



APPENDIX 2 - NORTHERN  
INTERCONNECT PIPELINE FAUNA ASSESSMENT  
(KINGFISHER, 2020)

GOLDFIELDS  
ASSESSMENT

# Northern Goldfields Interconnect Pipeline Fauna Assessment



Top: Malleefowl Mound on the Northern Goldfields Interconnect. Bottom: Acacia shrublands along the Northern Goldfields Interconnect.

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## EXECUTIVE SUMMARY

APA Group (APA) proposes to develop the Northern Goldfields Interconnect (NGI) pipeline within the Mid-West and Goldfields regions of Western Australia. The NGI pipeline is a proposed buried pipeline of approximately 580 km in length, commencing at Ambania (approximately 50 km east of Geraldton) and connecting into the existing Goldfields Gas Pipeline at approximately 40 km south of Leinster. The NGI project will include some associated aboveground infrastructure (e.g. the Ambania compressor station) sparsely located along the pipeline route. The proposed construction footprint varies but includes a 30m wide corridor along the pipeline route, with additional areas for the aboveground facilities and temporary construction activities.

To characterise the ecological values of the proposed pipeline route, and to inform forward environmental approvals, Kingfisher Environmental was commissioned by APA to conduct a fauna assessment along the proposed NGI pipeline. Field surveys were conducted in August and September 2020. This document summarises the results of the field surveys undertaken along the NGI pipeline, and discusses the significance of the local fauna assemblage with a focus on species of conservation significance, taking into account information on species habitat and distribution at a local and regional context.

The NGI fauna assessment was conducted in alignment with contemporary guidance and position statements published by the Western Australian Environmental Protection Authority (WA EPA) on fauna surveys and environmental protection, and Commonwealth biodiversity legislation. Due to the location and geographical scale of the proposal, combined with the perceived presence of significant fauna, the fauna assessment combined aspects of both Basic and Targeted Fauna Surveys with a preceding Desktop Review (EPA, 2020). Field surveys were conducted over two periods, a Reconnaissance Survey (August 2020), followed by a subsequent Basic and Targeted Survey (September 2020).

To accurately document the fauna assemblages of relevance to the NGI project, the field surveys employed a range of sampling techniques. Fauna was sampled and recorded during targeted searches, opportunistically and via passive detectors (motion-activated cameras and acoustic detection). All major vegetation types were sampled and assessed for the likelihood of supporting significant fauna, with a total of 153 habitat assessments conducted throughout. Those habitats deemed suitable to support significant fauna were subject to more intensive targeted surveying, including for the nationally Vulnerable Malleefowl and Priority listed Brush-tailed Mulgara.

A total of 119 fauna species were recorded during the field surveys, comprising nine reptile, 87 bird, 16 native mammal and seven introduced mammal species. The fauna assemblage recorded reflects the project's location on a vegetation transition from the eucalypt dominated, temperate south-west to the acacia dominated, arid interior. The assemblage includes elements from both regions, with several species occurring at the extremes of their range.

Most fauna occurring within the Pipeline Licence area are likely to be widespread, as the fauna habitats present are characterised by widespread vegetation. Some conservation significant fauna were recorded and additional significant taxa are considered likely to be present. The key species likely to be affected by the project include:

- Malleefowl: five old inactive mounds and fresh tracks recorded;
- Brush-tailed Mulgara: active burrows recorded within spinifex dominated sandplain;
- Gilled Slender Blue-tongue: likely resident as suitable Acacia shrublands present; and
- Northern Shield-backed Trapdoor Spider: previously recorded from habitats present.

Locally significant taxa (i.e. fauna with restricted or habitat limited ranges), may also occur in the area, including Carpet Python, Western Yellow Robin, Slender-billed Thornbill, Regent Parrot, Bush Stone Curlew.

Other conservation significant fauna were recorded during the field surveys, however these include species with minimal to no suitable habitat present within the Pipeline Licence area (Western Spiny-tailed Skink, Long-tailed Dunnart) and mobile taxa with large home ranges (Peregrine Falcon). The Malleefowl and Brush-tailed Mulgara are likely to have a limited occurrence within the Pipeline Licence area, as suitable breeding habitat (dense Acacia shrublands or spinifex dominated sandplains) represents a small proportion of the vegetation present (approximately 5%). Such habitat also occurs widely throughout the region. Similarly, while habitats known to support the Gilled Slender Blue-tongue and Northern Shield-backed Trapdoor Spider are present, these also have a widespread occurrence throughout the region.

Those habitats with minimal occurrence within the Pipeline Licence area (reflecting a reduced regional occurrence) include Granite Outcrops (<1% of the corridor area), Breakaways (<1%), Eucalypt Woodland (<1%), Callitris Woodlands (<1%), Banksia Woodlands (<1%) and remnant Woodlands and Shrublands within the wheatbelt (<1%).

While the Pipeline Licence area extends over a large distance, the proposed clearing footprint is typically narrow (a 30m wide corridor) and linear, meaning impact within any vegetation or fauna community is localised at a local and regional scale. The NGI pipeline is proposed to be buried and native vegetation rehabilitated after clearance, limiting long term impacts to fauna and their associated habitats. Due to the presence of some conservation significant fauna, consideration is required to manage important fauna habitats and local fauna populations. This is particularly relevant for the local Malleefowl population as disturbances to breeding sites should be minimised.

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# 1. INTRODUCTION

## 1.1 Project Background

APA Group (APA) proposes to develop the Northern Goldfields Interconnect (NGI) pipeline within the Mid-West and Goldfields regions of Western Australia. The NGI pipeline is proposed to be buried along an approximately 580 km corridor, commencing at Ambania (approximately 50 km east of Geraldton) and connecting into the existing Goldfields Gas Pipeline at approximately 40 km south of Leinster (Figure 1). The NGI project will include some associated aboveground infrastructure (e.g. the Ambania compressor station) sparsely located along the pipeline route.

Construction of the NGI is proposed for Quarter 3, 2021. The proposed construction footprint varies but includes a 30m wide corridor along the pipeline route, with additional areas for the aboveground facilities and temporary construction activities.

To characterise the ecological values of the proposed pipeline route, and to inform forward environmental approvals, Kingfisher Environmental (Kingfisher) was commissioned by APA to conduct a fauna assessment along to proposed NGI pipeline route. Field surveys were conducted in August and September 2020, with the survey scope developed in consultation with CDM Smith and APA. This document collates the results of the field surveys undertaken along the proposed NGI pipeline route and discusses the significance of the local fauna assemblage with a focus on species of conservation significance taking into account information on species habitat and distribution at a local and regional context.



**Figure 1. Locality Map of the NGI Pipeline**

## 1.2 Survey Area

The NGI fauna survey area ('survey area') corresponded to the proposed pipeline route (Figure 1). A buffer area of 50 m was included for the initial (western) 81.5 km (between Ambania and east of Mullewa) and then a 200 m buffer was included for the remaining (eastern) portion. However, in areas of high environmental sensitivity (such as habitats deemed suitable to support conservation significant fauna) the assessed buffer area was extended to the width of a 500m. The Pipeline Licence area forms a subsection of the area surveyed, typically a 200 m wide corridor. For the purpose of reporting, the survey area is described hereafter as the Pipeline Licence area, which represents the outer extent of the area that APA will undertake activities for the NGI Pipeline and related infrastructure. In practical terms, the actual footprint of the NGI Pipeline will be significantly smaller, to be reflected in an Indicative Disturbance Footprint for referral purposes.

## 1.3 Scoping Requirements

This document has been developed in consideration of the following:

1. *Environmental Protection Act 1986* (WA) and associated guidance;
2. Environmental Protection Authority (EPA) Position Statement No. 3, Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002);
3. Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016a);
4. Statement of Environmental Principles, Factors and Objectives (EPA, 2018);
5. Technical Guidance: Terrestrial Vertebrate fauna surveys for environmental impact assessment (EPA, 2020)<sup>1</sup>;
6. Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA, 2016b);
7. Conservation Advice for species listed under the EPBC Act (Department of Agriculture, Water and the Environment (or former named Departments), 2016 - 2020);
8. Survey and Monitoring Guidelines for the threatened fauna, such as the Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) (Department of Parks and Wildlife, DPaW, 2017) and Sandhill Dunnart (*Sminthopsis psammophila*) (DPaW, 2016; DPaW 2017);
9. Survey guidelines for Australia's threatened mammals, birds and reptiles: Guidelines for detecting fauna listed as threatened under the EPBC Act (Department of the Environment, Water, Heritage and the Arts, 2010a, b; Department of Sustainability, Environment, Water, Population and Communities 2011a, b);
10. Revised draft referral guidelines for three threatened black cockatoo species; Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso* (Department of the Environment and Energy, 2017);
11. National Malleefowl Monitoring Manual (National Malleefowl Recovery Team, 2016);
12. Department of Biodiversity, Conservation and Attractions (DBCAs) Standard Operating Procedures to conduct fauna work under DBCA Regulation 25 (DBCAs, 2020);
13. State and Commonwealth biodiversity legislation (*Biodiversity Conservation Act 2016*, *Environment Protection and Biodiversity Conservation Act 1999*, Department of

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<sup>1</sup> This guidance replaces two former Technical Guidance documents produced by the EPA: 'Technical Guidance – Sampling methods for terrestrial vertebrate fauna' and 'Technical Guidance – Terrestrial fauna surveys'.

Water and Environmental Regulation Ten Clearing Principles as listed under Schedule 5 of the *Environmental Protection Act 1986*), and Petroleum Pipelines (Environment) Regulations 2012 (WA); and

14. Published literature on local flora and fauna (e.g. Turpin *et al.*, 2018) held by the authors of this fauna assessment report from prior surveys and research.

#### 1.4 Fauna Assessment Objectives

The key objectives of fauna surveys for environmental impact assessment are outlined within EPA guidance and documents (EPA 2002, 2004, 2016a-b, 2020; see Scoping Requirements) and include:

1. Conduct a review of background information (a search of all sources for literature, data and map-based information);
2. Compile an inventory of vertebrate fauna present or expected to occur (regarding the fauna habitats present);
3. Identify species of conservation significance at an international, national, state, regional and local level;
4. Identify significant fauna habitats or areas of particular importance for fauna; and
5. Contextualise the results to provide a summary of the fauna assemblage and habitat values of the study area, and their significance in relation to the proposal and regional context, and any recommendations.

#### 1.5 Scope

The NGI Pipeline Fauna Assessment was conducted with attention to regulatory requirements and guidance (EPA 2002, 2004, 2016a-b, 2020; see Scoping Requirements). The scope of the NGI fauna assessment included:

- Desktop review of technical reports and relevant databases to determine the potential fauna (terrestrial vertebrates and short-range endemic fauna) and habitats within the Pipeline Licence area;
- Field survey, building upon the results of the desktop review, including:
  - Compilation of fauna recorded (or expected) within the area;
  - Targeted searches for species of conservation significance: those listed under the *Environment Protection and Biodiversity Conservation Act 1999*, *Biodiversity Conservation Act 2016* and State Priority listed fauna, see Conservation Significance); and
  - Habitat assessment, the suitability of habitats present to provide habitat or linkage for fauna, particularly those of conservation significance.
- Summary memorandum: prepared following the field survey to summarise the key survey results; and
- Preparation of a comprehensive technical report (this document).

## 2. BACKGROUND

### 2.1 Conservation Significance

Biodiversity in Western Australia is protected, managed and assessed under international, national and state agreements, legislation and policy. Fauna of conservation significance include those species listed under Commonwealth or State legislation (*Environment Protection and Biodiversity Conservation Act 1999*, the EPBC Act; and the *Western Australian Biodiversity Conservation Act 2016*, the BC Act), species listed as Priority Fauna by the Department of Biodiversity Conservation and Attractions (DBCA), species listed as threatened or declining in biodiversity publications and species considered locally significant (due to restrictions in range or sensitivities to threatening processes; Woinarski *et al.*, 2017). Categories of conservation significance are described in detail in Appendix 1.

*Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) - Commonwealth* Schedule 1 of the Commonwealth EPBC Act contains a list of species that are considered Critically Endangered, Endangered, Vulnerable, Extinct, Extinct in the Wild and Conservation Dependent. These categories are described in Appendix 1. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). Under the provisions of the EPBC Act, proposed actions which have the potential to have a significant impact on a matter of national environmental significance must be referred to the Commonwealth Minister for the Environment and Energy for a decision as to whether an assessment is required under the provisions of that Act (EPA, 2004). The EPBC Act also has lists of migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), Republic of Korea Australia Migratory Bird Agreement (ROKAMBA), and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

#### *Biodiversity Conservation Act 2016 (BC Act) - State*

Threatened and specially protected fauna are listed under Part 2 of the *Biodiversity Conservation Act 2016*. Similar to the EPBC Act, fauna are listed as Critically Endangered, Endangered, Extinct or Extinct in the Wild under the category of Threatened Fauna. Fauna can also be listed as Specially Protected Fauna, including those species listed under international agreements (such as CAMBA and JAMBA), or species listed as migratory, of special conservation interest or species otherwise in need of special protection. Threatened fauna listings are updated under the Threatened Fauna and Specially Protected Fauna Notice listed under Part 2 of the *Biodiversity Conservation Act 2016* (last updated: 11/09/2018). Categories of conservation significance are described in detail in Appendix 1.

#### Priority Fauna - State

In Western Australia, the DBCA has produced a supplementary list of Priority Fauna for species that are possibly threatened but do not meet the criteria for listing under the *Biodiversity Conservation Act 2016* or are otherwise data deficient. These species are added to the Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently

removed from the threatened species or other specially protected fauna lists, are placed in Priority 4. These species are considered to require regular monitoring. Categories of Priority fauna are described in detail in Appendix 1.

#### Other Conservation Significant Fauna

The EPA's (2016a) objective for protection of terrestrial fauna is to maintain representation, diversity, viability and ecological function at the species, population and assemblage level. The preservation of biodiversity at the genetic level is also highlighted as a key ecological value (EPA, 2002). As a result, species that are at their limit of distribution and/or occur in restricted, outlying or relictual populations, are considered to be of conservation significance. Additionally, some species listed as threatened or declining in biodiversity publications may not be listed under legislation or considered Priority by the DBCA. Therefore, an additional category of conservation significance is listed here, covering those species considered locally significant due to restrictions in range, published declines or sensitivities to threatening processes (Woinarski *et al.*, 2017). Species that are sensitive to impacts such as habitat fragmentation, may also be classed as conservation significant.

## **2.2 IBRA Bioregions**

The Interim Biogeographic Regionalisation of Australia (IBRA) has identified 26 bioregions in Western Australia. Bioregions are classified on the basis of climate, geology, landforms, vegetation and fauna (Thackway and Cresswell, 1995). IBRA Bioregions are affected by a range of different threatening processes and have varying levels of sensitivity to impact (EPA, 2004). The Bioregions are further subdivided into subregions.

The NGI pipeline traverses four IBRA Bioregions; Geraldton Sandplains (Geraldton Hills subregion), Avon Wheatbelt (Merredin subregion), Yalgoo (Talling subregion) and Murchison (Eastern Murchison subregion) (Figure 2). Therefore, the pipeline intersects a diverse assemblage of flora and fauna across the Mid-West and Goldfields regions.

#### Geraldton Sandplains Bioregion, Geraldton Hills subregion

The Geraldton Hills subregion occurs across the southern part of the Carnarvon Basin and northern part of the Perth Basin, where siltstones and sandstones are mostly overlain by sandplains, alluvial plains and coastal limestones. Sandplains support heaths with emergent *Banksia* and *Actinostrobus*, alluvial plains support York Gum woodlands and coastal limestones support proteaceous heaths or Acacia scrubs (McKenzie *et al.*, 2003). Hills, consisting of sandplain over undulating lateritic uplands, support proteaceous shrublands and mallees, with valleys of York Gum and Jam (McKenzie *et al.*, 2003). Significant fauna identified by McKenzie *et al.* (2003) as occurring in this region include:

- Tammar Wallaby (*Notamacropus eugenii*);
- Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*);
- Common Brushtail Possum (*Trichosurus vulpecula*);
- Western Brush Wallaby (*Notamacropus irma*);
- Peregrine Falcon (*Falco peregrinus*);
- Malleefowl (*Leipoa ocellata*);
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*);
- Red-tailed Tropicbird (*Phaethon rubricauda*);

- Lesser Noddy (*Anous tenuirostris melanops*);
- Western Spiny-tailed Skink (*Egernia stokesii badia*); and
- Carpet Python (*Morelia spilota imbricata*).

#### Avon Wheatbelt Bioregion, Merredin subregion

The Merredin subregion supports undulating plains with salt lakes occurring as remnants of ancient drainage systems. Residual lateritic uplands and derived yellow sandplains support proteaceous heaths, while alluvial and eluvial plains support mixed eucalypt woodlands, Jam and York Gum woodlands and/or woodlands of *Allocasuarina huegeliana* (McKenzie *et al.*, 2003). Many of the significant fauna identified in the bioregion are locally extinct, but species that remain extant include:

- Red-tailed Phascogale (*Phascogale calurus*);
- Black-flanked Rock-wallaby (*Petrogale lateralis lateralis*);
- Western Brush Wallaby (*Notamacropus irma*); and
- Common Brushtail Possum (*Trichosurus vulpecula*).

#### Yalgoo Bioregion, Tallering subregion

The Yalgoo Bioregion is in the interzone between the south-western bioregions and the Murchison. Earth and sandy-earth plains on the western Yilgarn craton support open woodlands or scrubs of mulga, *Callitris* and *Eucalyptus salubris*, or Bowgada (McKenzie *et al.* 2003). Regionally, significant fauna identified by McKenzie *et al.* (2003) include:

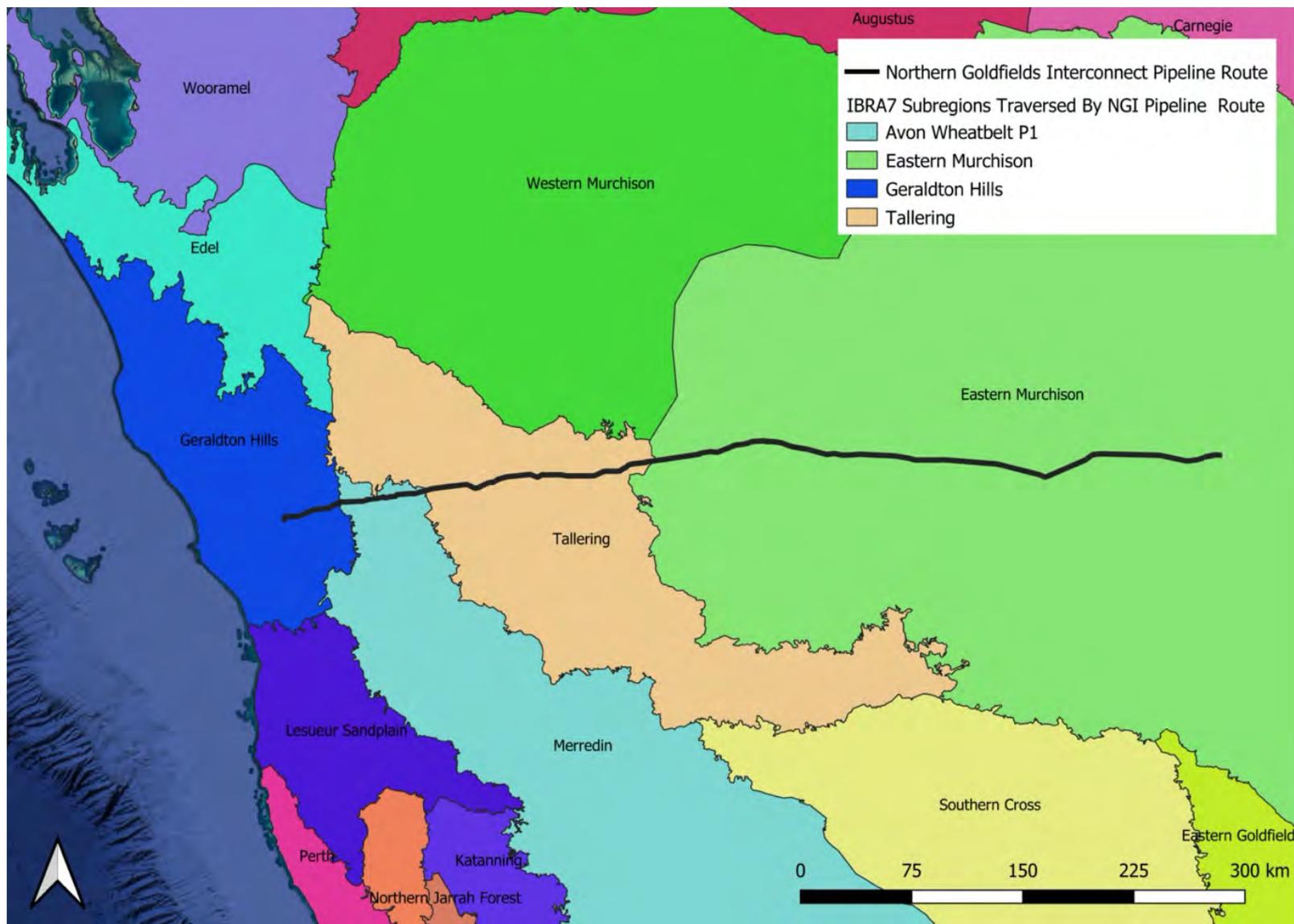
- Western Spiny-tailed Skink (*Egernia stokesii badia*);
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*); and
- Slender-billed Thornbill (*Acanthiza iredalei iredalei*).

