Bennelongia Environmental Consultants

Yindjibarndi Renewable Energy Jinbi Project

Short Range Endemic Invertebrate Desktop Assessment

Prepared for:

Yindjibarndi Energy Corporation

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Final Report

Short-Range Endemics I Subterranean Fauna

Waterbirds I Wetlands

Yindjibarndi Renewable Energy Jinbi Project
Short Range Endemic Invertebrate Desktop Assessment

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EXECUTIVE SUMMARY

Yindjibarndi Energy Corporation, a partnership between Yindjibarndi Aboriginal Corporation and renewable energy company ACEN Corporation, will be operating the Jinbi Project located in the Pilbara approximately 56 km south of Karratha and 80 km north-east of Pannawonica in Western Australia. The Project is a potential development of a solar power generation facility for the supply of energy to Rio Tinto. Yindjibarndi Energy Corporation is undertaking studies to inform environmental approval requirements for the Project within an area covering 15km^2 (the 'Investigation Area'). The focus of this Desktop Assessment is to document the possible occurrence of Short-Range Endemic (SRE) and listed invertebrate species in the Investigation Area.

Following the relevant guidelines for SRE fauna assessment, Bennelongia conducted a Desktop Assessment to determine the likelihood of species belonging to SRE Groups being present at the Investigation Area. An area of 100km x 100km around the Investigation Area was defined as the Desktop Search Area for examining the occurrence of SRE fauna. Surface geology, vegetation records, and land systems were reviewed to assess the occurrence of prospective habitat for SRE fauna. Records of fauna were compiled from Western Australian Museum and Bennelongia databases. Published research papers, available environmental reports, and online resources such as the Atlas of Living Australia and the Australian Faunal Directory were also reviewed.

The Desktop Assessment found records of 134 taxa in the Desktop Search Area of 100 x 100 km centred on the Investigation Area. Most taxa were identified to species level but some only to genus, family or order level (all are referred to as species henceforth). Species were analysed in further detail using literature and Bennelongia expertise to assess the likelihood that they truly are SRE species with restricted ranges. It was considered that the 134 species comprise three Confirmed SRE species, 62 Potential SRE species, and 69 widespread species. Any, or all, of the Confirmed SRE species found in the Desktop Survey Area might occur within the Investigation Area, as well as an unknown number of Potential SRE species.

The Investigation Area is topographically diverse landscape, with land systems, habitats and microhabitats suitable for SRE species occurrence. With records showing that Confirmed SRE species and many Potential SRE species occur in the vicinity of the Investigation Area, there is significant likelihood that a number of Confirmed SRE species occur within the Investigation Area.

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1. INTRODUCTION

Yindjibarndi Energy Corporation, a partnership between Yindjibarndi Aboriginal Corporation and renewable energy company ACEN Corporation, will be operating the Jinbi Project, located approximately 56 km south of Karratha and 80 km north-east of Pannawonica in Western Australia (Figure 1) within the Yindjibarndi Native Title Determination Areas. The focus of this Desktop Assessment is to document the possible occurrence of Short-Range Endemic (SRE) and listed invertebrate species in the Investigation Area.

Bennelongia Environmental Consultants (BEC) was commissioned by the Yindjibarndi Energy Corporation to provide baseline information on terrestrial invertebrate SREs in the Investigation area through Desktop Assessment. The likelihood of SRE occurring in the Investigation Area is appraised. This was based on mapping of prospective SRE habitats, combined with available records of SRE species occurrence. The Desktop follows relevant guidelines for SRE fauna assessment (EPA 2016a), with invertebrate records collated for a 100 x 100km Desktop Search Area surrounding the Investigation Area (Figure 1).

The objectives of this Desktop are to:

1. Assess habitat prospectivity for SRE invertebrate fauna based on surface geology, topographic features, and habitat systems; and
2. Identify the presence, or likely presence, of confirmed and/or potential SRE species at the Investigation Area.
3. Identify the presence, or likely presence, of any listed (Threatened or Priority) species at the Investigation Area.

1.1. SRE Framework

Short-range endemic invertebrate (SRE) species are defined as having a natural habitat range of less than 10,000 km^2 (Harvey 2002). Several groups of mostly ground-dwelling invertebrates have high proportions of SRE species and are referred to in Western Australia environmental impact assessments as the SRE Groups. SREs are particularly susceptible to disturbances because they tend to live in discontinuous habitats, grow slowly, and often produce few offspring. The main sources of disturbances that threaten persistence of the populations of SRE species include habitat removal, changes in fire regimes, and the introduction of weeds and pathogens. Because of their high susceptibility to disturbances, SREs are treated by the Environmental Protection Authority (EPA) as significant species and targets of protection in the environmental impact assessment process (EPA 2016b, 2018).

Most terrestrial invertebrates in Western Australia, especially ground-dwelling species, are undescribed and hence have unknown ranges and so ready-made lists of SRE species are not available. Instead assessment typically focuses on the number of SRE Group species present (EPA 2016b). Examples of SRE Groups include mygalomorph (trapdoor) and selenopid spiders, isopods (slaters), millipedes, centipedes, pseudoscorpions, scorpions, and snails. Not all species in these groups are SREs, but when any member of those groups are detected during assessment, scientific literature and other resources are consulted to estimate SRE status.

When there has been no survey of SRE Group species, likelihood of SRE occurrence can be inferred to some extent by assumed prospectivity of the habitats present, based on known habitats of SRE species. SREs tend to occupy relictual, isolated, sheltered, and moist habitats (Durrant 2011) that include rock outcrops, south-facing slopes, gorges and gullies, drainage lines, and vine thickets (EPA 2016b; Harvey 2002).

