

5.3 Additional Species of Significance

While additional species of significance have the potential to occur in the area, some are considered unlikely to occur within the Pipeline Licence area, due to the limitations of habitat or range (Table 14). This includes the Sandhill Dunnart, Night Parrot, Princess Parrot, Migratory Waders and *Teyl* sp. (Minnivale Trapdoor Spider). These are discussed below.

The Night Parrot (*Pezoporus occidentalis*, EPBC Endangered and BC Critically Endangered), has a poorly known distribution, however, has been recently recorded across several areas of arid Western Australia (Hamilton *et al.*, 2017; Jackett *et al.*, 2017). Historical records come from Mount Farmer (approximately 50 km north of the Pipeline Licence area) and near Mount Keith (approximately 130 km north of the Pipeline Licence area; Johnstone and Storr 1998) and suitable areas of habitat exist throughout the region (such as at Lake Noondie, 3 km south of the Pipeline Licence area; J. Turpin, pers. obs.). The DBCA has developed an interim guideline for Night Parrot survey in Western Australia (DPaW, 2017) and the majority of the NGI corridor is regarded as a medium priority for survey and assessment. The far western section of the Pipeline Licence area within the Wheatbelt is outside the species range. The Night Parrot is primarily associated with old and large spinifex clumps (often > 50 years unburnt), especially hummocks that are ring-forming (and is sometimes associated with other vegetation types, such as dense chenopod shrubs; DPaW, 2017). Such habitat occurs across the Murchison region, however, was not recorded from the Pipeline Licence area. The species has not been recently recorded in the local area and the types of spinifex typically found do not form large rings (potentially due to the interactions of soil and fire history). Spinifex was present in small areas associated with Mulga (Vegetation Code EkTbHG, Focused Vision 2020). Due to a lack of suitable habitat, the species is unlikely to roost or breed within the Pipeline Licence area.

The Sandhill Dunnart (*Sminthopsis psammophila*) is listed as Endangered under the EPBC and BC Acts, and is currently only known from the southern Great Victoria Desert. However, historical records come from near the Narring Ranges (approximately 20 km north of the Pipeline Licence area) and Lake Barlee (approximately 120 km south of the Pipeline Licence area, from material collected in 1985, A. Baynes pers. com). As such, the species formerly occurred in the region. The Sandhill Dunnart inhabits spinifex sandplains on deep yellow sands, with a diverse shrubby understorey. Such habitat occurs through the region such as near Sandstone, supporting other species characteristic of the Great Victoria Desert. However, suitable habitat is absent from the Pipeline Licence area and due to a lack of suitable vegetation, combined with an absence of recent records, the Sandhill Dunnart is unlikely to occur within the Pipeline Licence area.

The Grey Falcon is listed as Vulnerable under the BC Act. It inhabits grasslands on open plains, low acacia shrublands and occurs along eucalypt-lined drainage systems (J. Turpin, pers. obs.). Although it has an extremely large range across arid Australia, the Grey Falcon occurs at very low densities and its population has been precautionarily estimated to number fewer than 1,000 mature individuals (BirdLife Australia, 2020). In central Western Australia, populations appear to be concentrated around inland drainage systems. The species has been recorded from the Mullewa area, however, as few records exist near the Pipeline Licence area (DBCA, 2020), the species may be a rare visitor (vagrant) to the area.

Several waterbirds listed as Migratory under the BC Act and/or EPBC Act have been recorded within 50 km of the Pipeline Licence area (DBCA, 2020). These include the Glossy Ibis, Common Greenshank, Common Sandpiper, Curlew Sandpiper, Pectoral Sandpiper, Sharp-tailed Sandpiper, Wood Sandpiper, Gull-billed Tern and Osprey (DBCA, 2020). Migratory waterbirds are expected to occur in the region during periods of flooding, however, the survey area does not traverse any of the extensive salt lake systems in the region. The only potential habitat present is in seasonally or ephemerally inundated areas in broad drainages, and these habitats are limited in extent and significance as waterbird habitat. Due to a lack of suitable habitat, these species are unlikely to occur within Pipeline Licence area, except as occasional vagrants. Similarly, waterbirds listed as Priority by DBCA (Blue-billed Duck and Hooded Plover) are considered to have a very limited occurrence (expected as vagrants).

The Princess Parrot (*Polytelis alexandrae*) and Fork-tailed Swift (*Apus pacificus*) are highly mobile and occur in the region very infrequently. They are not expected to depend on habitats present within the Pipeline Licence area. The Fork-tailed Swift is a non-breeding visitor to Australia between September and April (Johnstone and Storr, 1998). Although a migratory species, it has a large range and a large population that appears to be stable (BirdLife International 2020). The Fork-tailed Swift is largely an aerial species in Australia, and is not likely to be reliant on any terrestrial habitat in the Pipeline Licence area.

The Letter-winged Kite (*Elanus scriptus*, DBCA Priority 4) is a nocturnal bird of prey that inhabits open or sparsely wooded country, mainly in eastern Australia (Johnstone and Storr, 1998, Garnett *et al.*, 2010). Its population fluctuates and, in good years when prey species are abundant, it has an irruptive population that can spread to any part of Australia (Garnett *et al.*, 2010). The Letter-winged Kite may occur as a vagrant in the region, but the Pipeline Licence area is unlikely to represent core habitat.

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). *Idiosoma nigrum* is unlikely to occur within the Pipeline Licence area. Other taxa are known from only one location, such as *Kwonkan moriartii* (Kathleen), or confined to restricted habitats absent from the Pipeline Licence area (*Teyl* sp., perched swamps, DBCA, 2020).

5.4 Significant Fauna Habitats

Habitats of conservation significance tend to be those both rare across the landscape and important for restricted fauna and/or for biodiversity (relictual habitats and refugia). For example, outlying mesic habitats (supporting restricted fauna) occur intermittently in the arid zone, and are often associated with elevated topography and moisture, where runoff allows for the development of dense thickets of vegetation and water ponds in occasional gnamma (rock) holes. Disturbance to such restricted habitat in a localised area can have significant impacts if restricted fauna is supported or if critical roosting or breeding habitats are disturbed.

The Pipeline Licence area is situated on a biogeographic interzone, crossing from the temperate south-west into the arid interior. As a result, the corridor contains a mix of vegetation types with elements of both regions. While most of the Pipeline Licence area is composed of widespread habitats (Section 4.1), some uncommon or regionally restricted habitats were noted to occur. Additionally, some habitats that support (or have the potential to support) significant or restricted fauna were identified. These include:

- Granite Outcrops:
 - An isolated habitat supporting a restricted, saxicoline assemblage including Wooley's Pseudantechinus, and has the potential to support the Western Spiny-tailed Skink and short-range endemic (SRE) fauna;
 - Occurs in small restricted areas with minimal occurrence along the Pipeline Licence area (15.84 ha);
- Breakaways:
 - An isolated habitat supporting a restricted, saxicoline assemblage including Wooley's Pseudantechinus, and has the potential to support the Western Spiny-tailed Skink and Short-range endemic (SRE) fauna;
 - Occurs in small restricted areas with minimal occurrence along the Pipeline Licence area (1.5 ha);
- Eucalypt Woodland (e.g. *E. loxophleba*, *E. kochii*, *E. horistes* – Codes EkEhW, EbW):
 - Likely to support several woodland species near the northern extreme of their range (e.g. locally significant fauna such as Rufous Treecreeper, Western Yellow Robin, Carpet Python);
 - Has the potential to support the Western Spiny-tailed Skink although the species was not recorded within the Pipeline Licence area;
- Banded Ironstone Ridge and adjacent stony slopes:
 - Supports a regionally restricted, saxicoline assemblage, including the Long-tailed Dunnart;
 - Situated outside of (but adjacent to) the Pipeline Licence area (at -28.363, 119.756).
- Spinifex Sandplains:
 - Some areas of spinifex sandplain (Vegetation code EkTbHG) traversed by the Pipeline Licence area support the DBCA Priority Brush-tailed Mulgara. Burrows are likely to be widespread in this habitat. Approximately 195 ha of unit EkTbHG occur within the Pipeline Licence area;
- Densely vegetated Acacia shrublands:

- o Some long-unburnt and densely vegetated, litter forming shrublands are traversed by the proposed pipeline route. Such habitat supports the Malleefowl and has the potential to support the Northern Shield-backed Trapdoor Spider, listed as Priority 3 by DBCA. The Joseph Land System encompasses approximately 470 hectares within the Pipeline Licence area (see Figure 14, Table 17).
- Remnant Native Vegetation of the Wheatbelt: Some small vegetated remnants are traversed by the Pipeline Licence area. Most are unlikely to support significant fauna, however the Western Spiny-tailed Skink was recorded adjacent to the Pipeline Licence area and *Lerista yuna* may occur within intact vegetation. Those areas of remnant vegetation of highest value to significant fauna include the Eucalypt Woodlands (EbW, ElW, EsMnS) as these provide nesting and shelter to a range of fauna including the Peregrine Falcon, and areas of Acacia shrublands (AnTOS, McS) have the potential to support the Gilled Slender Blue-tongue and Yuna broad-blazed slider (although the likelihood of their occurrence is reduced due to the small size of vegetated remnants). While Banksia Woodlands (BsCaW), may support the highly restricted Yuna broad-blazed slider and provide foraging habitat for the Carnaby's Cockatoo, the area of habitat within the Pipeline Licence area is extremely small (0.68 ha).

5.5. Summary

While most fauna occurring within the Pipeline Licence area are likely to be widespread, some conservation significant fauna occur (or are likely to be present). The Malleefowl, Brush-tailed Mulgara and Peregrine Falcon were confirmed to be present, while the Gilled Slender Blue-tongue, Northern Shield-backed Trapdoor Spider and five locally significant species (Carpet Python, Western Yellow Robin, Slender-billed Thornbill, Regent Parrot, Bush Stone Curlew) are considered likely to occur within the habitats present. The Western Spiny-tailed Skink is known to occur in adjacent habitats, however was not recorded during the survey and suitable shelter sites for colonies appear lacking. Similarly, the Long-tailed Dunnart was recorded from adjacent rocky habitats that are absent from the Pipeline Licence area. The regionally restricted Yuna Broad-blazed Spider and Geraldton Sandplains Trapdoor Spider have the potential to occur, however prefer habitats with only minimal presence within the Pipeline Licence area. Similarly, Carnaby's Cockatoo has the potential to forage within some of the smaller vegetated areas within the wheatbelt, but is unlikely to breed there. Wide-ranging and mobile species such as migratory waterbirds are likely to occur infrequently within the Pipeline Licence area. These taxa are discussed below (see Table 17).

The Malleefowl breeds within the dense shrublands present between Pindar and Wurarga, contained within the Joseph Land System. While fresh tracks were recorded outside of this area, breeding habitat to the east of Wurarga is minimal. The species has a widespread but patchy occurrence across southern Australia.

The Brush-tailed Mulgara, is restricted to those habitats containing spinifex (*Triodia basdowii*, mapped by Focus Vision as unit EkTbHG). Within the Pipeline Licence area, this habitat is contained within the Kalli and Tyrrell Land Systems. Both Land Systems are extensive in the local and regional area. The Pipeline Licence area, lies at the southern

extreme of the species range, with the Mulgara recorded within the area, previously undocumented and representing a southern range extension.

The Peregrine Falcon is a wide ranging species that breeds within cliff faces and large tree hollows. Due to a lack of suitable breeding sites, the species is likely to be a foraging visitor to the Pipeline Licence area.

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). The Land Systems supporting the species are widespread in the greater area.

The Yuna Broad-blazed Slider and Geraldton Sandplains Shield-backed Trapdoor Spider have small ranges that overlap with the Pipeline Licence area. Both are restricted to small and fragmented areas of native vegetation within the wheatbelt, reflected in their conservation status. Due to widescale land clearance in the wheatbelt, minimal habitat occurs within the Pipeline Licence area. The Pipeline Licence area passes through less than 5 hectares of potentially suitable remnant native vegetation, however such vegetation is contained within very small habitat patches (on average less than a hectare) and so prone to degradation. While both species have 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.

6. DISCUSSION

6.1 Overview

The Pipeline Licence area extends over approximately 580 km, and traverses four bioregions. The fauna assemblage present 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 (Western Yellow Robin, Brush-tailed Mulgara, Woolley's *Pseudantechinus*, Long-tailed Dunnart).

While the Pipeline Licence area extends over a large distance, the proposed clearing footprint is narrow (a 30m wide corridor along the pipeline route) and linear, meaning impact within any vegetation or fauna community is localised. The NGI pipeline is proposed to be buried and native vegetation rehabilitated after clearance, limiting long term impacts to fauna and their associated habitats. Potential impacts arising from the NGI project could include:

- Fauna mortality during clearing;
- Disturbances associated with noise, dust, vehicle movements or light;
- Habitat loss, degradation or fragmentation resulting from pipeline construction;
- Changes to fire regimes;
- Introduction or abundance change of invasive species; and
- Hydrological changes.

The Pipeline Licence area is comprised of vegetation in varying states of condition. While much of the vegetation is intact, some areas have been disturbed by previous agricultural, pastoral, exploration and mining activities and road and rail construction. Much of the Pipeline Licence area is composed of widespread vegetation and the fauna habitats present are widespread both along the pipeline route and throughout the containing regions. The local occurrence of fauna habitats within the Pipeline Licence area reflect their regional occurrence, with common and widespread habitats (such as Acacia shrublands) the dominant units across the majority of the route, and rare or restricted habitats having a minimal occurrence. Fauna habitats present within the Pipeline Licence area are mostly associated with Acacia, include Mulga shrublands (43%), mixed Acacia shrublands (10%), open Acacia or mixed shrublands (21%). Reduced areas of Chenopod shrubland (4%), Mulga with a *Spinifex* understorey (2%) and dense Acacia / *Melaleuca* shrublands (4%) occur. Those habitats with minimal occurrence (reflecting a reduced or restricted regional occurrence) include Granite Outcrops (<1%), Breakaways (<1%), Eucalypt Woodland (<1%), *Callitris* Woodlands (<1%), *Banksia* Woodlands (<1%) and remnant Woodlands and Shrublands within the wheatbelt (<1%). A similar pattern is observed with the Land Systems present, with those associated with Acacia on plains the dominant systems within the Pipeline Licence area. Five Land Systems present have over 450 ha mapped within the project's boundaries (the Joseph, Mileura, Monk, Tindalara and Woodline Systems, Pringle *et al.*, 1994). The Land Systems with restricted occurrences regionally, such as those associated with rocky hills or major drainages (e.g. Brooking, Bandy, Gabanintha, Wilson, Gransal, Gumbreak) have a minimal occurrence within the Pipeline Licence area. As the Pipeline Licence area extends through the Wheatbelt region, disturbed areas (e.g. pastures, cleared areas) comprise a significant portion of the fauna habitats present within the western portion of the pipeline (12.5 % overall).

Most fauna occurring within the Pipeline Licence area are likely to be widespread, as the fauna habitats present are dominated by those with extensive representation across the region. However some conservation significant fauna occur (or are likely to be present). The key species likely to be impacted by the proposed development include:

- Malleefowl (Vulnerable under the EPBC and BC Acts);
- Brush-tailed Mulgara (DBCA Priority 4);
- Gilled Slender Blue-tongue (Vulnerable under the BC Act);
- Northern Shield-backed Trapdoor Spider (DBCA Priority 3);
- Locally significant taxa (e.g. Carpet Python, Western Yellow Robin, Slender-billed Thornbill, Regent Parrot, Bush Stone Curlew).

Other significant fauna have the potential to be impacted, however these include species with minimal to no suitable habitat present within the Pipeline Licence area (Western Spiny-tailed Skink, Long-tailed Dunnart, Geraldton Sandplains Shield-backed Trapdoor Spider), mobile taxa which are unlikely to breed within the project's boundaries (e.g. Carnaby's Cockatoo, Peregrine Falcon) or poorly known taxa with few local known populations (Yuna Broad-blazed Slider, Woma). The local occurrence of significant fauna is summarized in Table 17 below. Table 17 lists those key fauna with resident populations expected within or adjacent to (within 10 km) the NGI Pipeline Licence area.

Table 17. Occurrence of Significant Fauna within the Pipeline Licence Area.

Species	Occurrence in Pipeline Licence	Local Habitat	Habitat Occurrence: NGI	Habitat Occurrence: Regional
Malleefowl	Present	Acacia	Breeding from Pindar – Wurarga (Joseph Land System, 470 ha), minor or foraging elsewhere.	Extensive, NGI represents 0.1 % of Joseph Land System overall.
Western Spiny-tailed Skink	Unlikely – no suitable habitat recorded	Woodland	Yalgoo, Mullewa	Fragmented, scattered throughout the region, associated with woodland and outcrops.
Gilled Slender Blue-tongue	Likely – suitable habitat recorded	Acacia	Gabanintha, Tindalra Land Systems	Extensive, NGI represents <0.1 % of regional habitat
Long-tailed Dunnart	Visitor – minimal suitable habitat recorded	Outcrops	Minimal (4 Ha, Brooking Land System north of Lake Noondie)	Fragmented, limited to rocky ridges. NGI represents <0.01 % of Brooking Land System.
Brush-tailed Mulgara	Present	Sandplain	Limited to approximately 10 km of sandplain (EkTbHG) totalling 195 Ha.	Extensive, NGI represents <0.1 % of regional habitat
Yuna Broad-blazed Slider	Potentially present – minimal suitable habitat recorded	Sandplain	Minimal in Mullewa area (approximately 4 ha)	Restricted to the Yuna area across approximately 70 km
Woma	Unlikely / Potentially Present (suitable habitat located outside known range)	Sandplain	Unlikely – historical records only. Suitable sandplains east of Pindar.	Unknown. Last recorded in 1989 from Watheroo
Northern Shield-backed Spider	Likely – suitable habitat recorded	Acacia	Challenge, Kalli Land Systems	Extensive, NGI represents <0.1 % of regional habitat
Peregrine Falcon	Present	Woodland	A widespread and mobile species, a visitor to most of the NGI	Extensive, NGI represents <0.1 % of regional habitat

Species	Occurrence in Pipeline Licence	Local Habitat	Habitat Occurrence: NGI	Habitat Occurrence: Regional
Carnaby's Cockatoo	Unlikely (potential for foraging)	Woodland	Minimal (approximately 4 ha), and some areas degraded	Extensive, NGI represents <0.1 % of regional habitat
Geraldton Sandplains Trapdoor Spider	Potentially Present – minimal suitable habitat recorded	Sandplain	Minimal (approximately 7 ha), and some areas degraded	Unknown

The Malleefowl breeds within the dense shrublands present between Pindar and Wurarga, contained within the Joseph Land System (totalling 470 Ha, Table 17). While fresh tracks were recorded outside of this area, breeding habitat to the east of Wurarga is minimal. The species has a widespread but patchy occurrence across southern Australia and is known to breed within a wide range of vegetation types, predominantly those characterised by dense, litter forming shrublands.

The Brush-tailed Mulgara, is restricted to those habitats containing spinifex (*Triodia basdowii*, mapped by Focus Vision as unit EkTbHG). Within the Pipeline Licence area, this habitat is contained within the Kalli and Tyrrell Land Systems. Both Land Systems are extensive in the local and regional area. The Pipeline Licence area, lies at the southern extreme of the species range, with the Mulgara recorded within the area previously undocumented, and representing a southern range extension.

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). The Land Systems supporting the species (particularly Tindalarra) are widespread in the greater area.

The Peregrine Falcon is a wide ranging species that breeds within cliff faces and large tree hollows. Due to a lack of suitable breeding sites (cliff faces or large Eucalypt trees), the species is likely to be a foraging visitor to the Pipeline Licence area. Some very small areas of large Eucalypts occur and these are associated with Eucalypt Woodlands on plains or fringing creeklines and have a minimal occurrence within the Pipeline Licence area.

The Yuna Broad-blazed Slider and Geraldton Sandplains Shield-backed Trapdoor Spider have small ranges that overlap with the Pipeline Licence area. Both are restricted to small and fragmented areas of native vegetation within the wheatbelt, reflected in their conservation status. Due to widescale land clearance in the wheatbelt, minimal habitat occurs within the Pipeline Licence area. The Pipeline Licence area passes through less than 5 hectares of potentially suitable remnant native vegetation, however such vegetation is contained within very small habitat patches (on average less than a hectare) and so prone to degradation. While both species have 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.

The Western Spiny-tailed Skink is known to occur in adjacent habitats, however was not recorded during the survey and suitable shelter sites for colonies appear lacking. Similarly, the Long-tailed Dunnart was recorded from adjacent rocky habitats that are absent from the Pipeline Licence area.

The regionally restricted Yuna Broad-blazed Spider and Geraldton Sandplains Trapdoor Spider have the potential to occur, however prefer habitats with only minimal presence within the Pipeline Licence area (Table 17). Similarly, Carnaby's Cockatoo has the potential to forage within some of the smaller vegetated areas within the wheatbelt, but is unlikely to breed there. Wide-ranging and mobile species such as migratory waterbirds are likely to occur infrequently within the Pipeline Licence area. Those species listed under the EPBC Act are discussed further below.

6.2 EPBC Listed Fauna

When developments propose to undertake an action that has, will have or is likely to have a significant impact on a species listed under the EPBC Act, the proposed development is required to be referred to the DAWE (Department of Agriculture, Water and the Environment). The Federal Environment Minister determines whether assessment is required under the EPBC Act (DAWE, 2020). Guidelines for a referral involving EPBC listed species have been prepared: Matters of National Environmental Significance Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (DoE, 2013; DAWE, 2020). The DAWE lists a significant impact as "an impact which is important, notable, or of consequence, having regard to its context or intensity" (DAWE, 2020).

Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts (DoE, 2013; DAWE, 2020). A significant impact is "likely" if the impact on the environment is a real (or not remote) chance or possibility. An action will require Commonwealth approval if the action has, will have, or is likely to have a significant impact on a species listed under the EPBC Act. While the proposed disturbance footprint is not yet known, the criteria below allow for a preliminary impact assessment.

Critically Endangered and Endangered Species

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

- Reduce the area of occupancy of the species;
- Lead to a long-term decrease in the size of a population;
- Fragment an existing population into two or more populations;
- Adversely affect habitat critical to the survival of a species;
- Disrupt the breeding cycle of a population;
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- Result in invasive species (that are harmful to a listed species) becoming established in the listed species' habitat;
- Introduce disease that may cause the species to decline; and/or
- Interfere with the recovery of the species (DoE, 2013).