Although this bioregion is diverse in flora and fauna, many of the species that occur are wide-ranging and occur in one or more neighbouring bioregions.

#### Murchison Bioregion, East Murchison subregion

The East Murchison subregion is characterised by its internal drainage, broad plains of red-brown soils, elevated red desert sandplains (with minimal dune development), salt lake systems and breakaway complexes (McKenzie *et al.* 2003). It contains vegetation dominated by mulga woodlands. McKenzie *et al.* (2003) identifies several significant vertebrate fauna species occurring from the Eastern Murchison subregion, including:

- Malleefowl (*Leipoa ocellata*);
- Chuditch (*Dasyurus geoffroii*);
- Princess Parrot (*Polytelis alexandrae*);
- Slender-billed Thornbill (*Acanthiza iredalei iredalei*);
- Brush-tailed Mulgara (*Dasyercus blythi*);
- Australian Bustard (*Ardeotis australis*);
- Bush Stone-curlew (*Burhinus grallarius*);
- Grey Falcon (*Falco hypoleucos*);
- Peregrine Falcon (*Falco peregrinus*);
- Carpet Python (*Morelia spilota imbricata*); and
- Major Mitchell's Cockatoo (*Cacatua leadbeateri*).



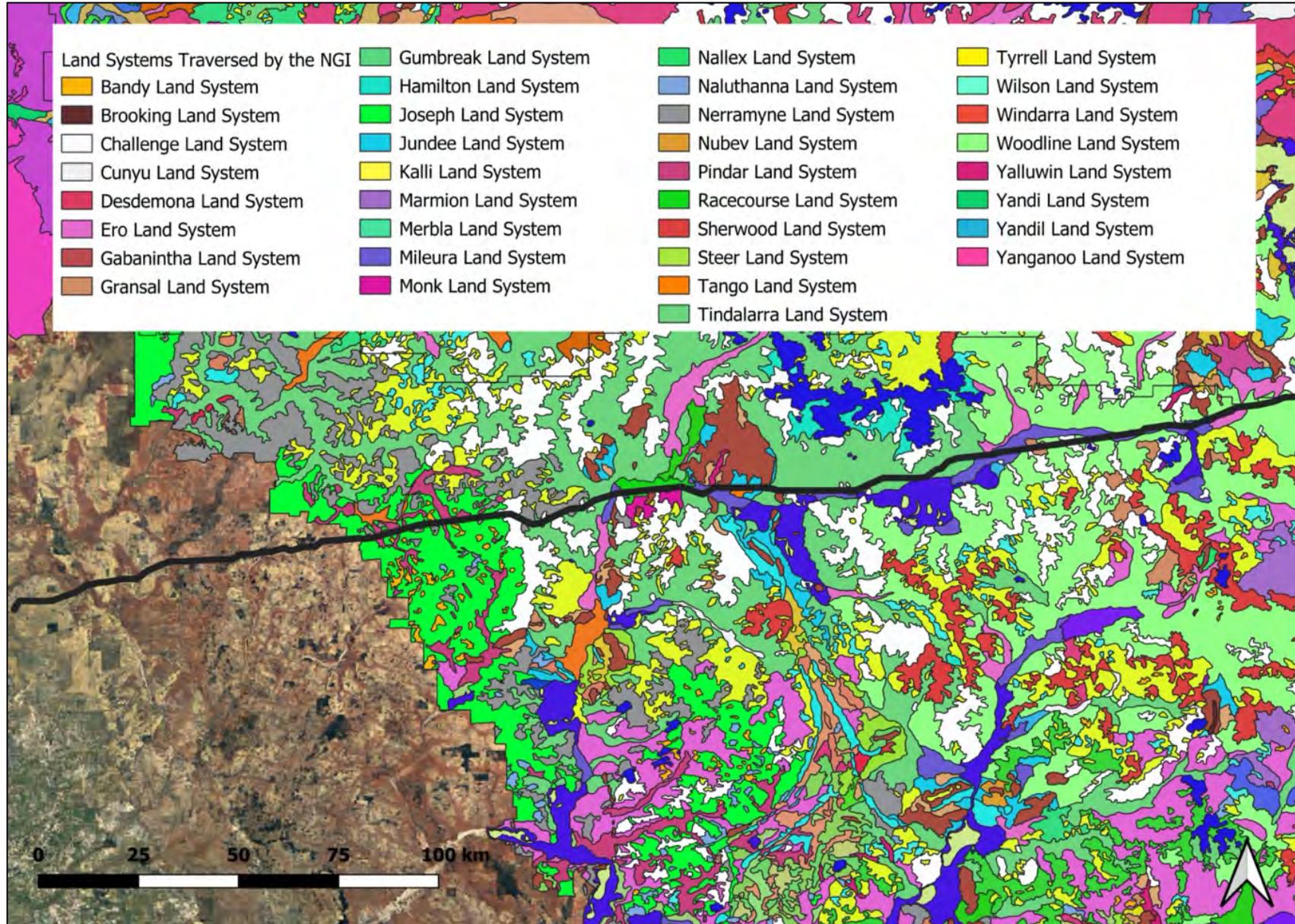
**Figure 2. IBRA Bioregions and Subregion**

## 2.3 Land Systems

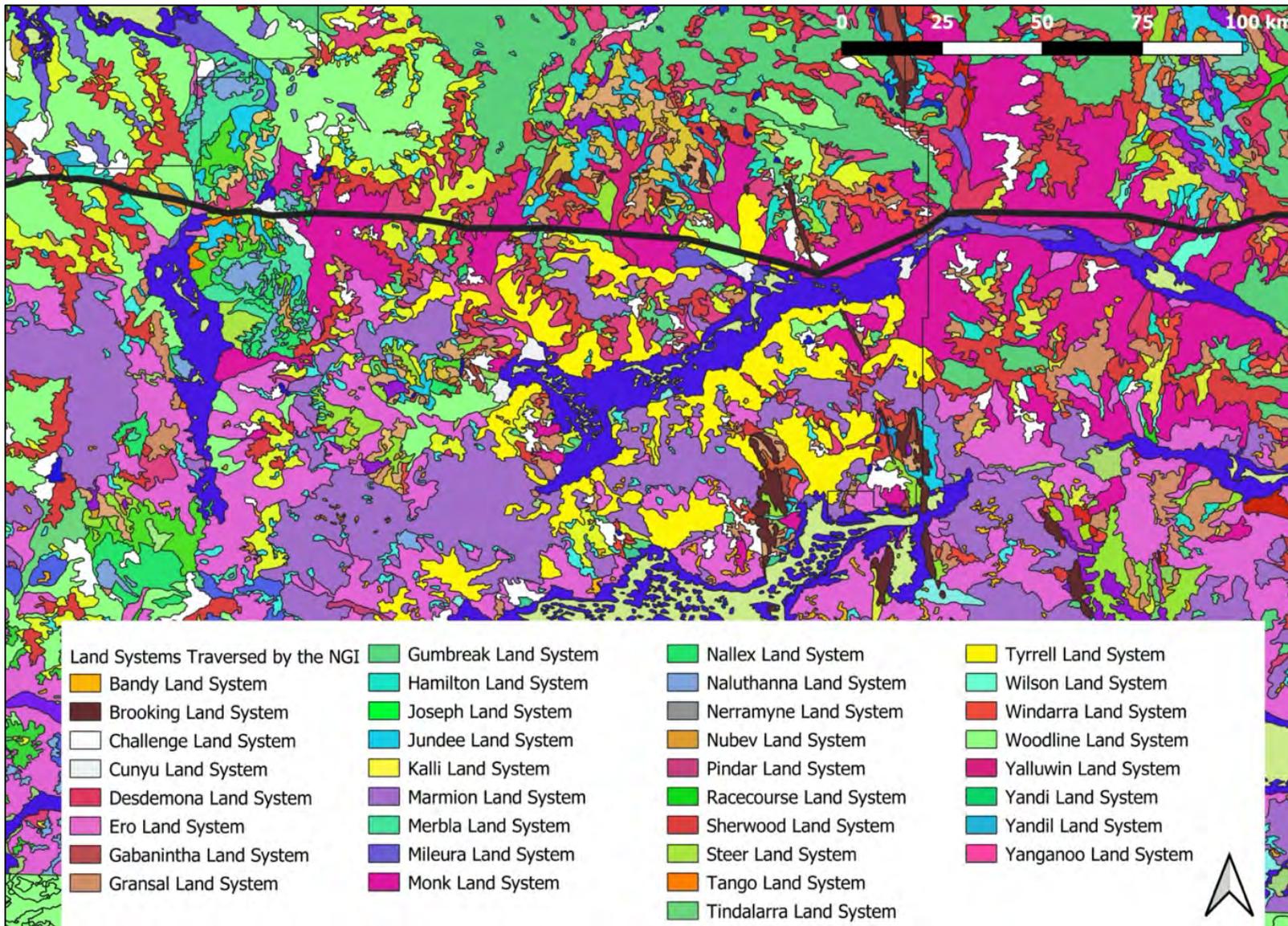
The region's landforms and vegetation have been classified into "Land Systems", which are broadly mapped according to similarities in landform, soil, vegetation, geology and geomorphology (Pringle *et al.* 1994). These provide a broad indication of the fauna habitats present. A total of 33 Land Systems occur across the Pipeline Licence area (Table 1, Figure 3).

**Table 1. Land Systems present in the NGI Pipeline Licence Area**

Land System	Landform and Vegetation	Area (ha)
Bandy	Gritty-surfaced plains and low outcrops of granite with scattered acacia shrublands.	13
Brooking	Prominent ridges of banded iron formation supporting mulga shrublands; occasional halophytic communities	4
Challenge	Gently undulating gritty-surfaced plains, occasional granite hills, tors and low breakaways, with acacia. shrubs.	291
Cunyu	Calcrete platforms and intervening alluvial floors and minor areas of alluvial plains, including channels with acacia shrublands and minor halophytic shrublands.	70
Desdemona	Extensive plains with deep sandy or loamy soils supporting mulga and wanderrie grasses.	355
Ero	Tributary floodplains with shallow, erodible duplex soils on red-brown hardpan, supporting acacia shrublands with halophytic and non-halophytic undershrubs	126
Gabanintha	Ridges, hills and footslopes of metamorphosed rocks (greenstones), supporting sparse acacia shrublands	10
Gransal	Stony plains and low rises based on granite supporting mainly halophytic shrublands.	70
Gumbreak	Low granite breakaways with extensive saline alluvial plains, supporting halophytic shrublands.	33
Hamilton	Hardpan plains, stony plains and incised drainage lines supporting mulga shrublands.	167
Joseph	Undulating yellow sandplain supporting dense mixed shrublands with patchy mallees.	470
Jundee	Hardpan plains with ironstone gravel mantles and occasional sandy banks supporting mulga shrublands.	90
Kalli	Elevated, gently undulating red sandplains edged by stripped surfaces on laterite and granite; acacia shrublands and understorey of wanderrie grasses (and spinifex locally); replaced by areas of Bullimore land system.	341
Marmion	Gently undulating sandplains with mixed shrublands and hummock grasslands.	39
Mileura	Saline and non-saline calcreted river plains, with clayey flood plains interrupted by raised calcrete platforms supporting diverse and very variable tall shrublands, mixed halophytic shrublands and shrubby grasslands.	1363
Monk	Hardpan plains with occasional sandy banks supporting mulga tall shrublands and wanderrie grasses.	3026
Nerramyne	Undulating plains of sandy-surfaced laterite and weathered granite, breakaways and rises supporting acacia	151
Nallex	Gently undulating stony plains supporting acacia tall shrublands and halophytic low shrublands.	1
Nubev	Gently undulating stony plains, minor limonitic low rises and drainages supporting mulga, halophytic shrublands.	124
Pindar	Loamy plains surrounded by sandplain supporting York gum woodlands and acacia shrublands.	121
Racecourse	Partly calcreted alluvial plains with dense acacia shrublands and bluebush and saltbush low shrublands	330
Sherwood	Breakaways, kaolinised footslopes, gently sloping plains supporting mulga shrublands, halophytic shrublands.	239
Steer	Gravelly alluvial plains with halophytic shrublands.	196
Tango	Saline hardpan plains with ironstone gravel mantles supporting mulga tall shrublands with understorey shrubs.	95
Tindalarra	Near level hardpan wash plains, narrow drainage lines and moderately saline drainage floors; supporting tall mixed acacia shrublands with wanderrie grasses, also minor saltbush/bluebush low shrublands.	1294
Tyrrell	Extensive sandplain with mallees, wattles, heath and spinifex.	256
Windarra	Gently undulating stony plains and low rises on granite, supporting acacia-eremophila shrublands.	58
Wilson	Large creeks with extensive distributary fans, supporting mulga and halophytic shrublands.	62
Woodline	Almost flat sandy-surfaced hardpan wash plains supporting tall shrublands and woodlands dominated by mulga.	1010
Yalluwin	Hardpan plains and drainage tracts, supporting mulga, curara and other acacia shrublands.	63
Yanganoo	Almost flat hardpan wash plains, supporting mulga shrublands and wanderrie grasses on banks.	331



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**Figure 3. Land Systems Traversed by the Pipeline Licence Area (western and eastern sections)**

## 2.4 Previous Survey Work

Previous biological studies conducted in a local and regional context are valuable to inform and direct desktop assessments and field surveys. Several biological surveys have been conducted near the NGI Pipeline Licence area and additionally, many regional fauna records are associated with nearby towns. Regionally, fauna surveys have been conducted by DBCA (e.g. Cowan *et al.*, 2017 at Black Range, 50 km north of the NGI pipeline), during the widescale Biological Survey of the Eastern Goldfields (How *et al.*, 1992) and during environmental impact assessment (e.g. GHD, 2020). Kingfisher has also conducted several regional surveys and holds an extensive fauna database for the area. Biological databases also provide an extensive level of information for the regions traversed by the Pipeline Licence area.

Table 2 lists the surveys, database and reports utilised during the desktop and field assessments. The results of these surveys are included in the desktop assessment (Section 3.4) and are detailed in Appendix 2. Previous surveys and fauna database provide background information relevant to the Pipeline Licence area, in particular the local distribution of conservation significant fauna and their associated habitat types. For example, conservation significant fauna recorded near the Pipeline Licence area include the Malleefowl (within 2 km at Wurarga, Urawa Nature Reserve and near Yalgoo, Appendix 2), Western Spiny-tailed Skink (Urawa Nature Reserve and near Yalgoo; Appendix 2), Long-tailed Dunnart (Mount Anderson; Appendix 2) and the Brush-tailed Mulgara (Yeelirrie sandplains, DBCA 2020; Figure 4). Additionally, historical records of the Sandhill Dunnart (*Sminthopsis psammophila*) and Night Parrot (*Pezoporus occidentalis*) occur near Yalgoo and Mount Magnet (Figure 4).