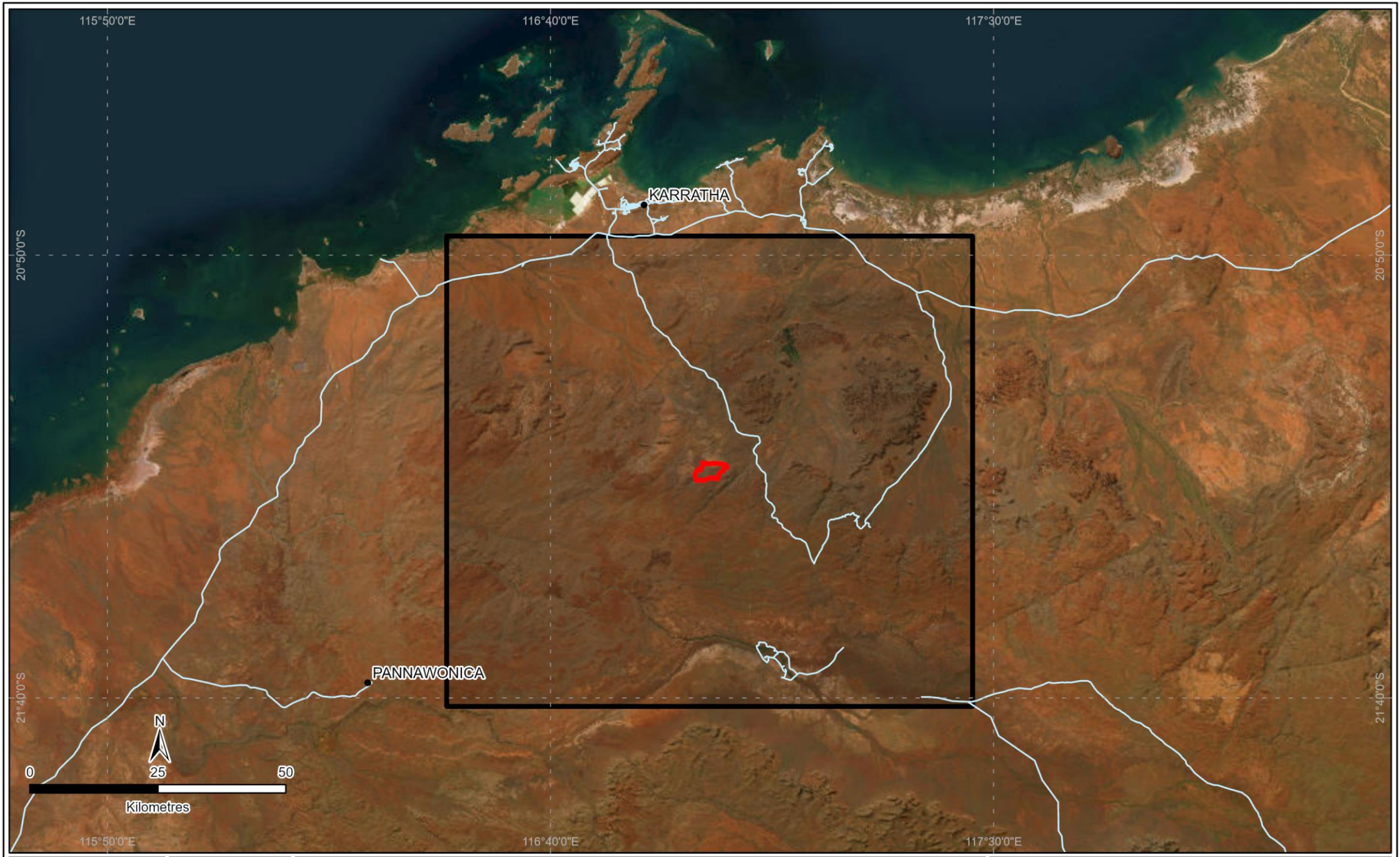


Figure 1. Location of the Yindjibarndi Renewable Energy Initiative Project's Investigation Area and the Desktop Assessment area.

Species investigated in this way are assigned an SRE category. This report uses the following categories:

- **Confirmed SREs:** well-defined species with a thoroughly surveyed range <10,000 km^2.
- **Potential SREs:** species for which there is some evidence of short-range endemism (e.g. close phylogenetic relationship to Confirmed SREs, occupation of isolated habitat, etc.) but insufficient sampling has been undertaken to ascertain the species' total range unequivocally. Within the category Potential SREs, species are further divided:
    - **Likely** if the species has strong taxonomic and ecological affinities to Confirmed SREs and has been collected only from prospective SRE habitat at multiple sites;
    - **Unlikely** if the species either has strong taxonomic affinities to species that are mostly not SREs or was collected at more than one site from a habitat that is not prospective for SREs and is widespread); or
    - **Data deficient** if the species cannot be identified to a sufficiently low level for further analysis (usually species) and/or is known from too few samples to speculate about its range. Most higher-order and/or singleton specimens, especially when collected from prospective habitat, are placed in this category pending further evidence.
- **Widespread:** species with known ranges >10,000 km^2.

While all Confirmed SRE species have relatively small ranges, they may be locally widespread around a project area. Therefore, assigning species to SRE categories is merely the first step in a filtering process used to determine which species may be threatened by a proposed development. Determining the level of threat to species persistence requires information about the extent of the species' preferred habitat, both within and outside the Investigation Area.

1.2. Conservation legislation

Native flora and fauna in Western Australia are protected at both State and Commonwealth levels. At the state level, the *Biodiversity Conservation Act 2016* (BC Act) provides a legal framework for protection of species, particularly for species listed by the Minister for the Environment as Threatened. In addition to the formal list of threatened species under the BC Act, the Department of Biodiversity, Conservation and Attractions (DBCA) also maintains a list of Priority fauna species that are of conservation importance but, for various reasons, do not meet the criteria for listing as threatened. At the national level, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna and ecological communities.

Both the EPBC and BC Acts provide frameworks for the protection of Threatened ecological communities (TECs), where an ecological community is defined as a naturally occurring group of plants, animals, and other organisms interacting in unique habitat (with the unique habitat created by the combination of the species and their landscape setting; DEC 2013). Within Western Australia, DBCA also informally recognises communities of potential conservation concern, but for which there is little information, as Priority ecological communities (PECs). There are currently no listed communities in Western Australia for which SREs are the principal justification for listing.

2. METHODS

Project information and mapping of the Investigation Area were supplied by Coterra Environment.

Prospectivity of the habitats within the Investigation Area for SRE species was assessed using information on:

- Climate (http://www.bom.gov.au/).
- Land systems (Van Vreeswyk *et al*. 2004).
- Surface geology and soil (GeoScience Australia 2000; Van Vreeswyk *et al*. 2004).
- Topography (aerial photography and contours).
- Vegetation (Beard et al. 2013; Mattiske 2024).

Information about the likely richness of SRE Group species in the Investigation Area was obtained from:

- Threatened and Priority fauna lists were provided by DBCA (https://www.dbca.wa.gov.au/wildlife-and-ecosystems/animals/list-threatened-and-priority-fauna) and the Department of Climate Change, Energy, the Environment and Water (https://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl).
- Records of SRE Group species in the 100x100 km area around the Project derived from searching the Western Australia Museum (WAM) and Bennelongia databases.
    - For each species returned in the searches (sometimes represented by multiple records), an SRE or conservation status was assigned according to the categories in sections 1.1 and 1.2.
    - For each species, the number of records (i.e. the number of times the taxon was found) and the number of individuals collected (i.e. how many were found in all record) were collated.
    - In cases where animals were not identified to species level, they were included as higher-level identifications.
- Records of SRE Group species in consultant reports, scientific literature and the Atlas of Living Australia for individual species to determine their likely distribution.

Analysis and mapping were undertaken using ArcGIS Pro v2.9.5.

3. RESULTS

3.1. Habitat Assessment

3.1.1. Climate

The Investigation Area is within the Pilbara region of Western Australia, which is characterised as arid (van Vreeswyk *et al.* 2004). Typically, weather conditions experienced in the region are hot dry summers and mild winters (BOM 2023). The majority of rainfall occurs in association with cyclones, which most commonly occur from December to May based on the southern oscillation index (SOI) air pressure patterns.

