



**Pilbara  
Minerals**

# Pilgangoora Lithium Project

Supporting Information for Native Vegetation Clearing (Purpose) Permit  
Application

Shire of East Pilbara

Rev 0

20 October 2023

Tenements: G45/351, L45/404, L45/411, L45/416, L45/430, L45/449, L45/473, L45/484, L45/485, L45/517,  
L45/555, L45/614, L45/695

## VERSION CONTROL

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## ACRONYMS AND DEFINITIONS

ACRONYM	MEANING
AHD	Australian Height Datum
AER	Annual Environmental Report
BoM	Bureau of Meteorology
DMIRS	Department of Mines, Industry Regulation and Safety
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESA	Environmentally Sensitive Area
GDE	Groundwater-Dependent Ecosystem
GDV	Groundwater Dependent Vegetation
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometres
LoM	Life of Mine
m	Metres
mm	Millimetres
Mt	Million tonnes
Mtpa	Million tonnes per annum
PEC	Priority Ecological Community
P	Priority flora
PLS	Pilbara Minerals Ltd
POPL	Pilgangoora Operations Proprietary Limited
PMST	Protected Matters Search Tool
t	Tonnes
TEC	Threatened Ecological Community
TSF	Tailings Storage Facility

# 1. PERMIT APPLICATION DETAILS

## 1.1 BACKGROUND

Pilgangoora Operations Pty Ltd (POPL), is a 100% subsidiary of Pilbara Minerals Limited (PLS), that owns and operates the Pilgangoora Lithium Project (the Project). The Project is located approximately 80 km south-southeast of the town of Port Hedland and 30 km north-east of the Wodgina mine, in the Shire of East Pilbara (Figure 1-1).

The Project is located within Wallareenya Station pastoral lease, an active cattle grazing property, through which unsealed roads provide access from the Great Northern Highway.

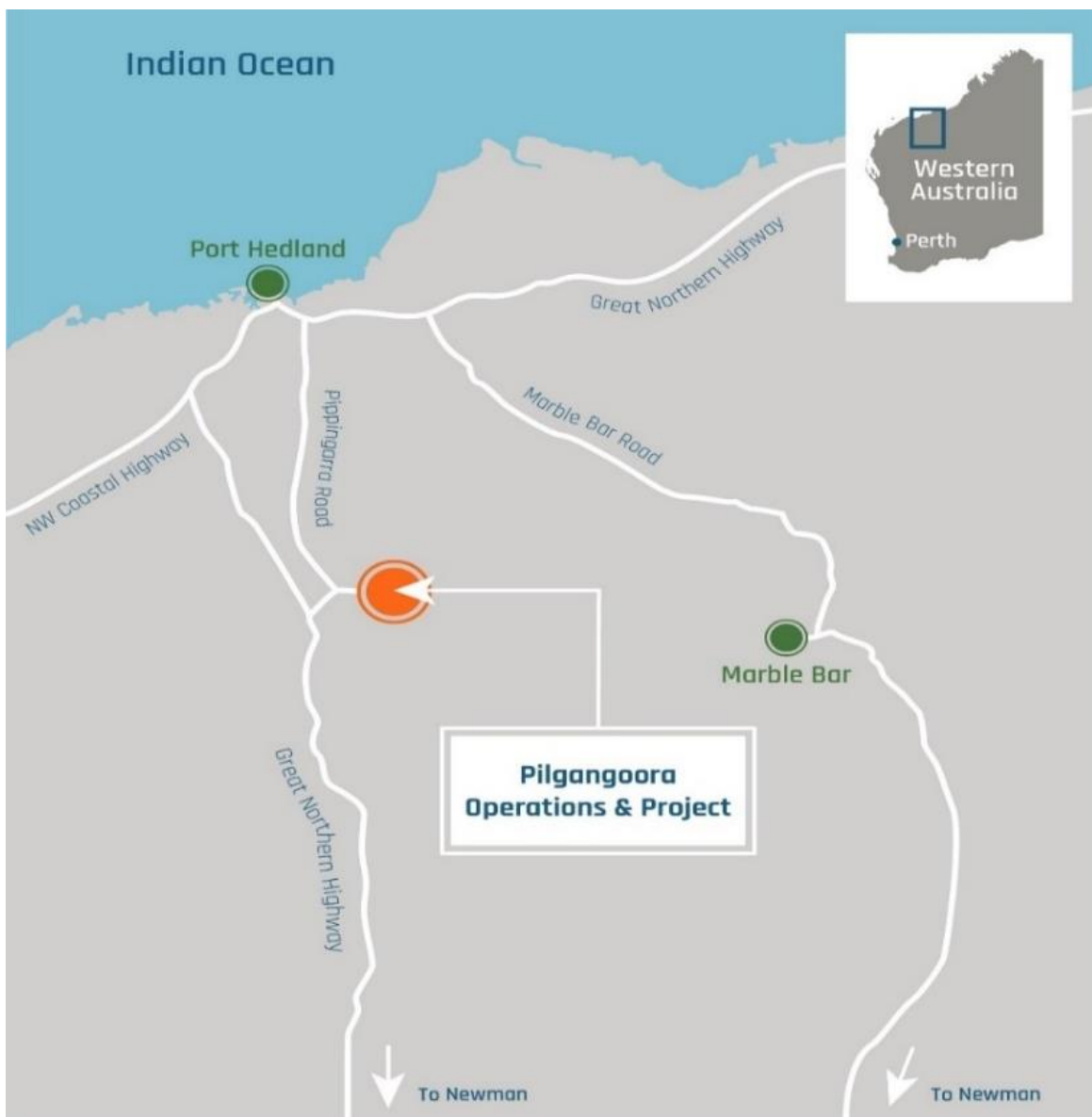


Figure 1-1: Regional location of the Pilgangoora Lithium Project

## 1.2 PROPOSAL DETAILS AND OWNERSHIP

POPL proposes to develop primary infrastructure and supporting facilities for the life of mine under assessment by the Department of Mines, Industry Regulation and Safety (DMIRS) within Mining Proposals Reg ID 117446 and Reg ID 120223.

Under these Mining Proposals further footprint development and waste rock landform development will take place. Supporting infrastructure including roads, drainage diversions, pipelines, solar fields, camp accommodation and facilities will be established.

This Native Vegetation Clearing Permit (NVCP) (purpose permit) application is being made for clearing to support these activities.

Ownership details of relevant tenements that comprise the proposed clearing permit area are presented below in Table 1 and with Government of Western Australia DMIRS extracts in Appendix 1.

**Table 1: Tenement Ownership Details**

TENEMENT TYPE	TENEMENT ID	STATUS	GRANT DATE	EXPIRY DATE	HOLDER
GENERAL PURPOSE LEASE	G 45/351	LIVE	25/05/2022	24/05/2043	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/404	LIVE	19/09/2016	18/09/2037	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/411	LIVE	21/11/2017	20/11/2038	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/416	LIVE	8/06/2017	7/06/2038	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/430	LIVE	2/10/2017	1/10/2038	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/449	LIVE	5/10/2018	4/10/2039	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/473	LIVE	29/11/2018	28/11/2039	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/484	LIVE	27/02/2020	26/02/2041	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/485	LIVE	9/07/2019	8/07/2040	Pilgangoora Operations Pty Ltd



TENEMENT TYPE	TENEMENT ID	STATUS	GRANT DATE	EXPIRY DATE	HOLDER
MISCELLANEOUS LICENCE	L 45/517	LIVE	11/05/2020	10/05/2041	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/555	LIVE	26/05/2023	25/05/2044	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/614	LIVE	11/10/2021	10/10/2042	Pilgangoora Operations Pty Ltd
MISCELLANEOUS LICENCE	L 45/695	LIVE	14/07/2023	13/07/2044	Pilgangoora Operations Pty Ltd

### 1.3 PROPOSED CLEARING EXTENT

The application area for the purpose permit measures 1, 597 ha. Within the application area, up to 1,000 ha of vegetation is proposed for clearing.

The location of the permit application area appears as Figure 1-2.

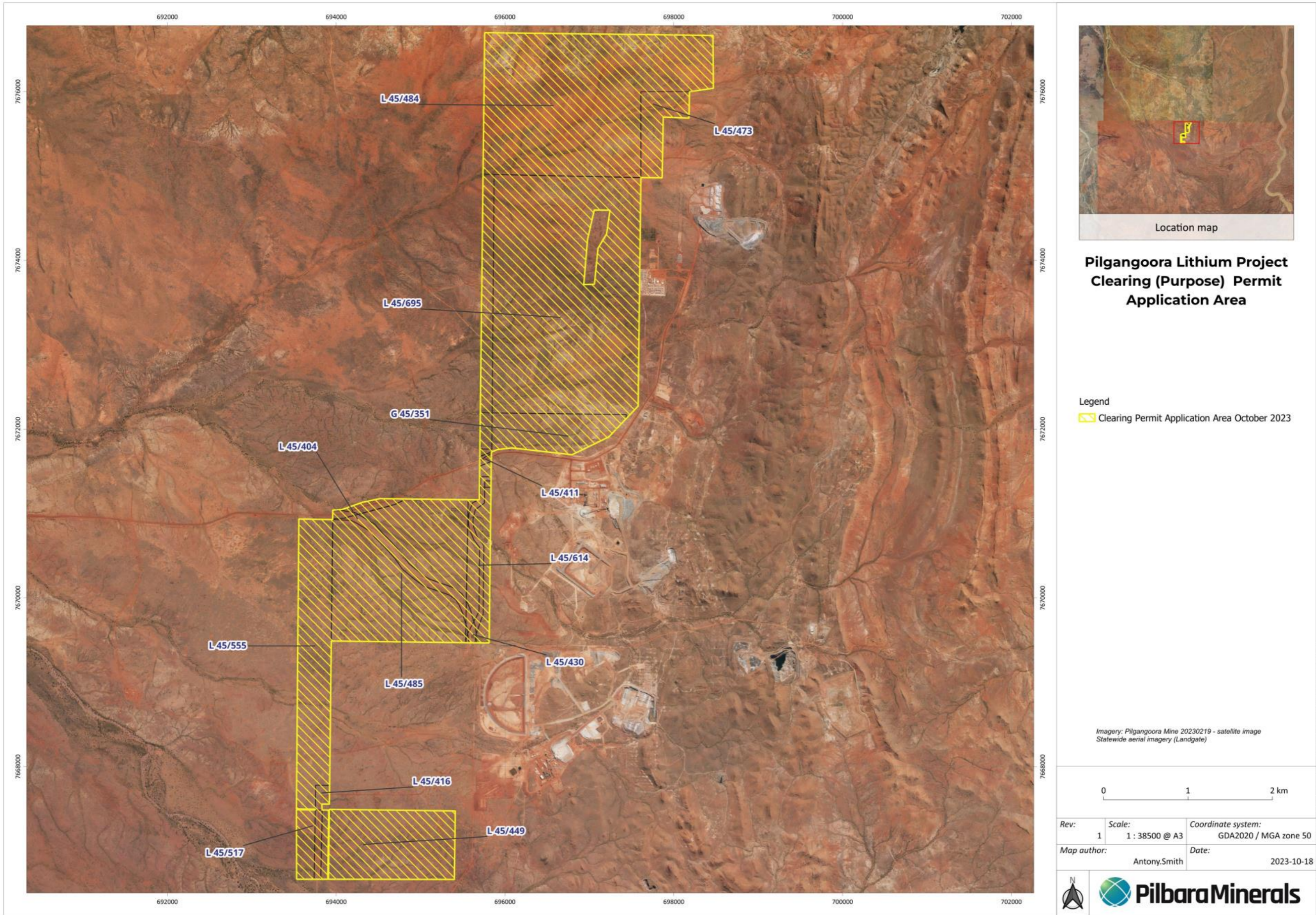


Figure 1-2: Clearing (Purpose) Permit Application Area

## 1.4 ALTERNATIVES CONSIDERED / ACTIONS TO MINIMISE CLEARING AND IMPACTS

### 1.4.1 ALTERNATIVES

A range of alternative options were investigated to understand the environmental sensitivities of the project application area, whilst supporting mining infrastructure. The alternatives considered are outlined below:

- Investigation of alternative locations for key mine infrastructure.
  - 5 options were assessed for location of a third tailings storage facility. Environmental assessments were completed for two of the locations, and a location to the south of the application area was chosen to support a TSF (not in this application area). Conducting thorough environmental impact assessments and surveys, have assisted with selecting a permit application area and minimising unnecessary land clearing.
- Tenement conditions and restraints.
  - Majority of the Mining Lease tenements are covered by the project area already and fall under existing CPS Permits 8175-2 and 7246-4. The expansions required for the supporting infrastructure will expand out onto miscellaneous tenure, and due to certain tenement conditions this application area was selected.
- The option of not applying for a Native Vegetation Clearing permit.
  - It was identified as a risk to business continuity and ability to support operations if a new native vegetation clearing permit was not applied for. Future supporting infrastructure may require additional area, expanding out from the project area, hence the total application area applied for.

### 1.4.2 ACTIONS TO MINIMISE CLEARING

A thorough environmental assessment has been completed over the purpose permit application area. The application area has been designed to avoid areas identified as critical habitat for the northern quoll, and limit impacts on surrounding habitats and vegetation.

Actions to minimise impacts are outlined below.

- Vegetation clearing protocols and the potential impacts of unauthorised clearing are included in the site induction.
- A Land Use Certificate system is in place and requires sign off by the Environmental Advisor prior to clearing being undertaken.
- Survey control will be utilised to set out the limits of areas to be cleared using survey pegs and flagging tape.
- All site personnel will be made aware of the vegetation clearing procedure and permitting requirements.
- All topsoil stripped will be retained for use in rehabilitation activities.
- Collect and correctly stockpile vegetative material and available growth medium for later use at selected sites.
- Progressively rehabilitate areas no longer required as soon as practicable.

- Where seed is required, only native plant species of local provenance will be used.
- To assist with ongoing review of the rehabilitation and impact assessment and environmental management at the site, the proponent will submit an annual environmental report to DMIRS as required by tenement conditions.
- The NVCP application area envelope was reduced to exclude critical habitat for the Northern Quoll, identified during environmental surveys.

## 2. EXISTING ENVIRONMENT

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### 2.1 REGIONAL SETTING

The topography of the permit application area is related to the range of hills that are located to the east of the mine site. These hills provide in the order of 90 m local relief with ground elevations rising from about 170 metres Australian Height Datum (mAHD) on the plains to the west, to about 260 mAHD in the vicinity of the mining areas. The Project area has the Turner River 20 km to the west and immediately to the east by a range of north-south trending hills that form the local watershed with the Strelley/De Grey River system.

The project area sits within the Turner River Catchment, with a number of ephemeral drainage lines dissecting the permit application area, including: the Northern Creek, Houston Creek, Pilgangoora Creek and Southern Creek, before discharging into the Pilgangoora Creek to the West.

### 2.2 CLIMATE

The Pilbara has very hot summers, mild winters and low and variable rainfall. It is classified as hot desert in northern and inland areas and hot grasslands in the north-west. The climate of the Chichester subregion of the Pilbara is described as semi-desert-tropical, receiving 300 millimetres (mm) of rainfall annually (Kendrick and McKenzie, 2001).