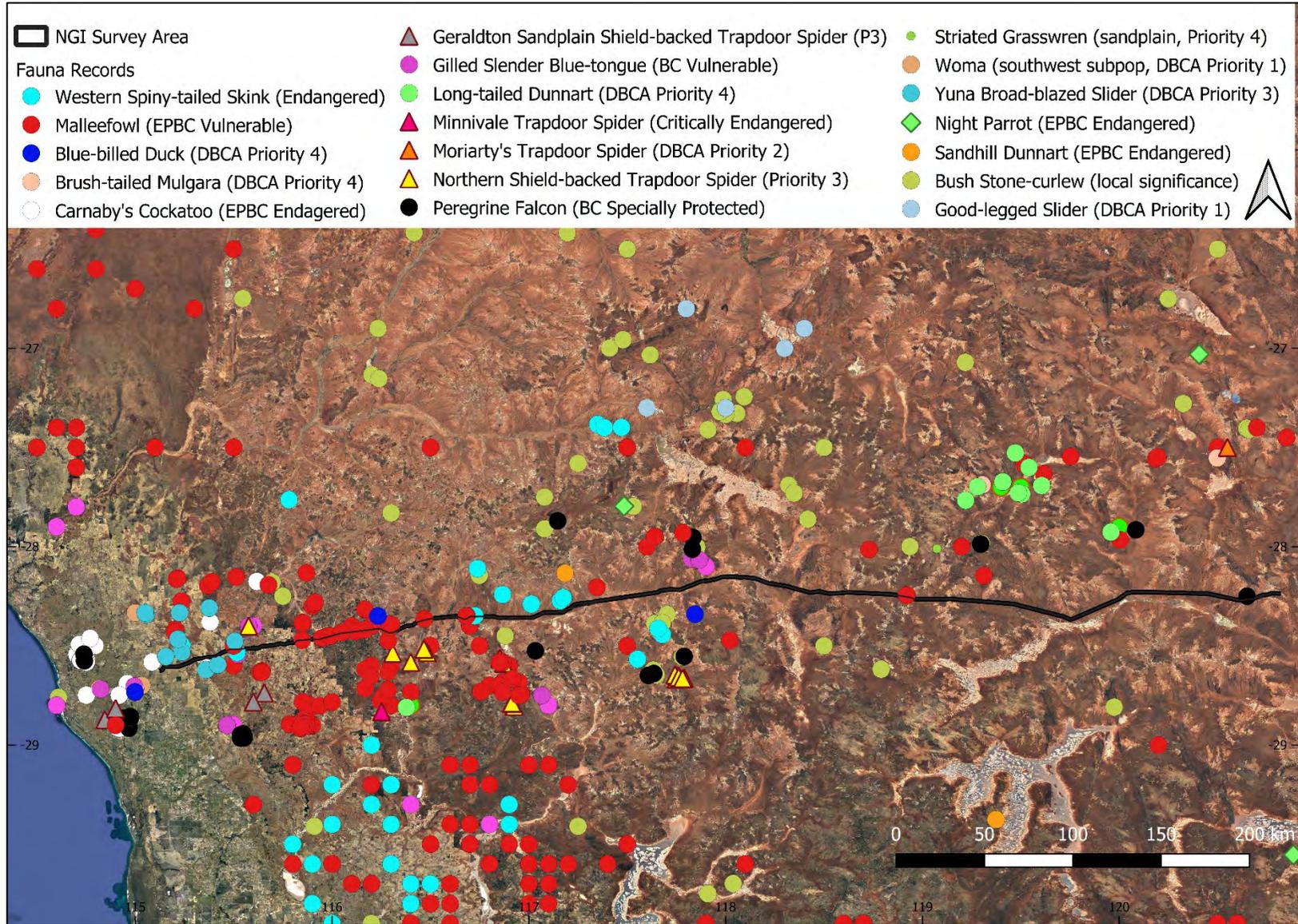


Figure 4. Conservation Significant Fauna Records in or near the NGI Project

**Table 2. Relevant Local and Regional Fauna Surveys**

Title	Comments	Year
Biological Survey of the Eastern Goldfields: Part 6, Youanmi - Leonora study area.	Detailed survey 24 km south of the Pipeline Licence area (How <i>et al.</i> , 1992)	1992
Mount Magnet Operations Fauna Monitoring Program: Terrestrial Fauna Assessment	Fauna Monitoring near Mt Magnet, 15 km north of the Pipeline Licence area (Murcox Biological Services, 1994)	1994
Windimurra Vanadium: Threatened Fauna Assessment	Level 1 Fauna Assessment conducted at Windimurra, 5 km south of the Pipeline Licence area (Western Wildlife, 2007)	2007
Flora and Fauna Survey Agnew Gold Mine	Fauna recorded at Agnew Gold Mine and surrounds (Stantec 2018), up to 20 km north of the Pipeline Licence area	2001-2018
Biodiversity in the southern rangelands: variation in biota over time and space on the Black Range and Lake Mason stations, Murchison Bioregion, Western Australia	Surveys conducted at Black Range and Lake Mason stations (50 km north of the Pipeline Licence area; Cowan <i>et al.</i> , 2017).	2017
Yogi - Magnetite Project Fauna Assessment	Detailed survey near Yalgoo, up to 15 km north of the Pipeline Licence area (GHD 2020). Unpublished report for FI Joint Venture Pty. Ltd.	2020
Fauna of Barnong Station	Fauna records from DBCA Conservation Estate (DBCA 2020), occurring adjacent to the Pipeline Licence area	2020
Fauna of Urawa Nature Reserve	Database records and results of fauna surveys at Urawa Nature Reserve, 4 km north of the Pipeline Licence area	2020
Kingfisher Fauna Database	Unpublished results from regional surveys, including from the Carnarvon – Mullewa Rd, Woolgorong, Boolardy, Murgoo stations and bird census of the northern Wheatbelt	2006 - 2020

### 3. SURVEY METHODS

#### 3.1 Approach

The NGI fauna assessment was conducted in alignment with contemporary guidance and position statements published by the WA EPA on fauna surveys and environmental protection, and Commonwealth biodiversity legislation (e.g. EPA, 2002, 2004, 2016a-b, 2020). The level of fauna assessment required by the EPA is determined by the characteristics of the proposal and the scale and nature of the impact, and is influenced by location and the sensitivity of the surrounding environment (EPA 2020). The type of survey required may vary both in response to regional characteristics such as landscape heterogeneity, the extents of geology and vegetation types, the degree of existing disturbance and the local level of biodiversity knowledge. Where species of high conservation significance are considered likely to occur, targeted surveys are required to better predict the residual impact to fauna (EPA, 2020). Due to the location and geographical scale of the proposal, combined with the perceived presence of significant fauna, the field assessment combined aspects of both a Basic and Targeted Fauna Survey (EPA, 2020).

As such the NGI Pipeline Fauna Assessment comprised a “Desktop Study”, followed by “Basic Survey” (inclusive of a Desktop Study) and “Targeted Field Survey”, supplemented with ecological information to map and describe fauna habitats (EPA, 2020). The purpose of a Desktop Study is to gather contextual information about an area (from existing surveys, literature, database searches and spatial datasets) to provide background information and to inform and direct field surveys and reporting (EPA, 2020). The reliability of such information is then verified during field surveys, and consequently is influenced by the experience of personnel undertaking field work and reporting. Advances in field techniques, taxonomy, conservation status and ecology combined with vegetation and ecological change (such as fire, disturbance, population decline) are important considerations. A Desktop Study includes background environmental information, an inventory of species and habitats likely to occur and a discussion of significant species and habitats identified (EPA, 2020).

The Basic Survey involves the collection of information at a local scale to gather broad fauna and habitat information, which is then used to verify the overall adequacy of the Desktop Study (as noted above) and to map and describe fauna habitats (EPA, 2020). A Targeted Survey is used to gather information on significant fauna and / or habitats, or to collect data where a Desktop Study or field survey has identified knowledge gaps (EPA, 2020). This includes to:

- confirm the presence of significant fauna;
- determine the distribution and abundance of significant fauna;
- determine fauna movement and habitat use;
- describe and map habitats or features that are important to significant fauna or faunal assemblages, such as for breeding, foraging or dispersal; and
- monitor significant species, assemblages or habitats.

Field surveys are therefore used to verify the accuracy of desktop studies, to further delineate and characterise the faunal assemblages present and to identify potential impacts. This involves *“a target area visit by suitably qualified personnel to undertake selective*

sampling of the fauna and faunal assemblages, and to provide habitat descriptions and habitat maps of the project area” (EPA, 2004).

### 3.2 Personnel, Licensing and Survey Timing

The NGI pipeline fauna assessment was conducted over two field survey periods and included a Reconnaissance Survey followed by a subsequent Basic and Targeted Survey. Each survey had targeted components. The surveys were conducted by:

- Reconnaissance and Targeted Survey: 3<sup>rd</sup> – 10<sup>th</sup> August 2020. Conducted by Jeff Turpin;
- Basic and Targeted Survey: 31<sup>st</sup> August – 11<sup>th</sup> September 2020. Conducted by Jen Wilcox and Brenden Metcalf.

The field surveys were conducted under the DBCA Fauna Taking (Biological Assessment) Licence, BA27000281, issued to J. M. Turpin, issued on 27<sup>th</sup> August 2020. This report was prepared by Jen Wilcox and Jeff Turpin.

### 3.3 Nomenclature and Taxonomy

As per the recommendations of the EPA (2020), the nomenclature and taxonomic order presented in this report are based on the Western Australian Museum’s *Checklist of the Vertebrates of Western Australia* (Western Australian Museum, 2020; updated April 2020).

### 3.4 Desktop Review

Information for the desktop review was drawn primarily from the results of previous surveys conducted in the region. This information was supplemented by searches of the DBCA database “NatureMap” and the DBCA Threatened Fauna Database (DBCA, 2020b), the BirdLife Australia Atlas Database (BirdLife Australia, 2020), the Atlas of Living Australia (ALA) Database (ALA, 2020) and EPBC Protected Matters Search Tool (Department of Agriculture, Water and the Environment, DAWE 2020, see Table 3). All databases were interrogated in July 2020.

**Table 3. Sources of Information used for the Desktop Review (see also Table 2)**

Title	Comments	Area Searched
DBCA Threatened Fauna Database	Records of specimens held in the WA Museum and DBCA database records. Includes historical data.	Pipeline Licence Area (plus 40 km buffer).
NatureMap	Records of specimens held in the WA Museum and DBCA database records. Includes historical data.	Pipeline Licence Area (plus 10 km buffer).
Atlas of Living Australia (ALA)	Fauna Records held on the ALA Australia Database.	Pipeline Licence Area (plus 10 km buffer).
Birds Australia Atlas Database	Records of bird observations in Australia, 1998 – 2020.	Pipeline Licence Area (plus 20 km buffer).
EPBC Protected Matters Search Tool	Records on matters protected under the EPBC Act, including threatened species and conservation estate.	Pipeline Licence area (plus 50 km buffer).
Index of Biodiversity Surveys for Assessments (IBSA)	Reports, fauna records and spatial data from biological surveys undertaken in Western Australia, primarily as part of the environmental impact assessment process.	Pipeline Licence area (plus 50 km buffer).
Local Fauna Surveys	Conducted near the Pipeline Licence area (How <i>et al.</i> , 1992; Murcox Biological Services, 1994; Western Wildlife, 2007; Stantec, 2018; Cowan <i>et al.</i> , 2017; GHD, 2020)	1992 – 2020, see Table 2.

### 3.5 Field Survey

#### 3.5.1 Survey Design

To accurately document the fauna assemblage of the survey area, the field surveys employed a range of sampling techniques. Fauna was sampled and recorded during targeted searches, opportunistically and via passive detectors (motion-activated cameras and acoustic detection). All major vegetation types were sampled and assessed for the likelihood of supporting conservation significant fauna, with a total of 153 habitat assessments conducted throughout. Those habitats deemed suitable to support significant fauna were subject to more intensive targeted surveying. While surveying focused on locating evidence of conservation significant fauna, all fauna species observed were recorded. As a result, the survey included:

- identification of vegetation types / major fauna habitats;
- fauna habitat assessment;
- targeted searches for species of conservation significance;
- bird surveys;
- deployment of motion-activated cameras;
- acoustic detection of bats; and
- opportunistic observations.

#### 3.5.2 Identification of Vegetation Types and Major Fauna Habitats

All major vegetation and fauna habitats occurring throughout the Pipeline Licence area were inspected during the survey. Vegetation throughout the survey area was identified using the Kingfisher Field Herbarium, online keys (e.g. EUCLID Eucalypts of Australia; Worldwide Wattle) and previous flora and fauna reports. Focused Vision conducted a detailed flora and vegetation survey concurrent to this fauna assessment (Focused Vision, 2020). The vegetation data from this survey and notes taken in the field aided in identifying the major vegetation types across the Pipeline Licence area, to provide for cross-consistency in habitat mapping across Flora / Vegetation and Fauna Assessments.

#### 3.5.3 Fauna Habitat Assessment

Fauna habitat assessments were undertaken in habitats throughout the Pipeline Licence area, with the aim of sampling all fauna habitats and identifying those areas requiring further survey effort, such as targeted searches for conservation significant fauna. Each habitat assessment included the following components (see Appendix 3):

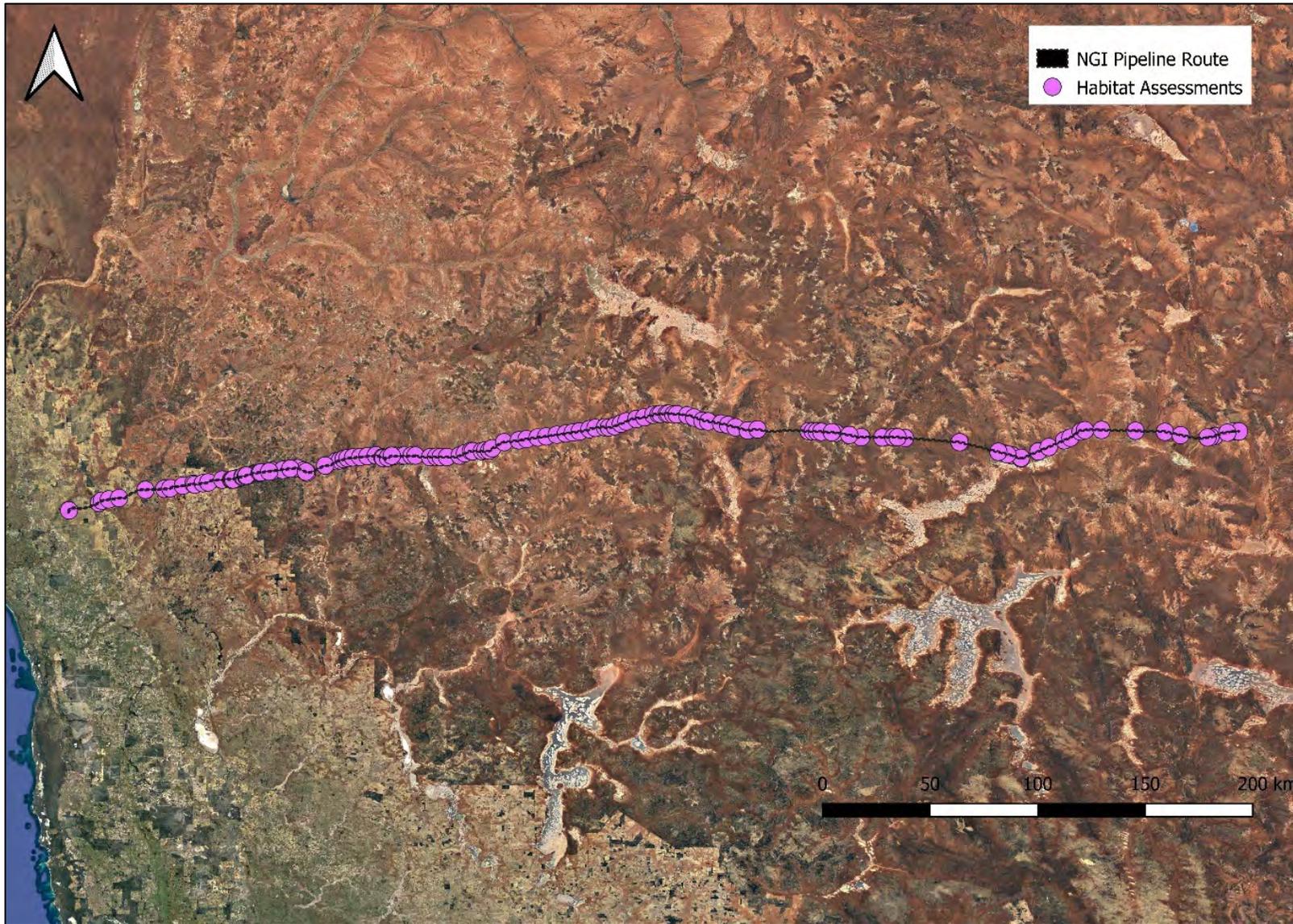
- GPS location;
- Representative photographs;
- Site name (e.g. Hab001);
- Habitat name;
- Habitat condition;
- Landform;
- Any evidence of disturbance;
- Fire history;
- Soil colour and type;
- Rock type, outcropping, surface rocks, pebbles;
- Presence of rock crevices or caves;
- Presence of termite mounds;
- Leaf litter accumulations;
- Presence of woody debris (logs, branches) and tree hollows;
- Brief description of vegetation; and
- Fauna observed over 10 – 30 mins.

Habitats deemed suitable to support conservation significant fauna were subject to further targeted searching. As such, all fauna habitats occurring along the Pipeline Licence area were inspected and assessed for the suitability of supporting conservation significant fauna, particularly the Malleefowl, Brush-tailed Mulgara and Western Spiny-tailed Skink, as described in Section 4. In total, 153 habitat assessments were conducted, with extensive coverage along the Pipeline Licence area (Figure 5, Appendices 4 and 5).

#### 3.5.4 Targeted Searching for Conservation Significant Fauna

Many species can be confirmed in an area by searching for evidence of their presence, including foraging (e.g. diggings, tracks and scats), sheltering (e.g. burrows) and breeding signs (e.g. nests). The current survey builds on methodologies previously employed to successfully detect conservation significant fauna in the local area. As several significant fauna species have been recorded locally, or throughout the wider region (Table 4), the field survey employed a combination of survey techniques to maximise the potential for their detection. Targeted searches for trace evidence such as scats, tracks, diggings or burrows were undertaken by conducting transect searches through potentially suitable habitat. Key species targeted included:

- Malleefowl (*Leipoa ocellata*) – EPBC Vulnerable.  
Searches for Malleefowl and its associated mounds were undertaken on foot by traversing through areas of suitable habitat and concentrated on areas of dense Acacia shrubland. The profile of a Malleefowl mound changes with breeding activity and age (erosion and vegetation growth). These profile stages are classified according to age (National Malleefowl Recovery Team, 2016) and are described in Table 5. When Malleefowl mounds were detected, the location, vegetation type, physical characteristics (mound width, height, depth, shape / profile and substrate) and activity status were recorded.
- Brush-tailed Mulgara (*Dasycercus blythi*) – DBCA Priority 4  
The Brush-tailed Mulgara inhabits spinifex sandplains. Searches for the species' distinctive burrows, tracks, diggings and scats were undertaken within sandplains supporting spinifex, and motion cameras were deployed to assess presence.
- Western Spiny-tailed Skink (*Egernia stokesii badia*) – EPBC Endangered  
This skink inhabits large fallen logs in eucalypt woodlands and rock crevices amongst complex rocky outcrops. Searches for the species' distinctive scats were focused on log piles and rocky outcrops.
- Other Significant Birds – EPBC or BC Act Endangered, Vulnerable or DBCA Priority  
Several species listed under the EPBC or BC Acts occur in the region, and are optimally detected by direct evidence (calls, observation) or by feeding or breeding sign (e.g. foraging on fruit, birds exiting hollows, DoEE 2017). Carnaby's Cockatoo and the Princess Parrot breed within Eucalypt hollows, and so Eucalypt Woodland was searched for their presence. The Night Parrot is rarely observed and survey effort for the species concentrated on determining the presence and extent of suitable habitat (DPaW, 2017). As most migratory waterbirds occur between October and April (outside of the survey period), waterbirds were assessed by the suitability of habitat.
- Other fauna, including birds, may be visually observed or detected via call playback, see Table 4), and trapdoor spiders may be located by their distinctive burrows.



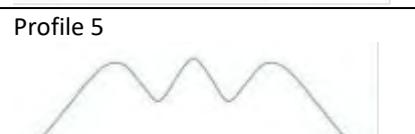
**Figure 5. Fauna Habitat Assessment Locations**

**Table 4. Survey Methods used to Detect Conservation Significant Fauna**

Common Name	Conservation Status				Local Records	Habitat	Survey Technique
	EPBC	BC	Priority	Local			
Sandhill Dunnart	E	E			Yalgoo	Dunes, sandplain	Motion cameras, tracks
Malleefowl	V	V			NGI	Woodland, Mallee	Searches for mounds, tracks
Night Parrot	E	CE			Mt Farmer	Chenopods, Spinifex	Search for suitable habitat
Western Spiny-tailed Skink	E	V			NGI	Woodland, outcrop	Target search
Princess Parrot	V	P4			Mt Magnet	Woodland	Bird survey
Carnaby's Black-cockatoo	E	E			Tenindewa	Woodland	Target search
Gilled Slender Blue-Tongue		V			Mt Magnet	Hills, clay plains	Target search
Black-flanked Rock-wallaby	E	E			Yeelirrie	Rocky hills	Scat searches, cameras
Peregrine Falcon		OS			NGI	Woodland	Bird survey
Migratory Waders	M	IA			Lake Austin, Yalgoo	Salt lakes	Bird survey
Yuna Broad-blazed Slider			P1		Mullewa	Sandplain, hills	Herpetofauna searches
Central Long-eared Bat			P3		Weld Range	Woodland	Bat Detectors
Brush-tailed Mulgara			P4		NGI	Sandplain	Motion cameras, scats
Long-tailed Dunnart			P4		NGI	Rocky hills	Motion cameras
Striated Grasswren			P4		Sandstone	Sandplain	Bird census, cameras
Slender-billed Thornbill				L	Lake Austin	Samphire	Bird survey
Bush Stone-curlew				L	Mt Magnet	Woodland	Bird survey
Shield-backed Trapdoor Spider	VU	E			Mt Gibson	Woodland, hills	Target search
Tree-stem Trapdoor Spider			P4		Mt Gibson	Woodland, hills	Target search
<i>Tey/ sp. (Minnivale trapdoor spider)</i>		CE			Mellenbye	Perched swamps	Target search
Trapdoor Spider ( <i>Kwonkan moriartii</i> )			P2		Kathleen	Unknown	Target search
Trapdoor Spider ( <i>Idiosoma arenaceum</i> )			P3		Sundown	Geraldton sandplains	Target search
Trapdoor Spider ( <i>Idiosoma clypeatum</i> )			P3		Wurarga, Weld Range	Shrubland, hills	Target search

\*Note: Conservation Codes includes taxa listed under the EPBC Act and BC Act: E = Endangered, V = Vulnerable, CE = Critically Endangered, M = Migratory, OS = Other Specially Protected, IA = listed under International Agreements; DBCA Priority Species: P1 - 4 = Priority 1 – 4; L = Locally significant, due to distribution or habitat limitations.