3.1.2. Land Systems

Land systems provide a broad description of the overall landscape of an area. Four land systems occur within the Investigation Area (see Table 1 and Figure 2) and the landscape can be broadly classified as being comprised of hills, ridges, spinifex grasslands, and sandy and stony plains. All four of the land systems are widespread in the Pilbara.

Confirmed and Potential SRE species have been collected in three land systems within the Desktop Search Area, although outside the Investigation Area.

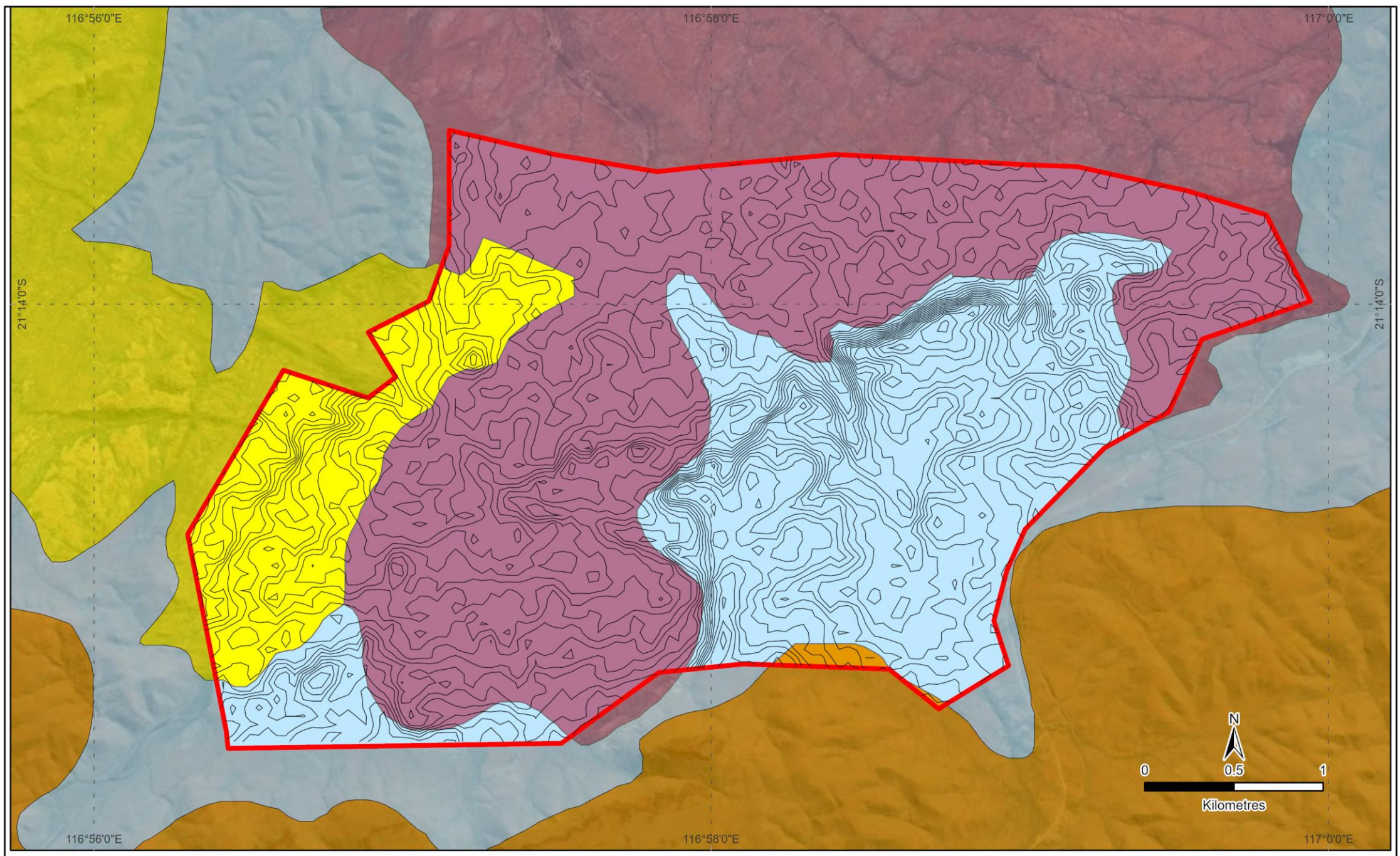
The section of the Investigation Area covered by the Boolaloo land system (Figure 2) is comprised of sandy plains with domes and gently sloped topographic features. The spinifex associated sandy plain in this area is a potential habitat for burrowing SRE species, such as scorpions and mygalomorph spiders. There are records of scorpions, millipedes and snails from the in the Desktop Search Area, mostly collected from under rocks and scree and beneath spinifex.

The section of the Investigation Area covered by the Capricorn land system has some topographic features of interest, including ridges, interfluves, south facing slopes and domes (see Figure 2). These features can provide microhabitats for fauna due to the accumulation of litter, increased shade and cover, and increased moisture levels. This system also supports 'low acacia shrublands', another habitat with an increased level of shelter and litter. Moderate numbers of SRE Group species occur in the Capricorn System across the Desktop Search Area, including isopods, spiders, pseudoscorpions, scorpions, centipedes, millipedes and snails (mostly collected from under rocks and in leaf litter). One Confirmed SRE species (*Antichiropus servulus*) and eight Potential SRE species have been found.

The Macroy land system in the Investigation Area includes some gentle slopes and rocky hills and some areas of open plains. There are no records of SRE Group species in this land system in the Desktop Search Area.

Table 1. Land systems within the Investigation Area

Land System Name	Land System Description	Proportion of Investigation Area
Boolaloo	Erosional surfaces; granite hills with boulder strewn slopes, tor heaps and bare domes surrounded by restricted stony and sandy plains; widely spaced tributary drainage patterns of narrow drainage floors and channels. Relief mostly <50 m, occasionally up to 100 m	190.22ha, 12.5%
Capricorn	Erosional surfaces; ranges and hills with steep rocky upper slopes, more gently sloping stony foot slopes, restricted stony lower plains and valleys; moderately spaced tributary drainage patterns. Relief up to 180 m.	546.51ha, 36.04%
Macroy	Erosional surfaces; gently undulating stony plains and interfluves with quartz surface mantles, sandy surfaced plains, minor calcrete plains, closely spaced tributary drainage lines in upper parts of system becoming much wider downslope; minor granite hills, tor fields and quartz ridges. Relief is up to 25 m	771.47ha, 50.87%
Rocklea	Erosional surfaces; hills, ridges and plateaux remnants on basalt with steep stony slopes, restricted lower slopes, stony interfluves and minor gilgai plains; moderately spaced tributary drainage patterns of small channels in shallow valleys in upper parts becoming broader floors and channels downslope. Relief up to 110 m	8.24ha, 0.54%



Bennelongia Environmental Consultants

GCS GDA 1994
Author: Grice
Date: 16/01/2024

Legend

- Contour Lines (2m)
- Investigation Area

Land Systems Within Project Area

- Boolaloo Land System
- Capricorn Land System
- Macroy Land System
- Rocklea Land System

Figure 2. Land systems and contours within the Yindjibarndi Renewable Energy Initiative Project.

