PHOENIX
ENVIRONMENTAL SCIENCES

Short-range endemic invertebrate fauna survey for the Mardie Project

Prepared for BCI Minerals Ltd

20 October 2021

Final

Short-range endemic invertebrate fauna survey for the Mardie Project
Prepared for BCI Minerals Ltd

Version history

Author/s	Reviewer/s	Version	Version number	Date submitted	Submitted to
A. Jacks	J. Scanlon	Draft for client comments	0.1	22-Sep-21	N. Dixon
A. Jacks		Final, client comments addressed	1.0	20-Oct-21	M. Frame

Phoenix Environmental Sciences Pty Ltd
2/3 King Edward Road OSBORNE PARK WA 6017
P: 08 6323 5410
E: admin@phoenixenv.com.au
Project code: 1424-MSP-BCI-TIN

EXECUTIVE SUMMARY

BCI Minerals Ltd (BCI) is seeking to develop the Mardie Project (the Project), located approximately 105 kilometres (km) southwest of Karratha, Western Australia (WA). The Project is a sodium chloride (NaCl) salt production project owned 100% by BCI on tenements between Dampier and Onslow. The Project is currently subject to environmental assessment under Part IV of the *Environmental Protection Act 1986* (EP Act; assessment number 2167) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; EPBC 2018/8236).

Baseline terrestrial fauna surveys were undertaken for the Project between December 2017 and August 2019. This included short-range endemic (SRE) sampling by active searches, focused primarily on islands within the mudflats of the study area as these were identified as the most likely habitat to support SREs. The Environmental Protection Authority (EPA) assessment report for the Project found the survey effort for SREs did not meet the requirements of Technical Guidance(EPA 2016b) therefore additional surveys were undertaken to determine the potential risk, mitigation and management measures for SRE invertebrates. A single-season field survey for SRE invertebrates in the study area, focusing primarily on habitats with higher suitability for SREs (islands) was undertaken on the 8 – 14 June 2021. Twenty sites were selected, half of which were located on islands surrounded by mudflat/saltflat habitats as these were considered to be potentially isolated SRE habitats. Riparian woodlands/shrublands and spinifex grassland habitats were also surveyed. Foraging and litter sifts were undertaken at each site and five wet pitfall traps were installed at each site for approximately 14 days (retrieval date 23 – 25 June 2021).

The desktop review identified seven confirmed SRE taxa and 186 potential SRE taxa from within the 100 km radius desktop search area. A further 48 taxa of uncertain SRE status were identified. Eleven non-SRE (i.e., widespread) taxa from SRE groups were also recorded. One Uncertain SRE was recorded from the study area, *Rhagada* sp. indet.

A total of 14 SRE habitats were identified in the study area. Three of these represent habitats found on islands within the mudflat or saltflat and/or tidal samphire mudflats. Of the 14 SRE fauna habitats, five have High Potential as habitat for SREs, comprising 4.34% of the study area, and nine have Low Potential for SRE habitat, comprising 85.24% of the study area. Cleared areas, tidal channel and ocean within the study area have no SRE habitat value and occupy the remaining 10.42% of the study area.

A total of 24 taxa from six SRE groups were collected in the study area during the field survey. Of these, 12 are Potential SREs, eight are of uncertain SRE status and four are not SREs. No Confirmed SRE taxa were collected in the field survey. Of the Potential SREs, four, all isopods, are considered new or potentially new species and two of these were not recorded outside the Development Envelope but are from outside the Disturbance Footprint:

- Paraplatyarthrus sp. indet. B. – singleton record from spinifex grassland habitat near the study area boundary
- Spherillo sp. indet. B. – singleton record from a spinifex grassland on island habitat.

A total of nine distinct taxa were recorded from island habitats. These include five Potential SREs, three Uncertain SREs, and one widespread non-SRE taxa. They represent only two SRE groups, isopods (6) and pseudoscorpions (3). Of these, one isopod is known only from an island habitat, *Spherillo* sp. B (mardie), and one isopod is potentially only known from an island habitat *Spherillo* sp. A (mardie). *Spherillo* sp. A (mardie) was recorded from five islands spanning 12 km within the study area. An additional record from the Expansion area, immediately NE adjacent to the study area increases this species distribution to 35 km along the coastline. The genus *Spherillo* is uncommonly collected and is known to be generally difficult to collect. It is likely that the singleton record of *Spherillo* sp. B (mardie) is an outcome of the elusiveness of this species rather than it being restricted to an island. Both of the *Spherillo* species from the survey are both have clear preferences for island habitats, however the islands are not considered a barrier to SRE dispersal given most species found on the islands are also recorded on other islands and/or non-island habitats.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

BCI Minerals Ltd (BCI) is seeking to develop the Mardie Project (the Project), located approximately 105 kilometres (km) southwest of Karratha, Western Australia (WA; Figure 1-1). The Project is a sodium chloride (NaCl) salt production project owned 100% by BCI on tenements between Dampier and Onslow. The Project is currently subject to environmental assessment under Part IV of the *Environmental Protection Act 1986* (EP Act; assessment number 2167) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; EPBC 2018/8236).

In May 2021, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by BCI to undertake a short-range endemic (SRE) invertebrate survey for the Project to support the State environmental assessment process.

1.1. BACKGROUND

Baseline terrestrial fauna surveys were undertaken for the Project between December 2017 and August 2019 (Phoenix 2020b). This included SRE sampling by active searches, focused primarily on islands within the mudflats of the study area (section 1.3), as these were identified as the most likely habitat to support SREs (Phoenix 2017, 2020b).

The Environmental Protection Authority (EPA) assessment report for the Project (EPA 2021) found the survey effort for SREs did not meet the requirements of Technical Guidance: Sampling of short-range endemic invertebrate fauna (EPA 2016b). BCI has commissioned additional surveys to determine the potential risk, mitigation and management measures for SRE invertebrates, including completion of additional surveys for SRE fauna habitat prior to ground disturbance.

Two additional terrestrial fauna surveys, which included SRE sampling, were conducted for the Project (both outside the current study area; section 1.3) and provide valuable context for the current survey:

- Mardie Optimisation and Quarry Area, in September 2020 (Phoenix in prep.-a)
- Mardie Expansion Area, in May 2021 (Phoenix in prep.-b).