**Table 5. Malleefowl Mound Profile Description**

Mound Profile	Description	Activity Status
Profile 1 	1. Typical crater with raised rim. This is the typical shape of an inactive (dormant) mound.	Inactive mound
Profile 2 	2. Excavated mound. Centrally, the mound slopes down steeply and at the base the sides drop vertically to form a box-like structure with sides usually 20-30cm deep. Some litter may have been raked into windrows and into the mound.	Mound Preparation
Profile 3 	3. Mound with litter. This is the next stage after Profile 2. Litter will have been raked into the mound by Malleefowl, and thick layers of litter are evident on the surface.	Mound Preparation
Profile 4 	4. Mound mounded up (no crater). This is the typical profile of an active but unopened Malleefowl mound (the active mound is closed, and dome shaped).	Active mound (unopened)
Profile 5 	5. Mound a crater with peak in centre. This is a typical profile of an active nest which is in the process of being closed by Malleefowl;	Active mound (opened)
Profile 6 	6. Abandoned nest, with reduced height and depth due to inactivity and erosion however still contains an obvious central depression	Inactive mound
Profile 7 	7. Mound low and flat without peak or crater. A very long unused mound (with reduced height and depth due to inactivity and erosion) and weathering has 'flattened' the original mound. No central depression.	Inactive mound

### 3.5.5 Bird Surveys

Birds were surveyed at each habitat assessment point (Figure 5), surveys consisting of 10 – 30 minute meandering transects within that habitat type. Outside of this, effort concentrated on locating birds poorly known from the region and so surveys were conducted within dense vegetation to locate species such the Malleefowl, Western Yellow Robin, Southern Scrub-robin and Quail-thrush species. Habitat supporting an isolated population of the DBCA Priority Striated Grasswren (known from its range extreme) was also inspected and compared to that present within the Pipeline Licence area. Other birds were also recorded opportunistically throughout the survey area and during targeted searches.

### 3.5.6 Motion-activated Cameras

Motion-activated cameras (Reconyx Hyperfire HC600 and Bushnell Trophy Cam HD) were placed at 10 sampling locations within the Pipeline Licence area (Table 6, Figure 6). Cameras were installed to maximise the detection of conservation significant fauna (e.g. the Brush-tailed Mulgara) and also located to sample the range of habitats present (including rocky hills, outcrops, woodland and spinifex sandplain). The optimal deployment time for motion-activated cameras varies, depending on the available habitats and the target species involved (Meek *et al.* 2012; Turpin 2014; Turpin *et al.* 2015; Turpin *et al.* 2018). The EPA (2016a) recommends a minimum sampling duration of seven days for fauna inventory surveys. Longer survey periods are recommended to detect rare or threatened fauna if they are considered likely to be present (Meek *et al.* 2012). Consequently, cameras were installed to maximise the detection of locally occurring fauna and operated over a sufficient time to sample the resident assemblage expected. Cameras were baited with universal bait (sardines, peanut butter, rolled oats) and surveyed a total of 342 camera nights overall.

**Table 6. Motion-activated Camera Locations (WGS 1984)**

Site	Latitude	Longitude	Habitat	Camera Deployment Days
cam18601	-28.2648	119.0979	Spinifex sandplain	30
cam3920	-28.2653	119.0832	Spinifex sandplain with Mulga shrubs	37
cam3991	-28.3629	119.7556	Banded Iron Formation rocky ridge	27
fb2	-28.2421	120.7564	Granite Outcrop	36
fd4	-28.2427	120.754	Granite Outcrop	32
fc4	-28.2418	120.7547	Granite Outcrop	36
fd3	-28.1511	118.0384	Breakaway	36
A1	-28.4655	115.9318	Acacia shrubland	36
A2	-28.4593	115.9534	Eucalypt Woodland ( <i>E. loxophleba</i> )	36
A3	-28.3550	116.6021	Drainage line (dense Acacia shrubland)	36
<b>Total</b>				342

### 3.5.7 Bat Acoustic Detection

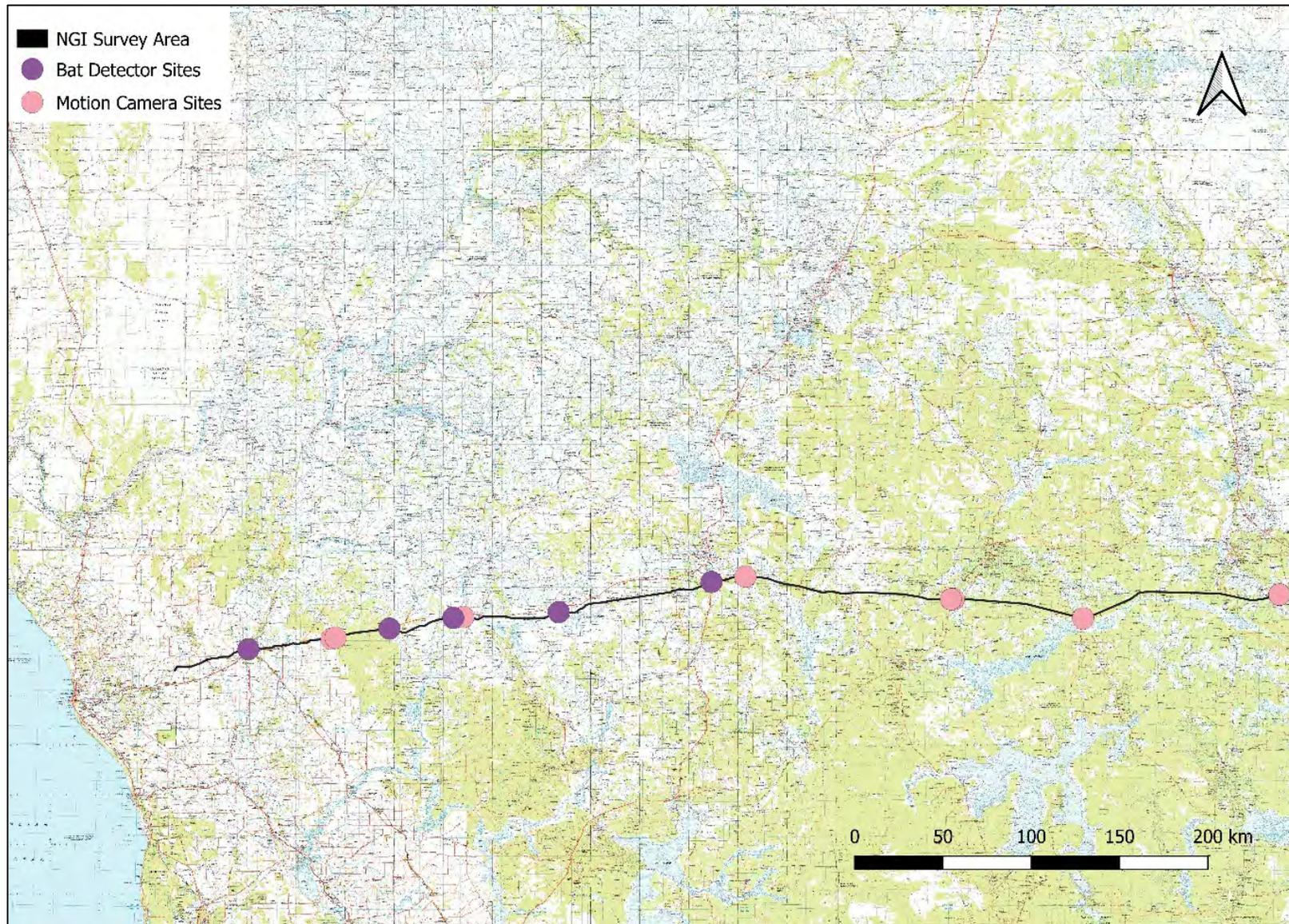
To sample for bats an Anabat Swift bat detector was placed at five sites in the Pipeline Licence area (Table 7, Figure 6). Detector locations were chosen to sample the range of bat species that could potentially occur, within the logistical requirements of deployment and pick-up of the unit. Further details of acoustic survey and analysis are provided in Appendix 4.

**Table 7. Bat Detector Locations (WGS 1984)**

Site	Latitude	Longitude	Habitat
Bat01	-28.5172	115.5093	Acacia shrubland in wheatbelt remnant vegetation
Bat02	-28.4137	116.2272	Acacia shrubland
Bat03	-28.3592	116.5512	Acacia shrubland
Bat04	-28.3302	117.0884	Minor drainage in mulga woodland
Bat05	-28.1783	117.8652	Mulga woodland

### **3.5.8 Opportunistic Observations**

At all times, observations of fauna were noted when they contributed to the accumulation of information on the local fauna assemblage.



**Figure 6. Motion-activated Camera and Bat Detector Locations**

### 3.6 Limitations

The EPA (2004, 2020) outlines a number of limitations that may arise during surveying. These survey limitations are addressed below in Table 8. The implementation of the survey was not hindered by any major constraints and therefore the survey objectives were fulfilled.

**Table 8. Survey Limitations.**

Limitation	Comment
Level of survey.	<b>Not a constraint.</b> Basic and Targeted Survey (as defined by EPA, 2020: including a desktop study, target searches for species of conservation significance, deployment of motion cameras, acoustic detectors, habitat descriptions, habitat mapping, avian census and opportunistic surveying).
Competency / experience of the consultant(s) carrying out the survey.	<b>Not a constraint.</b> The field personnel / authors have extensive fauna experience in the region (e.g. along the proposed Oakajee Rail, Weld Range, Carnarvon Mullewa Road, Western Wildlife, 2007) and have published scientific papers on the region's fauna (e.g. Turpin and Johnstone, 2017) and threatened fauna in Western Australia (Turpin, 2015, Turpin <i>et al.</i> 2015; Turpin <i>et al.</i> , 2018).
Scope. (What faunal groups were sampled and were some sampling methods not able to be employed because of constraints?)	<b>Not a constraint.</b> Mammals and birds were extensively sampled due to the nature of the survey. Motion cameras and bat detectors were installed to survey for larger mammals and bats. Several species were recorded by trace evidence (tracks, burrows, shelters, nests). Due to the cool, dry conditions, frogs and reptiles were generally inactive. Due to the survey timing, migratory waterbirds were absent, however, minimal habitat to such taxa was evident. Opportunistic surveying was conducted for all fauna.
Proportion of fauna identified, recorded and / or collected.	<b>Not a constraint.</b> All fauna observed were identified. Scats with the potential to belong to the Western Spiny-tailed Skink were collected. These may represent a previously unknown population and will be forwarded to Curtin University for genetic analysis.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	<b>Not a constraint.</b> Included previous fauna reports and databases (see Sections 2.4 and 3.4).
The proportion of the task achieved and further work which might be needed.	<b>Not a constraint.</b> Survey complete, in accordance with the scope. Subject to the outcome of further assessment and interpretation, there may be benefit in specific targeted survey or pre-clearance effort.
Timing / weather / season / cycle.	<b>Not a constraint.</b> Field surveys were conducted in August and September 2020. Due to the cool, dry conditions, few reptiles were active and recorded. However, survey timing was optimal for mammals and birds.
Disturbances (e.g. fire, flood, etc.) which affected results of survey.	<b>Not a constraint.</b> No disturbances affected the survey results.
Intensity (i.e. in retrospect, was the intensity adequate?)	<b>Not a constraint.</b> Survey intensity was moderate (desktop review, targeted survey with searching for significant fauna and deployment of passive detectors), and adequate to

Limitation	Comment
	satisfy EPA guidelines.
Completeness (e.g. was relevant area fully surveyed?).	<p><b>Not a constraint.</b></p> <p>The Pipeline Licence area and adjacent habitats were covered. Proposed development areas were inspected, and all major fauna habitats sampled. Habitats likely to support significant fauna were subject to further intensive sampling on foot.</p>
Resources (e.g. degree of expertise available in animal identification to taxon level).	<p><b>Not a constraint.</b></p> <p>All species identified to taxon level.</p>
Remoteness and/or access problems.	<p><b>Not a constraint.</b></p> <p>Much of the proposed NGI was accessible by vehicle and on foot. Some discrete localised sections of the route were unable to be safely accessed, as no tracks were present. However, the habitats present in inaccessible areas are widespread and were able to be surveyed elsewhere along the route.</p>
Availability of contextual (e.g. biogeographic) information on the region.	<p><b>Not a constraint.</b></p> <p>Regional information was available and was fully drawn on to inform the synthesis of knowledge of the fauna species and representative habitat in a regional context (see Table 2).</p>
Data Analysis	<p><b>Not a constraint.</b></p> <p>Due to the limitations of camera imagery and the small size of some fauna, some taxa recorded on camera were not identified to species level and excluded from analysis. However, this is not considered to have materially influenced the results of the field survey.</p>

## 4. RESULTS

### 4.1 Fauna Habitats

Focused Vision conducted a flora and vegetation survey concurrent to this fauna assessment, resulting in the identification of 33 broad vegetation types from the Pipeline Licence area (Focused Vision, 2020, Appendix 5). The vegetation mapping, land systems mapping (see Section 2.2) and field notes were used to identify 21 broad fauna habitats on the basis of their topography, soil type and associated dominant vegetation (Tables 9 and 10, Appendix 5). The dominant vegetation associations included acacia (*Acacia* spp.) shrublands (on stony, clay or sandy substrates), mallee (*Eucalyptus* spp.) over mixed shrubs (e.g. *Acacia* spp.) or spinifex (*Triodia basedowii*), mulga (*Acacia* spp.) and spinifex (*Triodia* spp.) associations and chenopod shrublands (*Tecticornia* spp., *Atriplex* spp., *Maireana* spp.) in low lying areas fringing salt lakes. Acacia shrublands ranged from dense areas on stony hills (e.g. *Acacia caesaneura*, *Acacia quadrimarginea*, *Acacia burkittii*) to open shrublands on stony plains. Topography ranged from low lying plains adjacent to salt lakes and drainages to low rocky hills, granite outcrops, elevated sand plains and sandy rises. Some uncommon or rare habitats were also encountered, including granite outcrops and *Eucalyptus loxophleba* Woodland. Habitats of significance are discussed in Section 5.4.

**Table 9. Broad Fauna Habitat Types**

Broad Unit	Habitat Description	Vegetation Unit Codes	Area (ha)	% of Licence Area
Banksia Woodland	Sandplain with <i>Banksia sceptrum</i> and <i>Callitris arenaria</i> Low Open Woodland	BsCaW	0.68	0.005
Callitris Woodland	Sandplain and rises supporting mixed <i>Acacia shrublands</i> and <i>Callitris columellaris</i> Woodland	CcLOW	104.76	0.845
Eucalyptus Woodland (Plains)	Plains supporting Eucalypt woodlands ( <i>E. kochii</i> , <i>Eucalyptus horistes</i> ) with mixed <i>Acacia</i> shrubs.	EkEhW	31.17	0.251
Eucalyptus Woodland (Drainages)	Major drainage lines supporting fringing Eucalypts ( <i>Eucalyptus camaldulensis</i> )	EcW	5.16	0.042
Breakaways	Lateritic duricrust (breakaways) supporting <i>Acacia</i> shrublands or sparse chenopods	Breakaway	1.505	0.012
Granite Outcrops	Granite outcrops and adjacent plains supporting <i>Acacia</i> shrublands and chenopod shrublands	Granite	15.842	0.128
Acacia sandplains	Undulating sandplains supporting mixed <i>Acacia</i> ( <i>Acacia mulganeura</i> , <i>Acacia caesaneura</i> and <i>Acacia ramulosa</i> ) shrublands with scattered Mallee ( <i>Eucalyptus kingsmillii</i> )	AmTS, EkAcS	132.09	1.065
Acacia / Melaleuca shrublands (Plains)	Undulating plains supporting mixed <i>Acacia</i> and <i>Melaleuca</i> shrublands (including <i>Acacia caesaneura</i> , <i>Acacia acuminata</i> and <i>Melaleuca leiocarpa</i> ) with scattered Mallee ( <i>Eucalyptus</i> spp.).	AcMIS	201.25	1.623
Acacia / Melaleuca shrublands (drainages)	Drainage tracts supporting dense <i>Melaleuca</i> and <i>Acacia</i> shrublands (dominated by <i>M. atroviridis</i> , <i>M. acutifolia</i> , <i>M. eleuterostachya</i> , <i>A. latior</i> , <i>A. acuminata</i> ).	MaTS	285.31	2.300
Mulga shrublands (plains)	Plains supporting Mulga ( <i>Acacia</i> spp.) shrublands, including <i>A. caesaneura</i> , <i>A. incurvaneura</i> and <i>Eremophila forrestii</i> , <i>Eremophila latrobei</i> , <i>Eremophila clarkeii</i> and <i>Aluta aspera</i> over tussock grasses	AcTOS	5322.655	42.912

Broad Unit	Habitat Description	Vegetation Unit Codes	Area (ha)	% of Licence Area
Mixed Acacia shrublands (plains)	Plains supporting mixed shrublands dominated by Acacia ( <i>A. caesaneura</i> , <i>A. tetragonophylla</i> and <i>A. aptaneura</i> ) with <i>Senna artemisioides</i> , <i>Aluta aspera</i> and <i>Eremophila fraseri</i>	AspTS	1232.0765	9.933
Mulga / Spinifex	Sandplains supporting Mallee ( <i>Eucalyptus kingsmillii</i> ), Mulga ( <i>Acacia</i> spp.) and Spinifex ( <i>Triodia basedowii</i> )	EkTbHG	195.05	1.573
Acacia / Eremophila shrublands	Sandplains supporting mixed shrublands dominated by Acacia (particularly <i>Acacia ramulosa</i> ) with <i>Eremophila latrobei</i> and mixed shrubs	ArEIS	85.09	0.686
Open mixed shrublands (Plains)	Open plains and drainage tracts supporting open shrublands with Acacia (including <i>A. caesaneura</i> , <i>A. incurvaneura</i> , <i>A. tetragonophylla</i> , <i>A. victoriae</i> , <i>A. burkittii</i> ), and Eremophila (species) and / or halophytic low shrubs.	AvS, MsFIS, AbTOS, AtHpS, AcEspS, HspTS	1895.2815	15.2801
Open Acacia shrublands (plains)	Plains supporting mixed Acacia shrublands including <i>Acacia tysonii</i> , <i>Acacia ligulata</i> and <i>Acacia aulacophylla</i>	AtTS	674.41	5.437
Chenopod Shrublands	Low lying plains supporting Chenopod (Samphire, Saltbush, Bluebush) shrublands	AbMpCS, MpCS, MgCS	538.06	4.338
Wheatbelt: Eucalypt	Remnant vegetation within the Wheatbelt: Eucalypt Woodland	EbW, EIW, EsMnS, EsBsW	6.78	0.055
Wheatbelt: Shrublands	Remnant vegetation within the Wheatbelt: Mixed Shrubland	AnTOS, SsTS, McS	21.07	0.170
Wheatbelt: Chenopods	Remnant vegetation within the Wheatbelt: Chenopod Shrubland	TspSS	58.28	0.470
Disturbed	Cleared vegetation or Isolated trees or shrubs in pasture	TSP, Cleared	1546.66	12.469
Not Assigned	Unmapped		50.39	0.406
	<b>Total</b>		<b>12,403.57</b>	<b>100</b>

## 4.2 Vertebrate Fauna

The desktop review identified 341 vertebrate fauna species with the potential to occur within the Pipeline Licence area and surrounds, comprising 12 frog, 108 reptile, 180 bird, 31 native mammal and 10 introduced mammal species (Appendix 2, Table 10). This assemblage included a number of species previously recorded within the Pipeline Licence area during preceding fauna assessments and research (e.g. ALA 2020; DBCA 2020). The overall predicted assemblage is diverse, as the Pipeline Licence area extends 580 km in a west-to-east direction and intersects four bioregions and 33 land systems. The assemblage includes many species typical of the arid interior of Western Australia, however as the western end of the NGI pipeline overlies the south-western botanical district, some species more typical of the temperate south-west are included.

