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ENVIRONMENTAL SCIENCES

Targeted and basic vertebrate fauna survey and Detailed flora assessment for the Roy Hill Stockpile Project

Prepared for Horizon Power

September 2023

Final

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Version history

Author/s	Reviewer/s	Version	Version number	Date submitted	Submitted to
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EXECUTIVE SUMMARY

Roy Hill have requested a 27-megawatt load for the Roy Hill Stockpile Project (the Project), located in Port Headland, Western Australia. Horizon Power (Horizon) proposes to supply the new Roy Hill SP3 load from the Hedland Distribution Terminal yard via the Southwest Creek substation, with a combination of overhead and underground transmission lines at 33kV and 66Kv.

In April 2023, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Horizon to undertake a flora, vegetation, and fauna survey for the Project. The flora survey was conducted from 21 to 23 June 2023, the fauna survey on 30 April 2023. The purpose of the survey was to support and inform environmental approvals required to facilitate development of a transmission line. The survey outcomes will inform environmental approvals required for the clearing of native vegetation. A desktop assessment of environmental constraints and species likely to occur within the proposed areas was conducted to inform flora and fauna survey followed by flora, vegetation, and fauna field surveys.

The desktop assessment identified the potential for 12 Priority flora to occur within the study area including one record for *Tephrosia rosea* var. Port Hedland (A.S. George 1114) (P1) and 2 records for *Bulbostylis burbidgeae* P4 previously recorded in the study area. No Threatened or Priority Ecological Communities (TEC/PEC) were likely to occur in the study area.

A total of 77 flora taxa representing 24 families and 50 genera were recorded in the study area during the field survey of which 72 were identified to species level. The assemblage included 67 native species and 5 introduced species, 63 perennial species, and 9 annual or short-lived species. The most prominent families recorded were Poaceae (16 spp.), Fabaceae (14 spp.), Chenopodiaceae (6 spp.), Malvaceae and Convolvulaceae (6 spp.).

No plants of *Bulbostylis burbidgeae* P4 were recorded at or in the vicinity of the desktop records in the study area and it is likely the plants were removed during road construction. A total of 305 plants of the Priority 1 species *Tephrosia rosea* var. Port Hedland (A.S. George 1114) were recorded in 3 populations in the study area.

A large proportion of the study area was cleared and devoid of vegetation, 5 vegetation types were defined in the remnant vegetation. One vegetation type (Te) may be considered to have local significance as it provides a role as a refuge for the Priority 1 flora *Tephrosia rosea* var. Port Hedland (A.S. George 1114). However, all plants of the Priority flora occurred in vegetation recorded to be in Degraded or Poor condition.

None of the vegetation was considered to be a TEC or PEC and the vegetation types defined were representative of vegetation associations with a broad distribution with a high proportion of pre-European extent remaining. The populations of *Tephrosia rosea* var. Port Hedland (A.S. George 1114) are the only significant botanical values in the study area.

Two discrete fauna habitats were identified within the study area, both of small extent that may occasionally be utilised by conservation significant fauna. The sandplains fauna habitat (comprising 68.34 ha) was the most extensive in the study area. This fauna habitat was predominantly of Very Good vegetation condition, but showed extensive evidence of disturbance from multiple sources. Despite the disturbance Bilby were present; however, considering the extent of the study area and the large home range of the species, it is unlikely this habitat in the study area is critical to their survival.

The intertidal mudflats fauna habitat represents a small portion of the South West Creek (comprising 2.81 ha). Two Migratory shorebird species were recorded in this habitat. Given the large extent of this fauna habitat type within the region it is unlikely that the study area provides critical and restricted habitat for these species.

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1 INTRODUCTION

Roy Hill have requested a 27-megawatt load for the Roy Hill Stockpile Project (the 'Project'), located in Port Headland, Western Australia (WA; Figure 1-1). Similar to the existing Roy Hill SP1 and 2 supply, Horizon Power (Horizon) proposes to supply the new Roy Hill SP3 load from the Hedland Distribution Terminal yard via the Southwest Creek substation, with a combination of overhead and underground transmission lines at 33kV and 66Kv.

In April 2023, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Horizon to undertake a flora, vegetation, and fauna survey for the Project.

The purpose of the survey was to support and inform environmental approvals required to facilitate development of a transmission line. The survey outcomes will inform environmental approvals required for the clearing of native vegetation.

The study area is located in the Shire of Port Hedland and the Eremaean Botanical Province and Climatic Region as defined by EPA (2016c) / EPA (2020).

1.1 SCOPE OF WORK

The scope of work for the flora, vegetation, and fauna survey was as follows:

- desktop assessment of environmental constraints and species likely to occur within the proposed areas, to inform flora and fauna survey effort
- flora, vegetation, and fauna surveys
- IBSA compliant spatial data package of the survey
- standalone technical memorandum.

The outcomes of the scope of works were to provide:

- identification of vegetation type and condition
- fauna habitat mapping
- identification of any Priority or TEC
- identification of any Priority or Threatened flora, including mapping the extent of any flora community if it extends outside the Project area to establish patch size
- identification of any Priority or Threatened fauna habitat to align with the mapping of vegetation type
- presence of weeds including Declared Pests and Weeds of National Significance
- opportunistic fauna sightings.

1.2 STUDY AREA

The study area is approximately 99 ha and located adjacent to existing Roy Hill Stockpile operations (Figure 1-1).

Horizon Power
Roy Hill Stockpile 3

Project No	1587
Date	5/09/2023
Drawn by	BK
Map author	PW

0 4 8
Kilometers

1:190,400 (at A4) GDA 1994 MGA Zone 50

- Study area
- DBCA managed land
- South west creek
- Environmentally Sensitive Areas
- Roads

Figure 1-1

Project location and study area

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2 LEGISLATIVE CONTEXT

The protection of flora and fauna in WA is principally governed by 3 acts:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- State *Biodiversity Conservation Act 2016* (BC Act)
- State *Environmental Protection Act 1986* (EP Act).

The BC Act came into full effect on 1 January 2019 and replaced the functions of the *Wildlife Conservation Act 1950* (WC Act).

2.1 COMMONWEALTH

The EPBC Act is administered by the Federal Department of Climate Change, Energy, the Environment and Water (DCCEEW). The EPBC Act provides for the listing of Threatened flora, Threatened fauna and Threatened Ecological Communities (TECs) as matters of National Environmental Significance (NES). Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of NES, require approval from the Australian Government Minister for the Environment through a formal referral process. Key threats and habitat critical to the survival of EPBC Act Threatened species are usually defined in the conservation advice and/or recovery plan for the species.

Conservation categories applicable to Threatened flora and fauna species under the EPBC Act are as follows:

- Extinct (EX)[1] – there is no reasonable doubt that the last individual has died
- Extinct in the Wild (EW) – taxa known to survive only in captivity
- Critically Endangered (CR) – taxa facing an extremely high risk of extinction in the wild in the immediate future
- Endangered (EN) – taxa facing a very high risk of extinction in the wild in the near future
- Vulnerable (VU) – taxa facing a high risk of extinction in the wild in the medium-term
- Conservation Dependent (CD)[1] – taxa whose survival depends upon ongoing conservation measures; without these measures, a conservation dependent taxon would be classified as Vulnerable, Endangered or Critically Endangered.

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English & Blyth 1997). There are 3 categories under which ecological communities can be listed as TECs under the EPBC Act: Critically Endangered, Endangered and Vulnerable.

The EPBC Act is also the enabling legislation for protection of Migratory species as matters of NES under several international agreements:

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

[1] Species listed as Extinct and Conservation Dependent are not matters of NES and therefore do not trigger the EPBC Act.

2.2 STATE

2.2.1 Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened flora and fauna species (Government of Western Australia 2018a, b)[2] in the following categories:

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future[3]
- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future[3]
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium-term future[3].

Species may also be listed as specially protected (SP) under the BC Act in one or more of the following categories:

- species of special conservation interest (conservation dependent fauna, CD) – species with a naturally low population, restricted natural range, of special interest to science, or subject to or recovering from a significant population decline or reduction in natural range
- Migratory species (Mig.), including birds subject to international agreement
- species otherwise in need of special protection (OS).

The Department of Biodiversity, Conservation and Attractions (DBCA) administers the BC Act and also maintains a non-statutory list of Priority flora and fauna. Priority species are still considered to be of conservation significance – that is they may be Threatened – but cannot be considered for listing under the BC Act until there is adequate understanding of threat levels imposed on them. Species on the Priority flora and fauna lists are assigned to one of 4 Priority (P) categories, P1 (highest) – P4 (lowest), based on level of knowledge/concern.

2.2.2 Critical habitat

Under the BC Act, habitat is eligible for listing as critical habitat if it is critical to the survival of a Threatened species, or a TEC and its listing is otherwise in accordance with the ministerial guidelines.

2.2.3 Threatened and Priority Ecological Communities

The BC Act provides for the listing of TECs in the following categories:

- Critically Endangered – facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future[3]
- Endangered – facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future[3]
- Vulnerable – facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future[3].

An ecological community may be listed as a collapsed ecological community under the BC Act if there is no reasonable doubt that the last occurrence of the ecological community has collapsed, or the

[2] The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the BC Act.

[3] As determined in accordance with criteria set out in the ministerial guidelines.

ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure.

The DBCA also maintains a non-statutory list of Priority Ecological Communities (PECs), which may become TECs in the future; however, do not currently meet survey criteria or that are not adequately defined. PECs are assigned to one of 5 categories depending on their priority for survey or definition, with Priority 1 of highest concern and Priority 5 of lowest concern.

2.2.4 Other significant flora, vegetation, and fauna

Under the EPA's environmental factor guidelines, flora, vegetation, and fauna may be considered significant for a range of reasons other than listing as a Threatened or Priority species or ecological community.

In addition to listing as Threatened or Priority, EPA (2016a) identifies the following:

- flora may be significant for
    - local endemism or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
    - new species or anomalous features that indicate a potential new species
    - representing the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
    - being unusual species, including restricted subspecies, varieties or naturally occurring hybrids
    - having relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape
- vegetation may be significant for:
    - having restricted distribution
    - subject to a degree of historical impact from threatening processes
    - having a role as a refuge
    - providing an important function required to maintain ecological integrity of a significant ecosystem.

In addition to listing as Threatened or Priority, EPA (2016b) identifies the following attributes that constitute significant fauna:

- species with restricted distribution
- species subject to a degree of historical impact from threatening processes
- providing an important function required to maintain the ecological integrity of a significant ecosystem.

Provided in the guide for assessment of applications to clear native vegetation (DER 2014) is a scale for assessing the bioregional conservation status of ecological vegetation classes (Table 2-1).

Table 2-1 Bioregional conservation status of ecological vegetation classes

Conservation status	Description
Presumed extinct	Probably no longer present in the bioregion
Endangered*	Less than 10% of pre-European extent remains
Vulnerable*	10-30% of pre-European extent exists
Depleted*	More than 30% and up to 50% pre-European extent exists

Conservation status	Description
Least Concern	More than 50% of pre-European extent exists and subject to little or no degradation over a majority of this area

*or a combination of depletion, loss of quality, current threats and rarity gives a comparable status.

2.2.5 Environmentally Sensitive Areas

Under section 51B of the EP Act the Minister for Environment may declare by notice either a specified area of the State or a class of areas of the State to be Environmentally Sensitive Areas (ESAs). ESAs are declared in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, which was gazetted on 8 April 2005 (Government of Western Australia 2005).

ESAs are areas where the vegetation has high conservation value. Several types of areas are declared ESAs including:

- the area covered by vegetation within 50 metres (m) of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened flora is located
- the area covered by a TEC
- a defined wetland (Ramsar wetlands, conservation category wetlands and nationally important wetlands) and the area within 50 m of the wetland
- Bush Forever sites.

2.2.6 Introduced flora

Introduced flora (weeds) pose threats to biodiversity and natural values by successfully out-competing native species for available nutrients, water, space and sunlight; reducing the natural structural and biological diversity by smothering native plants or preventing them from growing back after clearing, fire or other disturbance; replacing the native plants that animals use for shelter, food and nesting; and altering fire regimes, often making fires hotter and more destructive (Australian Weeds Committee 2007).

Management of some weed species is required under Commonwealth or State frameworks. Key classifications for significant introduced flora that are relevant to this report are:

- Declared Pest – the Biosecurity and Agriculture Management Act 2007 (BAM Act), Section 22 makes provision for a plant taxon to be listed as a Declared Pest organism in parts of, or the entire State. Under the Biosecurity and Agriculture Management Regulations 2013 Declared Pests are assigned to one of 3 control categories that dictate the level of management required (DPIRD 2019).
- Weed of National Significance (WoNS) – high impact, established introduced flora causing major economic, environmental, social and/or cultural impacts in a number of states/territories, and which have strong potential for further spread (Australian Weeds Committee 2012). Management is required in accordance with Department of Primary Industries and Regional Development (DPIRD) guidelines for particular WoNS.

Throughout this report, introduced flora species are indicated with an asterisk (*).

3 EXISTING ENVIRONMENT

3.1 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into large 'bioregions' and 'subregions' based on climate, geology, landform, native vegetation and species information (DoEE 2016). The study area lies within the Roebourne subregion (PIL4) of the Pilbara bioregion (PIL) which is in the central west region of Western Australia and is described a vast coastal plain and inland mountain range with deep gorges and cliffs (Figure 3-1). The total area of the PIL bioregion is approximately 17, 822, 614 ha (Department of Agriculture 2020). The subregional area is 1,861,724 ha. The PIL04 subregion is characterised by:

> *"quaternary alluvial and older colluvial coastal and sub-coastal plains with a savannah of mixed hummock and bunch grasses and dwarf shrub steppe of Acacia stellaticeps or A. pyrifolia and A. inaequilatera. The uplands are dominated by spinifex hummock grasslands. Ephemeral drainage lines support Eucalyptus victrix or Corymbia hamersleyana woodlands. Tecticornia (Samphire), Sporobolus and mangal occur on river deltas and marine alluvial flats. Resistant linear ranges of basalts occur across the coastal plains, with minimal exposures of granite. Nearby islands are either Quaternary sand accumulations or composed of basalt or limestone, or a combination of both."*

3.2 LAND SYSTEMS AND SURFACE GEOLOGY

DPIRD undertakes land system mapping for WA using a nesting soil-landscape mapping hierarchy (Schoknecht & Payne 2011). While the primary purpose of the mapping is to inform pastoral and agricultural land capability, it is also useful for informing biological assessments. Under this hierarchy, land systems are defined as areas with recurring patterns of landforms, soils, vegetation and drainage (Payne & Leighton 2004).

The majority of the study area is comprised of the Uaroo land system in the south and in a small section in the northern half of the study area (Table 3-1; Figure 3-2). The Uaroo land system covers a little more than the bottom half of the study and an edge of the top half of the study area. The Litorral land system comprises the remainder of the study area.

Table 3-1 Land systems and extent in study area

Land system	Description	Area (ha)	% of study area
Uaroo System	Broad sandy plains, pebbly plains and drainage tracts supporting hard and soft spinifex hummock grasslands with scattered acacia shrubs.	61.81	62.41
Littoral System	Bare coastal mudflats (unvegetated), samphire flats, sandy islands, coastal dunes and beaches, supporting samphire low shrublands, sparse acacia shrublands and mangrove forests.	37.24	37.59
	Total	**99.05**	**100.00**

According to the Surface Geology of Australia 1:1,000,000 scale, Western Australia database (Stewart et al. 2008), the study area intersects alluvium and estuarine and delta geological formations Table 2-1; Figure 3-2). Alluvial surface geology covers majority of the study area except for a small section to the north of the study area where estuarine and delta deposits occur.

Table 3-2 Surface geology of the study area, extent by deposit type

Surface geology	Abbr.	Description	Area (ha)	% of study area
Alluvium	Qa	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted	95.26	96.18
Estuarine and delta deposits	Qe	Coastal silt and evaporite deposits; estuarine, lagoonal, and lacustrine deposits	3.79	3.82
		Total	**99.05**	**100.00**

Horizon Power
Roy Hill Stockpile 3

Project No	1587
Date	5/09/2023
Drawn by	BK
Map author	PW

0 4 8
Kilometers

1:190,400 (at A4) GDA 1994 MGA Zone 50

Study area

Region, subregion

Pilbara, Chichester

Pilbara, Roebourne

Figure 3-1

Study area in relation to IBRA bioregions and subregions

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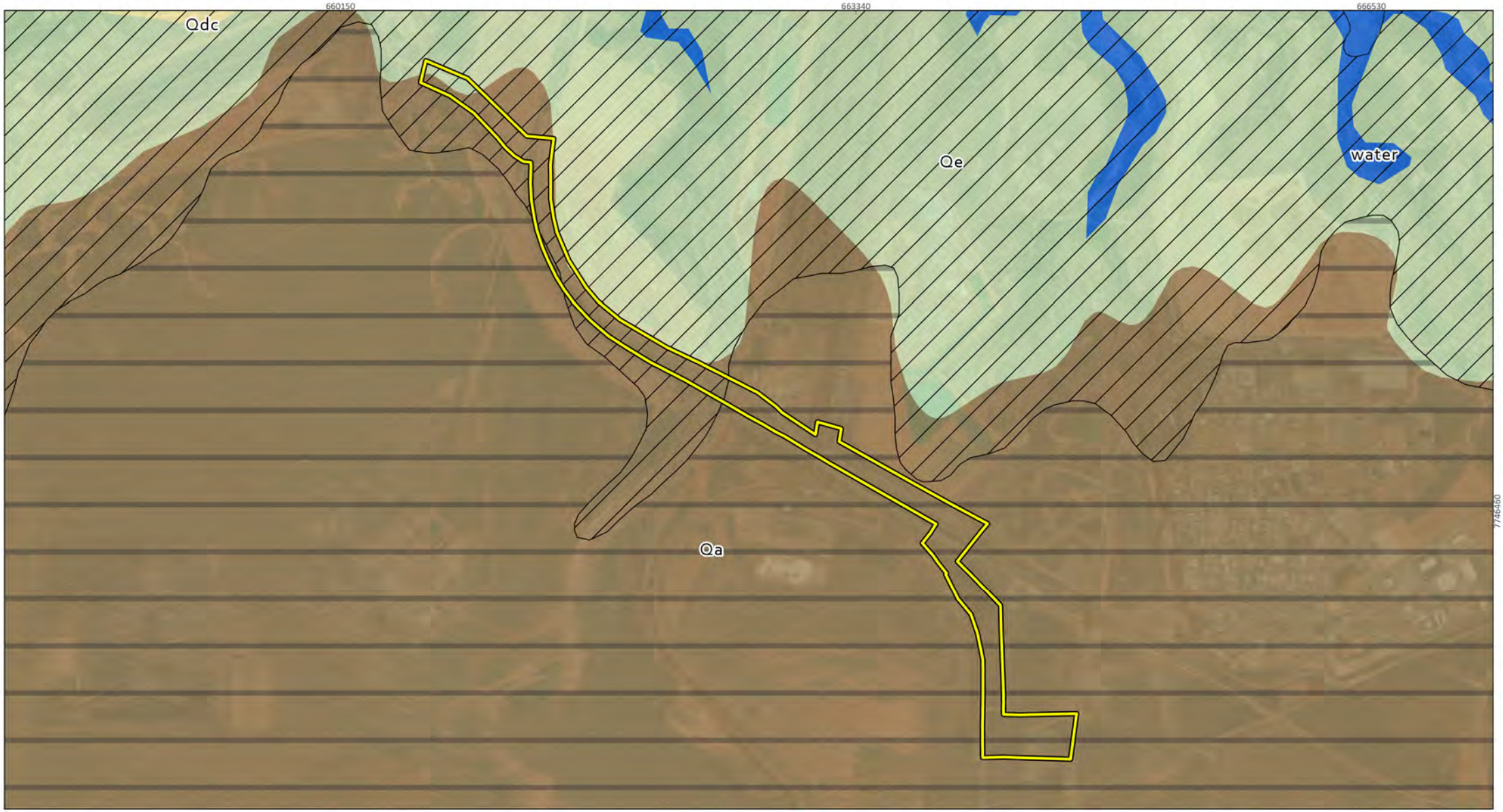

Horizon Power
Roy Hill Stockpile 3

Project No	1587
Date	5/09/2023
Drawn by	BK
Map author	PW

0 0.5 1
Kilometers

1:31,900 (at A4) GDA 1994 MGA Zone 50

Study area

Surface geology
- Qa
- Qdc
- Qe
- Water

Land systems
- Littoral System
- Uaroo System

Figure 3-2
Land systems and surface geology in the study area

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3.3 CLIMATE AND WEATHER

The climate of the Roebourne subregion is described as arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer (Kendrick & Stanley 2001). The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent historic climate data is Port Hedland Airport (no. 004032), Latitude: 20.37°S Longitude 118.63°E, located approximately 11 km north-east of the study area.

Port Hedland Airport records the highest mean maximum monthly temperature (36.8°C) in December and March (lowest in July, 27.4°C) and the lowest minimum mean monthly temperature (12.5°C) in July (highest in January, 25.7°C) (BoM 2023) (Figure 3-3). Median annual rainfall is 310.6 mm with January and February recording the highest monthly median (25.6 and 71.2 mm respectively; Figure 3-3). Cyclonic activity is significant with several systems affecting the coast and hinterland annually (Kendrick & Stanley 2001). Prior to commencement of the surveys, Cyclone Ilsa (Category 5) threatened the town of Port Hedland; however, local precipitation and damage was negligible.

Daily mean temperatures at Port Hedland Airport in the 3 months preceding the surveys were on average consistent with the long-term averages for the region (Figure 3-3). The average mean maximum and minimum temperatures were 0.3°C and 1.3°C warmer than the long-term averages, respectively. Daily maximum temperatures during the survey ranged from 31.7°C to 34.9°C, and daily minimum temperatures from 15.6°C to 25.4°C (Appendix 6)

Records from Port Hedland Airport show a total of 22.5 mm (19.8 %) more local precipitation was recorded in the 3 months leading up to the surveys compared to the long-term averages for the region; local precipitation was almost identical to the long-term median, with 3.8 mm more (314.4 mm) recorded in the 12 months preceding the survey. No rainfall was recorded during the survey (Appendix 6).

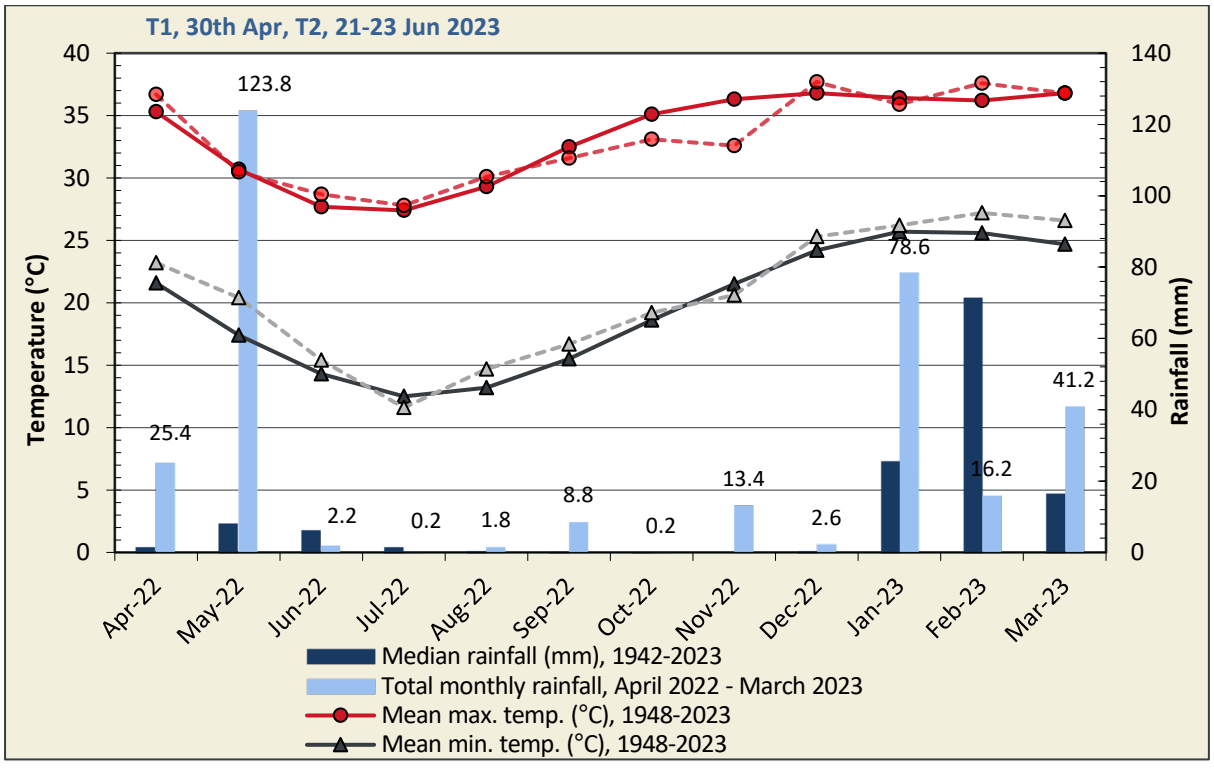

Figure 3-3 **Annual climate and weather data for Port Hedland Airport (no. 004032) and median monthly data for the 12 months preceding the fauna survey (BoM 2023)**

Mean daily maximum temperatures were equivalent to or slightly lower than the long-term averages in the 3 months preceding the survey (Figure 3-4). In contrast average minimum temperatures were slightly higher for 2 of the 3 months preceding the survey and lower in the month before the survey.

Total rainfall in the 12 months preceding the survey (197 mm) was well below the long-term annual average of 318.5 mm. Rainfall in the 3 months preceding the surveys (58.2 mm) was also well below the long-term average for March -May (103.7 mm).

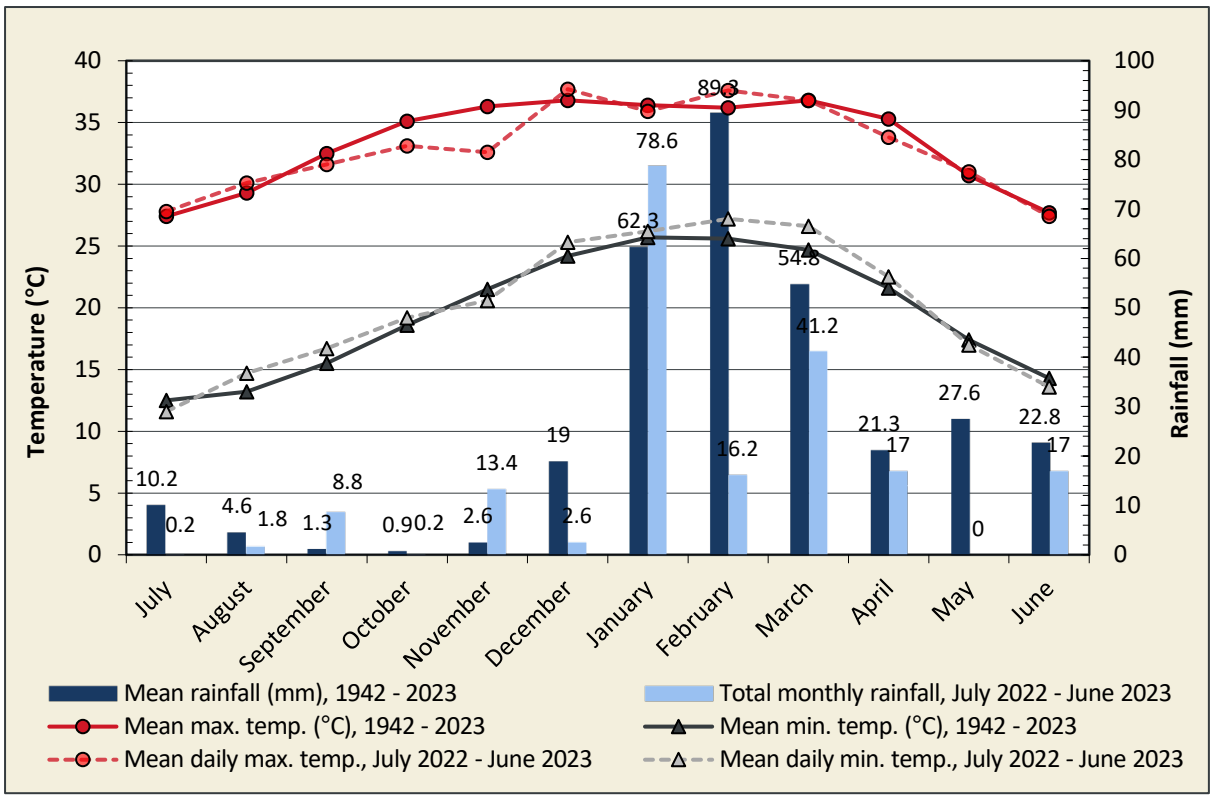

Figure 3-4 **Annual climate and weather data for Port Hedland Airport (no. 004032) and mean monthly data for the 12 months preceding the flora survey (BoM 2023)**

3.4 LAND USE

The dominant land use of the PIL4 subregion comprises grazing (native pastures), Aboriginal lands and reserves, conservation, mining leases and urban development (Kendrick & Stanley 2001). As per land use summaries extracted from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES 2018) and summarised in Table 3-3, 'production from relatively natural environments' and 'conservation and natural environments' are the dominant land use components comprising the PIL4 subregion. Land use across the study area is subject to similar usages (and proportional area) to the PIL4 subregion; the dominant secondary components represent 'conservation and natural environments' (76.1 ha, 72.2%) and 'production from relatively natural environments' (22.4 ha, 21.1%).