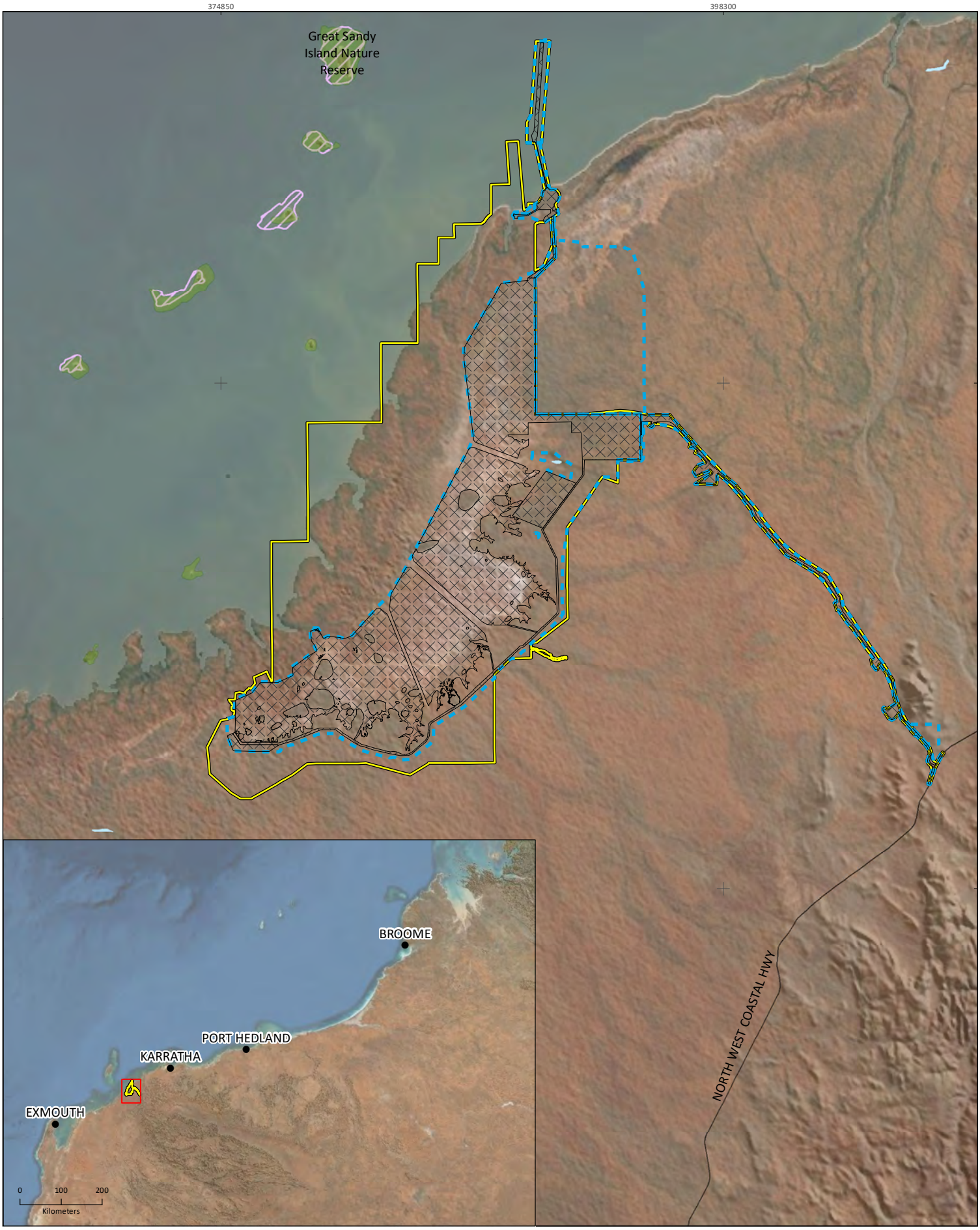
1.2. SCOPE OF WORK

The scope of work for the SRE invertebrate survey was as follows:

- undertake a single-season field survey for SRE invertebrates in the study area, focusing primarily on habitats with higher suitability for SREs
- undertake data analyses, sample processing and species identifications for samples collected during the field surveys
- identify key environmental assets
- prepare maps showing significant species records and habitats in the study area
- prepare a comprehensive technical report and supporting digital data.

1.3. STUDY AREA

The study area is located within tenements E08/2741, E08/1849, E082740 and E08/2836. It is 29,020.8 ha and encompasses a large part of the Development Envelope (DE) which is approximately 16,067 ha (Figure 1-1). Within the study area is the Development Footprint (DF), which is approximately 10,897 ha (Figure 1-1).



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	6/09/2021
Drawn by	IN
Map author	AJ

0 2.5 5
Kilometers

1:230,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_1_1_Project_Location.mxd

- Study area
- Disturbance footprint
- Development envelope
- DBCA managed land
- Environmentally sensitive areas
- Lake

Figure 1-1

Project location and study area

PHOENIX ENVIRONMENTAL SCIENCES

2. LEGISLATIVE CONTEXT

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

- Commonwealth EPBC Act
- State *Biodiversity Conservation Act 2016* (BC Act)
- State EP Act.

2.1. COMMONWEALTH

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES), require approval from the Australian Government minister for the Environment. The EPBC Act provides for the listing of Threatened native fauna as MNES.

Few invertebrate taxa from WA are listed as MNES. Those that are mostly include species that have experienced significant range contractions and population declines due to habitat loss, for example the Margaret River Marron (*Cherax tenuimanus*) (Critically Endangered) and the Shield-backed Trapdoor Spider (*Idiosoma nigrum*) (Vulnerable) (DoEE 2018).

2.2. STATE

2.2.1. Threatened and Priority species

In WA, the BC Act provides for the listing of Threatened fauna species (Government of Western Australia 2018a, b)[1] in the following categories:

- Critically Endangered (CR) – species facing an extremely high risk of extinction in the wild in the immediate future[2]
- Endangered (EN) – species facing a very high risk of extinction in the wild in the near future[Error! Bookmark not defined.]
- Vulnerable (VU) – species facing a high risk of extinction in the wild in the medium term future[Error! Bookmark not defined.].

Species may also be listed as specially protected (SP) under the BC Act under the category of 'species of special conservation interest' (conservation dependent fauna, CD), including species with a restricted natural range.

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

Few SRE invertebrate taxa are currently listed under the BC Act and while there are several invertebrate species on DBCA's Priority list (some of which are SRE taxa), these lists cannot be relied on as a complete guide to significant invertebrate taxa within a particular location. The most up-to-

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

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

date listings of terrestrial invertebrates and their distribution are available through the WA Museum invertebrate databases.

2.2.2. Overview of SRE invertebrates

Short-range endemic (SRE) fauna are defined as animals that display restricted geographic distributions, nominally less than 10,000 km^2, that may also be disjunct and highly localised (Harvey 2002). EPA (2016a) identifies species with restricted distributions as being significant fauna in the context of environmental impact assessments (EIA). SRE fauna need to be considered in EIA as localised, small populations of species that are generally at greater risk of changes in conservation status due to environmental change than other, more widely distributed taxa.

Short-range endemism in terrestrial invertebrates is believed to have evolved through two primary processes (Harvey 2002):

Relictual – where the drying climate reduced the area of suitable habitat available to a species, forcing a range contraction. Such habitats typically maintain historic mesic conditions (e.g. south-facing rock faces or slopes of mountains or gullies)

Habitat speciality – where species settled in particular isolated habitat types (e.g. rocky outcrops) by means of dispersal and evolved in isolation into distinct species.

However, SRE invertebrates have also been reported in more widespread habitats such as spinifex plains or woodlands, mainly in groups with low dispersal capabilities, for example mygalomorph spiders and millipedes (see for example Car & Harvey 2014; Rix *et al.* 2018).

There can be uncertainty in categorising a specimen as an SRE due to several factors including poor regional survey density, lack of taxonomic research and problems of identification, i.e. specimens that may represent SREs cannot be identified to species level based on the life stage at hand. For example, in contrast to mature males, juvenile and female millipedes, mygalomorph spiders and scorpions cannot be identified to species level. Molecular techniques such as 'barcoding' (Hebert *et al.* 2003a; Hebert *et al.* 2003b) are routinely employed to overcome taxonomic or identification problems.

Currently, there is no accepted system to determine the likelihood that a species is an SRE. The WA Museum applies four categories which were adopted in this assessment: confirmed, potential, uncertain and not SRE. Confirmed SREs are taxa for which the distribution is known to be less than 10,000 km^2, the taxonomy is well known and the group is well represented in collections and/ or via comprehensive sampling (WAM 2013). Potential SREs include those taxa for which there is incomplete knowledge of the geographic distribution of the group and its taxonomy, and the group is not well represented in collections.

3. EXISTING ENVIRONMENT

3.1. INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into large 'bioregions' and 'subregions' based on climate, geology, landform, native vegetation and species information (DoEE 2016). The study area is located in the Roebourne (PIL4) and Chichester (PIL1) subregions of the Pilbara bioregion (Figure 3-1). The Roebourne subregion is characterised as Quaternary alluvial and older colluvial coastal and sub-coastal plains with a grass savannah of mixed bunch and hummock grasses and dwarf shrubs. The uplands are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations, or composed of basalt or limestone, or combinations of any of these three (Kendrick & Stanley 2001).

The Chichester subregion is characterised as undulating Archaean granite and basalt plains including significant areas of basaltic ranges. The plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges (Kendrick & McKenzie 2001).

3.2. LAND SYSTEMS AND SURFACE GEOLOGY

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

The study area intersects eight land systems (Table 3-1; Figure 3-2). The Littoral system is the dominating land system, comprising 61.39% of the study area.