The nearest Bureau of Meteorology (BoM) weather station with a long historical record is at Port Hedland Airport (BoM Site Number: 004032), approximately 75 km northeast of the Survey Areas. Port Hedland Airport has recorded rainfall from 1942 – 2022 (80 years), and temperature from 1948 – 2022 (74 years). The climate data recorded for the region over these periods is shown in Figure 2-1. Monthly mean maximum temperature ranges from 36.8°C in March to 27.4°C in July. Monthly mean rainfall ranges from 90.2 mm in February to 0.9 mm in October, with a mean annual rainfall of 317.7 mm (BoM 2022).

The evaporation rate in the Pilbara is considerably higher than the average rainfall and can exceed 3000 mm per year.

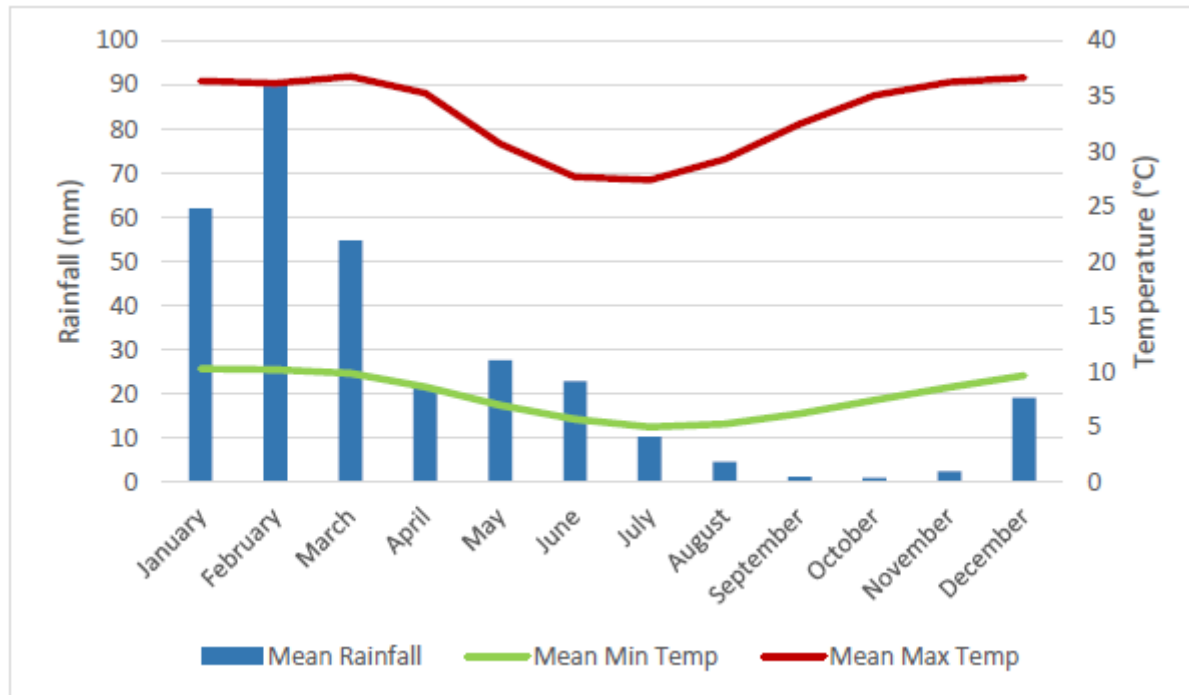


Figure 2-1: Climate data - Port Hedland Airport weather station (Station No. 004032) (BoM 2022)

## 2.3 BIOGEOGRAPHIC REGIONALISATION

The Interim Biogeographic Regionalisation for Australia (IBRA, version 7) classifies the Australian continent into regions (bioregions) of similar geology, landform, vegetation, fauna and climate characteristics (Thackway and Cresswell 1995). The mapping completed by Beard (1975) provides the basis for the IBRA bioregions. IBRA mapping (Version 7), places the Project within the Pilbara Bioregion.

The Pilbara Bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses.

The Pilbara Bioregion is further subdivided into the Chichester (PIL1), Fortescue (PIL2), Hamersley (PIL3) and Roebourne (PIL4) Sub-regions. The Project lies entirely within the Chichester Sub-region.

The Chichester Sub-region comprises the northern section of the Pilbara Craton and is comprised of undulating Archaean granite and basalt plains and includes significant areas of basaltic ranges. Plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges (Kendrick and McKenzie, 2001).

## 2.4 LAND SYSTEMS

Land system mapping classifies the Pilbara into 106 land systems (van Vreeswyk *et al.* 2004). The permit application area occurs within the Macroy, Satirist and Talga land systems. These land systems are described in Table 2 and shown on Figure 2-2

Table 2: Land Systems of the Project area

LAND SYSTEM	GEOLOGY	DESCRIPTION
Macroy	Level to gently undulating stony and gritty surfaced plains with occasional granite tor fields and domes and closely to moderately spaced dendritic tributary drainage floors, relief up to 25 metres	Stony plains and occasional tor fields based on granite supporting hard and soft spinifex grasslands
Satirist	Quaternary alluvium and colluvium; clay. Gravel and pebble deposits, minor Lower Proterozoic or Archaean chert, quartzite, shale and agglomerate	Stony plains and low rises supporting hard spinifex grasslands and gilgai plains supporting tussock grasslands
River	Quaternary alluvium	Active flood plains, major rivers and banks supporting grassy eucalypt woodlands, tussock grasslands and soft spinifex grasslands
Talga	Hill and ridge tracts of mafic and ultramafic rock (greenstones), other metamorphics and chert, relief up to 100 metres	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands

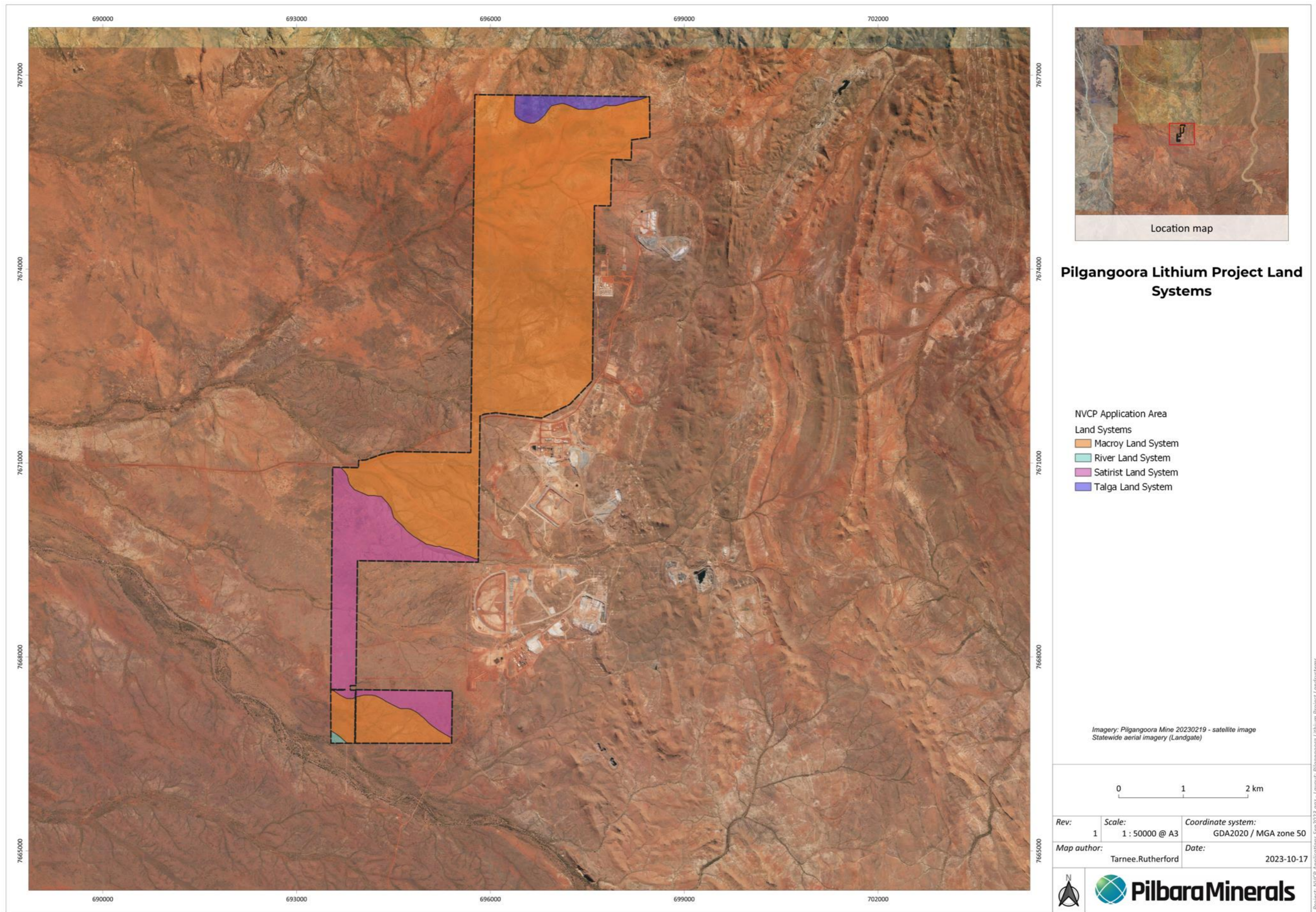


Figure 2-2: Land systems of the permit application area



## 2.5 GEOLOGY

### 2.5.1 REGIONAL GEOLOGY

The description of the geological conditions associated with the Project are derived from the 1:100,000 sheet (Wodgina) and explanatory notes provided by the Geological Survey of Western Australia (2014).

The Project area lies within the East Strelley Greenstone Belt of the Archean North Pilbara Craton, in the western part of the well exposed East Pilbara Granite Greenstone Terrane. Apart from a thin Cenozoic regolith cover, the region is entirely underlain by Archean rocks, comprising volcanic, sedimentary, mafic and ultramafic rocks of the Pilbara and De Grey Supergroups.

The East Strelley Greenstone Belt is characterised by a series of steeply dipping mafic meta-volcanics and amphibolites.

### 2.5.2 SITE GEOLOGY

The permit application area contains the following 18 geological formations:

- A-DA-mats; Dalton Suite; Serpentinite, schistose
- A-KEe-mbaq; Euro Basalt; Silicified amphibolite and metabasalt
- A-KEe-mu; Euro Basalt; Metamorphosed ultramafic rock;
- A-CLmo-xmgm-mgg; Motherin Monzogranite; Interleaved metamonzogranite, metagranodiorite, gneiss, and pegmatite; moderately to strongly foliated; intruded by abundant sheets of massive to weakly foliated muscovite-bearing metamonzogranite and pegmatite;
- A-CLmo-jmgm-mwa; Motherin Monzogranite; Interleaved seriate to porphyritic metamonzogranite, hornblende--biotite metagranodiorite, and pegmatite; strongly foliated and banded, locally gneissic; contains greenstone enclaves and pendants;
- A-mty-P; Pilbara Craton greenstones; Mylonitized metasandstone
- A-PI-musr; Pilbara Supergroup; Tremolite--chlorite--talc schist
- A-PI-mats; Pilbara Supergroup; Strongly sheared serpentine schist derived from intrusive ultramafic rocks
- A-Soc-mtqm; Corboy Formation; Muscovite-bearing quartzite; minor pelite
- A-SR-gp; Split Rock Supersuite; Pegmatite
- \_A1c; Alluvial unit; Sand, silt, and gravel in active drainage channels; includes clay, silt, and sand in poorly defined drainage courses on floodplains; unconsolidated.
- \_A1f-cb-vb; Alluvial unit; Clay, silt, sand, and basaltic or doleritic gravel on floodplains; gilgai surface in areas of expansive clay; derived from ferromagnesian parent rock; unconsolidated
- \_A1i; Alluvial unit; Mixed floodplain deposits; sand, silt, and clay adjacent to main drainage channels; numerous small claypans; unconsolidated
- \_A2-d-k; Alluvial unit; Partly consolidated alluvial gravel, sand, and silt; local carbonate cement; dissected by present-day drainage;

- \_C1; Colluvial unit; Colluvial sand, silt, and gravel in outwash fans; scree and talus; proximal mass-wasting deposits; unconsolidated;
- \_C2; Colluvial unit; Partly consolidated colluvial sand, silt, and gravel in proximal outwash fans; scree and talus; dissected by present-day drainage
- \_R1-g-pg; Residual or relict unit; Residual quartzofeldspathic sand, with quartz and rock fragments; overlying and derived from mass-wasting of granitic rocks; unconsolidated;
- \_S1\_S1; Sandplain unit; Sandplain deposits; sand of mixed residual, sheetwash, and eolian origin; unconsolidated;

## 2.6 SURFACE WATER

### 2.6.1 HYDROLOGICAL SETTING

The permit application area is located entirely within the Turner River catchment immediately to the west of the regional watershed divide with the Strelley River ( Figure 2-4). The Turner River is a regionally significant river system, draining a catchment area of some 4,800 km<sup>2</sup>. The Turner River catchment forms the eastern-most part of the Department of Water's designated Port Hedland Coast Basin (No. 709).

The headwaters of the Turner River East rise at the northernmost part of the broader Pilgangoora Project site and drain in a northerly direction before forming the river proper about 15 km to the north of the site. The Turner River East joins with the Turner River about 55 km northwest of the Project site and continues in a northerly direction for a further 35 km before discharging into the Indian Ocean via marshlands located 10 km west of Port Hedland.

Northern Creek, Houston Creek, Pilgangoora Creek and Southern Creek drain in a roughly east to west direction across the Project site. The smaller Pilgangoora and Houston Creeks discharge into Northern Creek which in turn reports to Southern Creek before emptying into Chinnamon Creek about 8 km west of the Project site. The catchment areas for these creeks are shown on Figure 2-3.

All creeks and drainages in the vicinity of the Project site are typical of watercourses in the Pilbara in that they are ephemeral and highly variable with flows that can increase from zero to hundreds of cubic metres per second in a matter of hours as a result of precipitation from tropical cyclones and low-pressure weather systems. Although none of the on-site creeks are gauged, it is understood that the majority of annual stream flow occurs during January, February and March, after which they usually recede and dry up by June or July.