**Table 10. Vertebrate Assemblage Expected and Observed in the Pipeline Licence Area**

Taxon	Fauna Assemblage		Species of Conservation Significance					
	Desktop Review	2020 NGI Field Surveys	Desktop Review			*NGI Fauna Records		
			EPBC/BC Acts	Priority	Local	EPBC/BC Acts	Priority	Local
Frogs	12	0	0	0	0	0	0	0
Reptiles	108	9	2 / 1	2	1	1 / 1	0	0
Birds	180	87	15 / 17	4	8	2 / 1	0	2
Native Mammals	31	16	0	2	0	0	2	0
Introduced Mammals	10	7	-	-	-	-	-	-
<b>Total</b>	<b>341</b>	<b>119</b>	<b>17 / 18</b>	<b>8</b>	<b>9</b>	<b>3 / 2</b>	<b>2</b>	<b>2</b>

\*Note: species recorded outside of the Pipeline Licence area are excluded from this table.

While a key objective of the field surveys was to detect species of conservation significance, opportunistic observations and the use of passive detectors (motion-activated cameras and Anabat Swift bat call recorders) enabled a large fauna assemblage to be recorded (Table 10). A total of 119 species were recorded during the reconnaissance and basic/targeted surveys, comprising nine reptile, 87 bird, 16 native mammals and seven introduced mammals (Table 10). Seven species of conservation significance were recorded from the Pipeline Licence area and additional species were recorded outside the area during transit. Species of conservation significance are discussed further below.

Eighteen fauna species were identified from the motion cameras installed during the survey. This comprised two reptile, seven bird, eight native mammal and one introduced mammal species (Table 11). A wide range of fauna were detected by camera, however due to size limitations, some smaller taxa were not identified to species level and were excluded from the analysis. While superficially similar, a number of Dasyurids were identified (based on size, body and tail shape). Large and distinctive Dasyurids were readily recognisable (e.g. Brush-tailed Mulgara and Long-tailed Dunnart – distinguished by a combination of size, head and tail shape and length, and in the case of the Long-tailed Dunnart, the characteristic tail held almost vertically). Smaller species were not identified to species level as several species of similar size and morphology overlap in range and habitat. The cameras successfully detected a number of rare or cryptic taxa, including:

- Long-tailed Dunnart (*Sminthopsis longicaudata*): DBCA Priority 4, few regional records. Recorded from one camera site (cam3991; -28.363031, 119.755652) installed on the slopes of a rocky ridge;
- Brush-tailed Mulgara (*Dasyercus blythi*): DBCA Priority 4, few regional records and occurs at the species southern range extreme. Recorded from a camera situated near an active burrow system within vegetation dominated by Spinifex (*Triodia basedowii*) and Mulga (*Acacia* spp.) (cam3920; -28.2653, 119.0832); and
- Woolley's Pseudantechinus (*Pseudantechinus woolleyae*): locally restricted to isolated, rocky areas, recorded from two cameras (from a rocky ridge and a lateritic breakaway) (FD3 and cam3991; -28.3629, 119.7556 and -28.1511, 118.0384).

**Table 11. Fauna Recorded on Motion Cameras**

Species Recorded	Comments	Site
<i>Ctenophorus sp.</i>	Likely <i>Ctenophorus scutulatus</i> .	3991
<i>Ctenopus sp.</i>	Likely <i>Ctenopus inornatus</i>	3920
Crested Pigeon	Recorded from a breakaway	FD3
Grey-crowned Babbler	Recorded from Acacia shrubland	FD4
Grey Shrike-thrush	Recorded from a breakaway	FD3
Crested Bellbird	Widely recorded from several cameras	FC4, FB2
Grey Butcherbird	Recorded from Mulga	FD4
Australian Magpie	Recorded from a granite outcrop	18601
Torresian Crow	Widely recorded from several cameras	FD3
Echidna	Recorded from spinifex sandplain	3920
Brush-tailed Mulgara (P4)	Recorded adjacent to an active burrow system	cam3920
Woolley's Pseudantechinus	Recorded from two rocky outcrops	3991, FD3
Long-tailed Dunnart (P4)	Extensively recorded from a rocky ridge with outcropping	cam3991
Striped-faced Dunnart	Identified by head stripe, size and tail shape	FB2, FD4
Euro	Recorded from granite outcrops	FB2, FD4
Spinifex Hopping Mouse	Recorded from spinifex sandplain	3920
Sandy Inland Mouse	Recorded from spinifex sandplain	3920
Feral Cat	Recorded from a granite outcrop	3920

Six bats were recorded on the basis of their calls as recorded on an Anabat Swift Bat Detector (Table 12, Appendix 4).

**Table 12. Fauna recorded on bat detectors**

Species Recorded	Comments
<i>Austronomus australis</i>	Recorded at three sites (Bat01, Bat02, Bat03)
<i>Ozimops kitcheneri</i>	Recorded at all five sites (Bat01, Bat02, Bat03, Bat04, Bat05)
<i>Chalinolobus gouldii</i>	Recorded at two sites (Bat04, Bat05)
<i>Chalinolobus morio</i>	Recorded at two sites (Bat04, Bat05)
<i>Nyctophilus geoffroii</i>	Recorded at three sites (Bat02, Bat04, Bat05)
<i>Scotorepens balstoni</i>	Recorded at one site (Bat04)

Over 900 records of 80 bird species were captured during habitat assessments (Table 13), with the remaining eight species recorded opportunistically. The most commonly recorded species was the Crested Bellbird (*Oreoica gutturalis*), at 76 of the 153 habitat assessment sites, followed by the Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*) at 67 sites and the Singing Honeyeater (*Gavicalis virescens*) at 57 sites. Many species were only recorded at one or two sites, including species that are naturally sparsely distributed, such as birds of prey.

**Table 13. Birds Recorded During Habitat Assessments**

Species Recorded	Number of Sites	Comments
Australasian Pipit	6	Recorded from open habitats
Australian Hobby	2	Recorded south of Sandstone
Australian Kestrel	6	Widespread along Pipeline Licence area
Australian Magpie	3	Recorded on Atley Station
Australian Raven	24	Widespread along Pipeline Licence area
Australian Ringneck	11	Widespread along Pipeline Licence area
Black-breasted Buzzard	2	Recorded near Windimurra
Black-eared Cuckoo	8	Widespread along Pipeline Licence area
Black-faced Cuckoo-shrike	8	Widespread along Pipeline Licence area
Black-faced Woodswallow	15	Widespread along Pipeline Licence area
Bourke's Parrot	4	Recorded from Mulga south of Sandstone
Brown Falcon	7	Widespread along Pipeline Licence area
Brown Honeyeater	1	Recorded near Mullewa
Brown Songlark	7	Widespread along Pipeline Licence area
Chestnut-rumped Thornbill	39	Widespread along Pipeline Licence area
Chiming Wedgebill	7	Common in low-lying areas near Yalgoo
Cockatiel	1	Recorded near Mullewa
Common Bronzewing	8	Widespread along Pipeline Licence area
Crested Bellbird	76	Widespread along Pipeline Licence area
Crested Pigeon	28	Widespread along Pipeline Licence area
Crimson Chat	3	Recorded on Pinnacles stations
Diamond Dove	2	Recorded on Atley Station
Elegant Parrot	1	Recorded near Yalgoo
Emu	17	Widespread along Pipeline Licence area
Fairy Martin	1	Recorded near Yalgoo
Galah	13	Widespread along Pipeline Licence area
Grey Butcherbird	15	Widespread along Pipeline Licence area
Grey Currawong	2	Recorded south of Sandstone
Grey Fantail	3	Recorded near Mullewa
Grey Shrike-thrush	25	Widespread along Pipeline Licence area
Grey Teal	1	Waterbird, in flooded drainage near
Grey-crowned Babbler	1	Recorded at eastern terminus
Hooded Robin	1	Recorded south of Mount Magnet
Horsfield's Bronze-cuckoo	1	Recorded south of Sandstone
Inland Thornbill	22	Widespread along Pipeline Licence area
Jacky Winter	1	Recorded north of Lake Noondie
Little Eagle	1	Recorded on Barnong
Little Woodswallow	1	Recorded along Breakaway
Magpie-lark	6	Widespread along Pipeline Licence area
Malleefowl (EPBC Vulnerable)	2	Inactive mounds and tracks recorded
Mistletoebird	2	Recorded south of Sandstone
Mulga Parrot	8	Widespread along Pipeline Licence area
Peregrine Falcon (Specially Protected)	1	Recorded within the Pipeline Licence area and near Agnew
Pied Butcherbird	9	Widespread along Pipeline Licence area
Pied Honeyeater	6	Widespread along Pipeline Licence area

Species Recorded	Number of Sites	Comments
Red-capped Robin	56	Widespread along Pipeline Licence area
Red-tailed Black Cockatoo (arid, inland form)	1	Recorded east of Yalgoo
Redthroat	19	Widespread along Pipeline Licence area
Rufous Songlark	1	Recorded south of Mount Magnet
Rufous Whistler	52	Widespread along Pipeline Licence area
Singing Honeyeater	57	Widespread along Pipeline Licence area
Slaty-backed Thornbill	36	Widespread along Pipeline Licence area
Southern Whiteface	28	Widespread along Pipeline Licence area
Spiny-cheeked Honeyeater	67	Widespread along Pipeline Licence area
Splendid Fairy-wren	18	Widespread along Pipeline Licence area
Spotted Harrier	2	Recorded near Mullewa
Spotted Nightjar	1	Nocturnal species
Striated Pardalote	1	Recorded south of Sandstone
Torresian Crow	9	Widespread along Pipeline Licence area
Tree Martin	3	Recorded near Mullewa
Varied Sitella	4	Recorded south of Sandstone
Variiegated Fairy-wren	4	Recorded south of Sandstone
Wedge-tailed Eagle	7	Widespread along Pipeline Licence area
Weebill	11	Widespread along Pipeline Licence area
Welcome Swallow	3	Recorded near Pindar
Western Bowerbird	1	Recorded south of Leinster
Western Gerygone	8	Widespread along Pipeline Licence area
Western Yellow Robin (locally significant)	2	Recorded east of Pindar
Whistling Kite	2	Recorded near Pindar
White-browed Babbler	32	Widespread along Pipeline Licence area
White-browed Treecreeper	9	Widespread along Pipeline Licence area
White-faced Heron	1	Waterbird, in flooded drainage near
White-fronted Chat	2	Recorded near Pindar
White-fronted Honeyeater	15	Widespread along Pipeline Licence area
White-winged Fairy-wren	11	Widespread along Pipeline Licence area
White-winged Triller	1	Recorded on Barnong
Willie Wagtail	28	Widespread along Pipeline Licence area
Yellow-rumped Thornbill	8	Widespread along Pipeline Licence area
Yellow-throated Miner	19	Widespread along Pipeline Licence area
Zebra Finch	6	Widespread along Pipeline Licence area
<b>Total records:</b>	<b>933</b>	

#### 4.2.2 Amphibians

Twelve frog species have been recorded from the region (Appendix 2). No frogs were recorded during the field surveys, a reflection of the cool and dry conditions experienced. No frog species expected to occur within the Pipeline Licence area are of conservation significance.

### 4.2.3 Reptiles

A total of 108 reptile species have been recorded from the region, with 94 taxa recorded during previous surveys conducted within approximately 25 km of the Pipeline Licence area (Appendix 2). Eight reptiles were recorded from the Pipeline Licence area, from observations of active individuals or from the identification of scats or burrows (e.g. Pygmy Spiny-tailed Skink, *Egernia depressa*).

Most reptile species expected to occur within the Pipeline Licence area are typical of the arid zone of Australia. However, as the proposed Pipeline Licence area overlies the south-western botanical district, some species more typical of the temperate south-west are included. This includes several species occurring in the area at the extreme edge of their range, such as the Barking Gecko (*Underwoodisaurus milii*), Marble-faced Delma (*Delma australis*) or Bobtail (*Tiliqua rugosa*), although these species are common elsewhere within their range. Five reptiles of conservation significance have the potential to occur within the Pipeline Licence area (Figure 4), with one species – the Western Spiny-tailed Skink (*Egernia stokesii badia*) recorded during the survey. Species of conservation significance are discussed further in Section 5.

### 4.2.4 Birds

Eighty-eight bird species were recorded during the field surveys (see Appendix 2). A total of 180 bird species have the potential to occur within the Pipeline Licence area, although this includes some species only likely in the area as irregular visitors, such as waterbirds. Most avian species expected to occur are widespread across the arid interior of Western Australia. However, as the Pipeline Licence area is located across a biogeographic interzone, some birds are likely to occur in the area near the extreme edge of their range. These include the Regent Parrot (*Polytelis anthopeplus*), Blue-breasted Fairy-wren (*Malurus pulcherrimus*), Brown-headed Honeyeater (*Melithreptus brevirostris*), Chestnut Quail-thrush (*Cinclosoma castanotum*), Gilbert's Whistler (*Pachycephala inornata*) and Dusky Woodswallow (*Artamus cyanopterus*). Several birds of conservation significance occur in the region and have the potential to occur within the Pipeline Licence area. These are discussed in Section 5.

### 4.2.5 Mammals

Thirty-one native mammals and ten introduced mammals have the potential to occur within the Pipeline Licence area (Appendix 2). Sixteen native mammal species and seven introduced species were recorded during the field survey. As the Pipeline Licence area lies on a biogeographic interzone, the potential assemblage includes a mix of temperate and arid zone species (e.g. Western Grey Kangaroo, Euro and Red Kangaroo). The Brush-tailed Mulgara (*Dasyercus blythi*) was recorded from areas of sandplain supporting spinifex and represent populations occurring at the species' southern range extreme. Several species such as the Woolley's False Antechinus (*Pseudantechinus woolleyae*) and Long-tailed Dunnart (*Sminthopsis longicaudata*) were recorded on motion-activated cameras (Table 11). Six bat species were recorded via acoustic detection (Table 12, Appendix 4). Several mammals of conservation significance occur in the greater region and have the potential to occur within the Pipeline Licence area. These are discussed in Section 5.

### **4.3 Invertebrate Fauna**

Surveying during the field surveys concentrated on the identification of fauna habitats and the vertebrate fauna present. Invertebrate fauna were recorded during the desktop review and are discussed further in Section 6.3.

## 5. CONSERVATION SIGNIFICANT FAUNA

### 5.1 Conservation Significant Fauna Recorded from the Region

Conservation significant fauna includes species listed under Commonwealth or State legislation, species listed as Priority Fauna by DBCA, species listed as declining in biodiversity publications and species considered locally significant (due to restrictions in range or sensitivities to threatening processes; Woinarski *et al.*, 2017).

Overall, 42 species of conservation significance have been recorded from the region (sourced from regional database searches and previous surveys). These species are outlined in Table 14 along with their conservation status and expected occurrence in the Pipeline Licence area. While a limited number of fauna surveys have been conducted in the local area, previous work has identified the presence of several conservation significant fauna. These include:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*; EPBC Endangered, previously recorded from near Mullewa and Tenindewa);
- Malleefowl (EPBC Act Vulnerable, BC Act Vulnerable; recorded from Wurarga, Urawa Nature Reserve and near Yalgoo);
- Western Spiny-tailed Skink (EPBC Endangered; previously recorded from near Yalgoo and Urawa Nature Reserve);
- Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*; BC Act Vulnerable, recorded from Mount Magnet);
- Peregrine Falcon (BC Act Specially protected; recorded from Lawlers);
- Long-tailed Dunnart (DBCA Priority 4, recorded from Mount Anderson);
- Brush-tailed Mulgara (DBCA Priority 4, recorded from Black Range);
- Yuna Broad-blazed Slider (*Lerista yuna*; DBCA Priority 3; previously recorded near Mullewa and from Urawa Nature Reserve);
- Woma (*Aspidites ramsayi*, southwest sub-population DBCA Priority 1; historical record from Eradu); and
- EPBC Migratory Waders (EPBC Migratory, several (5) waders listed under the EPBC have been recorded near the Pipeline Licence area).

Table 14 lists the likelihood of significant fauna occurring within the Pipeline Licence area. Fauna species are classified as:

- Recorded - either during the current survey or from previous observations;
- Likely Resident - recorded nearby (within 100 km), suitable habitat present;
- Potential Resident - recorded in region (not within 100 km), suitable habitat present;
- Visitor - expected to occur within the survey area at least on a seasonal basis;
- Foraging Visitor - expected to forage within the Pipeline Licence area only (breeding habitat is absent);
- Vagrant - rare visitor occurring outside the species usual range; and
- Unlikely - suitable habitat absent.