Five species listed as endangered under the EPBC Act have been recorded within the region and one of these, the Western Spiny-tailed Skink, was recorded during the survey. The Endangered Night Parrot and Carnaby's Cockatoo, while occurring in the wider region are unlikely to depend on habitats within the survey area. While both have the potential to occur occasionally within the survey area (vagrant individuals considered possible) they are unlikely to breed or regularly forage within the Pipeline Licence area. Additionally, a further two Endangered taxa, the Shield-back Trapdoor Spider and Sandhill Dunnart formerly occurred in the region. The Shield-backed Trapdoor Spider is now considered to be restricted to the Wheatbelt after taxonomic revision and Sandhill Dunnart is known only from historical records. Both are unlikely to occur within the survey area. As such, the Western Spiny-tailed Skink has the potential to be impacted by the proposed project and so is discussed below.

Vulnerable Species

The same process applies for Vulnerable listed taxa however applies to important populations, rather than the species as a whole. An 'important population' is a population that is necessary for a species' long-term survival and recovery (DoE, 2013). This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal;
- Populations that are necessary for maintaining genetic diversity; and/or
- Populations that are near the limit of the species range (DoE, 2013).

One species listed as Vulnerable, the Malleefowl, occurs in the survey area. The regional Malleefowl population is highly fragmented (due to range contractions and intermittent occurrence of suitable habitat) and lies near the arid extreme of the species range. As such, it can be considered an "important population" of a Vulnerable taxon. The Malleefowl is discussed below.

Migratory Species

A similar process applies to EPBC listed Migratory species. An area of 'important habitat' for a listed migratory species is:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- Habitat that is of critical importance to the species at particular life-cycle stages; and/or
- Habitat utilised by a migratory species which is at the limit of the species range; and/or
- Habitat within an area where the species is declining.

The survey area does not contain critical habitat suitable to support ecologically significant numbers of Migratory waterbirds. While a few temporary wetlands occur within the survey area (seasonally inundated clay pans or depressions) no major lakes or drainages are traversed by the Pipeline Licence area. Regionally significant lakes occur adjacent to the pipeline (e.g. Lake Noondie) however, associated habitats suitable for migratory waterbirds are not traversed by the pipeline. As a result, the habitat within the survey area is not considered to be "important" under the EPBC criteria.

Malleefowl Assessment

The Malleefowl is listed as Vulnerable under the EPBC Act and has a scattered occurrence across the Murchison region near its arid extreme. Malleefowl require dense, mature shrublands for roosting and protection, and an abundance of leaf-litter for egg incubation. The species is threatened by habitat loss and degradation (particularly arising from fire) and predation. Potential impacts that may arise from the project include:

- direct mortality through interactions with machinery or vehicles;
- habitat loss or fragmentation;
- disturbances associated with noise, dust, vehicle movements or light;
- predation and competition with feral fauna; and
- altered fire regimes.

A breeding Malleefowl population occurs in the vicinity of the pipeline, with evidence of previous breeding recorded (inactive mounds located). While all mounds recorded were old and inactive, the presence of fresh tracks reveals the species persists in the local area. All mounds recorded were associated with dense Acacia shrublands on sandy substrates, and located adjacent to the Geraldton – Mount Magnet Road. However, such habitat suitable for breeding forms a small component of the Pipeline Licence area as much of the vegetation present comprises open shrublands. To quantify its extent, potential Malleefowl habitat has been mapped (both within and adjacent to the Pipeline Licence area), using the presence of mounds, and Land Systems Mapping (Pringle *et al.*, 1994). All mounds recorded during the survey were located within 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, Figure 14).

Overall, the fragmented and degraded nature of habitat present (largely situated within road reserves or on active cattle stations) suggests that the Pipeline Licence area will intermittently support Malleefowl and form part of a small number of birds breeding and foraging range. Disturbances to habitat associated with the pipeline construction are likely to be reduced as the pipeline is proposed to be buried and native vegetation rehabilitated. As such, if disturbances to mounds and areas of breeding habitat can be minimised, impacts to a local Malleefowl population are unlikely to be significant. Disturbances to breeding sites (mounds) are recommended to be avoided as old, inactive mounds have the potential to be re-used (Benshemesh, 2016). The assessment of Malleefowl with regard to the EPBC Impact Criteria are summarised below (Table 18). Development of the project is unlikely to result in a significant impact to the local population if appropriate management measures are in place. Actions considered to be at “low risk” of significant impact include those which avoid habitat removal, adopt and implement best practice mitigation and have a management plan in place to monitor significant populations (DoE, 2013). Measures to reduce potential impacts of the project on the Malleefowl include:

- Avoid disturbance to Malleefowl mounds, particularly active or recently active mounds, however old mounds have the potential to be re-used;
- Minimise disturbance to Malleefowl habitat - disturbances to dense shrublands suitable for breeding should be avoided or minimised where possible;
- Conducted pre-clearance surveys to manage impacts to locally occurring significant fauna, including the Malleefowl.

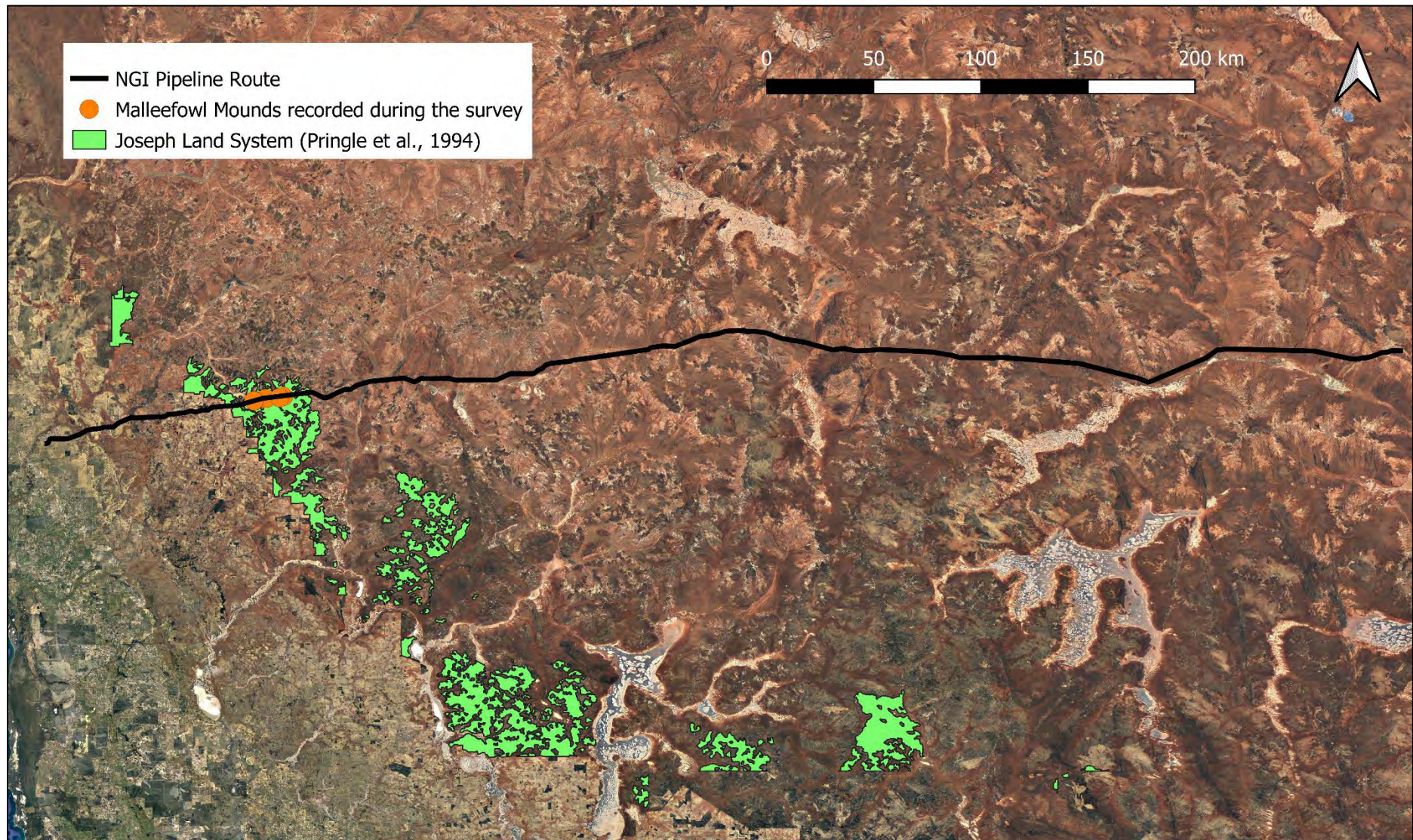


Figure 14. Malleefowl Breeding Habitat (Joseph Land System) Mapped across the Pipeline Licence Area

Table 18. Malleefowl Assessment against Significant Impact Criteria.

Impact Criteria	Comment
Lead to a long-term decrease in the size of an important population of a species.	Potential breeding habitat (dense Acacia shrublands) within the survey area occurs in small areas and has been fragmented by fire and suffered some degradation from previous disturbances (some areas situated in road reserves or on cattle stations). No active mounds were recorded, and the five inactive mounds present had not been used for some time. While suitable breeding habitat occurs within the Pipeline Licence area, it represents a small proportion of that occurring regionally. If disturbances to mounds and breeding habitat can be minimised, the development of the project is unlikely to reduce the size of an important population. Long-term impacts are likely to be reduced by the burial and rehabilitation of the areas required for the construction of the NGI project.
Reduce the area of occupancy of an important population.	Malleefowl breeding habitat includes dense shrublands on stony hills and rises and areas of densely vegetated sandplain. Suitable breeding habitat is uncommon, both locally and at a regional scale, due to a naturally intermittent occurrence, fire history, and previous disturbances associated with road construction and pastoral activities. Disturbances to important breeding areas (mounds), should be avoided where possible. If appropriate management measures are in place, the development of the project is unlikely to reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations.	Due to the linear nature of disturbance, coupled with the burial and rehabilitation of the areas required to support the construction of the NGI project, population fragmentation is considered unlikely.
Adversely affect habitat critical to the survival of a species.	Habitat critical to the survival of the Malleefowl includes breeding sites (mounds) and the habitat suitable to support breeding (dense shrublands containing a substrate suitable for mound construction). Mounds are constructed out of sand or gravel and so the species favours dense Acacia shrublands on gravelly hills and rises, or vegetated thickets on sandplain. Such habitat is uncommon, both locally and at a regional scale, due to a naturally intermittent occurrence, previous degradation and fire history. Malleefowl do not typically breed in low lying areas of clay or loam. 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). While suitable breeding habitat occurs within the Pipeline Licence area, it represents a small proportion of that occurring regionally and all known mounds present are old and inactive. If disturbances to breeding habitat and mounds can be avoided, the development of the project is unlikely to adversely affect critical habitat. Long-term impacts are likely to be reduced by the burial and rehabilitation of the areas required for the construction of the NGI project.
Disrupt the breeding cycle of an important population.	If disturbances to Malleefowl mounds can be avoided, the development is unlikely to disrupt the breeding cycle of the local population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Malleefowl breed within areas of dense vegetation which provide both protection from predators, roosting sites and the leaf litter required for egg incubation. Suitable breeding habitat within the survey area is associated with dense Acacia shrublands. If disturbances to mounds and breeding habitat can be minimised the development of the project is unlikely to cause population decline. A pre-clearance assessment prior to the clearance of any Malleefowl habitat is recommended to prevent inadvertent disturbance to mounds which were not located during the current study.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	The Malleefowl is vulnerable to predation by Feral Cats and Foxes and chick mortality is high. The species is also vulnerable to land degradation and competition by Feral Goats and Rabbits. However, due to the site's location and the presence of existing threats, the development of the project is unlikely to increase such threatening processes beyond that currently present.
Introduce disease that may cause the species to decline.	Considered unlikely.
Interfere substantially with the recovery of the species.	In the greater area, most Malleefowl records are of old, inactive mounds indicating a potential population decline. Disturbances to important mounds and breeding habitat are recommended to be minimised as the species can re-use the same site

Impact Criteria	Comment
	for many years or over generations. Long-term impacts are likely to be reduced by the burial and rehabilitation of the areas required for the construction of the NGI project.
Direct mortality through clearing activities or vehicle strikes.	The clearing of vegetation or vehicle movements can be managed to minimise impacts on the local population. Pre-clearance surveys are recommended to be conducted to minimise disturbances to local fauna of conservation significance.
Altered Fire Regimes.	High intensity fires can impact the Malleefowl through direct mortality and the loss of habitat (dense litter-forming shrublands). Habitat regeneration post fire can take decades to recover to a stage suitable for the species. Fire is a natural part of the landscape, however, within the Pipeline Licence area, much of the vegetation has not been burnt for many years and due to a lack of ground cover is not prone to natural bushfires. Nonetheless, fire is recommended to be managed within Malleefowl habitat as clearing activities have the potential to cause accidental fires.
Significant Impact	Considered unlikely providing appropriate management measures are in place.

Western Spiny-tailed Skink

The Western Spiny-tailed Skink (*Egernia stokesii badia*) is listed as Endangered under the EPBC Act and has a restricted occurrence across the mid-west region. The species occurs in Eucalypt Woodland or amongst rocky outcrops, inhabiting hollows logs or rock crevices. The species is threatened by habitat loss and degradation and predation. Potential impacts that may arise from the project include:

- direct mortality through interactions with machinery or vehicles;
- habitat loss or fragmentation;
- disturbances associated with noise, dust, vehicle movements or light;
- predation and competition with feral fauna; and
- altered fire regimes.

The Western Spiny-tailed Skink was recorded outside of the Pipeline Licence area during the field survey, and habitat present within the corridor appears lacking. Rocky outcrops are largely absent from the Pipeline Licence area and do not occur within the project boundaries in the vicinity of Yalgoo where the species was recorded. 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. Due to the minimal amount of habitat likely to be disturbed, impacts to the Western Spiny-tailed Skink are also likely to be minimal. Development of the project is unlikely to result in a significant impact to the local population if appropriate management measures are in place. Measures to reduce potential impacts of the project on the Western Spiny-tailed Skin include:

- Avoid disturbance to granite outcrops;
- Avoid disturbance to Eucalypt Woodland within the Wheatbelt region. Such habitat supports the Western Spiny-tailed Skink and other species of significance;

- Conducted pre-clearance fauna surveys to manage impacts to locally occurring significant fauna, including the Western Spiny-tailed Skink.

Table 19. Western Spiny-tailed Skink Assessment

Impact Criteria	Comment
Lead to a long-term decrease in the size of an important population of a species.	Habitat supporting the Western Spiny-tailed Skink includes Eucalypt Woodland and rocky outcrops. While present on the fringes of the Pipeline Licence area, such habitat is minimal along the proposed pipeline route. If disturbances to rocky outcrops and Eucalypt Woodland can be avoided, the development of the project is unlikely to reduce the size of an important population. Long-term impacts are likely to be reduced by the burial and rehabilitation of the areas required for the construction of the NGI project.
Reduce the area of occupancy of an important population.	If appropriate management measures are in place, the development of the project is unlikely to reduce the area of occupancy of the species.
Fragment an existing important population into two or more populations.	Due to the linear nature of disturbance, couple with the burial and rehabilitation of the areas required for the construction of the NGI project, population fragmentation is considered unlikely.
Adversely affect habitat critical to the survival of a species.	Habitat critical to the survival of the Western Spiny-tailed Skink includes rocky boulder piles and hollow Eucalypt logs, which provide shelter sites for breeding colonies. While present on the fringes of the Pipeline Licence area, such habitat is minimal along the proposed pipeline route. If disturbances to rocky outcrops and Eucalypt Woodland can be avoided, the development of the project is unlikely to adversely affect critical habitat. Long-term impacts are likely to be reduced by the burial and rehabilitation of the areas required for the construction of the NGI project.
Disrupt the breeding cycle of an important population.	If disturbances to rocky outcrops and Eucalypt logs can be avoided, the development is unlikely to disrupt the breeding cycle of the local population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Habitat supporting the Western Spiny-tailed Skink includes Eucalypt Woodland and rocky outcrops. While present on the fringes of the Pipeline Licence area, such habitat is minimal along the proposed pipeline route. If disturbances to rocky outcrops and Eucalypt Woodland can be avoided, the development of the project is unlikely to cause population decline. A pre-clearance assessment prior to the clearance of any suitable habitat is recommended to prevent inadvertent disturbance to individuals which were not located during the current study.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	The Western Spiny-tailed Skink is vulnerable to predation by Feral Cats and Foxes. The species is also vulnerable to land degradation and competition by Feral Goats and Rabbits. However, due to the site's location and the presence of existing threats, the development of the project is unlikely to increase such threatening processes beyond that currently present.
Introduce disease that may cause the species to decline.	Considered unlikely.
Interfere substantially with the recovery of the species.	Long-term impacts are likely to be reduced by the burial and rehabilitation of the areas required for the construction of the NGI project.
Direct mortality through clearing activities or vehicle strikes.	The clearing of vegetation or vehicle movements can be managed to minimise impacts on the local population. Pre-clearance surveys are recommended to be conducted to minimise disturbances to local fauna of conservation significance.
Altered Fire Regimes.	High intensity fires can impact the species through direct mortality and the loss of habitat. Fire is a natural part of the landscape, however, within the Pipeline Licence area, much of the vegetation has not been burnt for many years and due to a lack of ground cover is not prone to natural bushfires. Nonetheless, fire is recommended to be managed as clearing activities have the potential to cause accidental fires.
Significant Impact	Considered unlikely providing appropriate management measures are in place.

Other EPBC listed Fauna

Additional taxa listed under the EPBC Act have the potential to occur within the survey area, however, due to a lack of local records, and/or a lack of habitat, are unlikely to depend on habitats present. Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*) has been recorded near the Pipeline Licence area however its recognised range lies mostly to the west. The Night Parrot (*Pezoporus occidentalis*, EPBC Endangered and BC Critically Endangered) has a poorly defined range however roosts and breeds within habitat that appears lacking from the survey area. The Princess Parrot (*Polytelis alexandrae*) and Fork-tailed Swift (*Apus pacificus*) are highly mobile and appear to occur in region infrequently. They are not expected to depend on habitats present within the survey area.

The Night Parrot, has a poorly known distribution, however, has been recently recorded across several areas of arid Western Australia (Hamilton *et al.*, 2017; Jactett *et al.*, 2017). Historical records come from Mount Farmer (approximately 50 km north of the Pipeline Licence area) and near Mount Keith (approximately 130 km north of the Pipeline Licence area; Johnstone and Storr 1998) and suitable areas of habitat exist throughout the region (such as at Lake Noondie, 3 km south of the Pipeline Licence area; J. Turpin, pers. obs.). The DBCA has developed an interim guideline for Night Parrot survey in Western Australia (DPaW, 2017) and the Pipeline Licence area is regarded as a medium priority for survey and assessment. The Night Parrot is primarily associated with old and large spinifex clumps (often > 50 years unburnt), especially hummocks that are ring-forming (and is sometimes associated with other vegetation types, such as dense chenopod shrubs; DPaW, 2017). Such habitat occurs across the Murchison region, however, is mostly absent from the Pipeline Licence area. The species has not been recently recorded in the local area and the types of spinifex typically found do not form large rings (potentially due to the interactions of soil and fire history). Due to a lack of suitable habitat, the species is unlikely to roost or breed within the Pipeline Licence area.

Carnaby's Black-cockatoo (listed as Endangered under the EPBC Act) has been previously recorded adjacent to the Pipeline Licence area at Tenindewa (approximately 17 km west of Mullewa, and 7 km south of the proposed pipeline route, DBCA 2020) and from north of Mullewa at Nunierri (DBCA 2020). 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 (DOTE 2017), due to the widescale clearance of the Wheatbelt, minimal breeding or foraging habitat occurs within the proposed pipeline corridor. 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 (DOTE 2017).

The Sandhill Dunnart is listed as Endangered under the EPBC Act, and is currently only known from the southern Great Victoria Desert. However, historical records come from near the Narring Ranges (approximately 20 km north of the Pipeline Licence area) and Lake Barlee (approximately 120 km south of the Pipeline Licence area, A. Baynes pers. com.). As such, the species formerly occurred in the region. The Sandhill Dunnart inhabits spinifex sandplains on deep yellow sands, with a diverse shrubby understorey. Such habitat occurs through the region such as near Sandstone, supporting other species characteristic of the Great Victoria Desert. However suitable habitat is absent from the Pipeline Licence area and due to a lack

of suitable vegetation, combined with an absence of recent records, the Sandhill Dunnart is unlikely to occur within the Pipeline Licence area.

The distribution of the Shield-backed Trapdoor Spider (*Idiosoma nigrum*, listed as 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). *Idiosoma nigrum* is unlikely to occur within the survey area.

6.3 Short-range Endemic Fauna

Short-range endemics (SREs) are terrestrial and freshwater invertebrates with small geographic distributions (Harvey 2002), nominally less than 10,000 km² (Harvey 2002; EPA 2016d). Within this range, the actual areas occupied are typically small, discontinuous or fragmented. They are typically characterised by limited dispersal capabilities, seasonal activity, slow growth, and / or low levels of fecundity (Harvey 2002). Their limited dispersal capabilities result in small and isolated populations separated by inhospitable geographic features such as rivers, rocky ridges or plains. Prolonged isolation between populations eventually results in speciation, with each population becoming genetically and, or morphologically distinct over time. SREs are of high conservation concern as a restricted distribution contributes to rarity and increased chance of extinction (Harvey, 2002).

Invertebrate species considered to be short range endemics (SREs) often have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemism: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey, 2002).

Two types of short-range endemism have been recognised: Relictual Endemism and Habitat Specialist Endemism (Harvey 2002). Habitat specialist SREs are species that have adapted to very specific environment types, including those found in arid environments (e.g. rocky outcrops, isolated dune systems and salt lakes). Examples of habitat specialist SREs include spiders in the family Selenopidae, pseudoscorpions in the genus *Synsphyronus* (2002), scorpions in the genera *Lychas* and *Urodacus* and tiger beetles in the genus *Pseudotetracha* (Volschenk et al. 2010).

A review of invertebrate databases revealed 439 invertebrate records recorded within 10 km of the Pipeline Licence area (DBCA 2020, ALA 2020, Appendix 2, Figure 15). These comprised 286 taxa (including undescribed species and one DBCA Priority species) and were dominated by the beetles (Coleoptera), cockroaches (Blattodea), ants and wasps (Hymenoptera), butterflies and moths (Lepidoptera), spiders (Araneae), Scorpions (Scorpiones), Centipedes (Scolopendromorpha) and Flies (Diptera). Several species have recognised restricted ranges or comes from groups of invertebrates known to exhibit short-range endemism (e.g.