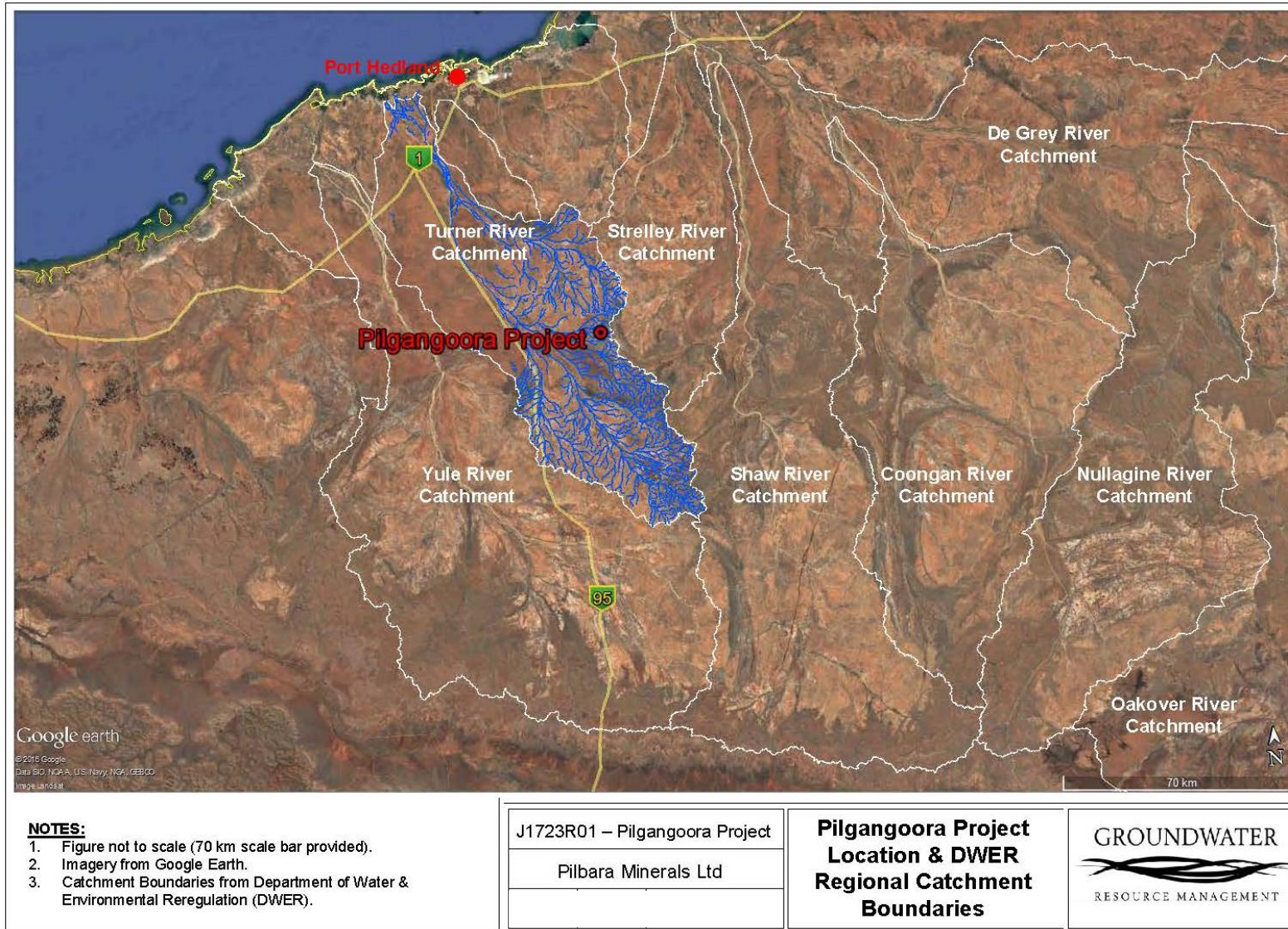


Figure 2-3: Regional surface water catchment boundaries

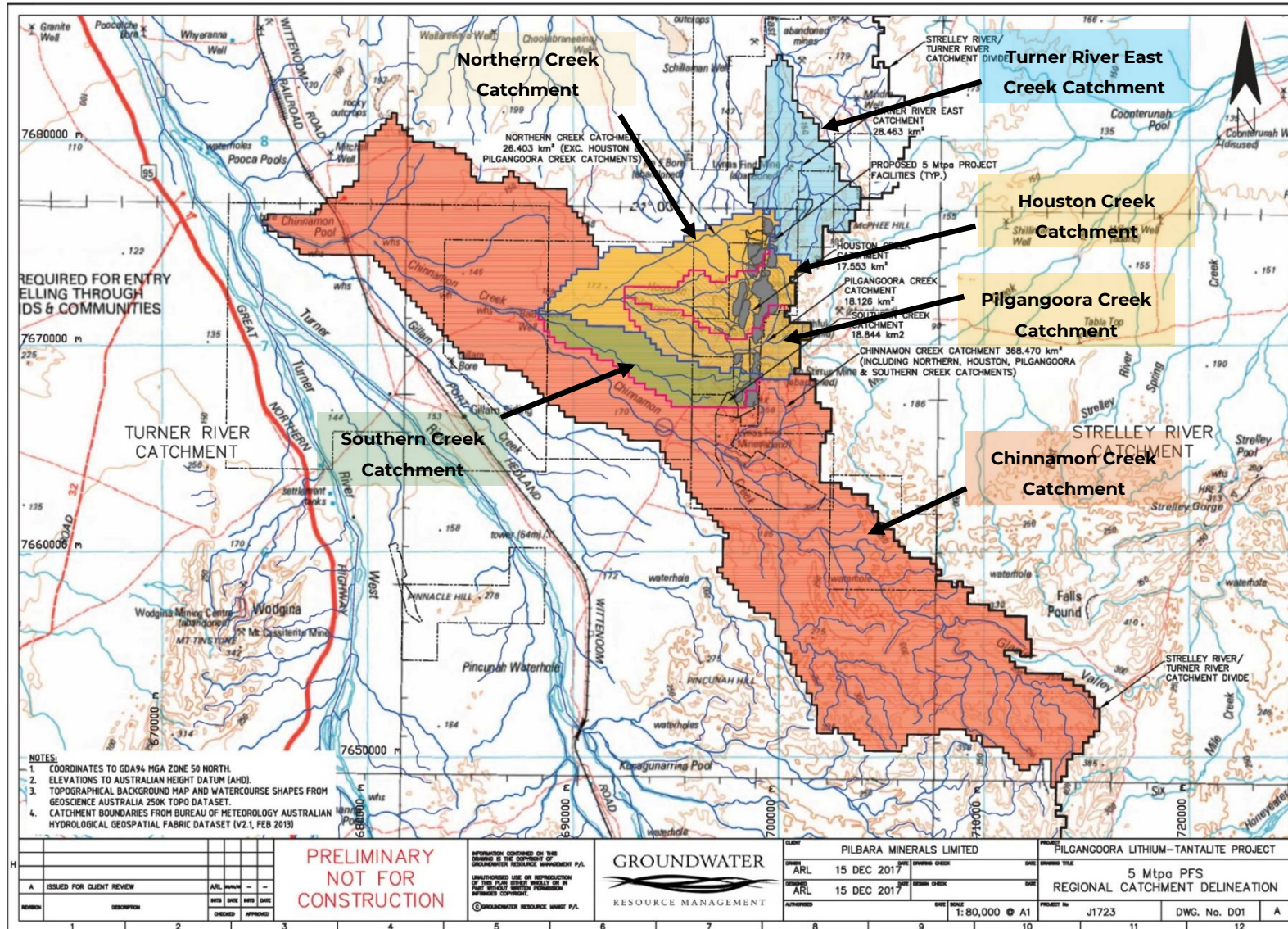


Figure 2-4: Surface water catchments at the Pilgangoora Project

## 2.6.2 LOCAL SURFACE WATER CATCHMENTS

The permit application area intersects all of the catchments identified in Figure 2-4. The pre-mining catchment areas are presented in Table 3 below.

**Table 3: Existing pre-mining catchment areas**

NO	CATCHMENT NAME	AREA (KM <sup>2</sup> )
1	Turner River East Creek <sup>see note 1</sup>	28.463
2	Northern Creek (exc. Houston and Pilgangoora Creeks) <sup>see note 2</sup>	26.403
3	Houston Creek <sup>see note 2</sup>	17.553
4	Pilgangoora Creek <sup>see note 2</sup>	18.126
5	Southern Creek	18.844
6	Chinnamon Creek <sup>see note 3</sup>	287.544
	<b>Total Combined Catchment Area</b>	<b>396.933</b>

Notes:

1. Turner River East Creek catchment area measured to confluence with eastern headwaters.
2. Northern Creek catchment area measured to confluence with Chinnamon Creek and excluding Houston Creek (17.553 km<sup>2</sup>) and Pilgangoora Creek (18.126 km<sup>2</sup>). Both Houston and Pilgangoora Creeks report to Northern Creek, giving it a combined catchment area of 62.082 km<sup>2</sup>.
3. All of the above creeks, excluding Turner River East Creek, report to Chinnamon Creek catchment which has a combined area of 368.470 km<sup>2</sup> upstream of its confluence with the Turner River.

All of these catchments ultimately report to the Turner River downstream of the Project site.

It is expected that the catchments with ephemeral creeks that intersect the permit application area will change over time, with portions of the catchment being lost upstream of the permit application area due to mining activities.

Where catchments are subject to changes in surface water hydrology associated with construction of infrastructure, these will be assessed under a *Rights in Water and Irrigation Act 1914*, section 11/17/21A permit to interfere with bed and banks.

## 2.7 GROUNDWATER

### 2.7.1 REGIONAL HYDROGEOLOGY

The Pilgangoora project lies within the East Pilbara Granite Greenstone Terrane. There are no highly productive aquifers in this province although fractured rock aquifers are associated with greenstones and occasional quartz veining.

Data from the broader Pilgangoora project indicates that there is an east to west hydraulic gradient across the site, with a typical depth to groundwater of between 23 m bgl and 53 m bgl. Mining activity has locally altered the groundwater table in the area, with drawdown around pits and supply bores and some localised mounding around existing tailings storage facilities.

Previous field investigations have found relatively low permeability in bedrock. Regions of higher permeability occur in alluvium and in some fracture zones in the bedrock, which tend to underly some of the alluvial waterways, such as Pilgangoora Creek.

Groundwater is recharged by direct rainfall or by stream flow during episodic rainfall events. Recharge is predominantly from surface water runoff and flooding events along the upper reaches of Pilgangoora Creek and Houston Creek (a tributary of Chinnamon Creek). Recharge occurs mainly on or adjacent to the groundwater divide and along drainage lines.

The hydrogeology of the Pilgangoora project area is characterised by an east to west draining system, with the groundwater divide coincident with the catchment divide (GRM, 2018). Throughflow is therefore considered to be limited given the setting at the top of the groundwater catchment. In the permit application area there is westerly trending creeklines; these likely feature a greater depth of weathering into the underlying basement, and are anticipated to act as preferential pathways for groundwater flow.

## 2.8 FLORA AND VEGETATION

### 2.8.1 SURVEYS

Flora and vegetation surveys conducted over areas of the permit application area appear in

Table 4 and are depicted in Figure 2-5. The survey reports are attached as Appendix 2- Appendix 4

Table 4: Flora, vegetation and fauna surveys

AUTHOR	REFERENCE	REPORT	YEAR	SURVEY AREA	STATUS
Animal Plant Mineral Pty Ltd (APM)	2022	Pilbara Minerals: TSF Options 2 and 5, Pilgangoora Project Biological Survey, Pilbara, Western Australia	2022	Option 2 and Option 5 area includes areas of: L45/695 L45/485	Detailed flora and vegetation survey and Targeted terrestrial vertebrate fauna survey
Animal Plant Mineral Pty Ltd (APM)	2023a	Pilbara Minerals E 45/2287 Infill Biological Survey	2023	E45/2287, P45/3058, L45/484, L45/473, L45/425	Detailed flora and vegetation survey and Targeted terrestrial vertebrate fauna survey
Animal Plant Mineral Pty Ltd (APM)	2023b	Pilbara Minerals Pilgangoora Project Biological Survey	2023	L45/695, L45/485, L45/479, L45/425, L45/473, E45/2287 L45/484, P45/3096, L45/430, L45/614 L45/404, L45/411, L45/555, L45/416, L45/5177, L45/449, E45/6298, G45/351, E45/2241, P45/3162	Detailed flora and vegetation survey and Targeted terrestrial vertebrate fauna survey

APM undertook their survey (2022a) between 4-8 October 2022. The rainfall in Winter/Spring preceding the survey was approximately double the average for the period. The higher-than-average winter rainfall is a result of a high total monthly rainfall in May of 123.8 millimetres (mm), which is almost 4.5 times higher than the long-term average of 52.3 mm for the same period.



APM undertook their survey (2023a) between 9 – 31 March 2023. The total summer rainfall prior to survey was below average. Monthly total rainfall at Port Hedland was below average in December, February and March and slightly above average in January.

APM undertook their survey(2023b) between the 27 of June - 3 August 2023. Rainfall in the season preceding the survey was below average. The timing of the flora and vegetation survey was within the recommended Supplementary survey period for the region (EPA 2016). The low rainfall preceding survey was a minor constraint to the completeness of the survey.

The details from the flora, vegetation and fauna assessments are provided below in the following sections.

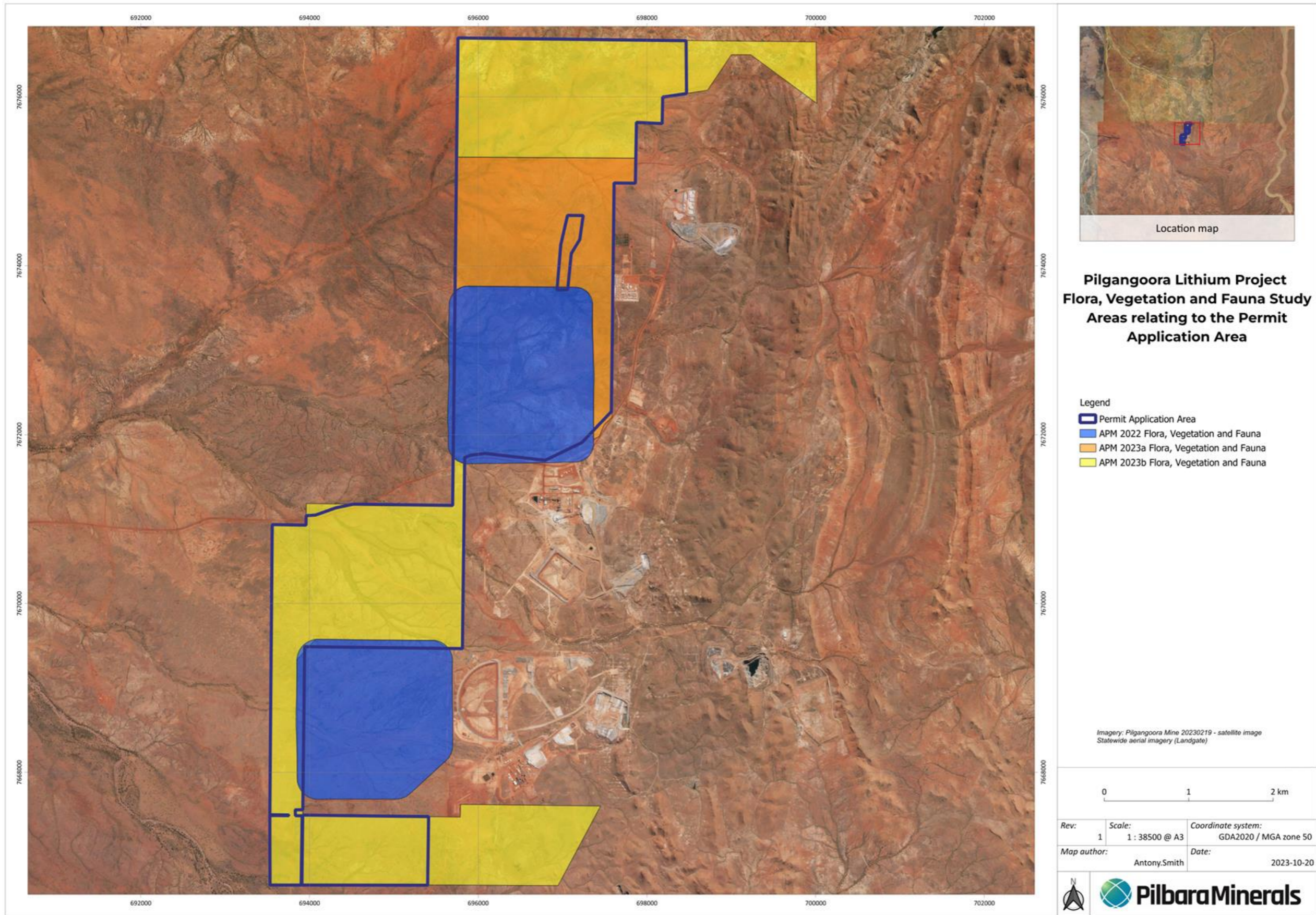


Figure 2-5: Flora, Vegetation and Fauna Surveys Relating to the Permit Application Area

## 2.8.2 FLORA

APM (2022) recorded a total of 123 species within the Survey Area, comprising 117 native species and six introduced species. APM found no conservation significant flora within the survey area.