Table 3-3 Land use of the study area, according to ABARES (2018)

Land use	PIL4 subregion		Study area	
	Area (ha)	% of PIL4	Area (ha)	% of study area
Conservation and natural environments	492,279.8	26.5	76.7	72.2
Intensive uses	8,481.1	0.5	4.3	4.0
Production from dryland agriculture and plantations	367.7	<0.01	0.3	0.3
Production from irrigated agriculture and plantations	0.4	<0.01	-	-
Production from relatively natural environments	1,302,639.7	70.1	22.4	21.1
Water	54,528.3	2.9	2.6	2.5
Total	**1,858,297.0**	**100.0**	**1,476.3**	**100.0**

3.5 CONSERVATION RESERVES AND ESAS

No conservation reserves intersect the study area or occur within the 40 km desktop search extent. The nearest conservation reserves are Mungaroona Range Nature Reserve and Eighty Mile Beach Marine Park, located approximately 115 km south-southwest and 103 km north-west from the study area boundary, respectively (Figure 1-1). No DBCA lands of interest proposed for conservation occur near the study area. A total of 7 ESAs occur within the desktop search extent (Figure 1-1; Table 3-4); 2 small ESAs (IDs 15126 and 15128) occur nearby, located approximately 12.1 and 11 km north-northwest and north-northeast of the study area, respectively. A larger ESA is located approximately 17.9 km north-east of the study area, encompassing salt evaporator ponds and the surrounding tidal mudflats. This system of evaporation ponds and adjacent mudflats is classified as an Important Bird Area due to its global importance for bird populations, particularly Red-necked Stints and Sharp-tailed Sandpipers (Birdlife International 2022) (Figure 1-1).

Table 3-4 ESAs in the desktop search extent

Identity	Area (ha)	Distance to study area
15127	38.7	9.1 NNE
15128	1.6	11.0 NNE
15126	8.4	12.1 NW
12075	12,027.5	17.9 NE
12070	39.0	36.1 NE
12074	105.5	40.0 NE
12071	20.2	41.4 NE

4 METHODS

The insert survey description survey was conducted in accordance with relevant survey guidelines and guidance, including:

- *DBCA Guideline for the survey and relocation of Bilby in Western Australia* (DBCA 2018)
- *Southgate et al. Verifying Bilby presence and the systematic sampling of wild populations using sign-based protocols – with notes on aerial and ground survey techniques and asserting absence* (Southgate *et al.* 2019).
- *EPA Environmental Factor Guideline: Terrestrial fauna* (EPA 2016b)
- *EPA Technical Guidance: Terrestrial fauna surveys* (EPA 2016e)
- *EPA Technical Guidance: Sampling methods for terrestrial vertebrate fauna* (EPA 2016d)
- *EPA Environmental Factor Guideline: Flora and vegetation* (EPA 2016a)
- *EPA Technical Guidance: Flora and vegetation surveys for Environmental Impact Assessment* (EPA 2016c)

4.1 DESKTOP REVIEW

Searches of several biological databases were undertaken to identify and prepare lists of significant flora and fauna that may occur within the study area (Table 4-1). A literature search was conducted for accessible reports for biological surveys conducted within 40 km of the study area to build on the lists developed from the database searches (Table 4-2). Notably, the GHD (2016) survey area is contained within the current study area.

Table 4-1 Database searches conducted for the desktop review

Database	Target group/s	Search coordinates and extent
Protected Matters Search Tool (DCCEEW 2023a)	EPBC Act Threatened flora, fauna and ecological communities	Study area plus a 40 km buffer
Threatened and Priority Fauna Database (DBCA 2023c)	Threatened and Priority fauna	Study area plus a 40 km buffer
Threatened and Priority Flora Database (DBCA 2023c)	Threatened and Priority flora	Study area plus a 40 km buffer
Threatened and Priority Ecological Communities Database (DBCA 2023b)	TECs and PECs	Study area plus a 40 km buffer
NatureMap Database (DBCA 2023a)	Fauna and flora records	Study area plus a 40 km buffer

Table 4-2 Survey reports included in the desktop review

Report author	Survey description	Project
Bennelongia (2011)	Migratory shorebird survey	Outer Harbour Development
ENV (2009)	Terrestrial fauna surveys	Outer Harbour Development
Phoenix (2022b)	Basic vertebrate fauna survey	Port Hedland Source Planning
Phoenix (2022c)	Detailed terrestrial fauna and targeted Bilby survey	Port Hedland Solar Farm
ENV (2011a)	Basic and targeted terrestrial fauna surveys	Port Hedland Regional Assessment
ENV (2011b)	Level 2 Flora and vegetation assessment	Port Hedland regional area
Emerge Associates (2019)	Reconnaissance Flora and vegetation assessment	Port Hedland airport highway precinct 2
GHD (2016)	Reconnaissance Flora and vegetation assessment	Roy Hill port facility
(Phoenix 2022a)	Baseline flora and vegetation survey	Port Hedland Solar Farm

4.2 FIELD SURVEY

4.2.1 Survey timing

Field survey dates are provided in Table 4-3.

Table 4-3 Survey dates

Survey type	Season	Dates
Targeted vertebrate fauna survey	Autumn	30th April 2023
Flora and vegetation	Winter	21-23rd June 2023

4.2.2 Flora and vegetation

Field methods for the flora and vegetation survey included:

- surveying of quadrats and relevés and collecting opportunistic flora specimens (4.2.2.1)
- targeted flora searches (4.2.2.2)
- defining vegetation type and condition (4.2.2.3, 4.2.2.4)

4.2.2.1 Quadrats, relevés and transects

Quadrat locations were selected to ensure that an accurate representation of the major vegetation types within the study area were sampled adequately. Two methods were used for the selection of quadrat placement within the study area. Preliminary quadrat locations were pre-selected using aerial photography, with selection based on apparent changes in the vegetation visible in the aerial imagery. Final quadrat placement was determined in the field while ground-truthing the study area on foot. Some preliminary quadrats were moved to locations which better represented vegetation types and some quadrats were changed to relevés, where only dominant vegetation was recorded for the purposes of accurate vegetation mapping.

In total, 11 quadrats and 4 relevés were surveyed across the study area (Figure 4-1; Appendix 1).

Quadrat sampling dimensions were 50 m x 50 m in accordance with EPA guidance for the Eremaean Botanical Province. The following information was recorded for each quadrat (Appendix 2):

- location – the geographic coordinates of all 4 corners of the quadrat in WGS84 projection
- description of vegetation – a broad description utilising the structural formation and height classes based on National Vegetation Information System (ESCAVI 2003) and in accordance with EPA (2016c) (Appendix 3)
- habitat – a brief description of landform and habitat
- geology – a broad description of surface soil type and rock type
- disturbance history – a description of any observed disturbance including an estimate of time since last fire, weed invasions, soil disturbance, human activity and fauna activity
- vegetation condition – using the condition scale in EPA (2016c) for the Eremaean Botanical Province
- height and percentage foliage cover (PFC) – a visual estimate of cover of total vegetation cover, cover of shrubs and trees >2 m tall, cover of shrubs <2 m, total grass cover and total herb cover
- photograph – a colour photograph of the vegetation within each quadrat in a south-easterly direction from the north-west corner of the quadrat
- flora species list – comprehensive list of all flora species recorded within the quadrat.

To ensure accurate taxonomic identification of flora species present within the study area, collections were made of each specimen at least once and each collection was pressed and documented for identification using the WA Herbarium resources.

For each species identified, records on FloraBase and the Australasian Virtual Herbarium were consulted to provide information on known ranges to determine whether the study area represented a range extension for the species.

Relevés were sampled within vegetation units where dominant species, soils and topography were representative of vegetation surveyed in quadrats. Information collected in relevés was the same as for quadrats with the exception that:

- only a single geographic coordinate was recorded
- only prominent flora species were recorded.

Prior to the commencement of the field survey, data including satellite imagery, survey boundary, and pre-selected vegetation quadrats were loaded onto electronic field devices. GPS locations of vegetation and condition boundaries, survey sites and flora specimen data were recorded digitally.

4.2.2.2 Targeted flora searches

Targeted searches were undertaken for significant flora (Threatened and Priority), Declared Pests and WoNS. Remnant vegetation was traversed by foot in meandering transects with the searches focused on habitats considered likely to support significant flora, in addition to previously recorded locations of significant plants or populations in close proximity to the study area.

If a flora species was considered to potentially be a significant species (i.e. similar floristic characteristics and occurring within suitable habitat) the following information was collected:

- GPS coordinates, including population boundary where applicable
- description of the habitat and floristic community in which the potential significant species was located
- population size estimate (i.e. estimated number of individual plants) where applicable
- specimen collection for taxonomic identification and lodgement at the WA Herbarium

- photograph of live plant in situ and description of important details, such as flower colour, height of individual or average height of population.

The location of all conservation significant flora recorded was mapped following the field survey. Assignment of population and subpopulation was undertaken according to the guidelines (Stack 2010) where:

- Plants more than 500 m from a known population are considered to be a new population
- Plants within 500 m of a known population are considered to be part of that population
- Within a recognised population, plants that occur on different land tenure parcels, or those that have considerable, recognisable separation between them (e.g. plants occur on either side of a river, or on close but distinct peaks or outcroppings) are considered to be separate subpopulations.

Following the field survey, the likelihood of occurrence for each significant flora species identified in the desktop review was assessed and assigned to one of 3 ratings:

- recorded – species recorded within the study area by previous or current survey
- possible – study area within known range of species; potential habitat within the study area, records within 5 km of study area and may not have been detectible during survey (e.g., survey conducted outside flowering period, annual plant survey conducted outside likely period of occurrence, small herbaceous plant in dense vegetation), or entire area of habitat not thoroughly searched
- unlikely – study area outside known range of species and/or no suitable habitat present in study area and/or suitable/potential habitat present but study area considered adequately searched for the species.

4.2.2.3 Vegetation type mapping

Vegetation mapping was undertaken at a scale of 1:10,000 using the National Vegetation Information System (NVIS) sub-association level (L5) for structural descriptions (ESCAVI 2003). The vegetation descriptions from quadrats and relevés from the survey were grouped according to similarity of community structure (i.e. canopy levels), species composition and combination of species and the prevalent community structure (i.e. woodland, shrubland, etc.). The vegetation boundaries were mapped utilising ArcGIS ESRI imagery and from vegetation boundaries recorded on GPS during the field survey.

To support delineation of vegetation types, a cluster analysis was conducted based on species presence in each quadrat. The fusion strategy for the site classification was flexible UPGMA with a beta value of -0.1 and Bray Curtis association measure in the software package PATN (Belbin 2003). A dendrogram was produced to illustrate the similarities between the vegetation units identified. Statistically distinct vegetation units (the floristic group) classified the vegetation at a local scale. Local scale vegetation units were described at NVIS Level V – Association (ESCAVI 2003). The term ‘vegetation type’ was used for local scale vegetation units in accordance with EPA technical guidance (EPA 2016c).

4.2.2.4 Vegetation condition mapping

The condition of vegetation was mapped across the study area based on the appropriate condition scale for the Eremaean Botanical Province (Keighery 1994 in EPA 2016c) (Table 4-4). The vegetation condition ratings relate to vegetation structure, the level of disturbance and weed cover at each

structural layer and the ability of the vegetation unit to regenerate. Vegetation condition ranges from Excellent being the highest rating to Completely Degraded as the lowest.

Table 4-4 Vegetation condition rating scale (EPA 2016c)

Condition rating	Description
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

4.2.2.5 Analysis of survey completeness

A species accumulation curve based on accumulated species versus number of sites surveyed was used to evaluate the level of adequacy of the survey effort. The species accumulation curve was generated by inputting the site-species matrix into Phoenix's proprietary spreadsheet.

661000 7749000 662000 7748500 663000 7747500 664000

RSP001R
RSP002
RSP003
RSP004R
RSP005
RSP006R
RSP007
RSP008R
RSP009
RSP010
RSP011

7747500 7747000 664000 7746500 7746000 7745500 665000 7745000

RSP011
RSP012
RSP013
RSP014
RSP015
RSP010
RSP009

7744500 665000

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Date	5/09/2023
Drawn by	GW
Map author	GW

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Kilometers

1:10,000 (at A3) GDA 1994 MGA Zone 50

Study area
Survey sites

Vegetation type

- AmTspp
- AsTe
- NaEm
- Te
- Ts
- Cleared

Figure 4-1

Flora and vegetation survey sites

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4.2.3 Terrestrial fauna

Field methods for the fauna survey included:

- habitat assessment (see 4.2.3.1)
- avifauna surveys (see 4.2.3.2)
- targeted surveys for Bilby (see 4.2.3.3)
- likelihood of occurrence (see 4.2.3.4)

A total of 6 survey sites were sampled (Figure 4-2; Appendix 1).

4.2.3.1 Habitat assessment

Initial habitat characterisation was undertaken using various remote geographical tools, including aerial photography (Google Earth®), land system maps and topographic maps. Habitats with the potential to support significant terrestrial fauna species were identified based on known habitats of such species within the PIL bioregion. Tentative sites were selected for the terrestrial fauna survey to represent all habitat types. Final survey site selection was conducted after ground-truthing of site characteristics.

Site selection considered aspect, topography, and land systems whilst maintaining good coverage of the study area. Sites were primarily chosen to represent the best example of distinct habitats within the broader habitat associations of the study area with a focus on species of conservation significance identified in the desktop review. Habitat descriptions and characteristics were recorded at all survey sites (Figure 4-2; Table 4-5; Appendix 4).

Table 4-5 Terrestrial fauna survey effort

Site	Site description	Birding	Targeted searches	Transects	Opportunistic
RHP01	1	2	2	2	-
RHP02	1	2	2	2	-
RHP03	1	2	2	2	-
RHP04	1	-	-	-	1
RHP05	1	1	-	-	-
RHP06	1	-	-	-	-

4.2.3.2 Avifauna surveys

Twenty-minute avifauna surveys were undertaken at several sites except 4 and 6 (Figure 4-2; Table 4-5). Avifauna surveys were confined to the habitat type (up to 2 ha) represented by each site to collect assemblage data for each habitat. Surveys consisted of bird recordings from visual sightings and call recognition. A total of 7 avifauna census surveys were undertaken during the field survey (Table 4-5).

Additional avifauna observations were also recorded at opportunistically while other field work was being completed, including observations made during travel and active searches.

4.2.3.3 Targeted surveys for Bilby (*Macrotis lagotis*, VU)

The objective of the targeted Bilby survey was to determine presence/absence from the study area and delineate currently occupied areas to areas forming part of their broader moving home range by adopting survey methods detailed in DBCA (2018).

In order to evenly sample a population (via scat collection), the current extent (boundary) of activity of the target population must be delineated by plotting the extent of fresh Bilby sign. This can be achieved by walking linear transects, conducting standardised 2 ha plot searches ('sign plots'), or a combination of both, as per DBCA's Guideline for the survey and relocation of Bilby in Western Australia (DBCA 2018).

Survey techniques must take into consideration the size and shape of the study area, the distribution and extent of suitable habitat, and whether comparable and quantifiable data is required. Linear transect searches are most effective when the area is smaller and where comparable, quantified data is not required (DBCA 2018a). Sign plots are preferrable when the survey area is larger (typically > 1,600 ha) and quantifiable and comparable data is required. As the study area is quite small (53.3 ha) linear transects were selected to provide extensive and representative coverage in all suitable habitat types across a large study area that varies considerably in shape. Linear transects were searched with appropriate spacing (~ 20 m) in the study area corridors where suitable habitat was located. A total transect distance of 15 km across all transects were searches to detect Bilby presence.

Bilby populations are known to have moving home ranges (Dziminski *et al.* 2020). Detection of secondary evidence including scats, tracks, burrows, and diggings is the most reliable technique to determine whether bilbies are currently or were formerly present in an area. The occurrence of fresh scats, definitive tracks and/or multiple concentrated diggings can be indicative of current presence; unclear tracks, burrows, and diggings in the open can indicate potential activity but cannot alone be used to verify current presence. Historic records considered in combination with the occurrence suitable habitat can be suggestive of potential Bilby presence or future use of an area due to their propensity for moving home ranges.

Individual bilbies deposit single or a small number of faecal pellets (usually 2 to 5) in a discrete group usually on top of, or within, the sand-spoil of food diggings. Bilby scats are difficult to age just by visual inspection alone (Dziminski *et al.* 2020). Scats that are found on top of, or within, the sand-spoil of a digging, can be assessed by examining the state of decomposition of the associated digging. Bilby scat becomes odourless shortly after deposition, and moist scats with a mild odour are considered less than 2 weeks old (fresh). The presence of fresh scats, in combination with foraging signs with loose spoil heaps and tracks indicate current or very recent regional Bilby presence.

The location of all scats was recorded on GPS enabled devices and photographed (Figure 4-2; Appendix 10). Scats were classed as old, recent, or fresh depending on their moistness, hardness, and smell. Scats which are over 2 weeks old are considered old. Scats which are 48 hours to 2 weeks old are considered recent. Scats which are up to 48 hours old are classed as fresh.

4.2.3.4 Likelihood of occurrence assessment

Following the field survey, the likelihood of occurrence for each significant fauna species identified in the desktop review was assessed and assigned to one of 4 ratings:

- recorded – species recorded within the study area by previous or current survey
- likely – study area within current known range of species, suitable habitat within the study area and home range of species intersects study area based on known records
- possible – study area within current known range of species, suitable habitat within the study area and home range of species does not intersect study area based on known records

- unlikely – study area outside current known range of species or no suitable habitat present in study area.

4.2.4 Survey personnel

The personnel involved in the surveys are listed in Table 4-6. All survey work was carried out under relevant licences issued by DBCA under the BC Act (Table 4-6).

Table 4-6 Survey personnel

Name	Permit	Qualifications	Role/s
Simon Pynt	Fauna taking (biological assessment) licence no. BA27000780, TFA2223-0183	BSc Zoology	Project management and logistics, field survey, reporting
Jade Larkman		BSc Environmental Sciences	Field survey, desktop review
Patrick Williams		MSc Environmental Sciences	Field survey, reporting
Will Purser		MSc Biological Sciences (Zoology)	Field survey
Dr Grant Wells	FB62000538	PhD Botany	Project management, field survey, reporting
Brody Loneragan	FB62000296-2	BScHons Environmental Management	Logistics, field survey
Dr Grace Wells	NA	PhD Botany	Mapping, report review
Dr David Leach	NA	PhD Plant Biology	Data analysis
Dr Andrew Perkins	NA	PhD Botany	Taxonomy
Brigitte Kovar	NA	MSc Geographical Information Systems (GIS)	GIS

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Project No	1587
Date	5/09/2023
Drawn by	JL
Map author	PW

0 0.5 1
Kilometers

1:30,800 (at A4) GDA 1994 MGA Zone 50

- Study area
- Sites
- Tracks

Figure 4-2

Terrestrial fauna survey sites and transects

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5 RESULTS

5.1 DESKTOP REVIEW

5.1.1 Flora and vegetation

5.1.1.1 Flora assemblage

The desktop review identified records of 486 flora taxa comprising 66 families and 209 genera within the desktop search extent (DBCA 2023c). A total of 1162 species are recorded for the Roebourne subregion (WA Herbarium 1998) with the dominant families represented by Fabaceae (16%), Poaceae (12%) and Malvaceae (6%).

A summary of the flora assemblages and survey effort from consultant surveys undertaken within the 40 km of the study area is provided in Table 5-1.

Table 5-1 Desktop floristic summary of previous surveys and this assessment

Survey	Area (ha)	No. survey sites	Families	Genera	Taxa	Taxa/ha
Phoenix (2022a)	670.37	19 quadrats, 11 relevés	38	88	146	0.2
ENV (2011b)	80874	158 quadrats, 3 relevés	58	152	338	0.004
Emerge Associates (2019)	37.99	5 quadrats	16	31	43	1.1
GHD (2016)	27.13	NA	15	23	28	1.0

Dominant plant families and weeds previously recorded in the Pilbara bioregion, Fortescue subregion (WA Herbarium 1998), study area and other surveys within 40 km of the study area are provided in Table 5-2.

Table 5-2 Flora statistics across the bioregion, subregion and recorded in survey areas within 40 km of the study area

IBRA/Study area	Taxa	Fabaceae	Poaceae	Malvaceae	Amaranthaceae	Weeds
Pilbara	2194	344 (15.6%)	236 (10.7%)	139 (6.3%)	72 (3.3%)	146 (6.6%)
Roebourne	1159	182 (15.7%)	139 (11.9%)	73 (6.3%)	52 (4.5%)	87 (7.5%)
Phoenix (2022a)	146	20 (13.7%)	29 (19.9%)	14 (9.6%)	7 (4.8%)	6 (4.1%)
ENV (2011b)	338	71 (21.0%)	51 (15.1%)	29 (8.6%)	18 (5.3%)	12 (3.6%)
Emerge Associates (2019)	43	6 (13.9%)	9 (20.9%)		5 (11.6%)	5 (11.6%)
GHD (2016)	28	5 (17.9%)	6 (21.4%)			3 (10.7%)
Study area and 40 km buffer	486	105 (21.6%)	81 (16.7%)	38 (7.8%)	22 (4.5%)	39 (8.0%)

5.1.1.2 Significant flora

Records of 12 significant flora species were identified by the DBCA database searches, comprising no Threatened flora listed under the EPBC Act and/or BC Act and 12 Priority flora (Table 5-3).

Records for 2 significant flora occurred in the study area (Figure 5-1, Table 5-3):

- *Tephrosia rosea* var. Port Hedland (A.S. George 1114) P1, one record in study area
- *Bulbostylis burbidgeae* P4, 2 records in study area

The literature review identified records for Priority flora and a locally significant species in previous surveys conducted in the vicinity of the study area.
ENV (2011b) recorded 4 Priority flora, *Tephrosia rosea* var. Port Hedland (A.S. George 1114) (P1), *Gomphrena pusilla* (P2), *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) (P3) and *Euploca mutica* (P3), all of which were identified by the database searches. No Threatened or Priority flora were recorded in any of the other previous assessments reviewed in this desktop assessment (Table 4-2). A specimen referred to as *Phyllanthus* sp. 'Port Hedland Solar Farm', that closely resembles the Priority 1 species *Lysiandra indigoferoides* and 3 unnamed *Phyllanthus* taxa was recorded approximately 1.5 km east of the study area in riparian vegetation (Phoenix 2022a). This species was considered locally significant as it may represent an undescribed species or a very large range extension of another *Phyllanthus* species.

Table 5-3 Significant flora identified from the database searches

Species	Status	Proximity to study area	Habitat
Tephrosia rosea var. Port Hedland (A.S. George 1114)	P1	Within study area	Predominantly recorded on coastal dunes but also in red sand plain in *Acacia* shrublands over *Triodia* hummock grasslands.
Gomphrena pusilla	P2	1.6 km WNW of study area	Grows in open Shrubland of *Acacia bivenosa* over open *Triodia epactia* hummock grassland of over an open tussock of *Cenchrus ciliaris* along limestone ridge tops on brown loam, exposed calcrete rock and calcareous coastal dunes.
Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	P3	10.6 km SW of study area	Grows in shrublands of *Acacia* sp. over *Triodia* hummock grasslands on sandy plains and floodplains in red-brown sandy clay-loam soil.
Eragrostis crateriformis	P3	3.8 km WSW of study area	Grows in low open woodlands over sparse *Acacia* shrublands over *Triodia* grasslands on red sandy clay-loam soil associated with drainage lines, floodplains and clay pans.
Gomphrena leptophylla	P3	5.1 km WSW of study area	Grows in hummock grassland, *with Triodia epactia, T. secunda* along drainage lines and floodplains in red sandy loam soils.
Gymnanthera cunninghamii	P3	1.4 km NW of study area	Grows in *Eucalyptus*, *Melaleuca* and *Acacia* woodlands over mixed grasslands associated with riverbanks, creeks, drainage lines and floodplains.
Euploca mutica	P3	7.4 km ESE of study area	Grows in *Acacia* shrubland over hummock grassland in sandy loam plains and floodplains.
Rothia indica subsp. *australis*	P3	12.2 km E of study area	Grows in shrublands over *Triodia* hummock grasslands in red sandy to loamy soils.
Triodia chichesterensis	P3	32.2 km S of study area	Grows in clay-loam soils frequently associated with quartzite on undulating plains and low rises in woodlands and shrublands over *Triodia* hummock grasslands.
Bulbostylis burbidgeae	P4	Within study area	Grows in *Triodia* hummock grasslands typically associated with granite boulders, hill tops and outcrops.
Ptilotus mollis	P4	29.6 km S of study area	Steep-sided gullies, hill slopes, mesa and ridge tops composed of clay-loam skeletal soils; Eucalyptus and Corymbia open woodlands over Acacia open shrubland over hummock grassland.
Sida sp. Barlee Range (S. van Leeuwen 1642)	P4	21.4 km SSW of study area	Grows in *Eucalyptus* and *Acacia* woodlands over *Triodia* hummock grasslands on rocky hills, breakaways and gorges.

Study area

Species within study area

- *Tephrosia rosea* var. Port Hedland (A.S. George 1114)
- *Bulbostylis burbidgeae*

Eighty Mile Land System

ORD RANGES

Port Hedland

Redbank

Boodarie

77 m

25 m

104 m

Strelley

138

Horseflat Land System of the Roebourne Plains

Gregory Land System

560000 570000 580000 590000 600000 610000 620000 630000 640000 650000 660000 670000 680000 690000 700000 710000 720000 730000

790000 780000 770000 760000 750000 740000 730000 720000 710000 700000

Horizon Power
Roy Hill Stockpile 3

Project No	1586
Date	5/09/2023
Drawn by	GW
Map author	GW

0 10 20
Kilometers

1:440,000 (at A3) GDA 1994 MGA Zone 50

Study area

40 km buffer

Conservation status

- P1
- P2
- P3
- P4

Priority Ecological Community (P3)

Eighty Mile Land System

Figure 5-1

Desktop records of significant flora and vegetation

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5.1.1.3 Introduced flora

The desktop review identified records of 39 introduced species within the desktop search extent (DBCA 2023c). A compilation of surveys conducted in the greater Port Hedland area (ENV 2011b) identified 3 Declared Pest species and one which is also a WoNS (Table 5-4).

Table 5-4 Desktop records of significant weeds

Species	Declared Pest	WoNS
**Calotropis procera*	Yes	
**Opuntia stricta*	Yes	
**Tamarix aphylla*	Yes	Yes

GHD (2016) recorded 2 introduced flora in a section of the current study area, **Cenchrus ciliaris* and **Aerva javanica*.