Mygalomorph Spiders, Harvestmen, Scorpions, Pseudoscorpions, Appendix 2). These are discussed below and shown in Figure 15.

Mygalomorph spiders often exhibit short-range endemism, and several taxa of conservation significance have been recorded in the vicinity of the Pipeline Licence area (recorded within 40 km, DBCA 2020). These include *Idiosoma arenaceum* (DBCA Priority 3), *Idiosoma clypeatum* (DBCA Priority 3), *Idiosoma nigrum* (EPBC Endangered), *Kwonkan moriartii* (DBCA Priority 2) and *Teyl* sp. (Critically Endangered). Due to limitations of range and habitat, only *Idiosoma clypeatum* is considered likely to occur within the Pipeline Licence area (Figure 15).

Idiosoma clypeatum 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, 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, while the Violet System is described as Acacia shrublands on gravelly 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 survey area. 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). *Idiosoma nigrum* is unlikely to occur within the survey area. Other taxa are known from only one location, such as *Kwonkan moriartii* (Kathleen), or confined to restricted habitats absent from the survey area (*Teyl* sp., perched swamps, DBCA, 2020).

While many Trapdoor spiders are restricted in range, some widespread taxa have also been recorded within 10 km of the Pipeline Licence area. These include *Gaius villosus*, *Aname mainae*, and *Idiommatia blackwalli* which belong to families (Idiopidae, Nemesiidae and Barychelidae) known to contain representatives with confirmed or potential short-range distributions (DBCA 2020). Some species have restricted ranges, such as *Wesmaldra urawa* (a Ground Spider restricted to the Urawa area) and fall into the category of SRE as defined by Harvey (2002, distribution of less than 10,000 km²). However, the species belongs to a group of spiders with typically widespread distributions (Araneomorphae) due to the ability to disperse widely.

Eight taxa recorded adjacent to the Pipeline Licence area have distributions of less than 10,000 km² and are classified within groups exhibiting short-range endemism. One species, *Idiosoma clypeatum*, is listed by DBCA as a Priority species:

- *Idiosoma clypeatum* (Mygalomorph Trapdoor Spider, DBCA Priority 3) has a scattered distribution through the Yalgoo and Murchison Bioregions. Recorded at several sites adjacent to the Pipeline Licence area and likely to occur;
- *Cormocephalus bungalbinensis* (Centipede): known from three locations, including one from near Anketell, approximately 30 km north of the Pipeline Licence area;

- *Aname armigera* (Mygalomorph Trapdoor Spider): only known from the Mullewa area and belonging to the Mygalomorph family Nemesiidae, a group known to exhibit short-range endemism;
- *Megalopsalis leptekes* (Harvestmen): highly restricted range, recorded from Talling Station (approximately 9 km north of the Pipeline Licence area), and belonging to a group known to exhibit short-range endemism;
- *Antichiropus* sp. (Millipede): collected 500m north of the Pipeline Licence area, from a rocky hill near Yalgoo, belongs to a genus known to exhibit short-range endemism;
- Undescribed Pseudoscorpions: two taxa (*Austrochthonius* sp. and *Synsphyronus* sp.) collected from a rocky hill 500 m north of Pipeline Licence area and Olpiidae sp. collected 100 m north of the survey area.

Millipedes are diverse in Western Australia, with the most speciose group being the genus *Antichiropus* of the family Paradoxosomatidae. With the exception of *Antichiropus variabilis* (which inhabits the Jarrah forests of south-western WA), all species of the genus are known to be SREs, and many are known from only a few hundred square kilometres (Harvey 2002; EPA 2016d). An *Antichiropus* is known from the rocky hills near Yalgoo, occurring to the north of the Pipeline Licence area. It is likely to be a short-range endemic taxon, restricted to the rocky hills of the region, which are largely avoided by the pipeline route.

Pseudoscorpions occur in most undisturbed terrestrial habitats but are highly cryptic and poorly known in Western Australia. However, many are short-range endemics (Harvey 2002, EPA 2016d). Three undescribed specimens have been collected from the vicinity of the Pipeline Licence area.

Four undescribed scorpions (*Lychas* spp., *Urodacus* sp. and BUTHIDAE sp.) have been recorded adjacent to the Pipeline Licence area. Scorpions and Centipedes are extensive across Western Australia, and while some are common and widespread short-range endemism is noted from Buthidae, Urodacidae and Hormuridae (in Scorpions) and Geophilomorpha and Cryptopidae (in Centipedes). Most species of *Urodacus* and *Lychas* appear to be relatively widespread (e.g. *Urodacus hoplurus*, recorded adjacent to the Pipeline Licence area, DBCA 2020) but are often patchily distributed, meaning that their distribution does not equate to their area of occupation (Volschenk et al. 2010). Several *Urodacus* species are also known to be SREs (e.g. *Urodacus planimanus*, *Urodacus koolanensis* and several undescribed species, Volschenk et al. 2010).

Short-range Endemic invertebrates are known from the region with at least eight taxa recorded within 10 km of the Pipeline Licence area. Several of these come from habitats known to promote short-range endemism, such as isolated hills or rocky outcrops, which are mostly avoided by the proposed pipeline route. Overall, the survey corridor lacks the distinctive and isolated geological features known to promote short-range endemism in invertebrates (such as isolated rocky ridges, deep caves, salt lakes, relictual habitats). Restricted, mesic or relictual habitats can support SRE fauna, however much of the Pipeline Licence area is composed of widespread and extensive vegetation and soil types. Although some restricted habitats do occur and those with the potential to support SRE fauna include some small, scattered granite outcrops and minor drainage lines. While relictual habitats are an uncommon feature of the Pipeline Licence area, the habitat characteristics that restrict some SRE taxa (for example scorpions and trapdoor spiders) are unclear and they can be

found in environments that do not support relictual species. As some taxa live in burrows which may offer specific microclimates that are not reflected in the surface environment, soil characteristics may play an important part in limiting their distributions (Volschenk et al. 2010).

The NGI pipeline is proposed to be buried and native vegetation rehabilitated after clearance, limiting long term impacts to any short-range endemic fauna present. Due to the linear nature of the Pipeline Licence area, combined with its limited width in any given habitat type, significant disturbances to SRE fauna appear unlikely, however it is important to note, by definition SRE fauna can have very restricted ranges and even small amounts of disturbance can be significant if critical habitat is impacted. Potential impacts from the construction of the NGI project could include:

- physical destruction of the habitat resulting from pipeline construction;
- dust pollution resulting from the construction and operation of unsealed roads near SRE habitats; and
- modification of surface drainage patterns resulting in diversion of water that would normally reach SRE habitats. This is more likely to be a factor impacting drainage line habitats.

The Northern Shield-backed Trapdoor Spider is considered likely to occur within the Pipeline Licence area. It occurs within Land Systems traversed by the Pipeline Licence area (Challenge and Kalli Land Systems), which are widespread throughout the Murchison region.

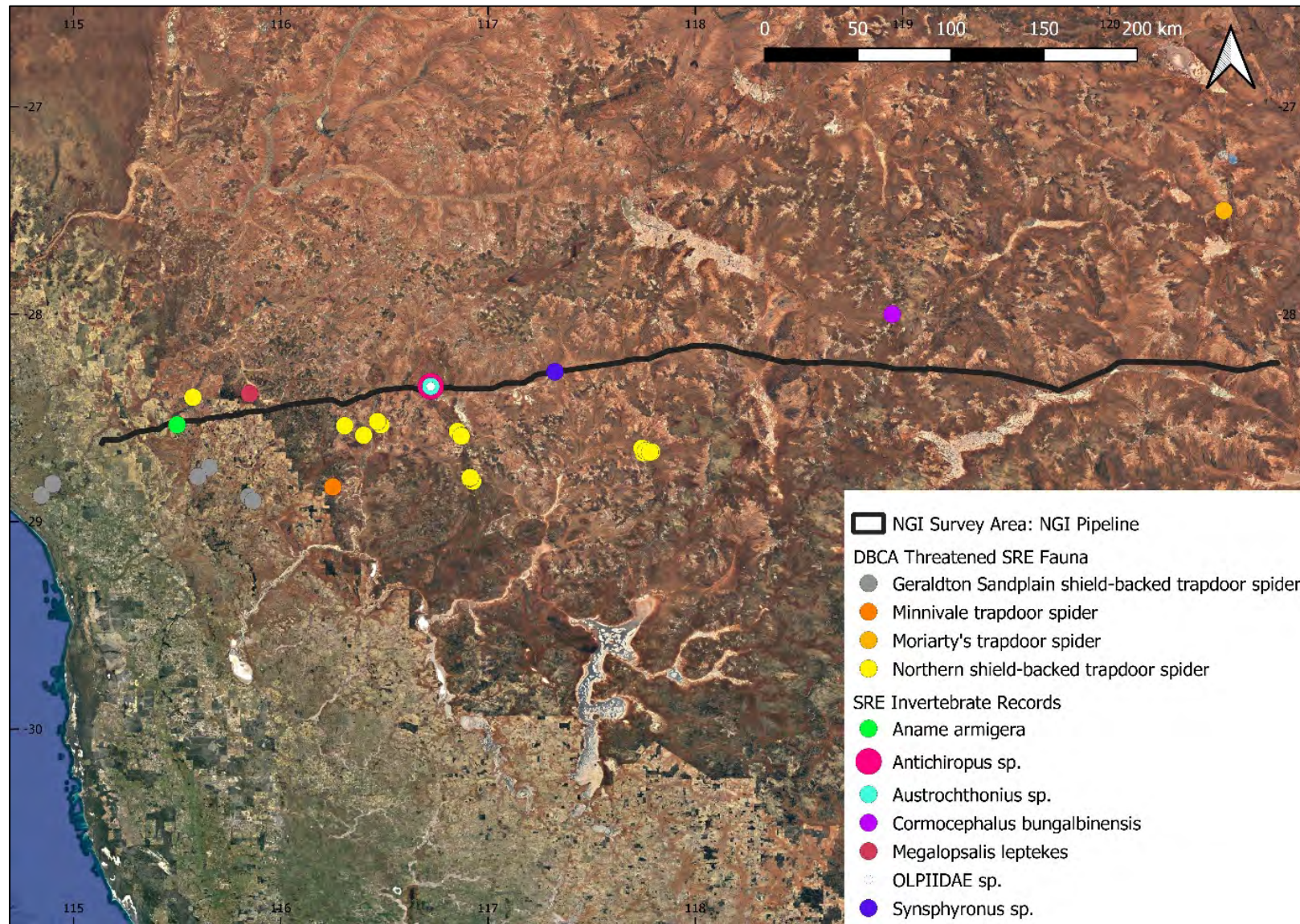


Figure 15. Short-range Endemic Fauna Recorded within 10 km of the Pipeline Licence Area

7. CONCLUSION

The Pipeline Licence area route extends over approximately 580 km, and traverses four bioregions. The fauna assemblage present 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 (Western Yellow Robin, Brush-tailed Mulgara, Woolley's Pseudantechinus, Long-tailed Dunnart).

While the Pipeline Licence area extends over a large distance, the proposed clearing footprint is narrow (a 30m wide corridor) and linear, meaning impact within any vegetation or fauna community is localised. The NGI pipeline is proposed to be buried and native vegetation rehabilitated after clearance, limiting long term impacts to fauna and their associated habitats.

Much of the Pipeline Licence area is composed of widespread vegetation and the fauna habitats present are widespread both along the pipeline route and throughout the greater regions. Fauna habitats present within the Pipeline Licence area are mostly associated with Acacia, include Mulga shrublands (43% of the Pipeline Licence area), mixed Acacia shrublands (10%), open Acacia or mixed shrublands (21%). Reduced areas of Chenopod shrubland (4%), Mulga with a Spinifex understorey (2%) and dense Acacia / Melaleuca shrublands (4%) occur. Those habitats with minimal occurrence (reflecting a reduced or restricted regional occurrence) include Granite Outcrops (<1%), Breakaways (<1%), Eucalypt Woodland (<1%), Callitris Woodlands (<1%), Banksia Woodlands (<1%) and remnant Woodlands and Shrublands within the wheatbelt (<1%).

Most fauna occurring within the Pipeline Licence area are likely to be widespread, as the fauna habitats present are characterised by widespread vegetation. However some conservation significant fauna occur (or are likely to be present). The key species likely to be impacted by the proposed development include:

- Malleefowl (Vulnerable under the EPBC and BC Acts);
- Brush-tailed Mulgara (DBCA Priority 4);
- Gilled Slender Blue-tongue (Vulnerable under the BC Act); and
- Northern Shield-backed Trapdoor Spider (DBCA Priority 3).

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 significant fauna have the potential to be impacted, however these include species with minimal to no suitable habitat present within the Pipeline Licence area (Western Spiny-tailed Skink, Long-tailed Dunnart, Geraldton Sandplains Shield-backed Trapdoor Spider), mobile taxa which are unlikely to breed within the project's boundaries (e.g. Carnaby's Cockatoo, Peregrine Falcon) or poorly known taxa with few local known populations (Yuna Broad-blazed Slider, Woma).

The Malleefowl breeds within the dense shrublands present between Pindar and Wurarga, contained within the Joseph Land System (totalling 470 Ha, Table 18). Targeted searching revealed the presence of five old inactive mounds within the Joseph Land System and did not detect mounds outside of this area. While breeding habitat is present within the Pipeline Licence area, it has a wide occurrence throughout the region.

The Brush-tailed Mulgara occurs in habitats containing spinifex, which within the Pipeline Licence area, is restricted to a stretch of approximately 10 km. Suitable habitat (the Kalli and Tyrrell Land Systems) is extensive to the north of the pipeline route, both locally and throughout the region. The occurrence of the Brush-tailed Mulgara within the Pipeline Licence area represents a previously undocumented population at the species southern range extreme.

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. The Land Systems supporting the species are widespread in the greater area.

The Northern Shield-backed Trapdoor Spider is considered likely to occur within the Pipeline Licence area. It occurs within Land Systems traversed by the Pipeline Licence area (Challenge and Kalli Land Systems), which are widespread throughout the Murchison region.

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.

8. REFERENCES

- Atlas of Living Australia (ALA) (2020). Atlas of Living Australia Database. Atlas of Living Australia. <http://www.ala.org.au/page name>. Accessed August 2020.
- BirdLife Australia (2020). BirdLife Australia Database. <https://birddata.birdlife.org.au/> Accessed August 2020.
- Benshemesh, J. (1992). The conservation ecology of Malleefowl, with particular regard to fire. Pages 1-224. Monash University, Clayton.
- Benshemesh, J. (2007). National Recovery Plan for Malleefowl. Department of Environment Water Heritage and the Arts, Canberra.
- Benshemesh, J. (2016). Malleefowl Monitoring Protocols for Use in the Great Victoria Desert. Produced for the Great Victoria Desert Biodiversity Trust.
- BirdLife International (2020). Species factsheets. Downloaded from <http://www.birdlife.org> on 20/08/2020.
- Bruton, M., Wilson, S., Shea, G., Ellis, R., Venz, M., Hobson, R. & Sanderson, C. (2017). *Aspidites ramsayi*. The IUCN Red List of Threatened Species 2017: e.T2176A83765377. <https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T2176A83765377.en>. Downloaded on 01 October 2020.
- Bush, B., Maryan, B., Browne-Cooper, R., and Robinson, D. (2007). 'Reptiles and Frogs in the Bush: Southwestern Australia.' University of Western Australia Press: Perth.
- Cowan, M. (2001). Eastern Murchison Subregion (MUR1). In "A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions 2002".
- Dell, J., How, R. A., Milewski, A. V., and Keighery, G. J. (1988). The Biological Survey of the Eastern Goldfields of Western Australia: Part 5 Edjudina-Menzies Study Area. Records of the Western Australian Museum, Supplement No. 31.
- Department of Environment and Conservation (DEC) (2007). Banded Ironstone Formation Ranges of the Midwest and Goldfields. Interim Murchison River catchment, Western Australia. Technical Bulletin No.84, Department of Agriculture Status Report – Biodiversity Values and Conservation Requirement.
- Department of Biodiversity, Conservation and Attractions (DBCA) (2020). NatureMap. Fauna database accessed August 2020.
- Department of Environment and Conservation (DEC) (2007). Banded Ironstone Formation Ranges of the Midwest and Goldfields. Interim Murchison River catchment, Western Australia. Technical Bulletin No.84, Department of Agriculture Status Report – Biodiversity Values and Conservation Requirement.
- Department of Environment, Water, Heritage and the Arts (2010a) Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act.
- Department of Environment, Water, Heritage and the Arts (2010b) Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act.

- Department of Parks and Wildlife (2016). Survey and Monitoring Guidelines for the Sandhill Dunnart (*Sminthopsis psammophila*) in Western Australia. Prepared for the Great Victoria Desert Biodiversity Trust, 2016.
- Department of Parks and Wildlife (DPAW) (2017). Interim guideline for preliminary surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia. Department of Parks and Wildlife, Kensington, WA. Available at: https://www.dpaw.wa.gov.au/images/documents/plantsanimals/animals/interim_guideline_for_night_parrot_survey.pdf.
- Department of Sustainability, Environment, Water, Population and Communities (2011a) Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act.
- Department of Sustainability, Environment, Water, Population and Communities (2011b) Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act.
- Department of Sustainability, Environment, Water, Population and Communities (2012). Threatened Species Profiles. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66699
- Department of Sustainability, Environment, Water, Population and Communities (2020). Key threatening processes under the EPBC Act.
<http://www.environment.gov.au/cgi-in/sprat/public/publicgetkeythreats.pl>
- Department of the Environment (2013). Matters of National Environmental Significance Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment.
- Department of the Environment (2016). EPBC Species Profiles: Species Profile and Threats Database, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>.
- Department of the Environment and Energy (DoEE) (2017). Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo. Commonwealth of Australia. <https://www.environment.gov.au/system/files/consultations/1a21997c-5542-4cd6-ace9-561865bbff29/files/draft-revised-referral-guideline-black-cockatoos.pdf>
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009). Assessment of Australia's Terrestrial Biodiversity 2008. Department of the Environment, Water, Heritage and the Arts, Canberra.
- Department of Agriculture, Water and the Environment (DAWE) (2020). Protected Matters Database. Department of Agriculture, Water and the Environment, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed August 2020.
- Department of the Environment, Water, Heritage and the Arts (2010). Survey Guidelines for Australia's Threatened Bats. Department of the Environment, Water, Heritage and the Arts, Canberra.

- Department of Water and Environmental Regulation (2020). Index of Biodiversity Surveys for Assessments. Available at: <https://biocollect.ala.org.au/ibsa>
- Environment Australia. (1999). An Overview of the EPBC Act. Department of Environment and Heritage, Canberra.
- Environmental Protection Authority. (2002). Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3. Environmental Protection Authority, Perth, Western Australia.
- Environmental Protection Authority. (2004). Guidance for the assessment of environmental factors: Terrestrial fauna surveys for environmental impact assessment in Western Australia. No. 56. Environmental Protection Authority, Perth, Western Australia.
- Environmental Protection Authority (2016a). Environmental Factor Guideline: Terrestrial Fauna. EPA, Western Australia.
- Environmental Protection Authority (2016b) Technical Guidance: Sampling of short range endemic invertebrate fauna. EPA, Western Australia.
- Environmental Protection Authority (2016c). Environmental Factor Guideline: Terrestrial Fauna. EPA, Western Australia.
- Environmental Protection Authority (2018) Statement of Environmental Principles, Factors and Objectives, EPA, Western Australia.
- Environmental Protection Authority (2020). Technical Guidance: Terrestrial Vertebrate fauna surveys for environmental impact assessment, EPA, Western Australia.
- Focused Vision (2020). Northern Goldfields Interconnect Pipeline Project Detailed Flora and Vegetation Assessment. Unpublished report for APA Group Australia.
- Fox, E., McNee, S., Douglas, T. (2016). Birds of the Great Western Woodlands. Report for The Nature Conservancy. BirdLife Australia, Melbourne.
- GHD (2020). Yogi - Magnetite Project Fauna Assessment. Unpublished report for Report for FI Joint Venture Pty. Ltd.
- Hamilton, N. A., Onus, M., Withnell, B. & Withnell, K. (2017). Recent sightings of the Night Parrot (*Pezoporus occidentalis*) from Matuwa (Lorna Glen) and Millrose Station in Western Australia. Australian Field Ornithology 34: 71–75.
- Harvey, M. (2002). Short-range Endemism amongst the Australian fauna: examples from non-marine environments. Invertebrate Systematics, 16: 555-570.
- How, R. A; Dell, J; Milewski, A. V; Western Australian Museum (1992), The Biological survey of the Eastern Goldfields of Western Australia. Part 6, Youanmi - Leonora study area. Part 7, Duketon - Sir Samuel study area, Western Australian Museum, ISBN 978-0-7309-4651-9
- How R. A. and Dell, J. (2000) Ground vertebrate fauna of Perth's vegetation remnants: impact of 170 years of urbanization Pacific Conservation Biology 6: 198–217.
- Jackett, N.A., Greatwich, B.R., Swann, G. & Boyle, A. (2017). A nesting record and vocalisations of the Night Parrot *Pezoporus occidentalis* from the East Murchison, Western Australia. Australian Field Ornithology 34, 144–150.

- Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds Vol 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.
- Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds. Vol 2: Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth.
- McKenzie, N. L., May, J. E. and McKenna, S. (2003). Bioregional Summary of the 2002 Biodiversity Audit for Western Australia. The National Land and Water Resources Audit and the Western Australian Department of Conservation and Land Management, Perth, Western Australia.
- Malleefowl Preservation Group (2013). Malleefowl Species Profile. <http://www.malleefowl.com.au>.
- Meek, P.D., Ballard, G. and Fleming, P. (2012). An Introduction to Camera Trapping for Wildlife Surveys in Australia. PestSmart Toolkit publication, Invasive Animals Cooperative Research Centre, Canberra, Australia.
- Menkhorst, P. and Knight, F. (2010). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.
- Murcox Biological Services (1994). Mount Magnet Operations Fauna Monitoring Program: Report on Baseline Study. Unpublished report for Hill 50 Gold Mine N.L
- National Malleefowl Recovery Team (2016). National Malleefowl Monitoring Manual: Edition: 2016-1. Standards, Protocols and Monitoring Procedures.
- Pavey, C. (2002). Threatened Species of The Northern Territory: Slender-Billed Thornbill (western subspecies) *Acanthiza iredalei iredalei*.
- Pavey, C. (2006). Threatened Species of The Northern Territory: Long-tailed Dunnart *Sminthopsis longicaudata*.
- Priddel, D. and Wheeler, R. (2003). Nesting activity and demography of an isolated population of Malleefowl, *Leipoa ocellata*. Wildlife Research. 30:451-464.
- Pringle, H.J.R. (1994). Vegetation, in: Pringle, H.J.R., van Vreeswyk, A.M.E. & Gilligan S.A. (eds) An inventory and condition survey of rangelands in the north-eastern Goldfields, Western Australia, Western Australia Department of Agriculture Technical Bulletin no. 87, Perth.
- QGIS Development Team (2018). QGIS Geographic Information System. Open Source Geospatial Foundation Project. <http://qgis.osgeo.org>.
- Rix M. G., Huey J. A., Cooper S. J.B., Austin A. D. and Harvey M. S. (2018). Conservation systematics of the shield-backed trapdoor spiders of the nigrum-group (Mygalomorphae, Idiopidae, Idiosoma): integrative taxonomy reveals a diverse and threatened fauna from south-western Australia. ZooKeys. 2018 756 p.1
- Saunders, D. and Ingram, J. (1995). Birds of south-western Australia. An atlas of changes in distribution and abundance of the wheatbelt fauna. Surrey Beatty, Sydney.
- Stantec (2018). Flora and Fauna Survey: Agnew Gold Mine, Camp, Power Plant, Airport, Wind Farm And Pipeline. Prepared for Gold Fields Australia Pty Ltd.

- Thackway, R. and Cresswell, I.D. (eds.) (1995) An Interim Biogeographic Regionalisation for Australia: A Framework for Establishing the National System of Reserves, Version 4.0. Australian Nature Conservation Agency, Canberra.
- Turpin, J. M. (2015). North Kimberley mammals – on the fringe of the high-rainfall zone. *Australian Mammalogy* 37, 86–91.
- Turpin, J.M. and Bamford, M. (2015). A new population of the northern quoll (*Dasyurus hallucatus*) on the edge of the Little Sandy Desert, Western Australia. *Australian Mammalogy*, 37(1) 86-91.
- Turpin, J.M. and Johnstone, R.E. (2017). An isolated population of the southern scrub-robin (*Drymodes brunneopygia*) in the Great Victoria Desert. *Pacific Conservation Biology* 23 (1), 95 – 106.
- Turpin, J. M., White, N. E., Dunlop, J. A., and Bamford, M. J. (2018). New populations of the black-flanked rock-wallaby (*Petrogale lateralis*) from the Little Sandy Desert and Murchison, Western Australia. *Australian Mammalogy* 40, 234–242.
- Van Dyck, S and Strahan, R. (ed.). (2008). *Mammals of Australia*. 3rd Edition. Reed New Holland, Sydney.
- Volschenk, E.S., Burbidge, A.H., Durrant, B.J. and Harvey, M.S. (2010). Spatial distribution patterns of scorpions (Scorpiones) in the arid Pilbara region of Western Australia. *Records of the Western Australian Museum, Supplement* 78, 271–284.
- Western Australian Museum (2020). Checklist of the Terrestrial Vertebrate Fauna of Western Australia. Western Australian Museum. Available at <http://museum.wa.gov.au/research/departments/terrestrial-zoology/checklist-terrestrial-vertebrate-fauna-western-australia>
- Western Wildlife (2007). Windimurra Vanadium: Threatened Fauna Assessment. Unpublished report for Windimurra Vanadium Pty Ltd.
- Wilson, B. A., Valentine, L. E., Reaveley, A., Isaac, J., and Wolfe, K. M. (2012). Terrestrial mammals of the Gnamptogaea Groundwater System, Western Australia: history, status, and the possible impacts of a drying climate. *Australian Mammalogy* 34, 202–216.
- Woinarski, J. C. Z., Woolley, L. A., Garnett, S. T., Legge, S. M., Murphy, B. P., Lawes, M. J., Comer, S., Dickman, C. R., Doherty, T. S., Edwards, G., Nankivell, A., Palmer, R., and Paton, D. (2017). Compilation and traits of Australian bird species killed by cats. *Biological Conservation* 216: 1–9. doi:10.1016/j.biocon.2017.09.017.
- Woolley, L.A., Geyle, H.M., Murphy, B.P., Legge, S.M., Palmer, R., Dickman, C.R., Augusteyn, J., Comer, S., Doherty, T.S., Eager, C.E., Edwards, G.E., Harley, D.K.P., Leiper, I., McDonald, P.J., McGregor, H.W., Moseby, K.E., Myers, C., Read, J.L., Riley, J.L., Stokeld, D., Turpin, J.M., Woinarski, J.C.Z. (2019). Introduced cats (*Felis catus*) eating a continental mammal fauna: inventory and traits of species killed. *Mammal Review*, pp. 1-15, doi: 10.1111/mam.12167.

Appendix 1. Categories Used in the Assessment of Conservation Status.

IUCN categories as used for the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Biodiversity Conservation Act 2016*.

CATEGORY	DEFINITION
Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild	Taxa known to survive only in captivity.
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not Threatened.

Definitions of relevant categories under the EPBC Act 1999.

CATEGORY	DEFINITION
Endangered (EN)	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable (VU)	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Migratory (M)	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: <ul style="list-style-type: none"> the Bonn Convention ((Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a range state. The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); or The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Categories used in the *Biodiversity Conservation Act 2016*.

CATEGORY	DEFINITION
Critically Endangered	Facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	Facing a very high risk of extinction in the wild in the near future.
Vulnerable	Facing a high risk of extinction in the wild in the medium-term future.
Extinct	There is no reasonable doubt that the last individual has died. A species is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the species' life cycle and life form.
Extinct in the wild	It is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A species is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the species' life cycle and life form
Special Conservation Interest	It is of special conservation interest because it - (i) has a naturally low population range; or (ii) has a restricted natural range; or (iii) is subject to or recovering from a significant population decline or reduction in natural range Conservation dependent species – that is species that have previously been listed as threatened, but have recovered to the extent that they no longer meet the criteria for threatened, and the species is dependent on conservation actions continuing, i.e. the species is the focus of a specific conservation programme, the cessation of which would result in it again becoming eligible for listing as a threatened species within a period.
Migratory	A native species is eligible for listing in the category of migratory if: (i) Members of the species periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or (ii) the species is the subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth. International agreements that apply to the listing of a species as a migratory species are: Japan - Australia Migratory Birds Agreement (JAMBA); China - Australia Migratory Birds Agreement (CAMBA); Republic of Korea - Australia Migratory Birds Agreement (ROKAMBA); and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn).
Species otherwise in need of special protection	A species that is otherwise in need of special protection if it does not meet any of the above criteria, but is a species for which a need for special protection exists.

Department of Biodiversity, Conservation and Attractions Priority Fauna Species Category Codes.

CATEGORY	DEFINITION
Priority One (P1)	Poorly-known species. Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority Two (P2)	Poorly-known species. Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority Three (P3)	Poorly-known species. Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority Four (P4)	Rare, Near Threatened and other species in need of monitoring: (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix 2: Fauna Recorded or Expected in the Pipeline Licence Area.

Fauna Recorded (X) and Expected from the Survey Area (Tables 1 to 4).

These lists are derived from the results of database and literature searches and from previous field surveys conducted in the local area. These are:

- NatureMap (NM; 10 km buffer), Birdlife Australia (BA; 20 km buffer) and Atlas of Living Australia (ALA; 10 km buffer) Databases;
- DBCA Threatened Fauna Database (40 km buffer);
- DBCA records from Urawa Nature Reserve and Barnong Station (DBCA 2020);
- Surveys conducted at the Yogi Magnetite Project (up to 15 km north of Pipeline Licence area; GHD 2018);
- Surveys at Mount Magnet (Murcox Biological Services 1994);
- Biological Survey at Yuinmery Station (24 km south of Pipeline Licence area, How *et al.*, 1992);
- Surveys conducted at Black Range and Lake Mason stations (50 km north of the Pipeline Licence area; Cowan *et al.*, 2017);
- Surveys conducted at Agnew (Stantec 2018);
- Species recorded during the 2020 NGI Fauna Assessment (this assessment, listed in pale blue columns).

Key:

Note the conservation status of significant taxa is listed under “Status”. This includes species listed under legislation, DBCA Priority Fauna and Locally Significant Fauna.

Table 1. Frogs Expected to Occur and Recorded in the Pipeline Licence Area.

Common Name	Species Name	Status	ALA	NM	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
HYLIDAE												
Sheep Frog	<i>Cyclorana maini</i>							X				
Western Water-holding Frog	<i>Cyclorana occidentalis</i>		X	X		X	X	X				
Little Red Tree Frog	<i>Litoria rubella</i>						X	X			X	
LIMNODYNASTINAE												
Western Banjo Frog	<i>Limnodynastes dorsalis</i>		X		X							
Kunapalari Frog	<i>Neobatrachus kunapalari</i>		X	X			X					
Humming Frog	<i>Neobatrachus pelobatoides</i>		X	X								
Desert Trilling Frog	<i>Neobatrachus sudellae</i>							X	X			
Shoemaker Frog	<i>Neobatrachus sutor</i>		X	X			X		X			
Wilsmore's Frog	<i>Neobatrachus wilsmorei</i>		X	X		X	X		X	X		
Centralian Burrowing Frog	<i>Platyplectrum spenceri</i>		X	X			X					
Gunther's Toadlet	<i>Pseudophryne guentheri</i>		X			X	X	X				
Western Toadlet	<i>Pseudophryne occidentalis</i>		X	X			X			X		
Total Number of Species: 12			9	7	1	3	8	5	3	2	1	0

Table 2. Reptiles Expected to Occur and Recorded in the Pipeline Licence Area.

Common Name	Species Name	Status	DBCA	ALA	NM	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
CHELIDAE													
Steindachner's Long-Necked Turtle	<i>Chelodina steindachneri</i>							X					
AGAMIDAE													
Laverton Ring-tailed Dragon	<i>Ctenophorus infans</i>			X									
Ring-tailed Dragon	<i>Ctenophorus caudicinctus</i>								X		X	X	
Crested Dragon	<i>Ctenophorus cristatus</i>							X					
Mallee Military Dragon	<i>Ctenophorus fordii</i>												
Military Dragon	<i>Ctenophorus isolepis</i>										X	X	
Spotted Military Dragon	<i>Ctenophorus maculatus</i>							X					
Central Netted Dragon	<i>Ctenophorus nuchalis</i>			X	X					X	X	X	X
Ornate Dragon	<i>Ctenophorus ornatus</i>			X	X			X	X				
Western Netted Dragon	<i>Ctenophorus reticulatus</i>			X	X		X	X	X	X	X		
Claypan Dragon	<i>Ctenophorus salinarum</i>			X						X	X		
Lozenge-marked Dragon	<i>Ctenophorus scutulatus</i>				X			X	X	X	X		X
Mulga Dragon	<i>Diporiphora amphiboluroides</i>							X		X		X	
Long-nosed Dragon	<i>Gowidon longirostris</i>							X					
Thorny Devil	<i>Moloch horridus</i>				X				X	X	X		X
Bearded Dragon	<i>Pogona minor</i>				X		X	X	X	X	X		
Goldfields Pebble Dragon	<i>Tympanocryptis pseudopsephos</i>			X	X			X		X	X	X	
DIPODACTYLIDAE													
Fat-tailed Gecko	<i>Diplodactylus conspicillatus</i>										X		
Western Stone Gecko	<i>Diplodactylus granariensis</i>			X	X					X	X	X	
Beautiful Gecko	<i>Diplodactylus pulcher</i>			X	X			X	X	X	X	X	
Main's Ground Gecko	<i>Lucasium maini</i>												
Mottled Ground Gecko	<i>Lucasium squarrosum</i>			X	X	X		X	X	X	X		
Sandplain Gecko	<i>Lucasium stenodactylum</i>										X		
Western marbled velvet gecko	<i>Oedura fimbria</i>				X			X					
Beaked Gecko	<i>Rhynchoedura ornata</i>			X	X			X		X	X	X	
Thorn-tailed Gecko	<i>Strophurus assimilis</i>			X	X			X		X	X		
Jewelled Gecko	<i>Strophurus elderi</i>									X	X		
Western Spiny-tailed Gecko	<i>Strophurus strophurus</i>			X	X			X		X	X		
Western Spiny-tailed Gecko	<i>Strophurus wellingtonae</i>			X	X						X	X	

Common Name	Species Name	Status	DBCA	ALA	NM	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
CARPHODACTYLIDAE													
Smooth Knob-tailed Gecko	<i>Nephrurus levis</i>				X								
Midline Knob-tailed Gecko	<i>Nephrurus vertebralis</i>			X	X			X	X	X	X		
Banded Knob-tailed Gecko	<i>Nephrurus wheeleri wheeleri</i>									X	X		
Barking Gecko	<i>Underwoodisaurus milii</i>											X	
GEKKONIDAE													
Purplish Dtella	<i>Gehyra purpurascens</i>												
Spotted Dtella	<i>Gehyra punctata</i>			X	X		X	X					
Tree Dtella	<i>Gehyra variegata</i>			X	X	X	X	X	X	X	X	X	
Bynoe's Gecko	<i>Heteronotia binoei</i>			X	X		X	X	X	X	X	X	X
PYGOPODIDAE													
Marble-faced Delma	<i>Delma australis</i>							X					
Unbanded Dema	<i>Delma butleri</i>			X	X					X	X		
Excitable Delma	<i>Delma tinctoria</i>			X	X			X					
Burton's Legless-Lizard	<i>Lialis burtonis</i>								X	X			
Western Hooded Scaly-foot	<i>Pygopus nigriceps</i>			X	X			X		X	X		
SCINCIDAE													
Buchanan's Snake-eyed Skink	<i>Cryptoblepharus buecananii</i>				X					X	X		X
Snake-eyed Skink	<i>Cryptoblepharus plagiocephalus</i>												
Ajana Ctenotus	<i>Ctenotus alleni</i>				X								
Ariadna's Ctenotus	<i>Ctenotus ariadnae</i>			X	X								
Southern Mallee Ctenotus	<i>Ctenotus atlas</i>									X			
Wedge-snout Ctenotus	<i>Ctenotus brooksi</i>												
Giant Desert Ctenotus	<i>Ctenotus grandis</i>				X						X		
Clay-soil Ctenotus	<i>Ctenotus helenae</i>									X	X		
Bar-shouldered Ctenotus	<i>Ctenotus inornatus</i>			X									
Leonhard's Ctenotus	<i>Ctenotus leonhardii</i>			X	X			X		X	X		
Checker-sided Ctenotus	<i>Ctenotus mimetes</i>					X		X					
Panther Skink	<i>Ctenotus pantherinus</i>				X	X	X				X		
Fourteen-lined Ctenotus	<i>Ctenotus quattuordecimlineatus</i>										X		
Wedge-snouted Ctenotus	<i>Ctenotus schomburgkii</i>			X	X		X	X	X	X	X		X
Rock Ctenotus	<i>Ctenotus severus</i>				X		X	X	X		X		
Spotted Ctenotus	<i>Ctenotus uber</i>				X			X	X		X		

Common Name	Species Name	Status	DBCA	ALA	NM	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
Spinifex Slender Blue-tongue	<i>Cyclodomorphus melanops</i>												
Gilled Slender Blue-tongue Skink	<i>Cyclodomorphus branchialis</i>	V	X		X	X		X					
Pygmy Spiny-tailed Skink	<i>Egernia depressa</i>			X	X			X		X	X		X
Goldfields Crevice Skink	<i>Egernia formosa</i>			X	X			X					
Western Spiny-tailed Skink	<i>Egernia stokesii badia</i>	V	X	X	X			X					X
Broad-banded Sandswimmer	<i>Eremiascincus richardsonii</i>			X	X			X	X	X	X		
North-western Sandslider	<i>Lerista bipes</i>												
Central Deserts Robust Slider	<i>Lerista desertorum</i>										X	X	
Bold-striped Robust Slider	<i>Lerista gerrardii</i>			X			X	X		X			
Common Mulch Lerista	<i>Lerista kingi</i>						X						
Southern Dotted-line Robust Slider	<i>Lerista lineopunctulata</i>				X								
Unpatterned robust slider	<i>Lerista macropisthopus.</i>				X						X		
Inland broad-blazed slider	<i>Lerista nichollsi</i>			X	X		X	X					
Common Mulch Lerista	<i>Lerista timda</i>			X	X	X		X		X	X	X	
Yuna Broad-blazed Slider	<i>Lerista yuna</i>	P1	X	X	X	X							
Desert Skink	<i>Liopholis inornata</i>				X					X	X		
Night Skink	<i>Liopholis striata</i>												
Common Dwarf Skink	<i>Menetia greyii</i>			X	X	X	X	X	X	X	X	X	
Woodland Dark Fleck Skink	<i>Morethia butleri</i>			X	X		X	X		X	X		
Western Blue-tongue	<i>Tiliqua occipitalis</i>			X	X	X				X	X		
Bobtail	<i>Tiliqua rugosa</i>			X									
VARANIDAE													
Pygmy Mulga Monitor	<i>Varanus caudolineatus</i>			X	X	X		X	X	X	X		
Pygmy Desert Monitor	<i>Varanus eremius</i>				X						X		
Perentie	<i>Varanus giganteus</i>			X	X			X			X		
Sand Monitor	<i>Varanus gouldii</i>			X	X			X	X	X	X	X	
Yellow-spotted Monitor	<i>Varanus panoptes rubidus</i>			X	X			X		X	X	X	X
Racehorse Monitor	<i>Varanus tristis tristis</i>									X	X		
TYPHLOPIDAE													
Southern Blind Snake	<i>Anilius australis</i>												
Dark-spined Blind Snake	<i>Anilius bicolor</i>												
Prong-snouted Blind Snake	<i>Anilius bituberculatus</i>									X			
Hook-Snouted Blind Snake	<i>Anilius hamatus</i>			X							X		
Common Beaked Blind Snake	<i>Anilius waitii</i>			X				X			X		

Common Name	Species Name	Status	DBCA	ALA	NM	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
BOIDAE													
Pygmy Python	<i>Antarsia perthensis</i>							X					
Stimson's Python	<i>Antaresia stimsoni</i>							X	X		X		
Woma	<i>Aspidites ramsayi</i>	P1	X										
Carpet Python	<i>Morelia spilota imbricata</i>	L		X	X			X					
ELAPIDAE													
Desert Death Adder	<i>Acanthophis pyrrhus</i>			X	X								
North-western Shovel-nosed Snake	<i>Brachyuropsis approximans</i>			X	X			X					
Southern Shovel-nosed Snake	<i>Brachyuropsis semifasciata</i>				X					X	X		
Narrow-banded Snake	<i>Brachyuropsis fasciolatus</i>												
Yellow-faced Whipsnake	<i>Demansia psammophis</i>			X	X			X					
Moon Snake	<i>Furina ornata</i>			X	X			X					
Black-naped Snake	<i>Neelaps bimaculatus</i>												
Monk Snake	<i>Parasuta monachus</i>			X	X			X	X				
Mulga Snake	<i>Pseudechis australis</i>						X	X					
Spotted Mulga Snake	<i>Pseudechis butleri</i>			X	X			X	X				
Ringed Brown Snake	<i>Pseudonaja modesta</i>			X	X			X	X		X	X	
Western Brown Snake	<i>Pseudonaja mengdeni</i>			X	X			X	X		X		
Jan's Banded Snake	<i>Simoselaps bertholdi</i>			X	X			X		X	X		
Rosen's Snake	<i>Suta fasciata</i>			X	X			X			X		
Total Number of Species: 108		5	4	53	63	10	14	56	24	42	57	18	9

Table 3. Birds Expected to Occur and Recorded in the Pipeline Licence Area.