The Rocklea land system occupies a very small part of the Investigation Area and contains gentle slopes with no significant topographic features. However, records from the Desktop Search Area suggest many SRE Group species occur in this system, including isopods, spiders, pseudoscorpions, scorpions, centipedes and millipedes.

3.1.3. Surface Geology and Soils

The Investigation Area lies within the Pinderi Hills region of the Pilbara (Geoscience Australia 2000). The regolith within the Investigation Area is comprised of exposed rocks, with seven surface geologies present (see Figure 3 and Table 2 - geological descriptions have been extracted from the Western Australian Geological Survey 1:100,000 Explanatory Notes). The soil is comprised of shallow, stony, brown and earthy loams (see Table 3). All of these geological and soil systems are widespread in the Pilbara and are not representative of any exclusive habitats.

Sandy soils and rocky outcropping / scree have high suitability for burrowing species in SRE Groups, providing microhabitats with moisture retention, vegetation growth, accumulation of debris, and cover from the elements. When these geologies/soils occur on south-facing hill slopes, ridges, and gullies (all occurring in the Investigation Area), habitat can be favourable for SRE species.

Granite forms a substantial component of the Macroy land system in the Investigation Area. Although some of the information comes from south-western Australia, it is a recognized habitat for SRE Group species, with some mygalomorph spiders burrowing in loose soil of granite meadows (especially the mygalomorph *Teyl* genus and the family Selenopidae: Main 2000; Crews 2023) and some pseudoscorpions occurring on the underside of granite rocks (Withers and Edward 1997). Consequently, the absence of SRE Group species in the Desktop Search Area from Cherratta Granitoid Complex and the Macroy land system is surprising, except that it is probable this geology and land system have not been sampled (see section 3.2.1). This is an example of the difficulty of determining prospectivity of the Investigation Area for SRE species though desktop assessment.

Soft silts and sands comprise suitable soils for burrowing species in the SRE Groups, such as mygalomorph spiders and scorpions. These soils are represented in the Investigation Area by alluvium, colluvium, sand, and silt. Alluvial soils (Qaa – Table 2, Figure 3) occur in long narrow stretches across the whole Desktop Search Area in close association with major drainage lines. Within the Investigation Area boundaries, alluvium occurs in narrow stretches with one isolated section located centrally at an interfluve and major drainage line, which likely to have increased shade and cover, higher moisture content, more vegetation growth, and a higher capacity to accumulate leaf litter due to the topography. The occurrence of snails, pseudoscorpions, and spiders in alluvial areas associated with drainage lines in the Desktop Search Area confirm alluvium is a prospective habitat type.

3.1.4. Vegetation

There are three broad vegetation associations in the Investigation Area, with two major vegetation systems (detailed in Table 4). These systems can be broadly described as hummock and spinifex grasslands, tree and shrub steppes, with some areas of low open woodland and mid to low sparse shrubland.

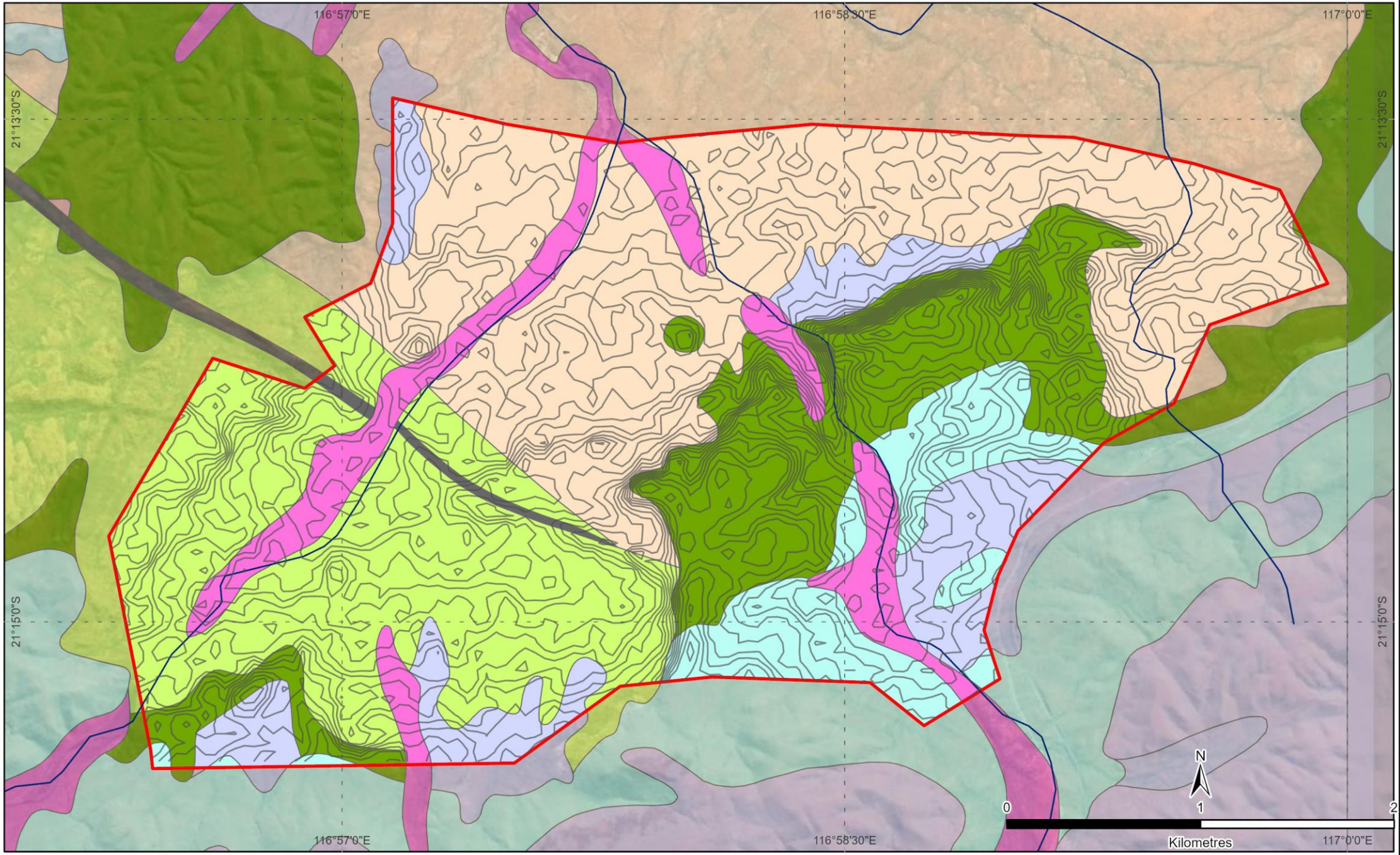
Increased vegetation density around drainage lines is expected and aerial imagery reflect this within the major, medium and minor drainage lines in the Investigation Area. These environments provide important factors in habitat preference for invertebrate fauna, including shade coverage and leaf litter.