5.1.1.4 Vegetation associations

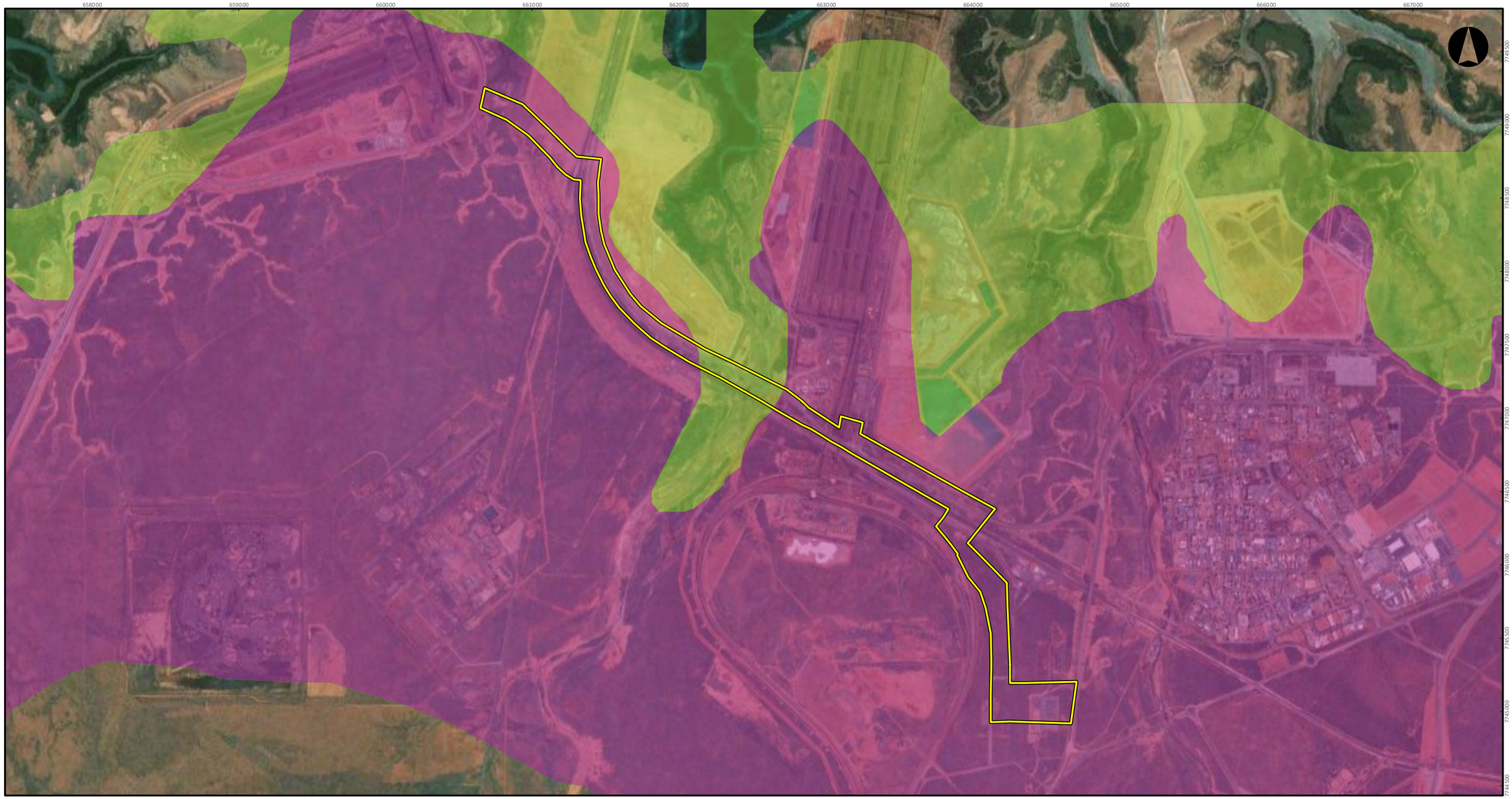
Regional scale pre-European vegetation mapping for Western Australia (Beard *et al.* 2013; DPIRD 2018) identifies mapped 2 vegetation association in the study area (Table 5-5; Figure 5-2). The remaining extent of all vegetation associations at the Statewide scale exceeds 94% (Government of Western Australia 2019) and they are therefore considered of Least Concern.

Table 5-5 Statewide extent of Pre-European vegetation associations present in the study area (Government of Western Australia 2019)

Vegetation association	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	Current extent in DBCA lands (%)	% of study area
127, Bare areas; mud flats	737,724.05	697,871.38	94.6	12.3	8.76
647, Hummock grasslands, dwarf shrub steppe; *Acacia translucens* over soft spinifex	195,860.89	191,711.41	97.88	0	91.24

GHD (2016) identified 4 vegetation types within a section of the current study area:

- *Acacia stellaticeps* low shrubland over *Triodia epactia* grassland
- *Triodia epactia* and *T. secunda* grassland
- *Tecticornia* low open shrubland
- *Avicennia marina* tall shrubland



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Project No	1586
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Study area

Vegetation association

127

647

Figure 5-2

Vegetation associations of the study area

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5.1.1.5 Significant vegetation

The DBCA Threatened and Priority Ecological Communities database search identified the presence of one PEC within the desktop search extent (Figure 5-1; Table 5-6). This PEC does not intersect the study area.

Table 5-6 TECs and PECs identified in the desktop review

Community name	Status	Proximity to study area	Description
Eighty Mile System	P3 (DBCA)	36.6 km NE	Beach foredunes, longitudinal coastal dunes and sandy plains with tussock grasslands and spinifex grasslands. Threats: extensive threatening processes acting at landscape scales, namely altered fire regimes, over grazing, erosion, and weed invasion (buffel grass).

5.1.2 Terrestrial fauna

5.1.2.1 Vertebrate fauna

The desktop review identified records of 264 vertebrate taxa within the desktop search extent. The list comprised 6 frogs, 42 reptiles, 190 birds (including one naturalised species) and 21 mammals (including 4 introduced species) (Table 5-7; Appendix 6).

Table 5-7 Summary of terrestrial fauna desktop results

Class	Introduced	Native	Total
Amphibians	0	6	**6**
Reptiles	0	42	**42**
Birds	1	190	**191**
Mammals	4	21	**25**
Total	**5**	**259**	**264**

Sixty-two significant vertebrate species were identified in the desktop review, comprising 9 species listed as Threatened, Conservation Dependent or Specially Protected under the EPBC Act and/or BC Act, 47 avifauna species listed as Migratory under the EPBC Act and BC Act, and a further 6 species are listed as Priority by DBCA (Table 5-8).

A total of 40 significant species were recorded within 5 km of the study area, comprising one reptile, 34 birds and 5 mammals (highlighted in grey in Table 5-8).

Table 5-8 Significant vertebrate fauna identified in the desktop review. Significant species recorded within 5 km of the study area highlighted in grey.

Species	Status	Proximity to study area	Habitat
Non-migratory birds (3)			
Peregrine Falcon *Falco peregrinus*	OS (BC Act)	3.2 km SSE of study area	The Peregrine Falcon's preferred habitat includes cliffs and wooded watercourses. Nesting occurs mainly on cliff ledges, granite outcrops, quarries and in trees with old raven or Wedge-tailed Eagle nests.
Fairy Tern *Sternula nereis nereis*	VU (EPBC & BC Acts)	4.8 km NW of study area	They nest on sheltered, sandy beaches. They have also been known to occur on the edges of offshore, estuaries, islands, wetlands and other areas of the mainland coastline (DCCEEW 2023a).
Grey Falcon *Falco hypoleucos*	VU (BC Act)	4.9 km SW of study area	It uses a large variety of habitats such timbered plains, creek lines, shrublands and open grasslands.
Migratory birds (47)			
Osprey *Pandion cristatus*	Mig. (EPBC & BC Acts)	397 m E of study area	P. cristatus is present across most of coastal Australia but is absent from Tasmania and Victoria. In south coastal Western Australia, the species extends as far east as Esperance (Johnstone & Storr 1998; Poole *et al.* 2002).
Wood Sandpiper *Tringa glareola*	Mig. (EPBC & BC Acts)	784 m ESE of study area	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes (DoEE 2018c).
Caspian Tern *Hydroprogne caspia*	Mig. (EPBC & BC Acts)	810 m ENE of study area	Found in sheltered coastal habitats and near-coastal terrestrial wetlands (DAWE 2022).
Little Curlew *Numenius minutus*	Mig. (EPBC & BC Acts)	1.3 km NE of study area	They spend the non-breeding season in northern Australia from Port Hedland to the Queensland coast (DoEE 2018c). The Little Curlew is most often found feeding in grassland and sedgeland with scattered, shallow freshwater pools or areas seasonally inundated. It will also use open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts. Mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used (Higgins & Davies 1996).
White-winged Black Tern *Chlidonias leucopterus*	Mig. (EPBC & BC Acts)	1.3 km NE of study area	Typically occurs in wetland environments such as brackish, saline, and coastal areas. They are also known to occupy sheltered areas such as estuaries. harbours and lagoons particularly those with sandflats and mudflats (DCCEEW 2023a).

Species	Status	Proximity to study area	Habitat
Terek Sandpiper *Xenus cinereus*	Mig. (EPBC & BC Acts)	1.6 km SSE of study area	Found primarily in coastal areas and inland wetlands of the Pilbara and Kimberley regions (DCCEEW 2023a).
Grey-tailed Tattler *Tringa brevipes*	Mig. EPBC and BC Acts; P4 DBCA list	1.6 km SSE of study area	Occurs on sheltered coasts with reefs and rock platforms or mudflats, and can also be found on reefs or platforms that are exposed at low tide (DCCEEW 2023b). It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayment's, estuaries and coastal lagoons, especially fringed with mangroves.
Gull-billed Tern *Gelochelidon nilotica*	Mig. (BC Act)	1.7 km SSE of study area	Gull-billed Terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands, and grasslands. They are only rarely found over the ocean.
Oriental Pratincole *Glareola maldivarum*	Mig. (EPBC & BC Acts)	1.7 km SSE of study area	Inhabits open plains, floodplains or short grassland, wetlands, saltworks and sewage farms. May also occur along the coast, inhabiting beaches, mudflats and islands, or around coastal lagoons.
Pin-tailed Snipe *Gallinago stenura*	Mig. (EPBC & BC Acts)	2.6 km NE of study area	Usually found in the edges of swamps, ponds, and lakes with vegetation available. They have also been found in open claypans and arid parts of the overall species range. They have been recorded in sewage ponds and less often in intertidal wetlands (DCCEEW 2023a).
Curlew Sandpiper *Calidris ferruginea*	CR/Mig./CR (EPBC Act; BC Act)	2.7 km S of study area	Occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.
Red-necked Stint *Calidris ruficollis*	Mig. (EPBC & BC Acts)	2.7 km S of study area	They are found across a wide range of open mudflat-like habitats in salt as well as in freshwater systems.
Sharp-tailed Sandpiper *Calidris acuminata*	Mig. (EPBC & BC Acts)	2.7 km S of study area	Muddy edges of shallow fresh or brackish vegetated wetlands, including lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland (DoEE 2018a).
Common Sandpiper *Actitis hypoleucos*	Mig. (EPBC & BC Acts)	2.7 km S of study area	Small ponds, large inlets, mudflats where they forage on the shore usually close to the vegetation.
Common Greenshank *Tringa nebularia*	Mig. (EPBC & BC Acts)	2.7 km S of study area	They prefer coastal open mudflats.

Species	Status	Proximity to study area	Habitat
Long-toed Stint *Calidris subminuta*	Mig. (EPBC & BC Acts)	3.0 km S of study area	They occupy a variety of wetlands. They appear to favour shallow, freshwater, and brackish wetlands including river floodplains, sewage ponds, swamps, and lagoons. They are also known to occupy muddy shorelines, weeds, and sedges and occasionally stunted samphire. They are known to occupy permanent wetlands and artificial lakes (DCCEEW 2023a).
Ruddy Turnstone *Arenaria interpres*	Mig. (EPBC & BC Acts)	3.0 km S of study area	Usually found in coastal regions containing exposed rocks. They are also found in tidal pools and beaches. They are also known to be found on sandy beaches, clay ridges and occasionally in estuaries, harbours, and lagoons. They have been recorded on sewage ponds and on mudflats (DCCEEW 2023a).
Barn Swallow *Hirundo rustica*	Mig. (EPBC & BC Acts)	3.2 km S of study area	Inhabits open country in coastal lowlands and, in or over freshwater wetlands, woodland, shrublands and tussock grassland.
Eastern Curlew *Numenius madagascariensis*	CR/Mig./CR (EPBC Act; BC Act)	3.2 km SSE of study area	Australia's largest and elusive shorebird. Little information is available on this species given this species shyness and records taking flight at the first sign of disturbance (DCCEEW 2023a).
Crested Tern *Thalasseus bergii*	Mig. (BC Act)	3.2 km SSE of study area	Occurs in temperate and tropical environments in South Africa and Australia. They found in coastal areas including low lying rocky, sandy, and coral islands. Many of the areas they occur have a distinct lack of shelter. They are often found on open shores and less often found in tidal creeks and inland waterbodies (ALA 2023).
Whimbrel *Numenius phaeopus*	Mig. (EPBC & BC Acts)	3.2 km SSE of study area	Usually found on intertidal mudflats and sheltered coastal areas. They have also been found in other waterbodies including harbours, lagoons, estuaries, rivers, and mangroves. Occasionally they are found in sandy and rocky beaches or intertidal areas (DCCEEW 2023a).
Bar-tailed Godwit *Limosa lapponica*	Mig. (EPBC & BC Acts)	3.2 km SSE of study area	Occupies a variety of aquatic habitats such as intertidal sandflats, banks, mudflats, estuaries coastal lagoons and harbours. They have also been found in saltmarshes and brackish coastal wetlands (DCCEEW 2023a).
Grey Plover *Pluvialis squatarola*	Mig. (EPBC & BC Acts)	3.2 km SSE of study area	Inhabits coastal areas, typically those sheltered such as embayment's and estuaries, although they are also known to occupy rocky coasts and platforms. Occasionally they are found in inland waterbodies (DCCEEW 2023a).
Glossy Ibis *Plegadis falcinellus*	Mig. (EPBC & BC Acts)	3.6 km S of study area	Inland, freshwater wetlands are preferred, in particular permanent or ephemeral waterbodies on floodplains and shallow swamps with abundant aquatic flora.

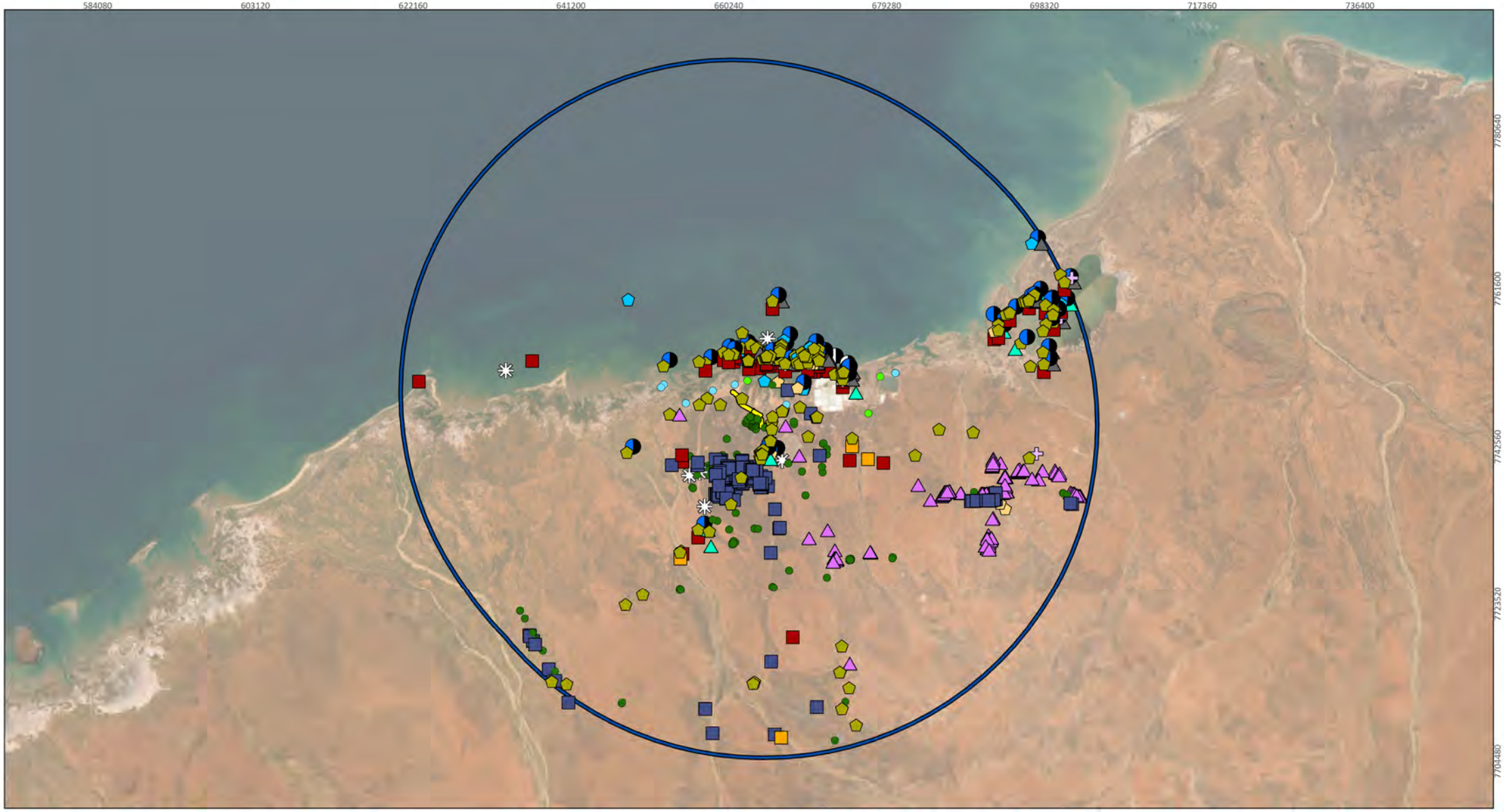
Species	Status	Proximity to study area	Habitat
Red Knot *Calidris canutus*	EN/Mig./EN (EPBC Act; BC Act)	3.8 km S of study area	Typically occupying intertidal mudflats, sandflats, and sheltered coasts. They are also known to occupy beaches, lagoons, harbours, and sandy beaches. They have also been recorded occupying saline terrestrial wetlands and sewage ponds and rarely found in freshwater swamps (DCCEEW 2023a).
Black-tailed Godwit *Limosa limosa*	Mig. (BC Act)	3.8 km S of study area	Typically found in coastal environments with sheltered bays, estuaries, and lagoons. Habitat use is dictated by the tides. They are also found in shallow and sparsely vegetated near-coastal wetlands (DCCEEW 2023a).
Greater Sand Plover *Charadrius leschenaultii*	VU/Mig./VU (EPBC Act; BC Act)	4.2 km NNE of study area	Utilises coastal and estuarine environments. They typically occupy sheltered sandy or muddy beaches as well as intertidal sandbanks and mudflats, reefs and rock platforms. They have occassional records occupying saltworks, saltlakes and marginal saltmarshes and brackish swamps (DCCEEW 2023a).
Great Knot *Calidris tenuirostris*	CR/Mig./CR (EPBC Act; BC Act)	4.6 km N of study area	They usually occupy sheltered coastal habitats as well as mudflats and sandflats such as inlets, bays, harbours, estuaries, and lagoons. They have been known to occupy reefs and rock platforms as well as shorelines and mangroves. There are also records in swamps near the coast, salt lakes and non-tidal lagoons (DCCEEW 2023a).
Little Tern *Sternula albifrons*	Mig. (EPBC & BC Acts)	4.6 km N of study area	Inhabit a variety of aquatic environments including estuaries, lagoons, sheltered coastal areas, lakes, bays, and harbours. Particularly those with sand banks or splits and exposed ocean beaches. This species is widespread but not favouring offshore continental islands or coral cays (DCCEEW 2023a).
Bridled Tern *Onychoprion anaethetus*	Mig. (EPBC & BC Acts)	4.8 km NW of study area	They occupy subtropical and tropical sea environments including islands, coral cays with adequate vegetation, continental islands but rarely recorded on inshore continental waters, although they have been reported breeding on mainland Western Australia(DCCEEW 2023a).
Lesser Sand Plover *Charadrius mongolus*	EN/Mig. (EPBC & BC Acts)	4.9 km NNW of study area	Typically found in coastal and estuarine environments. They are known to utilise intertidal mudflats and sandflats, as well as sheltered and harbours. They are known to occasionally occupy sandy beaches and rock platforms. There are records of this species utilising saltmarshes, mangrove saltworks, brackish swamps and silt islands (DCCEEW 2023a).
Bar-tailed Godwit (Northern Siberian) *Limosa lapponica menzbieri*	CR/Mig./VU/Mig. (EPBC Act; BC Act)	11.2 km ENE of study area	Occurs predominantly on coastal habitats including sandflats, banks, mudflats harbours, estuaries and lagoons and bays. There are some records of sightings in sewage farms, salt lakes and brackish wetlands near the coast, as well as sandy beaches and rock platforms (Department of the Environment 2015).

Species	Status	Proximity to study area	Habitat
Brown Booby *Sula leucogaster*	Mig. (EPBC & BC Acts)	12.0 km NNE of study area	In Western Australia, the Brown Booby is found from Bedout Island and near Onslow, and north to Bunker Group of islands in Queensland Off north-west Western Australia, Brown Boobies are most abundant 18–36 km from land, but also occur inside and outside these limits (DoEE 2018c). It uses both marine and terrestrial habitat, but tends to stay close to breeding sites, such as tropical islands, continental islands, sand cays and atolls for breeding. It is known to approach mainland coastlines more than other boobies and has been recorded in coastal waters, harbours and estuaries and near offshore islands but seldom flying over land (DoEE 2018c).
Ruff *Philomachus pugnax*	Mig. (EPBC & BC Acts)	14.5 km SSW of study area	Typically occupies saline and brackish wetlands with mudflats. They have been found in a range of wetlands including lakes, swamps, tidal rivers, and flood lands. There are some records of them occupying sheltered coastal areas such as harbours and estuaries and wetlands surrounded by dense vegetation (DCCEEW 2023a).
Oriental Plover *Charadrius veredus*	Mig. (EPBC & BC Acts)	5.2 km NNE of study area	Oriental Plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland, where they are found in sparsely vegetated plains or recently burnt open areas.
Marsh Sandpiper *Tringa stagnatilis*	Mig. (EPBC & BC Acts)	5.2 km NNE of study area	The Marsh Sandpiper occurs along the Western Australian coast and throughout parts of eastern Australia. It inhabits coastal and inland wetlands, estuarine and mangrove mudflats, beaches, swamps, lakes and several other types of wetlands (Morcombe 2004).
Lesser Frigatebird *Fregata ariel*	Mig. (EPBC & BC Acts)	5.2 km NNE of study area	It is usually seen in tropical or warmer waters off northern Western Australia, Northern Territory, Queensland, and northern New South Wales. The species is usually pelagic and often found far from land, but is also found over shelf waters, in inshore areas, and inland over continental coastlines (Marchant & Higgins 1990).
Common Tern *Sterna hirundo*	Mig. (EPBC & BC Acts)	5.4 km NNE of study area	They occur in marine, coastal and pelagic environments and are usually observed in coastal waters in beaches, platforms and sheltered areas including harbours and estuaries (DCCEEW 2023a).
Sanderling *Calidris alba*	Mig. (EPBC & BC Acts)	5.7 km NE of study area	Found utilising coastal environments open to sea swell as well as sandbars and spits and shingle banks. They also occur on wave-washed rock outcrops. They are also less frequently found in estuaries and inlet harbours and near-coastal inland wetlands (DCCEEW 2023a).

Species	Status	Proximity to study area	Habitat
Fork-tailed Swift *Apus pacificus*	Mig. (EPBC & BC Acts)	5.8 km SW of study area	Occurs in a wide range of dry or open habitats, including riparian woodlands, tea-tree swamps, low scrub, heathland, Saltmarsh, grassland and spinifex sandplains, open farmland and inland and coastal sand dunes (DSEWPaC 2011b).
Pectoral Sandpiper *Calidris melanotos*	Mig. (EPBC & BC Acts)	6.2 km E of study area	Shallow fresh to saline wetlands such as coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains, and artificial wetlands.
Yellow Wagtail *Motacilla flava*	Mig. (EPBC & BC Acts)	6.6 km NE of study area	Uses a large variety of habitats.
Broad-billed Sandpiper *Limicola falcinellus*	Mig. (BC Act)	6.8 km NE of study area	Found in sheltered coastal environments, mudflats and favours estuarine habitats. Occasionally, they have been found occupying saltmarshes, freshwater lagoons, saltworks and sewage farms. They have also been known to occupy creeks, swamps and lakes near the coast, favouring those with mudflats and exposed sands with receding tides (DCCEEW 2023a).
Asian Dowitcher *Limnodromus semipalmatus*	Mig. (EPBC & BC Acts)	6.8 km NE of study area	Inhabits sheltered coastal habitats including tidal creeks, coastal lagoons, and estuaries. There are many records utilising mudflats and sand flats. They are also known to occupy ponds, saltworks and sewage farms (DCCEEW 2023a).
Pacific Golden Plover *Pluvialis fulva*	Mig. (EPBC & BC Acts)	6.8 km NE of study area	Typically inhabits coastal environments and occasionally can be found in wetlands, mudflats, and sandflats in sheltered areas. They have been found on islands, sand, and coral cays. They have been recorded in terrestrial environments, usually near waterbodies and paddocks areas (DCCEEW 2023a).
Wilson's Storm Petrel *Oceanites oceanicus*	Mig. (EPBC & BC Acts)	6.9 km NE of study area	This species spends most of their life at sea, although during the non-breeding season they can occur in tropical and subtropical waters (DCCEEW 2023a).
Red-necked Phalarope *Phalaropus lobatus*	Mar/Mig. (EPBC Act; BC Act)	32.0 km E of study area	Records indicate their preference for occurring at sea during non-breeding periods. They have been recorded in inland coastal areas, highly saline water bodies including lakes, swamps and wetlands in Australia (DCCEEW 2023a).
Reptiles (2)			

Species	Status	Proximity to study area	Habitat
Airlie Island Ctenotus *Ctenotus angusticeps*	P3 (DBCA list)	867 m NNE of study area	The Airlie Island Ctenotus is known from approximately 12 locations in north-west WA (DoEE 2018c). On the mainland it generally inhabits the landward fringe of salt marsh communities in samphire shrubland or marine couch grassland (Maryan *et al.* 2013) in the intertidal zone along mangrove (Grey Mangrove (Avicennia marina) with occasional Red Mangrove (Rhizophora stylosa)) margins, however, subtle differences in vegetation/topography exist among sites where the species has been recorded (Biologic 2012). The Airlie Island Ctenotus is strongly associated with samphire species Tectornia halocnemoides subsp.tenuis and Suaeda arbusculoides,which occur on clayey soils, and mixed herb and grass cover of Muellerolimon salicorniaceum and Sporobolus virginicus, which occur on sandy soils (Maryan *et al.* 2013).
Pilbara Olive Python *Liasis olivaceus* subsp. *barroni*	VU (EPBC & BC Acts)	36.2 km S of study area	It is commonly found in rocky areas in association with watercourses and pools and often associated with areas of permanent pooling water near rocky habitats, such as gullies, gorges and rocky ranges or boulder sites.
Mammals (9)			
Crest-tailed Mulgara *Dasycercus cristicauda*	P4 (DBCA list)	43 m S of study area	Typically found on sand dunes, grasses and areas close to salt lakes and Nitre bush (DCCEEW 2023a).
Brush-tailed Mulgara *Dasycercus blythi*	P4 (DBCA list)	43 m S of study area	Occurs in spinifex grasslands throughout much of the arid zone, digging their burrows in the flats between low sand dunes.
Northern Quoll *Dasyurus hallucatus*	EN (EPBC & BC Acts)	1.2 km E of study area	Found in a variety of habitats; however, rocky areas provide important denning habitat, while they forage in nearby grasslands and creek lines.
North-western Free-tailed Bat *Mormopterus cobourgianus*	P1 (DBCA list)	2.0 km NNE of study area	Restricted range appearing to favour mangroves and adjoining areas in small spouts, crevices, and dead branches of mangroves. This species is relatively data deficient (Australian Museum 2020).
Bilby *Macrotis lagotis*	VU (EPBC & BC Acts)	3.8 km SW of study area	Prefers hummock grassland in plains and alluvial areas, open tussock grassland on uplands and hills, and Mulga woodland/shrubland on ridges and rises.
Banded hare-wallaby *Lagostrophus fasciatus fasciatus*	VU (EPBC & BC Acts)	5.9 km ENE of study area	This species utilises a variety of habitats such as grasslands, heathlands, and dunes. They typically occur in dense vegetation and utilise shrubs for shelter. Runways are produced beneath shrubs to allow efficient movement. These runways in dense vegetation are important for predator evasion (DCCEEW 2023a).

Species	Status	Proximity to study area	Habitat
Pilbara Leaf-nosed Bat *Rhinonicteris aurantia* (Pilbara)	VU (EPBC & BC Acts)	26.0 km ESE of study area	Roosts in caves and mine adits with stable, warm, and humid microclimates in the Hamersley and Chichester Ranges.
Ghost Bat *Macroderma gigas*	VU (EPBC & BC Acts)	26.2 km ESE of study area	Prefers to roost in caves beneath bluffs of low, rounded hills composed of Marra Mamba geology, and granite rock piles in the Pilbara and sandstone elsewhere, as wells as adits (abandoned mines).
Western Pebble-mound Mouse *Pseudomys chapmani*	P4 (DBCA list)	26.3 km ESE of study area	The mounds are located on the gentle slopes of rocky ranges covered in rocky mulch, hard spinifex and sparse trees and shrubs (Eucalyptus, Senna, Acacia and Ptilotus). They are also often found near Acacia-dominated drainage lines.