**Table 14. Conservation Significant Fauna Recorded within the Pipeline Licence Area and Surrounds**

Taxa	Conservation Status*				Local Records	Preferred Habitat Type	Nearest Record to the NGI Pipeline Licence Area	Status in Pipeline Licence Area		
	EPBC Act	BC Act	DBCA	Local				Habitat Present	Expected Status	NGI Record
<b>REPTILES</b>										
Western Spiny-tailed Skink	E	V			Yalgoo	Woodland, outcrops	100 m (north)	Woodland	Potential Resident	
Gilled Slender Blue-tongue		V			Mt Magnet	Mallee, shrublands	2 km (south)	Shrubland	Resident	
Yuna Broad-blazed Slider			P3		Mullewa	Shrublands, sandy soils	4 km (north)	Shrubland	Potential Resident	
Woma			P1		Eradu	Sandplains	14 km (south-west)	Sandplain	Potential Resident	
Carpet Python				L	Yalgoo	Woodland, outcrops	1 km (north)	Woodland	Resident	
<b>BIRDS</b>										
Malleefowl	V	V			Yalgoo	Acacia, rocky hills	Recorded within NGI	Shrubland	Resident	Recorded
Carnaby's Cockatoo	E	E			Tenindewa	Woodlands, Heath	5 km (south)	Minimal	Visitor	
Princess Parrot	V		P4		Mt Magnet	Marble Gum woodland	12 (north)	No	Vagrant	
Peregrine Falcon		OS			Lawlers	Shrubland, woodland	Recorded within NGI	Woodland	Resident / Visitor	Recorded
Grey Falcon		V			Mullewa	Open grasslands	1 km (south)	No	Vagrant	
Fork-tailed Swift	M	IA			Mullewa	Aerial	1 km (south)	No	Vagrant	
Night Parrot	E	CE			Mt Farmer	Spinifex, chenopod	48 km (north)	Minimal	Unlikely	
Blue-billed Duck			P4		Wurarga	Wetlands	6 km (north)	Minimal	Vagrant	
Striated Grasswren			P4		Sandstone	Spinifex sandplain	27 km (north)	Minimal	Unlikely	
Hooded Plover			P4		Lake Barlee	Salt lakes	80 km (south)	No	Unlikely	
Letter-winged Kite			P4		Urawa	Eucalypt woodland	12 km (north)	Minimal	Vagrant	
Major Mitchell's Cockatoo				L	Mullewa	Woodland, mallee	1 km (south)	Woodland	Potential Resident	

Taxa	Conservation Status*				Local Records	Preferred Habitat Type	Nearest Record to the NGI Pipeline Licence Area	Status in Pipeline Licence Area		
	EPBC Act	BC Act	DBCA	Local				Habitat Present	Expected Status	NGI Record
Slender-billed Thornbill				L	Mt Magnet	Samphire, chenopods	12 (north)	Chenopods	Resident	
Scarlet-chested Parrot				L	Cue	Shrublands	83 km (north)	Minimal	Potential Visitor	
Regent Parrot				L	Yalgoo	Eucalypt woodlands	1 km (north)	Woodland	Resident	
Bush Stone-curlew				L	Atley	Acacia shrublands	4 km (north)	Shrubland	Resident	
Rufous Treecreeper				L	Yalgoo	Eucalypt Woodland	1 km (north)	Woodland	Potential Resident	
Western Yellow Robin				L	Wilroy	Shrublands, woodland	Recorded within NGI	Shrubland	Resident	Recorded
Southern Scrub-robin				L	Wilroy	Mallee, shrublands	13 km (south)	Minimal	Potential Resident	
Glossy Ibis	M	IA			Ellendale Pool	Wetlands, salt lakes	28 km (south-west)	Minimal	Vagrant	
Common Sandpiper	M	IA			Barnong	Wetlands, salt lakes	27 km (south)	Minimal	Vagrant	
Pectoral Sandpiper	M	IA			Pindar	Wetlands, salt lakes	1 km (south)	Minimal	Vagrant	
Common Greenshank	M	IA			Yalgoo	Wetlands, salt lakes	16 km (south)	Minimal	Vagrant	
Curlew Sandpiper	M	IA			Durawah	Wetlands, salt lakes	21 km (west)	Minimal	Vagrant	
Sharp-tailed Sandpiper	M	IA			Yalgoo	Wetlands, salt lakes	28km (south)	Minimal	Vagrant	
Wood Sandpiper	M	IA			Yuna	Wetlands, salt lakes	37 km (north-west)	Minimal	Vagrant	
Gull-billed Tern	M	IA			Yalgoo	Wetlands, salt lakes	15 km (south)	Minimal	Vagrant	
Osprey	M	IA			Ellendale Pool	Rivers, Wetlands	28 km (south-west)	Absent	Unlikely	
<b>MAMMALS</b>										
Sandhill Dunnart	E	E			Yalgoo	Sandplains, dunes	18 km (north)	Minimal	Unlikely	
Brush-tailed Mulgara			P4		Black Range	Spinifex sandplains	Recorded within NGI	Spinifex	Resident	Recorded
Long-tailed Dunnart			P4		Mt Anderson	Stony hills and ridges	Recorded within NGI	Outcrops	Visitor	
<b>INVERTEBRATES</b>										
Shield-backed Trapdoor Spider	VU	E			Mt Gibson	Woodland, hills	None	Minimal	Unlikely	

Taxa	Conservation Status*				Local Records	Preferred Habitat Type	Nearest Record to the NGI Pipeline Licence Area	Status in Pipeline Licence Area		
	EPBC Act	BC Act	DBCA	Local				Habitat Present	Expected Status	NGI Record
Tree-stem Trapdoor Spider			P4		Mt Gibson	Woodland, hills	150 km (south)	Minimal	Unlikely	
Minivale Trapdoor Spider (Teyl sp.)		CE			Mellenbye	Perched swamps	46 km (south)		Unlikely	
Trapdoor Spider ( <i>Kwonkan moriartii</i> )			P2		Kathleen	Unknown	84 km (north)		Unlikely	
Tradpoor Spider ( <i>Idiosoma arenaceum</i> )			P3		Sundown	Geraldton sandplains	11 km (south)	Minimal	Potential	
Trapdoor Spider ( <i>Idiosoma clypeatum</i> )			P3		Wurarga	Shrubland, hills	26 km (south)		Likely Resident	

\*Note: Status includes taxa listed under the EPBC Act and BC Act: E = Endangered, V = Vulnerable, M = Migratory, OS = Other Specially Protected, IA = listed under International Agreements; DBCA Priority Species: P1 - 4 = Priority 1 – 4; L = Locally significant, due to distribution or habitat limitations.

## 5.2 Significant Fauna Recorded or Expected within the Pipeline Licence Area

Seven species of conservation significance were recorded during the 2020 field surveys (Figure 7). The locations of significant fauna are listed in Table 15 and comprise:

1. Malleefowl (EPBC and BC Act Vulnerable): five old, inactive mounds (breeding sites) recorded and the species distinctive tracks recorded at three locations;
2. Western Spiny-tailed Skink (EPBC Act Endangered, BC Act Vulnerable): several scat latrines recorded, associated with rock outcrops and log piles;
3. Brush-tailed Mulgara (DBCA Priority 4): recorded on motion camera (Figure 7) and active burrows, tracks and scats recorded on sandplain;
4. Long-tailed Dunnart (DBCA Priority 4): recorded on camera at one location, associated with rocky ridge;
5. Peregrine Falcon (Specially Protected): single birds sighted to the north of, and within, the Pipeline Licence area;
6. Striated Grasswren (DBCA Priority 4): one group observed north of the Pipeline Licence area; and
7. Western Yellow Robin (locally significant): birds recorded at two locations, at the arid extreme of the species range.

An eighth species, the Bush Stone-curlew (*Burhinus grallarius*, locally significant), was reported to occur in the area by local pastoralists at Atley station, however not observed directly as part of this fauna survey assessment.

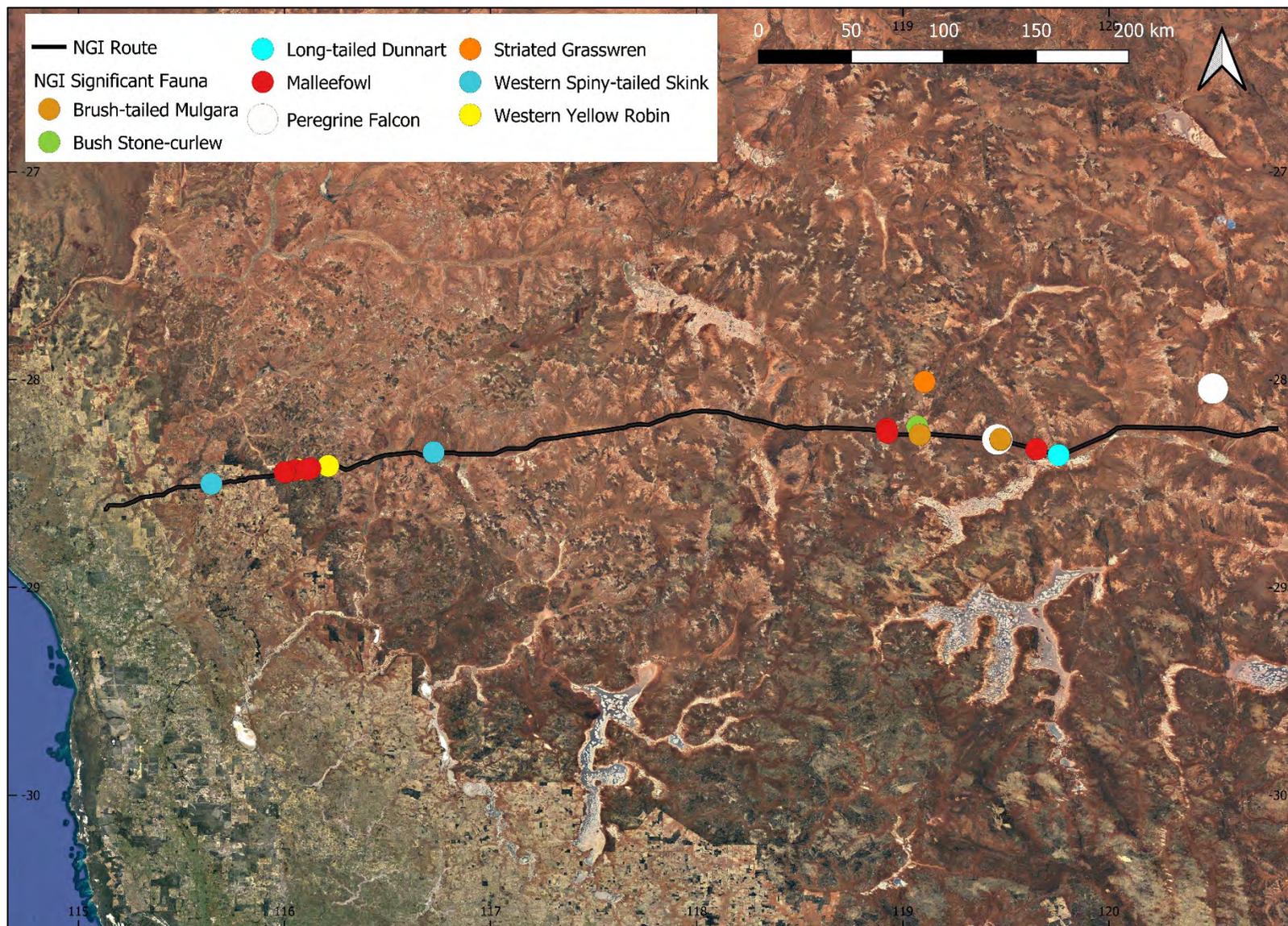
**Table 15. Conservation Significant Fauna Recorded during the Survey (WGS 1984)**

Common Name	Status	Latitude	Longitude	Comments	Fauna Habitat	Within Pipeline Licence Area
Malleefowl	Vulnerable (EPBC, BC Acts)	-28.436	116.0514	Old inactive mound	Callitris Woodland	Yes
Malleefowl		-28.4269	116.1253	Old inactive mound	Acacia / Melaleuca Shrubland (Plains)	Yes
Malleefowl		-28.4456	116.0027	Old inactive mound	Mixed Acacia Shrubland (Plains)	No
Malleefowl		-28.4452	116.0012	Old inactive mound	Mixed Acacia Shrubland (Plains)	No
Malleefowl		-28.432	116.11	Old inactive mound	Acacia / Melaleuca Shrubland (Plains)	No
Malleefowl		-28.3351	119.6476	Fresh tracks	Mulga Shrubland	Yes
Malleefowl		-28.2375	118.9212	Fresh tracks	Mulga Shrubland	No
Malleefowl		-28.2546	118.9248	Fresh tracks	Mulga Shrubland	Yes
Western Spiny-tailed Skink	Endangered (EPBC), Vulnerable (BC)	-28.350068	116.722769	Fresh scat latrine	Rocky Outcrop (outside Licence Area)	No
Western Spiny-tailed Skink		-28.34984	116.722915	Fresh scat latrine	Rocky Outcrop (outside Licence Area)	No
Western Spiny-tailed Skink		-28.349483	116.723402	Fresh scat latrine	Rocky Outcrop (outside Licence Area)	No
Western Spiny-tailed Skink		-28.349276	116.723334	Fresh scat latrine	Rocky Outcrop (outside Licence Area)	No
Western Spiny-tailed Skink		-28.501037	115.645118	Old scat latrine	Wheatbelt: Eucalypt Woodland	No
Peregrine Falcon	Other Specially Protected Species	-28.0431	120.5039	One bird sighted	Open Acacia Shrubland	No
Peregrine Falcon		-28.288	119.458	One bird sighted	Mulga/ Spinifex	Yes
Long-tailed Dunnart	Priority 4	-28.363031	119.755652	Recorded on camera	Rocky Outcrop (outside Licence Area)	No
Brush-tailed Mulgara	Priority 4	-28.2905	119.474	Active burrow	Mulga/ Spinifex	Yes
Brush-tailed Mulgara		-28.2859	119.4731	Burrow, fresh scats	Mulga/ Spinifex	No
Brush-tailed Mulgara		-28.286	119.4732	Active burrow	Mulga/ Spinifex	No
Brush-tailed Mulgara		-28.2653	119.0831	Burrow, fresh scat	Mulga/ Spinifex	Yes
Brush-tailed Mulgara		-28.2653	119.0832	Burrow, fresh scat	Mulga/ Spinifex	Yes
Brush-tailed Mulgara		-28.2656	119.0815	Active burrow	Mulga/ Spinifex	Yes
Brush-tailed Mulgara		-28.2656	119.0815	Active burrow	Mulga/ Spinifex	Yes
Striated Grasswren	Priority 4	-28.010759	119.104774	Observed	Yellow sandplain	No
Western Yellow Robin	Local	-28.433	116.069	One bird sighted	Callitris Woodland	No
Western Yellow Robin		-28.415	116.212	One bird sighted	Mixed Acacia Shrubland (Plains)	No

Several additional species have the potential to occur within the Pipeline Licence area. These include species expected in resident populations, and wide-ranging species which may visit the Pipeline Licence area periodically.

1. Carnaby's Cockatoo (EPBC and BC Endangered): foraging visitor. While the western portion of the Pipeline Licence area passes through the species' predicted range, due to widescale habitat clearance, minimal breeding or foraging habitat occurs within the Pipeline Licence area;
2. Gilled Slender Blue-tongue (BC Vulnerable): Resident. Several records are located near the Pipeline Licence area (Mullewa, Mt Magnet, Urawa Nature Reserve) and due to the presence of suitable habitat the species is likely to occur as a resident;
3. Yuna Broad-blazed Slider (DBCA Priority 3): Potential Resident. Has a highly restricted range near the NGI pipeline's western terminus at Yuna, and recorded adjacent to the Pipeline Licence area at Yuna and Urawa Nature Reserves and Tenindewa. Due to widescale land clearance, minimal habitat occurs within the Pipeline Licence area, however the species can persist in small, vegetated fragments;
4. Woma (DBCA Priority 1): Potential Resident. Historical records come from near the NGI pipeline's western terminus at Yuna and Eradu (1965, DBCA 2020). As the species can persist in cleared or regrowth landscapes (so long as suitable underground shelter sites remain, Bruton *et al.*, 2017), the Woma may persist in the local area;
5. Carpet Python (locally significant): Resident. Recorded from Yalgoo and has the potential to occur within the Pipeline Licence area as a resident;
6. Eight locally significant bird taxa may occur in small, restricted populations. This includes declining woodland species and species occurring at the extreme of their range (e.g. Rufous Treecreeper, Major Mitchell's Cockatoo, Southern Scrub-robin, Regent Parrot, Western Yellow Robin, Slender-billed Thornbill, Scarlet-chested Parrot and Bush Stone-curlew);
7. Northern Shield-backed Trapdoor Spider (*Idiosoma clypeatum*, DBCA Priority 3): Resident. Has a scattered distribution through the Yalgoo and Murchison Bioregions where it is the only known species in the *nigrum*-group (Rix *et al.*, 2018). Several records lie within 20 km of the Pipeline Licence area, south of Wurarga. Suitable habitat is extensive within the Pipeline Licence area, and widespread throughout the region.

The distribution of the Shield-backed Trapdoor Spider (*Idiosoma nigrum*, listed as EPBC Vulnerable and BC Endangered) has been recently revised during taxonomic revision (Rix *et al.*, 2018). While formerly thought to occur in the region, the species distribution is restricted to the central and central-western Wheatbelt (Rix *et al.*, 2018), and as such, *Idiosoma nigrum* is unlikely to occur within the Pipeline Licence area.



**Figure 7. Conservation Significant Fauna Recorded during the NGI Survey**

### 5.2.1 Western Spiny-tailed Skink (*Egernia stokesii badia*)

The Western Spiny-tailed Skink is listed as Endangered under the EPBC Act and Vulnerable under the BC Act. The northern, rock dwelling form of the Western Spiny-tailed Skink is restricted to a select, small number of granite outcrops, and rocky ridges, scattered through the Murchison from Boolardy Station in the north, to near Yalgoo in the south (Figure 4). The Wheatbelt form inhabits Eucalypt woodland (sheltering within hollow logs), scattered through the Wheatbelt from north of Mullewa to near Merredin (ALA 2020). The species has been previously recorded within the Mullewa area (e.g. Urawa Nature Reserve, Figure 4, ALA 2020).

The Western Spiny-tailed Skink has a highly restricted occurrence, with colonies (in the Mullewa and Yalgoo areas) limited to crevices in large, rocky outcrops or within large, fallen Eucalypt logs (particularly *E. loxophleba*). Within the Pipeline Licence area, all rocky outcrops were inspected for the species presence, as were the few, small areas of Eucalypt Woodland, supporting *E. loxophleba*.

The rock inhabiting form was recorded outside of the Pipeline Licence area, with several scat latrines located amongst rock piles on the slopes of a hill near Yalgoo (Table 15, Figure 7, Plate 1). In this location, the rock outcrops do not extend into the Pipeline Licence area. The Wheatbelt form was also recorded outside of the Pipeline Licence area, from a small remnant of vegetation (adjacent to the Pipeline Licence area), with a single scat latrine recorded from a hollow log (Table 15, Figure 7).

No sign (scat latrines) of the Western Spiny-tailed Skink was located within the Pipeline Licence area. Furthermore, no rocky outcrops or logs piles with the potential to support a colony were located, suggesting the species may not occur within the Pipeline Licence area. Records from adjacent habitats (e.g. one scat latrine was located approximately 100 m north of the Pipeline Licence boundary, within Eucalypt Woodland) suggest the species occurs nearby and these locations should be considered during project planning.

Due to the lack of rocky habitats, the northern, rock dwelling form of the Western Spiny-tailed Skink is considered unlikely to occur within the Pipeline Licence area. The southern form inhabiting Eucalypt woodlands has the potential to occur within the Pipeline Licence area, however no sign or suitable log piles were located. The Pipeline Licence area passes through approximately seven hectares of Eucalypt Woodland within the range of the wheatbelt form and an additional 31 ha of Eucalypt Woodland east of Pindar (currently outside of the species known range). Such habitat, while regionally restricted, extends widely outside of the Pipeline Licence area.