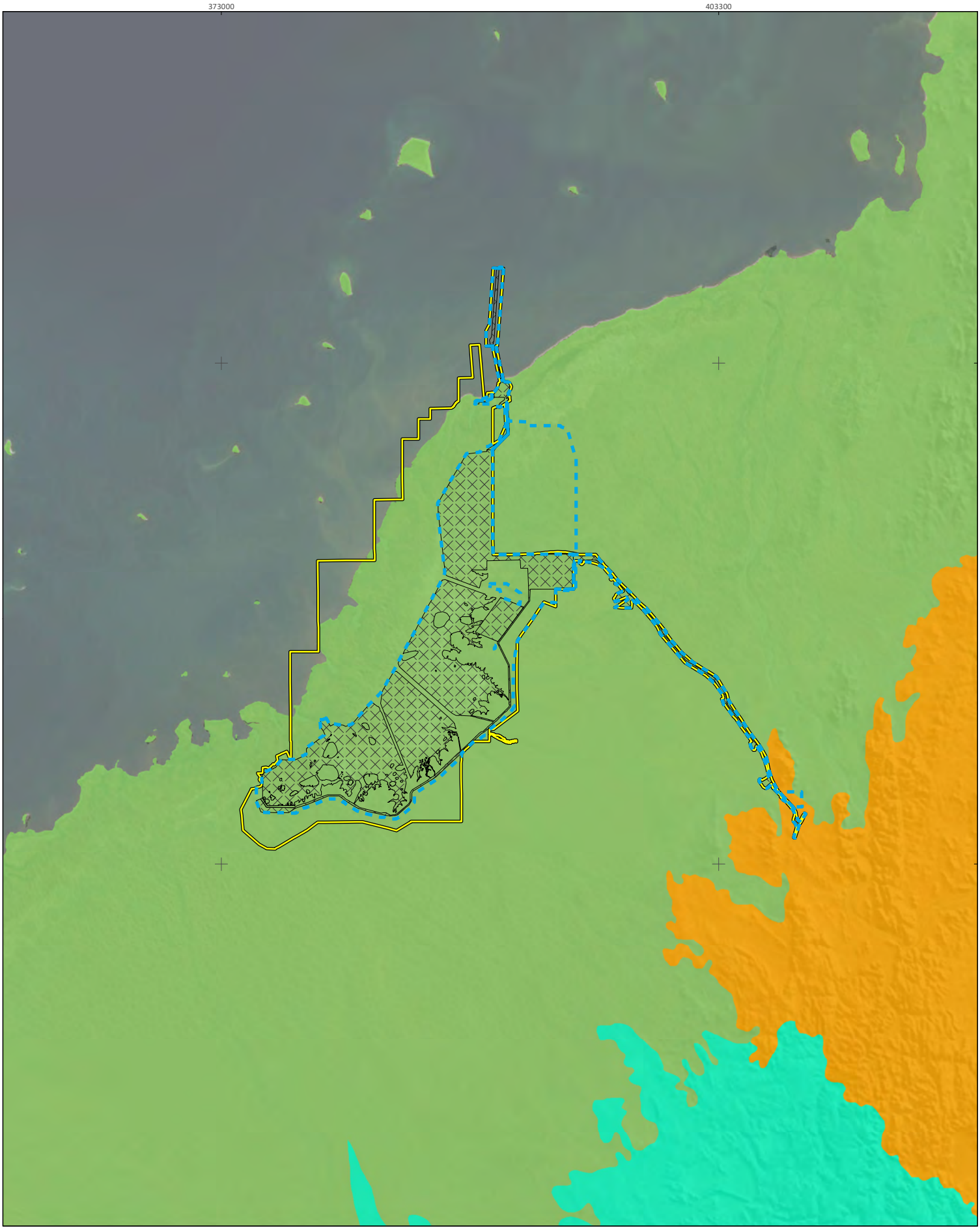
Table 3-1 Land systems and extent in study area

Land system	Description	Area (ha)	% of study area
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	3.2	0.01%
Horseflat	Gilgaied clay plains supporting Roebourne Plains grass grasslands and minor grassy snakewood shrublands.	1,838.5	6.34%
Littoral	Bare coastal mudflats (unvegetated), samphire flats, sandy islands, coastal dunes and beaches, supporting samphire low shrublands, sparse acacia shrublands and mangrove forests.	17,815.1	61.39%
Onslow	Undulating sandplains, dunes and level clay plains supporting soft spinifex grasslands and minor tussock grasslands.	5,518.3	19.02%
Peedamulla	Gravelly plains supporting hard spinifex grasslands and minor snakewood shrublands.	33.3	0.11%
Rocklea	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	81.2	0.28%
Ruth	Hills and ridges of volcanic and other rocks supporting shrubby hard spinifex and occasionally soft spinifex grasslands.	49.6	0.17%
Yamerina	Flood plains and deltaic deposits supporting tussock grasslands, woodlands with buffel grass and minor halophytic low shrublands.	1,463.6	5.04%
Unmapped	Ocean and marine areas.	2,218.0	7.64%
Total		**29,020.8**	**100%**

According to the Surface Geology of Australia 1:1,000,000 scale, Western Australia database (Stewart *et al.* 2008), the study area intersects eight geological formations (Table 3-2; Figure 3-2).

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

Surface geology	Abbreviation	Description	Area (ha)	% of study area
Alluvium 38485	Qa	Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted	5,516.2	19.01%
Coastal dunes 38488	Qdc	Beach sand, sand dunes, coastal dunes, beaches, and beach ridges; calcareous and siliceous, locally shelly and/or cemented (beach rock); locally reworked	549.9	1.89%
Colluvium 38491	Qrc	Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite	6,770.1	23.33%
Estuarine and delta deposits 38489	Qe	Coastal silt and evaporite deposits; estuarine, lagoonal, and lacustrine deposits	13,242.3	45.63%
Fortescue Group	Awf	Mafic volcanics; andesitic and basaltic lavas, chert, clastic sedimentary rocks, minor thin tuff units	52.7	0.18%
Jeerinah Formation	Awfj	Shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows	2. 8	0.01%
Maddina Formation	Abfm	Massive, vesicular and amygdaloidal basalt, basaltic andesite, and andesite, minor dacite, dolerite sills; bedded lapilli, vitric, crystal and lithic tuff, volcaniclastic siltstone, shale, chert, sandstone, dolomite	75.0	0.26%
Tumbiana Formation	Awft	Pisolitic tuff, siliceous limestone and dolomite, mudstone, tuffaceous shale, siltstone, sandstone, volcaniclastic sandstone and siltstone, calcareous sandstone, local basalt and basaltic breccia, chert, local conglomerate, shale, jasper	16.1	0.06%
Water		Water	2,795.7	9.63%
Total			**29,020.8**	**100.00%**



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	7/09/2021
Drawn by	IN
Map author	AJ

0 5 10
Kilometers

1:300,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_3_1_IBRA.mxd

Study area
Disturbance footprint
Development envelope

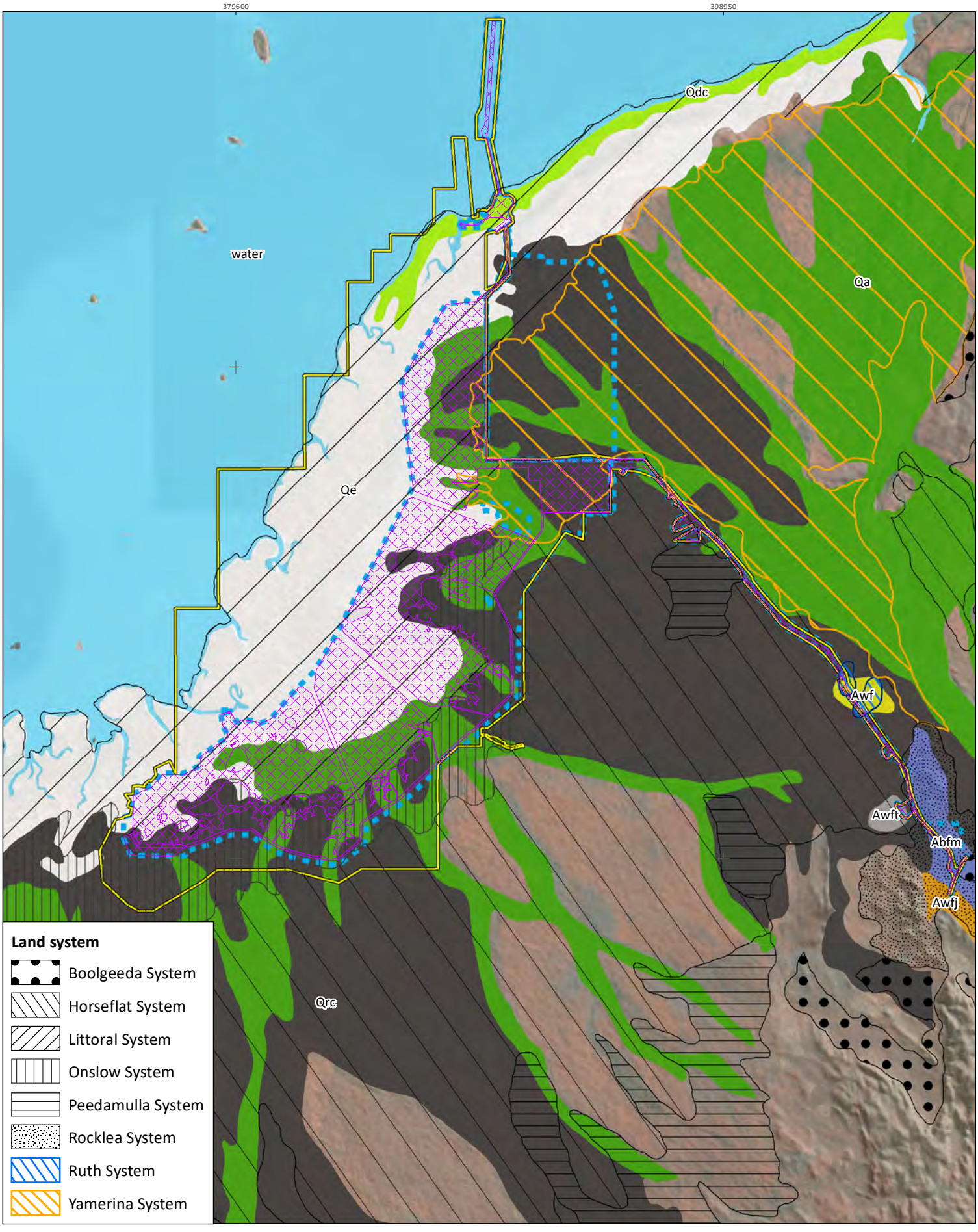
IBRA region and subregion

Pilbara, Chichester
Pilbara, Hamersley
Pilbara, Roebourne

Figure 3-1

Study area in relation to IBRA bioregions and subregions

PHOENIX ENVIRONMENTAL SCIENCES



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	7/09/2021
Drawn by	IN
Map author	AJ