Horizon Power
Roy Hill Stockpile 3

Project No	1587
Date	1/09/2023
Drawn by	BK
Map author	PW

0 12.5 25
Kilometers

1:622,100(at A4) GDA 1994 MGA Zone 50

- Study area
- 40km search area

Status

- CR/Mig./CR (EPBC Act; BC Act)
- CR/Mig./VU/Mig. (EPBC Act; BC Act)
- EN (EPBC & BC Acts)
- EN/Mig. (EPBC & BC Acts)
- EN/Mig./EN (EPBC Act; BC Act)
- Mar/Mig. (EPBC Act; BC Act)
- Mig. (BC Act)
- Mig. (EPBC & BC Acts)
- Mig. EPBC and BC Acts; P4 DBCA list
- OS (BC Act)
- P1 (DBCA list)
- P3 (DBCA list)
- P4 (DBCA list)
- VU (BC Act)
- VU (EPBC & BC Acts)
- VU/Mig./VU (EPBC Act; BC Act)

Figure 5-3

Desktop records of significant vertebrate fauna

PHOENIX ENVIRONMENTAL SCIENCES

5.2 FIELD SURVEY

5.2.1 Flora and vegetation

5.2.1.1 Flora assemblage

A total of 77 flora taxa representing 24 families and 50 genera were recorded in the study area of which 72 were identified to species level (Appendix 7). 5 specimens were collected that could not be identified to species level (see section 5.2.1.4).

Species richness ranged from 5 to 27 species between quadrats (Appendix 2; Appendix 8). The assemblage included 67 native species and 5 introduced species, including 63 perennial species, and 9 annual or short-lived species. The most prominent families recorded were Poaceae (16 spp.), Fabaceae (14 spp.), Chenopodiaceae (6 spp.), Malvaceae and Convolvulaceae (6 spp.).

5.2.1.2 Significant flora

A large proportion of the study area was foot searched for the presence of significant flora (Figure 5-4). No Threatened flora and one Priority flora were recorded during the field survey, *Tephrosia rosea* var. Port Hedland (A.S. George 1114) (P1) (Table 5-9; Figure 5-5). A total of 305 *Tephrosia rosea* var. Port Hedland (A.S. George 1114) plants were recorded within 3 populations (Table 5-10). Population 1 included 2 subpopulations and Population 3 included 3 subpopulations (Figure 5-5).

Table 5-9 Details of listed significant flora recorded during the field survey

Species	Status	Distribution and ecology	Survey records	Photograph
Tephrosia rosea var. Port Hedland (A.S. George 1114)	P1	Occurs in the Pilbara and Great Sandy Desert bioregions (WA Herbarium 1998). There are 44 records of this species in FloraBase (WA Herbarium 1998) Habitat descriptions include sand dunes and plains, coastal sand dunes frequently in *Acacia* shrublands over *Triodia* grasslands but also in disturbed areas such as road sides with large weed infestations. Population sizes for the FloraBase records range from one to 300 individuals to comments of locally common and abundant	3 populations were recorded in the field survey, all occurred in vegetation type Te	

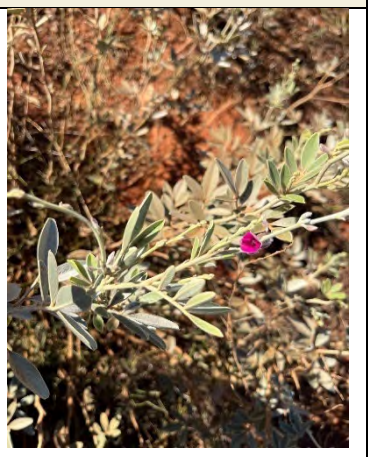
Species	Status	Distribution and ecology	Survey records	Photograph
				

Table 5-10 Details of *Tephrosia rosea* var. Port Hedland (A.S. George 1114) populations

Population Number	Subpopulation Number	Number of Individuals
1	Sub-1, Sub-2	124
2	-	43
3	Sub-1, Sub-2, Sub-3	141
	Total	**308**

The likelihood of occurrence assessment (section 4.2.2.2) for the remaining significant species identified in the desktop review determined one may possibly occur and the remaining 10 are unlikely to occur (Table 5-11).

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Western Australia
PERTH

Horizon Power
Roy Hill Stockpile 3

Project No	1586
Date	5/09/2023
Drawn by	GW
Map author	GW

0 235 470
Meters

1:8,800 (at A3) GDA 1994 MGA Zone 50

Study area
GPS tracks

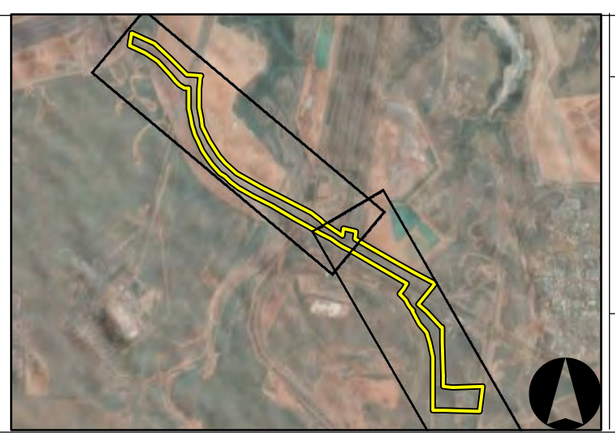
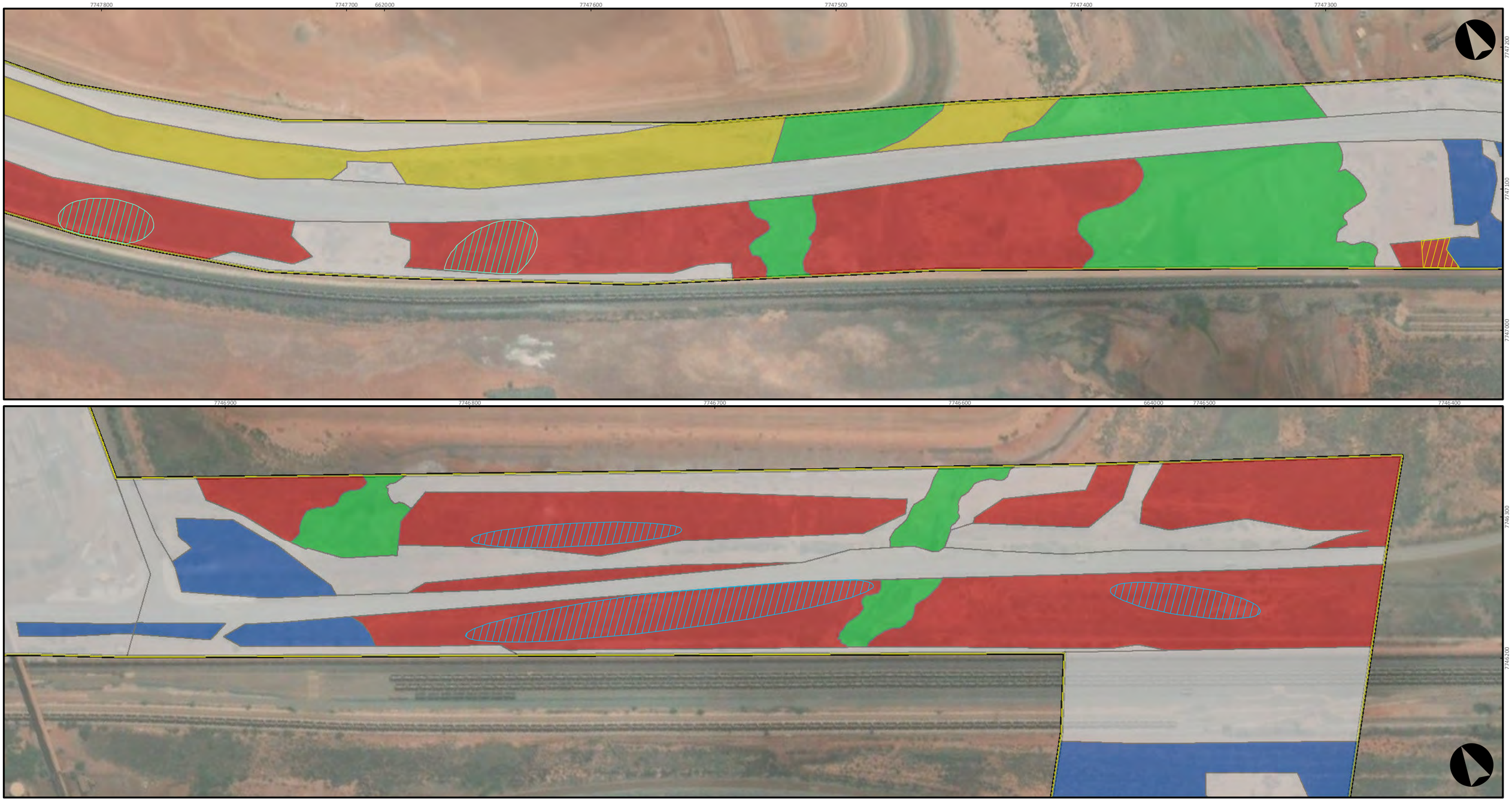


Figure 5-4

GPS tracks of survey effort

PHOENIX ENVIRONMENTAL SCIENCES

P:\Data\Projects\RoyHillStockPile3\1586-RHS-HOR-BOT\GIS\Mapping\MapDocuments\Figures\Figure5-4_GPSTracksOfSurveyEffort.mxd



Horizon Power
Roy Hill Stockpile 3

Project No	1586
Date	5/09/2023
Drawn by	GW
Map author	GW

0 80 160
Meters

1:3,000 (at A3) GDA 1994 MGA Zone 50

Study area

***Tephrosia rosea* var. Port Hedland (A.S. George 1114)**

Population 1
Population 2
Population 3

Vegetation type

AmTspp
AsTe
NaEm
Te
Cleared

Figure 5-5

Significant flora records from the field survey

PHOENIX ENVIRONMENTAL SCIENCES

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Table 5-11 Likelihood of occurrence for significant flora identified in the desktop review

Species	Status	Likelihood of occurrence
Tephrosia rosea var. Port Hedland (A.S. George 1114)	P1	Recorded.
Gomphrena pusilla	P2	Unlikely, lack of suitable habitat in the study area.
Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	P3	Unlikely, study area was adequately searched to locate individuals of this species.
Eragrostis crateriformis	P3	Unlikely, lack of suitable habitat in the study area.
Gomphrena leptophylla	P3	Unlikely, lack of suitable habitat in the study area.
Gymnanthera cunninghamii	P3	Unlikely, lack of suitable habitat in the study area and the study area was adequately searched to locate any individuals.
Euploca mutica	P3	Unlikely, study area was adequately searched to locate individuals of this species.
Rothia indica subsp. *australis*	P3	Possible, suitable habitat occurs in the study area and despite the survey being conducted within the flowering period, it is possible that this annual species was not detectable at the time of the survey.
Triodia chichesterensis	P3	Unlikely, lack of suitable habitat in the study area and the study area lies outside of the recorded distribution for the species.
Bulbostylis burbidgeae	P4	Unlikely, a thorough search conducted at the desktop record for the species located in the study area failed to locate the species and identified a lack of suitable habitat at this location and throughout the study area.
Ptilotus mollis	P4	Unlikely, lack of suitable habitat in the study area and the study area was adequately searched to locate any individuals.
Sida sp. Barlee Range (S. van Leeuwen 1642)	P4	Unlikely, lack of suitable habitat in the study area and the study area was adequately searched to locate any individuals.

5.2.1.3 Introduced flora

Five introduced flora species were recorded during the survey, none of which are a WoNS or Declared Pest (Table 5-12).

Table 5-12 Introduced flora recorded in the field survey

Family	Species	Declared Pest	WoNS
Amaranthaceae	**Aerva javanica*	No	No
Poaceae	**Cenchrus ciliaris*	No	No
Poaceae	**Chloris barbata*	No	No
Fabaceae	**Indigofera sessiliflora*	No	No
Fabaceae	**Stylosanthes hamata*	No	No

5.2.1.4 Unidentified flora

Five specimens collected during the survey could not be identified to species level (Table 5-13), mainly as a result of insufficient taxonomic characters, as plants were sterile (lacking reproductive structures) or reproductive structures were too old/dry or damaged to be useful.

Table 5-13 Unidentified taxa recorded during the field survey

Taxon	Comments
Tecticornia sp. (sterile 1)	Specimens completely sterile
Tecticornia sp. (sterile 2)	Specimens completely sterile
Abutilon aff. *lepidium*/*dioicum* variant	Insufficient reproductive characters for definitive identification
Abutilon sp.	Specimen completely sterile
Sida ?*arenicola*	Morphologically similar to *S. arenicola* but lack of reproductive characters for definitive identification

5.2.1.5 Vegetation types

There were 5 vegetation types were defined for the study area based on the cluster analysis (Figure 5-6). They comprised *Triodia* grasslands (AsTe, Te, Ts) with or without a low *Acacia stellaticeps* shrub layer, a sparse mangrove shrubland over sparse samphire shrubland (AmmTspp) and Degraded areas virtually completely cleared with isolated shrubs and grasses (NaEm).(Table 5-14; Figure 5-7).

Almost one third (32.9%) of the study area was cleared and completely devoid of vegetation. The *Triodia* grasslands were the most prominent vegetation, accounting for a combined 52.1% of the study area (78.5% of the remnant vegetation). The mangrove/samphire shrubland was the next most prominent, accounting for 9.3% of the study area (14% of the remnant vegetation). The Degraded areas with sparse plant cover accounted for 5.7% of the study area and 8.6% of the remnant vegetation (Table 5-14).

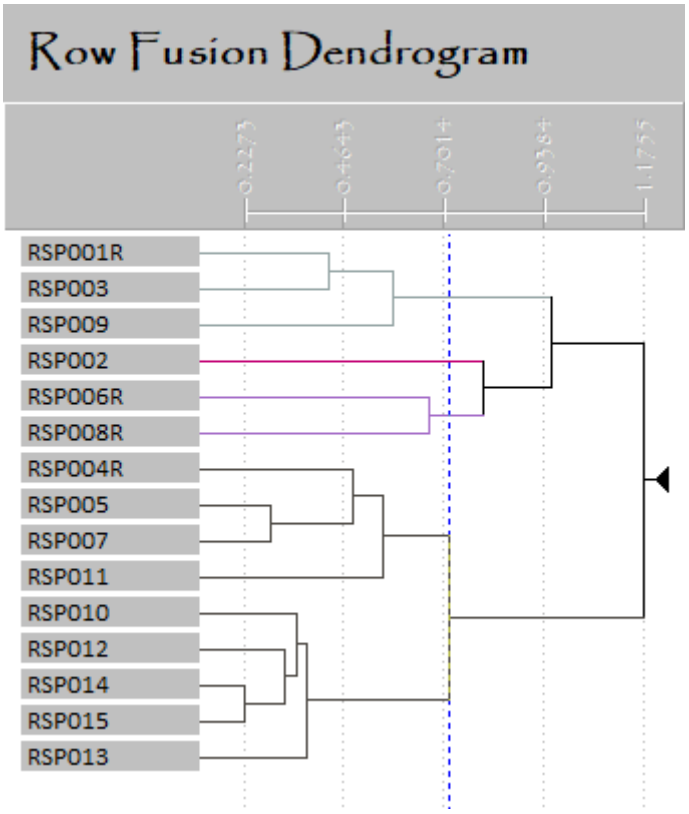

Figure 5-6 Hierarchical clustering (UPGMA) of the flora quadrats of the study area

Table 5-14 Vegetation types, description and extent in the study area

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
AmTspp	RSP001R, RSP003, RSP009	Variably present low to tall sparse shrubland of *Avicennia marina* subsp. *marina*, over low sparse to open shrubland of *Tecticornia* spp.	9.19, 9.3%	
Ts	RSP002	Isolated low shrubs of *Cynanchum viminale* subsp. australe, *Tecticornia indica* subsp. *leiostachya*, and *Neobassia astrocarpa*, over low hummock grassland of *Triodia secunda* and *T. epactia*.	1.61, 1.6%	

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
NaEm	RSP006R, RSP008R	Low isolated shrubs of *Neobassia astrocarpa*, with variably present *Tecticornia indica* subsp. *leiostachya* and *T.* sp. (sterile2), over low isolated tussock grasses of *Eriachne mucronata*, *Eragrostis falcata*, and **Chloris barbata*.	5.65, 5.7%	
Te	RSP004R, RSP005, RSP007, RSP011	Low isolated shrubs of *Acacia stellaticeps*, *Corchorus incanus* subsp. *incanus*, and *Solanum cleistogamum*, over low sparse hummock grassland to hummock grassland of *Triodia epactia* and *T. secunda* variably with invading **Cenchrus ciliaris*.	20.76, 21%	

Vegetation type	Site/s	Vegetation description	Extent in study area (ha) and % of study area	Representative photograph
AsTe	RSP010, RSP012, RSP013, RSP014, RSP015	Low sparse shrubland to shrubland of *Acacia stellaticeps*, *Solanum cleistogamum*, and *Pluchea tetranthera*, over low open hummock grassland to hummock grassland of *Triodia epactia*, *T. schinzii*, and occasionally *T. secunda*.	29.14, 29.5%	

661000 7749000 662000 7748500 663000 7747500 664000

7747500 7747000 664000 7746500 7746000 7745500 665000 7745000

7741000 664000 7746500 665000 7744500

Horizon Power
Roy Hill Stockpile 3

Project No	1586
Date	5/09/2023
Drawn by	GW
Map author	GW

0 0.25 0.5
Kilometers

1:10,000 (at A3) GDA 1994 MGA Zone 50

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Study area

Vegetation type

- AmTspp
- AsTe
- NaEm
- Te
- Ts
- Cleared

Figure 5-7

Vegetation types recorded in the field survey

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5.2.1.6 Vegetation condition

Almost a third (32.91%) of the study area was cleared, completely devoid of native vegetation and subsequently categorised as Completely Degraded. Remnant vegetation in the study area was recorded to be in Degraded to Excellent condition (Figure 5-8) with more than half (53.94%%) in Degraded to Good condition and the remaining 46.06% in Very Good to Excellent condition (Table 5-15).

Areas classed as Degraded condition were areas that had either:

- been historically completely cleared, had altered hydrology, comprised isolated native plant species associated with introduced flora, or
- had multiple disturbances including partial historic clearing, litter, vehicle tracks and introduced flora were dominant

Areas in Poor condition also showed signs of partial clearing and were heavily weed infested. Areas in Good condition contained vehicle tracks and smaller infestations of weeds, Very Good areas had isolated weeds and areas in Excellent condition showed no observable evidence of human impact.

Table 5-15 Vegetation condition – extent of each condition rating in study area

Condition rating	Area (ha)	% of study area	% of remnant vegetation
Excellent	20.95	21.19	31.58
Very Good	9.61	9.72	14.48
Good	6.78	6.85	10.21
Poor	9.35	9.46	14.10
Degraded	19.66	19.88	29.63
Completely Degraded	32.54	32.91	0

5.2.1.7 Significant vegetation

None of the vegetation was considered representative of a TEC or PEC.

Vegetation type Te was considered to have local significance as it provides a role as a refuge for the Priority 1 flora *Tephrosia rosea* var. Port Hedland (A.S. George 1114). None of the remaining vegetation was considered to have either local or regional significance.

5.2.1.8 Analysis of survey completeness

The near flattening of the species accumulation curve (Figure 5-9) indicates that sufficient sites (quadrats and relevés) were surveyed to capture the diversity of flora present at the time of the field surveys.

661000 7749000 662000 7748500 663000 7747500 664000

7747500 7747000 664000 7746500 7746000 7745500 665000 7745000

7741000 664000 7746500 7744500 665000

Horizon Power
Roy Hill Stockpile 3

Project No	1586
Date	5/09/2023
Drawn by	GW
Map author	GW

0 0.25 0.5
Kilometers

1:10,000 (at A3) GDA 1994 MGA Zone 50

Study area

VEG_COND

- Excellent
- Very Good
- Good
- Poor
- Degraded
- Completely Degraded

Figure 5-8

Vegetation condition in the study area

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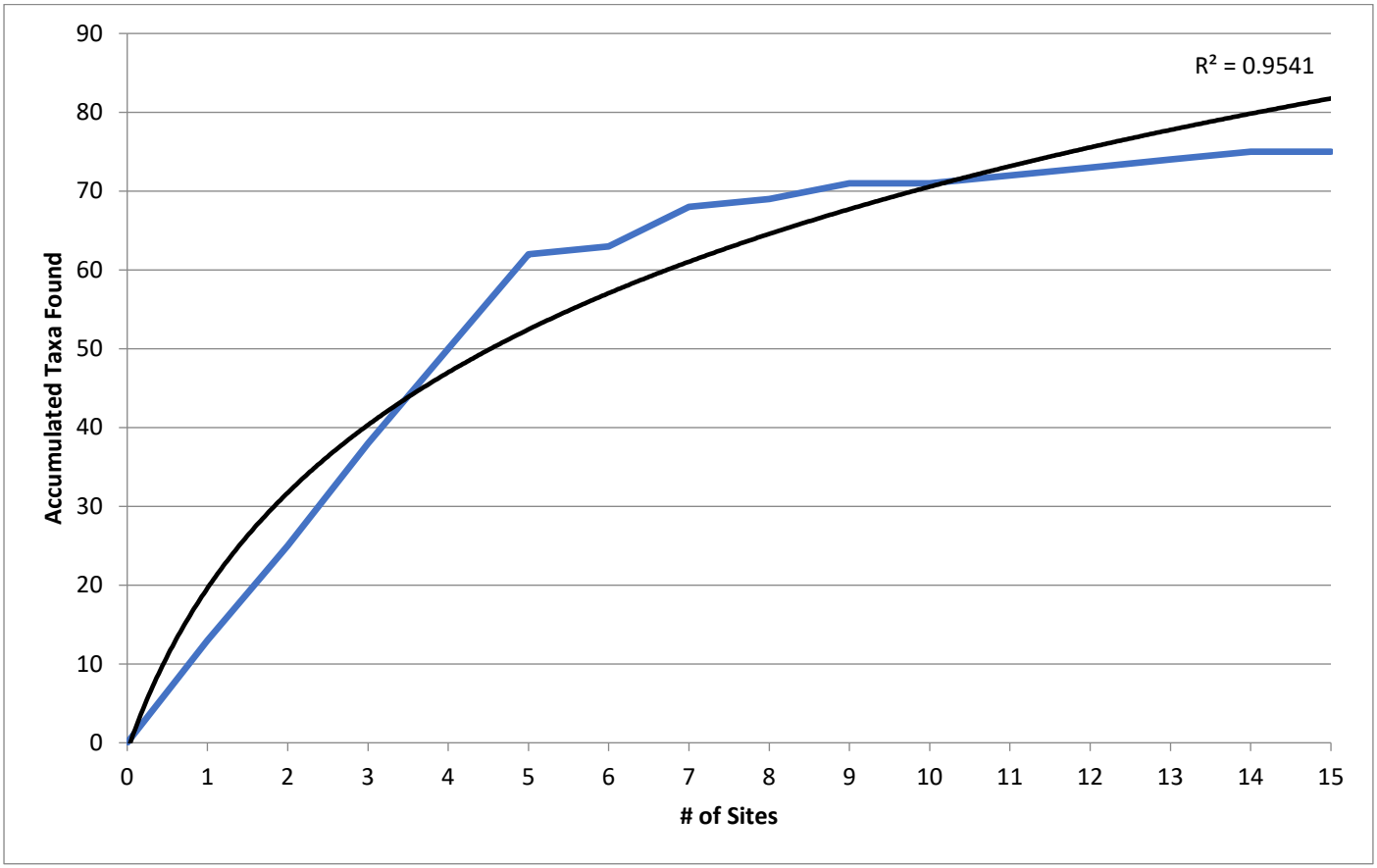


Figure 5-9 **Species accumulation curve for Phoenix survey sites (thin black line represents trend line)**

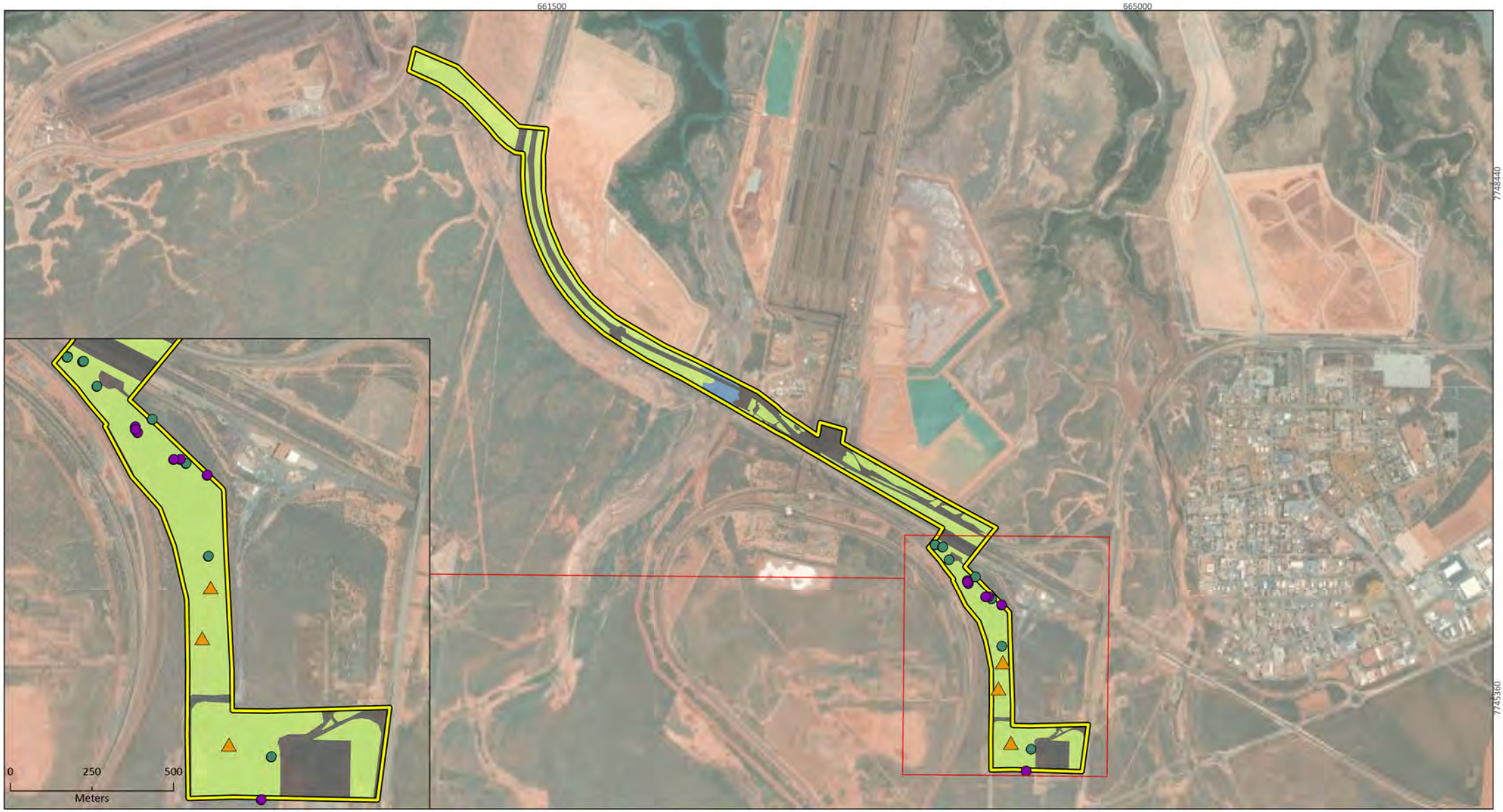
5.2.2 Vertebrate fauna

5.2.2.1 Habitats

Two broad fauna habitat types were identified in the study area, comprising sandplain and intertidal mudflats (Table 5-16; Figure 5-10). The sandplains dominated the study area comprising everything except the small intertidal mudflat in the middle of the study area.

Table 5-16 Extent and description of each fauna habitat in the study area

Habitat type	Site/s	Description	Extent in study area and % of study area	Representative photograph
Sandplain	RHP01, RHP02, RHP03, RHP04, RHP06	Mixed *Acacia* dominant low shrubs over spinifex hummock grassland on predominantly sandy soils with some clay present. Some sections almost entirely Degraded as they are reduced to small strips in-between railway and road. **Suitable habitat for Bilby and Mulgara present.**	68.34	
Intertidal mudflat	RHP05	Intertidal zone forming a channel under road and rail infrastructure. Adjacent terrestrial habitats heavily disturbed and not suitable to support native fauna assemblages. **Suitable habitat for Migratory shorebirds present.**	2.81	
Cleared	-	Infrastructure and access tracks.	34.89	



Horizon Power
Roy Hill Stockpile 3

Project No	1587
Date	5/09/2023
Drawn by	JL
Map author	PW

0 0.5 1
Kilometers

1:30,800 (at A4) GDA 1994 MGA Zone 50

Study area

Habitat
- Cleared
- Intertidal mudflats
- Sandplains

Bilby record
- Fresh scat
- Old Scat
- Old digging

Figure 5-10

Fauna habitats and significant fauna records from the field survey

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5.2.2.2 Assemblage

A total of 20 terrestrial vertebrate species representing 17 families and 19 genera were recorded in the study area during the field surveys (Appendix 6) 19 native species and one introduced species.