Common Name	Species Name	Status	DBCA	ALA	NM	BA	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
CASUARIIDAE														
Emu	<i>Dromaius novaehollandiae</i>			X	X	X	X	X	X	X	X	X	X	X
PHASIANIDAE														
Stubble Quail	<i>Coturnix pectoralis</i>					X								
MEGAPODIIDAE														
Malleefowl	<i>Leipoa ocellata</i>	V	X	X	X	X	X	X				X		X
ANATIDAE														
Musk Duck	<i>Biziura lobata</i>			X		X								X
Black Swan	<i>Cygnus atratus</i>			X	X	X		X				X		
Australian Shelduck	<i>Tadorna tadornoides</i>				X	X	X	X		X		X		
Australian Wood Duck	<i>Chenonetta jubata</i>			X	X	X		X		X		X		
Pacific Black Duck	<i>Anas superciliosa</i>				X	X		X		X		X		
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>			X	X	X						X		
Grey Teal	<i>Anas gracilis</i>			X	X	X	X	X		X		X		X
Australasian Shoveler	<i>Anas rhynchotis</i>					X		X						
Hardhead	<i>Aythya australis</i>			X	X	X								
Blue-billed Duck	<i>Oxyura australis</i>	P4	X	X		X								
PODICIPEDIDAE														
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>			X	X	X	X	X				X		
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>			X	X	X		X					X	
COLUMBIDAE														
Common Bronzewing	<i>Phaps chalcoptera</i>			X	X	X	X	X	X	X	X	X	X	X
Crested Pigeon	<i>Ocyphaps lophotes</i>			X	X	X	X	X	X	X	X	X	X	X
Diamond Dove	<i>Geopelia cuneata</i>			X	X	X			X	X		X	X	X
Laughing Dove	<i>Streptopelia senegalensis</i>			X	X	X								
PODARGIDAE														
Tawny Frogmouth	<i>Podargus strigoides</i>			X	X	X		X	X	X	X	X		
EUROSTOPODIDAE														
Spotted Nightjar	<i>Eurostopodus argus</i>			X	X	X		X	X	X	X	X		X
AEGOTHELIDAE														
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>			X	X	X	X	X	X		X	X		X
APODIDAE														
Fork-tailed Swift	<i>Apus pacificus</i>	M	X	X	X	X								

Common Name	Species Name	Status	DBCA	ALA	NM	BA	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
THRESKIORNITHIDAE														
Straw-necked Ibis	<i>Threskiornis spinicollis</i>			X	X	X		X	X			X		
Glossy Ibis	<i>Plegadis falcinellus</i>	M	X											
Yellow-billed Spoonbill	<i>Platalea flavipes</i>					X						X		
ARDEIDAE														
White-faced Heron	<i>Egretta novaehollandiae</i>			X	X	X	X	X		X	X			X
White-necked Heron	<i>Ardea pacifica</i>			X	X	X		X			X			
Eastern Great Egret	<i>Ardea modesta</i>			X		X						X		
ACCIPITRIDAE														
Black-shouldered Kite	<i>Elanus axillaris</i>			X	X	X				X				
Letter-winged Kite	<i>Elanus scriptus</i>	P4	X	X										
Square-tailed Kite	<i>Lophoictinia isura</i>					X								
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>			X		X			X					X
Whistling Kite	<i>Haliastur sphenurus</i>			X	X	X	X		X			X	X	X
Black Kite	<i>Milvus migrans</i>					X								
Brown Goshawk	<i>Accipiter fasciatus</i>			X	X	X			X	X		X	X	
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>			X	X	X	X		X		X			
Spotted Harrier	<i>Circus assimilis</i>			X	X	X			X	X				X
Wedge-tailed Eagle	<i>Aquila audax</i>			X	X	X	X	X	X	X	X	X	X	X
Little Eagle	<i>Hieraaetus morphnoides</i>			X	X	X			X		X			X
FALCONIDAE														
Nankeen Kestrel	<i>Falco cenchroides</i>			X	X	X	X	X	X	X	X	X	X	X
Brown Falcon	<i>Falco berigora</i>			X	X	X	X	X	X	X	X	X	X	X
Australian Hobby	<i>Falco longipennis</i>			X	X	X			X	X	X	X	X	X
Peregrine Falcon	<i>Falco peregrinus</i>	OS	X		X	X				X		X		X
Grey Falcon	<i>Falco hypoleucos</i>	V												
RALLIDAE														
Eurasian Coot	<i>Fulica atra</i>			X	X	X								
Black-tailed Native-hen	<i>Tribonyx ventralis</i>			X	X	X		X				X		
Australian Spotted Crake	<i>Porzana fluminea</i>					X								
OTIDIDAE														
Australian Bustard	<i>Ardeotis australis</i>				X	X		X	X		X	X		
BURHINIDAE														
Bush Stone-curlew	<i>Burhinus grallarius</i>	L			X	X		X	X			X		*A

Common Name	Species Name	Status	DBCA	ALA	NM	BA	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
RECURVIROSTRIDAE														
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>					X						X		
Black-winged Stilt	<i>Himantopus himantopus</i>			X	X	X	X	X				X		
Banded Stilt	<i>Cladorhynchus leucocephalus</i>			X		X						X		
CHARADRIIDAE														
Red-capped Plover	<i>Charadrius ruficapillus</i>			X		X		X	X			X		
Black-fronted Dotterel	<i>Euseyonis melanops</i>			X	X	X	X	X		X		X	X	
Red-kneed Dotterel	<i>Erythronyx cinctus</i>			X	X	X		X				X		
Inland Dotterel	<i>Charadrius australis</i>					X			X			X		
Oriental Plover	<i>Charadrius veredus</i>	M												
Grey Plover	<i>Pluvialis squatarola</i>	M												
Australian Pratincole	<i>Stiltia isabella</i>											X		
Banded Lapwing	<i>Vanellus tricolor</i>			X	X	X	X	X	X			X	X	
SCOLOPACIDAE														
Common Greenshank	<i>Tringa nebularia</i>	M	X			X		X						
Wood Sandpiper	<i>Tringa glareola</i>	M	X											
Red-necked Stint	<i>Calidris ruficollis</i>	M												
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	M	X											
Curlew Sandpiper	<i>Calidris ferruginea</i>	M	X											
Common Sandpiper	<i>Actitis hypoleucos</i>	M	X			X		X						
Pectoral Sandpiper	<i>Calidris melanotos</i>	M	X	X	X	X								
TURNICIDAE														
Little Button-quail	<i>Turnix velox</i>					X				X				
LARIDAE														
Silver Gull	<i>Larus novaehollandiae</i>			X		X								
Whiskered Tern	<i>Chlidonias hybrida</i>											X		
Gull-billed Tern	<i>Gelochelidon nilotica</i>	IA	X											
CACATUIDAE														
Galah	<i>Cacatua roseicapilla</i>			X	X	X	X	X	X	X	X	X	X	X
Little Corella	<i>Cacatua sanguinea</i>			X	X	X	X	X				X		R
Cockatiel	<i>Nymphicus hollandicus</i>			X	X	X	X	X		X	X	X	X	X
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	L				X		X			X	X		
Carnaby's Black-Cockatoo	<i>Calyptorhynchus latirostris</i>	E	X	X	X	X								
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>				X	X	X	X						X
PSITTACIDAE														

Common Name	Species Name	Status	DBCA	ALA	NM	BA	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>			X										
Australian Ringneck	<i>Barnardius zonarius</i>			X	X	X	X	X	X	X	X	X	X	X
Mulga Parrot	<i>Psephotus varius</i>			X	X	X			X	X	X	X	X	X
Budgerigar	<i>Melopsittacus undulatus</i>			X	X	X		X	X	X	X	X		
Bourke's Parrot	<i>Neopsephotus bourkii</i>			X	X	X		X	X		X	X		X
Scarlet-chested Parrot	<i>Neophema splendida</i>	L												
Regent Parrot	<i>Polytelis anthopeplus</i>	L				X			X					
Elegant Parrot	<i>Neophema elegans</i>					X								X
Princess Parrot	<i>Polytelis alexandrae</i>	P4	X											
CUCULIDAE														
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>			X		X								
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>			X	X	X			X	X	X	X		X
Black-eared Cuckoo	<i>Chrysococcyx osculans</i>			X	X	X						X		X
Pallid Cuckoo	<i>Cacomantis pallidus</i>			X	X	X	X	X	X	X	X	X		
STRIGIDAE														
Southern Boobook	<i>Ninox novaeseelandiae</i>			X		X			X	X	X	X		
TYTONIDAE														
Eastern Barn Owl	<i>Tyto alba</i>					X			X			X		
HALCYONIDAE														
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>			X	X	X		X	X	X	X	X	X	
Sacred Kingfisher	<i>Todiramphus sanctus</i>			X	X	X			X			X		
MEROPIIDAE														
Rainbow Bee-eater	<i>Merops ornatus</i>			X	X	X		X	X		X	X	X	
CLIMACTERIDAE														
White-browed Treecreeper	<i>Climacteris affinis</i>			X	X	X			X		X	X		X
Rufous Treecreeper	<i>Climacteris rufa</i>	L		X										
PTILONORHYNCHIDAE														
Western Bowerbird	<i>Ptilonorhynchus guttatus</i>			X	X	X		X	X	X	X	X	X	X
MALURIDAE														
Splendid Fairy-wren	<i>Malurus splendens</i>			X	X	X	X	X	X	X	X	X	X	X
White-winged Fairy-wren	<i>Malurus leucopterus</i>			X	X	X		X	X		X	X		X
Variegated Fairy-wren	<i>Malurus lamberti</i>			X	X	X	X	X	X	X	X	X	X	X
Blue-breasted Fairy-wren	<i>Malurus pulcherrimus</i>			X	X	X								*R
Striated Grasswren	<i>Amytornis striatus striatus</i>	P4	X			X								*R

Common Name	Species Name	Status	DBCA	ALA	NM	BA	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
ACANTHIZIDAE														
Rufous Fieldwren	<i>Calamanthus campestris</i>					X		X			X	X		
Redthroat	<i>Pyrrholaemus brunneus</i>			X	X	X	X	X	X	X	X	X		X
Weebill	<i>Smicronis brevirostris</i>			X	X	X		X	X		X	X	X	X
White-browed Scrubwren	<i>Sericornis frontalis</i>			X	X	X			X					
Western Gerygone	<i>Gerygone fusca</i>			X	X	X	X	X	X		X	X	X	X
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>				X	X	X	X	X	X	X	X	X	X
Chestnut-rumped Thornbill	<i>Acanthiza uropygialis</i>			X	X	X	X	X	X	X	X	X	X	X
Slaty-backed Thornbill	<i>Acanthiza robustirostris</i>			X	X	X			X	X	X	X		X
Inland Thornbill	<i>Acanthiza apicalis</i>			X	X	X	X	X	X		X	X	X	X
Slender billed Thornbill	<i>Acanthiza iredalei</i>	L		X	X	X							X	
Southern Whiteface	<i>Aphelocephala leucopsis</i>			X	X	X	X	X	X	X	X	X	X	X
PARDALOTIDAE														
Spotted Pardalote	<i>Pardalotus punctatus</i>													
Striated Pardalote	<i>Pardalotus striatus</i>			X	X	X	X	X	X		X	X	X	X
MELIPHAGIDAE														
Pied Honeyeater	<i>Certhionyx variegatus</i>			X	X	X		X	X	X	X	X	X	X
Singing Honeyeater	<i>Gavicalis virescens</i>			X	X	X			X	X	X	X	X	X
White-eared Honeyeater	<i>Lichenostomus leucotis</i>			X		X								
Yellow-plumed Honeyeater	<i>Ptilotula ornata</i>					X			X					
Grey-fronted Honeyeater	<i>Ptilotula plumula</i>			X		X			X		X	X		
White-plumed Honeyeater	<i>Ptilotula penicillata</i>											X		
White-fronted Honeyeater	<i>Purnella albifrons</i>			X	X	X		X	X	X	X	X	X	X
Yellow-throated Miner	<i>Manorina flavigula</i>			X	X	X	X	X	X	X	X	X	X	X
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>			X	X	X	X	X	X	X	X	X	X	X
Red Wattlebird	<i>Anthochaera carunculata</i>			X	X	X								
Crimson Chat	<i>Epthianura tricolor</i>			X	X	X	X	X	X	X	X	X	X	X
White-fronted Chat	<i>Epthianura albifrons</i>			X	X	X	X	X		X				X
Orange Chat	<i>Epthianura aurifrons</i>					X				X		X		
Black Honeyeater	<i>Sugomel niger</i>			X		X			X	X		X		
Brown Honeyeater	<i>Lichmera indistincta</i>			X	X	X	X	X	X	X		X	X	X
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>			X		X								
Tawny-crowned Honeyeater	<i>Glyciphila melanops</i>			X	X	X								

Common Name	Species Name	Status	DBCA	ALA	NM	BA	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
Grey Honeyeater	<i>Lacustroica whitei</i>			X	X	X								
White-cheeked Honeyeater	<i>Phylidonyris niger</i>					X								
POMATOSTOMIDAE														
Grey-crowned Babbler	<i>Pomatostomus temporalis</i>			X	X	X		X	X			X	X	X
White-browed Babbler	<i>Pomatostomus superciliosus</i>			X	X	X	X	X	X	X	X	X	X	X
PSOPHODIDAE														
Chestnut-breasted Quail-thrush	<i>Cinclosoma castaneothorax</i>			X	X	X			X	X				X
Western Quail-thrush	<i>Cinclosoma marginatum</i>				X	X			X	X		X		
Chiming Wedgebill	<i>Psophodes occidentalis</i>			X	X	X			X	X	X	X		X
NEOSITTIDAE														
Varied Sittella	<i>Daphoenositta chrysoptera</i>			X	X	X			X	X	X	X		X
CAMPEPHAGIDAE														
Ground Cuckoo-shrike	<i>Coracina maxima</i>			X	X	X		X			X	X		X
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>			X	X	X	X	X	X	X	X	X	X	X
White-winged Triller	<i>Lalage tricolor</i>			X	X	X			X	X	X	X		X
PACHYCEPHALIDAE														
Gilbert's Whistler	<i>Pachycephala inornata</i>				X	X								
Golden Whistler	<i>Pachycephala pectoralis</i>			X		X								*R
Rufous Whistler	<i>Pachycephala rufiventris</i>			X	X	X	X	X	X	X	X	X	X	X
Grey Shrike-thrush	<i>Colluricincla harmonica</i>			X	X	X	X	X	X	X	X	X	X	X
Crested Bellbird	<i>Oreoica gutturalis</i>			X	X	X	X	X	X	X	X	X	X	X
ARTAMIDAE														
Masked Woodswallow	<i>Artamus personatus</i>			X	X	X		X	X		X	X	X	X
Black-faced Woodswallow	<i>Artamus cinereus</i>			X	X	X	X	X	X		X	X	X	X
Little Woodswallow	<i>Artamus minor</i>					X			X			X	X	X
Dusky Woodswallow	<i>Artamus cyanopterus</i>					X								
Grey Butcherbird	<i>Cracticus torquatus</i>			X	X	X	X	X	X	X	X	X	X	X
Pied Butcherbird	<i>Cracticus nigrogularis</i>			X	X	X	X	X	X	X	X	X	X	X
Australian Magpie	<i>Cracticus tibicen</i>			X	X	X	X	X	X	X	X	X	X	X
Grey Currawong	<i>Strepera versicolor</i>			X	X	X		X			X	X	X	X
RHIPIDURIDAE														
Grey Fantail	<i>Rhipidura albiscapa</i>			X	X	X		X						X
Willie Wagtail	<i>Rhipidura leucophrys</i>			X	X	X	X	X	X	X	X	X	X	X

Common Name	Species Name	Status	DBCA	ALA	NM	BA	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
CORVIDAE														
Little Crow	<i>Corvus bennetti</i>			X	X	X	X	X	X	X	X	X	X	X
Torresian Crow	<i>Corvus orru</i>			X	X	X	X	X			X	X	X	X
Australian Raven	<i>Corvus coronoides</i>			X	X	X	X	X	X	X	X		X	X
MONARCHIDAE														
Magpie-lark	<i>Grallina cyanoleuca</i>			X	X	X	X	X	X	X	X	X	X	X
PETROICIDAE														
Red-capped Robin	<i>Petroica goodenovii</i>			X	X	X	X	X	X	X	X	X	X	X
Hooded Robin	<i>Melanodryas cucullata</i>			X	X	X		X	X	X	X	X	X	X
Jacky Winter	<i>Microeca fascians</i>			X	X	X			X		X			X
Western Yellow Robin	<i>Eopsaltria griseogularis</i>	L		X		X								X
Southern Scrub-robin	<i>Drymodes brunneopygia</i>	L				X			X					*R
MEGALURIDAE														
Rufous Songlark	<i>Cincloramphus mathewsi</i>			X		X				X		X		X
Brown Songlark	<i>Cincloramphus cruralis</i>			X		X				X	X			X
HIRUNDINIDAE														
White-backed Swallow	<i>Cheramoeca leucosterna</i>			X	X	X		X	X	X	X		X	
Welcome Swallow	<i>Hirundo neoxena</i>			X	X	X	X	X	X	X		X	X	X
Fairy Martin	<i>Petrochelidon ariel</i>			X	X	X	X	X		X	X	X		X
Tree Martin	<i>Petrochelidon nigricans</i>			X	X	X	X	X	X			X	X	X
NECTARINIIDAE														
Mistletoebird	<i>Dicaeum hirundinaceum</i>			X	X	X			X		X	X	X	X
ESTRILDIDAE														
Painted Finch	<i>Emblema pictum</i>											X		
Zebra Finch	<i>Taeniopygia guttata</i>			X	X	X	X	X	X	X	X	X	X	X
MOTACILLIDAE														
Australasian Pipit	<i>Anthus novaeseelandiae</i>			X	X	X			X	X	X	X	X	X
ZOSTEROPIDAE														
Silvereye	<i>Zosterops lateralis</i>			X	X	X		X						X
Total Number of Species: 180		29	16	132	121	161	56	89	92	74	78	112	63	88

* Note: species recorded outside of the Pipeline Licence area during transit are listed as "R" (Regional Record) but are not included in species totals. One additional species marked (A), the Bush Stone-curlew, was not recorded during the current survey but reported to occur by local pastoralists.

Table 4. Mammals Expected to Occur and Recorded in the Pipeline Licence Area.

Common Name	Species Name	Status	DBCA	ALA	NM	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
TACHYGLOSSIDAE													
Echidna	<i>Tachyglossus aculeatus</i>				X			X	X	X	X	X	X
DASYURIDAE													
Brush-tailed Mulgara	<i>Dasycercus blythi</i>	P4	X								X		X
Ride's Ningau	<i>Ningau ridei</i>				X					X	X		
Kultarr	<i>Antechinomys laniger</i>						X		X	X	X		
Woolley's Pseudantechinus	<i>Pseudantechinus woolleyae</i>			X	X			X			X		X
Fat-tailed Dunnart	<i>Sminthopsis crassicaudata</i>				X				X	X	X		
Little Long-tailed Dunnart	<i>Sminthopsis dolichura</i>			X	X	X		X	X	X		X	
Long-tailed Dunnart	<i>Sminthopsis longicaudata</i>	P4	X					X			X		X
Hairy-footed Dunnart	<i>Sminthopsis hirtipes</i>				X					X	X		
Stripe-faced Dunnart	<i>Sminthopsis macroura</i>							X	X	X	X	X	X
Ooldea Dunnart	<i>Sminthopsis ooldea</i>										X		
MACROPODIDAE													
Western Grey Kangaroo	<i>Macropus fuliginosus</i>				X							X	X
Euro	<i>Osphranter robustus</i>			X	X			X	X	X	X	X	X
Red Kangaroo	<i>Osphranter rufus</i>			X	X		X	X	X	X	X	X	X
EMBALLONURIDAE													
Hill's Sheath-tail Bat	<i>Taphozous hilli</i>							X	X			X	
MOLOSSIDAE													
Inland Freetail Bat	<i>Ozimops petersi</i>							X		X		X	
Southern Freetail Bat	<i>Ozimops kitcheneri</i>												X
White-striped Freetail Bat	<i>Austronomus australis</i>			X				X	X			X	X
VESPERTILIONIDAE													
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>				X			X		X	X	X	X
Chocolate Wattled Bat	<i>Chalinolobus morio</i>							X				X	X
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>			X	X				X	X	X	X	X
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>				X			X		X		X	X
Southern Forest Bat	<i>Vespadelus regulus</i>									X			
Inland forest bat	<i>Vespadelus baverstocki</i>												
Inland Cave Bat	<i>Vespadelus finlaysoni</i>			X	X			X	X			X	
MURIDAE													
Spinifex Hopping Mouse	<i>Notomys alexis</i>				X			X			X		X
Mitchell's Hopping Mouse	<i>Notomys mitchellii</i>			X	X					X			
Ash-grey Mouse	<i>Pseudomys albocinereus</i>												
Bolam's Mouse	<i>Pseudomys bolami</i>												

Common Name	Species Name	Status	DBCA	ALA	NM	Urawa	Barnong	Yogi	Mt Magnet	Yuinmery	Black Range	Agnew	NGI 2020
Desert Mouse	<i>Pseudomys desertor</i>										X		
Sandy Inland Mouse	<i>Pseudomys hermannsburgensis</i>							X	X	X	X		X
INTRODUCED MAMMALS													
Dingo / Dog	<i>Canis lupus</i>							X				X	X
European Red Fox	<i>Vulpes vulpes</i>							X	X	X			
Feral Cat	<i>Felis catus</i>							X	X			X	X
Rabbit	<i>Oryctolagus cuniculus</i>						X	X	X	X		X	X
House Mouse	<i>Mus musculus</i>			X	X	X		X	X	X	X		X
Goat	<i>Capra hircus</i>			X				X	X	X		X	X
Horse	<i>Equus caballus</i>							X					
Dromedary Camel	<i>Camelus dromedarius</i>												
Cattle	<i>Bos taurus</i>							X	X	X		X	X
Sheep	<i>Ovis aries</i>				X			X	X	X			X
Total Number of Native Species: 31		5	2	8	15	1	2	16	12	16	17	14	16
Total Number of Introduced Species: 10		0	0	2	2	1	1	9	7	6	1	5	7

Table 5. Invertebrates Recorded within 10 km of the Pipeline Licence Area (sourced from NatureMap, DBCA 2020, Western Australian Museum and Atlas of Living Australia, 2020).