Table 2. Surface geology within the Investigation Area.

Surface Geology Type	JN Code	Geology Description	Proportion of Investigation Area
Alluvial Deposits	Qaa	Present-day drainage systems containing alluvial clay, silt, and sand in channels on floodplains, and sand and gravel in rivers and creeks.	118 ha, 7.8%
Cherratta Granitoid Complex	AgCm	Locally porphyritic foliated and weakly banded granite to granodiorite rock.	512 ha, 33.8%
Colluvium Drainage Lines	Qc	Course, pebbly sand, silt, and gravel in outwash fans, scree slopes, and claypans or temporary flooded areas.	137 ha, 9.0%
Dolerite Dyke	d	Massive, medium, to course-grained dolerites or various age.	7 ha, 0.5%
Hardey Formation	AFh	Medium to course-grained sandstone, conglomerate, siltstone, shale, and tuff.	253 ha, 16.7%
Lyre Creek Member	AFhy	Felsic tuff and agglomerate, and felsic to intermediate volcaniclastic sandstone and conglomerate; local abundant accretionary lapilli.	121 ha, 8.0%
Porphyritic Syenogranite and Monzogranite	AgCp	Metamorphosed medium grained foliated and weakly gneissic plagioclase, quartz and hornblende with extensive outcropping containing megacrysts of microcline.	368 ha, 24.2%

Table 3. Soil types within the Investigation Area.

Soil Type	Soil Map Code	Soil Description	Proportion of Investigation Area
Brown and earthy loams	Gf1	Steep ranges on basic lavas along with dolomites, tuff, banded iron formations, and dolerite dykes, with some narrow valley plains and high-level gently undulating areas of limited extent. The soils are generally shallow and stony and there are large areas without soil cover: chief soils are brown loams (Um6.23) along with significant areas of earthy loams (Um5.51). Hard alkaline red soils (Dr2.33) occur on lower slopes, with earthy clays (Uf6.71) and red brown clays (Ug5.37) on valley floors	1516 ha, 100%



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GCS GDA 1994
Author: Grice
Date: 16/01/2024

Legend

- Contour Lines (2m)
- Major Drainage Lines
- Investigation Area

Surface Geology

- Alluvial Deposits
- Cherratta Granitoid Complex
- Colluvium Drainage Lines
- Dolerite Dyke
- Hardey Formation
- Lyre Creek Member
- Porphyritic Syenogranite and Monzogranite

Figure 3. Surface geology within the Yindjibarndi Renewable Energy Initiative Investigation Area.

A predominant plant genus occurring in the Investigation Area and surrounds is the spinifex *Triodia*, which is a common component of perennial grass communities in the wider Pilbara region. *Triodia* hummocks on drainage lines often support SRE some snail species (EPA 2016b).

Eucalyptus species are present within the Investigation Area, providing important microhabitats existing under bark and shading surrounding terrestrial microhabitats. There are also numerous *Acacia* species present, a dominant vegetation type across the wider Pilbara subregion that also produces litter and shades surrounding microhabitats.

Table 4. Vegetation associations within the Investigation Area.

Vegetation System Name	Association Number	Description	Proportion of Investigation Area
Chichester Plateau	587	Hummock grasslands, shrub steppe; kanji over soft spinifex.	1,498 ha 99%
	93	Mosaic: Hummock grasslands, open low tree-steppe; snappy gum over Triodia wiseana / Hummock grasslands, shrub-steppe; kanji over Triodia pungens	
Abydos Plain	152	Hummock grasslands, grass steppe; soft & hard spinifex soft spinifex.	18 ha 1%

3.2. Taxon Records

3.2.1. SRE Group Records in the Desktop Search Area

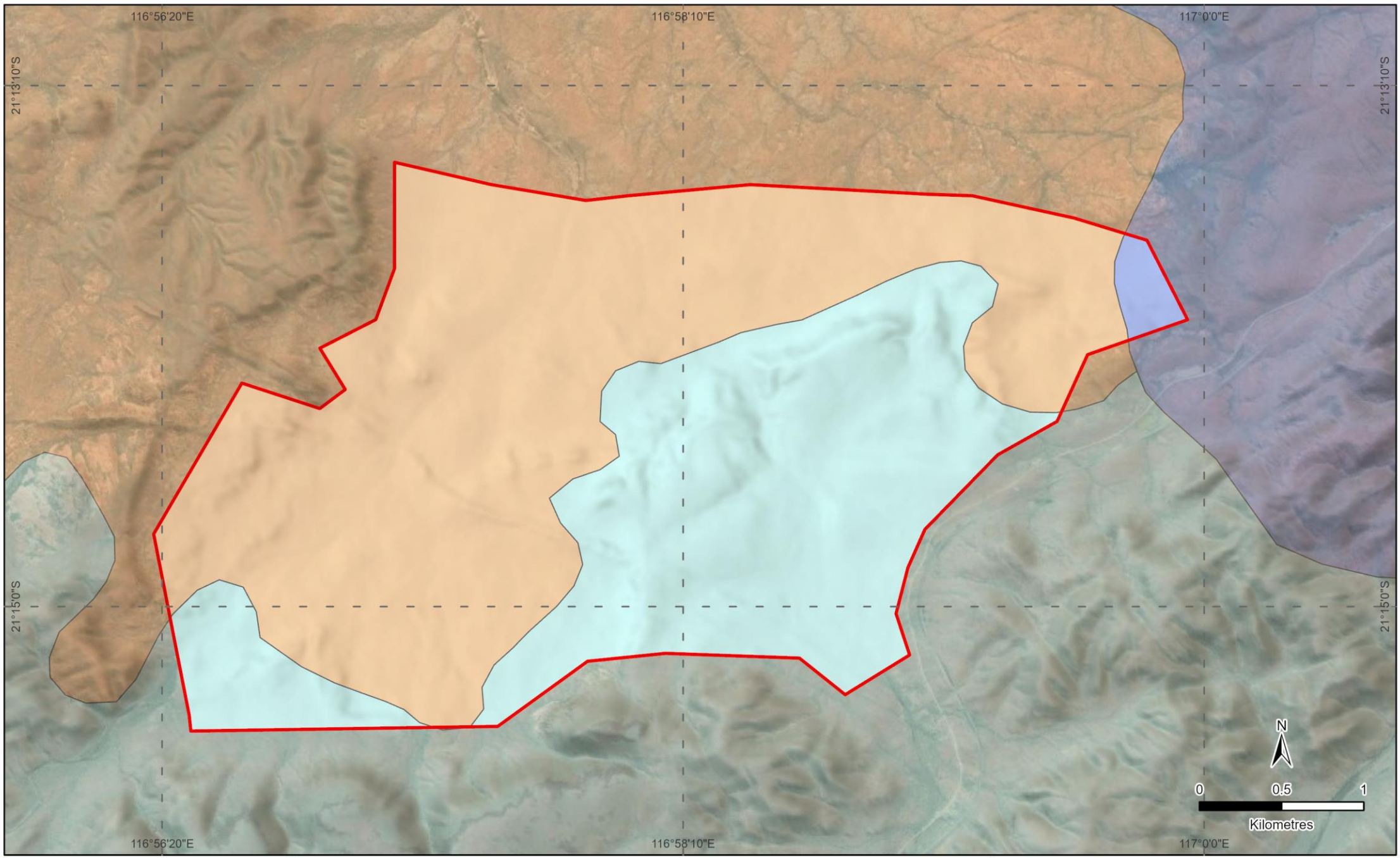
There were no records of SRE Group species within the Investigation Area, which has never been surveyed.