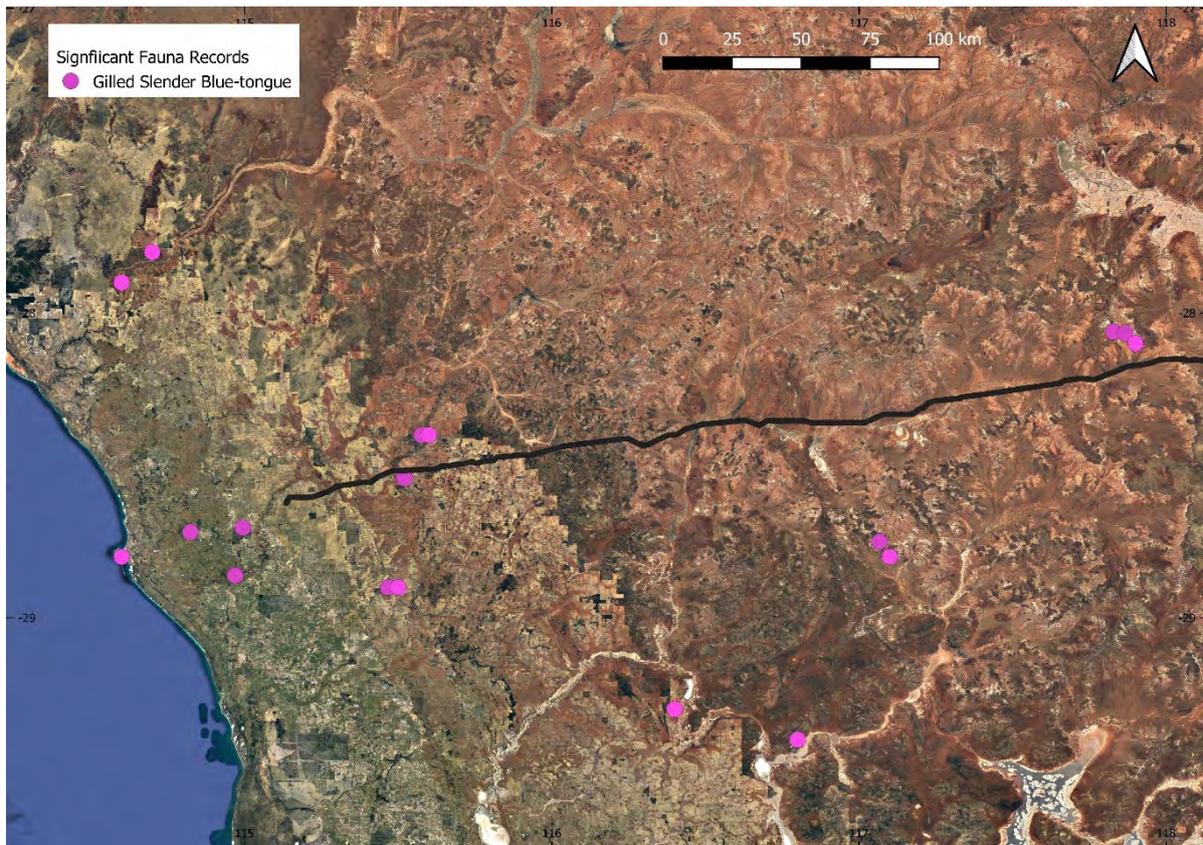
**Plate 1. Western Spiny-tailed Skink Scats Recorded During the Survey.**

### **5.2.2 Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*)**

The Gilled Slender Blue-tongue is listed as Vulnerable under the BC Act. It is confined to the midwest coast, in the Murchison and Irwin River areas, inland to Mount Magnet (Bush *et al.*, 2007). The species is poorly known and recorded from few locations (e.g. nine locations on ALA and 17 on DBCA Databases), most within 100 km of the Pipeline Licence area (DBCA 2020, Figure 8). It has been recorded from Acacia shrublands on loam plains and also rocky areas, including Ellendale Pool and the Koolanooka Hills (DBCA 2020). Several records exist near the Pipeline Licence area, including from Mullewa (in 2016) and Urawa Nature Reserve (in 1998, DBCA 2020), from vegetated remnants in the Wheatbelt. Three records also come from Mount Magnet, with the species recorded on low stony rises (DBCA 2020).

The Gilled Slender Blue-tongue has the potential to occur within the Pipeline Licence area. While known from few locations, the pipeline passes through the species known distribution and habitats known to support it (Acacia shrublands on both loam and stony soils) are present within the Pipeline Licence area. Due to the small size of habitat fragments, the species is unlikely to persist within native vegetation within wheatbelt, however it may occur within the expansive Acacia shrublands east of Pindar (to Mount Magnet).

From a regional perspective, the Gilled Slender Blue-tongue has been recorded within the Austin, Gabanintha, Jundee, Tindalarra and Kalbarri Land Systems (Pringle *et al.*, 1994). Some of these Land Systems occur, but with a minimal presence within the Pipeline Licence area (Gabanintha, 10 ha, and Tindalarra, 1294 ha). Such systems are regionally extensive (Figure 3). As such, the habitat present within the Pipeline Licence area, represents less than 0.1 % of that present regionally (approximately 1304 ha of potential habitat present, comprising the Gabanintha and Tindalarra Land Systems).



**Figure 8. Gilled Slender Blue-tongue Records Adjacent to the Pipeline Licence Area and Surrounds**

### 5.2.3 Yuna Broad-blazed Slider (*Lerista yuna*)

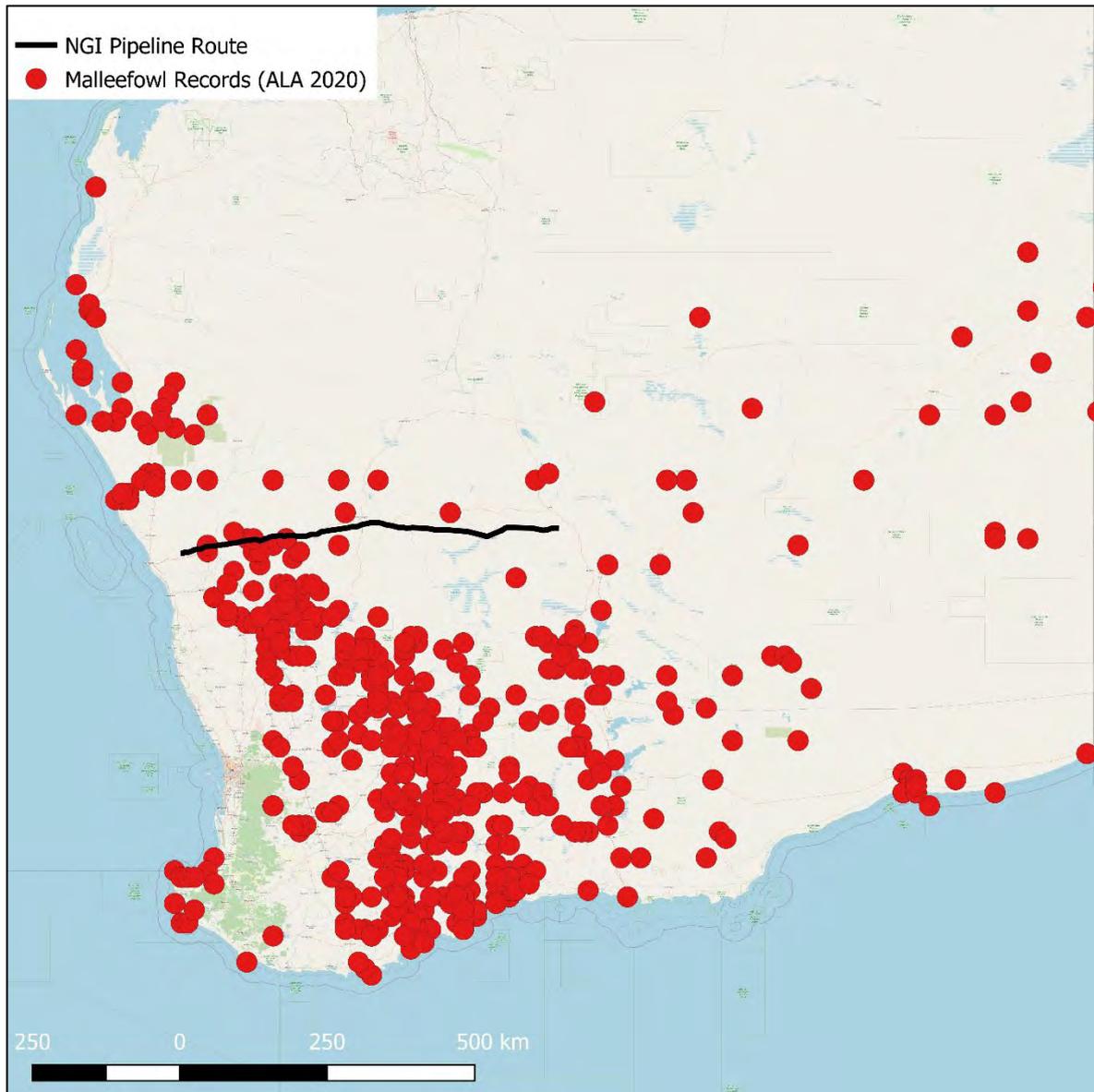
The Yuna Broad-blazer Slider is listed as Priority 3 by DBCA. It has a restricted distribution, known only from the Yuna area (across approximately 70 km, displayed in Figure 9). Several records are located in the vicinity of the western end of the Pipeline Licence area. It has been recorded adjacent to the Pipeline Licence area at Yuna, Urawa Nature Reserves and Tenindewa (Figure 9). The Yuna Broad-blazer Slider inhabits semi-arid Acacia shrublands, burrowing in loose, sandy soils, where it is strongly associated with yellow sands (Teal *et al.*, 2020, R. Lloyd pers. com.). Records near the Pipeline Licence area come from Acacia shrublands on sandy soils (DBCA 2020).

Due to widescale land clearance in the Wheatbelt, minimal habitat occurs within the Pipeline Licence area,. The Pipeline Licence area passes through 4.4 hectares of potentially suitable remnant native vegetation, within the known range of the Yuna Broad-blazed Slider (Appendix 5). These comprise some areas of Eucalypt Woodland, Acacia Shrubland and Banksia Woodland (Table 9). Such vegetation is contained within very small habitat patches (on average less than a hectare) and so prone to degradation. However the species can persist in small, vegetated fragments such as near the Pipeline Licence area, although these are mostly more than 20 hectares in size. While the species has the potential to occur within the Pipeline Licence area, areas of potential habitat, represent a very small portion of that present within the species known range



### 5.2.6 Malleefowl (*Leipoa ocellata*)

The Malleefowl is listed as Vulnerable under State and Commonwealth legislation. The species primarily inhabits dense shrublands and woodlands across semi-arid and arid southern Australia (Benshemesh, 2016, Figure 10). In Western Australia, Malleefowl occur in scrubs and thickets of mallee (*Eucalyptus* spp.), Boree (*Melaleuca lanceolata*), Bowgada (*Acacia ramulosa*), and other dense, litter-forming shrublands including mulga (*Acacia aneura*, Johnstone and Storr, 2004).



**Figure 10. The Malleefowl distribution in Western Australia (records from ALA, 2020)**

Dense vegetation provides protection from predators and the accumulation of leaf litter required for breeding. The Malleefowl's distribution was once larger and less fragmented, but the widespread clearing of suitable habitat, coupled with the degradation of habitat by fire and livestock, and fox predation has reduced Malleefowl numbers considerably (Johnstone and Storr, 2004). The Malleefowl was recorded during the survey with five

inactive mounds recorded and the species distinctive tracks recorded from three locations (Table 16, Figure 11, Plates 2 and 3).

**Table 16. Malleefowl Mounds Recorded During the Survey (WGS 1984)**

Mound	Latitude	Longitude	Profile	Width (m)	Height (cm)	Depth (cm)	Vegetation Code (Focused Vision, 2020)	Land System	Status (Age)
1	-28.436	116.0514	7	5	40	10	CcLOW (inside Pipeline Licence area)	Joseph	Old, inactive
2	-28.4269	116.1253	6	4	30	10	MaTS (inside Pipeline Licence area)	Joseph	Old, inactive
3	-28.4456	116.0027	7	4	30	10	AspTS (outside Pipeline Licence area)	Joseph	Old, inactive
4	-28.4452	116.0012	6	4	30	10	AspTS (outside Pipeline Licence area)	Joseph	Old, inactive
5	-28.432	116.11	7	4	30	10	AcMIS (outside Pipeline Licence area)	Joseph	Old, inactive

Malleefowl construct distinctive nests that comprise a large mound covering a central core of leaf litter. Eggs are laid within the mound, buried and left to incubate by the heat generated from decomposing leaf litter or radiant heat from the sun (Benshemesh, 2007). The mound is constructed out of sand, loam, pebbles or small rocks and as a result, a sandy or gravelly substrate, an abundance of leaf litter and winter rainfall are required for breeding (Benshemesh, 2016).

Malleefowl mounds range in size and diameter, depending on age and activity, however mounds commonly span more than five metres and are up to one metre high. Malleefowl will often renovate old mounds rather than construct new mounds afresh each year so mound construction typically commences with the excavation of an existing mound (although new mounds are also built; National Malleefowl Recovery Team, 2016). The mound is prepared and maintained by an adult pair over 9 - 11 months of the year. Nest preparation occurs in autumn and the male will tend the nest through summer until temperatures begin to fall. Females can forage widely during this time, in search of the nourishment needed to sustain egg production (Priddel and Wheeler, 2003). Malleefowl maintain the mound temperature by adjusting soil cover to either retain or expel heat from the egg chamber (National Malleefowl Recovery Team, 2016). A pair of Malleefowl will often use the same nest over subsequent seasons however nest fidelity is highly variable. Some Malleefowl pairs have been recorded using the same mound for up to nine years while others relocate seasonally between a cluster of two, three or four mounds (Priddel and Wheeler, 2003). Where Malleefowl mounds are used over many generations, mounds can attain a size of over 20 metres (MPG, 2013).

Malleefowl require large amounts of leaf litter for egg incubation and so are generally restricted to areas of dense vegetation that have not been burnt for many years. In the Murchison, Malleefowl are often associated with densely vegetated Mulga shrublands on sandplain, between sand dunes or on gravelly rises. As mound construction and breeding rely heavily on rainfall, Malleefowl fail to breed and abandon mound construction during seasons of low rainfall (Priddel and Wheeler, 2003).

All mounds recorded were old and inactive, however the species has the potential to breed in the area. Mounds were recorded from areas of dense vegetation, typically dense Acacia thickets (*Acacia spp.*) with *Eremophila*, Mallee (*Eucalyptus spp.*) and *Melaleuca*. Mounds were located within Vegetation Codes CcLOW, MaTS, AspTS, and AcMIS (all Acacia dominated vegetation types with the inclusion of *Callitris* and *Melaleuca*, and some Mallee, *Eucalyptus spp.*, Table 16, Appendix 5).

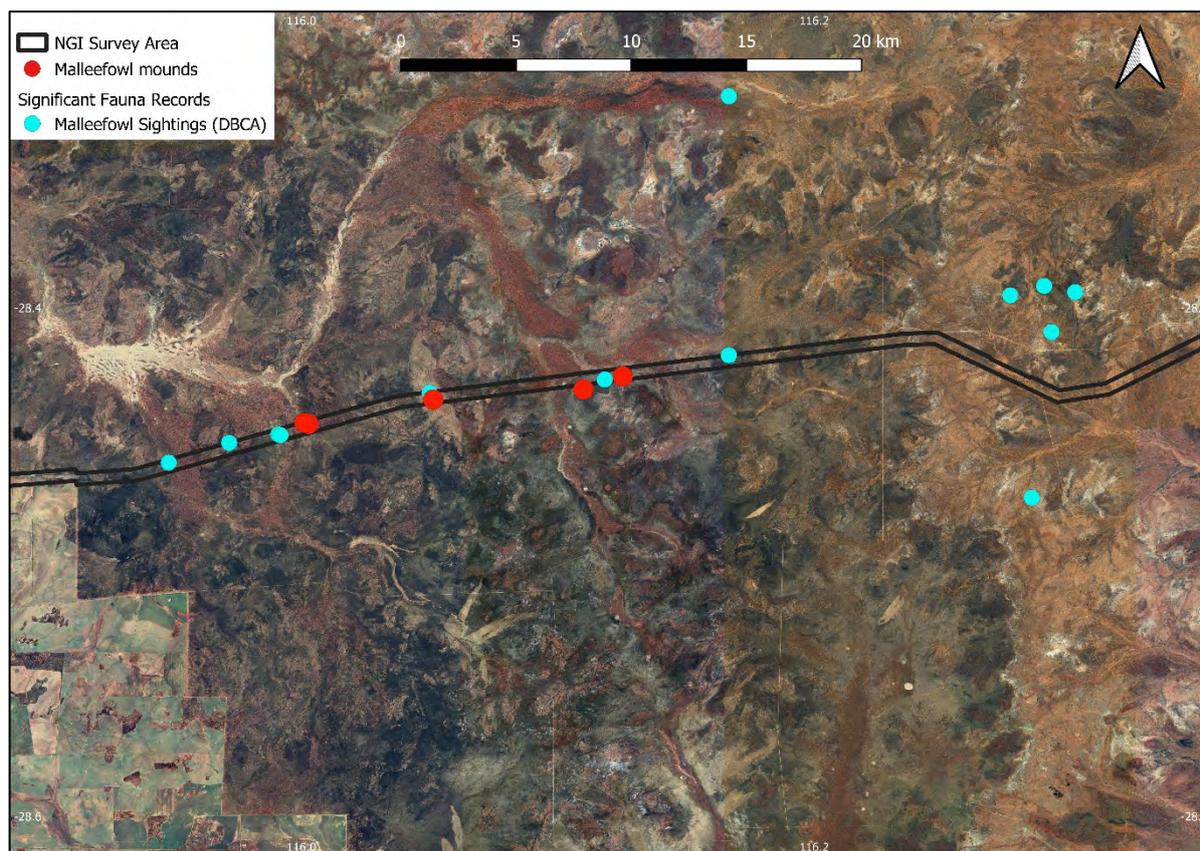
Suitable habitat occurs within the Pipeline Licence area, and due to the minimal presence of habitat within the wheatbelt region, this is restricted to the expansive Acacia shrublands west of Pindar. All Malleefowl mounds present were recorded from the Joseph Land System, described as “Undulating yellow sandplain supporting dense mixed shrublands with patchy mallees” (Pringle *et al.*, 1994). There is 470 hectares of the Joseph Land System present within the Pipeline Licence area (representing 0.1 % of the total Land System occurring in the region). Malleefowl breed in dense vegetation, and as the Pipeline Licence area extends from near Mullewa into the arid interior of Western Australia, most areas of suitable breeding habitat occur in the western parts of the Pipeline Licence area. This reflects the transition of vegetation from dense and diverse Acacia shrublands (with *Melaleucas* and Mallee, near Pindar) to open, species poor, Mulga dominated habitats east of Yalgoo. As such, the majority of habitat suitable for Malleefowl to breed within, along the Pipeline Licence area occurs between Pindar and Wurarga. This area contains the vegetation codes AspTS, AcMIS, AtTS, MaTS, ArEIS, CcLOW, as mapped by Focused Vision (2020). The Joseph Land System is the dominant system present in this area, Due to the open understorey typically present within Eucalypt Woodlands, the species is unlikely to breed within such habitat.