Taxon	ORDER (Family)	Conservation Status	Restricted Range	Recognised SRE Group
<i>Acariformes sp.</i>	ACARIFORMES (Superorder)			
<i>Aeshnidae sp.</i>	ODONATA (AESHNIDAE)			
<i>Amblyomma triguttatum</i>	IXODIDA (IXODIDAE)			
<i>Aname armigera</i>	ARANEAE (NEMESIIDAE)		Yes	Yes
<i>Aname mainae</i>	ARANEAE (NEMESIIDAE)			
<i>Anidiops villosus</i>	ARANEAE (IDIOPIDAE)			
<i>Asadipus phaleratus</i>	ARANEAE (LAMPONIDAE)			
<i>Austracantha minax</i>	ARANEAE (ARANEIDAE)			
<i>Boolathana mainae</i>	ARANEAE (TROCHANTERIIDAE)			
<i>Ceratopogonidae sp.</i>	DIPTERA (CERATOPOGONIDAE)			
<i>Cercophonius sulcatus</i>	SCORPIONES (BOTHRIURIDAE)			
<i>Chironominae sp.</i>	DIPTERA (CHIRONOMIDAE)			
<i>Coenagrionidae sp.</i>	ODONATA (COENAGRIONIDAE)			
<i>Corduliidae sp.</i>	ODONATA (CORDULIIDAE)			
<i>Cormocephalus bungalbinensis</i>	SCOLOPENDROMORPHA (SCOLOPENDRIDAE)		Yes	Yes
<i>Cormocephalus strigosus</i>	SCOLOPENDROMORPHA (SCOLOPENDRIDAE)			
<i>Ctenocolletacarus brevirostris</i>	SARCOPTIFORMES (ACARIDAE)			
<i>Culicidae sp.</i>	DIPTERA (CULICIDAE)			
<i>Cyrtophora parnasia</i>	ARANEAE (ARANEIDAE)			
<i>Dytiscidae sp.</i>	COLEOPTERA (DYTISCIDAE)			
<i>Ephydriidae sp.</i>	DIPTERA (EPHYDRIDAE)			
<i>Ethmostigmus rubripes</i>	SCOLOPENDROMORPHA (SCOLOPENDRIDAE)			
<i>Hoggicosa bicolor</i>	ARANEAE (LYCOSIDAE)			
<i>Hoggicosa castanea</i>	ARANEAE (LYCOSIDAE)			
<i>Hoggicosa storri</i>	ARANEAE (LYCOSIDAE)			
<i>Hogna crispipes</i>	ARANEAE (LYCOSIDAE)			
<i>Holconia nigrigularis</i>	ARANEAE (SPARASSIDAE)			
<i>Holoplatys pamberton</i>	ARANEAE (SALTICIDAE)			
<i>Hydraenidae sp.</i>	COLEOPTERA (HYDRAENIDAE)			
<i>Hydrophilidae sp.</i>	COLEOPTERA (HYDROPHILIDAE)			
<i>Idiommatia blackwalli</i>	ARANEAE (BARYCHELIDAE)			
<i>Idiosoma clypeatum</i>	ARANEAE (IDIOPIDAE)	Priority 3		
<i>Isometroides vesus</i>	SCORPIONES (BUTHIDAE)			
<i>Isopoda leishmanni</i>	ARANEAE (SPARASSIDAE)			
<i>Isopedella saundersi</i>	ARANEAE (SPARASSIDAE)			
<i>Lampona cylindrata</i>	ARANEAE (LAMPONIDAE)			
<i>Lamponina scutata</i>	ARANEAE (LAMPONIDAE)			
<i>Latrodectus hasseltii</i>	ARANEAE (THERIDIIDAE)			
<i>Leptoceridae sp.</i>	TRICHOPTERA (LEPTOCERIDAE)			

Taxon	ORDER (Family)	Conservation Status	Restricted Range	Recognised SRE Group
<i>Lestidae sp.</i>	ODONATA (LESTIDAE)			
<i>Lychas jonesae</i>	SCORPIONES (BUTHIDAE)			
<i>Lycosa australicola</i>	ARANEAE (LYCOSIDAE)			
<i>Lycosa godeffroyi</i>	ARANEAE (LYCOSIDAE)			
<i>Mainosa longipes</i>	ARANEAE (LYCOSIDAE)			
<i>Masasteron complector</i>	ARANEAE (ZODARIIDAE)			
<i>Megalopsalis leptekes</i>	OPILIONES (NEOPILIONIDAE)		Yes	Yes
<i>Missulena granulosa</i>	ARANEAE (ACTINOPODIDAE)			
<i>Missulena occatoria</i>	ARANEAE (ACTINOPODIDAE)			
<i>Molycrria vokes</i>	ARANEAE (PRODIDOMIDAE)			
<i>Neosparassus sp.</i>	ARANEAE (SPARASSIDAE)			
<i>Nicodamus mainae</i>	ARANEAE (NICODAMIDAE)			
<i>Nomindra leeuweni</i>	ARANEAE (PRODIDOMIDAE)			
<i>Orphnaeus brevilabiatus</i>	GEOPHILOMORPHA (ORYIDAE)		No	Yes
<i>Pediana tenuis</i>	ARANEAE (SPARASSIDAE)			
<i>Pellenes bitaeniata</i>	ARANEAE (SALTICIDAE)			
<i>Pyralidae sp.</i>	LEPIDOPTERA (PYRALIDAE)			
<i>Scolopendra laeta</i>	SCOLOPENDROMORPHA (SCOLOPENDRIDAE)			
<i>Scolopendra morsitans</i>	SCOLOPENDROMORPHA (SCOLOPENDRIDAE)			
<i>Staphylinidae sp.</i>	COLEOPTERA (STAPHYLINIDAE)			
<i>Storena sinuosa</i>	ARANEAE (ZODARIIDAE)			
<i>Storosa sp.</i>	ARANEAE (ZODARIIDAE)			
<i>Stratiomyidae sp.</i>	DIPTERA (STRATIOMYIDAE)			
<i>Tanypodinae sp.</i>	DIPTERA (CHIRONOMIDAE)			
<i>Tasmanicosa leuckartii</i>	ARANEAE (LYCOSIDAE)			
<i>Thereuopoda lesueurii</i>	SCUTIGEROMORPHA (SCUTIGERIDAE)			
<i>Urodacus armatus</i>	SCORPIONES (URODACIDAE)			
<i>Urodacus hartmeyeri</i>	SCORPIONES (URODACIDAE)			
<i>Urodacus hoplurus</i>	SCORPIONES (URODACIDAE)			
<i>Urodacus novaehollandiae</i>	SCORPIONES (URODACIDAE)			
<i>Venator immansueta</i>	ARANEAE (LYCOSIDAE)			
<i>Venator yalkara</i>	ARANEAE (LYCOSIDAE)			
<i>Wesmaldra urawa</i>	ARANEAE (PRODIDOMIDAE)		Yes	No
<i>Withius piger</i>	PSEUDOSCORPIONES (WITHIIDAE)		No	Yes
Undescribed Taxa from Groups exhibiting Short-range Endemism				
Millipedes				
<i>Antichiropus sp.</i>	POLYDESMIDA (PARADOXOSOMATIDAE)		Likely	Yes
Pseudoscorpions				
<i>Austrochthonius sp.</i>	PSEUDOSCORPIONES (CHTHONIIDAE)		Likely	Yes
<i>OLPIIDAE sp.</i>	PSEUDOSCORPIONES (OLPIIDAE)		Likely	Yes
<i>Synsphyronus sp.</i>	PSEUDOSCORPIONES (GARYPIDAE)		Likely	Yes
Scorpions				

Taxon	ORDER (Family)	Conservation Status	Restricted Range	Recognised SRE Group
<i>Lychas sp. 1</i>	SCORPIONES (BUTHIDAE)		Unknown	Yes
<i>Lychas sp. 2</i>	SCORPIONES (BUTHIDAE)		Unknown	Yes
<i>Urodacus sp.</i>	SCORPIONES (URODACIDAE)		Unknown	Yes
<i>BUTHIDAE sp.</i>	SCORPIONES (BUTHIDAE)		Unknown	Yes
Spiders				
<i>Pelcinus sp.</i>	ARANEAE (OONOPIDAE)		Potential	No
<i>Aname sp.</i>	ARANEAE (NEMESIIDAE)		Potential	Yes
<i>Australomisidia sp.</i>	ARANEAE (THOMISIDAE)		Potential	No
<i>Badumna sp.</i>	ARANEAE (DESIDAE)		No	No
<i>Grymeus sp.</i>	ARANEAE (OONOPIDAE)		Potential	No
<i>Adoxotoma sp.</i>	ARANEAE (SALTICIDAE)		Potential	No
<i>Selenocosmia sp.</i>	ARANEAE (THERAPHOSIDAE)		Potential	Yes

Appendix 3: Habitat Assessment Site Details.

Field Code	Latitude	Longitude	Survey Type	Date
Hab001	-28.616	115.139	10 - 30 minute habitat assessment and opportunistic recording of fauna	31/08/2020
Hab002	-28.58	115.284	10 - 30 minute habitat assessment and opportunistic recording of fauna	31/08/2020
Hab003	-28.569	115.298	10 - 30 minute habitat assessment and opportunistic recording of fauna	31/08/2020
Hab004	-28.563	115.332	10 - 30 minute habitat assessment and opportunistic recording of fauna	31/08/2020
Hab005	-28.556	115.382	10 - 30 minute habitat assessment and opportunistic recording of fauna	31/08/2020
Hab006	-28.517	115.51	10 - 30 minute habitat assessment and opportunistic recording of fauna	1/09/2020
Hab007	-28.517	115.51	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab008	-28.512	115.601	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab009	-28.509	115.63	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab010	-28.497	115.691	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab011	-28.488	115.742	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab012	-28.492	115.749	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab013	-28.485	115.788	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab014	-28.481	115.814	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab015	-28.468	115.882	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab016	-28.463	115.947	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab017	-28.463	115.951	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab018	-28.46	115.959	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab019	-28.459	115.962	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab020	-28.448	116.003	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab021	-28.446	116.008	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab022	-28.445	116.013	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab023	-28.437	116.041	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab024	-28.438	116.044	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab025	-28.437	116.047	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab026	-28.436	116.057	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab027	-28.428	116.122	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab028	-28.426	116.128	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab029	-28.419	116.189	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab030	-28.419	116.187	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab031	-28.42	116.183	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab032	-28.421	116.175	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab033	-28.414	116.227	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab034	-28.413	116.238	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab035	-28.413	116.248	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab036	-28.424	116.277	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab037	-28.431	116.291	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab038	-28.435	116.293	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab039	-28.399	116.384	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab040	-28.379	116.436	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab041	-28.375	116.453	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab042	-28.369	116.471	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020

Field Code	Latitude	Longitude	Survey Type	Date
Hab043	-28.364	116.49	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab044	-28.361	116.516	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab045	-28.359	116.551	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab046	-28.355	116.586	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab047	-28.351	116.627	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab048	-28.361	116.659	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab049	-28.362	116.688	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab050	-28.354	116.699	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab051	-28.353	116.719	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab052	-28.353	116.753	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab053	-28.352	116.766	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab054	-28.352	116.8	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab055	-28.352	116.819	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab056	-28.36	116.89	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab057	-28.358	116.92	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab058	-28.359	116.941	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab059	-28.359	116.972	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab060	-28.352	117.033	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab061	-28.341	117.059	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab062	-28.33	117.088	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab063	-28.331	117.097	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab064	-28.331	117.141	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab065	-28.327	117.158	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab066	-28.328	117.177	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab067	-28.317	117.191	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab068	-28.288	117.249	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab069	-28.279	117.32	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab070	-28.273	117.358	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab071	-28.265	117.412	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab072	-28.26	117.453	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab073	-28.252	117.504	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab074	-28.246	117.548	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab075	-28.241	117.582	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab076	-28.236	117.615	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab077	-28.225	117.663	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab078	-28.219	117.692	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab079	-28.216	117.738	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab080	-28.217	117.757	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab081	-28.211	117.785	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab082	-28.199	117.815	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab083	-28.188	117.842	10 - 30 minute habitat assessment and opportunistic recording of fauna	5/09/2020
Hab084	-28.176	117.89	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab085	-28.168	117.929	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020

Field Code	Latitude	Longitude	Survey Type	Date
Hab086	-28.156	117.972	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab087	-28.153	117.998	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab088	-28.152	118.008	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab089	-28.151	118.038	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab090	-28.151	118.047	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab091	-28.155	118.07	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab092	-28.154	118.086	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab093	-28.159	118.137	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab094	-28.169	118.17	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab095	-28.185	118.21	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab096	-28.188	118.238	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab097	-28.198	118.301	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab098	-28.205	118.335	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab099	-28.216	118.371	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab100	-28.468	115.925	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab101	-28.468	115.93	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab102	-28.467	115.935	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab103	-28.454	115.98	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab104	-28.453	115.983	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab105	-28.451	115.996	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab106	-28.448	115.999	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab107	-28.434	116.064	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab108	-28.433	116.069	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab109	-28.429	116.11	10 - 30 minute habitat assessment and opportunistic recording of fauna	2/09/2020
Hab110	-28.415	116.212	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab111	-28.43	116.288	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab112	-28.4	116.381	10 - 30 minute habitat assessment and opportunistic recording of fauna	3/09/2020
Hab113	-28.364	116.663	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab114	-28.362	116.685	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab115	-28.353	116.704	10 - 30 minute habitat assessment and opportunistic recording of fauna	4/09/2020
Hab116	-28.243	118.857	10 - 30 minute habitat assessment and opportunistic recording of fauna	7/09/2020
Hab117	-28.265	119.098	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020
Hab118	-28.351	119.711	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab119	-28.339	119.665	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab200	-28.231	118.43	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab201	-28.226	118.478	10 - 30 minute habitat assessment and opportunistic recording of fauna	6/09/2020
Hab202	-28.235	118.726	10 - 30 minute habitat assessment and opportunistic recording of fauna	7/09/2020
Hab203	-28.236	118.746	10 - 30 minute habitat assessment and opportunistic recording of fauna	7/09/2020
Hab204	-28.237	118.766	10 - 30 minute habitat assessment and opportunistic recording of fauna	7/09/2020
Hab205	-28.238	118.787	10 - 30 minute habitat assessment and opportunistic recording of fauna	7/09/2020
Hab206	-28.24	118.838	10 - 30 minute habitat assessment and opportunistic recording of fauna	7/09/2020
Hab207	-28.265	119.082	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020
Hab208	-28.264	118.981	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020

Field Code	Latitude	Longitude	Survey Type	Date
Hab209	-28.253	118.923	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020
Hab210	-28.264	119.137	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020
Hab211	-28.268	119.193	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020
Hab212	-28.264	119.157	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020
Hab213	-28.288	119.458	10 - 30 minute habitat assessment and opportunistic recording of fauna	8/09/2020
Hab214	-28.366	119.755	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab215	-28.363	119.756	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab216	-28.332	119.84	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab217	-28.311	119.89	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab218	-28.279	119.965	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab219	-28.266	119.995	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab220	-28.237	120.045	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab221	-28.23	120.066	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab222	-28.229	120.146	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab223	-28.346	119.689	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab224	-28.334	119.646	10 - 30 minute habitat assessment and opportunistic recording of fauna	9/09/2020
Hab225	-28.233	120.311	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab226	-28.238	120.453	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab227	-28.254	120.53	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab228	-28.258	120.696	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab229	-28.236	120.783	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab230	-28.236	120.813	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab231	-28.242	120.756	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab232	-28.263	120.674	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020
Hab233	-28.265	120.66	10 - 30 minute habitat assessment and opportunistic recording of fauna	10/09/2020

Appendix 4: Bat Call Analysis.



**Acoustic analysis and bat call identification
from Mullewa – Mt Magnet,
Western Australia**

Prepared for **Western Wildlife**

Version **27 October 2020**

SZ project reference **SZ538**

Prepared by **Dr Kyle Armstrong and Yuki Konishi**

Specialised Zoological ABN 92 265 437 422
Tel +61 (0)404 423 264
kyle.n.armstrong@gmail.com
<http://szool.com.au>



© Copyright - Specialised Zoological, ABN 92 265 437 422. This document and its content are copyright and may not be copied, reproduced or distributed (in whole or part) without the prior written permission of Specialised Zoological other than by the Client for the purposes authorised by Specialised Zoological ("Intended Purpose"). The Client acknowledges that the Final Report is intended for the sole use of the Client, and only to be used for the Intended Purpose. Any representation or recommendation contained in the Final Report is made only to the Client. Specialised Zoological will not be liable for any loss or damage whatsoever arising from the use and/or reliance on the Final Report by any third party. To the extent that the Intended Purpose requires the disclosure of this document and/or its content to a third party, the Client must procure such agreements, acknowledgements and undertakings as may be necessary to ensure that the third party does not copy, reproduce, or distribute this document and its content other than for the Intended Purpose. This disclaimer does not limit any rights Specialised Zoological may have under the *Copyright Act 1968 (Cth)*.

This report should be included as an appendix in any larger submission to Government, and cited as:

Specialised Zoological (2020). Acoustic analysis and bat call identification from Mullewa – Mt Magnet, Western Australia. Unpublished report by Specialised Zoological for Western Wildlife, 27 October 2020, project reference SZ538.

SZ538: Acoustic analysis and bat call identification from Mullewa – Mt Magnet, Western Australia

Summary

Bat identifications from acoustic recordings are provided from between Mullewa and Mt Magnet, Western Australia. Six species of bat were identified as being present (**Tables 1 and 2**). Representative echolocation calls for each identification are illustrated (**Figure 1**), as recommended by the Australasian Bat Society (ABS 2006). Further details are available should verification be required.

Methods

The data provided were recorded in full spectrum WAV format with a Titley Scientific Anabat Swift bat detector (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise).

Each WAV was inspected in a spectrogram within the software Anabat Insight version 1.9.6-0-g81d15cb. Species were identified based on information in Churchill (2008); and nomenclature follows Jackson and Groves (2015).

Comments on identifications

The identification of bat species from full spectrum WAV-format recordings of their echolocation calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics. Information on known distributions (Churchill 2008) was also used to aid identification.

References

- ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6–9. [ISSN 1448-5877]
- Churchill, S.K. (2008). *Australian bats*. 2nd ed. Allen and Unwin, Crows Nest, NSW.
- Jackson, S.M. and Groves, C.P. (2015). *Taxonomy of Australian mammals*. CSIRO Publishing, Victoria.

SZ538: Acoustic analysis and bat call identification from Mullewa – Mt Magnet, Western Australia

Limitations

The identifications presented in this report have been made within the following context:

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was set up and supplied by Specialised Zoological. The equipment was operated by the third party during the survey.
4. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
8. The analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.

SZ538: Acoustic analysis and bat call identification from Mullewa – Mt Magnet, Western Australia

Table 1. Species identified in the present survey from all sites combined.

VESPERTILIONIDAE	
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>
Chocolate Wattled Bat	<i>Chalinolobus morio</i>
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>
Inland Broad-nosed Bat	<i>Scotorepens balstoni</i>
MOLOSSIDAE	
White-striped Free-tailed Bat	<i>Austronomus australis</i>
Western Free-tailed Bat	<i>Ozimops kitcheneri</i>

Table 2. Species identifications, with the degree of confidence indicated by a code. Date and recording unit number correlates with site; see Table 1 for full species names.

		<i>A. australis</i>	<i>C. gouldii</i>	<i>C. morio</i>	<i>N. geoffroyi</i>	<i>O. kitcheneri</i>	<i>S. balstoni</i>
Date	Coordinates						
Swift 49995							
31/08/2020	28.517213 S, 115.509258 E	◆	—	—	—	◆	—
2/09/2020	28.413753 S, 116.227157 E	◆	—	—	◆	◆	—
3/09/2020	28.359123 S, 116.551155 E	◆	—	—	—	◆	—
4/09/2020	28.330162 S, 117.088412 E	—	◆	◆	◆	◆	◆
5/09/2020	28.178327 S, 117.864990 E	—	◆	◆	◆	◆	—

Definition of confidence level codes

— Not detected.

◆ Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or a DNA sequence.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the *Comments on identifications* section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

SZ538: Acoustic analysis and bat call identification from Mullewa – Mt Magnet, Western Australia

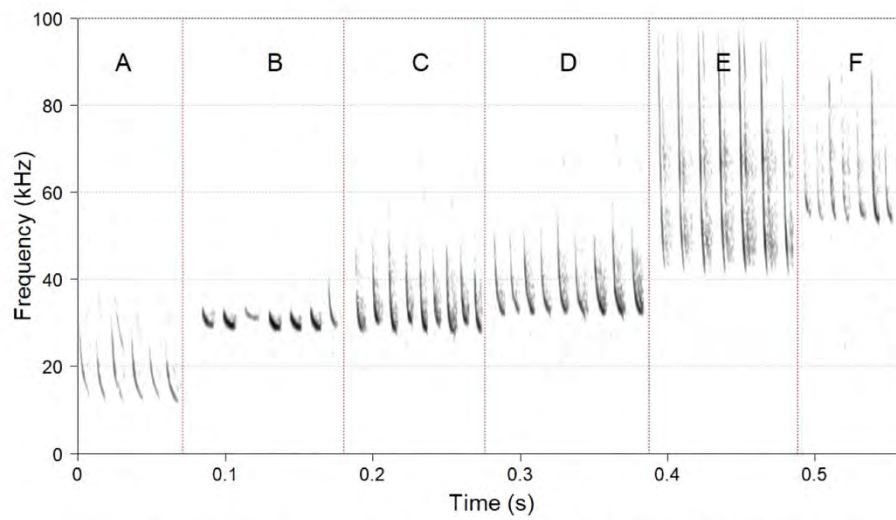


Figure 1. Representative echolocation call sequence portions of the species identified (A: *Austronomus australis*; B: *Ozimops kitcheneri*; C: *Chalinolobus gouldii*; D: *Scotorepens balstoni*; E: *Nyctophilus geoffroyi*; F: *Chalinolobus morio*; time between pulses has been compressed).

Appendix 5: Broad habitats mapped across the survey area.