APM (2023a) recorded a total of 119 within the Survey Area, comprising 117 native species and two introduced species. Two P3 species were recorded during the survey. These were *Euploca mutica* and *Triodia chichesterensis*.

APM (2023b) recorded a total of 143 species within the Survey Area, comprising 139 native species and four introduced species. Of these, one Priority Flora (Priority 3) species *Triodia chichesterensis* was identified in areas where quartzite was the dominant rock type at the surface.

## 2.8.3 VEGETATION TYPES

APM (2022 and 2023) mapped 10 vegetation types within the survey area, summarised in Table 5 below.

Table 5: Vegetation Types of the Permit Application Area

CODE	LANDFORM	VEGETATION DESCRIPTION	PERMIT APPLICATION AREA	
			ha	%
4b	Major Drainage Line	Low open woodland of <i>Eucalyptus victrix</i> and <i>Corymbia hamersleyana</i> over <i>Cajanus cinereus</i> , <i>Acacia cowleana</i> and <i>Acacia pyrifolia</i> mid sparse shrubland with <i>Triodia epactia</i> , <i>Cenchrus ciliaris</i> and <i>Triodia angusta</i> mid open hummock and tussock grassland	11.3	0.7
7b	Drainage depressions	Low open woodland of <i>Corymbia hamersleyana</i> ; over <i>Acacia acradenia</i> , <i>Acacia adsurgens</i> and <i>Indigofera rugosa</i> mid open shrubland and <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Triodia chichesterensis</i> hummock grassland	132.4	8.3
9a	Stony plains and rises	Mid isolated shrubs of <i>Acacia inaequilatera</i> , <i>Acacia acradenia</i> and <i>Hibiscus sturtii</i> with <i>Triodia wiseana</i> , <i>Triodia epactia</i> and <i>Triodia chichesterensis</i> hummock grassland	70.4	4.4
9c	Granite outcrops and rises	Isolated low <i>Corymbia hamersleyana</i> over <i>Acacia adsurgens</i> , <i>Acacia cowleana</i> and <i>Acacia maitlandii</i> mid sparse shrubland with <i>Triodia lanigera</i> , <i>Triodia wiseana</i> and <i>Triodia epactia</i> hummock grassland.	7.9	0.5
12a	Undulating plains	Isolated low <i>Corymbia hamersleyana</i> over mid to tall, isolated shrubs of <i>Acacia tumida</i> , <i>Acacia adsurgens</i> and <i>Acacia inaequilatera</i> with hummock grassland of <i>Triodia angusta</i> , <i>Triodia wiseana</i> and <i>Triodia lanigera</i>	1253.1	78.5
13a	Creeks	Low open woodland of <i>Eucalyptus camaldulensis</i> , <i>Corymbia hamersleyana</i> and <i>Eucalyptus victrix</i>	65.4	4.1

CODE	LANDFORM	VEGETATION DESCRIPTION	PERMIT APPLICATION AREA	
			ha	%
		sparse mid to tall shrubland of <i>Acacia tumida</i> , <i>Acacia stellaticeps</i> and <i>Acacia bivenosa</i> over <i>Triodia epactia</i> , * <i>Cenchrus ciliaris</i> and * <i>Cenchrus setiger</i> tussock/hummock grassland		
15a	Sandy Creek	Low open woodland of <i>Corymbia hamersleyana</i> over <i>Acacia cowleana</i> , <i>Acacia adsurgens</i> and <i>Indigofera rugosa</i> mid open shrubland with <i>Triodia epactia</i> , <i>Triodia lanigera</i> and <i>Triodia wiseana</i> hummock grassland.	21.8	1.4
16a	Claypans	Open herb field of <i>Sida fibulifera</i> , <i>Eriachne mucronata</i> and <i>Neptunia dimorphantha</i> .	4.7	0.3
D	Disturbed	Disturbed – clear of vegetation	30	1.8

None of the mapped vegetation types correspond to Commonwealth (*Environment Protection and Biodiversity Conservation Act 1999*) or State (*Biodiversity Conservation Act 2016*) listed Threatened Ecological Communities (TEC's) or Priority Ecological Communities (PECs). One Priority 3 Ecological Community is located approximately 30 km west of the permit application area; the Gregory Land System.

The APM 2022 and 2023 vegetation mapping appears below in Figure 2-6.

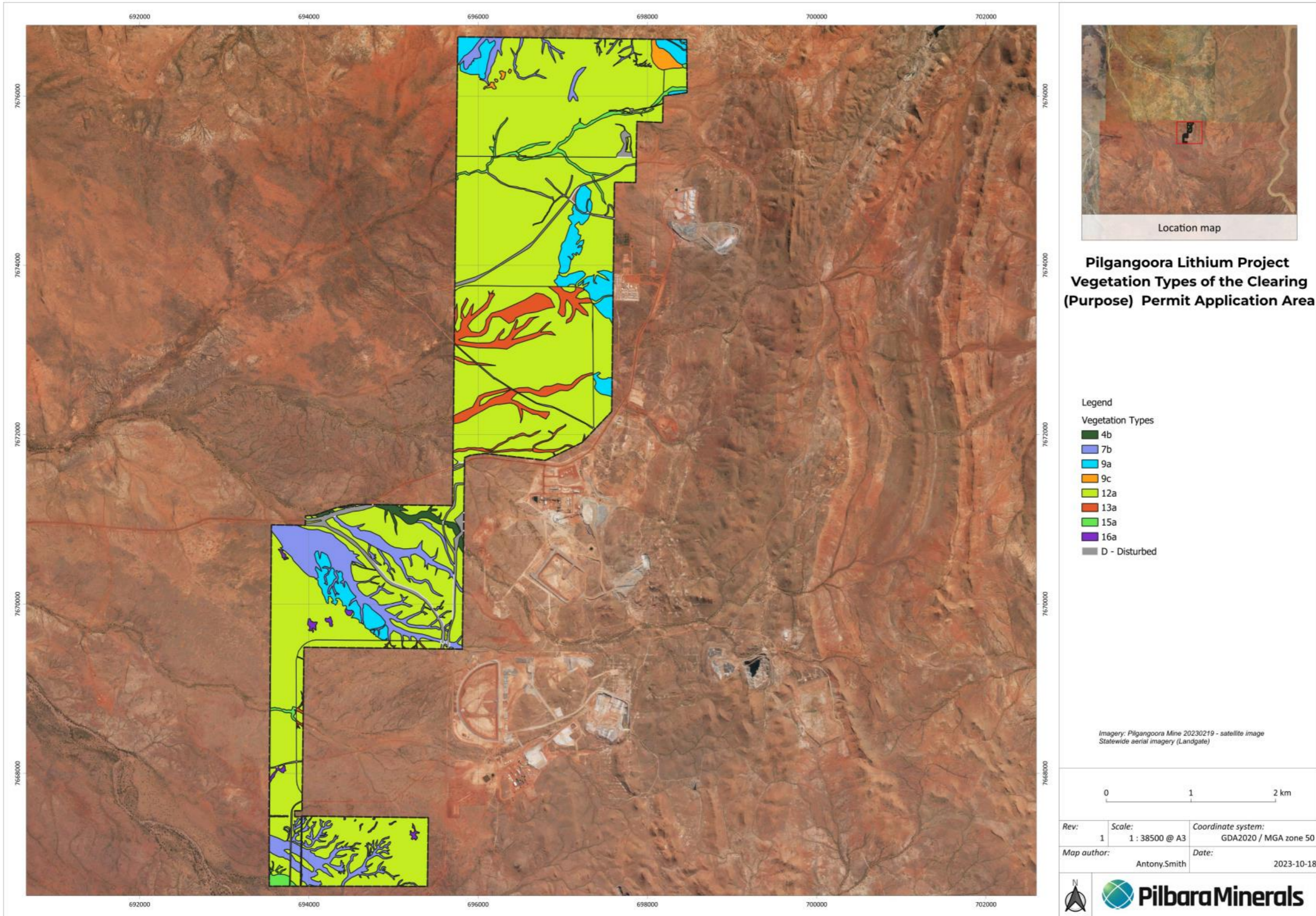


Figure 2-6: Vegetation types of the permit application area

## 2.8.4 VEGETATION CONDITION

APM (2022) recorded vegetation condition within the Survey Area as predominately *Very Good* (94.8%) and *Good* (2.26%), with remaining areas as *Completely Degraded* (2.93%). The primary sources of disturbance on site are moderate to high grazing impact from cattle and roads to support the pastoralism activities and mining activities.

APM (2023a) recorded vegetation condition within the Survey Area as predominately *Excellent* (11.6 %) and *Very Good* (85.1 %), with remaining areas as *Completely Degraded* (3.3 %). The primary sources of disturbance on site are recent fire scarring, low to moderate grazing impact from cattle and roads to support the pastoralism activities and mining activities

APM (2023b) recorded vegetation condition within the Survey Area as predominately *Very Good* (94.8%) and *Good* (2.26%), with remaining areas as *Completely Degraded* (2.93%). The primary sources of disturbance on site are moderate to high grazing impact from cattle and roads to support the pastoralism activities and mining activities

## 2.8.5 SIGNIFICANT FLORA

APM (2022) did not record any priority flora however they do discuss the possibility of occurrence of *Triodia chichesterensis*, the known range of the species (Survey Areas being in the middle of the known range) and the difficulty of distinguishing it from *Triodia lanigera*. APM discusses that where the two co-occur, there is a subtle but consistent substrate change that marks the shift in species, with *T. lanigera* occurring on sandier soils and *T. chichesterensis* on rockier soils with quartzite pieces.

APM (2023a) found two P3 species *Euploca mutica* and *Triodia chichesterensis* during the survey.

### *Euploca Mutica*

*Euploca mutica* is a small, perennial herb/shrub that grows to approximately 0.3 m. The species was first recorded in the local area during surveys undertaken by MMWC Environmental in 2016a.

*Euploca mutica* was found at four locations within the Survey Area within the undulating sandy plains in generally low, scattered abundance. Targeted searches were conducted where individuals were found to identify the population size and extent within these areas. Thirty-one individuals were recorded.

### *Triodia chichesterensis*

*Triodia chichesterensis* is described by Anderson et al. (2017). It is characterised by being a short-leaved species, distinguished by the combination of diminutive stature, glabrous leaf sheaths, relatively unbranched inflorescence, often short pedicels, and pubescent lemma midlobe. The short pedicels and pubescent lemma midlobe contrast with the typically longer pedicels and glabrous lemma midlobes of other short-leaved species in the complex (*T. nana*, *T. scintillans*, *T. vanleeuwenii*).

The species has a limited distribution and has been found only in a narrow area in the central Chichester region of the Pilbara of WA. The areas immediately to the west and east of its known distribution are poorly explored, but it is likely to be restricted to an area <100 km beyond current collections, given intensive collecting efforts in the Pilbara (Anderson et al. 2017).

Within the Survey Area, the species was also recorded within sandy red soils with a substantial coverage of rocks and pebbles including quartzite. *Triodia lanigera* was common on the sandy soils with minimal surface rock and generally lacking in quartzite.

APM (2023b) found the P3 species *Triodia chichesterensis* during the survey.

### 2.8.6 SIGNIFICANT VEGETATION

APM (2022) reports The Chichester Subregion includes seven Ecosystems at Risk which are subject to a range of threatening processes (Kendrick and McKenzie 2001). None of these ecosystems are relevant to the permit application area.

Two species that have been associated with GDEs were recorded in the vegetation type 13a. The red gum and coolabah within the 13a vegetation type are of low height and stem diameter, likely to be a consequence of intermittent water availability, supporting the assessment of a low likelihood of access to groundwater.

Regional Vegetation Associations within the permit application area, as described by Beard, have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within the permit application areas is of 'Least Concern'.

No vegetation types occurring within the permit application area are analogous to any known TEC's or PEC's.

One species associated with Groundwater Dependent Ecosystems was recorded during the APM (2023b) survey. *Eucalyptus victrix* was recorded in vegetation type 4b in the Major Drainage Line. Individuals were relatively old with a large diameter at breast height compared to other trees in the surrounding habitats. *Eucalyptus victrix* is regarded as being a facultative phreatophyte that most likely draws most of its water requirement from the unsaturated zone but can use groundwater opportunistically.

Clearing of major creek lines and ephemeral creeks will be limited, no riparian vegetation will be impacted. Clearing will be minimised and where required a bed and banks application will be applied for.

### 2.8.7 INTRODUCED FLORA

APM (2022 and 2023) identified eight introduced flora species in the Survey Areas.

A compiled list from the surveys appears as Table 6. These species are listed as 'Permitted' on the Western Australian Organism List (DAFWA 2016) and are not Weeds of National Significance.

Table 6: Compiled list of introduced flora appearing in Survey Areas

SPECIES	COMMON NAME	DESCRIPTION
BAM Act S11 - Permitted		
<i>Aerva javanica</i>	Kapok	Erect, much-branched perennial herb, 0.4-1.6 m high. Flowers white from January to October. Often found growing on sandy soils and along drainage lines.
<i>Cenchrus ciliaris</i>	Buffel grass	Tufted or sometimes stoloniferous perennial, grass-like or herb. 0.2 - 1.5 m high. Flowers purple from February to October. Grows on white, red, or brown sand, stony red loam, or black cracking clay.
<i>Cenchrus setiger</i>	Birdwood grass	Erect, tussocky, stoloniferous perennial, herb or grass-like. Grows to 0.5 m high. Flowers cream to purple from April to May.