The SRE Group records from the Desktop Search Area included 134 species belonging to 36 families (Appendix 1). There were many records not identified to species level (i.e. only a genus or family level of identification) and these were included as species in the total species account and were assigned an SRE status as well. It should also be noted that in some cases a species may appear in the list (through error) under two or more names (especially if an undescribed species), thus inflating the species list in Appendix 1. However, sampling in the Desktop Search Area has not been intensive (Figure 5) and many more species will be present than collected and listed in Appendix 1.

Three Confirmed SRE species (Table 5), 62 Potential SRE species and 69 Widespread (Not SRE) species have been collected in the Desktop Search Area. A summary for each major group, with an assessment of the SRE status of its species is provided below.

Table 5. Confirmed SRE Species recorded in the Desktop Search Area.

Higher Order	Species	SRE Status or Known Distribution
Diplopoda	*Antichiropus servulus*	Millstream (Car *et al.* 2019)
	Boreohesperus undulatus	Mardie Stn, linear range 50 km (Car and Harvey 2013)
Pseudoscorpiones	*Feaella linetteae*	Millstream (Harvey *et al.* 2016) (Museum 2023)



Bennelongia Environmental Consultants

GCS GDA 1994
Author: Grice
Date: 24/01/2024

Legend

Investigation Area

Hummock Grasslands

Abydos Plain

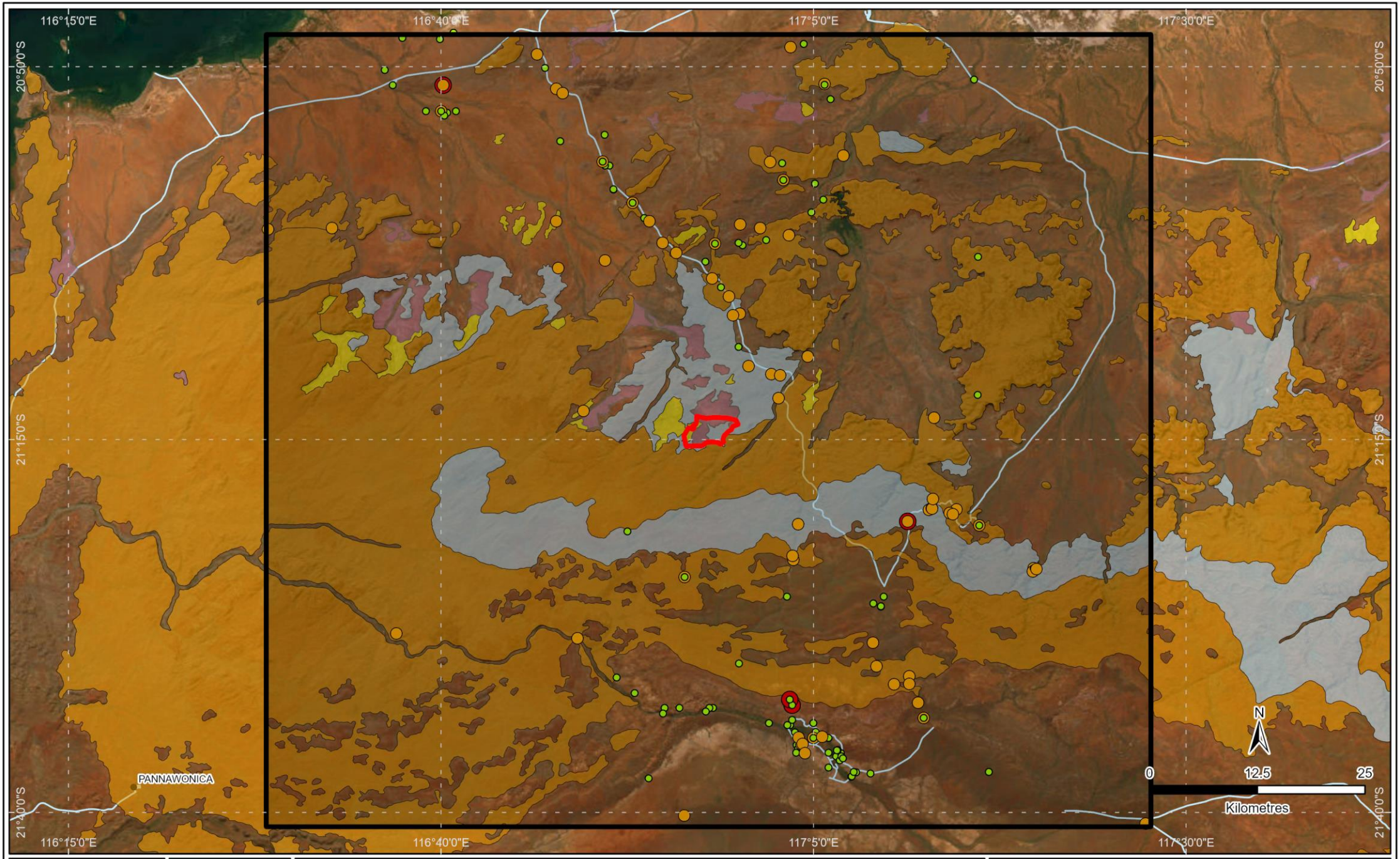
Grass Steppe with Spinifex

Chichester Plateau

Shrub Steppe with Kanji over Spinifex

Open Low Tree Steppe

Figure 4. Vegetation within the Yindjibarndi Renewable Energy Initiative Project.