0 2.5 5
Kilometers

1:195,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_3_2_LandSystems.mxd

Study area
Disturbance footprint
Development envelope

Surface geology

Abfm
Awf
Awfj
Awft
Qa
Qdc
Qe
Qrc
water

Figure 3-2

Land systems and surface geology in the study area

PHOENIX ENVIRONMENTAL SCIENCES

3.3. CLIMATE AND WEATHER

The climate of the Roebourne subregion is described as arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer (Kendrick & Stanley 2001). The climate of the Chichester subregion is described as semi-desert-tropical, receiving 300 mm of rainfall annually (Kendrick & McKenzie 2001). The nearest Bureau of Meteorology (BoM) weather station with comprehensive data collection and recent historic climate data is Mardie (no. 005008), Latitude: 21.19°S Longitude 115.98°E), located 0.7 km east of the study area.

Mardie records the highest mean maximum monthly temperature (37.9°C) in January, with the lowest in July, 27.8°C, and the lowest minimum mean monthly temperature (11.9°C) in July, with the highest in January, 25.4°C (BoM 2021; Figure 3-3). Average annual rainfall is 275.4 mm, with February and March recording the highest monthly averages (62.6 and 48.8 mm respectively; Figure 3-3).

Daily mean maximum temperatures at Mardie preceding the surveys were lower than the long-term averages for all months except July, August, September, and January. The mean minimum temperatures for every month prior to the survey, excluding March, were higher than the historical averages. January was the warmest month (40.1°C mean maximum, 27.2°C mean minimum) and June was the coolest month (26.1°C mean maximum, 14.1°C mean minimum). In the three months preceding the survey, temperatures were generally consistent with long-term averages, however June was slightly cooler than expected (Figure 3-3).

Records from Mardie show that the total rainfall level in the 12 months leading up to the survey was 467.9 mm, which is much higher than the historical annual average. September, October and November did not receive any rainfall, whereas February received the highest amount at 126.6 mm, 64 mm more than the average for that month. In the three months prior to the survey, rainfall levels were significantly higher than expected, with May in particular receiving 86.9 mm more than the long-term average. The study area was likely wetter than usual leading up to, and during, the survey period (Figure 3-3).

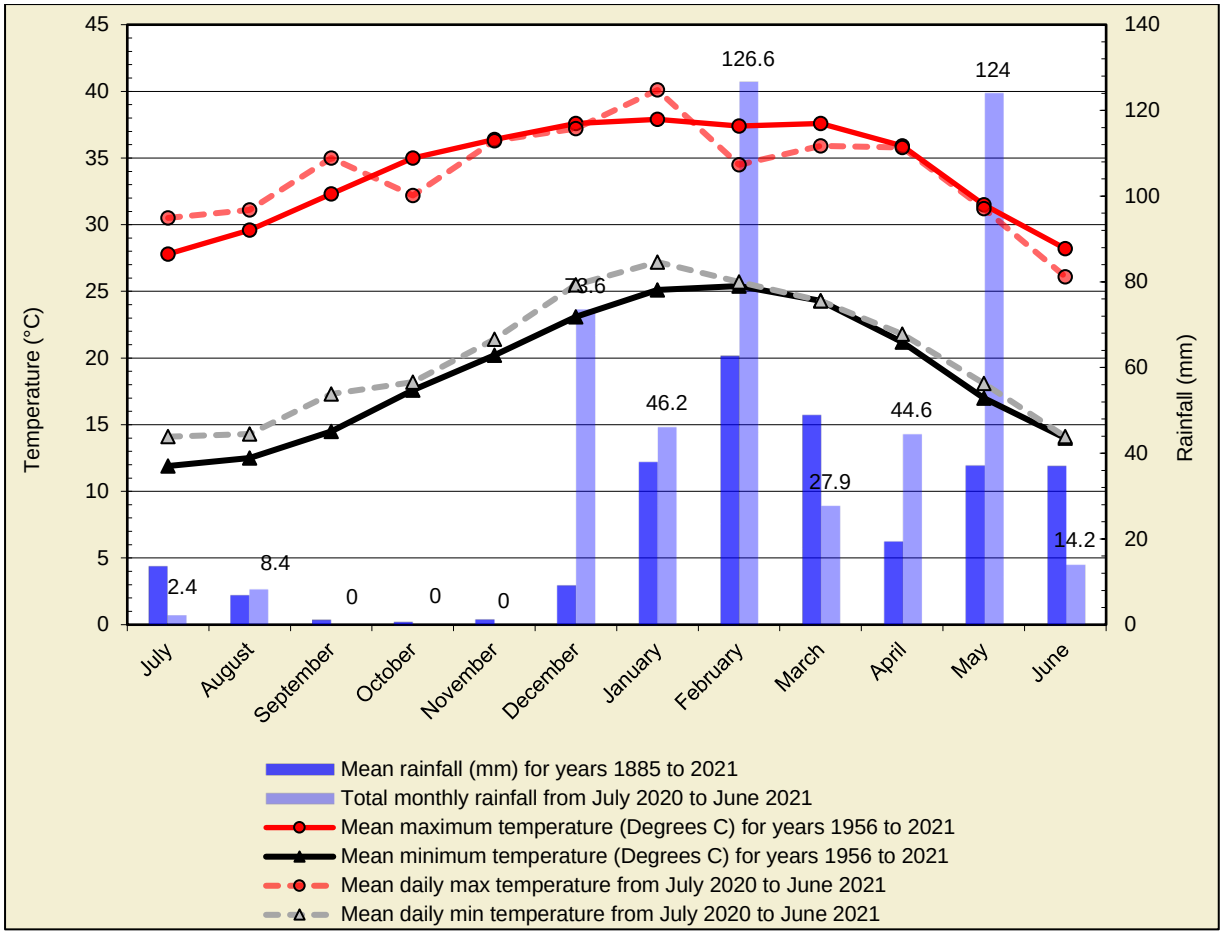


Figure 3-3 **Annual climate and weather data for Mardie (no. 005008) and mean monthly data for the 12 months preceding the survey (BoM 2021).**

3.4. LAND USE

The dominant land use of the Roebourne subregion is native pastures, Aboriginal lands, conservation, mining leases and urban (Kendrick & Stanley 2001). The study area falls within the Mardie pastoral station, and the dominant existing land use is livestock grazing.

The dominant land use of the Chichester subregion is native pastures, Aboriginal land and reserves, UCL and Crown reserves, conservation and mining (Kendrick & McKenzie 2001).

3.5. CONSERVATION RESERVES AND ENVIRONMENTALLY SENSITIVE AREAS

The nearest reserve is the Great Sandy Island Nature Reserve, which is a group of islands located to the west, north and north-east of the study area, with the closest island being approximately 3 km from the western boundary. The nearest environmentally sensitive area is a small island located 6 km north-west of the study area (Figure 1-1).

4. METHODS

The SRE survey was conducted in accordance with EPA Technical Guidance: Sampling of short range endemic invertebrate fauna (EPA 2016b).

4.1. DESKTOP REVIEW

Searches of several biological databases were undertaken to identify and prepare lists of SRE invertebrates that may occur within the study area (Table 4-1). A literature search was conducted for accessible reports for biological surveys conducted within 100 km of the study area to build on the lists developed from the database searches (Table 4-2).