SPECIES	COMMON NAME	DESCRIPTION
		Grows on brown sands, red loam, or pindan soils on sand dunes, plains, rangelands, stony hillsides, or floodplains.
<i>Echinochloa colona</i>	Awnless barnyard grass	Tufted annual, grass-like or herb, 0.2-0.6(-0.9) m high. Flowers green/purple, February to July. Grows on black sand, black clay. Near watercourses and swamps.
<i>Flaveria trinervia</i>	Speedy weed	An erect, annual herb preferring wet areas. Often in disturbed areas.
<i>Malvastrum americanum</i>	Spiked malvastrum	Erect perennial, herb or shrub, 0.5-1.3 m high. Fl. yellow-orange, Apr to Jul. Orange/red/yellow sands, gritty alluvial sand, black/brown clay, alluvial cracking clays, limestone, calcrete. Stony ridges and hillsides, floodplains, along drainage lines.
<i>Triumfetta pentandra</i>	-	Woody annual, herb or shrub, to 1.5 m high. Fl. yellow-green, Apr to May. Brown sand, black clayey sand, red-brown clay, sandstone.  Sandbank above river flood plain, forest edges, coastal sites, disturbed areas.
<i>Tribulus terrestris</i>	Caltrop	Prostrate annual, herb, plants villous; leaflet pairs 4 - 7; cocci with distinct divergent, median spines 3 - 8 mm long. Flowers yellow from January to December. Often grows on sandy soils and in waste places.

## 2.9 FAUNA

### 2.9.1 FAUNA SURVEYS

Fauna desktop and field surveys were undertaken over the permit application area by APM in 2022 and 2023 and were reported as per

Table 4 and appear as Appendix 4 . The APM studies provide the most recent results for the area and have been used as the basis for this application.

### 2.9.2 DESKTOP FAUNA STUDY RESULTS

The Department of Biodiversity Conservation and Attractions (DBCA) database search returned 16 species of significant fauna that have previously been recorded within 30 km of the Survey Areas. Of these, three are listed as migratory bird species (MI) and one as Other Specifically Protected (OS). Record locations of significant fauna in relation to the Survey Area are shown in Figure 5-1 of Appendix 4.

No T or P fauna species have previously been recorded within the Survey Areas.

The PMST returned 13 additional species, five T, six MI and two that are both T and MI. These are species that do not have records within 30 km but where modelling has identified that suitable habitat is known to occur or may occur.



The literature review returned additional information about the locations and abundance of Northern quoll, Pilbara leaf-nosed bat, Ghost bat and Pebble mound-mouse records, including a scat for the T fauna Northern quoll, previously recorded within the Survey Area (APM 2023a).

Database search results of T, P and MI fauna within 30 km of the Survey Areas are listed in Table 7, with the outcome of the likelihood of occurrence assessment.

Table 7: Significant fauna database records and likelihood of occurrence

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
<i>Actitis hypoleucos</i>	Common sandpiper	MI	MI	
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MI	MI	
<i>Calidris ferruginea</i>	Curlew sandpiper	CR	CR, MI	Unlikely. No saline or coastal habitats available.
<i>Calidris melanotos</i>	Pectoral sandpiper	-	MI	Freshwater habitats are likely to be seasonally present in the claypans (gilgai) within the Stony Plains however the high evaporation rate means these habitats are unlikely to persist more than a few weeks at most. The major drainage line with granite bedrock has the potential for ephemeral pools however there are no permanent or semi-permanent pools evident.
<i>Numenius madagascariensis</i>	Eastern curlew	CR	CR, MI	
<i>Glaucola maldivarum</i>	Oriental pranticole	MI	MI	
<i>Hirundo rustica</i>	Barn swallow	MI	MI	
<i>Motacilla cinerea</i>	Grey wagtail	MI	MI	
<i>Motacilla flava</i>	Yellow wagtail	MI	MI	
<i>Apus pacificus</i>	Fork-tailed swift	MI	MI	
<i>Charadrius veredus</i>	Oriental plover	MI	MI	Likely. Suitable habitat in the open plains.
<i>Polytelis alexandrae</i>	Princess parrot	-	VU	Unlikely, preferred feeding species are not present in high densities along the major drainage.
<i>Erythrotriorchis radiatus</i>	Red goshawk	VU	VU	Unlikely. Not within the known range of the species distribution.
<i>Falco hypoleucos</i>	Grey falcon	VU	VU	Likely. All areas are suitable for foraging. No suitable nesting habitat.
<i>Falco peregrinus</i>	Peregrine falcon	OS	-	Likely. All areas are suitable for foraging. No suitable nesting habitat.

Species	Common Name	Conservation Code		Assessment of Occurrence
		BC Act	EPBC Act	
<i>Pezoporus occidentalis</i>	Night parrot	CR	EN	Possible. No local records. Habitat modelling includes the Survey Area at the extremity of the species potential extent. Foraging resources are limited.
<i>Rostratula australis</i>	Australian painted-snipe	EN	EN	Unlikely. No habitat occurs in the Survey Area. Vegetation too open to provide well vegetated shallows.
<i>Dasyercus blythi</i>	Brush-tailed mulgara	P4	-	Likely. Sandy plains habitat is suitable.
<i>Dasyurus hallucatus</i>	Northern quoll	EN	EN	Present. Suitable foraging habitat in the creeks but of low quality. Limited suitable denning and foraging habitat available in the Rocky Outcrops.
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled hare-wallaby	P4	-	Present. Historic records nearby and suitable habitat is present in the Shallow Drainage Basins and Creeks habitat.
<i>Macroderma gigas</i>	Ghost bat	VU	VU	Likely. Foraging habitat available. No roosting habitat available.
<i>Macrotis lagotis</i>	Greater bilby	VU	VU	Possible. All habitats are suitable.
<i>Pseudomys chapmani</i>	Western pebble-mound mouse	P4	-	Present. Mounds located in the plains where suitable pebbles occur.
<i>Rhinonicteris aurantia</i>	Pilbara leaf-nosed bat	VU	VU	Present. No roosting habitat available, foraging habitats present.
<i>Sminthopsis longicaudata</i>	Long-tailed dunnart	P4	-	Unlikely. No suitable habitat.
<i>Anilius ganei</i>	Gane's blind snake (Pilbara)	P1	-	Unlikely. No suitable habitat.
<i>Liasis olivaceus</i> subsp. <i>baronni</i>	Pilbara olive python	VU	VU	Unlikely. No suitable habitat.
<i>Liopholis kintorei</i>	Great desert skink	VU	VU	Unlikely. No records in the local area. May occur 10 km to the east.

Dandjoo database records did not return any introduced fauna, however the superseded NatureMap records for eight introduced fauna recorded within 30 km of the Survey Areas were returned and are listed below:

- Camel (*Camelus dromedarius*);
- Cat (*Felis catus*);
- Cattle (*Bos taurus*);
- Dog (*Canis lupus*);
- Donkey (*Equus asinus*)
- Fox (*Vulpes vulpes*)
- Horse (*Equus caballus*); and
- House mouse (*Mus musculus*).

### 2.9.3 FAUNA FIELD SURVEY RESULTS

#### *Fauna Habitat*



The permit application area is characterised by sandy to stony undulating plains with first and second order ephemeral creeks and shallow drainage basins. Low rocky rises occur in the eastern extents in the north and south. There are higher ranges to the east and water sheds from these into the Survey Area through the minor drainages that continue to the west. The presence of water is ephemeral, and no permanent or semi-permanent water is available. Seasonal inundation is expected to occur within the claypan habitats, with the duration of inundation dependent on the amount of any given rainfall event, but is generally expected to be short (days to weeks) due to high evaporation rates. Vegetation is sparse on the rocky rises and plains, and densest in the shallow drainage basins.

The permit application area has moderate (burnt 2-5 years previously) to very old fire age. Recent fires recorded on the DBCA (2022) database indicate approximately 66 ha burned in 2019, 237 ha burned in 2017, 5 ha burned in 2015, 58 ha burned in 2014, 17 ha burned in 2012 and 88 ha burned in 2009, totalling 39.5% of the Survey Area (2023b) being burned in the past 25 years. Burns appear to be low to moderate intensity with larger woody vegetation frequently surviving and good post-fire establishment of ground cover and mid story shrubs.

There has been no critical habitat identified within the permit application area.

The fauna habitats described for the Survey Areas (APM 2023b) are summarised in Table 8 below. The distribution of fauna habitats is shown in Figure 2-7.

Table 8: Fauna habitat description of the survey area

Habitat Code	Name	Sites	Description	Photo	
FH1	Undulating plains	MSC06	Undulating plains with clay soils in the lowest areas interspersed with higher ground of sandy and stony surface soils. Seasonal inundation likely to occur in the lower areas. Sandy rises suitable for burrowing species. Stony areas suitable for pebble mound mouse. Hummock grasses in some areas are large.		
		MSC07			
		MSC10			
		MSC11			
		NP001			
		NP002			
		NP003			
		BM01			
		BM02			
		BM03			The vegetation consists of Isolated low <i>Corymbia hammersleyana</i> over mid to tall, isolated shrubs of <i>Acacia tumida</i> , <i>Acacia adsurgens</i> and <i>Acacia inaequilatera</i> with hummock grassland of <i>Triodia angusta</i> , <i>Triodia wiseana</i> and <i>Triodia lanigera</i>
		BM04			
		BM05			
BM06					
BM07					
BM08					
BM09					
BM10					
BM11					
FH2	Ephemeral creeks	MSC04	Ephemeral creeklines with rocky sandy loam soil. Riparian banks are often present with alluvial loamy soils. Creeks are all ephemeral with no permanent or semi-permanent pools present. Sandy soils is suitable for burrowing species. Occasional trees but generally of insufficient size to have hollows and no fallen hollow branches observed. This habitat may act as a wildlife corridor for birds, bats, mammals, and reptiles. The condition of the habitat is poor, the cover of weedy grasses is high, there is a low leaf litter or accumulation of dead wood to provided microhabitats, and a high grazing pressure.		
		MSC12			
		MSC14			
		MSC16			
		AS622904			
		AS642029			
		AS660630			
		AS660654			
NP004	The vegetation consists of Low open woodland of <i>Eucalyptus camaldulensis</i> , <i>Corymbia hammersleyana</i> and <i>Eucalyptus victrix</i> , sparse mid to tall shrubland of <i>Acacia tumida</i> , <i>Acacia stellaticeps</i> and <i>Acacia bivenosa</i> over <i>Triodia epactia</i> , <i>*Cenchrus ciliaris</i> and <i>*Cenchrus setiger</i> tussock/hummock grassland.				
RV001					
D	Disturbed				

### Stony plains

#### Survey Sites:

C33(2)  
FH006  
FH006b  
FH007  
FH009  
FH010  
FH10a  
FH012  
FH012b  
FH014

This habitat type is characterised by its red sandy loam soils with variable surface rock/pebble cover, but generally stones are present. The Stony Plains habitat is typical of those described by van Vreeswyk *et al.* (2004) where it is interspersed with granite domes in the extent of the Macroy Land System and interspersed with gilgai in the extent of the Satirist Land System.

The sandy substrate is suitable for burrowing species, a sparse Eucalypt overstorey is present, offering perching opportunities but with limited hollow development, sparse termite mounds are present. Granite domes have some exfoliating rock but microhabitats are limited to narrow and shallow cracks. Higher clay content soils in the gilgai may offer cracked clay in the dry season and shallow inundation following rain.

Vegetation consists of isolated low *Corymbia hamersleyana* over mid to tall *Acacia adsurgens*, *Acacia inaequilatera* and *Grevillea wickhamii* sparse tall shrubland with mid hummock grassland of *Triodia lanigera*, *Triodia wiseana* and *Triodia epactia*.



### Shallow Drainage basins and creeks

#### Survey Sites:

C9/C33(1)  
C11/C30(1)  
C18/C36(1)  
C21x/C31(1)  
AS450007  
FH008  
FH015

Minor sandy bottomed ephemeral first and second order creeks, and shallow drainage depressions. The densest vegetation of the Survey Area occurs in this habitat type, with thick *Acacia* shrubs found in the drainage depressions, and on the edges of defined creek banks.

The sandy substrate indicates that water pooling is unlikely to occur, and no evidence of water pooling was observed.

Sand in the stream beds is suitable for burrowing species. Stands of trees occur but generally of insufficient size to have hollows and no fallen hollow branches were observed. Small amounts of litter were present. The dense vegetation provides cover for species sensitive to predation. This habitat may act as a wildlife corridor for birds, bats, mammals, and reptiles.

Cattle impacts were moderate. The weedy and fire prone introduced fodder grass genus *Cenchrus* is present in low frequency and density. Fires are of moderate frequency and low to moderate intensity.

The vegetation consists of low open woodland of *Corymbia hamersleyana*, over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland and *Triodia wiseana*, *Triodia epactia* and *Triodia lanigera* hummock grassland.

This habitat type is synonymous with habitat FH2 described and mapped for the TSF Survey (APM 2022b) and Infill Survey (APM 2023b).



### Low hills

Survey Sites:  
FH004  
FH005

Gently undulating stony surfaces of quartzite, laterite or granite on shallow red sandy loam soils. This habitat is suitable for small species that construct shelters from small stones, however in most areas stones are too large for species such as Pebble mound mouse. This habitat type contains limited microhabitats providing limited vegetation with sparse midstory, very few, generally small trees lacking hollows, unsuitable substrate for burrowing, few to no logs and limited leaf litter. This habitat lacks structure and microhabitats and provides limited value to fauna.

The vegetation consists of mid isolated shrubs of *Acacia inaequilatera*, *Acacia acradenia* and *Hibiscus sturtii* with *Triodia wiseana*, *Triodia epactia* and *Triodia chichesterensis* hummock grassland.

This habitat is the same as the FH3 Habitat described for Lynas Find (APM 2022a).



### Platy Rock Outcrops

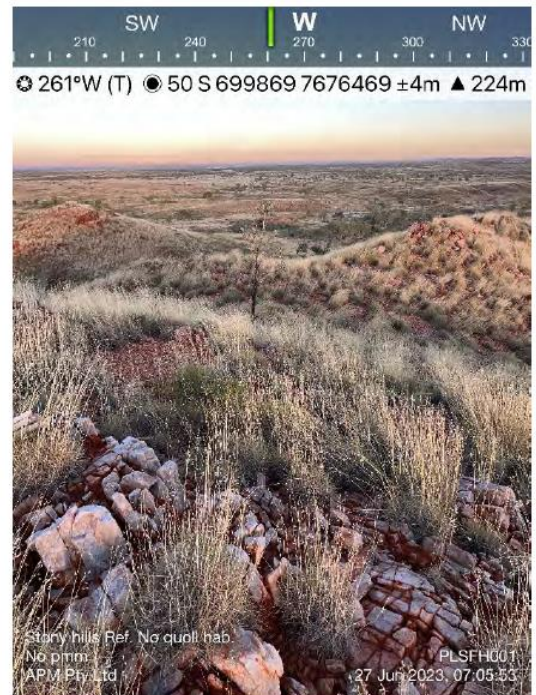
Survey Sites:  
C21/32 (2)  
C34(2)  
FH001  
FH013

Rocky outcrops and ridges composed of platy, sharp, red granite or schist or blocky quartzite with >75% rock cover. Weathered bedrock provides cracks and crevices as important shelter sites for small ground dwelling reptiles and small mammals. Soils are hard and unsuitable for burrowing species due to the surface rock cover.