5.2.2.3 Significant vertebrate fauna

Evidence of Bilby was detected at several sites in the form of recent scats, tracks, and diggings (Figure 5-11). Scats of multiple sizes were documented at one site meaning it is likely there were at least 2 individuals present within the study area. Several scats were considered fresh as they were moist and odorous. Two Migratory shorebird species were documented at site RHP05, including one Whimbrel (Mig.) and one Grey-tailed Tattler (Mig; P4).

Figure 5-11 **Evidence of Bilby (*Macrotis lagotis*) within the study area. Top 2 photos display foraging diggings. Bottom photo displays tracks of 2 individuals and scats of varying sizes, likely comprising an adult and juvenile.**

The likelihood of occurrence assessment (section 4.2.3.4) for the remaining significant species identified in the desktop review (section 5.1.2) determined 4 were likely to occur in the study area, 31 may possibly occur and 28 are unlikely to occur (Table 5-17).

Table 5-17 Likelihood of occurrence of relevant significant vertebrate fauna identified in the desktop survey and recorded in the field survey

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
Reptiles (2)					
Ctenotus angusticeps Airlie Island Ctenotus	P3 (DBCA list)	867 m NNE of study area	The Airlie Island Ctenotus is known from approximately 12 locations in northwest WA (DoEE 2018a). On the mainland it generally inhabits the landward fringe of salt marsh communities in samphire shrubland or marine couch grassland (Maryan *et al.* 2013) in the intertidal zone along mangrove (Grey Mangrove (*Avicennia marina*) with occasional Red Mangrove (*Rhizophora stylosa*)) margins, however, subtle differences in vegetation/topography exist among sites where the species has been recorded (Biologic 2012).	Unlikely	The Project is unlikely to significantly impact populations nearby and this species may only be detected in low abundance (if detected at all).
Liasis olivaceus barroni Pilbara Olive Python	VU (EPBC & BC Acts)	Projected Distribution	It is commonly found in rocky areas in association with watercourses and pools and often associated with areas of permanent pooling water near rocky habitats, such as gullies, gorges and rocky ranges or boulder sites.	Unlikely	Given the lack of recent records and the wide available habitats outside the study area, it is unlikely that the study area supports a significant number of this species or provides important resources for significant life history stages.
Non-migratory Birds (5)					
Falco hypoleucos Grey Falcon	VU (BC Act)	4.9 km SW of study area	It uses a large variety of habitats such as timbered plains, creeklines, shrublands and open grasslands.	Likely	This species was recorded several times less than 5km away and is known to occupy a wide range of habitats. It is likely this species will use the study area for foraging.
Falco peregrinus Peregrine Falcon	OS (BC Act)	3.2 km SSE of study area	The Peregrine Falcon's preferred habitat includes cliffs and wooded watercourses. Nesting occurs mainly on cliff ledges, granite outcrops, quarries and in trees with old raven or Wedge-tailed Eagle nests.	Unlikely	Given this species' potentially wide dispersal ability, it is possible to utilise the available habitat within the study area. While they can disperse, they often return to their initial home range once mature to breed. This species is not considered common in any part of Australia therefore the potential to

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
					detect them within the study area is possible but may not occur.
Pezoporus occidentalis Night Parrot	EN/CR (EPBC Act; BC Act)	Projected Distribution	For roosting and nesting, Night Parrot appears to favour areas of dense vegetation comprising old-growth spinifex (*Triodia* spp.), especially hummocks that form rings (often > 50 years unburnt). It is thought that spinifex hummocks that are <40-50 cm in height are not likely to provide adequate shelter for roosting and nesting (DPaW 2017).	Unlikely	While suitable habitat exists within the study area, the lack of records reduces the probability of occupying the study area. Considering the threats to dispersal for Night Parrot, it is likely the study area occurs outside their typical range and would not support this species.
Rostratula australis Australian Painted Snipe	EN (EPBC & BC Acts)	Projected Distribution	Inhabits shallow terrestrial fresh-brackish wetlands, including temporary and permanent lakes, swamps and claypans, waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains.	Unlikely	Negligible suitable habitat is within the study area, it is unlikely to be the preferred habitat when other, better-quality habitat is available.
Sterna nereis nereis Fairy Tern	VU (BC Act)	4.8 km NW of study area	In WA, the species is present along the entire coastline, with rare records from the far north (Kimberley) and off the Nullarbor Plain. They usually nest on islands, estuaries or sandy beaches. They nest on sheltered, sandy beaches. They have also been known to occur on the edges of offshore, estuaries, islands, wetlands and other areas of the mainland coastline (DCCEEW 2023b).	Unlikely	While possible for this species to occur, the lack of spatial data and limited available habitat means that it is unlikely for this species to occupy the available habitat in significant numbers or during important life history stages (e.g., courtship or breeding).
Migratory Birds (52)					
Apus pacificus Fork-tailed Swift	Mig. (EPBC & BC Acts)	5.8 km SW of study area	Occurs in a wide range of dry or open habitats, including riparian woodlands, tea-tree swamps, low scrub, heathland, Saltmarsh, grassland and spinifex sandplains, open farmland and inland and coastal sand dunes (DSEWPaC 2011a).	Likely	This species was recorded just over 5km away, however it is known to utilise a wide range of habitats and is unlikely to be impacted by this Project.
Pandion cristatus Osprey	Mig. (EPBC & BC Acts)	397 m E of study area	P. *cristatus* is present across most of coastal Australia but is absent from Tasmania and Victoria. In south coastal Western Australia, the species extends as far east as Esperance (Johnstone & Storr 1998; Poole *et al.* 2002).	Likely	This species has been recorded quite close to the study area recently. However, it each individual occupies a large home range along the coast line, and there is very little suitable habitat in the study area.
Actitis hypoleucos Common Sandpiper	Mig. (EPBC & BC Acts)	Projected Distribution	Found in a wide range of wetlands: small ponds, large inlets and mudflats. Small ponds, large inlets, and mudflats	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
			where they forage on the shore usually close to the vegetation.		a significant number of individuals and therefore the outcome is unlikely.
Anous stolidus Common Noddy	Mig. (EPBC & BC Acts)	Projected Distribution	Found primarily in coastal areas and inland wetlands of the Pilbara and Kimberley regions (DCCEEW 2023b).	Unlikely	Given the lack of recent records and the wide available habitats outside the study area, it is unlikely that the study area supports a significant number of this species or provides important resources for significant life history stages.
Arenaria interpres Ruddy Turnstone	Mig. (EPBC & BC Acts)	3.0 km S of study area	Usually found in coastal regions containing exposed rocks. They are also found in tidal pools and beaches. They are also known to be found on sandy beaches, clay ridges and occasionally in estuaries, harbours and lagoons. They have been recorded on sewage ponds and on mudflats (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Calidris acuminata Sharp-tailed Sandpiper	Mig. (EPBC & BC Acts)	Projected Distribution	Usually found in coastal regions containing exposed rocks. They are also found in tidal pools and beaches. They are also known to be found on sandy beaches, clay ridges and occasionally in estuaries, harbours and lagoons. They have been recorded on sewage ponds and mudflats (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Calidris alba Sanderling	Mig. (EPBC & BC Acts)	5.7 km NE of study area	Found utilising coastal environments open to sea swell as well as sandbars and spits and shingle banks. They also occur on wave-washed rock outcrops. They are also less frequently found in estuaries and inlet harbours and near-coastal inland wetlands (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Calidris canutus Red Knot	EN/Mig./EN (EPBC Act; BC Act)	3.8 km S of study area	Muddy edges of shallow fresh or brackish vegetated wetlands, including lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland (DoEE 2018c).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Calidris ferruginea Curlew Sandpiper	CR/Mig./CR (EPBC Act; BC Act)	2.7 km S of study area	Typically occupying intertidal mudflats, sandflats and sheltered coasts. They are also known to occupy beaches, lagoons, harbours and sandy beaches. They have also been recorded occupying saline terrestrial wetlands and sewage	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
			ponds and are rarely found in freshwater swamps (DCCEEW 2023b).		
Calidris melanotos Pectoral Sandpiper	Mig. (EPBC & BC Acts)	6.2 km E of study area	Occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.	Possible	Negligible suitable habitat is within the study area, it is unlikely to be the preferred habitat when other, better-quality habitat is available.
Calidris ruficollis Red-necked Stint	Mig. (EPBC & BC Acts)	2.7 km S of study area	Shallow fresh to saline wetlands such as coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Calidris subminuta Long-toed Stint	Mig. (EPBC & BC Acts)	3.0 km S of study area	They are found across a wide range of open mudflat-like habitats in salt as well as freshwater systems.	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Calidris tenuirostris Great Knot	CR/Mig./CR (EPBC Act; BC Act)	4.6 km N of study area	They occupy a variety of wetlands. They appear to favour shallow, freshwater and brackish wetlands including river floodplains, sewage ponds, swamps and lagoons. They are also known to occupy muddy shorelines, weeds and sedges and occasionally stunted samphire. They are known to occupy permanent wetlands and artificial lakes (DCCEEW 2023b).	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Calonectris leucomelas Streaked Shearwater	Mig. (EPBC & BC Acts)	Projected Distribution	They usually occupy sheltered coastal habitats as well as mudflats and sandflats such as inlets, bays, harbours, estuaries and lagoons. They have been known to occupy reefs and rock platforms as well as shorelines and mangroves. There are also records in swamps near the coast, salt lakes and non-tidal lagoons (DCCEEW 2023b).	Unlikely	Coastal environments are marginally available within the study area but prone to disturbance. While technically possible due to dispersal potential, habitat preferences and lack of evidence mean it is unlikely for this species to occupy the study area in significant numbers or for significant life history stages.

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
Charadrius leschenaultii Greater Sand Plover	VU/Mig./VU (EPBC Act; BC Act)	Projected Distribution	It occurs frequently in northern Australia, with records from central Western Australia, around the north coast, and south to central New South Wales (Marchant & Higgins 1990).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Charadrius mongolus Lesser Sand Plover	EN/Mig. (EPBC & BC Acts)	4.9 km NNW of study area	Utilises coastal and estuarine environments. They typically occupy sheltered sandy or muddy beaches as well as intertidal sandbanks and mudflats, reefs and rock platforms. They have occasional records occupying saltworks, salt lakes and marginal saltmarshes and brackish swamps (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Charadrius veredus Oriental Plover	Mig. (EPBC & BC Acts)	5.2 km NNE of study area	Oriental Plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland, where they are found in sparsely vegetated plains or recently burnt open areas.	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Chlidonias leucopterus White-winged Black Tern	Mig. (EPBC & BC Acts)	1.3 km NE of study area	Typically found in coastal and estuarine environments. They are known to utilise intertidal mudflats and sandflats, as well as sheltered harbours. They are known to occasionally occupy sandy beaches and rock platforms. There are records of this species utilising saltmarshes, mangrove saltworks, brackish swamps and silt islands (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Fregata ariel Lesser Frigatebird	Mig. (EPBC & BC Acts)	5.2 km NNE of study area	Typically occurs in wetland environments such as brackish, saline and coastal areas. They are also known to occupy sheltered areas such as estuaries. harbours and lagoons particularly those with sandflats and mudflats (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Fregata minor Greater Frigatebird	Mig. (EPBC & BC Acts)	Projected Distribution	This species has a wide distribution, moving between countries along the equator during non-breeding season, including the northern parts of Australia (BirdLife International 2023).	Unlikely	Coastal environments are marginally available within the study area but prone to disturbance. While technically possible due to dispersal potential, habitat preferences and lack of evidence mean it is unlikely for this species to occupy the study area in

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
					significant numbers or for significant life history stages.
Gallinago stenura Pin-tailed Snipe	Mig. (EPBC & BC Acts)	2.6 km NE of study area	Usually found in the edges of swamps, ponds and lakes with vegetation available. Tey have also been found in open claypans and arid parts of the overall species range. They have been recorded in sewage ponds and less often in intertidal wetlands (DCCEEW 2023b).	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Gelochelidon nilotica Gull-billed Tern	Mig. (BC Act)	1.7 km SSE of study area	Gull-billed Terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands. They are only rarely found over the ocean.	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Glareola maldivarum Oriental Pratincole	Mig. (EPBC & BC Acts)	1.7 km SSE of study area	Inhabits open plains, floodplains or short grassland, wetlands, saltworks and sewage farms. May also occur along the coast, inhabiting beaches, mudflats and islands, or around coastal lagoons.	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Hirundo rustica Barn Swallow	Mig. (EPBC & BC Acts)	3.2 km S of study area	Inhabits open country in coastal lowlands and, in or over freshwater wetlands, woodland, shrublands and tussock grassland.	Possible	Given the recent record, ability to disperse and abundance of habitat it is possible that this species may rely on resources within the study area and was not detected during the survey.
Hydroprogne caspia Caspian Tern	Mig. (EPBC & BC Acts)	810 m ENE of study area	Found in a variety of aquatic habitats including coastal areas, salt exploitation sites, wastewater treatment areas, cliffs and rocky islands, estuaries and intertidal areas with sand, rocks, mud or a combination of these substrates.	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Limicola falcinellus Broad-billed Sandpiper	Mig. (BC Act)	6.8 km NE of study area	Found in sheltered coastal environments, mudflats and favours estuarine habitats. Occasionally they have been found occupying saltmarshes, freshwater lagoons, saltworks and sewage farms. They have also been known to occupy creeks, swamps and lakes near the coast, favouring those with mudflats and exposed sands with receding tides (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Limnodromus semipalmatus Asian Dowitcher	Mig. (EPBC & BC Acts)	6.8 km NE of study area	Found in sheltered coastal habitats and near-coastal terrestrial wetlands (DAWE 2022).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
					a significant number of individuals and therefore the outcome is unlikely.
Limosa lapponica Bar-tailed Godwit	Mig. (EPBC & BC Acts)	3.2 km SSE of study area	Inhabits sheltered coastal habitats including tidal creeks, coastal lagoons and estuaries. There are many records utilising mudflats and sandflats. They are also known to occupy ponds, saltworks and sewage farms (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Limosa limosa Black-tailed Godwit	Mig. (BC Act)	3.8 km S of study area	Occurs predominantly in coastal habitats including sandflats, banks, mudflats harbours, estuaries and lagoons and bays. There are some records of sightings in sewage farms, salt lakes and brackish wetlands near the coast, as well as sandy beaches and rock platforms.	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Macronectes giganteus Southern Giant Petrel	EN/Mig./Mig. (EPBC Act; BC Act)	Projected Distribution	Typically found in coastal environments with sheltered bays, estuaries and lagoons. Habitat use is dictated by the tides. They are also found in shallow and sparsely vegetated near-coastal wetlands (DCCEEW 2023b).	Unlikely	It is very unlikely this species will occupy the study area and if found inside or nearby, will likely be passing through and not reliant on the habitat available within the study area in significant proportions or during important life history stages.
Motacilla cinerea Grey Wagtail	Mig. (EPBC & BC Acts)	Projected Distribution	Pelagic. Breeds on 6 subantarctic and Antarctic islands in Australian territory (DoEE 2018b).	Unlikely	Given the lack of recent records and the wide available habitats outside the study area, it is unlikely that the study area supports a significant number of this species or provides important resources for significant life history stages.
Motacilla flava Yellow Wagtail	Mig. (EPBC & BC Acts)	6.6 km NE of study area	Uses a large array of habitats. A small wagtail that is a vagrant visitor to Australia that inhabits fast-flowing streams and rivers (IUCN 2019).	Unlikely	Given the lack of recent records and the wide available habitats outside the study area, it is unlikely that the study area supports a significant number of this species or provides important resources for significant life history stages.
Numenius madagascariensis Eastern Curlew	CR/Mig./CR (EPBC Act; BC Act)	Projected Distribution	Uses a large variety of habitats.	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
Numenius minutus Little Curlew	Mig. (EPBC & BC Acts)	1.3 km NE of study area	Australia's largest and elusive shorebird. Little information is available on this species given this species' shyness and records taking flight at the first sign of disturbance (DCCEEW 2023b).	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Numenius phaeopus Whimbrel	Mig. (EPBC & BC Acts)	Projected Distribution	They spend the non-breeding season in northern Australia from Port Hedland to the Queensland coast (DoEE 2018c).	**Recorded**	
Oceanites oceanicus Wilson's Storm Petrel	Mig. (EPBC & BC Acts)	6.9 km NE of study area	Usually found on intertidal mudflats and sheltered coastal areas. They have also been found in other waterbodies including harbours, lagoons, estuaries, rivers and mangroves. Occasionally they are found in sandy and rocky beaches or intertidal areas (DCCEEW 2023b).	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Onychoprion anaethetus Bridled Tern	Mig. (EPBC & BC Acts)	Projected Distribution	Usually found on intertidal mudflats and sheltered coastal areas. They have also been found in other waterbodies including harbours, lagoons, estuaries, rivers and mangroves. Occasionally they are found in sandy and rocky beaches or intertidal areas (DCCEEW 2023b).	Possible	Given the age of this record as well as the species' habitat preferences, it is unlikely that this species will be occupying habitats within the study area and even less likely to be found within the study area in significant abundance.
Phalaropus lobatus Red-necked Phalarope	Mar/Mig. (EPBC Act; BC Act)	32.0 km E of study area	Records indicate their preference for occurring at sea during non-breeding periods. They have been recorded in inland coastal areas, highly saline water bodies including lakes, swamps and wetlands in Australia (DCCEEW 2023b)	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Philomachus pugnax Ruff	Mig. (EPBC & BC Acts)	14.5 km SSW of study area	Typically occupies saline and brackish wetlands with mudflats. They have been found in a range of wetlands including lakes, swamps, tidal rivers, and flood lands. There are some records of them occupying sheltered coastal areas such as harbours and estuaries and wetlands surrounded by dense vegetation (DCCEEW 2023b).	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Plegadis falcinellus Glossy Ibis	Mig. (EPBC & BC Acts)	3.6 km S of study area	Marine habitats and tropical waters. They typically occur in Pisonia-coconut vegetation and on sandy substrates. Other habitat preferences are not well understood (DCCEEW 2023b) .	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Pluvialis fulva Pacific Golden Plover	Mig. (EPBC & BC Acts)	6.8 km NE of study area	Inland, freshwater wetlands are preferred, permanent or ephemeral waterbodies on floodplains and shallow swamps with abundant aquatic flora.	Unlikely	It is unlikely the Project would provide suitable habitat in significant proportions for

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
					a significant number of individuals and therefore the outcome is unlikely.
Pluvialis squatarola Grey Plover	Mig. (EPBC & BC Acts)	3.2 km SSE of study area	Typically inhabits coastal environments and occasionally can be found in wetlands, mudflats and sandflats in sheltered areas. They have been found on islands, sand and coral cays. They have been recorded in terrestrial environments, usually near waterbodies and paddocks areas (DCCEEW 2023b).	Possible	It is unlikely the Project would provide suitable habitat in significant proportions for a significant number of individuals and therefore the outcome is unlikely.
Thalasseus bergii Crested Tern	Mig. (EPBC & BC Acts)	3.2 km SSE of study area	Inhabit a variety of aquatic environments including estuaries, lagoons, sheltered coastal areas, lakes, bays and harbours. Particularly those with sand banks or splits and exposed ocean beaches. This species is widespread but not favouring offshore continental islands or coral cays (DCCEEW 2023b).	Unlikely	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.
Sterna hirundo Common Tern	Mig. (EPBC & BC Acts)	5.4 km NNE of study area	Occupies mostly sheltered coastal areas such as harbours, lagoons, estuaries and river deltas, particularly those with margins of sand or mud. They have been recorded utilising inland wetlands of both fresh and saline conditions, including lakes, rivers, creeks and artificial wetlands (sewage pools and saltworks included) (DCCEEW No date).	Possible	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.
Sternula albifrons Little Tern	Mig. (EPBC & BC Acts)	4.6 km N of study area	Occupies a range of natural and artificial aquatic environments including irrigation land, water storage areas, lagoons, estuaries, coastal dunes, freshwater lakes as well as seasonal and intermittent freshwater lakes.	Possible	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.
Sula leucogaster Brown Booby	Mig. (EPBC & BC Acts)	12.0 km NNE of study area	In Western Australia, the Brown Booby is found from Bedout Island and near Onslow, and north to Bunker Group of islands in Queensland Off north-west Western Australia, Brown Boobies are most abundant 18–36 km from land, but also occur inside and outside these limits (DoEE 2018c). It uses both marine and terrestrial habitats but tends to stay close to breeding sites, such as tropical islands, continental islands, sand cays and atolls for	Unlikely	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
			breeding. It is known to approach mainland coastlines more than other boobies and has been recorded in coastal waters, harbours and estuaries and near offshore islands but seldom flying over land (DoEE 2018c).		
Tringa brevipes Grey-tailed Tattler	Mig. (EPBC and BC Acts; P4 DBCA list)	1.6 km SSE of study area	Inhabits coastal areas, typically those sheltered such as embayments and estuaries, although they are also known to occupy rocky coasts and platforms. Occasionally they are found in inland waterbodies (DCCEEW 2023b).	**Recorded**	
Tringa glareola Wood Sandpiper	Mig. (EPBC & BC Acts)	784 m ESE of study area	Habitat preferences vary with activities. Feeding habitat preferences include shallow water and intertidal areas on rocky substrates, coral rubble, mudflats, mangroves and potentially seagrass. Breeding habitat includes the branches of mangroves or shrubs and driftwood. Otherwise, they favour habitats in sheltered coastal environments and mudflat aquatic areas (DCCEEW 2023b).	Possible	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.
Tringa nebularia Common Greenshank	Mig. (EPBC & BC Acts)	2.7 km S of study area	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes (DoEE 2018c).	Possible	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.
Tringa stagnatilis Marsh Sandpiper	Mig. (EPBC & BC Acts)	5.2 km NNE of study area	They prefer coastal open mudflats.	Possible	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.
Xenus cinereus Terek Sandpiper	Mig. (EPBC & BC Acts)	1.6 km SSE of study area	The Marsh Sandpiper occurs along the Western Australian coast and throughout parts of eastern Australia. It inhabits coastal and inland wetlands, estuarine and mangrove mudflats, beaches, swamps, lakes and several other types of wetlands (Morcombe 2004).	Possible	Suitable habitat is not available within the study area. Individuals can move through the study area in search of other suitable habitats. This species is unlikely to occur in significant numbers or undertake important life history stages.
Mammals (9)					

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
Dasycercus blythi Brush-tailed Mulgara	P4 (DBCA list)	43 m S of study area	Occurs in spinifex grasslands throughout much of the arid zone, digging their burrows in the flats between low sand dunes.	Likely	Suitable habitat is present throughout the study area and there is known records of the species within 50m of the study area.
Macrotis lagotis Greater Bilby	VU (EPBC & BC Acts)	Recorded	Prefers hummock grassland in plains and alluvial areas, open tussock grassland on uplands and hills, and Mulga woodland/shrubland on ridges and rises.	**Recorded**	
Dasyurus hallucatus Northern Quoll	EN (EPBC & BC Acts)	1.2 km E of study area	Found in a variety of habitats; however, rocky areas provide important denning habitat, while they forage in nearby grasslands and creeklines.	Possible	Recent records for this species are available, additionally, records are within the study area. Therefore, it is likely that the study area can support this species.
Pseudomys chapmani Western Pebble-mound Mouse	P4 (DBCA list)	Projected Distribution	The mounds are located on the gentle slopes of rocky ranges covered in rocky mulch, hard spinifex and sparse trees and shrubs (*Eucalyptus*, *Senna*, *Acacia* and *Ptilotus*). They are also often found near Acacia-dominated drainage lines.	Possible	Given the potential suitable habitat, proximity and date of the record, the study area may support a proportion of this population.
Rhinonicteris aurantia (Pilbara) Pilbara Leaf-nosed Bat	VU (EPBC & BC Acts)	26.0 km ESE of study area	Obligate cave roosting species, forage for insects almost exclusively over freestanding water. Disperses between roost and foraging habitat via humid gorges and gullies to avoid desiccation and shelter from predation.	Possible	Given the distance to travel and forage within the study area, it is unlikely that the study area provides significant resources to this species.
Macroderma gigas Ghost Bat	VU (EPBC & BC Acts)	26.2 km ESE of study area	Prefers to roost in caves beneath bluffs of low, rounded hills composed of Marra Mamba geology, granite rock piles in the Pilbara and sandstone elsewhere, as well as addits (abandoned mines).	Unlikely	Unlikely for this species to occupy the study area for important life history stages. Possible for them to infrequently use the habitat for foraging, although abundant foraging habitat is available outside the study area. Therefore, it is unlikely the study area supports this population significantly.
Lagostrophus fasciatus fasciatus Banded Hare-wallaby (mainland)	P4 (DBCA list)	Projected Distribution	Once widespread in the distribution of the Spectacled Hare-wallaby has contracted northwards and is now found in northern Queensland, the Northern Territory and northern WA (Kimberley and a small section of the Pilbara) (Burbidge 2004; Van Dyck & Strahan 2008). In WA, habitat is dominated by spinifex, where large hummocks are available.	Unlikely	Given the lack of recent records and the wide available habitats outside the study area, it is unlikely that the study area supports a significant number of this species or provides important resources for significant life history stages.

Species	Status	Proximity to Study Area	Habitat Preferences	Likelihood	Comment
Mormopterus cobourgianus North-western Free-tailed Bat	P1 (DBCA list)	2.0 km NNE of study area	Restricted range appearing to favour mangroves and adjoining areas in small spouts, crevices and dead branches of mangroves. This species is relatively data deficient (Australian Museum 2020).	Unlikely	Unlikely for this species to occupy the study area for important life history stages. Possible for them to infrequently use the habitat for foraging, although abundant foraging habitat is available outside the study area. Therefore, it is unlikely the study area supports this population significantly.

5.3 SURVEY LIMITATIONS

The limitations of the flora and vegetation survey and terrestrial fauna survey have been considered in accordance with EPA (2016c, e) (Table 5-18).

Table 5-18 Consideration of potential survey limitations

Limitations	Comments
Availability of contextual information at a regional and local scale	Region has been very well studied in recent times and data is readily available locally and regionally.
Competency/experience of the team carrying out the survey	Fauna team comprised of highly experienced zoologists. Project manager working within the industry and region since 2007. The flora team was led by Phoenix Principal Botanist who has 18 years' experience conducting surveys in the Pilbara bioregion.
Scope and completeness	Scope complete
Proportion of flora and fauna recorded and/or collected, any identification issues	This survey was a targeted and basic fauna survey so not all groups were documented. A small proportion number of species could not be identified to species level, but none were considered likely to represent any Threatened or Priority flora. Species accumulation curve indicates a high proportion of flora in the study area were recorded.
Access within the study area	Great access within the study area.
Timing, rainfall, season	Fauna survey conducted during optimal season. Rainfall within the region has been high over recent times with Cyclone Ilsa hitting the study area less than 3 weeks before the field survey. The flora season was conducted during the Primary survey period for the botanical province but following well below average rainfall in the 12 months and 3 months preceding the survey which may have contributed to the relatively low number of annual species recorded.
Disturbance that may have affected the results of the survey	No recent disturbances documented that affected the results of the surveys.

6 DISCUSSION

6.1 FLORA AND VEGETATION

The current survey recorded 14.8% of the species identified in the desktop assessment from an area representing less than 0.02% of the desktop assessment 40 km radius survey extent. The number of species recorded in the current survey (72 in 99 ha) also compares favourably with the number recorded in the ENV (2011b) regional survey (388 in 80 874 ha). The Poaceae, Fabaceae and Malvaceae were dominant families for the desktop assessment and the field survey and these families were also prominent in the previous regional survey (ENV 2011b).

6.1.1 Significant flora

Tephrosia rosea var. Port Hedland (A.S. George 1114) was recorded at a location identified in the desktop assessment to occur in the study area. Further searches determined the presence of another 2 populations in the study area. As there are few records of population numbers (WA Herbarium 1998) it is not possible to determine what proportion of the total population of the species occurs within the study area. Notably, the populations occurred in disturbed areas in Degraded to Poor condition and a further desktop record outside of the study area was visited during the field survey also occurred in vegetation in Poor condition. It appears as though the species may be a disturbance opportunist.

The location of a desktop record of *Bulbostylis burbidgeae* is now a sealed bitumen road. Foot searches in remnant vegetation adjacent to this location failed to locate any individuals of the species. The second desktop location for this species occurred in close proximity to the same road and again foot searches in remnant vegetation adjacent to this location failed to locate any individuals of the species.