**Plate 2. Malleefowl Mounds 1 – 3, Recorded in the Pipeline Licence Area**



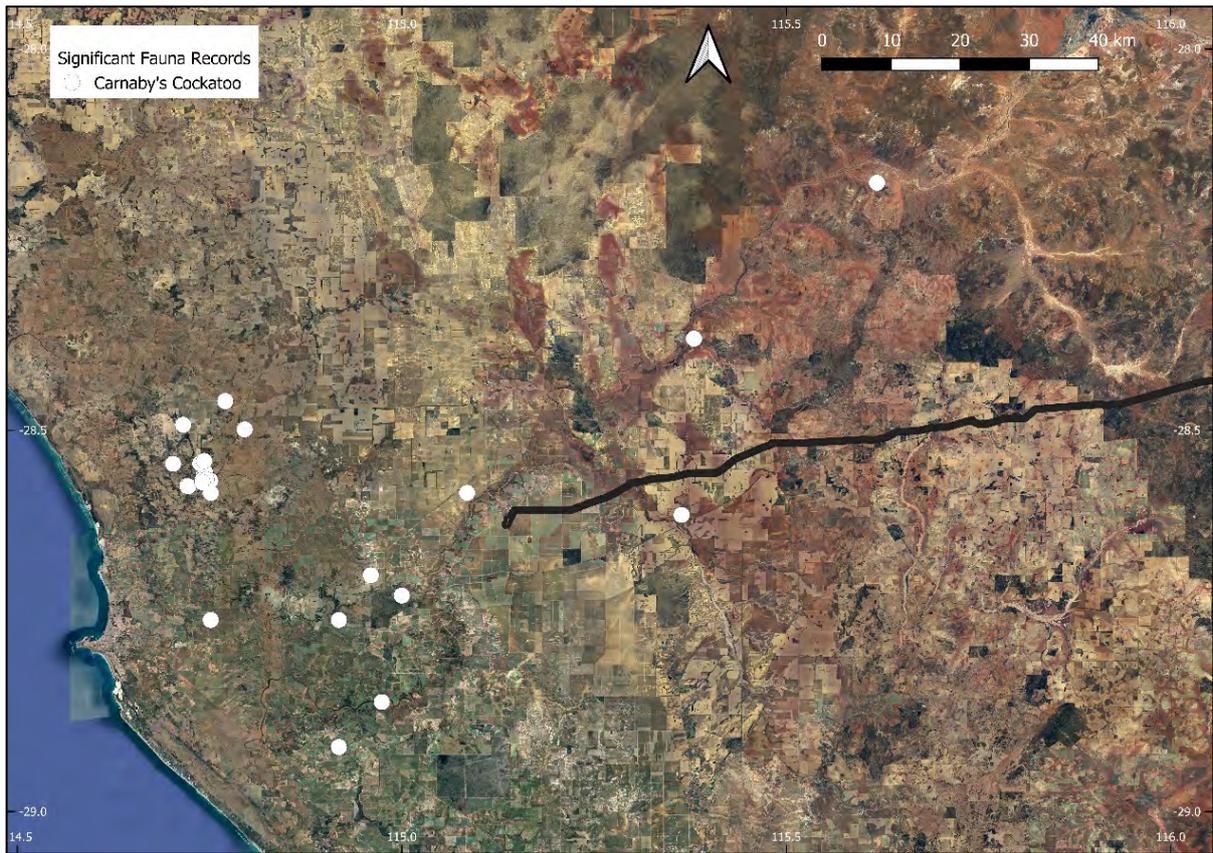
**Plate 3. Malleefowl Mounds 4 - 5, Recorded in the Pipeline Licence Area**



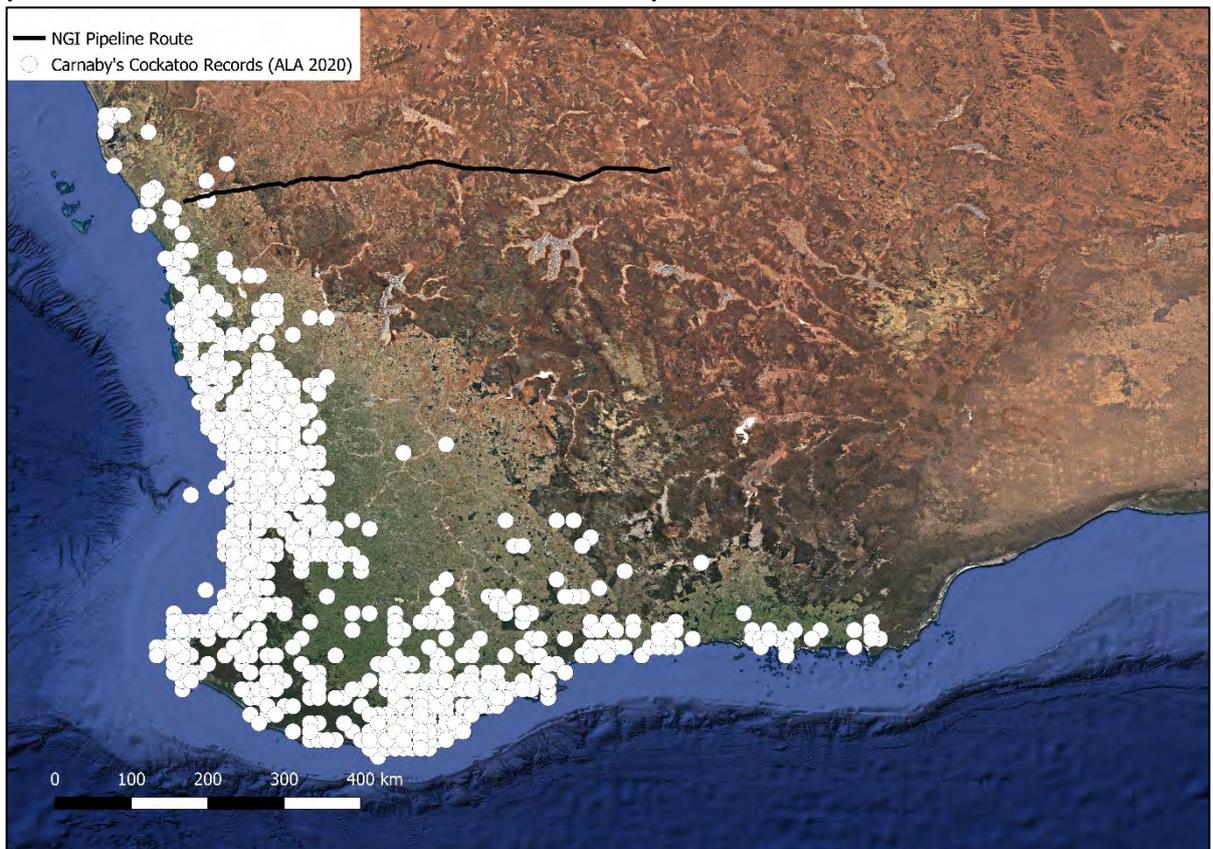
**Figure 11. Malleefowl Records in the Pipeline Licence Area and Surrounds**

### 5.2.7 Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black-cockatoo (listed as Endangered under the EPBC and BC Acts) has been previously recorded adjacent to the NGI project at Tenindewa (approximately 17 km west of Mullewa, and 7 km south of the Pipeline Licence area, DBCA 2020) and from north of Mullewa at Nunierra (DBCA, 2020) (Figure 12). It occurs across a broad swathe of south-western Western Australia, from Kalbarri to Cape Arid (Johnstone and Storr 1998, Figure 12). The species breeds within tree hollows of large Eucalypts and forages within proteaceous shrublands (Johnstone and Storr, 1998). While the western portion of the Pipeline Licence area passes through the known or predicted range of Carnaby's Cockatoo (DoE, 2017), due to the widescale clearance of the Wheatbelt, minimal breeding or foraging habitat occurs within the Pipeline Licence area. Within the Pipeline Licence area, the species predicted range extends from Ambania to near Mullewa (Figures 12 and 13), and the small number of vegetated areas present totals 4 ha (woodlands and shrubland, Table 9). These comprise the vegetation units EbW and BsCaW and are Eucalypt Woodlands and Banksia Shrublands. No large Eucalypt trees, suitable for breeding were recorded, and so the species is unlikely to breed in these areas. Some areas of Eucalypt Woodland (including *E. loxophleba*, a known nesting species, Johnstone and Storr, 1998) occur within the extensive tracts of vegetation east of Mullewa, however these areas lie outside the species current known or predicted range (DoE, 2017). These areas total 31.2 ha (are denoted by Vegetation Code EkEhW, Appendix 5) and are the plains supporting Eucalypt woodlands (*E. kochii*, *Eucalyptus horistes*) with mixed Acacia shrubs. However, no suitable breeding trees were recorded within the Pipeline Licence area, either within the tracts of woodland east of Pindar or within the species known range.



**Figure 12. Carnaby's Cockatoo Records Adjacent to the Pipeline Licence Area and Surrounds (records from DBCA Threatened Fauna Database)**



**Figure 13. Carnaby's Cockatoo Range in Western Australia (records from ALA, 2020)**

### 5.2.8 Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed as Other Specially Protected Fauna under the BC Act, but is generally widespread across its range. The species is found in a variety of habitats, including rocky ledges, cliffs, watercourses, open woodland and acacia shrublands (Johnstone and Storr, 1998). The distribution of the Peregrine Falcon is often tied to the abundance of prey as it predated heavily on other birds. The Peregrine Falcon lays its eggs in recesses of cliff faces, tree hollows or in large abandoned nests of other birds (Johnstone and Storr, 1998). Single birds were recorded from two locations, one north of Pipeline Licence area and one within the Pipeline Licence area (Table 15, Figure 7). Unlike many threatened species, the Peregrine Falcon is not confined to a specific habitat type, instead it occurs across most of Australia. This species generally nests on cliffs, or in tall trees when cliffs are unavailable. Although likely to forage in the Pipeline Licence area, potential breeding habitat is very limited with suitable cliffs absent and suitably tall trees rare.

### 5.2.9 Striated Grasswren (*Amytornis striatus striatus*)

The Striated Grasswren (*Amytornis striatus striatus*) is listed as Priority 4 by DBCA and has a scattered occurrence across arid Western Australia with very few records from the Murchison region. The species favours long unburnt spinifex grasslands, typically with a taller shrub layer. Due to the effects of fire, suitable habitat is uncommon and highly fragmented. An apparently isolated population occurs near Sandstone (based on historic DBCA records) and the species was recorded there during transit during the survey period. Occupied habitat was inspected and as such habitat (long unburnt spinifex grasslands on yellow sandplains with tall dense shrubs) is absent from the Pipeline Licence area, the Striated Grasswren is considered unlikely to occur within the Pipeline Licence area.

### 5.2.4 Brush-tailed Mulgara (*Dasyercus blythi*)

The Brush-tailed Mulgara is listed as Priority 4 by DBCA and has a scattered occurrence across the Murchison, with few regional records (DBCA 2020, Figure 4). The species was recorded within the Pipeline Licence area from motion camera, and via trace evidence, with a number of active burrows located (Table 15, Figure 7). Several active burrows were recorded from sandplains dominated by *Triodia basedowii* with mixed Acacia shrubs (Mulga, Plates 4, 5, 6). These records represent significant regional records and lie on the species southern range extreme (DBCA, 2020). Minimal habitat suitable for the species is traversed by the Pipeline Licence area, with much of the area traversing shrublands devoid of spinifex. Approximately 10 km of suitable habitat (sandplains supporting *T. basedowii*) is traversed by the proposed pipeline in the vicinity of the recorded burrows (Vegetation Unit EkTbHG, Focused Vision 2020, Appendix 5). Minor areas of spinifex may occur outside of this and have the potential to support the species.

The two areas supporting the Brush-tailed Mulgara within the Pipeline Licence area are situated within the Kalli and Tyrrell Land Systems, characterised by sandplains supporting Acacia shrublands and Spinifex (*Triodia basedowii*, Pringle *et al.*, 1994). Both Land Systems are extensive in the local and regional area (Figure 3). The unit areas present within the Pipeline Licence area represent less than 0.002 % of that occurring in the greater region. As the pipeline traverses a significant population (previously undocumented and potentially isolated), on the species southern range extreme, disturbances to active burrows are recommended to be avoided where possible.



**Plate 4. Brush-tailed Mulgara Recorded from the Pipeline Licence Area (burrow; scats inset left; camera inset right).**



**Plate 5. Brush-tailed Mulgara Burrows Recorded from the Pipeline Licence Area**



**Plate 6. Brush-tailed Mulgara Burrow Recorded from the Pipeline Licence Area**

### **5.2.5 Long-tailed Dunnart (*Sminthopsis longicaudata*)**

The Long-tailed Dunnart is listed as Priority 4 by DBCA as it is known from few scattered localities across arid western and central Australia. In Western Australia the species has been recorded from few widely separated populations, extending from the Pilbara south to the Murchison and Gibson Desert (DBCA, 2020). The Long-tailed Dunnart is a specialist of rugged, rocky landscapes, inhabiting rocky ridges, hills and breakaways (Pavey, 2006). Across the Murchison the species is significantly dependant on the banded ironstone formation ranges scattered through the region (DEC, 2007) resulting in its highly fragmented range. There are few records for the species in the southern Murchison, however the species has been recorded at its southern extent from banded ironstone ridges at Mount Ida and Mount Forest (DBCA, 2020). Throughout its range the Long-tailed Dunnart occurs in rugged rocky landscapes that support a low open woodland or shrubland of Acacias (particularly Mulga; Pavey, 2006).

The Long-tailed Dunnart was recorded during the NGI survey, with an individual recorded on motion camera established on the slopes of an ironstone ridge (Table 15, Figure 7, Plate 7). However this location was located outside of the Pipeline Licence area, approximately 300 m north of the project boundary (Appendix 5). The species was readily identified by a combination of size, body shape, tail length and tail position; an exceptionally long tail held in a range of positions, including almost vertically during movement. The Pipeline Licence area lies near the southern extent of the Long-tailed Dunnart's distribution (DBCA, 2020).

The Long-tailed Dunnart was recorded on a stony scree slope adjacent to a heavily dissected area of ironstone outcropping near the crest of an ironstone ridge. Vegetation was dominated by Acacia shrubs, particularly mulga (*Acacia aneura* complex) with an understory including *Eremophila* species. The record is located within the Brooking Land System, described as “Prominent ridges of banded iron formation supporting mulga shrublands” (Pringle *et al.*, 1994). While recorded outside of the Pipeline Licence area, the stony slopes associated with the Brooking Land System encroach the Pipeline Licence area, with approximately 4 hectares within the project boundaries. As the Long-tailed Dunnart is mobile, it has the potential to traverse the Pipeline Licence area, although suitable habitat appears minimal and limited to the 4 hectares adjacent to the ironstone ridge.

The Long-tailed Dunnart is likely to occur throughout the wider area, however, is restricted to rocky habitats, which lie mostly outside the Pipeline Licence area. As such, minimal habitat exists within the proposed Pipeline Licence area.



**Plate 7. Long-tailed Dunnart Recorded During the Survey.**

### 5.2.10 Locally Significant Birds

Several woodland bird species are recognised as declining in Western Australia (Saunders and Ingram, 1995; Fox *et al.*, 2016; BirdLife Australia, 2020) and sensitive to threatening processes (Johnstone and Storr 1998, 2004; Woinarski *et al.*, 2017). Listed species include the Regent Parrot, Southern Scrub-robin, Western Yellow Robin, Rufous Treecreeper, Bush Stone-curlew, Major Mitchell’s Cockatoo and Scarlet-chested Parrot (Table 14). These species have lost considerable areas of habitat within the Wheatbelt (due to widescale land clearance for agriculture), and, as they are now increasingly absent or rare over much of their former range, their retention is of conservation significance (Duncan *et al.*, 2006). The Pipeline Licence area lies near the arid extreme of several species range, and so woodland birds present are likely to occur there in small, fragmented and vulnerable populations.

One species, the Western Yellow Robin was recorded during the survey (albeit outside the project’s boundaries by 50 – 60 m). It occurs in temperate woodlands and shrublands of the south-west and occurs inland to the Mullewa (Fox *et al.*, 2016; DBCA, 2020). The species was recorded from densely vegetated shrublands east of Mullewa (Table 15, Figure 7), likely to be near the arid extreme of the species range. Along the arid fringes of its range, the Western Yellow Robin occurs in scattered refugia, inhabiting dense thickets of acacia.

The Slender-billed Thornbill was formerly listed as Vulnerable under the EPBC Act and is considered threatened, declining and regionally significant (McKenzie *et al.*, 2003, BirdLife International, 2020). It occurs in chenopod shrubland, typically in areas of saltmarsh dominated by Samphire (*Tecticornia* spp.), Bluebush (*Maireana* spp.) or Saltbush (*Atriplex* spp.) around salt lakes or low heath on sandplain (Pavey, 2002). The species is declining over much of its range due to the degradation of chenopod vegetation by livestock and rabbits (Johnstone and Storr, 2004). Across inland Western Australia, the Slender-billed Thornbill occurs in several disjunct populations and is rare and declining (in some places locally extinct, Johnstone and Storr, 2004). The Slender-billed Thornbill was not recorded during the survey, however, has been recorded from the Mount Magnet area and from drainage systems near Yalgoo (ALA 2020). As suitable vegetation exists in the Pipeline Licence area, there is potential for the species to occur.

The Bush Stone-curlew was until recently classified as Priority 4 by DBCA and due to large scale declines over much of southern Australia, is considered threatened (state listed in South Australia, Victoria and New South Wales). Bush Stone-curlews are ground dwelling birds (they roost, nest and forage at ground level) and are sensitive to predation and habitat fragmentation (Johnstone and Storr, 1998; Woinarski *et al.*, 2017). The species has a scattered occurrence throughout the Murchison, where it is often associated with acacia shrublands (including mulga), banded ironstone ranges and ephemeral or permanent watercourses (J. Turpin, pers. obs.). The Bush Stone-curlew occurs in the local area and has been reported to occur in the vicinity of the Pipeline Licence area on Atley Station. It is likely to occur within the Pipeline Licence area, however it's preferred habitat (Acacia shrublands and Eucalypt Woodlands) are regionally extensive, reflecting the species widespread regional distribution (Figure 4).

#### **5.2.11 Northern Shield-backed Trapdoor Spider**

The Northern Shield-backed Trapdoor Spider, *Idiosoma clypeatum*, is listed as Priority 3 by DBCA. It has a scattered distribution through the Yalgoo and Murchison Bioregions where it is the only known species in the *nigrum*-group (Rix *et al.*, 2018). Several records lie within 20 km of the Pipeline Licence area south of Wurarga (from 11 km south), within the Challenge, Kalli and Violet Land Systems (DBCA, 2020, see Section 2.3). The Challenge and Kalli Land Systems are also traversed by the Pipeline Licence area and are described as supporting Acacia shrublands on plains (Pringle *et al.*, 1994). While such habitat is extensive within the Pipeline Licence area, it is also widespread throughout the Murchison region. As such, *Idiosoma clypeatum* is likely to occur within the Pipeline Licence area.

#### **5.2.12 Geraldton Sandplains Shield-backed Trapdoor Spider**

The Geraldton Sandplains Shield-backed Trapdoor Spider (*Idiosoma arenaceum*) is listed as Priority 3 by DBCA. It has a moderately widespread distribution in the Geraldton Sandplains and far northern Wheatbelt bioregions of south-western Western Australia, from near Yandanooka, Canna, and Geraldton north to Zuytdorp (Rix *et al.*, 2018). It has been recorded burrowing amongst the leaf litter of Acacia and Casuarina shrubs (Rix *et al.*, 2018). The nearest records of the species to the Pipeline Licence area come from approximately 26 km south, from large areas of native vegetation including the Canna and Warrawah Nature Reserves (DBCA 2020). While the Pipeline Licence area passes through the species known

range, due to the extensive land clearance across the wheatbelt, areas of native vegetation within the project are minimal (shrublands totalling approximately 7 ha, although most are less than one hectare between Ambania and Warramboe Lake). The species is considered to have the potential to occur within the Pipeline Licence area, however due to the small areas of habitat, its occurrence seems unlikely.