Table 4-1 Database searches conducted for the desktop review

Database	Target group/s	Search coordinates and extent
WA Museum Arachnid and Myriapod Database, Mollusca Database and Crustacea Database	Arachnid, myriapod mollusc and crustacea SREs	100 km^2 search area encompassing the study area -20.1722°S, 115.0124°E (northwest corner) and -21.9730°S, 116.9907°E (southeast corner)

Table 4-2 Survey reports included in the desktop review

Report author	Survey description	Project
Phoenix (in prep.-b)	Level 1 Fauna and SRE Survey (Optimisation Area and Quarry Area)	Mardie Project
Phoenix (in prep.-b)	Basic (Level 1) terrestrial fauna survey (Expansion Area)	Mardie Project
Phoenix (2020b)	Level 2 targeted terrestrial fauna survey	Mardie Project
Phoenix (2009b)	SRE invertebrate fauna survey	Mineralogy Cape Preston Iron Ore Mining Project
Phoenix (2009a)	Cape Preston SRE invertebrate fauna survey	Cape Preston
Slack-Smith and Whisson (2009)	The land snail component of a faunal survey in the Cape Preston area	Cape Preston
WAM (2009)	The SRE invertebrate fauna from Cape Preston	Cape Preston

4.2. FIELD SURVEY

The field survey was conducted over a seven-day period season in June 2021 (Table 4-3). Sampling for SRE invertebrates was conducted at 20 sites (Figure 4-1), in areas identified as suitable habitat for SREs. Sampling comprised the following methods:

- wet pit trapping
- active foraging
- litter/soil sieving.

Table 4-3 Survey dates

Survey type	Dates
Trap installation, foraging and litter/soil sieving	8-14 June 2021
Trap retrieval	23-25 June 2021

4.2.1. Habitat assessment and site selection

The vegetation units defined by Phoenix (Phoenix 2020a) were re-interpreted in relation to terrestrial SRE invertebrates, based on vegetation type and structure, substrate and position in the landscape (factors considered important in defining fauna assemblages). Each fauna habitat was then rated for its potential to support SREs (Potential Habitat Rating; PHR) as follows:

- High – defined/known areas of habitat that contain elements that often give rise to specialisation or dependency in invertebrate fauna, such as aspect (e.g., south-facing slopes, deeply incised gullies), geological features (e.g., granite), soil types that retain water (e.g., clay, loam).
- Low – areas of largely intact native vegetation that occur broadly across the landscape, are less incised and typically link more restricted habitats. This includes land that was cleared but has since been rehabilitated or is in the process of being rehabilitated.
- None – land that has been previously cleared for other uses that no longer contains native vegetation.

Survey sites were pre-selected using aerial imagery and were chosen to represent the various habitats within the study area. Sites were chosen in both coastal and inland habitats, with an emphasis on isolated habitats such as islands associated with mudflats. Sampling within these sites was then conducted in typical SRE habitats, such as drainage lines and creek riparian zones. Islands were identified as areas of any fauna habitat surrounded completely by an area that is devoid of terrestrial vegetation or prone to inundation, e.g. mudflat/salt flat, tidal channel and ocean, tidal samphire mudflat.

4.2.2. SRE wet pit trapping

Twenty wet pitfall trapping sites were established (Table 4-4), each comprising of five one-litre PVC containers with a 70 mm diameter dug in flush with the surface in suitable microhabitats at each site. Traps were half-filled with a 50% propylene glycol, 50% ethanol solution, which has been shown to preserve DNA under laboratory conditions in invertebrates (Vink *et al.* 2005) and from which Phoenix has successfully sequenced Cytochrome Oxidase Subunit I (COI) in previous surveys. All traps were covered with a plastic lid elevated 2 cm above the trap with wooden blocks to minimise by-catch of vertebrates, where possible. Traps remained open following the setup and were retrieved approximately two weeks later.

4.2.3. Active foraging

A standardised approach to active foraging was undertaken whereby each site was sampled for two person hours and a total search effort of approximately 40 hours was achieved (Table 4-4). Active foraging for SRE invertebrate groups comprised inspection of logs, larger plant debris, the underside of bark of larger trees and the underside of rocks. Methodical searches were conducted amongst the leaf litter of shade-bearing tall shrubs and trees, including raking of litter, and spinifex bases were inspected thoroughly. Rocks and rock crevices were inspected, particularly for pseudoscorpions. Trapdoor spider burrows identified during the searches were excavated if they were considered inhabited. Excavation involved removing soil from around the burrow to carefully expose the burrow chamber and remove the spider.

4.2.4. Litter/soil sieving

Combined litter/soil sifts were undertaken at 20 sites, with up to three sifts conducted at each site dependent on abundance of leaf litter. In total, 60 sifts were undertaken (Table 4-4). The collection of

leaf litter samples was standardised volumetrically by the diameter and height (310 mm x 50 mm = 1.55 L) of the sieves which were filled with compressed litter and the upper layers of underlying soil. Samples were sieved through three stages of decreasing mesh size over a round tray and invertebrates were picked from the sieves and tray with forceps. These samples particularly targeted small spiders (Araneomorphae), pseudoscorpions, buthid scorpions, millipedes, centipedes (in particular Geophilomorpha and Cryptopidae), smaller species of molluscs (e.g. Pupillidae) and slaters.

Table 4-4 Survey effort

Site	Number of wet pit traps	Nights deployed	Total # nights	Foraging (hrs)	Litter sifts (#)	Inside DE	Inside DF
SRE01	5	15	75	2	3	Yes	Yes
SRE02	5	15	75	2	3	No	No
SRE03	5	15	75	2	3	No	No
SRE04	5	15	75	2	3	Yes	No
SRE05	5	15	75	2	3	Yes	No
SRE06	5	15	75	2	3	Yes	No
SRE07	5	15	75	2	3	Yes	No
SRE08	5	15	75	2	3	Yes	No
SRE09	5	15	75	2	3	Yes	Yes
SRE10	5	15	75	2	3	Yes	No
SRE11	5	15	75	2	3	No	No
SRE12	5	15	75	2	3	Yes	No
SRE13	5	15	75	2	3	Yes	No
SRE14	5	15	75	2	3	Yes	No
SRE15	5	15	75	2	3	No	No
SRE16	5	15	75	2	3	Yes	No
SRE17	5	15	75	2	3	Yes	Yes
SRE18	5	15	75	2	3	Yes	No
SRE19	5	15	75	2	3	No	No
SRE20	5	15	75	2	3	No	No
Total	**100**	**300**	**1500**	**40**	**60**	**14**	**3**

4.2.5. Identification of SRE taxa

4.2.5.1. Morphological identification and molecular sequencing

Morphological identifications of specimens within SRE groups were identified to the lowest taxonomic level where possible. Molecular identification was subsequently undertaken for five specimens, one mygalomorph spider, three centipedes and one scorpion.

DNA barcoding was conducted based on comparisons between the mitochondrial gene Cytochrome Oxidase I (COI). DNA was extracted from each specimen and the 658 base pair COI gene was amplified by Genotyping Australia using universal COI primers (Folmer *et al.* 1994). The data was subsequently compared to previously published sequences uploaded into Genbank using the BLAST function in Geneious Prime v11.1.5. Sequences were also compared inhouse, to Phoenix's molecular database. The top blast hits for each major taxon were reported, the sequences from the survey were added, duplicate sequences were removed, and remaining sequences then analysed with a Maximum

Likelihood phylogenetic analysis using a GTR+G model of evolution and 100 bootstraps (RAxML). Distances were calculated via tree-based estimates of identical bases in Geneious Prime.

Species delineation was determined through analysis of pairwise similarity matrices and RAxML trees showing clusters of specimens with similar DNA to those from the current survey and GenBank, and if other clusters were present but clearly forming a separate species.

4.2.5.2.Nomenclature

The nomenclature follows a number of taxon-specific references; however, many invertebrate species are currently unnamed requiring morphospecies designation as listed in this report. These are adopted from the nomenclatural systems developed by the WA Museum or other respective taxonomic authorities. Interim project specific codes are used for some of the species identified using molecular tools pending a code-designation by the WA Museum. Reference collections for these morphospecies generally reside with WA Museum, as expected by EPA (EPA 2016b).

4.2.5.3.SRE status

All taxa collected from SRE target groups were assigned an SRE status using the WAM (2013) categories of Confirmed, Potential, Uncertain or Not SRE. These definitions are explained further in section 2.2.2.

