meiri et al. 2017). This is one of the species called 'lost' and 'rediscovered' by Lindken et al. 2024.	P1		1980		2		47.93			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Reptile	*Liasis olivaceus barroni*	Pilbara Olive Python	Deep gorges and water holes in the ranges of the Pilbara region (DEECCW, 2024)	VU	V	2019		4		26.73		Likely	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Macroderma gigas*	Ghost Bat	Northern Australia, inhabiting arid Pilbara to tropical savanna woodlands and rainforests rainforest, monsoon and vine thicket, open woodlands and arid areas and reside in caves, rock crevices and disused mine adits (DoE, 2016).	VU	V	1958		1		26.73		Likely	0	0	0	0	0	Negligible	Negligible	No suitable habitat
Invertebrate	*Nososticta pilbara*	Threadtail Damselfly	It has only been found in the Pilbara region of Western Australia, where it inhabits streams and pools.	P2		2007		6		25.03			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Reptile	*Notoscincus butleri*	Lined Soil-Crevice Skink	The preferred natural habitat of *N. butleri* is stony grassland.	P4		2011		24		14.75			0	1	1	0	2	Moderate	Low	May occur, suitable habitat present and records within 20 km
Bird	*Numenius phaeopus*	Whimbrel	Along the Australian coast, inhabiting estuaries, mangroves, tidal flats, flooded paddocks, and bare grasslands (Pizzey & Knight, 2007)	IA	Mi	1977		1		44.66			0	0	0	0	0	Negligible	Negligible	No suitable habitat
Bird	*Pandion haliaetus*	Osprey	Littoral and coastal habitats, terrestrial wetlands of tropical and temperate Australia, and offshore islands. Atypical habitats incude heath, woodland or forest (DCCEEW, 2024).		Ma	1977		1		44.66		Known	0	0	0	0	0	Negligible	Negligible	No suitable habitat
Bird	*Plegadis falcinellus*	Glossy Ibis	Well vegetated wetlands, wet pastures, floodwaters, brackish wetlands and mudflats (Pizzey & Knight, 2007).	IA	Mi	2013		3		35.62			0	0	1	0	1	Negligible	Negligible	No suitable habitat
Mammal	*Pseudomys chapmani*	Western Pebble-mound Mouse	It is associated with eroding sands and can be found in the Pilbara region in areas of rocky hummock grassland with little or no soil and an overstorey of Acacia spp. (Kitchener 1983; Burbidge 2016).	P4		2004		9		5.60			0	1	1	2	4	High	Moderate	No suitable habitat
Mammal	*Rhinonicteris aurantia* (Pilbara form)	Pilbara Leaf-Nosed Bat	Tropical woodland to semi-arid grasslands.	VU	V	2018		2		25.85		Likely	0	0	1	0	1	Negligible	Negligible	No suitable habitat
Bird	*Rostratula australis*	Australian Painted Snipe	Shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DCCEEW, 2024).	EN	E	2011		2		18.73		May	0	1	1	0	2	Negligible	Negligible	No suitable habitat
Bird	*Tringa glareola*	Wood Sandpiper	Common in Northern Australia, a casual visitor to southern parts, occuping wetland margins, saltmarshes and sewage ponds (Pizzey & Knight, 2007).	IA	Mi	2015		2		40.84			0	0	1	0	1	Negligible	Negligible	No suitable habitat