Bennelongia Environmental Consultants

GCS GDA 1994
Author: Grice
Date: 24/01/2024

Legend

- Towns
- Roads
- 100x100km Desktop Study Area
- Investigation Area

Land Systems Intersecting Project Area

- Boolaloo Land System
- Capricorn Land System
- Macroy Land System
- Rocklea Land System

SRE Group Status

- Confirmed SRE
- Potential
- Widespread

Figure 5. SRE Group Records within the Desktop Search Area for the Yindjibarndi Renewable Energy Initiative Project.

3.2.2. SRE Status

Spiders

The Desktop Assessment returned records of 13 Araneae species within the Desktop Search Area as detailed in Appendix 1. This included Families Actinopodidae, Anamidae, Barychelid, Halonoproctidae, and Idiopidae. Within the Araneae Order there were:

- 8 Potential SRE species, and
- 5 Widespread (Not SRE) species.

Opiliones

The Desktop Assessment returned records of 1 higher order unidentified species within the Desktop Search Area as detailed in Appendix 1.

Millipedes

The Desktop Assessment returned records of five Geophilida species, seven Polydesmida species, and three Spirobolida species within the Desktop Search Area as detailed in Appendix 1.

- 2 Confirmed SRE species,
- 5 Potential SRE species, and
- 8 Widespread species.

Centipedes

The Desktop Assessment returned records of seven species within the Desktop Search Area as detailed in Appendix 1. This included Families Cryptopidae and Scolopendridae. Within the Scolopendrida Order there were:

- 1 Potential SRE species, and
- 6 Widespread species.

Isopods

The Desktop Assessment returned records of 21 species within the Desktop Search Area as detailed in Appendix 1. This included Families Armadillidae and Philosciidae. Within the Isopoda Order there were:

- 11 Potential SRE species.
- 10 Widespread species.

Pseudoscorpiones

The Desktop Assessment returned records of 28 species within the Desktop Search Area as detailed in Appendix 1. This included Families Atemnidae, Cheiridiidae, Chernetidae, Chthoniidae, Feaellidae, Garypidae, Geogarypidae, Hyidae, Olpiidae, Sternophoridae, and Syarinidae. Within the Pseudoscorpion Order there were:

- 1 Confirmed SRE species,
- 12 Potential SRE species, and
- 15 Widespread species.

Scorpiones

The Desktop Assessment returned records of 22 species within the Desktop Search Area as detailed in Appendix 1. This included Families Buthidae, Urodacidae, and Trigoniulida. Within the Scorpiones Order there were:

- 15 Potential SRE species, and
- 7 Widespread species.

Mollusca

The Desktop Assessment returned records of 28 species within the Desktop Search Area as detailed in Appendix 1. This included Families Assimineidae, Achatinidae, Bithyniidae, Camaenidae, Gastrocoptidae, Helicodiscidae, and Pupillidae. Within the Mollusca Phylum there were:

- 10 Potential SRE species, and
- 17 Widespread species.

3.2.3. Protected and Threatened Species in the Desktop Search Area

There are no records in the Desktop Search Area of listed terrestrial threatened or priority invertebrate species (Threatened and Priority Fauna provided by the Department of Biodiversity, Conservation and Attractions (DBCA)).

4. DISCUSSION

4.1. SRE Habitat Prospectivity

Suitable SRE habitats tend to be isolated areas, protected from extreme weather, that retain moisture throughout drier months of the year. These habitats include the biotic and abiotic elements which provide suitable environments for fauna to breed, forage, and live (EPA 2016b). When assessing the potential habitat and therefore likely presence of SRE species, the focus is on the presence of major landforms that contextually provide a combination of elements conducive to prospective SRE habitat.

When unburnt, the Investigation Area supports a diverse range of habitat types with potentially many microhabitats present. There are some isolated areas of varying landforms across the Investigation Area, which comprise focus points for further investigation of the SRE fauna of the area. The only way to determine what animals inhabit these areas, and other parts of the Investigation Area, is through a field survey.

Based on the habitat systems present in the Investigation Area, as discussed earlier in this report, there is evidence of prospective SRE habitats. These broadly include soft sandy soils (for burrowing species), rocky scree and plains, drainage lines (with increased moisture content and soft alluvial soils), gullies and ridges, hills and slopes, and some tree coverage and litter. Each of these will be discussed below in a wider context of the landforms that occur across the Project's Investigation Area.

4.1.1. Drainage Lines (Major, Medium, Minor)

Drainage lines tend to support microhabitats suitable for SRE species due to the prevalence of water retention in these geological features after rainfall events. A high level of water entering these systems allows for the growth of larger trees than in the wider landscape, and where bark is able to be exfoliated from the trunk this provides shelter for animals to inhabit, making trees with peeling bark preferential to these animals. The resulting bark (on the trees themselves), leaf litter, and fallen logs, are all important microhabitats for some SRE species (i.e. pseudoscorpions, slaters, centipedes, millipedes, snails).

Depending on the geological or soil substrate of the drainage system, i.e. rocks (granite, sandstone, dolerite) (slaters, centipedes), or sand (alluvium, colluvium) (mygalomorph spiders and burrowing scorpions) can also provide microhabitats that support some species. The Investigation Area appears from aerial imaging and drainage mapping to contain some major, moderate and minor drainage lines. These areas also form gullies, ridges, south facing slopes, all of which are significant SRE habitat environments. From a Desktop Assessment analysis, these areas appear to have a high likelihood of SRE presence but cannot be confirmed without a baseline survey.

4.1.2. Stony Plains

Rocky outcrops, plains, and scree are important habitats for many invertebrate fauna species, including SRE groups. The rocks provide a form of shelter, moisture retention, can harbour soil and debris, and are home to many burrowing species. In the Investigation Area there are many areas with rocky scree, rocky plains, and gullies that have potential to harbour SRE groups.

4.1.3. Gorges and Gullies

Like drainage lines, gorges and gullies can contain water long after rainfall, and are protected from extreme weather in a similar way to south facing slopes. These landforms often contain rocky slopes, which retain both moisture and alluvium washed from higher surfaces, as well as allowing trees to grow providing bark, litter and logs. The Investigation Area has condensed areas containing many gullies, associated with major, medium and minor drainage lines, with soft soils and vegetation present. These in combination present a rich prospective habitat to support SRE species.

4.1.4. Hill Crests/Hill Slopes (South Facing)

Hillslopes, particularly south facing slopes, are protected from harsh conditions (weather and full sun) supporting the prevalence of SRE species. Rocky slopes can retain moisture and provide habitat for slaters, and centipedes. Small pockets of alluvium built up in rock crevices can harbour mygalomorph spiders. Rocky ledges and breakaways often contain pseudoscorpions, slaters, and selenopid spiders. Trees on these slopes provide cover under bark or in leaf litter for a variety of SRE species. The Project is situated on a mixture of some flat plains of land and some ridges, gulleys, and domes. This landscape is likely to support some sloped habitats ideal for SRE species.