Crevices are restricted to shallow and narrow cracks in rocks, unsuitable for conservation significant species.

The vegetation consists of Mid isolated shrubs of *Acacia inaequilatera*, *Acacia acradenia* and *Hibiscus sturtii* with *Triodia wiseana*, *Triodia epactia* and *Triodia chichesterensis* hummock grassland.

This habitat is the same as 'Platy Rock Outcrops' of the Lynas Find Survey Area.



**Major Drainage Line**

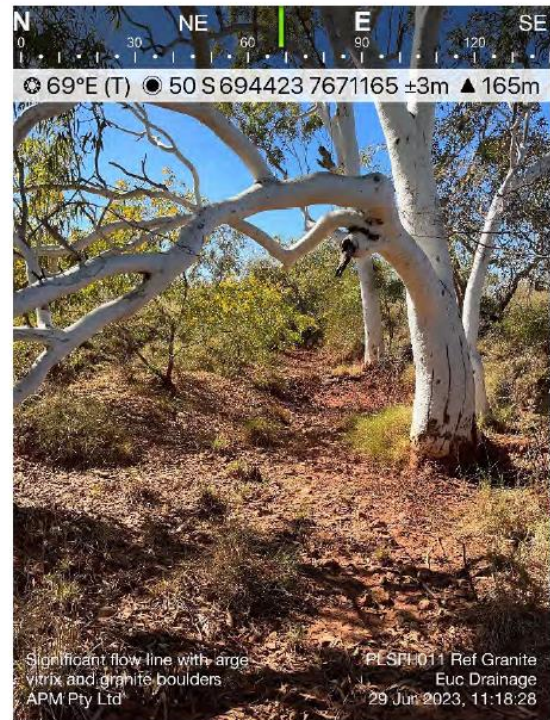
Survey Sites:  
 C14/16(1)  
 C11/36(2)  
 C6/10(1)  
 AS642022  
 AS45085  
 FH011

Major sandy bottomed ephemeral drainage line, with exposed granite and large trees.

In areas where granite bedrock is exposed there is opportunity for ephemeral pools. Large trees are present in places that support many upright very large hollows and some hollow logs large enough for quoll. Fallen hollow timbers and crevices in granite provide opportunity for sheltering fauna. Dense tall vegetation provides shading and litter accumulation. Rainbow Bee Eater which was observed to have nests where incised steep clay edges were present. Sand in the stream beds is suitable for burrowing species.

Cattle impacts were moderate. The weedy and fire prone introduced fodder grass genus *Cenchrus* is present in low frequency and density. Fires are of moderate frequency and low to moderate intensity.

The vegetation consists of low open woodland of *Corymbia hamersleyana*, over *Acacia acradenia*, *Acacia adsurgens* and *Indigofera rugosa* mid open shrubland and *Triodia wiseana*, *Triodia epactia* and *Triodia lanigera* hummock grassland.



**Historic Mine workings**

Survey Sites:  
 C20/32(1)  
 AS660630  
 FH003

Appears to be old screening site. Many piles of gravel. Deep soil profile in some gullies (deposition). Drainage line dammed at 3 points. Entire closed valley disturbed by dams.

The gravel piles and areas of deposition provide soft substrate for burrowing animals and the presence of open surface water provides semi-permanent pools. The open vegetation and semi-permanent water are likely to provide suitable foraging habitat for Pilbara leaf-nosed bat.

Vegetation consists of *Eucalyptus leucophloia* and *Corymbia hamersleyana* low open woodland; *Acacia inaequalata*, *Acacia acradenia* and *Corchorus incanus* sparse mid shrubland over *Triodia epactia*, *Triodia chichesterensis* and *Triodia brizoides* mid hummock grassland.

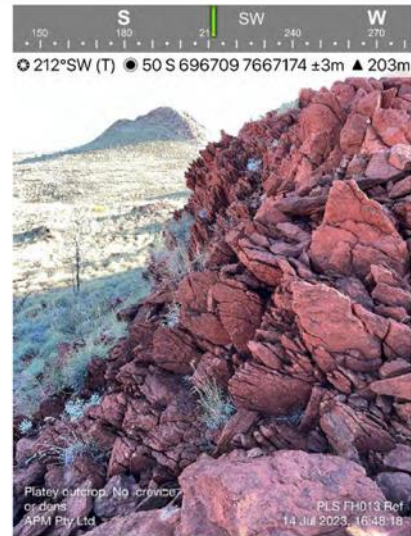


### Rocky Outcrop

Survey Sites:  
 C13/35(1)  
 C21/34(1)  
 C7/37(1)  
 C21x(2)  
 C13/35(2)  
 C7/37(2)  
 AS660654  
 FH013  
 FH002


Rocky outcrops composed of angular, red granite boulders, occurring on hill tops or in steeply incised drainage lines. Small crevices and overhangs present, which may provide important shelter sites for small and large reptiles such as goannas and snakes, and mammals such as the Northern quoll. No large caves are present that would be sufficient for the Pilbara leaf-nosed bat or Ghost bat roosting. Soils are shallow and occur in small pockets between rocks and are unsuitable for burrowing species. One hill supports a patch of *Ficus* (a known preferred food of the Northern quoll).

This fauna habitat is synonymous with the FH1 fauna habitat reported in (APM 2022a) and Infill Survey (2023) and the Rocky Hill habitat reported in 360 Environmental (2016). The occurrences in the northern extent of the Survey Area are continuous with previously mapped similar habitat at Lynas Find. In the southern extent of the Survey Area, occurrences are small, isolated outcrops, fragmented from the adjoining ranges by plains areas, but does contain the stand of *Ficus*.



D Disturbed

Extent in Survey: Completely Degraded – cleared land.  
 10.76 ha (3.2%)

Code/Name/Sites	Description	Photo
<p><b>Sandy Plains</b></p> <p>Habitat Code: FH4</p> <p>Survey Sites:            MSC020,            MSC024            NP1            T04, T06, T07,            T10, T11, T12</p> <p>Extent in Survey Area: 137.01 ha (40.9%)</p>	<p>This habitat type is characterised by its red sandy loam soils with low surface rock/pebble cover. The sandy substrate is suitable for burrowing species and in some places the spinifex hummocks are large, which can provide shelter for fauna. A sparse Eucalypt overstory is present, however trees are mature and sometimes large, offering perching opportunities and the potential for future hollow development.</p> <p>Availability of microhabitats in a sparse canopy, and in the groundcover of spinifex and soft substrate mean the habitat value is moderate.</p> <p>Approximately half of this habitat type was burned in a low intensity fire in the past 2 years.</p> <p>Cattle grazing intensity was moderate to high. Cat tracks were also recorded within this habitat type.</p> <p>The vegetation consists of Isolated low <i>Corymbia hammersleyana</i> over mid to tall <i>Acacia adsurgens</i>, <i>Acacia cowleana</i> and <i>Acacia coleii</i> sparse shrubland with mid hummock grassland of <i>Triodia lanigera</i>, <i>Triodia epactia</i> and <i>Triodia wiseana</i>.</p> <p>This fauna habitat is synonymous with the FH4 fauna habitat reported in APM (2022a) and the Sandy Plain habitat reported in 360 Environmental (2016).</p>	



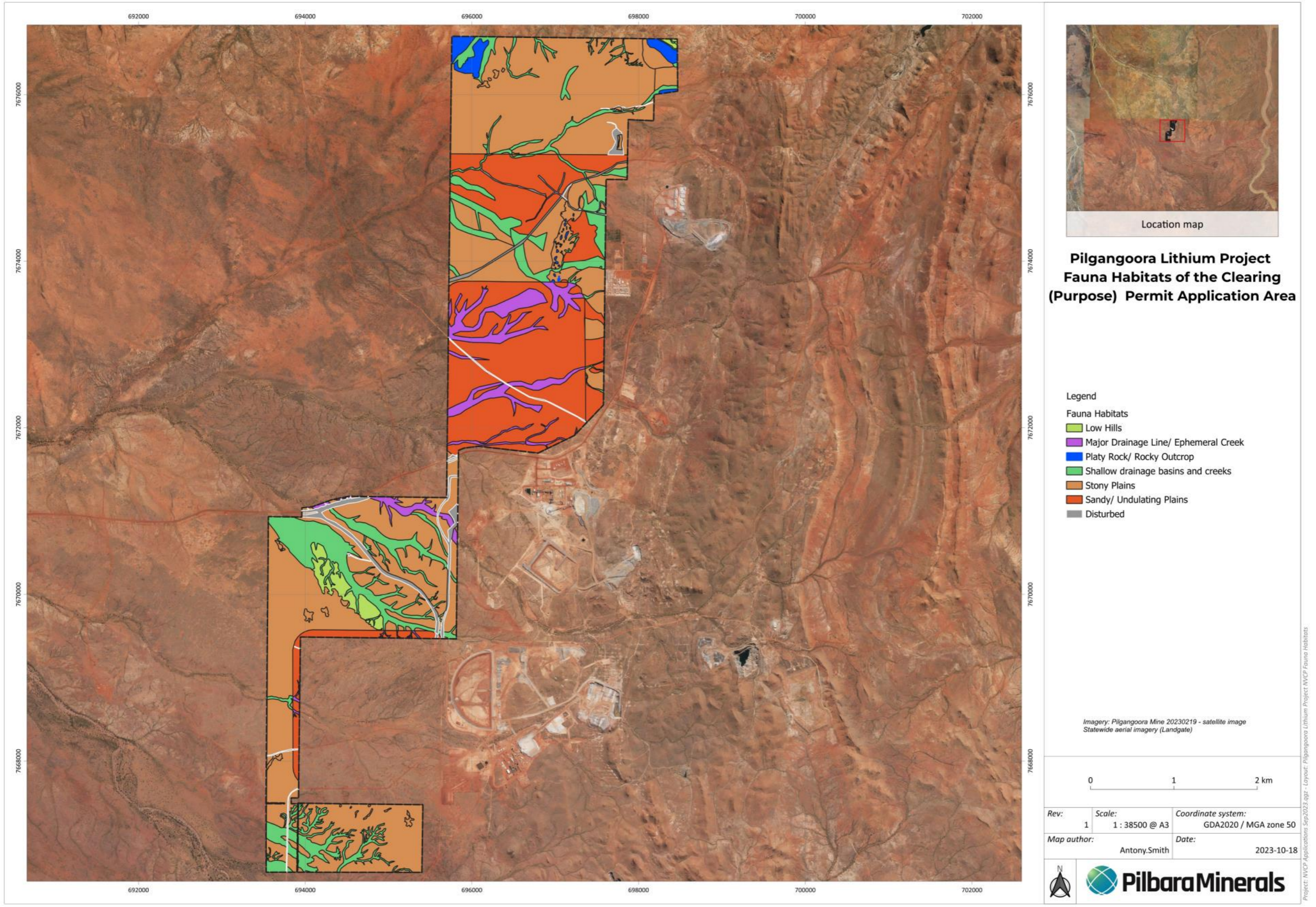


Figure 2-7: Fauna habitats of the permit application area

### *Conservation Significant Fauna*

#### APM 2022 Study

The APM 2022 survey recorded active Pebble mound mouse mounds. The Pebble mound mouse is known to occur in the area and its presence within the Survey Areas is confirmed. The suitability of mound building habitat is confined by the availability of suitable size pebbles, which occur on the higher rises.

The Northern quoll is known to occur in the local area and critical habitat has been identified in the ridgeline to the east of the Survey Areas, outside of the permit application area. The 2022 Survey Area is more than 4 km from this critical habitat.

The 2022 Survey Area contain habitats that are of possible value to the Northern quoll for foraging and dispersal however, they are of low quality. No signs of the Northern quoll were recorded and no captures on cameras were obtained. It is possible the Northern quoll occasionally uses the Survey Areas however, they do not constitute critical habitat.

Pilbara leaf-nosed bat activity has been recorded in the local area for foraging purposes, with diurnal roosts occurring at least 2.7 km outside of the permit application area. The quality of habitat for the Pilbara leaf-nosed bat is limited to low quality foraging – the species may occasionally use the site for foraging or in transit to other more productive areas.

The Ghost bat is known to occur in the local area and diurnal roosts are known to occur within range of the Survey Areas. There has been no known roosts identified within the project area fauna surveys. Any occurrence is likely to occur only for foraging purposes.

The Grey falcon is known to occur in the local area and the Survey Areas are within foraging range of the species. Grey falcon nesting in the Turner River area are likely to visit the Survey Areas only for the purpose of foraging.

During periods of inundation, the Survey Areas are likely to sustain habitat suitable for migratory shorebirds. The quality of the habitat is likely to be lower than those available in the near coastal areas, as reflected in the lack of records from the site and immediate surrounds. There are no nationally or internationally significant aggregations of migratory species known to occur within or near the Survey Areas.

An abandoned burrow that may once have hosted Brush-tailed mulgara was recorded. The burrow was collapsed, however there were indications of a multi-entranced burrow system as used by the Brush tailed mulgara. Suitable habitat is limited to the sandy rises that occur sporadically throughout the undulating plains. No further signs were recorded. There is no evidence of the species being currently present.

#### APM 2023a Survey Area

The APM 2023 a targeted survey for conservation significant fauna identified one call sequence of the Pilbara Leaf-nosed bat was recorded within the Permit Application Area. The detection of a single short echolocation call sequence away from areas of suitable roosting habitat is indicative of an individual of this species out foraging.

The Western pebble-mound mouse is present within the application area, with three mound locations identified. The Pebble mound mouse is known to occur in the wider region.

The Grey falcon is known to occur in the wider region and the application area is within foraging range of the species.

Denning, foraging and dispersal habitat suitable for the Northern quoll occurs, but evidence of presence was limited to one scat. Critical habitat has been identified outside of the permit application area, 4 km to the east. The Permit application area has excluded all identified critical habitat for the Northern Quoll.

Abandoned burrows for what may be identified as the Brush-tailed mulgara possibly indicate the species was historically present.

Wallaby scats possibly indicate the presence of Spectacled Hare-wallaby (mainland), but with no records during the survey.

#### APM 2023b Survey Area

Previous records of Threatened or Priority fauna species in the Survey Area is restricted to a Northern Quoll scat recorded in a Rocky Outcrop area in the south-eastern extent. An additional eight conservation significant fauna are likely to occur based upon local records and the availability of suitable habitat.

Denning, foraging and dispersal habitat suitable for the Northern quoll in the Rocky Outcrop areas. Northern quoll presence was confirmed in the north-eastern extent through camera captures, and in the southern extent, where previous evidence was found, in the form of scats. No critical habitats identified within the permit application area.