The records for *Bulbostylis burbidgeae* obtained from the DBCA database searches were recorded in 2007 with the sites described as a track and a small track. It is therefore likely that the species was removed during the construction of the road that currently sits upon or adjacent the recorded sites.

The likelihood off occurrence assessment determined that *Rothia indica* subsp. *australis* (P3) may possibly occur in the study area. This species is known from 21 records (WA Herbarium 1998) that occur in the Dampierland, Great Sandy Desert, Pilbara and Victoria Bonaparte bioregions. There are few records of population sizes recorded for the species which range from 1 to more than 100 plants.

None of the 5 taxa that could not be identified to species level are considered to represent any Threatened or Priority flora.

Specimens identified to be *Abutilon* aff. *lepidium*/*dioicum* variant were collected as they were considered in the field to possibly represent *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) but examination by taxonomists at the State herbarium determined they were not the Priority species. The *Abutilon* sp. specimen also did not resemble *Abutilon* sp. Pritzelianum (S. van Leeuwen 5095) or *Abutilon* sp. Onslow (F. Smith s.n. 10/9/61) which is the only other Priority *Abutilon* species recorded in the Pilbara bioregion (WA Herbarium 1998).

Sida ?*arenicola* was an erect shrub with leaf shape and general morphology typical of *Sida arenicola* that differs markedly from *Sida* sp. Barlee Range (S. van Leeuwen 1642) identified in the desktop assessment. The *Sida* ?*arenicola* specimen also differed markedly to *Sida* sp. Hamersley Range (K. Newbey 10692) and *Sida* sp. Turee Creek (P.-L.de Kock PLDK1116) which are the only other Priority *Sida* species recorded for the Pilbara bioregion (WA Herbarium 1998).

There are 3 *Tecticornia* Priority species recorded for the Pilbara bioregion (WA Herbarium 1998), *T. globulifera*, *T. medusa* and *T.* sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063). The closest record for each of these species is hundreds of kilometres from the study area and none have

been recorded in coastal mangrove habitat. It is therefore unlikely that *Tecticornia* sterile 1 and *Tecticornia* sterile 2 represent a Priority species.

6.1.2 Introduced flora

None of the weed species recorded are a Declared Pest or WoNS.

All of the introduced flora recorded during the field have previously been recorded in the Pilbara bioregion (WA Herbarium 1998) and all have an extensive range in Western Australia recorded in numerous bioregions.

6.1.3 Vegetation

The pre-European vegetation association 647, Hummock grasslands, dwarf shrub steppe; *Acacia translucens* over soft spinifex was dominant in the study area. The vegetation types, AsTe, Te and Ts recorded within the study area in the current survey represent *Triodia* grasslands with or without a low shrub layer of *Acacia stellaticeps*.

A review of the distribution of *Acacia translucens* (WA Herbarium 1998) has determined that the species is predominantly recorded in the Kimberley bioregion and the closest record of the species to the study area is approximately 125 km to the east of Port Hedland/the study area. *Acacia translucens* is closely related to *A. stellaticeps* which are both part of the *A. stigmatophylla* group (Kodela *et al.* 2001). *A. stellaticeps* is conspecific with *Acacia translucens* var. *humilis* but was determined to represent a separate species in 2001 (Kodela *et al.* 2001). Subsequently the vegetation recorded in the study area in the current survey is considered representative of vegetation association 647 which covers over 190000 ha with over 97% pre-European extent remaining (Government of Western Australia 2019) and is classed as Least Concern.

The AmTssp. Vegetation type of the current survey is representative of the 127 vegetation association that covers over 697000 ha with over 95% pre-European extent remaining (Government of Western Australia 2019) and is classed as Least Concern.

The NaEm vegetation type of the current survey was recorded in Degraded areas where virtually all native vegetation had previously been cleared with isolated plants remaining and subsequently was not considered to have conservation significance.

The Te vegetation type may be considered locally significant providing a role as a refuge for *Tephrosia rosea* var. Port Hedland (A.S. George 1114).

The vegetation types recorded in the current survey reflect the vegetation types defined previously (GHD 2016) within the study area that were not identified to have conservation significance.

A large proportion of the vegetation in the study area has been impacted by multiple disturbances and this vegetation has low conservation value as a result with the exception of those Poor and Degraded areas inhabited by *Tephrosia rosea* var. Port Hedland (A.S. George 1114).

6.2 VERTEBRATE FAUNA

A total of 2 fauna habitats were documented within the study area, comprising sandplains and intertidal mudflats. The sandplains fauna habitat (comprising 68.34 ha) was the most extensive throughout the study area. This fauna habitat was predominantly of Very Good vegetation condition however most showed evidence of disturbance from multiple sources.

Bilbies formerly occupied most of WA but have undergone a significant decrease in range. Current habitats are varied and include hummock grassland in plains and alluvial areas, *Triodia* and *Acacia* on sand plains and dune systems, open tussock grassland on uplands and hills, and Mulga

woodland/shrubland on ridges and rises. These habitats are normally characterised as being of low relief with light to medium soils that are often sandy, ideal for burrow excavation. Most of the area currently occupied by the species is considered likely to represent the least favourable portions of its former range (Pavey 2006). Determining habitat critical to the survival of the species is difficult within the bounds of current knowledge, as conceded by the national Bilby recovery plan (Pavey 2006).

Several records of Bilby were documented within the study area, including evidence of scats, tracks, and diggings. The sandplains habitat type represents suitable habitat for the species and whilst there are several records of Bilby within the study area it is unlikely that these individuals are restricted to the study area.

The intertidal mudflats fauna habitat covers a small section of the South West Creek (comprising 2.81 ha). During the field survey 2 conservation significant Migratory shorebird species (Whimbrel, Grey-tailed Tattler) were detected within this fauna habitat. This fauna habitat does not meet the criteria for 'important habitat' for a Migratory species as defined by DoE (2013). Given the extent of this fauna habitat type within the region it is unlikely that the study area provides critical and restricted habitat for these species.

6.3 CONCLUSION

The 2 fauna habitats occurring in the study area support conservation significant species; however, neither are considered critical to the survival of those taxa given the size of each relative to their extent outside the study area, and the general level of disturbance present.

The populations of *Tephrosia rosea* var. Port Hedland (A.S. George 1114) are the only significant botanical values in the study area.

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Appendix 1 Survey site locations

Flora sites

Sitename	Sample type	Latitude	Longitude
001TRVP	Individual specimen	-20.371537	118.566072
002TRVP	Individual specimen	-20.371599	118.566151
0041TRVP	Individual specimen	-20.371603	118.566191
005TRVP	Individual specimen	-20.371673	118.566321
10TRVP	Individual specimen	-20.367591	118.558395
10TRVP1	Individual specimen	-20.372309	118.567881
11TRVP	Individual specimen	-20.362373	118.549362
12TRVP	Individual specimen	-20.364077	118.55207
12TRVP1	Individual specimen	-20.371877	118.567199
13TRVP	Individual specimen	-20.371952	118.567154
1TRVP	Individual specimen	-20.36231	118.549187
1TRVP1	Individual specimen	-20.362399	118.549228
1TRVP10	Individual specimen	-20.363982	118.551846
1TRVP101	Individual specimen	-20.371999	118.567331
1TRVP11	Individual specimen	-20.36416	118.551938
1TRVP111	Individual specimen	-20.372098	118.567371
1TRVP12	Individual specimen	-20.364117	118.551978
1TRVP121	Individual specimen	-20.372093	118.567448
1TRVP13	Individual specimen	-20.367643	118.558436
1TRVP131	Individual specimen	-20.372176	118.567893
1TRVP14	Individual specimen	-20.367478	118.558423
1TRVP141	Individual specimen	-20.374083	118.571274
1TRVP15	Individual specimen	-20.373515	118.570501
1TRVP16	Individual specimen	-20.371405	118.567397
1TRVP17	Individual specimen	-20.371341	118.567353
1TRVP2	Individual specimen	-20.362314	118.549386
1TRVP21	Individual specimen	-20.37132	118.567267
1TRVP3	Individual specimen	-20.362528	118.549586
1TRVP31	Individual specimen	-20.371301	118.567163
1TRVP4	Individual specimen	-20.362474	118.54954
1TRVP41	Individual specimen	-20.371199	118.567114
1TRVP5	Individual specimen	-20.362454	118.549582
1TRVP51	Individual specimen	-20.37091	118.566392
1TRVP6	Individual specimen	-20.362424	118.54954
1TRVP61	Individual specimen	-20.372084	118.567531
1TRVP7	Individual specimen	-20.364004	118.551632
1TRVP71	Individual specimen	-20.371736	118.566892

Sitename	Sample type	Latitude	Longitude
1TRVP8	Individual specimen	-20.36398	118.551684
1TRVP81	Individual specimen	-20.372011	118.567196
1TRVP9	Individual specimen	-20.364002	118.551695
1TRVP91	Individual specimen	-20.372042	118.567268
2TRVP	Individual specimen	-20.36237	118.549247
2TRVP1	Individual specimen	-20.362393	118.549297
2TRVP10	Individual specimen	-20.364157	118.551972
2TRVP11	Individual specimen	-20.367465	118.558251
2TRVP12	Individual specimen	-20.367597	118.55833
2TRVP13	Individual specimen	-20.371261	118.567213
2TRVP14	Individual specimen	-20.372142	118.567842
2TRVP2	Individual specimen	-20.362581	118.549552
2TRVP21	Individual specimen	-20.372124	118.567574
2TRVP3	Individual specimen	-20.362507	118.549525
2TRVP31	Individual specimen	-20.371983	118.56748
2TRVP4	Individual specimen	-20.363999	118.551764
2TRVP41	Individual specimen	-20.372034	118.567372
2TRVP5	Individual specimen	-20.364044	118.551822
2TRVP51	Individual specimen	-20.371939	118.567321
2TRVP6	Individual specimen	-20.363963	118.551875
2TRVP61	Individual specimen	-20.371768	118.566697
2TRVP7	Individual specimen	-20.364002	118.551894
2TRVP71	Individual specimen	-20.37176	118.566755
2TRVP8	Individual specimen	-20.364145	118.551862
2TRVP81	Individual specimen	-20.372072	118.567334
2TRVP9	Individual specimen	-20.364111	118.552056
2TRVP91	Individual specimen	-20.372168	118.567597
3TRVP	Individual specimen	-20.362393	118.549357
3TRVP1	Individual specimen	-20.362456	118.549481
3TRVP11	Individual specimen	-20.371723	118.566836
3TRVP2	Individual specimen	-20.362531	118.549456
3TRVP21	Individual specimen	-20.371688	118.566794
3TRVP3	Individual specimen	-20.364036	118.551792
3TRVP31	Individual specimen	-20.372235	118.567701
3TRVP4	Individual specimen	-20.364012	118.551858
3TRVP41	Individual specimen	-20.372175	118.567996
3TRVP5	Individual specimen	-20.364024	118.551848
3TRVP51	Individual specimen	-20.372404	118.56848
3TRVP6	Individual specimen	-20.364172	118.551831
3TRVP7	Individual specimen	-20.364074	118.551885
3TRVP8	Individual specimen	-20.372065	118.567665
4TRVP	Individual specimen	-20.364054	118.55195

Sitename	Sample type	Latitude	Longitude
4TRVP1	Individual specimen	-20.364071	118.552121
4TRVP11	Individual specimen	-20.371928	118.567387
4TRVP2	Individual specimen	-20.364124	118.552003
4TRVP21	Individual specimen	-20.372017	118.567258
4TRVP3	Individual specimen	-20.367529	118.55835
4TRVP31	Individual specimen	-20.372212	118.567628
4TRVP4	Individual specimen	-20.372371	118.568424
4TRVP5	Individual specimen	-20.371965	118.56744
5TRVP	Individual specimen	-20.362397	118.549332
5TRVP1	Individual specimen	-20.364153	118.552112
5TRVP11	Individual specimen	-20.371795	118.566825
5TRVP2	Individual specimen	-20.367442	118.558287
5TRVP21	Individual specimen	-20.371881	118.567001
5TRVP3	Individual specimen	-20.372077	118.567712
6TRVP	Individual specimen	-20.3625	118.549408
6TRVP1	Individual specimen	-20.3675	118.558282
6TRVP11	Individual specimen	-20.37179	118.567003
6TRVP2	Individual specimen	-20.367469	118.558328
6TRVP21	Individual specimen	-20.371761	118.566954
6TRVP3	Individual specimen	-20.367534	118.558401
6TRVP31	Individual specimen	-20.371904	118.56708
6TRVP4	Individual specimen	-20.371855	118.567137
7TRVP	Individual specimen	-20.362455	118.549397
7TRVP1	Individual specimen	-20.36402	118.551976
7TRVP2	Individual specimen	-20.37186	118.56694
8TRVP	Individual specimen	-20.371934	118.567163
8TRVP1	Individual specimen	-20.371824	118.567096
RSP001R	Relevé	-20.348745	118.539618
RSP002	Quadrat	-20.349201	118.539926
RSP003	Quadrat	-20.350162	118.541485
RSP004R	Relevé	-20.351298	118.543366
RSP005	Quadrat	-20.357707	118.546073
RSP006R	Relevé	-20.358623	118.547206
RSP007	Quadrat	-20.363047	118.550012
RSP008R	Relevé	-20.366297	118.556995
RSP009	Quadrat	-20.367478	118.558825
RSP010	Quadrat	-20.367551	118.558459
RSP011	Quadrat	-20.371061	118.567244
RSP012	Quadrat	-20.375699	118.570822
RSP013	Quadrat	-20.378287	118.57258
RSP014	Quadrat	-20.381976	118.573373
RSP015	Quadrat	-20.385597	118.57727

Sitename	Sample type	Latitude	Longitude
TRvP01	Individual specimen	-20.362322	118.54919
TRvP01a	Individual specimen	-20.364015	118.55164
TRvP02	Individual specimen	-20.367499	118.558308

Fauna sites

Site	Site type	Latitude	Longitude
RHP01	Fauna site	-20.385670	118.574158
RHP02	Fauna site	-20.381972	118.573137
RHP03	Fauna site	-20.378448	118.572421
RHP04	Fauna site	-20.371178	118.565801
RHP05	Fauna site	-20.367114	118.557693
RHP06	Fauna site	-20.352069	118.546123

Appendix 2 Flora survey site descriptions

Site details			
Site	**RSP001R**	**Position (WGS84)**	-20.34874482, 118.53961771
Slope	gentle	**Topography**	mudflat
Soil colour	red-orange	**Soil texture**	SC
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (21 Jun 2023)	
Sample description	Isolated tall *Avicennia marina* subsp. *marina* shrubs over low open *Tecticornia pterygosperma* subsp. *denticulata*, *T. halocnemoides* subsp. *longispicata* and *T.* sp. sterile 1 shrubland.

Habitat	samphire shrubland		
Disturbance	vehicle tracks,erosion channels,current operations,historic clearing		
Vegetation condition	Good	**Fire age**	not evident
Total veg. cover (%)	20	**Tree cover (%)**	0
Shrub cover (%)	20	**Grass cover (%**	0.1
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	21-Jun-2023	unbounded	Grant Wells

Species (13)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Tecticornia sp. (sterile 1)	local sig.	10	0.4		
Tecticornia pterygosperma subsp. *denticulata*		5	0.3		
Tecticornia halocnemoides subsp. *longispicata*		2	0.3		
Avicennia marina subsp. *marina*		1	2.2		
Muellerolimon salicorniaceum		0.2	0.15		
Tecticornia indica subsp. *leiostachya*		0.1	0.3		
Tecticornia auriculata		0.1	0.3		
Salsola australis		0.1	0.2		
Neobassia astrocarpa		0.1	0.2		
Frankenia pauciflora		0.1	0.2		
Sporobolus virginicus		0.1	0.15		
Surreya diandra		0.1	0.1		
Eragrostis falcata		0.1	0.1		

Site details			
Site	**RSP002**	**Position (WGS84)**	-20.34920063, 118.53992608
Slope	gentle	**Topography**	undulating plain
Soil colour	brown,whitish	**Soil texture**	SC
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (21 Jun 2023)	
Sample description	Isolated clumps of low *Cynanchum viminale* subsp. *australe* and *Tecticornia indica* subsp. *leiostachya* shrubs over *Triodia schinzii* and *T. epactia* grassland over isolated clumps of low *Neobassia*

Habitat	spinifex grassland		
Disturbance	vehicle tracks		
Vegetation condition	Excellent	**Fire age**	not evident
Total veg. cover (%)	30	**Tree cover (%)**	0
Shrub cover (%)	0.1	**Grass cover (%**	30
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	21-Jun-2023	50m x 50m	Grant Wells

Species (5)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia secunda		30	0.2		
Cynanchum viminale subsp. *australe*		0.1	0.5		
Triodia epactia		0.1	0.3		
Tecticornia indica subsp. *leiostachya*		0.1	0.2		
Neobassia astrocarpa		0.1	0.15		

Site details			
Site	**RSP003**	**Position (WGS84)**	-20.35016191, 118.5414852
Slope	negligible	**Topography**	mudflat
Soil colour	brown,white	**Soil texture**	SC
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (21 Jun 2023)			
Sample description	Low open *Tecticornia* sp. sterile 2, *T.* sp. sterile 1 and *T. auriculata* shrubland over isolated clumps of low *Sporobolus virginicus* grasses and isolated clumps of low *Muellerolimon salicorniaceum* and *Su*		
Habitat	samphire shrubland		
Disturbance	none evident		
Vegetation condition	Excellent	**Fire age**	not evident
Total veg. cover (%)	15	**Tree cover (%)**	0
Shrub cover (%)	15	**Grass cover (%**	0.1
Herb cover (%)	0		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	21-Jun-2023	50m x 50m	Grant Wells

Species (9)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Tecticornia sp. (sterile 2)	local sig.	8	0.15		
Tecticornia sp. (sterile 1)	local sig.	2	0.3		
Tecticornia auriculata		2	0.2		
Tecticornia indica subsp. *leiostachya*		1	0.2		
Tecticornia halocnemoides subsp. *longispicata*		1	0.2		
Sporobolus virginicus		0.1	0.2		
Muellerolimon salicorniaceum		0.1	0.2		
Avicennia marina subsp. *marina*		0.1	0.2		
Surreya diandra		0.1	0.1		

Site details			
Site	**RSP004R**	**Position (WGS84)**	-20.35129849, 118.5433656
Slope	negligible	**Topography**	plain
Soil colour	brown,whitish	**Soil texture**	SC
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (21 Jun 2023)			
Sample description	Isolated clumps of mod *Acacia trachycarpa* shrubs over isolated low *Trianthema turgidifolia*, *Acacia ampliceps* and *A. stellaticeps* shrubs over isolated low **Cenchrus ciliaris*, *Triodia epactia* and		
Habitat	spinifex grassland		
Disturbance	current operations,historic clearing,vehicle tracks,weed infestation,litter		
Vegetation condition	Degraded	**Fire age**	not evident
Total veg. cover (%)	10	**Tree cover (%)**	0
Shrub cover (%)	4	**Grass cover (%**	6
Herb cover (%)	1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	21-Jun-2023	unbounded	Grant Wells

Species (15)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
**Cenchrus ciliaris*	Weed	4	0.3		
Trianthema turgidifolium		3	0.4		
Triodia epactia		1	0.4		
Eragrostis falcata		0.3	0.3		
Triodia secunda		0.2	0.2		
Acacia trachycarpa		0.1	1.9		
Acacia tumida var. *pilbarensis*		0.1	0.6		
Acacia ampliceps		0.1	0.5		
Acacia stellaticeps		0.1	0.4		
**Chloris barbata*	Weed	0.1	0.3		
Salsola australis		0.1	0.2		
Neobassia astrocarpa		0.1	0.2		
Corchorus incanus subsp. *incanus*		0.1	0.2		
**Aerva javanica*	Weed	0.1	0.1		
Aristida contorta		0.1	0.1		

Site details			
Site	**RSP005**	**Position (WGS84)**	-20.35770667, 118.5460727
Slope	gentle	**Topography**	undulating plain
Soil colour	red-orange	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (22 Jun 2023)			
Sample description	Isolated clumps of tall *Acacia ampliceps* over isolated low *Trianthema turgidifolium, Acacia stellaticeps* and *Salsola australis* shrubs over low *Triodia epactia* and *T. secunda* grassland.		
Habitat	spinifex grassland		
Disturbance	current operations,excavation,historic clearing,large-scale clearing,litter,vehicle tracks,weed infestation		
Vegetation condition	Poor	**Fire age**	moderate (>5 years)
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	2	**Grass cover (%**	38
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	22-Jun-2023	50m x 50m	Grant Wells

Species (18)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		32	0.3		
Triodia secunda		3	0.15		
Trianthema turgidifolium		2	0.3		
Eriachne mucronata		1	0.3		
**Cenchrus ciliaris*	Weed	0.5	0.25		
Eragrostis falcata		0.3	0.2		
Cassytha capillaris		0.2	0.3		
Acacia ampliceps		0.1	2		
Salsola australis		0.1	0.5		
**Aerva javanica*	Weed	0.1	0.5		
Pterocaulon serrulatum var. *velutinum*		0.1	0.4		
**Chloris barbata*	Weed	0.1	0.3		
Acacia stellaticeps		0.1	0.3		
Solanum cleistogamum		0.1	0.2		
Eragrostis eriopoda		0.1	0.2		
Neobassia astrocarpa		0.1	0.2		
Murdannia graminea		0.1	0.15		
Sporobolus actinocladus		0.1	0.1		

Site details			
Site	**RSP006R**	**Position (WGS84)**	-20.35862285, 118.54720635
Slope	negligible	**Topography**	mudflat
Soil colour	red-brown,whitish	**Soil texture**	SC
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (22 Jun 2023)			
Sample description	Isolated low *Tecticornia* sp. sterile 2, *T. indica* subsp. *leiostachya* and **Aerva javanica* shrubs over isolated low *Eriachne mucronata*, **Chloris barbata* and *Sporobolus actinocladus*		
Habitat	samphire shrubland		
Disturbance	current operations,erosion channels,excavation,historic clearing,large-scale clearing,litter,vehicle tracks,weed infestation		
Vegetation condition	Completely Degraded	**Fire age**	not evident
Total veg. cover (%)	3	**Tree cover (%)**	0
Shrub cover (%)	1	**Grass cover (%**	1
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	22-Jun-2023	unbounded	Grant Wells

Species (9)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Tecticornia sp. (sterile 2)	local sig.	0.5	0.5		
Tecticornia indica subsp. *leiostachya*		0.5	0.5		
Eriachne mucronata		0.3	0.15		
**Aerva javanica*	Weed	0.2	0.4		
**Chloris barbata*	Weed	0.2	0.2		
Streptoglossa bubakii		0.1	0.3		
Acacia stellaticeps		0.1	0.2		
Sporobolus actinocladus		0.1	0.15		
Neobassia astrocarpa		0.1	0.15		

Site details			
Site	**RSP007**	**Position (WGS84)**	-20.36304661, 118.55001245
Slope	gentle	**Topography**	undulating plain
Soil colour	red-brown	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (22 Jun 2023)			
Sample description	Isolated clumps of mid *Acacia ampliceps* shrubs over isolated low *Acacia stellaticeps*, *Trianthema turgidifolium* and *Afrohybanthus aurantiacus* shrubs over low *Triodia epactia* and *T. secunda* grasslan		
Habitat	spinifex grassland		
Disturbance	current operations,evidence of feral animals,excavation,historic clearing,large-scale clearing,litter,vehicle tracks,weed infestation		
Vegetation condition	Poor	**Fire age**	not evident
Total veg. cover (%)	60	**Tree cover (%)**	0
Shrub cover (%)	1	**Grass cover (%**	60
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	22-Jun-2023	50m x 50m	Grant Wells

Species (23)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		55	0.35		
Triodia secunda		4	0.15		
Eriachne mucronata		1	0.15		
Trianthema turgidifolium		0.5	0.3		
Acacia stellaticeps		0.5	0.3		
Acacia ampliceps		0.1	1.5		
Stemodia grossa		0.1	0.6		
Senna notabilis		0.1	0.5		
Tecticornia pterygosperma subsp. *denticulata*		0.1	0.5		
Corchorus incanus subsp. *incanus*		0.1	0.5		
Afrohybanthus aurantiacus		0.1	0.4		
Bonamia alatisemina		0.1	0.4		
Cassytha capillaris		0.1	0.3		
Chrysopogon fallax		0.1	0.3		
Sida sp. Rabbit Flat (B.J. Carter 626)		0.1	0.3		
Pluchea longiseta		0.1	0.3		
Pluchea tetranthera		0.1	0.3		
Neobassia astrocarpa		0.1	0.2		
**Cenchrus ciliaris*	Weed	0.1	0.2		
Solanum cleistogamum		0.1	0.2		
Murdannia graminea		0.1	0.2		
Eragrostis falcata		0.1	0.15		
Abutilon sp.		0.1	0.1		

Site details			
Site	**RSP008R**	**Position (WGS84)**	-20.36629678, 118.55699533
Slope	negligible	**Topography**	plain
Soil colour	red-orange,whitish	**Soil texture**	SL
Rock cover (%)	0	**Rock type**	quartz,sandstone,granite - rocks

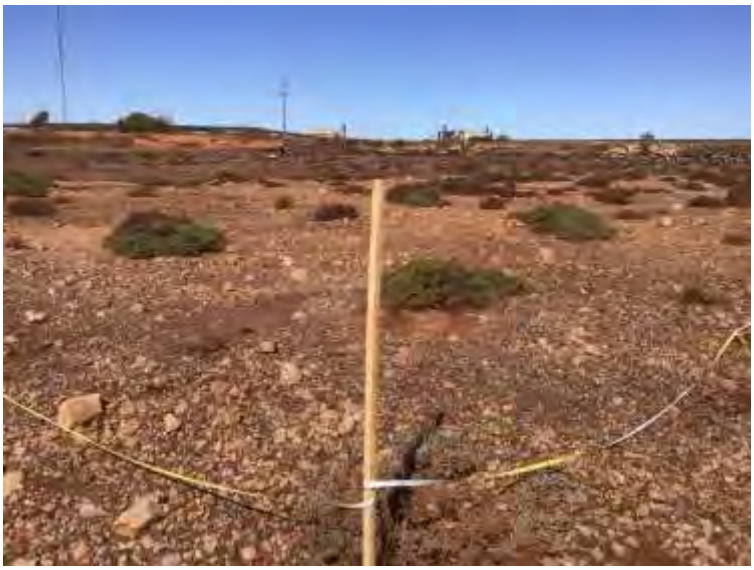
Observation details - visit 1 (22 Jun 2023)			
Sample description	Isolated low *Acacia colei* var. *colei*, *Trianthema turgidifolium* and *Salsola australis* shrubs over isolated low **Chloris barbata*, *Eragrostis falcata* and *Eriachne mucronata* grasses.		
Habitat	shrubland		
Disturbance	current operations,excavation,historic clearing,large-scale clearing,litter,vehicle tracks,weed infestation		
Vegetation condition	Completely Degraded	**Fire age**	not evident
Total veg. cover (%)	1	**Tree cover (%)**	0
Shrub cover (%)	0.5	**Grass cover (%**	0.5
Herb cover (%)	0		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Relevé	1	22-Jun-2023	unbounded	Grant Wells

Species (9)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
**Chloris barbata*	Weed	0.2	0.2		
Eragrostis falcata		0.2	0.1		
Sesbania cannabina		0.1	0.5		
Salsola australis		0.1	0.5		
Acacia colei var. *colei*		0.1	0.5		
Trianthema turgidifolium		0.1	0.2		
Neobassia astrocarpa		0.1	0.2		
Eriachne mucronata		0.1	0.2		
Ipomoea muelleri		0.1	0.1		

Site details			
Site	**RSP009**	**Position (WGS84)**	-20.36747837, 118.55882468
Slope	gentle	**Topography**	tidal creek
Soil colour	brown	**Soil texture**	SC
Rock cover (%)	0	**Rock type**	quartz

Observation details - visit 1 (22 Jun 2023)			
Sample description	Isolated low *Tecticornia* sp. sterile 2, *T. pterygosperma* subsp. *denticulata* and *T. indica* subsp. *leiostachya* shrubs over isolated clumps of low *Sporobolus virginicus* grasses.		
Habitat	samphire shrubland		
Disturbance	current operations,historic clearing,large-scale clearing,litter,vehicle tracks		
Vegetation condition	Good	**Fire age**	not evident
Total veg. cover (%)	5	**Tree cover (%)**	0
Shrub cover (%)	5	**Grass cover (%**	0.1
Herb cover (%)	0		



Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	22-Jun-2023	50m x 50m	Grant Wells