5. CONCLUSIONS

This Desktop Assessment identified and analysed the presence of habitats suitable for SRE species. Additionally, three Confirmed SRE species were found in the Desktop Search Area in the land systems and habitat types that occur within the Investigation Area. Furthermore, 62 Potential SRE species records were identified within the Desktop Search Area.

Drainage lines and topographical features such as ridges, gullies, and slopes had high incidences across the Desktop Search Area with many SRE Group species collected. The Investigation Area has a topographically diverse landscape, with many vegetation dense and elevated areas, providing many microhabitats suitable for SRE occurrence. With confirmation that Confirmed SRE species occur in the vicinity of the Investigation Area, there is significant likelihood that Confirmed SRE species also occur within the Investigation Area.

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Appendix 1 – SRE Groups found within the Project Area

Phylum	Class	Order	Family	Lowest ID	No. of Animals
Mollusca	Gastropoda	Stylommatophora	Achatinidae	Eremopeas interioris	1
			Bothriembryontidae	Bothriembryon `Pilbara`	57
				Bothriembryon cf. costulatus	1
			Camaenidae	Camaenidae sp.	3
				Quistrachia herberti	16
				Quistrachia sp.	6
				Quistrachia sp. X `Anketell Point`	1
				Rhagada `Pannawonica`	2
				Rhagada `small banded`	23
				Rhagada convicta	53
				Rhagada ngurrana	2
				Rhagada pilbarana	32
				Rhagada radleyi	94
				Rhagada richardsonii	1
				Rhagada sp.	30
				Rhagada sp. `george pool`	2
				Rhagada sp. `large banded`	1
				Rhagada sp. `med banded`	6
				Rhagada sp. `small-med banded`	2
				Rhagada tescorum	1
			Gastrocoptidae	Gastrocopta larapinta	9
				Gastrocopta mussoni	19
			Helicodiscidae	Stenopylis coarctata	5
			Pupillidae	Pupoides beltianus	30
				Pupoides eremicolus	7

				Pupoides lepidulus	3
				Pupoides pacificus	16
Arthropoda		Scorpiones	Buthidae	Lychas `adonis`	2
				Lychas `gracilimanus`	1
				Lychas `hairy tail group`	1
				Lychas `harveyi group`	1
				Lychas `multipunctatus complex`	2
				Lychas `racing stripe`	1
				Lychas `SCO023`	2
				Lychas `SCO024`	1
				Lychas `sp. 1`	16
				Lychas `sp. 2`	19
				Lychas `sp. 3`	3
				Lychas `sp. 4`	19
				Lychas `sp. 6`	4
				Lychas `sp.`	15
				Lychas `warramboo 1`	1
			Urodacidae	Urodacus `hamersley black`	3
				Urodacus `pilbara 5`	1
				Urodacus `SCO004`	1
				Urodacus `sp. 5`	2
				Urodacus `sp. 9`	4
				Urodacus sp.	1
				Urodacus megamastigus	2
		Pseudoscorpiones	Atemnidae	Oratemnus sp.	9
				Paratemnoides sp.	1
			Cheiridiidae	`PSEAAB` sp.	1
			Chernetidae	`PSEAAF` `PSE-A`	5
				`PSEAAF` sp.	8

				Chernetidae sp.	1
			Chthoniidae	Austrochthonius `sp.`	5
			Feaellidae	Feaella linetteae	2
			Garypidae	Garypidae sp.	1
				Synsphyronus `Mortland River`	1
				Synsphyronus `PSE127`	45
				Synsphyronus `PSE128`	1
				Synsphyronus `sp. B`	2
				Synsphyronus `sp.`	2
			Geogarypidae	Geogarypus `sp.`	1
			Hyidae	Indohya `PSE178`	2
			Olpiidae	Austrohorus `sp.`	11
				Beierolpium `sp. 8/3`	1
				Beierolpium `sp. 8/4 small`	12
				Beierolpium `sp. 8/4`	1
				Beierolpium sp.	2
				Beierolpium 8/4 sp.	1
				Euryolpium sp. B10	3
				Indolpium sp.	40
				Olpiidae sp.	10
			Sternophoridae	Afrosternophorus `sp. A`	1
				Afrosternophorus `sp.`	6
			Syarinidae	Ideoblothrus `PSE198`	3
	Arachnida	Araneae	Actinopodidae	Missulena melissae	1
				Missulena rutraspina	2
			Anamidae	Aname sp.	1
				`MYGAAB` sp.	3
				Aname mellosa	51
			Barychelidae	Aurecocrypta `MYG775`	2

			Halonoproctidae	Conothele `MYG298`	5
				Conothele `MYG568`	2
				Conothele `MYG574`	1
				Conothele sp.	3
			Idiopidae	Euoplos `MYG081, lake_poongkaliyarra`	1
				Idiosoma sp.	1
				Idiosoma occidentale	1
		Opiliones	Assamiidae	Assamiidae sp.	1
		Isopoda	Armadillidae	Acanthodillo sp.	4
				Barrowdillo `sp. 2`	1
				Barrowdillo `sp. 3`	1
				Buddelundia `sp. 10`	18
				Buddelundia `sp. 13`	3
				Buddelundia `sp. 14`	10
				Buddelundia `sp. 14hr`	2
				Buddelundia `sp. 15`	4
				Buddelundia `sp. 17`	2
				Buddelundia `sp. 33`	11
				Buddelundia `sp. 34`	2
				Buddelundia `sp. 35`	3
				Buddelundia `sp. 36`	2
				Buddelundia `sp. 37`	1
				Buddelundia `sp. 40`	1
				Buddelundia `sp. 41`	1
				Buddelundia `sp. 61`	2
				Buddelundia sp.	12
				Buddelundiinae sp.	2
				Spherillo sp.	1
			Philosciidae	Laevophiloscia sp.	1

	Chilopoda	Geophilida		Geophilida sp.	1
			Chilenophilidae	Chilenophilidae sp.	1
			Mecistocephalidae	Mecistocephalidae sp.	1
			Oryidae	Oryidae sp.	1
			Schendylidae	Schendylidae sp.	4
		Scolopendrida	Cryptopidae	Cryptops sp. B48	1
			Scolopendridae	Arthrorhabdus mjobergi	1
				Arthrorhabdus paucispinus	2
				Cormocephalus turneri	4
				Ethmostigmus curtipes	2
				Scolopendra laeta	10
				Scolopendra morsitans	9
	Diplopoda	Polydesmida	Paradoxosomatidae	Antichiropus `DIP023, millstream`	1
				Antichiropus `DIP032`, bluespec`	1
				Antichiropus sp.	8
				Antichiropus picus	4
				Antichiropus salutus	4
				Antichiropus servulus	4
				Boreohesperus undulatus	2
		Spirobolida	Trigoniulidae	Austrostrophus `DIP054`	11
				Austrostrophus stictopygus	8
				Trigoniulidae sp.	4
				TOTAL RECORDS	**946**