Appendix C

Species by Family by Site

Appendix C Flora Species List

Family	Taxon	GQ01	GQ02	GQ03
Amaranthaceae				
	Achyranthes aspera	x		
	Ptilotus exaltatus	x	x	x
Boraginaceae				
	Trichodesma zeylanicum var. *zeylanicum*	x	x	x
Chenopodiaceae				
	Alysicarpus muelleri	x	x	
	Salsola australis			x
	Sclerolaena cornishiana	x		
Cleomaceae				
	Arivela viscosa	x	x	x
Convolvulaceae				
	Bonamia pilbarensis			x
	Evolvulus alsinoides		x	x
	Ipomoea ?muelleri	x		
	Ipomoea costata			x
	Ipomoea muelleri	x		
Cucurbitaceae				
	Cucumis variabilis	x		
Cyperaceae				
	Cyperus vaginatus		x	
Euphorbiaceae				
	Euphorbia australis var. *subtomentosa*	x	x	x
	Euphorbia coghlanii	x	x	x
	Euphorbia drummondii	x		x
Fabaceae				
	Acacia ancistrocarpa		x	x
	Acacia bivenosa	x	x	x
	Acacia colei var. *ileocarpa*			x
	Acacia inaequilatera			x
	Acacia pyrifolia var. *pyrifolia*	x	x	x
	Acacia trachycarpa	x		
	Crotalaria medicaginea	x	x	
	Indigofera linnaei	x		
	Indigofera monophylla			x
	Rhynchosia minima	x	x	x
	Senna glutinosa		x	x
	Senna notabilis	x	x	x
	Sesbania cannabina	x	x	
	Swainsona formosa	x	x	x
	Tephrosia densa	x		x
Goodeniaceae				
	Goodenia muelleriana		x	x
Gyrostemonaceae				
	Codonocarpus cotinifolius			x
Lauraceae				
	Cassytha filiformis		x	x

Appendix C Flora Species List

Family	Taxon	GQ01	GQ02	GQ03
Malvaceae				
	Abutilon ?otocarpum	x		
	Corchorus incanus subsp. *incanus*		x	x
*	*Malvastrum americanun*		x	
	Sida fibulifera	x	x	
	Triumfetta clementii		x	x
Myrtaceae				
	Corymbia hamersleyana			x
	Eucalyptus camaldulensis	x	x	
	Melaleuca argentea		x	
Nyctaginaceae				
	Boerhavia gardneri	x	x	x
Oleaceae				
	Jasminum didymum subsp. *lineare*		x	x
Orobanchaceae				
	Striga curviflora	x		
Phyllanthaceae				
	Phyllanthus maderaspatensis		x	
Plantaginaceae				
	Stemodia grossa	x	x	
Poaceae				
	Aristida latifolia		x	
*	*Cenchrus ciliaris*	x	x	x
*	*Cenchrus setiger*	x	x	
	Cymbopogon ambiguus	x	x	x
	Dactyloctenium radulans	x		
	Enneapogon lindleyanus		x	x
	Eriachne mucronata	x	x	
	Panicum decompositum		x	
	Paraneurachne muelleri		x	
	Themeda triandra		x	
	Triodia wiseana	x	x	x
Portulacaceae				
	Portulaca oleracea	x		
Proteaceae				
	Grevillea pyramidalis	x		x
	Hakea lorea			x
Rubiacae				
	Dolichocarpa crouchiana	X		
Solanaceae				
	Solanum cleistogamum			x
	Solanum diversiflorum	x	x	x
Violaceae				
	Afrohybanthus aurantiacus		x	
Zygophyllaceae				
	Tribulus hirsutus	x	x	

Appendix D

Flora Site Data

Appendix D Site Data

Site No: GQ01	**Date**: 05/06/2024	**Longitude:** 117.10157180	**Latitude**: -21.34750467

Type: Quadrat
Size: 50m x 50m
Topography: Minor Drainage
Vegetation Type: Eucalypts along minor channel
Fire: 1-2 years
Rock Type: ironstone, calcrete, blue metal

Soil Types: sandy clay loam, calcrete, pale brown
Effort: 1 person
Surface:
Vegetation Condition: good to poor, weed dominated, old ballast from rail, rubbish
Condition Notes: weeds, rubbish

Vegetation Community: *Eucalyptus camaldulensis, Melaleuca argentea* and *Grevillea pyramidalis* mid open woodland over *Sesbania cannabina, Trichodesma zeylanicum* var. *zeylanicum* and *Acacia trachycarpa* mid to tall sparse shrubland over **Cenchrus ciliaris, *Cenchrus setiger* and *Eriachne mucronata* tall tussock grassland.