Species (6)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Tecticornia sp. (sterile 2)	local sig.	3	0.15		
Tecticornia pterygosperma subsp. *denticulata*		1	0.3		
Tecticornia indica subsp. *leiostachya*		0.5	0.2		
Sporobolus virginicus		0.1	0.15		
Surreya diandra		0.1	0.1		
Frankenia pauciflora		0.1	0.1		

Site details			
Site	**RSP010**	**Position (WGS84)**	-20.36755079, 118.55845939
Slope	gentle	**Topography**	undulating plain
Soil colour	red-orange	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (22 Jun 2023)			
Sample description	Isolated clumps of mid *Acacia colei* var. *colei*, *A. ampliceps* and *Hakea lorea* subsp. *lorea* shrubs over low open *Acacia stellaticeps* shrubland over low *Triodia epactia*, *T.*		
Habitat	shrubland		
Disturbance	current operations,historic clearing,large-scale clearing,vehicle tracks,weed infestation,litter		
Vegetation condition	Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	50	**Tree cover (%)**	0
Shrub cover (%)	25	**Grass cover (%**	30
Herb cover (%)	0.5		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	22-Jun-2023	50m x 50m	Grant Wells

Species (27)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		25	0.45		
Triodia epactia		25	0.25		
Triodia schinzii		4	0.3		
Chrysopogon fallax		1	0.25		
Acacia colei var. *colei*		0.1	1.4		
Hakea lorea subsp. *lorea*		0.1	1.4		
Acacia ampliceps		0.1	1.2		
**Aerva javanica*	Weed	0.1	1		
Ptilotus fusiformis		0.1	0.8		
Pterocaulon serrulatum var. *velutinum*		0.1	0.8		
Salsola australis		0.1	0.7		
**Cenchrus ciliaris*	Weed	0.1	0.6		
Trianthema turgidifolium		0.1	0.6		
Cucumis variabilis		0.1	0.6		
Euphorbia australis var. *subtomentosa*		0.1	0.5		
Sida rohlenae subsp. *rohlenae*		0.1	0.5		
Senna notabilis		0.1	0.5		
Cassytha capillaris		0.1	0.4		
Pluchea tetranthera		0.1	0.4		
Bonamia alatisemina		0.1	0.3		
Eragrostis eriopoda		0.1	0.3		
Panicum decompositum		0.1	0.3		
Solanum cleistogamum		0.1	0.25		
Sida sp. Rabbit Flat (B.J. Carter 626)		0.1	0.2		
Sida ?arenicola		0.1	0.2		
**Stylosanthes hamata*	Weed	0.1	0.2		
Eriachne mucronata		0.1	0.2		

Site details			
Site	**RSP011**	**Position (WGS84)**	-20.37106114, 118.56724363
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (23 Jun 2023)			
Sample description	Isolated low *Corchorus incanus* subsp. *incanus*, *Acacia stellaticeps* and *Trianthema turgidifolium* and shrubs over low **Cenchrus ciliaris* and *Triodia epactia* grassland.		
Habitat	grassland		
Disturbance	current operations,excavation,historic clearing,large-scale clearing,litter,vehicle tracks,weed infestation		
Vegetation condition	Completely Degraded	**Fire age**	moderate (>5 years)
Total veg. cover (%)	60	**Tree cover (%)**	0
Shrub cover (%)	3	**Grass cover (%**	57
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	23-Jun-2023	50m x 50m	Grant Wells

Species (17)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
**Cenchrus ciliaris*	Weed	55	0.4		
Corchorus incanus subsp. *incanus*		2	0.8		
Triodia epactia		2	0.3		
Trianthema turgidifolium		0.5	0.5		
Acacia stellaticeps		0.5	0.4		
**Aerva javanica*	Weed	0.1	0.8		
Salsola australis		0.1	0.5		
Cassytha capillaris		0.1	0.4		
Sida rohlenae subsp. *rohlenae*		0.1	0.4		
Abutilon aff. *lepidium/dioicum* variant		0.1	0.3		
Chrysopogon fallax		0.1	0.3		
Tephrosia rosea var. Port Hedland (A.S. George 1114)	P1 (DBCA list)	0.1	0.3		
Eriachne mucronata		0.1	0.2		
**Indigofera sessiliflora*	Weed	0.1	0.2		
Solanum cleistogamum		0.1	0.2		
Arivela viscosa		0.1	0.2		
Goodenia forrestii		0.1	0.15		

Site details			
Site	**RSP012**	**Position (WGS84)**	-20.37569935, 118.57082203
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

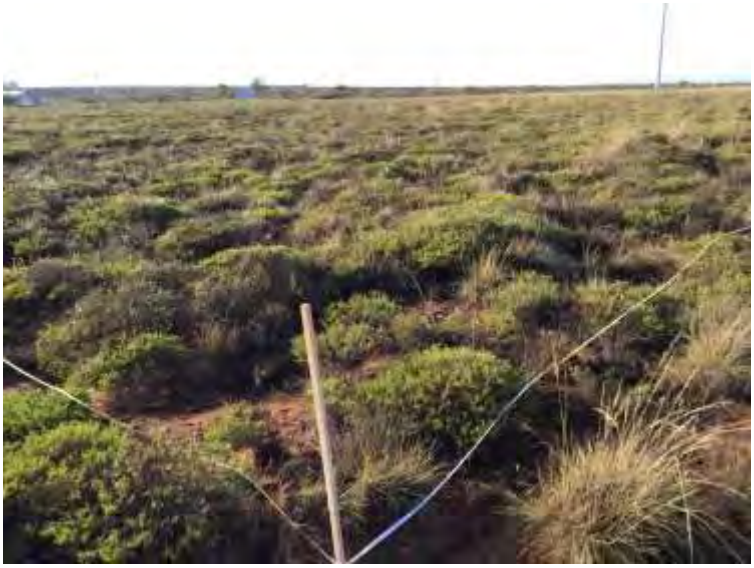
Observation details - visit 1 (23 Jun 2023)			
Sample description	Low open *Acacia stellaticeps* shrubland over low *Triodia epactia*, *T. secunda* and *Eriachne mucronata* grassland.		
Habitat	spinifex grassland		
Disturbance	historic clearing		
Vegetation condition	Excellent	**Fire age**	moderate (>5 years)
Total veg. cover (%)	60	**Tree cover (%)**	0
Shrub cover (%)	10	**Grass cover (%**	50
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	23-Jun-2023	50m x 50m	Grant Wells

Species (14)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		48	0.4		
Acacia stellaticeps		10	0.5		
Eriachne mucronata		2	0.2		
Triodia secunda		1	0.2		
Pluchea tetranthera		0.1	0.4		
Cassytha capillaris		0.1	0.4		
Afrohybanthus aurantiacus		0.1	0.4		
Abutilon aff. *lepidium/dioicum* variant		0.1	0.4		
Triodia schinzii		0.1	0.3		
Hakea lorea subsp. *lorea*		0.1	0.3		
Chrysopogon fallax		0.1	0.3		
Tephrosia leptoclada		0.1	0.2		
Solanum cleistogamum		0.1	0.2		
Ptilotus fusiformis		0.1	0.1		

Site details			
Site	**RSP013**	**Position (WGS84)**	-20.3782868, 118.5725798
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (21 Jun 2023)			
Sample description	Low *Acacia stellaticeps* and *Pluchea tetranthera* shrubland over low open *Triodia schinzii*, *T. epactia* and *Eriachne mucronata* grassland.		
Habitat	shrubland		
Disturbance	none evident		
Vegetation condition	Excellent	**Fire age**	moderate (>5 years)
Total veg. cover (%)	55	**Tree cover (%)**	0
Shrub cover (%)	40	**Grass cover (%**	20
Herb cover (%)	0.1		



Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	21-Jun-2023	50m x 50m	Grant Wells

Species (14)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		40	0.4		
Triodia schinzii		10	0.3		
Eriachne mucronata		10	0.2		
Triodia epactia		0.5	0.4		
Solanum cleistogamum		0.1	0.3		
Ptilotus fusiformis		0.1	0.3		
Pluchea tetranthera		0.1	0.3		
Chrysopogon fallax		0.1	0.3		
Solanum diversiflorum		0.1	0.2		
Evolvulus alsinoides var. *villosicalyx*		0.1	0.2		
Cassytha capillaris		0.1	0.2		
Bonamia alatisemina		0.1	0.2		
Afrohybanthus aurantiacus		0.1	0.2		
Trigastrotheca molluginea		0.1	0.1		

Site details			
Site	**RSP014**	**Position (WGS84)**	-20.38197647, 118.57337306
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (21 Jun 2023)			
Sample description	Isolated clumps of mid *Hakea lorea* subsp. *lorea* shrubs over low open *Acacia stellaticeps* shrubland over low open *Triodia epactia*,*T. schinzii* and *Eriachne mucronata* grassland.		
Habitat	shrubland		
Disturbance	none evident		
Vegetation condition	Excellent	**Fire age**	moderate (>5 years)
Total veg. cover (%)	40	**Tree cover (%)**	0
Shrub cover (%)	25	**Grass cover (%**	20
Herb cover (%)	0.1		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	21-Jun-2023	50m x 50m	Grant Wells

Species (12)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Acacia stellaticeps		25	0.4		
Triodia epactia		15	0.3		
Triodia schinzii		4	0.3		
Eriachne mucronata		1	0.2		
Hakea lorea subsp. *lorea*		0.1	1.3		
Cassytha capillaris		0.1	0.4		
Solanum cleistogamum		0.1	0.3		
Pluchea tetranthera		0.1	0.3		
Chrysopogon fallax		0.1	0.3		
Cyperus blakeanus		0.1	0.25		
Eragrostis eriopoda		0.1	0.2		
Bonamia linearis		0.1	0.2		

Site details			
Site	**RSP015**	**Position (WGS84)**	-20.38559699, 118.57726998
Slope	negligible	**Topography**	plain
Soil colour	red-orange	**Soil texture**	S
Rock cover (%)	0	**Rock type**	none

Observation details - visit 1 (21 Jun 2023)			
Sample description	Isolated tall *Acacia tumida* var. *pilbarensis* shrubs over low sparse *Acacia stellaticeps* and *Corchorus incanus* subsp. *incanua* shrubland over *Digitaria brownii*, *Triodia epactia* and *T. s*		
Habitat	grassland		
Disturbance	litter,historic clearing		
Vegetation condition	Very Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	55	**Tree cover (%)**	0
Shrub cover (%)	8	**Grass cover (%**	50
Herb cover (%)	0.2		

Sample and effort summary				
Sample method	**Visit**	**Sample date**	**Dimensions**	**Observer**
Quadrat	1	21-Jun-2023	50m x 50m	Grant Wells

Species (24)	Status	Visit 1		Visit 2	
		Cover (%)	Height (m)	Cover (%)	Height (m)
Triodia epactia		15	0.4		
Triodia schinzii		10	0.5		
Digitaria brownii		10	0.2		
Acacia stellaticeps		5	0.6		
Corchorus incanus subsp. *incanus*		1	1.2		
Eriachne mucronata		1	0.2		
Acacia tumida var. *pilbarensis*		0.5	2.5		
Eragrostis eriopoda		0.2	0.2		
Acacia colei var. *colei*		0.1	1.8		
Acacia trachycarpa x *tumida* var. *pilbarensis*		0.1	1.7		
Sida cardiophylla		0.1	0.7		
Ptilotus polystachyus		0.1	0.5		
Cassytha capillaris		0.1	0.4		
Sida sp. Pilbara (A.A. Mitchell PRP 1543)		0.1	0.4		
Chrysopogon fallax		0.1	0.3		
Solanum cleistogamum		0.1	0.3		
Pluchea tetranthera		0.1	0.3		
Bonamia erecta		0.1	0.25		
Bonamia linearis		0.1	0.2		
		0.1	0.1		
Evolvulus alsinoides var. *villosicalyx*		0.1	0.1		
Glycine tomentella		0.1	0.1		
Trigastrotheca molluginea		0.1	0.1		
Solanum diversiflorum		0.1	0.1		

Appendix 3 NVIS hierarchy

Western Australia current practice			National standard		
Hierarchy of terms	**Brief description in WA**	**Indicative scale**	**NVIS Level**	**Description**	**NVIS structural/floristic components required**
Vegetation formation	Structure and growth form – e.g. Forest, Woodland.	1:5 000 000	I	Class	Dominant growth form for the ecologically or structurally dominant stratum.
Vegetation sub-formation	Structural and dominant vegetation layer - Eucalypt Forest, Banksia Woodland.	1:2 500 000 I	II	Structural Formation	Dominant growth form, cover and height for the ecologically or structurally dominant stratum.
Vegetation association	Structural form and dominant species – e.g. Medium woodland; York gum (*Eucalyptus loxophleba*) & Wandoo.	1:1 000 000 to 1:250 000	III	Broad Floristic Formation	Dominant growth form, cover, height and dominant land cover genus for the uppermost or dominant stratum.
Vegetation complex	Structural and floristic description linked to geomorphology – e.g. Quindalup Complex.	1:250 000 to 1:100 000	IV	Sub-Formation	Dominant growth form, cover, height and dominant genus and Family for the 3 traditional strata. (i.e. Upper, Mid and Ground).
Vegetation type	Floristic definition by strata with structural detail. Often represented with a code and floristic description.	1:100 000 to 1:10 000	V	Association	Dominant growth form, height, cover and up to 3 species for the 3 traditional strata. (i.e. Upper, Mid and Ground).
Plant community	Basic unit of vegetation classification, site specific and highly localised with detailed floristics for each stratum.	1:10 000	VI	Sub-Association	Dominant growth form, height, cover and up to 5 species for all layers/ strata.
Floristic Community Type	Floristic composition definition; e.g. Northern banksia woodlands over herb rich shrublands on the Swan Coastal Plain.	No absolute scale			

Appendix 4 Terrestrial fauna survey site descriptions

Site details			
Site	**RHP01**	**Position (WGS84)**	-20.3856707, 118.5741589
Topography	plain	**Soil texture**	sand
Slope	negligible	**Rock type**	none
Soil colour	red-brown	**Rock cover (%)**	0

Sample and effort summary

Visit	Sample method	Sample quant. (hrs)	Repli-cation	Date start	Date stop
1	Transect	0	0	30 Apr 2023	30 Apr 2023
1	Foraging	0	0	30 Apr 2023	30 Apr 2023
1	Birding	0	0	30 Apr 2023	30 Apr 2023

Site description - visit 1 (30 Apr 2023)

Mixed *Acacia* dominant low shrubs over spinifex hummock grassland on predominantly sandy soils with some clay present.

Habitat	grassland		
Disturbance	Evidence of ferals, vehicle tracks, weed infestation		
Vegetation condition	Very Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	85	**Litter distribution**	under vegetation
Tree cover (%)	1	**Litter depth(cm)**	0.1
Shrub cover (%)	35	**Litter cover (%)**	1
Grass cover (%)	65		
Herb cover (%)	0.1		

Site details			
Site	**RHP02**	**Position (WGS84)**	-20.3819721937, 118.573137699
Topography	plain	**Soil texture**	sandy clay
Slope	negligible	**Rock type**	not recorded
Soil colour	red-brown	**Rock cover (%)**	0

Sample and effort summary

Visit	Sample method	Sample quant. (hrs)	Repli-cation	Date start	Date stop
1	Transect	0	0	30 Apr 2023	30 Apr 2023
1	Foraging	0	0	30 Apr 2023	30 Apr 2023
1	Birding	0	0	30 Apr 2023	30 Apr 2023

Site description - visit 1 (30 Apr 2023)

Mixed *Acacia* dominant low shrubs over spinifex hummock grassland on predominantly sandy soils with some clay present.

Habitat	spinifex grassland		
Disturbance	Evidence of ferals, vehicle tracks, weed infestation		
Vegetation condition	Very Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	85	**Litter distribution**	under vegetation
Tree cover (%)	0	**Litter depth(cm)**	0.1
Shrub cover (%)	35	**Litter cover (%)**	1
Grass cover (%)	55		
Herb cover (%)	0.1		

Site details			
Site	**RHP03**	**Position (WGS84)**	-20.3784484, 118.5724217
Topography	plain	**Soil texture**	sand
Slope	negligible	**Rock type**	quartz
Soil colour	red-brown	**Rock cover (%)**	1

Sample and effort summary

Visit	Sample method	Sample quant. (hrs)	Repli-cation	Date start	Date stop
1	Transect	0	0	30 Apr 2023	30 Apr 2023
1	Foraging	0	0	30 Apr 2023	30 Apr 2023
1	Birding	0	0	30 Apr 2023	30 Apr 2023

Site description - visit 1 (30 Apr 2023)

Mixed *Acacia* dominant low shrubs over spinifex hummock grassland on predominantly sandy soils with some clay present.

Habitat	spinifex grassland		
Disturbance	Evidence of ferals, vehicle tracks, weed infestation		
Vegetation condition	Very Good	**Fire age**	long-unburnt (>10 years)
Total veg. cover (%)	90	**Litter distribution**	under vegetation
Tree cover (%)	0.1	**Litter depth(cm)**	0.1
Shrub cover (%)	35	**Litter cover (%)**	0.5
Grass cover (%)	65		
Herb cover (%)	0.1		

Site details			
Site	**RHP04**	**Position (WGS84)**	-20.3711784, 118.5658015
Topography	plain	**Soil texture**	sand
Slope	negligible	**Rock type**	none
Soil colour	red-brown	**Rock cover (%)**	0

Site description - visit 1 (30 Apr 2023)			
Almost entirely disturbed narrow strip of habitat between rail and road. Mixed grasses and shrubs including scattered to isolated halophytes.			
Habitat	spinifex grassland		
Disturbance	Evidence of ferals, vehicle tracks, weed infestation		
Vegetation condition	Very Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	15	**Litter distribution**	none
Tree cover (%)	0	**Litter depth(cm)**	0
Shrub cover (%)	10	**Litter cover (%)**	0
Grass cover (%)	15		
Herb cover (%)	0.1		

Site details			
Site	**RHP05**	**Position (WGS84)**	-20.367114, 118.557693
Topography	plain	**Soil texture**	sand
Slope	negligible	**Rock type**	none
Soil colour	red-brown	**Rock cover (%)**	0

Site description - visit 1 (30 Apr 2023)			
Intertidal zone forming a channel under road and rail infrastructure. Adjacent terrestrial habitats heavily disturbed and not suitable to support native fauna assemblages.			
Habitat	intertidal mudflat		
Disturbance	Evidence of ferals, vehicle tracks, weed infestation		
Vegetation condition	Good	**Fire age**	not recorded
Total veg. cover (%)	0	**Litter distribution**	none
Tree cover (%)	0	**Litter depth(cm)**	0
Shrub cover (%)	0	**Litter cover (%)**	0
Grass cover (%)	0		
Herb cover (%)	0		

Site details			
Site	**RHP06**	**Position (WGS84)**	-20.3520694, 118.5461231
Topography	drainage line	**Soil texture**	clay
Slope	negligible	**Rock type**	none
Soil colour	red-brown	**Rock cover (%)**	0

Site description - visit 1 (30 Apr 2023)			
Almost entirely disturbed narrow strip of habitat between rail and road. Mixed grasses and shrubs including scattered to isolated halophytes.			
Habitat	spinifex grassland		
Disturbance	Evidence of ferals, vehicle tracks, weed infestation		
Vegetation condition	Good	**Fire age**	moderate (>5 years)
Total veg. cover (%)	0	**Litter distribution**	sparse
Tree cover (%)	0	**Litter depth(cm)**	0.1
Shrub cover (%)	15	**Litter cover (%)**	1
Grass cover (%)	35		
Herb cover (%)	0.1		

Appendix 5 Introduced flora identified in the desktop review

Family	Taxon
Aizoaceae	**Trianthema portulacastrum*
Apocynaceae	**Calotropis procera*
Asteraceae	**Cyanthillium cinereum* var. *cinereum*
	**Tridax procumbens*
Cactaceae	**Opuntia stricta*
Convolvulaceae	**Distimake dissectus* var. *dissectus*
Cucurbitaceae	**Citrullus amarus*
	**Coccinia grandis*
Euphorbiaceae	**Jatropha gossypiifolia*
Fabaceae	**Clitoria ternatea*
	**Desmodium scorpiurus*
	**Indigofera hochstetteri*
	**Indigofera oblongifolia*
	**Indigofera sessiliflora*
	**Leucaena leucocephala*
	**Parkinsonia aculeata*
	**Senna occidentalis*
	**Stylosanthes guianensis* var. *guianensis*
	**Stylosanthes hamata*
	**Vachellia farnesiana*
Malvaceae	**Gossypium hirsutum*
	**Malvastrum americanum*
Papaveraceae	**Argemone ochroleuca* subsp. *ochroleuca*
Passifloraceae	**Passiflora foetida* var. *hispida*
Poaceae	**Andropogon gayanus*
	**Cenchrus ciliaris*
	**Cenchrus setaceus*
	**Cenchrus setiger*
	**Chloris barbata*
	**Chloris virgata*
	**Digitaria ciliaris*
	**Echinochloa colona*
	**Eragrostis pilosa*
	**Lamarckia aurea*
	**Paspalum fasciculatum*
	**Setaria sphacelata*
Solanaceae	**Physalis angulata*
Tamaricaceae	**Tamarix aphylla*

Appendix 6 Vertebrate fauna desktop and field survey results

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Reptiles (94)										
Agamidae	*Amphibolurus gilberti*	Ta-ta				X				
	Amphibolurus longirostris	Long-nosed Dragon				X	X	X		
	Ctenophorus caudicinctus	Ring-tailed Dragon				X		X		
	Ctenophorus isolepis	Central Military Dragon					X	X		
	Ctenophorus nuchalis	Central Netted Dragon				X	X	X		
	Ctenophorus reticulatus	Western Netted Dragon				X				
	Diporiphora paraconvergens	Grey-striped Western Desert Dragon				X				
	Diporiphora pindan					X				
	Diporiphora valens	Southern Pilbara Tree Dragon				X				
	Diporiphora vescus	Northern Pilbara Tree Dragon				X				
	Pogona minor	Dwarf Bearded Dragon				X		X		
Boidae	*Antaresia childreni*	Children's Python				X				
	Antaresia perthensis	Pygmy Python				X				
	Aspidites melanocephalus	Black-headed Python				X	X	X		
	Aspidites ramsayi	Woma				X		X		
	Liasis olivaceus subsp. barroni	Pilbara Olive Python	VU (EPBC & BC Acts)		X	X			X	
Carphodactylidae	*Nephrurus levis*	Smooth Knob-tailed Gecko				X	X	X		

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Colubridae	*Fordonia leucobalia*	White-bellied Mangrove Snake				X				
Diplodactylidae	*Diplodactylus bilybara*	Western Fat-tailed Gecko					X			
	Diplodactylus conspicillatus	Fat-tailed Gecko				X		X		
	Lucasium stenodactylum					X	X	X		
	Rhynchoedura ornata	Western Beaked Gecko				X	X			
	Strophurus ciliaris					X	X	X		
	Strophurus elderi					X				
	Strophurus jeanae					X				
Elapidae	*Acanthophis pyrrhus*	Desert Death Adder				X				
	Acanthophis wellsi	Pilbara Death Adder				X		X		
	Brachyurophis approximans	North-western Shovel-nosed Snake				X		X		
	Demansia psammophis	Yellow-faced Whipsnake				X		X		
	Demansia rufescens	Rufous Whipsnake				X	X	X		
	Furina ornata	Moon Snake				X		X		
	Pseudechis australis	Mulga Snake				X	X	X		
	Pseudonaja mengdeni	Western Brown Snake				X	X	X		
	Pseudonaja modesta	Ringed Brown Snake				X		X		
	Pseudonaja nuchalis	Gwardar				X		X		
	Simoselaps anomalus	Desert Banded Snake				X		X		
	Suta punctata	Spotted Snake				X				

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Gekkonidae	*Gehyra pilbara*					X				
	Gehyra punctata	Spotted Dtella				X		X		
	Gehyra purpurascens					X				
	Gehyra variegata	Variegated Dtella				X	X	X		
	Hemidactylus frenatus	Asian House Gecko		*		X				
	Heteronotia binoei	Bynoe's Gecko				X	X	X		
	Heteronotia spelea	Desert Cave Gecko				X				
Pygopodidae	*Delma butleri*	Unbanded Delma				X		X		
	Delma haroldi					X		X		
	Delma nasuta					X				
	Delma pax	Peace Delma				X	X			
	Delma tincta	Excitable Delma				X	X	X		
	Lialis burtonis	Burton's Legless Lizard				X				
	Pygopus nigriceps					X				
Scincidae	*Carlia munda*	Shaded-litter Rainbow Skink				X		X		
	Carlia triacantha	Desert Rainbow Skink					X	X		
	Cryptoblepharus buchananii					X				
	Cryptoblepharus plagiocephalus	Peron's Snake-eyed Skink				X				
	Ctenotus angusticeps	Airlie Island Ctenotus	P3 (DBCA list)			X			X	
	Ctenotus duricola					X	X	X		

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Ctenotus dux					X				
	Ctenotus grandis	Grand Ctenotus				X	X	X		
	Ctenotus hanloni	Nimble Ctenotus				X	X			
	Ctenotus helenae	Clay-soil Ctenotus				X	X	X		
	Ctenotus pantherinus	Leopard Ctenotus				X	X	X		
	Ctenotus piankai	Coarse Sands Ctenotus				X	X	X		
	Ctenotus rufescens					X	X	X		
	Ctenotus saxatilis	Rock Ctenotus				X	X	X		X
	Ctenotus serventyi					X	X	X		
	Egernia depressa	Southern Pygmy Spiny-tailed Skink				X	X	X		
	Egernia epsisolus	Eastern Pilbara Spiny-tailed Skink				X				
	Eremiascincus isolepis	Northern Bar-lipped Skink				X				
	Eremiascincus musivus	Mosaic Desert Skink						X		
	Eremiascincus pallidus	Western Narrow-banded Skink				X		X		
	Eremiascincus richardsonii	Broad-banded Sand Swimmer				X				
	Lerista bipes	North-western Sandslider				X	X	X		
	Lerista clara	Sharp-blazed Three-toed Slider				X				
	Lerista muelleri	Wood Mulch-slider				X		X		
	Lerista verhmens					X				
	Menetia greyii	Common Dwarf Skink				X	X	X		
	Morethia ruficauda	Lined Firetail Skink				X	X	X		

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Notoscincus ornatus					X				
	Proablepharus reginae					X				
	Tiliqua multifasciata	Central Blue-tongue				X		X		
Typhlopidae	*Anilios ammodytes*	Sand-diving Blind Snake				X		X		
	Anilios grypus					X	X	X		
	Anilios pilbarensis					X	X			
	Indotyphlops braminus			*		X				
Varanidae	*Varanus acanthurus*	Spiny-tailed Monitor				X	X	X		
	Varanus brevicauda	Short-tailed Pygmy Monitor				X	X	X		
	Varanus bushi	Pilbara Mulga Monitor				X		X		
	Varanus eremius	Pygmy Desert Monitor				X	X	X		
	Varanus giganteus	Perentie				X		X		
	Varanus gouldii	Bungarra or Sand Monitor				X	X	X		
	Varanus panoptes	Yellow-spotted Monitor				X	X			
	Varanus pilbarensis	Pilbara Rock Monitor				X				
	Varanus tristis	Racehorse Monitor				X				
Birds (231)										
Bufonidae	*Platyplectrum spenceri*	Centralian Burrowing Frog				X	X	X		
Hylidae	*Cyclorana maini*	Sheep Frog				X	X	X		
	Cyclorana sp.	Giant Frog				X		X		
	Litoria caerulea	Green Tree Frog				X		X		
	Litoria rubella	Little Red Tree Frog				X	X	X		

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Limnodynastidae	*Neobatrachus aquilonius*	Northern Burrowing Frog				X	X			
	Neobatrachus sutor	Shoemaker Frog				X				
	Notaden nichollsi	Desert Spadefoot				X	X	X		
Myobatrachidae	*Uperoleia glandulosa*	Glandular Toadlet				X	X			
	Uperoleia russelli	Northwest Toadlet				X		X		
	Uperoleia saxatilis	Pilbara Toadlet				X				
	Uperoleia talpa	Ratcheting Toadlet				X				
Class: Aves (218)										
Acanthizidae	*Gerygone fusca*	Western Gerygone				X				
	Gerygone tenebrosa	Dusky Gerygone				X		X		
	Smicrornis brevirostris	Weebill				X				
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk				X				
	Accipiter fasciatus	Brown Goshawk				X				
	Aquila audax	Wedge-tailed Eagle				X		X		
	Circus approximans	Swamp Harrier				X		X		
	Circus assimilis	Spotted Harrier				X		X		
	Elanus caeruleus	Black-shouldered Kite				X		X		
	Haliaeetus leucogaster	White-bellied Sea-Eagle				X		X		
	Haliastur indus	Brahminy Kite				X	X	X		
	Haliastur sphenurus	Whistling Kite				X		X		
	Hieraaetus morphnoides	Little Eagle				X		X		