Focused Vision (2020) Vegetation Units

Vegetation Unit Code	Vegetation Description	Representative Quadrats/Relevés	Area (ha)	% of Project Area
BsCaW <i>Banksia</i> Woodland	<i>Banksia sceptrum</i> and <i>Callitris arenaria</i> Low Open Woodland over <i>Beaufortia aestiva</i> Sparse Shrubland over <i>Austrostipa elegantissima</i> Low Sparse Grassland.	FW04R	0.68	0.005
CcLOW <i>Callitris</i> Woodland	<i>Callitris columellaris</i> , <i>Melaleuca fulgens</i> and <i>Acacia ramulosa</i> var. <i>linophylla</i> Tall Shrubland over <i>Acacia colletioides</i> , <i>Eremophila latrobei</i> subsp. <i>latrobei</i> and <i>Aluta aspera</i> subsp. <i>hesperia</i> Sparse Shrubland over <i>Goodenia capillosa</i> , <i>Waitzia acuminata</i> var. <i>acuminata</i> and <i>Calocephalus multiflorus</i> Low Sparse Forbland.	18, S16^, W16	104.76	0.845
EbW <i>Eucalyptus</i> Woodland	<i>Eucalyptus beardiana</i> Low Woodland over <i>Pimelea microcephala</i> subsp. <i>microcephala</i> Isolated Shrubs over <i>Solanum hesperium</i> Low Sparse Forbland.	FW03R	2.21	0.018
EcW <i>Eucalyptus</i> Woodland	<i>Eucalyptus camaldulensis</i> Woodland over <i>Acacia burkittii</i> , <i>Senna artemisioides</i> subsp. <i>artemisioides</i> Tall Sparse Shrubland over <i>Themeda triandra</i> and <i>Eragrostis tenellula</i> Low Sparse Grassland.	97, 100, 101, 102, E01	5.16	0.042
EkAcS <i>Eucalyptus</i> Woodland	<i>Eucalyptus kingsmillii</i> Mallee Woodland over <i>Acacia ?fusaneura</i> and <i>Acacia caesaneura</i> Tall Open Shrubland over <i>Ptilotus drummondii</i> and <i>Ptilotus obovatus</i> Low Sparse Chenopod Shrubland.	CEN12	60.44	0.487
EkEhW <i>Eucalyptus</i> Woodland	<i>Eucalyptus kochii</i> subsp. <i>borealis</i> , <i>Eucalyptus kochii</i> subsp. <i>plenissima</i> and <i>Eucalyptus horistes</i> Low Open Woodland over <i>Acacia ramulosa</i> var. <i>linophylla</i> , <i>Acacia fusaneura</i> , <i>Acacia aulacophylla</i> and <i>Acacia tetragonophylla</i> Tall Sparse Shrubland over <i>Ptilotus obovatus</i> and <i>Rhagodia drummondii</i> Low Sparse Shrubland.	20, 22, TEC01^, TEC02^, W13^, W14^, W15	31.17	0.251
EkTbHG <i>Eucalyptus</i> Woodland	<i>Eucalyptus kingsmillii</i> Low Woodland over <i>Acacia caesaneura</i> , <i>Acacia incurvaneura</i> and <i>Acacia effusifolia</i> Tall Open Shrubland over <i>Triodia basedowii</i> Low Hummock Grassland.	75b, 81, 82, 82B^	195.05	1.573
EIW <i>Eucalyptus</i> Woodland	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> Low Woodland over <i>Melaleuca eleuterostachya</i> Tall Sparse Shrubland over <i>Atriplex semilunaris</i> and <i>Chenopodium gaudichaudianum</i> Low Sparse Chenopod Shrubland.	7	2.24	0.018
EsBsW <i>Eucalyptus</i> Woodland	<i>Eucalyptus</i> sp., and <i>Banksia</i> sp. Low Open Woodland over <i>Acacia</i> sp. Sparse Shrubland over introduced weeds and grasses.	FW02R	0.66	0.005
EsMnS <i>Eucalyptus</i> Woodland	<i>Eucalyptus subangusta</i> Low Open Forest over <i>Melaleuca nematophylla</i> , <i>Dodonaea inaequifolia</i> and <i>Philotheca brucei</i> subsp. <i>brucei</i> Tall Open Shrubland over <i>Waitzia acuminata</i> var. <i>acuminata</i> Low Sparse Forbland.	S23	1.67	0.013
HspTS <i>Hakea</i> Woodland	<i>Pittosporum angustifolium</i> and <i>Hakea preissii</i> Tall Shrubland over <i>Acacia victoriae</i> and <i>Acacia tetragonophylla</i> Sparse Shrubland over <i>Eriachne flaccida</i> and <i>Maireana pyramidata</i> Low Sparse Shrubland.	CEN13R^, S01, S02^	42.62	0.344
MgCS <i>Hakea</i> Woodland	<i>Hakea preissii</i> isolated Trees over <i>Maireana glomerifolia</i> and <i>Frankenia setosa</i> Low Sparse Chenopod Shrubland.	105, 106^	3.29	0.027
AtTS <i>Acacia</i> Shrubland	<i>Acacia tysonii</i> , <i>Acacia ligulata</i> and <i>Acacia aulacophylla</i> Tall Shrubland over <i>Atriplex ?bunburyana</i> and <i>Ptilotus obovatus</i> Sparse Shrubland over <i>Frankenia ?cinerea</i> and <i>Roepera eremaea</i> Low Sparse Shrubland.	28, 29, 30, 31, 35	674.41	5.437

Vegetation Unit Code	Vegetation Description	Representative Quadrats/Relevés	Area (ha)	% of Project Area
AbTOS <i>Acacia</i> Shrubland	<i>Acacia burkittii</i> Tall Open Shrubland.	56, 69, 69a	102.99	0.830
AnTOS <i>Acacia</i> Shrubland	<i>Acacia neurophylla</i> subsp. <i>erugata</i> , <i>Acacia</i> sp. and <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i> Tall Open Shrubland over <i>Trachymene cyanopetala</i> and <i>Chenopodium gaudichaudianum</i> Low Sparse Shrubland.	9	5.74	0.046
AspTS <i>Acacia</i> Shrubland	<i>Acacia caesaneura</i> , <i>Acacia tetragonophylla</i> and <i>Acacia aptaneura</i> Tall Shrubland over <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Aluta aspera</i> subsp. <i>hesperia</i> , <i>Eremophila fraseri</i> subsp. <i>fraseri</i> Sparse Shrubland over <i>Ptilotus obovatus</i> and <i>Maireana triptera</i> Low Sparse Shrubland.	23, 36, 37 [^] , 38, 39, 41, 42, 44, 45, CEN02R	1,237.69	9.978
AcTOS <i>Acacia</i> / <i>Eremophila</i> Shrubland	<i>Acacia caesaneura</i> , <i>Acacia tetragonophylla</i> , <i>Acacia craspedocarpa</i> , <i>Acacia incurvaneura</i> Tall Shrubland over <i>Eremophila forrestii</i> , <i>Eremophila latrobei</i> and <i>Aluta aspera</i> subsp. <i>hesperia</i> Low Sparse Shrubland over <i>Eragrostis eriopoda</i> Low Open Grassland.	40, 57, 58 [^] , 61, 73, 81e [^] , 88 [^] , 89, 90, 91, 94, 95, 98, 99, 103, 104, 108, 71b, 76c, 91e, CEN11R [^] , E02, E03, E04 [^] , E05 [^] , E06 [^] , E08, E09, E10	5,324.16	42.924
AmTS <i>Acacia</i> / <i>Eremophila</i> Shrubland	<i>Acacia mulganeura</i> , <i>Acacia caesaneura</i> and <i>Acacia ramulosa</i> var. <i>ramulosa</i> Tall Shrubland over <i>Eremophila forrestii</i> Sparse Shrubland.	S03 [^] , S04	71.65	0.578
ArEIS <i>Acacia</i> / <i>Eremophila</i> Shrubland	<i>Acacia ramulosa</i> var. <i>linophylla</i> Tall Shrubland over <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , <i>Hemigenia divaricata</i> and <i>Philotheca brucei</i> subsp. <i>brucei</i> Sparse Shrubland over <i>Borya sphaerocephala</i> and <i>Waitzia acuminata</i> var. <i>acuminata</i> Low Sparse Forbland.	S17, S18	85.09	0.686
AvS <i>Acacia</i> / <i>Eremophila</i> Shrubland	<i>Acacia victoriae</i> , <i>Acacia ?inaequilatera</i> and <i>Eremophila ?longiflora</i> Tall Shrubland <i>Ptilotus aervoides</i> and <i>Ptilotus obovatus</i> Sparse Shrubland.	55, 70 [^]	26.44	0.213
AcEspS <i>Acacia</i> / <i>Eremophila</i> Shrubland	<i>Acacia caesaneura</i> , <i>Acacia incurvaneura</i> , <i>Acacia mulganeura</i> Tall Open Shrubland over <i>Eremophila forrestii</i> subsp. <i>forrestii</i> , <i>Eremophila compacta</i> subsp. <i>compacta</i> Low Sparse Shrubland.	43, 46, 47 [^] , 51, 60, 62 [^] , 63, CEN03, CEN04, CEN06, CEN07, CEN09, E11, S10 [^]	1,524.05	12.287
AtHpS <i>Acacia</i> / <i>Hakea</i> Shrubland	<i>Acacia tetragonophylla</i> , <i>Acacia incurvaneura</i> and <i>Hakea preissii</i> Tall Open Shrubland over <i>Eremophila clarkeii</i> and <i>Eremophila latrobei</i> subsp. <i>latrobei</i> Sparse Shrubland over <i>Ptilotus obovatus</i> , <i>Maireana trichoptera</i> and <i>Maireana georgei</i> Low Chenopod Shrubland.	74 [^] , 107, 109, 77B, E07 [^] , W12 [^]	182.99	1.475
AcMIS <i>Acacia</i> / <i>Melaleuca</i> Shrubland	<i>Acacia caesaneura</i> , <i>Acacia acuminata</i> and <i>Melaleuca leiocarpa</i> Tall Shrubland over <i>Philotheca brucei</i> Sparse Shrubland over <i>Waitzia acuminata</i> var. <i>acuminata</i> Low Sparse Forbland.	S13, S14 [^] , S15	201.25	1.622
AbMpCS Chenopod Shrubland	<i>Atriplex ?bunburyana</i> , <i>Maireana pyramidata</i> and <i>Cratystylis subspinescens</i> Low Open Chenopod Shrubland.	48 [^] , 49 [^] , 50 [^] , 53, 54 [^] , 64, 65 [^] , 66	506.81	4.086
MpCS Chenopod Shrubland	<i>Hakea preissii</i> or <i>Acacia ?fusaneura</i> isolated Trees over <i>Maireana pyramidata</i> , <i>Maireana triptera</i> and <i>Frankenia setosa</i> Low Sparse Chenopod Shrubland.	68, CEN01R [^] , CEN08R, CEN10 [^]	27.95	0.225
McS <i>Melaleuca</i> / <i>Acacia</i> Shrubland	<i>Eucalyptus ?oleosa</i> or <i>Eucalyptus comitae-vallis</i> Low isolated Trees over <i>Melaleuca concreta</i> , <i>Melaleuca stereophloia</i> and <i>Acacia acuminata</i> Tall Shrubland over <i>Waitzia acuminata</i> var. <i>acuminata</i> Low Sparse Forbland..	10, S21	14.49	0.117

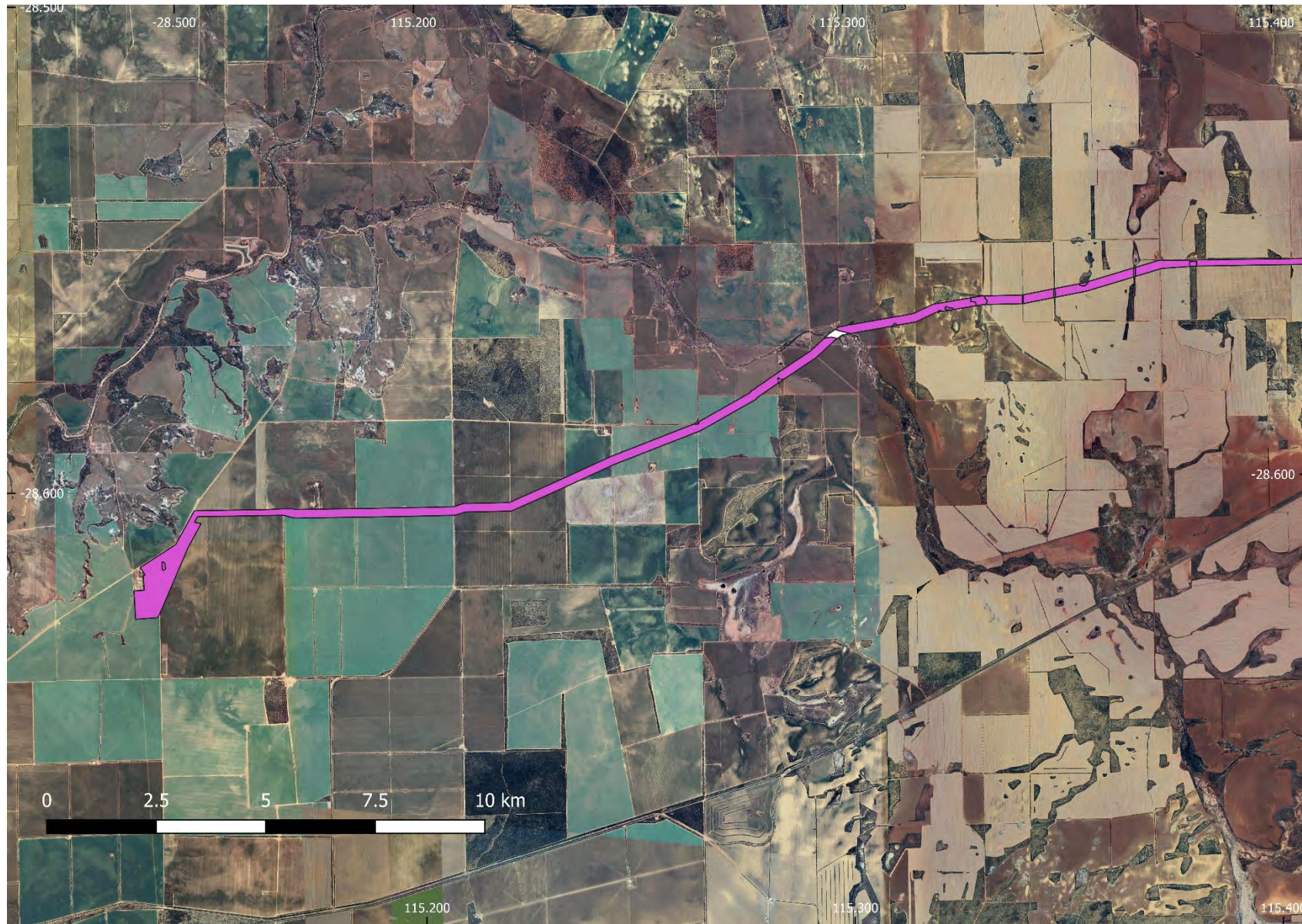
Vegetation Unit Code	Vegetation Description	Representative Quadrats/Relevés	Area (ha)	% of Project Area
MaTS <i>Melaleuca</i> Shrubland	<i>Melaleuca atroviridis</i> , <i>Melaleuca acutifolia</i> and <i>Melaleuca eleuterostachya</i> Tall Shrubland over <i>Acacia latior</i> , <i>Acacia acuminata</i> and <i>Acacia tetragonophylla</i> Sparse Shrubland.	21, 32, 33, 34	285.31	2.300
MsFIS <i>Melaleuca</i> Shrubland	<i>Melaleuca stereophloia</i> Tall Shrubland over <i>Frankenia laxiflora</i> Low Open Shrubland.	CEN05R	26.43	0.213
TSP Pasture	Isolated Trees and/or shrubs in pasture.	01R, 03R, 06R, FW01R	105.73	0.852
TspSS Samphire Shrubland	<i>Tecticornia</i> spp. Low Open Samphire Shrubland.	2, 11, 52, S19	58.28	0.470
SsTS <i>Stylobasium</i> Shrubland	<i>Stylobasium spathulatum</i> Tall Sparse Shrubland over <i>Melaleuca filifolia</i> Sparse Shrubland over <i>Seringia hermannifolia</i> , <i>Podotheca gnaphalioides</i> and <i>Schoenia cassiniana</i> Low Open Forbland.	5	0.84	0.007
Cleared			1,440.93	11.617
Unmapped			50.39	0.406
Total			12,403.57	100

Focus Vision (2020) Vegetation Codes Aligned with Fauna Habitats

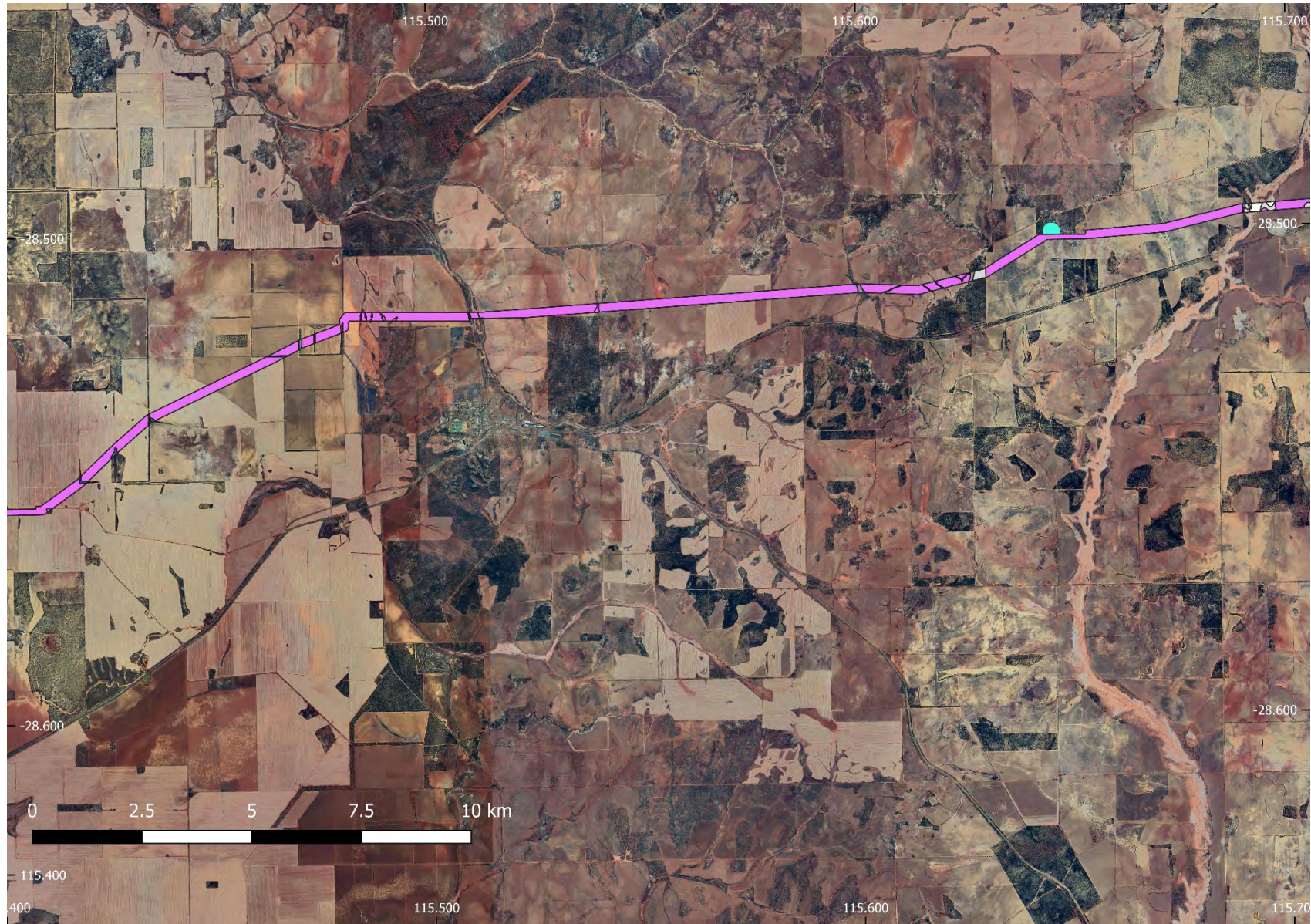
Broad Unit	Habitat Description	Vegetation Unit Codes	Area (ha)	% of Licence Area
Banksia Woodland	Sandplain with <i>Banksia sceptrum</i> and <i>Callitris arenaria</i> Low Open Woodland	BsCaW	0.68	0.005
Callitris Woodland	Sandplain and rises supporting mixed <i>Acacia shrublands</i> and <i>Callitris columellaris</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 clarkei</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 <i>Eremophila</i> (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
	Unmapped		50.39	0.406
	Total		12,403.57	100

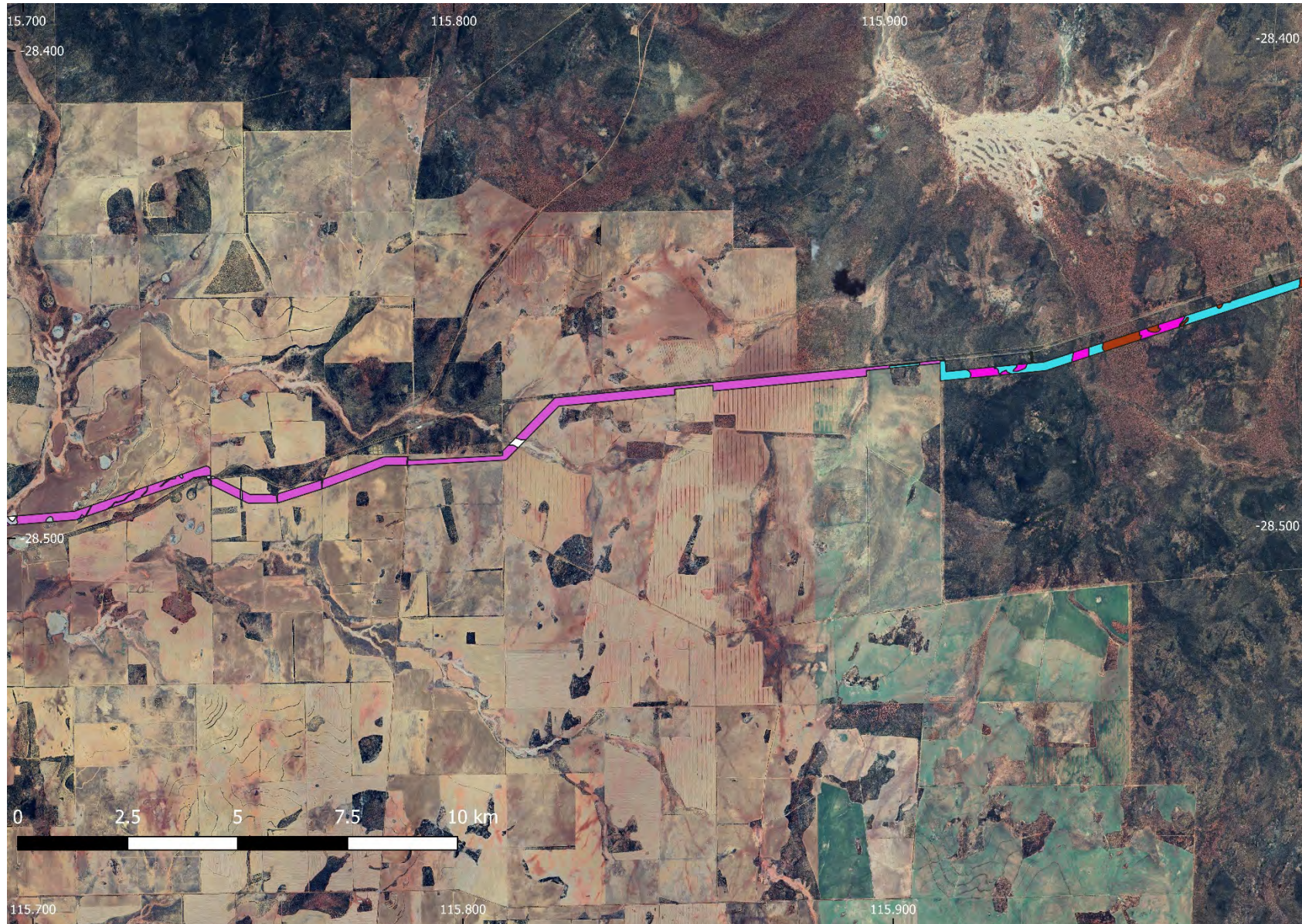
Fauna Habitat Maps (Pages 126 – 145, Legend Page 146)