Cons. Status	*Taxon*	Height (cm)	% Cover	Comment
	Abutilon ?otocarpum	0.3	0.1	CM240605-17
	Acacia bivenosa	0.9	0.1	
	Acacia trachycarpa	3	0.5	CM240605-10
	Acacia pyrifolia var. *pyrifolia*	1.8	0.1	
	Achyranthes aspera	0.6	0.1	CM240605-16

Cons. Status	*Taxon*	Height (cm)	% Cover	Comment
	Alysicarpus muelleri	0.6	0.1	CM240605-08
	Arivela viscosa	0.6	0.1	
	Boerhavia gardneri	0.01	0.1	CM240605-09
*	*Cenchrus ciliaris*	0.8	35	
*	*Cenchrus setiger*	0.8	25	
	Crotalaria medicaginea	0.5	0.1	
	Cucumis variabilis	0	0.1	
	Cymbopogon ambiguus	1.1	0.1	
	Dactyloctenium radulans	0.1	0.1	
	Dolichocarpa crouchiana	0.1	0.1	CM240605-13
	Eriachne mucronata	0.4	0.1	CM240605-12
	Eucalyptus camaldulensis	9	4	CM240605-06
	Euphorbia coghlanii	0.2	0.1	
	Euphorbia drummondii	0.4	0.1	CM240605-07
	Euphorbia coghlanii	0.01	0.1	CM240605-18
	Grevillea pyramidalis	2.3	0.1	
	Indigofera linnaei	0.2	0.1	
	Ipomoea ?muelleri	0	0.1	CM240605-11
	Ipomoea muelleri	0.2	0.1	CM240605-15
	Jasminum didymum subsp. *lineare*	0.4	0.1	CM240605-14
	Portulaca oleracea	0.01	0.1	
	Ptilotus exaltatus	0.4	0.1	
	Rhynchosia minima	0	0.1	
	Sclerolaena cornishiana	0.3	0.1	CM240605-21
	Senna notabilis	0.1	0.1	
	Sesbania cannabina	1.3	1	
	Sida fibulifera	0.2	0.1	
	Solanum diversiflorum	0.4	0.1	
	Stemodia grossa	0.1	0.1	
	Swainsona formosa	0.1	0.1	
	Tephrosia densa	0.4	0.1	
	Tribulus hirsutus	0.01	0.1	CM240605-20
	Trichodesma zeylanicum var. *zeylanicum*	0.2	0.1	
	Triodia wiseana	0.5	0.5	CM240605-19

Site No: GQ02	**Date**: 05/06/2024	**Longitude:** 117.099719440	**Latitude**: -21.346437762

Type: Quadrat
Size: 50m x 50m
Topography: Minor Drainage
Vegetation Type: Eucalypts along drainage and associated floodplain
Fire: 1-2 years
Rock Type: ironstone, calcrete, blue metal

Soil Types: sandy clay loam, calcrete, pale brown
Effort: 1 person
Surface:
Vegetation Condition: good to poor, weed dominated, old ballast from rail, rubbish, weird disturbance area
Condition Notes: weeds, rubbish, borrow pit

Vegetation Community: *Eucalyptus camaldulensis, Melaleuca argentea* and *Grevillea pyramidalis* mid open woodland over *Sesbania cannabina, Trichodesma zeylanicum* var. *zeylanicum* and *Acacia trachycarpa* mid to tall sparse shrubland over **Cenchrus ciliaris, *Cenchrus setiger* and *Eriachne mucronata* tall tussock grassland.



Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Acacia ancistrocarpa	1.5	0.1	
	Acacia bivenosa	0.9	0.1	
	Acacia pyrifolia var. *pyrifolia*	0.6	0.1	
	Afrohybanthus aurantiacus	0.4	0.1	
	Alysicarpus muelleri	0.4	0.1	
	Aristida latifolia	0.5	0.1	CM240605-28
	Arivela viscosa	0.6	0.1	

Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Boerhavia gardneri	0.4	0.1	CM240605-26
	Cassytha filiformis	0	0.1	CM240605-27
*	*Cenchrus ciliaris*	0.5	10	
*	*Cenchrus setiger*	0.6	10	
	Corchorus incanus subsp. *incanus*	1.1	0.1	CM240605-25
	Crotalaria medicaginea	0.2	0.1	
	Cymbopogon ambiguus	0.4	0.1	
	Cyperus vaginatus	0.5	0.1	CM240605-23
	Enneapogon lindleyanus	0.4	0.1	CM240605-24
	Eriachne mucronata	0.4	0.1	
	Eucalyptus camaldulensis	9	6	
	Euphorbia coghlanii	0.3	0.1	
	Euphorbia australis var. *subtomentosa*	0.01	0.1	
	Evolvulus alsinoides	0.1	0.1	
	Goodenia muelleriana	0.3	0.1	
	Jasminum didymum subsp. *lineare*	0.8	0.1	
*	*Malvastrum americanum*	0.2	0.1	
	Melaleuca argentea	5.3	0.5	
	Panicum decompositum	0.7	0.1	CM240605-23
	Paraneurachne muelleri	0.5	0.1	
	Phyllanthus maderaspatensis	0.3	0.1	
	Ptilotus exaltatus	0.05	0.1	
	Rhynchosia minima	0.3	0.1	
	Senna glutinosa	0.8	0.1	
	Senna notabilis	0.2	0.1	
	Sesbania cannabina	0.6	0.1	
	Sida fibulifera	0.2	0.1	
	Solanum diversiflorum	0.01	0.1	
	Stemodia grossa	0.6	0.1	
	Swainsona formosa	0.4	0.1	
	Themeda triandra	0.9	0.1	
	Tribulus hirsutus	0.01	0.1	
	Trichodesma zeylanicum var. *zeylanicum*	1.5	0.5	
	Triodia wiseana	0.3	1	
	Triumfetta clementii	0.3	0.1	CM240605-22