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Milvus migrans	Black Kite				X		X		
	Pandion cristatus	Osprey	Mig. (EPBC & BC Acts)		X	X		X	X	
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar				X		X		
Alaudidae	*Mirafra javanica*	Horsfield's Bushlark				X	X	X		
Anatidae	*Anas gracilis*	Grey Teal				X		X		
	Anas rhynchotis	Australasian Shoveler				X				
	Anas superciliosa	Pacific Black Duck				X		X		
	Aythya australis	Hardhead				X		X		
	Cygnus atratus	Black Swan				X		X		
	Dendrocygna arcuata	Wandering Whistling Duck				X				
	Dendrocygna eytoni	Plumed Whistling Duck				X		X		
	Malacorhynchus membranaceus	Pink-eared Duck				X		X		
Anhingidae	*Anhinga novaehollandiae*	Australasian Darter				X		X		
Apodidae	*Apus pacificus*	Fork-tailed Swift	Mig. (EPBC & BC Acts)		X	X	X			
Ardeidae	*Ardea garzetta*	Little Egret				X	X	X		X
	Ardea ibis	Cattle Egret				X		X		
	Ardea intermedia	Intermediate Egret				X				
	Ardea modesta	Great Egret				X		X		X
	Ardea novaehollandiae	White-faced Heron			X	X	X	X		
	Ardea pacifica	White-necked Heron				X		X		

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Ardea sacra	Eastern Reef Egret				X		X		
	Butorides striata	Striated Heron				X		X		
	Nycticorax caledonicus	Rufous Night Heron				X				
Artamidae	*Artamus cinereus*	Black-faced Woodswallow				X	X	X		
	Artamus cyanopterus	Dusky Woodswallow				X				
	Artamus leucorynchus	White-breasted Woodswallow				X	X	X		X
	Artamus minor	Little Woodswallow				X				
	Artamus personatus	Masked Woodswallow				X				
	Artamus superciliosus	White-browed Woodswallow				X		X		
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew				X				
	Esacus magnirostris	Beach Stone-curlew				X				
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike				X	X	X		
	Lalage tricolor	White-winged Triller				X		X		
Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar				X		X		
Centropodidae	*Centropus phasianinus*	Pheasant Coucal						X		
Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	VU/Mig./VU (EPBC Act; BC Act)		X	X	X	X	X	
	Charadrius mongolus	Lesser Sand Plover	EN/Mig. (EPBC & BC Acts)		X		X	X	X	
	Charadrius ruficapillus	Red-capped Plover				X	X	X		X

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Charadrius veredus	Oriental Plover	Mig. (EPBC & BC Acts)		X	X		X	X	
	Elseyornis melanops	Black-fronted Dotterel				X	X	X		
	Erythrogonys cinctus	Red-kneed Dotterel				X		X		
	Pluvialis fulva	Pacific Golden Plover	Mig. (EPBC & BC Acts)		X	X			X	
	Pluvialis squatarola	Grey Plover	Mig. (EPBC & BC Acts)		X	X		X	X	
	Vanellus miles	Masked Lapwing				X	X			
	Vanellus tricolor	Banded Lapwing				X		X		
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork				X	X	X		X
Cinclosomatidae	*Cinclosoma castaneothorax*	Chestnut-breasted Quail-thrush				X				
Columbidae	*Columba livia*	Domestic Pigeon		*		X		X		
	Geopelia cuneata	Diamond Dove				X	X	X		X
	Geopelia humeralis	Bar-shouldered Dove				X				
	Geopelia striata	Zebra Dove				X				
	Geopelia striata subsp. placida	Peaceful Dove					X	X		
	Geophaps plumifera	Spinifex Pigeon				X		X		
	Ocyphaps lophotes	Crested Pigeon				X	X	X		
	Phaps chalcoptera	Common Bronzewing				X	X	X		
	Phaps histrionica	Flock Bronzewing				X				

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Corvidae	*Corvus bennetti*	Little Crow				X				
	Corvus coronoides	Australian Raven				X				
	Corvus orru	Torresian Crow				X	X	X		
Cracticidae	*Cracticus nigrogularis*	Pied Butcherbird				X		X		
	Cracticus tibicen	Australian Magpie				X				
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo				X		X		
	Chrysococcyx basalis	Horsfield's Bronze Cuckoo				X		X		
	Chrysococcyx osculans	Black-eared Cuckoo				X				
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird				X				
Dicruridae	*Grallina cyanoleuca*	Magpie-lark				X	X	X		
	Rhipidura albiscapa	Grey Fantail				X				
	Rhipidura leucophrys	Willie Wagtail				X	X	X		
	Rhipidura phasiana	Mangrove Grey Fantail				X		X		
Dromaiidae	*Dromaius novaehollandiae*	Emu				X		X		
Estrilidae	*Emblema pictum*	Painted Finch				X		X		
	Heteromunia pectoralis	Pictorella Mannikin				X				
	Neochmia ruficauda	Star Finch				X				
	Taeniopygia guttata	Zebra Finch				X	X	X		X
Falconidae	*Falco berigora*	Brown Falcon				X	X	X		
	Falco cenchroides	Australian Kestrel				X	X	X		X
	Falco hypoleucos	Grey Falcon	VU (BC Act)		X	X			X	

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Falco longipennis	Australian Hobby				X		X		
	Falco peregrinus	Peregrine Falcon	OS (BC Act)			X			X	
Fregatidae	*Fregata ariel*	Lesser Frigatebird	Mig. (EPBC & BC Acts)		X	X		X	X	
	Fregata minor	Greater Frigatebird	Mig. (EPBC & BC Acts)		X					
Glareolidae	*Glareola maldivarum*	Oriental Pratincole	Mig. (EPBC & BC Acts)		X	X			X	
	Stiltia isabella	Australian Pratincole				X				
Gruidae	*Grus rubicunda*	Brolga				X				
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher				X		X		
	Haematopus longirostris	Pied Oystercatcher				X		X		
Halcyonidae	*Dacelo leachii*	Blue-winged Kookaburra				X		X		
	Todiramphus chloris	Collared Kingfisher				X		X		
	Todiramphus pyrrhopygius	Red-backed Kingfisher				X		X		
	Todiramphus sanctus	Sacred Kingfisher				X	X	X		
Hirundinidae	*Cheramoeca leucosterna*	White-backed Swallow				X		X		
	Hirundo neoxena	Welcome Swallow				X	X			
	Hirundo rustica	Barn Swallow	Mig. (EPBC & BC Acts)		X	X			X	
	Petrochelidon ariel	Fairy Martin				X	X	X		
	Petrochelidon nigricans	Tree Martin				X		X		X

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Hydrobatidae	*Oceanites oceanicus*	Wilson's Storm Petrel	Mig. (EPBC & BC Acts)			X			X	
Laridae	*Anous stolidus*	Common Noddy	Mig. (EPBC & BC Acts)		X					
	Chlidonias leucopterus	White-winged Black Tern	Mig. (EPBC & BC Acts)						X	
	Hydroprogne caspia	Caspian Tern	Mig. (EPBC & BC Acts)		X	X		X	2	
	Larus novaehollandiae	Silver Gull				X	X	X		
	Onychoprion anaethetus	Bridled Tern	Mig. (EPBC & BC Acts)			X			X	
	Sterna bengalensis	Lesser Crested Tern				X		X		
	Sterna hirundo	Common Tern	Mig. (EPBC & BC Acts)			X			X	
	Sterna hybrida	Whiskered Tern				X		X		
	Sternula albifrons	Little Tern	Mig. (EPBC & BC Acts)		X	X	X	X	X	
	Sternula nereis subsp. nereis	Fairy Tern	VU (EPBC & BC Acts)		X	X		X	X	
	Thalasseus bergii	Crested Tern	Mig. (BC Act)			X		X	X	
Maluridae	*Malurus lamberti*	Variegated Fairy-wren				X		X		
	Malurus leucopterus	White-winged Fairy-wren				X	X	X		
	Stipiturus ruficeps	Rufous-crowned Emu-wren				X				
Meliphagidae	*Epthianura aurifrons*	Orange Chat				X				
	Epthianura tricolor	Crimson Chat				X				

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Gavicalis virescens	Singing Honeyeater				X	X	X		
	Lichmera indistincta	Brown Honeyeater				X	X	X		
	Manorina flavigula	Yellow-throated Miner				X	X	X		
	Melithreptus gularis	Black-chinned Honeyeater				X				
	Ptilotula keartlandi	Grey-headed Honeyeater				X				
	Ptilotula penicillata	White-plumed Honeyeater				X	X	X		
	Sugomel nigrum	Black Honeyeater						X		
Meropidae	*Merops ornatus*	Rainbow Bee-eater				X	X	X		X
Motacillidae	*Anthus australis*	Australian Pipit				X	X	X		
	Motacilla cinerea	Grey Wagtail	Mig. (EPBC & BC Acts)		X					
	Motacilla flava	Yellow Wagtail	Mig. (EPBC & BC Acts)		X	X			X	
Otididae	*Ardeotis australis*	Australian Bustard				X		X		
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush				X		X		
	Oreoica gutturalis	Crested Bellbird				X				
	Pachycephala lanioides	White-breasted Whistler				X		X		
	Pachycephala melanura	Mangrove Golden Whistler				X		X		
	Pachycephala rufiventris	Rufous Whistler				X				
Pardalotidae	*Pardalotus rubricatus*	Red-browed Pardalote				X		X		
	Pardalotus striatus	Striated Pardalote				X				
Passeridae	*Passer montanus*	Eurasian Tree Sparrow		*		X				

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican				X		X		
Petroicidae	*Eopsaltria pulverulenta*	Mangrove Robin				X		X		
	Petroica goodenovii	Red-capped Robin				X				
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant				X				
	Phalacrocorax melanoleucos	Little Pied Cormorant				X		X		
	Phalacrocorax sulcirostris	Little Black Cormorant				X				
	Phalacrocorax varius	Pied Cormorant				X		X		
Phasianidae	*Coturnix ypsilophora*	Brown Quail				X	X	X		
Podargidae	*Podargus strigoides*	Tawny Frogmouth				X		X		
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe				X				
	Poliocephalus poliocephalus	Hoary-headed Grebe				X				
	Tachybaptus novaehollandiae	Australasian Grebe				X		X		
Pomatostomidae	*Pomatostomus superciliosus*	White-browed Babbler				X				
	Pomatostomus temporalis	Grey-crowned Babbler				X				
Procellariidae	*Calonectris leucomelas*	Streaked Shearwater	Mig. (EPBC & BC Acts)		X					
	Macronectes giganteus	Southern Giant Petrel	EN/Mig./Mig. (EPBC Act; BC Act)		X					

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Psittacidae	*Cacatua roseicapilla*	Galah				X	X	X		
	Cacatua sanguinea	Little Corella				X	X	X		
	Melopsittacus undulatus	Budgerigar				X	X	X		X
	Nymphicus hollandicus	Cockatiel				X	X	X		X
	Pezoporus occidentalis	Night Parrot	EN/CR (EPBC Act; BC Act)		X					
	Platycercus spurius	Red-capped Parrot				X				
	Platycercus zonarius	Australian Ringneck			X	X				
Ptilonorhynchidae	*Ptilonorhynchus maculatus*	Spotted Bowerbird				X				
Rallidae	*Fulica atra*	Eurasian Coot				X				
	Gallirallus philippensis	Buff-banded Rail				X	X			
	Porphyrio porphyrio	Purple Swamphen				X				
	Porzana fluminea	Australian Spotted Crake				X				
	Tribonyx ventralis	Black-tailed Native-hen				X				
Recurvirostridae	*Cladorhynchus leucocephalus*	Banded Stilt				X		X		
	Himantopus himantopus	Black-winged Stilt				X	X	X		X
	Recurvirostra novaehollandiae	Red-necked Avocet				X				
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	EN (EPBC & BC Acts)		X					

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	Mig. (EPBC & BC Acts)		X	X		X	X	
	Arenaria interpres	Ruddy Turnstone	Mig. (EPBC & BC Acts)		X	X	X	X	X	
	Calidris acuminata	Sharp-tailed Sandpiper	Mig. (EPBC & BC Acts)		X	X			X	
	Calidris alba	Sanderling	Mig. (EPBC & BC Acts)		X			X	X	
	Calidris canutus	Red Knot	EN/Mig./EN (EPBC Act; BC Act)		X	X	X	X	X	
	Calidris ferruginea	Curlew Sandpiper	CR/Mig./CR (EPBC Act; BC Act)		X	X	X	X	X	
	Calidris melanotos	Pectoral Sandpiper	Mig. (EPBC & BC Acts)		X	X			X	
	Calidris ruficollis	Red-necked Stint	Mig. (EPBC & BC Acts)			X	X	X	X	
	Calidris subminuta	Long-toed Stint	Mig. (EPBC & BC Acts)		X	X			X	
	Calidris tenuirostris	Great Knot	CR/Mig./CR (EPBC Act; BC Act)		X	X	X	X	X	
	Gallinago stenura	Pin-tailed Snipe	Mig. (EPBC & BC Acts)			X			X	
	Limicola falcinellus	Broad-billed Sandpiper	Mig. (BC Act)		X	X		X	X	
	Limnodromus semipalmatus	Asian Dowitcher	Mig. (EPBC & BC Acts)		X	X			X	

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Limosa lapponica	Bar-tailed Godwit	Mig. (EPBC & BC Acts)		X	X	X	X	X	
	Limosa limosa	Black-tailed Godwit	Mig. (BC Act)		X	X			X	
	Numenius madagascariensis	Eastern Curlew	CR/Mig./CR (EPBC Act; BC Act)		X	X	X	X	X	
	Numenius minutus	Little Curlew	Mig. (EPBC & BC Acts)		X	X		X	X	
	Numenius phaeopus	Whimbrel	Mig. (EPBC & BC Acts)		X	X	X	X	X	X
	Phalaropus lobatus	Red-necked Phalarope	Mar/Mig. (EPBC Act; BC Act)		X	X			X	
	Philomachus pugnax	Ruff	Mig. (EPBC & BC Acts)			X			X	
	Tringa brevipes	Grey-tailed Tattler	Mig. EPBC and BC Acts; P4 DBCA list		X	X	X	X	X	X
	Tringa glareola	Wood Sandpiper	Mig. (EPBC & BC Acts)		X	X	X		X	
	Tringa nebularia	Common Greenshank	Mig. (EPBC & BC Acts)		X	X		X	X	
	Tringa stagnatilis	Marsh Sandpiper	Mig. (EPBC & BC Acts)		X	X		X	X	
	Xenus cinereus	Terek Sandpiper	Mig. (EPBC & BC Acts)		X	X	X	X	X	
Strigidae	*Ninox connivens*	Barking Owl				X				

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Sturnidae	*Gelochelidon nilotica*	Gull-billed Tern	Mig. (BC Act)			X	X	X	X	
Sulidae	*Sula leucogaster*	Brown Booby	Mig. (EPBC & BC Acts)		X	X			X	
Sylviidae	*Acrocephalus australis*	Australian Reed Warbler				X				
	Cincloramphus mathewsi	Rufous Songlark				X		X		
	Eremiornis carteri	Spinifex-bird				X	X	X		
	Megalurus cruralis	Brown Songlark				X	X	X		
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill				X				
	Platalea regia	Royal Spoonbill				X				
	Plegadis falcinellus	Glossy Ibis	Mig. (EPBC & BC Acts)			X			X	
	Threskiornis moluccus	Australian White Ibis				X	X	X		
	Threskiornis spinicollis	Straw-necked Ibis				X	X	X		
Turnicidae	*Turnix velox*	Little Button-quail				X	X	X		
Tytonidae	*Tyto alba*	Barn Owl				X		X		
Zosteropidae	*Zosterops luteus*	Yellow White-eye				X		X		
Mammals (46)										
Bovidae	*Bos taurus*	European Cattle		*		X	X	X		
	Capra hircus	Goat		*		X				
Camelidae	*Camelus dromedarius*	Dromedary		*		X				
Canidae	*Canis familiaris*	Dog		*		X	X	X		
Canidae	*Vulpes vulpes*	Red Fox		*		X	X	X		X

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Dasyuridae	*Antechinomys laniger*	Kultarr				X				
	Dasycercus blythi	Brush-tailed Mulgara	P4 (DBCA list)			X	X		X	
	Dasykaluta rosamondae	Little Red Kaluta				X	X	X		
	Dasyurus hallucatus	Northern Quoll	EN (EPBC & BC Acts)		X	X			X	
	Ningaui timealeyi	Pilbara Ningaui				X				
	Planigale ingrami	Long-tailed Planigale				X				
	Pseudantechinus woolleyae	Woolley's Pseudantechinus				X				
	Sminthopsis macroura	Stripe-faced Dunnart				X				
	Sminthopsis youngsoni	Lesser Hairy-footed Dunnart				X	X	X		
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheath-tailed Bat				X		X		
	Taphozous georgianus	Common Sheath-tailed Bat				X		X		
Equidae	*Equus asinus*	Donkey		*		X				
	Equus caballus	Horse		*		X		X		
Felidae	*Felis catus*	Cat		*		X	X	X		X
Hipposideridae	*Rhinonicteris aurantia (Pilbara)*	Pilbara Leaf-nosed Bat	VU (EPBC & BC Acts)		X	X			X	
Leporidae	*Oryctolagus cuniculus*	Rabbit		*		X		X		
Macropodidae	*Macropus rufus*	Red Kangaroo					X			
	Osphranter robustus	Euro				X		X		
	Osphranter rufus	Red Kangaroo								X
	Petrogale rothschildi	Rothschild's Rock-wallaby				X				

Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
Megadermatidae	*Macroderma gigas*	Ghost Bat	VU (EPBC & BC Acts)		X	X			X	
Molossidae	*Chaerephon jobensis*	Greater Northern Freetail-bat				X	X	X		
	Mormopterus cobourgianus	North-western Free-tailed Bat	P1 (DBCA list)			X		X	X	
	Mormopterus lumsdenae	Northern Free-tailed Bat						X		
Muridae	*Mus musculus*	House Mouse		*		X		X		
	Notomys alexis	Spinifex Hopping-mouse				X	X	X		
	Pseudomys chapmani	Western Pebble-mound Mouse	P4 (DBCA list)			X			X	
	Pseudomys delicatulus	Delicate Mouse				X				
	Pseudomys desertor	Desert Mouse				X				
	Pseudomys hermannsburgensis	Sandy Inland Mouse				X	X	X		
	Pseudomys nanus	Western Chestnut Mouse				X		X		
	Rattus rattus	Black Rat		*		X				
	Zyzomys argurus	Common Rock-rat				X		X		
Pteropodidae	*Pteropus scapulatus*	Little Red Flying-fox				X		X		
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna				X				
Thylacomyidae	*Macrotis lagotis*	Bilby	VU (EPBC & BC Acts)		X	X	X		X	X
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat				X	X	X		
	Nyctophilus arnhemensis	Arnhem Land Long-eared Bat				X		X		

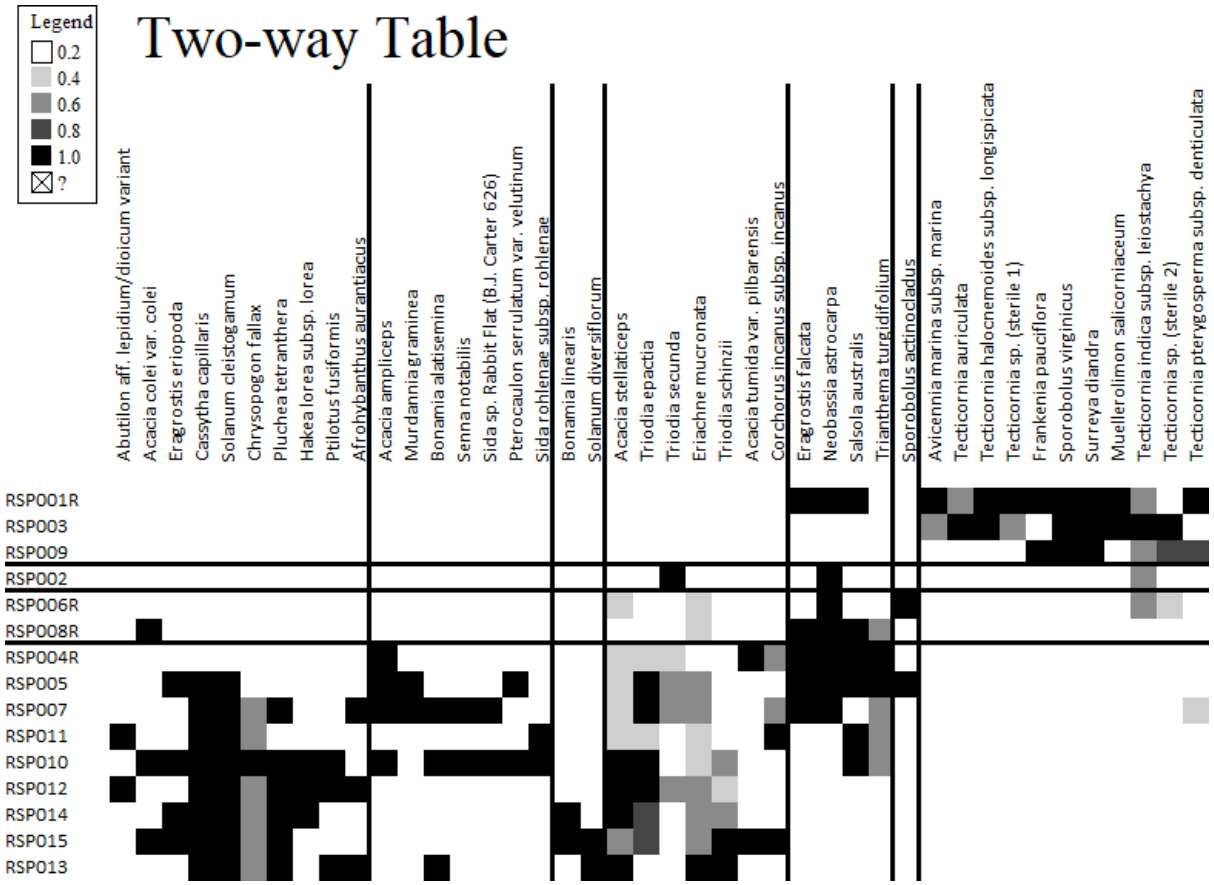
Family	Species	Common name	Status	Introduced	EPBC Protected Matters	NatureMap	Phoenix database	Other	DBCA Threatened fauna	This survey
	Nyctophilus geoffroyi	Lesser Long-eared Bat				X		X		
	Scotorepens greyii	Little Broad-nosed Bat				X	X	X		
	Vespadelus finlaysoni	Finlayson's Cave Bat				X	X	X		

Appendix 7 Flora species inventory

Family	Species	Status
Acanthaceae	*Avicennia marina subsp. marina*	
Aizoaceae	*Trianthema turgidifolium*	
Amaranthaceae	**Aerva javanica*	Weed
	Ptilotus fusiformis	
	Ptilotus polystachyus	
	Surreya diandra	
Apocynaceae	*Cynanchum viminale subsp. australe*	
Asteraceae	*Pluchea longiseta*	
	Pluchea tetranthera	
	Pterocaulon serrulatum var. *velutinum*	
	Streptoglossa bubakii	
Chenopodiaceae	*Neobassia astrocarpa*	
	Salsola australis	
	Tecticornia auriculata	
	Tecticornia halocnemoides subsp. *longispicata*	
	Tecticornia indica subsp. *leiostachya*	
	Tecticornia pterygosperma subsp. *denticulata*	
	Tecticornia sp. (sterile 1)	local sig.
	Tecticornia sp. (sterile 2)	local sig.
Cleomaceae	*Arivela viscosa*	
Commelinaceae	*Murdannia graminea*	
Convolvulaceae	*Bonamia alatisemina*	
	Bonamia erecta	
	Bonamia linearis	
	Evolvulus alsinoides var. *villosicalyx*	
	Ipomoea muelleri	
Cucurbitaceae	*Cucumis variabilis*	
Cyperaceae	*Cyperus blakeanus*	
Euphorbiaceae	*Euphorbia australis* var. *subtomentosa*	
Fabaceae	**Indigofera sessiliflora*	Weed
	**Stylosanthes hamata*	Weed
	Acacia ampliceps	
	Acacia colei var. *colei*	
	Acacia stellaticeps	
	Acacia trachycarpa	
	Acacia trachycarpa x *tumida* var. *pilbarensis*	
	Acacia tumida var. *pilbarensis*	
	Glycine tomentella	
	Rhynchosia minima	

Family	Species	Status
	Senna notabilis	
	Sesbania cannabina	
	Tephrosia leptoclada	
	Tephrosia rosea var. Port Hedland (A.S. George 1114)	P1
Frankeniaceae	*Frankenia pauciflora*	
Goodeniaceae	*Goodenia forrestii*	
Lauraceae	*Cassytha capillaris*	
Malvaceae	*Abutilon* aff. lepidium/dioicum variant	
	Abutilon sp.	
	Corchorus incanus subsp. *incanus*	
	Sida ?*arenicola*	
	Sida cardiophylla	
	Sida rohlenae subsp. *rohlenae*	
	Sida sp. Pilbara (A.A. Mitchell PRP 1543)	
	Sida sp. Rabbit Flat (B.J. Carter 626)	
Molluginaceae	*Trigastrotheca molluginea*	
Plantaginaceae	*Stemodia grossa*	
Plumbaginaceae	*Muellerolimon salicorniaceum*	
Poaceae	**Cenchrus ciliaris*	Weed
	**Chloris barbata*	Weed
	Aristida contorta	
	Aristida holathera var. *holathera*	
	Chrysopogon fallax	
	Digitaria brownii	
	Eragrostis eriopoda	
	Eragrostis falcata	
	Eriachne mucronata	
	Panicum australiense var. *australiense*	
	Panicum decompositum	
	Sporobolus actinocladus	
	Sporobolus virginicus	
	Triodia epactia	
	Triodia schinzii	
	Triodia secunda	
Proteaceae	*Hakea lorea* subsp. *lorea*	
Solanaceae	*Solanum cleistogamum*	
	Solanum diversiflorum	
Violaceae	*Afrohybanthus aurantiacus*	

Appendix 8 Flora species by site matrix



Appendix 9 Fauna species by site matrix

Class	Order	Family	Scientific name	Common name	RHP01	RHP02	RHP03	RHP04	RHP05
Aves	*Charadriiformes*	*Charadriidae*	*Charadrius ruficapillus*	Red-capped Plover					1
Aves	*Charadriiformes*	*Recurvirostridae*	*Himantopus himantopus*	Black-winged Stilt					4
Aves	*Charadriiformes*	*Scolopacidae*	*Numenius phaeopus*	Whimbrel					1
Aves	*Charadriiformes*	*Scolopacidae*	*Tringa brevipes*	Grey-tailed Tattler					1
Aves	*Ciconiiformes*	*Ardeidae*	*Ardea garzetta*	Little Egret					1
Aves	*Ciconiiformes*	*Ardeidae*	*Ardea modesta*	Great Egret					1
Aves	*Ciconiiformes*	*Ciconiidae*	*Ephippiorhynchus asiaticus*	Black-necked Stork					1
Aves	*Columbiformes*	*Columbidae*	*Geopelia cuneata*	Diamond Dove	6				
Aves	*Coraciiformes*	*Meropidae*	*Merops ornatus*	Rainbow Bee-eater		1			
Aves	*Falconiformes*	*Falconidae*	*Falco cenchroides*	Australian Kestrel			1		1
Aves	*Passeriformes*	*Artamidae*	*Artamus leucorynchus*	White-breasted Woodswallow				1	
Aves	*Passeriformes*	*Estrilidae*	*Taeniopygia guttata*	Zebra Finch	12				1
Aves	*Passeriformes*	*Hirundinidae*	*Petrochelidon nigricans*	Tree Martin	5	1	7		
Aves	*Psittaciformes*	*Psittacidae*	*Melopsittacus undulatus*	Budgerigar	371	1	150		30
Aves	*Psittaciformes*	*Psittacidae*	*Nymphicus hollandicus*	Cockatiel	48	5	94	30	3
Mammalia	*Carnivora*	*Canidae*	*Vulpes vulpes*	Red Fox	1				
Mammalia	*Carnivora*	*Felidae*	*Felis catus*	Cat	1				
Mammalia	*Diprotodontia*	*Macropodidae*	*Osphranter rufus*	Red Kangaroo	1	1			
Mammalia	*Peramelemorphia*	*Thylacomyidae*	*Macrotis lagotis*	Bilby	1	1	1		
Reptilia	*Squamata*	*Scincidae*	*Ctenotus saxatilis*	Rock Ctenotus		1			

Appendix 10 Photos of Bilby scat