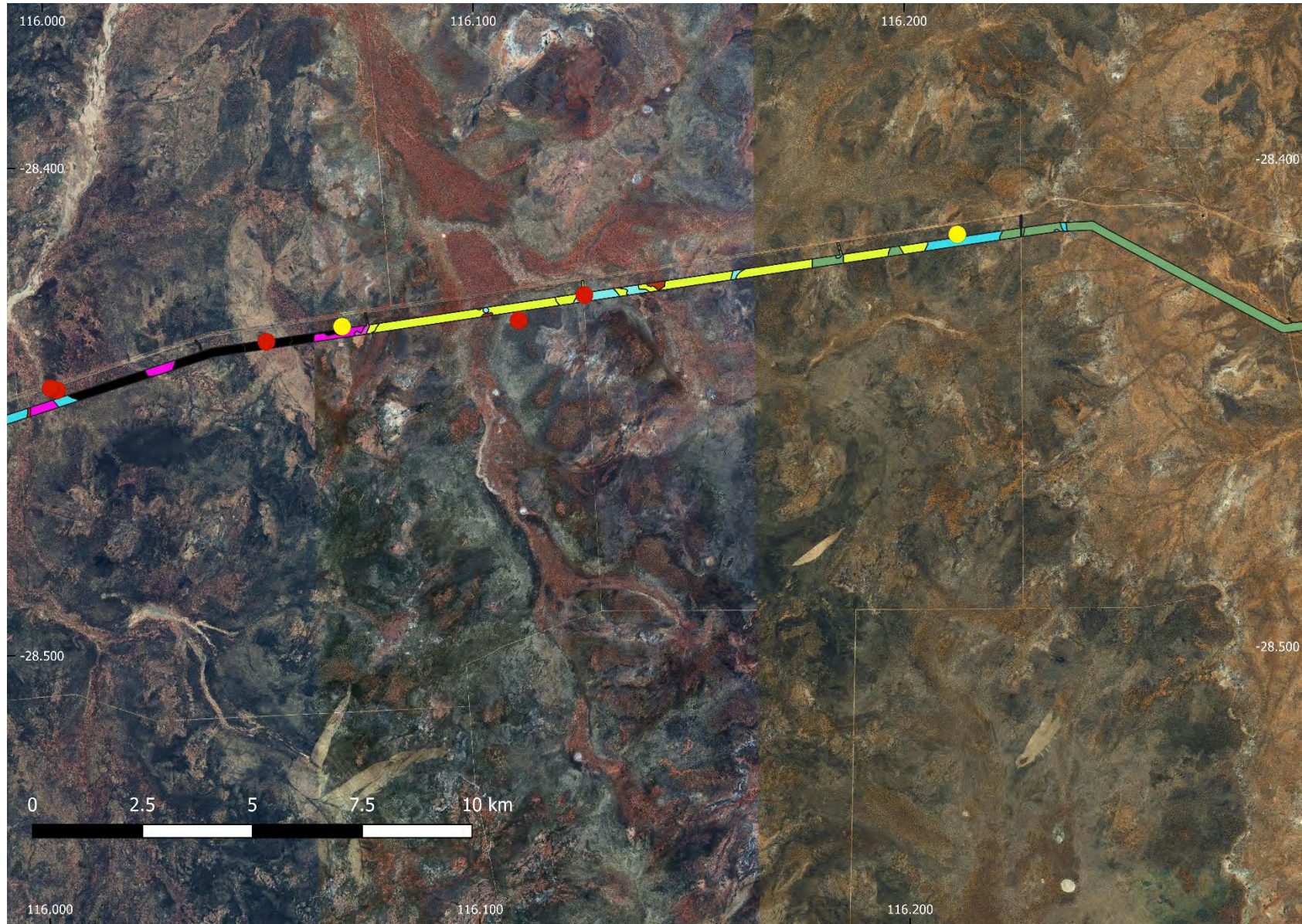
This document has been prepared for use by APA Group by Kingfisher Environmental



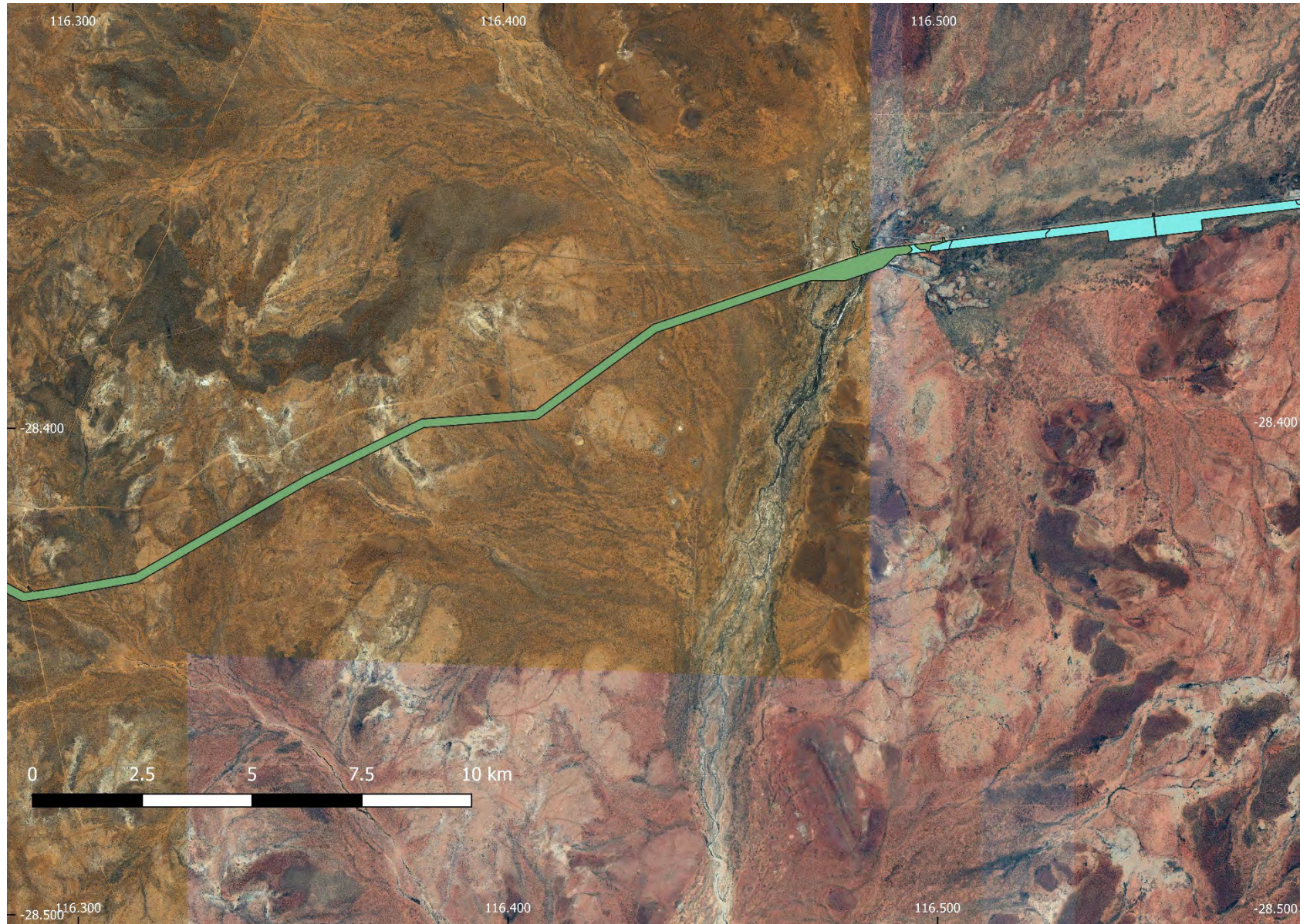
This document has been prepared for use by APA Group by Kingfisher Environmental



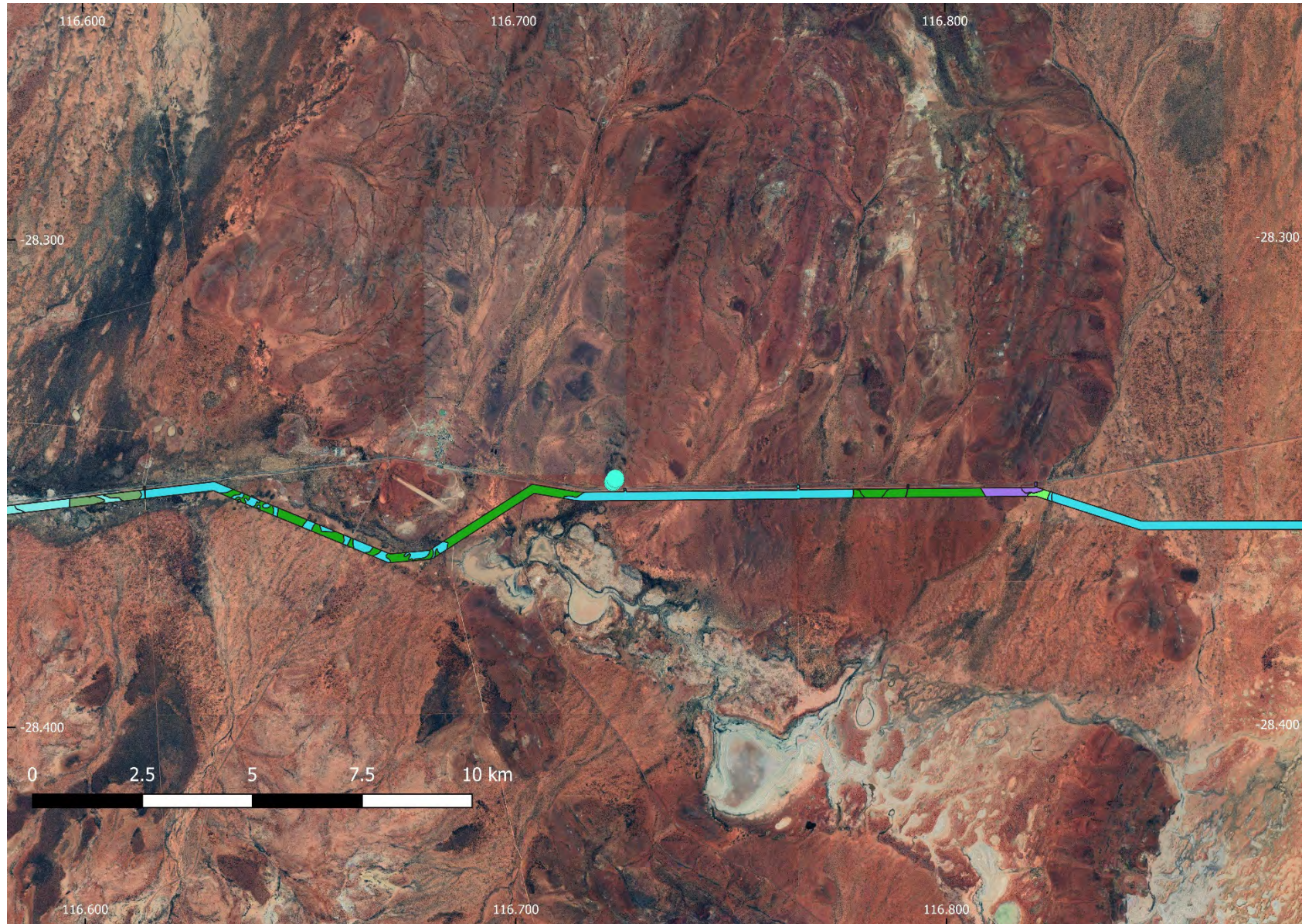
This document has been prepared for use by APA Group by Kingfisher Environmental



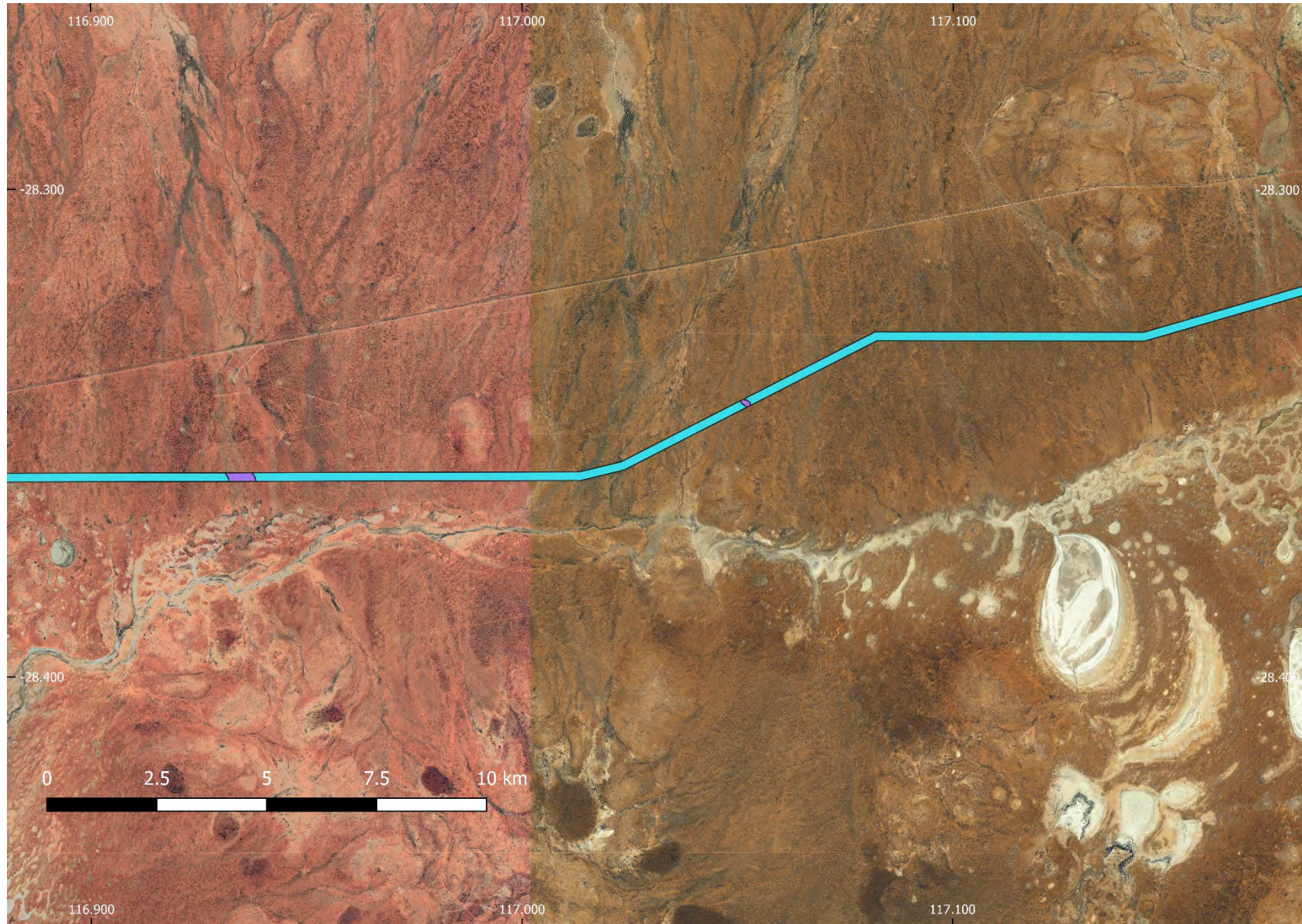
This document has been prepared for use by APA Group by Kingfisher Environmental

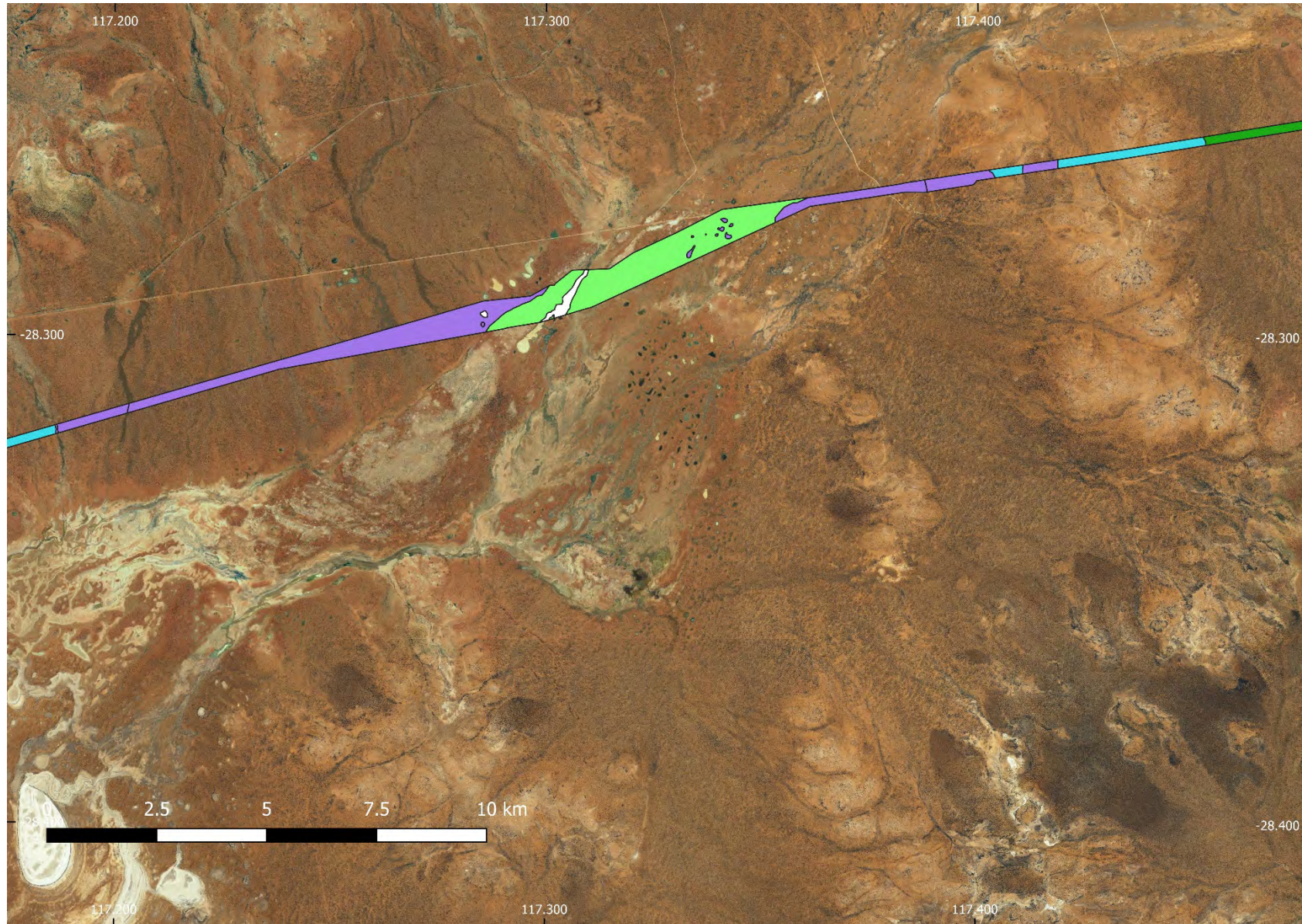


This document has been prepared for use by APA Group by Kingfisher Environmental

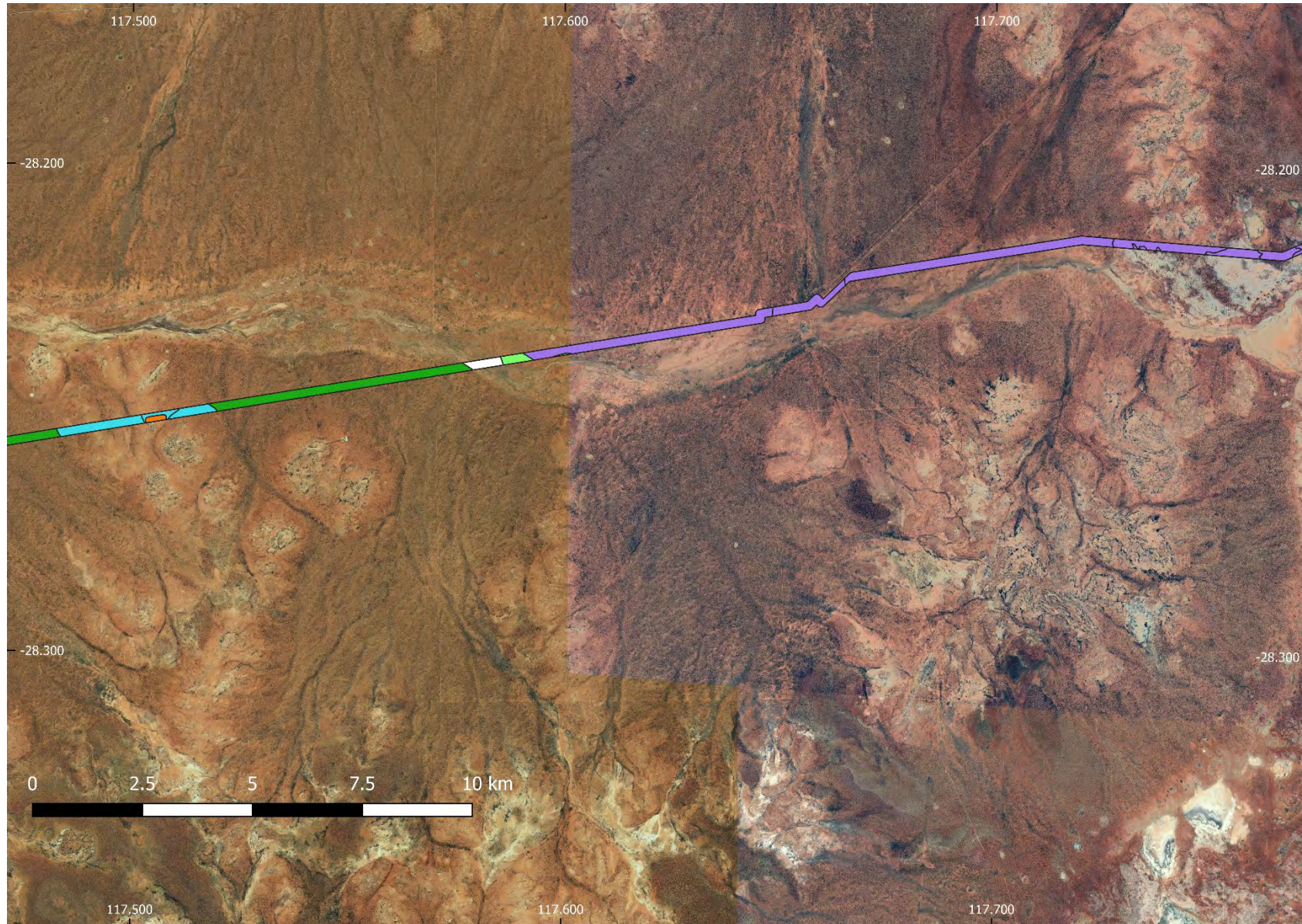


This document has been prepared for use by APA Group by Kingfisher Environmental





This document has been prepared for use by APA Group by Kingfisher Environmental



This document has been prepared for use by APA Group by Kingfisher Environmental