4.2.6. Analysis of survey completeness/effectiveness

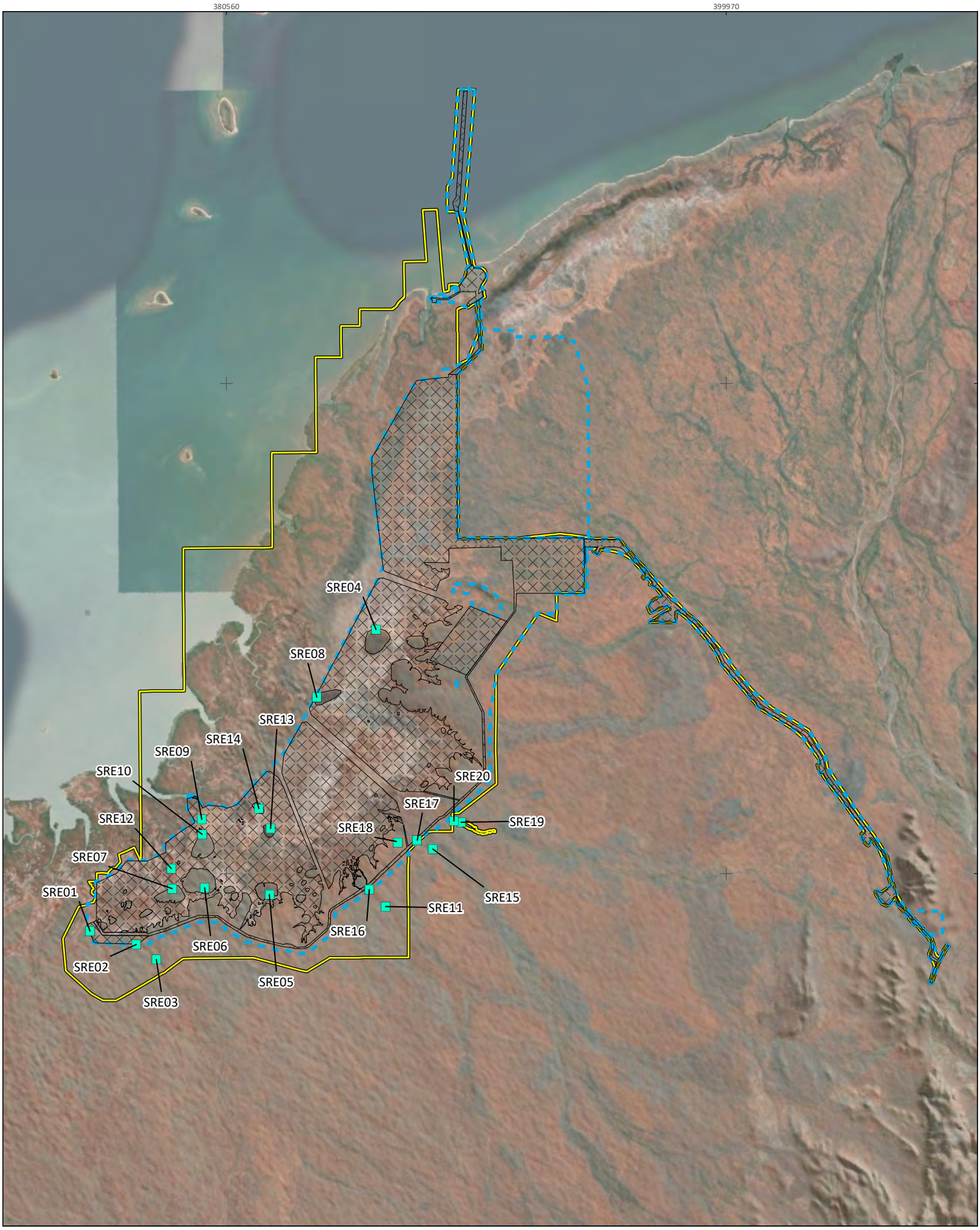
In order to assess whether further diversity remained hidden due to under sampling, species rarefaction-extrapolation (R/E) curves and the associated 95% confidence intervals were generated, where sample sizes permitted extrapolation (Chao 2014; Hsieh *et al.* 2016). The R.cran package iNEXT (Hsieh *et al.* 2016) enabled assessment of whether or not the survey adequately detected a representative of the projected population within the study area. iNEXT focuses on three measures of Hill numbers of order q: species richness (q=0), Shannon diversity (q=1), and Simpson diversity (q=2). Diversity estimates used abundance-based data [3]. An abundance-based estimator tallies the abundance of each species within each sample. Individual sample-size R/E curves were produced for two of the groups of interest for the survey (isopods and pseudoscorpions) and were produced to determine if the rate of discovery of new species slowed down or reached saturation with an increase in sample size. All other groups had too few samples to extrapolate from. Results were represented by the means of repeated resampling (1,000 bootstrap replicates).

4.2.7. Survey personnel

The personnel involved in the surveys are listed in Table 4-5. The survey was carried out under Fauna taking (biological assessment) licence no. BA27000446.

Table 4-5 Survey personnel

Name	Qualifications	Role/s
Jarrad Clark	BSc. (Env. Mgmt)	Project manager
Simon Pynt	BSc. (Zool.)	Field survey
Anna Jacks	BSc. (Env. Science) (Hons)	Reporting
Jade Larkman	BSc. (Env. Mgmt)	Field survey, sample processing, reporting



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	8/09/2021
Drawn by	IN
Map author	AJ

0 2.5 5
Kilometers

1:191,200 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_4_1_SurveySites_v2.mxd

- Study area
- Disturbance footprint
- Development envelope
- Site

Figure 4-1

Survey sites

PHOENIX ENVIRONMENTAL SCIENCES

5. RESULTS

5.1. DESKTOP REVIEW

The desktop review identified records of seven confirmed SRE taxa and 186 potential SRE taxa from within the SRE desktop search area (Table 5-1; Figure 5-1). A further 48 taxa of uncertain SRE status were identified. Eleven non-SRE (i.e., widespread) taxa from SRE groups were also recorded.

One Uncertain SRE species has previously been recorded within the study area (Figure 5-1):

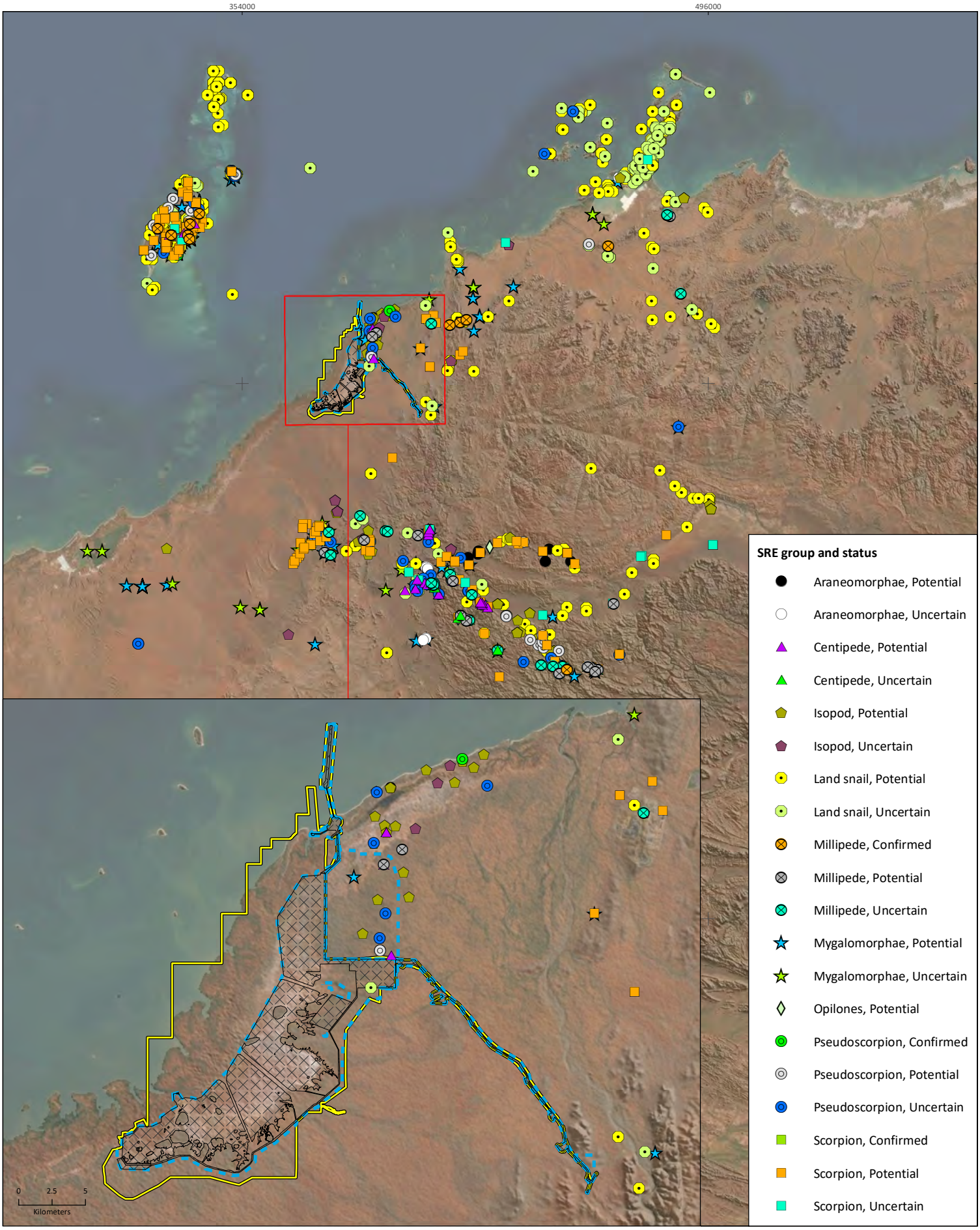
- Land snail
    - *Rhagada* 'sp. indet.' (Uncertain), recorded from WA Museum Mollusca database (WAM 2021). Several records of this taxon occur inside and outside the DE, none are in the DF; given taxonomic ambiguity of these specimens, no further comment can be made on distribution.