Call sequences of the Pilbara leaf-nosed Bat. The Pilbara leaf-nosed Bat is known to occur in the local area and diurnal roosts occur within the range of the Survey Area. There are no roosts suitable for the Pilbara leaf-nosed Bat in the Survey Area. The conservation ranking of foraging habitat in the Survey Area is limited to small areas of Priority 2 (Historic Mine Workings) and 3 (Rocky Outcrop) in the north-eastern extent. These areas remain outside the permit application area.

Some signs that could be attributed to Bilby were identified within the area, however there was no presence confirmed. Even if the signs were confirmed to belong to bilby, the occurrence would be transitory and indicates that limited forage was available, and therefore the application area does not present important habitat for this species.

Two active, four intermediate and two extinct Pebble-mound mouse mounds. The suitability of mound building habitat is confined by the availability of suitable size pebbles, which occur in subsections of the Stony Plains and Low Hills habitats

Wallaby scats were identified within the area, but no visual records. Suitable habitat for the species would be the Shallow Drainage Basins and Creeks.

Habitats that would be subject to inundation in the Survey Area are limited to the claypans or gilgai within the Stony Plains habitat. Due to the high evaporation rate and low vegetation cover these are unlikely to retain water for more than a short period and are unlikely to sustain habitat suitable for migratory shorebirds. There are no nationally or internationally significant aggregations of migratory species known to occur within or near the Survey Area

Foraging habitat suitable for the Grey falcon and Ghost bat occurs and may be used by local populations, however no evidence of their presence was recorded.

It should be noted the NVCP purpose permit application area excludes any potential habitat for the Northern Quoll, including low quality habitats.

## 2.10 ENVIRONMENTALLY SIGNIFICANT AREAS

### 2.10.1 CONSERVATION ESTATE

The Western Australian Conservation Estate includes land and waters vested in the Conservation and Parks Commission under the Conservation and Land Management Act 1984. The Conservation Estate is managed by the Parks and Wildlife Service of DBCA to protect WA's biodiversity, and includes National Parks, Nature Reserves, Conservation Reserves, and other areas managed primarily for biodiversity conservation (DEE 2016).

A search of the Collaborative Australian Protected Area Database returned no conservation estates located within 50 km of the Survey Areas. The nearest gazetted terrestrial conservation estate is Mungaroona Range, 85 km to the south-west of the Survey Areas.

No part of the permit application area appears within the Western Australian conservation estate.

### 2.10.2 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally Sensitive Areas (ESA) are areas that are defined by the Department of Water and Environment Regulation (DWER) (2019) as:

- A declared World Heritage property as defined in s.13 of the EPBC Act;
- An area that is included on the Register of the National Estate, because of its natural heritage value under the Australian Heritage Council Act 2003;
- A defined wetland and the area within 50 m of the wetland;
- The area covered by vegetation within 50 m of T flora, to the extent to which the vegetation is continuous with the vegetation in which the T flora is located;
- The area covered by a TEC;
- A Bush Forever site;
- Areas covered by the Gnangara Mound Crown Land Policy and Western Swamp Tortoise Policy;
- Areas covered by lakes, wetlands and fringing vegetation of the Swan Coastal Plain Lakes Policy, including Southwest Agricultural Zone Wetlands Policy and Swan and Canning Rivers Policy; and
- Protected wetlands as defined in the Environmental Protection (Southwest Agricultural Zone Wetlands) Policy 1998.

The Australian Wetlands Database includes nationally significant wetlands (as listed in the directory of important wetlands), wetlands listed under the Ramsar convention, wetlands that are representative, rare or unique, or wetlands that are considered of international importance (DEE 2019). The nearest wetlands listed in the Directory of Important Wetlands within 150 km of the Survey Areas are the Leslie (Port Hedland) Salt fields System, 80 km to the north, the De Grey River System, 85 km to the north-east, and the Fortescue Marshes, 130 km to the south-west.

No sites within the permit application area comprise *Environmentally Sensitive Areas* within the *Environmental Protection (Environmentally Sensitive Area) Notice 2005*, declared under Part V, Division 2 of the *EP Act 1986*.

### 3. ENVIRONMENTAL RISK MANAGEMENT

#### 3.1 IDENTIFYING ENVIRONMENTAL THREATS

Threats related to clearing of native vegetation at the Pilgangoora Project are summarised in Table 9.

Table 9: Threats from native vegetation clearing

ENVIRONMENTAL THREAT	POTENTIAL RISK
Clearing of native vegetation	Clearing beyond approved boundaries and/or exceeding approved disturbance areas.
Dust	Impacts to native flora caused by dust emanating from the site.
Impacts to surface water flows	Clearing of vegetation leading to changes to runoff or mobilisation of sediment resulting in adverse impacts to natural surface water flows, potentially impacting creek lines and downstream riparian vegetation.
Native fauna and habitat	Clearing of vegetation and activity associated with the project has potential to directly (vehicle strikes, habitat removal) and indirectly impact native fauna (changes to foraging or dispersion dynamics).
Introduced flora	Weeds competing with native species and impacting the success of rehabilitation.

#### 3.2 RISK ASSESSMENT

An Environmental Risk Assessment was undertaken for the threats identified above using the criteria adopted from the DMIRS Statutory Guidelines for Mining Proposals (2020) – see Table 10 below. The Site Environmental Risk Assessment process appears in Appendix 5.

Table 10: Environmental risk assessment

ENVIRONMENTAL THREAT	CAUSE	POTENTIAL IMPACT	BEFORE MANAGEMENT			MANAGEMENT PRACTICES TO BE IMPLEMENTED	AFTER MANAGEMENT		
			Consequence	Likelihood	Inherent Risk		Consequence	Likelihood	Residual risk
Clearing of vegetation	Clearing works undertaken for project development	Clearing of vegetation in unapproved areas and/or outside the tenement boundary.  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Possible	Moderate (B3)	<ul style="list-style-type: none"> <li>Survey undertaken prior to clearing.</li> <li>Induction training highlights the procedure for clearing and the consequences of unauthorised clearing.</li> <li>Land Use Certificate permitting system and procedure is in place.</li> <li>Survey control of areas to be cleared.</li> <li>Post clearing checks to ensure clearing has been undertaken in accordance with approval.</li> </ul>	Moderate	Unlikely	Moderate (C4)
		Clearing of vegetation resulting in loss of conservation significant species or habitat.  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Likely	High(C2)	<ul style="list-style-type: none"> <li>Survey undertaken prior to clearing.</li> <li>Induction training highlights the procedure for clearing and the consequences of unauthorised clearing.</li> <li>Land Use Certificate permitting system and procedure is in place.</li> <li>Survey control of areas to be cleared.</li> <li>Understand and record Priority Flora locations. Maintain GIS records and record impacts to Priority Flora if they are subject to clearing.</li> </ul>	Moderate	Possible	Moderate (B3)
Dust	Vehicle and machinery movement	Dust resulting from movement of vehicles and operation of machinery settles on adjacent vegetation and causes plant death.  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem	Minor	Likely	Moderate (B2)	<ul style="list-style-type: none"> <li>Regular dust suppression of vehicle access roads, hardstand areas using water carts.</li> <li>Stripping and movement of topsoil not to be undertaken in windy conditions where practical.</li> </ul>	Minor	Unlikely	Low (B4)
	Wind	Dust generated by wind blowing across cleared areas and stockpiles settles on adjacent vegetation and causes plant death.  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem	Minor	Likely	Moderate (B2)	<ul style="list-style-type: none"> <li>Regular dust suppression of vehicle access roads, hardstands using water carts.</li> <li>Dust suppression of stockpiles as required.</li> <li>Clearing of vegetation to be undertaken progressively.</li> </ul>	Minor	Possible	Moderate (B3)
Surface water flows	Interruption of natural surface water flows	Surface water flows are captured or redirected away from the natural drainage channels resulting in impact to riparian vegetation.  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem • Water resources	Major	Possible	High (D3)	<ul style="list-style-type: none"> <li>Surface water flows to be redirected away from operational areas in an effort to minimise disruption of surface flow.</li> <li>Surface Water Management Plan to implemented.</li> </ul>	Major	Unlikely	Moderate (D4)

ENVIRONMENTAL THREAT	CAUSE	POTENTIAL IMPACT	BEFORE MANAGEMENT			MANAGEMENT PRACTICES TO BE IMPLEMENTED	AFTER MANAGEMENT		
			Consequence	Likelihood	Inherent Risk		Consequence	Likelihood	Residual risk
	Uncontrolled surface water movement	Surface water flows carry sediment into surrounding vegetation causing vegetation death.  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem • Water resources	Moderate	Likely	High (C2)	<ul style="list-style-type: none"> <li>Drainage and containment structures to direct flows to sediment traps for removal of sediment before discharge to the environment.</li> </ul>	Moderate	Unlikely	Moderate (C4)
Native fauna and habitat	Clearing of Vegetation	Clearing results in loss of conservation-significant fauna or suitable habitat  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Possible	Moderate (C3)	<ul style="list-style-type: none"> <li>Survey undertaken prior to clearing.</li> <li>Clearing managed with the Land Use Certificate process.</li> </ul>	Moderate	Unlikely	Moderate (C4)
	Interaction with fauna	Interaction with native fauna causes detriment to significant species.  Environmental factor: • Biodiversity/Flora/Fauna/ Ecosystem	Moderate	Possible	Moderate (C3)	<ul style="list-style-type: none"> <li>Induction and site rules relating to avoiding interaction with fauna.</li> <li>Appropriate management of waste.</li> <li>Speed limits imposed on Project roads.</li> <li>Management of site landfill in accordance with DWER licence conditions.</li> </ul>	Moderate	Unlikely	Moderate (C4)
Introduced flora	New weed species introduced to site	Machinery and equipment brought to site carrying seeds of weed species not currently found in the project area. Environmental factor: • Biodiversity/Flora/Fauna/Ecosystem	Minor	Possible	Moderate (B3)	<ul style="list-style-type: none"> <li>Weed hygiene procedure.</li> <li>Machinery and equipment to be cleaned prior to being mobilised to site.</li> <li>Inspection of machinery on arrival, not permitted to work until appropriately cleaned.</li> <li>Weed surveys to be undertaken.</li> </ul>	Minor	Unlikely	Low (B4)

### 3.3 SPECIFIC MANAGEMENT ACTIONS TO ADDRESS IMPACTS FROM CLEARING

An assessment of the environmental risks related to development and operation of the Pilgangoora Project has been undertaken. The following sections summarise the management methods for each of the key risks identified in the risk assessment. Factors assessed as having a Low level of risk (refer to Table 10) are not considered further.

#### 3.3.1 CLEARING OF NATIVE VEGETATION

##### *Mitigating factors*

Vegetation in the Pilbara is resilient and typically recovers quickly following disturbance.

Populations of *Triodia chichesterensis* (P3) and *Euploca mutica* (P3) were recorded within the purpose permit application area.

The species are believed to be disturbance opportunists and are therefore likely to respond positively to small areas of disturbance. This species was not found in the APM 2022 survey. If the species still occurs within the proposed application area, they are expected to be cleared for establishment of infrastructure at the Project.

##### *Management Actions*

To ensure clearing is managed appropriately management actions will include:

- The locations of Priority 3 flora species *Triodia chichesterensis* and *Euploca mutica* have been documented and is included in the GIS database. Impacts will be recorded as areas are cleared. Periodic inspection of soil stockpiles will be undertaken to monitor germinants of these species.
- Vegetation clearing protocols and the potential impacts of unauthorised clearing are included in the site induction.
- A Land Use Certificate system is in place and requires sign off by the Environmental Advisor prior to clearing being undertaken.
- If the species are identified on site, efforts to minimise clearing and disturbance of the areas and surrounding vegetation will be implemented.
- Survey control will be utilised to set out the limits of areas to be cleared using survey pegs and flagging tape.
- All site personnel will be made aware of the vegetation clearing procedure and permitting requirements.

#### 3.3.2 DUST

The main environmental impact resulting from dust emission is vegetation death emanating from high levels of dust settling on plant leaves, preventing photosynthesis and respiration.

The main sources of dust are clearing of vegetation, vehicle movement, machinery operation and strong winds.

Freshly cleared ground, as well as open areas such as laydowns and soil stockpiles have potential to generate dust, particularly in windy conditions.



#### *Mitigating Factors*

There is no vegetation believed to be particularly sensitive to dust. Rainfall during the wet season will assist in settling dust as well as removing it from plants.

#### *Management Actions*

To minimise dust generation management actions will include:

- Land clearing will be undertaken progressively and only when required.
- Land clearing and handling of topsoil in windy conditions will be avoided as far as practical.
- Ongoing annual vegetation assessments will continue to assess possible impacts from dust.

### **3.3.3 SURFACE WATER**

The creeks and drainages within the permit application area are ephemeral in nature and only convey flow following periods of significant rainfall. High intensity, short duration rainfall events occur during the summer months when the potential exposure to tropical cyclones and other low-pressure related events is greatest.

Surface water management will be implemented where required, to maintain the creek line function during mine development and operations in the permit application area.

#### *Potential Impacts*

Potential impacts to surface water drainage include:

- interruption to natural surface water flow patterns
- reduction of surface water runoff volume to the downstream environment
- adverse impact to riparian vegetation downstream from the Project
- increased risk of erosion and sedimentation resulting from ground disturbance

#### *Mitigating Factors*

Flood protection will be constructed around the key mining activities and infrastructure where required. This will ensure a significant volume of surface runoff continues to make its way to the natural drainage channels and minimise sedimentation.

Surface water flows and subsequent runoff into the creeks is very intermittent and highly variable. Riparian vegetation in the region is therefore adapted to intermittent and variable water availability.

#### *Management Actions*

Within the permit application area, where required any changes to the surface water hydrology will be assessed as part of future applications for a Bed and Banks Permits, under the *Rights in Water and Irrigation Act 1914*.

### **3.3.4 NATIVE FAUNA AND HABITAT**

It is proposed that within the Permit Application Area, up to 1000 ha of vegetation may be cleared.

#### *Potential Impacts*

Clearing of vegetation has potential to impact fauna habitat.

Increased vehicle and machinery movements have potential to result in animal impacts from vehicle strikes.

#### *Mitigating Factors*

There are no Environmentally Sensitive Areas (ESA) or Threatened Ecological Communities (TEC) within the Project area.

The conservation significant fauna species recorded in the Project area are considered to be relatively common across the Pilbara (western pebble-mound mouse, grey falcon) or only foraging within the Project area with no active roosts present (Pilbara leaf-nosed bat).

The purpose permit application area has been defined to exclude any habitat for the Northern Quoll.

#### *Management actions*

The specific management measures to mitigate the potential impacts from land clearing on fauna habitat include:

- Clearing of vegetation will be kept to the minimum required for the Project
- Land clearing management actions will be implemented to ensure clearing is undertaken as per the conditions of any granted Native Vegetation Clearing Permit
- Where required, the PLS Northern Quoll Management Plan will be implemented.