Site No: GQ03	**Date**: 05/06/2024	**Longitude:** 117.101571807	**Latitude**: -21.347504679

Type: Quadrat
Size: 50m x 50m
Topography: Minor Drainage
Vegetation Type:
Fire: 1-2 years
Rock Type: ironstone, calcrete, blue metal

Soil Types: sandy clay loam, calcrete, pale brown
Effort:
Surface:
Vegetation Condition: good to poor, weed dominated, old ballast from rail, rubbish
Condition Notes: weeds, rubbish

Vegetation Community: *Corymbia hamersleyana, Codonocarpus cotinifolius* and *Grevillea pyramidalis* low sparse woodland over *Acacia pyrifolia* var. *pyrifolia, Acacia bivenosa* and *Acacia inaequilatera* tall to mid sparse shrubland over *Triodia wiseana, *Cenchrus ciliaris* and *Enneapogon lindleyanus* tall mixed hummock and tussock grassland.



Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Acacia ancistrocarpa	2.7	0.1	
	Acacia bivenosa	0.8	0.1	
	Acacia inaequilatera	2.8	0.1	
	Acacia pyrifolia var. *pyrifolia*	2.2	1.5	
	Acacia colei var. *ileocarpa*	1.4	0.1	CM240605-30
	Arivela viscosa	0.2	0.1	
	Boerhavia gardneri	0.3	0.1	
	Bonamia pilbarensis	0.01	0.1	CM240605-31

Cons. Status	Taxon	Height (cm)	% Cover	Comment
	Cassytha filiformis	0	0.1	
*	*Cenchrus ciliaris*	0.5	3	
	Codonocarpus cotinifolius	3.6	0.1	
	Corchorus incanus subsp. *incanus*	1.1	0.1	
	Corymbia hamersleyana	4	1	
	Cymbopogon ambiguus	0.7	0.1	
	Enneapogon lindleyanus	0.3	0.5	
	Euphorbia australis var. *subtomentosa*	0.01	0.1	
	Euphorbia coghlanii	0.4	0.1	
	Euphorbia drummondii	0.4	0.1	
	Evolvulus alsinoides	0.01	0.1	
	Evolvulus alsinoides	0.3	0.1	
	Grevillea pyramidalis	3.2	0.1	
	Hakea lorea	0.7	0.1	
	Indigofera monophylla	0.5	0.1	
	Ipomoea costata	1.6	0.5	CM240605-29
	Jasminum didymum subsp. *lineare*	0.7	0.1	
	Ptilotus exaltatus	0.01	0.1	
	Rhynchosia minima	0	0.1	
	Salsola australis	0.4	0.1	
	Senna glutinosa	2.1	0.1	
	Senna notabilis	0.1	0.1	
	Solanum cleistogamum	0.2	0.1	NC
	Solanum diversiflorum	0.4	0.1	
	Swainsona formosa	0.1	0.1	
	Tephrosia densa	0.2	0.1	
	Trichodesma zeylanicum var. *zeylanicum*	0.6	0.1	
	Triodia wiseana	0.6	32	
	Triumfetta clementii	0.3	0.1	

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a Fortune 500 firm and its Professional Services business had revenue of $14.1 billion in fiscal year 2024. See how we are delivering sustainable legacies for generations to come at aecom.com and @AECOM.

aecom.com

© 2024 AECOM. All Rights Reserved.