Of the 193 confirmed or potential SRE taxa, 31 are named species, of which 14 are land snails, five are millipedes, four are pseudoscorpions, three are mygalomorph spiders, two are centipedes, one is a scorpion, one is an isopod, and one is an araneomorph spider. The remaining 162 comprise taxa named only to morphospecies codes (118 taxa) as applied by the WA Museum or are not identified to confirmed species level (i.e. "sp." or "cf.") (44 taxa). The majority of taxa records of uncertain SRE status are unidentifiable ("sp. indet.", i.e. female or juvenile specimens) or could not be identified to species or morphospecies, and may represent new species or other species listed in the same genus where records exist (Table 5-1).

Table 5-1 Summary of SRE taxa identified in the desktop review

Family	SRE status				Total
	Confirmed	Potential	Uncertain	Not SRE	
Class: Arachnida, Infraorder: Mygalomorphae (Trapdoor spiders)					
Actinopodidae		1	1		2
Barychelidae		8	2	1	11
Halonoproctidae		3	1		4
Idiopidae		5	1		6
Nemesiidae		22	4	1	27
Class: Arachnida, Infraorder: Araneomorphae (Modern spiders)					
Selenopidae		6	1		7
Class: Arachnida, Order: Opiliones (Harvestmen spiders)					
Assamiidae		3			3
Class: Arachnida, Order: Pseudoscorpiones (Pseudoscorpions)					
Atemnidae		2	1		3
Cheiridiidae		1	1		2
Chthoniidae		4	1	1	6
Garypidae	1	3	1		5
Garypinidae			1		1
Geogarypidae			1		1
Hyidae		1			1
Olpiidae		2	11		13
Sternophoridae			1		1

Family	SRE status				Total
	Confirmed	Potential	Uncertain	Not SRE	
Class: Arachnida, Order: Scorpiones (Scorpions)					
Buthidae		11	3		14
Urodacidae	1	6	1	2	10
Class: Chilopoda (Centipedes)					
`Family indet.`		3			3
Ballophilidae		1			1
Chilenophilidae		3			3
Cryptopidae		9	1		10
Geophilidae				1	1
Mecistocephalidae		5	1		6
Trigoniulidae		1	1		2
Diplopoda (Millipedes)					
Paradoxosomatidae	5	13	1		19
Siphonotidae			1		1
Class: Crustacea, Order: Isopoda (Slaters)					
Armadillidae		26	3	2	33
Oniscidae			1	1	2
Paraplatyarthidae		1			1
Philosciidae		6	2		8
Gastropoda (Land snails)					
Bothriembryontidae		1			1
Camaenidae		39	5	2	46
Grand Total	**7**	**186**	**48**	**11**	**254**



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	9/09/2021
Drawn by	IN
Map author	AJ

0 25 50
Kilometers

1:1,500,000 (at A4) GDA 1994 MGA Zone 50

Study area
Disturbance footprint
Development envelope

Figure 5-1

Desktop records of SRE invertebrates

PHOENIX ENVIRONMENTAL SCIENCES

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_5-1_Desktop_SREs_v2.mxd

5.2. FIELD SURVEY

5.2.1. Habitats

A total of 14 SRE habitats were identified in the study area. Three of these represent habitats found on islands within the mudflat or saltflat and/or tidal samphire mudflats; in low shrubland on island, spinifex grassland on island, and low shrubland over spinifex on island. These three habitats are also present as non-islands, i.e.. areas that are not disconnected from other terrestrial habitats by mudflats or saltflats. Of the 14 SRE fauna habitats, five have High Potential as habitat for SREs and nine have Low Potential for SRE habitat (Table 5-2; Figure 5-2). Low Potential SRE habitats occupy the majority of the study area (85.24%), and is comprised largely of mudflats and salt flats, and plains grasslands or shrublands over spinifex and/or tussock grasses. The High Potential SRE habitats, a freshwater pool (and the surrounding vegetation), open woodland (riparian), and the habitats found on islands together comprise 4.34% of the study area of which the majority (4.09% of the study area) are islands. Cleared areas, tidal channel and ocean within the study area have no SRE habitat value and occupy the remaining 10.42% of the study area.

Table 5-2 Extent and description of each SRE habitat in the study area

Habitat type	Site/s (*Italics* = outside DE, **Bold** = in DF)	Vegetation description	Potential SRE habitat rating	Extent in study area and % of study area
Beach and dune	-	Bare sand, sporadic vegetation may be present	Low	10.6 (0.04%)
Freshwater pool	-	Soak surrounded by Isolated tall shrubs to open shrubland, frequently *Acacia coriacea*, **Prosopis glandulosa* x *velutina* and *Myoporum montanum* over isolated low shrubs to open shrubland of **Aerva javanica* over low closed *Triodia epactia*; permanent freshwater pool	High	1.2 <0.01%)
Low shrubland	-	Low *Trianthema turgidifolium*, *Neobassia* astrocarpa *and Pluchea rubelliflora* shrubland over low *Sporobolus virginicus* grassland over isolated low *Trianthema cussackianum* forbs on low lying plains	Low	13.7 (0.05%)
low shrubland on island	-	As above, on island	High	5.8 (0.02%)
Mangal community	-	Mid open *Avicennia marina* and *Rhizophora stylosa* shrubland over low closed *Muellerolimon salicorniaceum* shrubland surrounding tidal creek	Low	1,673.1 (5.77%)
Mudflat or salt flat		Mudflat or salt flat areas predominantly devoid of vegetation; algal mat	Low	10,405.2 (35.85%)
Open woodland (riparian)	*SRE11*, *SRE15*, **SRE17**, *SRE19*, *SRE20*	Isolated low trees to low open *Eucalyptus victrix* woodland occasionally with *Corymbia candida* trees over mid to tall open shrubland with *Acacia* spp., *Ehretia saligna*; mid *Melaleuca argentea*, **Phoenix dactylifera* and *Sesbania formosa* woodland over tall open **Prosopis glandulosa* x *velutina* woodland over isolated tall *Typha* domingensis, *Schoenoplectus subulatus* and *Cyperus vaginatus* sedges in creeks	High	73.5 (0.25%)

Habitat type	Site/s (*Italics* = outside DE, **Bold** = in DF)	Vegetation description	Potential SRE habitat rating	Extent in study area and % of study area
Shrubland over spinifex grassland	*SRE02*, *SRE03*	Various combinations of shrubland species (**Prosopis glandulosa* x *velutina*, *Acacia bivenosa*, *A. ancistrocarpa, A. pyrifolia* var. *pyrifolia*, *A. synchronicia, A. sclerosperma*, *Senna glutinosa* subsp. *glutinosa*, *Hakea chordophylla*, and/or *Trianthema turgidifolia*) over hummock and/or tussock grasslands (such as **Cenchrus ciliaris*, *Triodia longiceps*, *T. wiseana*, *T. epactia*)	Low	5,231.3 (18.03%)
Shrubland over spinifex grassland on island	SRE05	As above, on island	High	145.9 (0.50%)
Shrubland over tussock grassland		Variably present isolated low trees of *Eucalyptus victrix* over a mid shrubland of **Prosopis glandulosa* x *velutina* and variably present *Acacia sclerosperma subsp. sclerosperma* over low isolated mixed grasses including **Cenchrus ciliaris*	Low	84.7 (0.29%)
Spinifex grassland	SRE16, SRE18	*Triodia longiceps* hummock grassland; *Triodia epactia* hummock grassland on sand dunes	Low	1,817.7 (6.26%)
Spinifex grassland on island	**SRE01**, SRE04, SRE06, SRE07, SRE08, **SRE09**, SRE10, SRE12, SRE13, SRE14	As above, on island	High	1,037.4 (3.57%)
Tidal samphire mudflat	-	Low mixed *Tecticornia* species sparse samphire shrubland to samphire shrubland on mudflats and low sandy rises	Low	5,208.9 (17.95%)
Tussock grassland	-	Isolated mid shrubs, **Prosopis glandulosa* x *velutina*, *Acacia xiphophylla* and *A. inaequilatera* over low *Eragrostis xerophila* tussock grassland with occasional **Cenchrus ciliaris* and *Triodia* spp. grasses over isolated low *Corchorus tridens*	Low	287.2 (0.99%)
Tidal channel and ocean	-	Ocean or tidal creek predominantly without vegetation	None	2,780.67(9.58%)
Cleared	-	Cleared areas	None	243.9 (0.84%)
Total	20			29,020.8(100%)