Management measure related to direct impact or interaction between personnel and fauna include:

- All employees and contractors will be required to participate in the site induction which will cover general and site-specific fauna issues, including information about legal obligations to protect fauna.
- Employees and contractors who are nominated to handle fauna, for example, the removal of snakes from work areas, will require suitable training and permits
- Vehicle movements will be confined to defined haul roads and access roads, and all roads within the mining area will have a maximum speed limit of 60km/h
- Native fauna will not be captured or intentionally handled except by personnel or consultants qualified and required to do so
- Road kills to be removed from the road by a minimum distance of 10 m into the vegetation to avoid further impacts on fauna, such as birds of prey feeding on carcasses

### **3.3.5 INTRODUCED FLORA**

Eight introduced flora species have been identified within the permit application area. They are common throughout the Pilbara Region.

#### *Potential Impacts*

Introduced flora has potential to spread throughout the project area as a result of vehicle and soil movement. Many of these species thrive in disturbed ground and subsequently compete with native species in rehabilitated areas, potentially adversely impacting the success of rehabilitation.

Buffel grass is a preferred fodder crop for cattle in the region. The species is widespread in lower-lying and previously disturbed ground, as well as creek lines, throughout the project area.

#### *Management actions*

To minimise the potential for adverse impacts resulting from introduced flora, PLS have implemented, or are in the process of implementing the following management actions:

- Weed surveys commenced in 2018 to determine introduction and/or spread of weed species and are ongoing throughout the broader project area.
- An ongoing weed control program within the broader project area.
- A weed hygiene program is in place and includes a requirement for machinery to be thoroughly cleaned and inspected before entering the site.
- Vegetation monitoring sites are to be established when sufficient rehabilitation has been completed and will include a measure of weed abundance in rehabilitation areas. The intent is that weed abundance in rehabilitated areas post-mining will not exceed weed abundance in comparable non-mining areas.

## 4. ADDRESSING THE TEN CLEARING PRINCIPLES

Under section 51-O of the *EP Act*, the CEO must have regard to the clearing principles, outlined in Schedule 5 of the *EP Act*, when deciding to grant, or refuse, a permit. Table 11 below addresses the ten clearing principles in relation to the permit application area.

Table 11: Addressing the Ten Clearing Principles

THE TEN PRINCIPLES OF CLEARING NATIVE VEGETATION	
<b>Principle (a)</b>	<b>Native vegetation should not be cleared if it comprises a high level of biological diversity</b>
<p>The flora and vegetation surveys within the Permit Application Area recorded a total of:</p> <ul style="list-style-type: none"> <li>• 120 taxa (67 genera from 28 families) recorded by APM (2022) for TSF Option 2 (which also includes an additional similar sized area called TSF Option 5),</li> <li>• 118 taxa (67 genera and 25 families) recorded by APM (2023a) for the E45/2287 Infill Survey</li> <li>• 143 taxa (74 genera and 28 families) within the APM (2023b) survey area.</li> </ul> <p>The level of flora diversity in the permit application area is not high, relative to other surveys in the local and regional area.</p> <p>Fauna habitats recorded are like those recorded in the surrounding areas and are not unique to the permit application area. On a regional level, Burbidge et al. (2010) find that habitats that support significantly higher biodiversity for avian fauna in the Pilbara are riverine levees, riverine beds, or clay pans with River Gums and/or paperbark trees.</p> <p>Whilst the survey areas contain drainage lines, including a Major Drainage Line (APM 2023b), the riparian vegetation does not contain Red Gum or Melaleuca and is not as well developed as described by Burbidge et al. (2010). On a National and International level there are no Key Biodiversity Areas in the survey areas, with the closest being the Fortescue Marsh, 140 km to the south.</p> <p>Thereby the proposed clearing is unlikely to have a significant impact on biological diversity and it is unlikely to be considered to be at variance with clearing principle (a).</p>	
<b>Principle (b)</b>	<b>Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia</b>
<p>Fauna habitats within the Permit Application Area are typical of the local and regional area and are not unique to the area. The survey areas are typical of the Land Systems within which they occur (Department of Primary Industries and Regional Development, 2019).</p> <p>The Land Systems comprising the Permit Application Area include the Macroy, River, Satirist and Talga systems, with the distribution of the Macroy system described as very common and the River and Talga systems described as common. The Satirist system, described as Level stony plains, low rises, clay plains with gilgai microrelief and drainage tracts with few channels with relief up to 10 m, has an uncommon distribution, but is mapped as occupying 377 km<sup>2</sup>.</p> <p>The Permit Application Area contains less than 3 km<sup>2</sup> of the Satirist Land System and therefore does not comprise the whole of any fauna habitat.</p>	

The Permit Application Area has been allocated to avoid high value Rocky Outcrop habitat, identified in the east of the project area for the Northern Quoll. The only identified northern quoll critical habitat is located outside of the permit application area, 4 km to the east.

A small, isolated outcrop of Rocky Outcrop (APM 2023a), fragmented from the adjoining ranges to the east, was identified as possible low quality habitat. This area has also been excluded from the permit application area. In the surveys completed, this habitat type does not appear to be frequented by the species.

On current knowledge, foraging or dispersal habitat is recognised (CoA 2016) to be any land comprising predominantly native vegetation in the immediate area (i.e. within 1 km) of shelter habitat, quoll records or land comprising predominately native vegetation that is connected to shelter habitat within the range of the species. The permit Application Area has avoided areas within 1 km of Rocky Outcrop, that have been identified as critical habitat.

Significant habitat for the Pilbara leaf-nosed bat occurs 2.7 km northeast and 2.9 km east of the northeastern extent of the Permit Application Area. The former is the Category 1 or 2 roost with an estimated population of 25 to 50 bats. The latter is the abandoned pit lake that provides high quality foraging habitat. Both areas are located outside of the proposed permit application areas. There are no caves or areas in the Permit Application Area suitable for Pilbara leaf-nosed bat roosting.

Clearing is not likely to be at variance with Principle B.

**Principle (c)**

**Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.**

No rare (Threatened) flora has been recorded from the permit application area and the vegetation in the assessment area is unlikely to include, or be necessary for the continued existence of rare flora.

Vegetation was determined as unsuitable habitat (or suitable land system) for the Endangered *Quoya zonalis* (formerly *Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4)).

Two Priority three (P3) species have been recorded in the permit application area. *Triodia chichesterensis* has been recorded in the Clearing Application Area (APM 2022a, 2023a, 2023b) and is also known from database records. Within 30 km there are 15 occurrences listed on databases, of which nine record it as the dominant species

Clearing of vegetation containing *Triodia chichesterensis* is unlikely to be at variance with Principle C if:

- Allocation of disturbances retains some of the occurrences within the Clearing Application Area; and
- Cumulative clearing within the broader Pilgangoora Project Area retains some occurrences outside of the Clearing Application Area

*Euploca mutica* (P3) was recorded in the APM (2023a) survey, with 31 individuals across four locations. Within 30 km there are 26 occurrences listed on databases, predominantly occurring as single or few individuals, and one record of over 100 individuals. Clearing vegetation containing *Euploca mutica* is unlikely to be at variance with Principle C.

As discussed in section 3.3.1 the Land Use Certificate process will be implemented prior to clearing and areas assessed by Senior Environmental Personnel. Disturbances to vegetation and known species will be limited where possible.

The proposed clearing is not likely to be at variance with clearing principle (c).

<b>Principle (d)</b>	<b>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.</b>
<p>The vegetation of permit application area is not consistent with the description of any threatened ecological community.</p> <p>The closest Priority Ecological Community to the permit application area is the Gregory Landsystem, over 30 km away. Given the distance from the PEC the clearing will not impact the community.</p> <p>Therefore, the clearing is not likely to be at variance with clearing principle (d).</p>	
<b>Principle (e)</b>	<b>Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.</b>
<p>Regional Vegetation Associations within the permit application area as described by Beard have over 99% pre-European Vegetation extent remaining. Conservation significance ranking of vegetation associations occurring within the permit application area are of 'Least Concern'.</p> <p>The proposed clearing is not likely to be at variance with clearing principle (e).</p>	
<b>Principle (f)</b>	<b>Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.</b>
<p>The permit application area intersects a major drainage line, minor creek lines and drainage depressions. The ephemeral creeks flow periodically during high rainfall events associated with cyclonic events and tropical lows. Being ephemeral creeks, the associated vegetation is adapted long periods with no stream-flows.</p> <p>Five vegetation types were mapped within the drainage features of the permit application area, including vegetation types: 4b, 7b, 13a, 14a and 15a.</p> <p>Major drainage lines and creek lines will be avoided during clearing, to maintain connectivity. Where required, stream-flows are proposed to be diverted around cleared areas and directed back into the catchments. If creeklines are required to be cleared, it will be for very small isolated and limited activities (i.e.- for a road) in which a bed and banks permit will be applied for.</p> <p>The connectivity of streams within the permit application area will be preserved and vegetation within those streams retained.</p> <p>Proposed clearing within the clearing envelope is not likely to be at variance with principle (f)</p>	
<b>Principle (g)</b>	<b>Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.</b>
<p>Clearing within the permit application area is for the development of mining infrastructure. The infrastructure will be constructed in accordance with appropriate guidelines and standards to prevent appreciable land degradation.</p> <p>The clearing will be undertaken to minimise potential erosion, sediment movement, dust impacts and water contamination in accordance with management actions outlined in Section 3.3 above. Weed impacts will be managed by undertaking the activities outlined in Section 3.3.5.</p>	

The proposed clearing is not likely to be at variance with clearing principle (g).	
<b>Principle (h)</b>	<b>Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.</b>
<p>The nearest conservation area to the assessment is the DBCA-managed Mungarooka Range Nature Reserve, which is approximately 80 km south-west of the assessment area.</p> <p>Millstream-Chichester National Park is 120 km west-south-west while Karijini National Park is 140 km south.</p> <p>The proposed clearing is not likely to be at variance with clearing principle (h).</p>	
<b>Principle (i)</b>	<b>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.</b>
<p>Clearing native vegetation may temporarily cause runoff and sedimentation. However with appropriate management actions, impacts on hydrology and drainage should be manageable, particularly as the soils of the Macroy, Talga and Satirist land systems have low erodibility.</p> <p>Impacts to surface and groundwater will be managed as discussed in Section 3.3.3 Any proposed clearing is not likely to intersect groundwater resources of the area as the reported groundwater is &gt;15 metres below ground level.</p> <p>Clearing will be undertaken in accordance with a Land Use Certificate permitting system. Controls outlined in the Land Use Certificate permitting system reduce potential clearing during wet periods or inappropriate conditions that would lead to surface water quality deterioration.</p> <p>Clearing is to be undertaken shortly before commencement of infrastructure construction (&lt; 3 months), limiting the period during which cleared land is subject to erosion that would lead to surface water quality decline.</p> <p>The proposed clearing is not likely to be at variance with principle (i).</p>	
<b>Principle (j)</b>	<b>Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.</b>
<p>The Permit Application Area does intersect one major and multiple ephemeral creek lines. The substrate is predominantly sandy, indicating that rainfall is likely to infiltrate and surface flow is likely only during high magnitude (i.e. prolonged) or high intensity rainfall events.</p> <p>The proposed clearing will support future mining infrastructure and activities. Any proposed clearing for infrastructure is expected to further reduce the volume of water produced by the catchment and so potential for causing or exacerbating the incidence or intensity of flooding is minimal.</p> <p>The proposed clearing is not likely to be at variance with principle (j).</p>	

## 5. REFERENCES

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## 6. APPENDICES

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## APPENDIX 1 - OWNERSHIP OF TENEMENTS

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## **APPENDIX 2 - ANIMAL PLANT MINERAL BIOLOGICAL SURVEY REPORT**

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Animal Plant Mineral Pty Ltd (2022) *Pilbara Minerals: TSF Options 2 and 5, Pilgangoora Project Biological Survey, Pilbara, Western Australia*

## **APPENDIX 3 - ANIMAL PLANT MINERAL BIOLOGICAL SURVEY REPORT**

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Animal Plant Mineral Pty Ltd (2023) *Pilbara Minerals: Infill Biological Survey, Pilbara, Western Australia*

## **APPENDIX 4 - ANIMAL PLANT MINERAL BIOLOGICAL SURVEY REPORT**

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Animal Plant Mineral Pty Ltd (2023) *Pilbara Minerals: Pilgangoora Biological Survey, Pilbara, Western Australia*

## APPENDIX 5 - SITE ENVIRONMENTAL RISK ASSESSMENT PROCESS

The Site Environmental Risk Assessment was undertaken to identify the high-level environmental risks for the construction, operation and closure phases for the Project. The primary objectives of the risk assessment process were to identify major environmental risks to ensure:

- Prioritisation of risk management activities
- Adequate control measures are in place to manage the identified major risks
- Identification of risks that require additional control measures
- Development of an Environmental Obligations Register
- Understanding amongst key operational staff of the environmental risks associated with the project.

Each identified risk or potential impact was analysed for likelihood and consequence and a risk ranking assigned. The levels for likelihood and consequence used are detailed in Table 1 and Table 2.

The risk matrix (Table 3) combines the level of likelihood and consequence to determine the level of associated risk. The risk rating (or environmental impact) for each risk was categorised as extreme (red), high (orange), medium (yellow) or low (green).

For each risk, an assessment was made of the associated risk rating assuming no operational controls or treatments were in place. This provided the inherent risk for the hazard. The risk rating for each risk or potential impact was then re-assessed assuming the proposed operational controls were in place to provide a residual risk rating. The risk assessment is included as Table 10.

Table 1: Likelihood definitions

LIKELIHOOD	#	DESCRIPTION
Almost Certain	1	The event is a common or frequent occurrence or an ongoing impact (e.g. daily).
Likely	2	The event is expected to occur under some conditions, or has occurred more than once.
Possible	3	The event will probably occur, or has occurred under some conditions (e.g. yearly).
Unlikely	4	Known to have occurred but not often.
Rare	5	Very unlikely/may occur in exceptional circumstances.

Table 2: Consequence definitions

CONSEQUENCE	#	DESCRIPTION
Insignificant	A	Confined to the immediate area, rapid clean up, no environmental damage.
Minor	B	Confined to an isolated area, rapid clean up using internal resources, minimal environmental damage, vegetation recovery within 1-2 years.
Moderate	C	Impact confined to the mine, clean up may require external assistance, moderate environmental damage, vegetation recovery within 2-5 years, regulatory report required.
Major	D	Major environmental impact, extends beyond mine, considerable clean up using internal and external resources, vegetation recovery takes 5+ years, potential for prosecution and adverse publicity.
Catastrophic	E	Severe environmental impact, extensive clean up and recovery period, requires ongoing internal and external resources, vegetation may not recover, prosecution.

Table 3: Environmental Risk Matrix

RISK MATRIX		CONSEQUENCE				
		Insignificant (A)	Minor (B)	Moderate (C)	Major (D)	Catastrophic (E)
Likelihood	Almost Certain (1)	Moderate	High	Critical	Critical	Critical
	Likely (2)	Moderate	Moderate	High	Critical	Critical
	Possible (3)	Low	Moderate	Moderate	High	High
	Unlikely (4)	Low	Low	Moderate	Moderate	High
	Rare (5)	Low	Low	Low	Moderate	Moderate