5.2.2. SRE records

A total of 24 taxa from six SRE groups were collected in the study area during the field survey (Figure 5-2; Table 5-3). Of these, 12 are Potential SREs, eight are of uncertain SRE status due to taxonomic ambiguity and four are not SREs (i.e., are widespread species). No Confirmed SRE taxa were collected in the field survey. Isopods represented the most speciose of the Potential SREs, with seven taxa recorded during the survey. This was followed by pseudoscorpions (four species), centipedes (two species) and mygalomorph spiders (one species). Of the Potential SREs, eight were also recorded from

the desktop review and therefore also known from outside the study area. The remaining four, all isopods, are considered new or potentially new species and two of these species were not recorded outside the DE:

- *Buddelundia* '34ms' – collected from six sites, of which one is within the DF and five are outside the DE. All six sites are located at the southeast of the study area in two habitat types, open woodland (riparian) and shrubland over spinifex grassland habitats which are considered High and Low PHR habitats, respectively. This species is similar and may be conspecific to *Buddelundia* '34'which is known from records 20 km east of the study area.
- *Paraplatyarthrus* sp. indet. B. – collected from one site within the DE but not within the DF. The record is from spinifex grassland habitat which is a well-represented habitat in the eastern part of the study area. This habitat also extends outside of the study area and is considered a Low Potential SRE habitat.
- *Spherillo* sp. indet. B. – collected from one site within the DE but not within the DF. The record is from spinifex grassland on island habitat which is considered a High Potential SRE habitat. The genus *Spherillo* is uncommonly collected in the Pilbara and a poorly known genus due to its size and lack of specimens.
- *Spherillo* sp. A (mardie) was collected from the survey from the same habitat as *Spherillo* sp. indet. B. (Spinifex grassland on island) but from more locations, soil types, land systems and surface geologies.

Of the 24 taxa collected from the survey, 17 are morphospecies, those that could be distinguished from other taxa either morphologically or using molecular techniques and seven were indeterminate and could not be assigned a species. These indeterminate species may represent a new species or a species that is already recorded in the survey or from elsewhere.

Table 5-3 Specimens from SRE groups recorded in the field survey

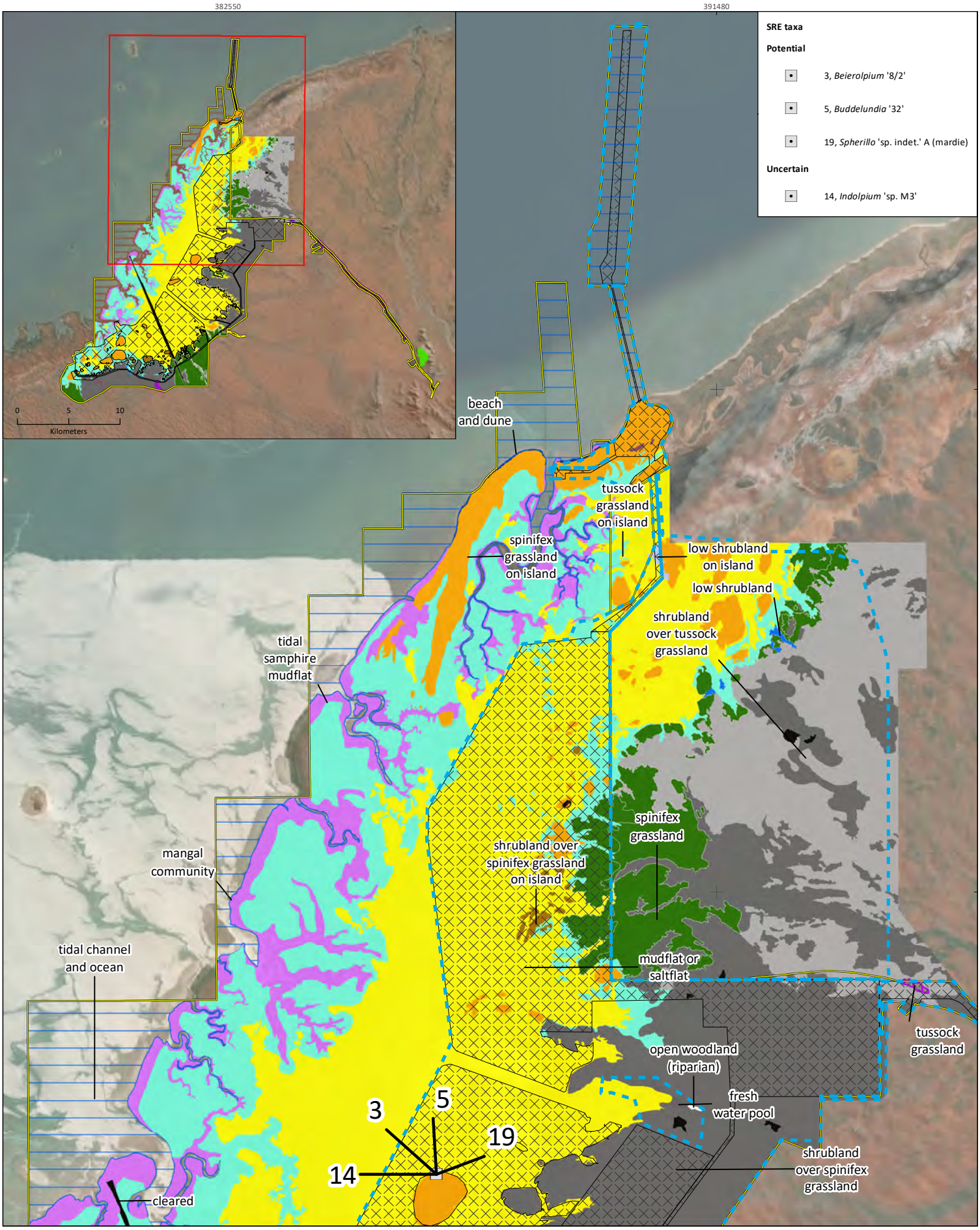
Higher order/ Family	Taxon	SRE status[1]	Site/s (*Italics* = outside DE, **Bold** = in DF, Underline = island)	Habitat	PHR	Soil type[2]	Land system	Surface geology[3]	No. of speci-mens	Comments
Class: Arachnida, Infraorder: Araneomorphae (modern spiders)										
Selenopidae	*Karaops* sp. indet.	U	SRE16	Spinifex grassland	Low	Oc72	Onslow	Qa	2	Indeterminate species, six *Karaops* species were returned in the desktop review and this specimen may represent one of those or may be a new species.
Class: Arachnida, Infraorder: Mygalomorphae (trapdoor spiders)										
Idiopidae	*Euoplos* 'MYG307'	P	*SRE02*	Shrubland over spinifex grassland	Low	Oc72	Onslow	Qa	1	Genetically matched (1.4% intraspecific divergence) to a specimen recorded 60 km SE of the study area.
Class: Arachnida, Order: Scorpiones (scorpiones)										
Buthidae	*Lychas* 'SCO046'	Not SRE	*SRE11*	Open woodland (riparian)	High	Oc72	Onslow	Qa	1	This specimen belongs to the *Lychas* 'multipunctatus complex', thought to be comprised of multiple cryptic species. This specimen is 2.7% divergent from MW078434, from Mulga Downs (approx. 310 km ESE of the study area).
Class: Arachnida, Order: Pseudoscorpiones (pseudoscorpiones)										
Chthoniidae	*Tyrannochthonius* sp. indet.	Not SRE	*SRE15*	Open woodland (riparian)	High	Oc72	Onslow	Qa	2	Likely *T. aridus* which is widespread and found on Barrow Island.
Olpiidae	*Austrohorus* 'M1'	U	SRE16	Spinifex grassland	Low	Oc72	Onslow	Qa	1	This genus is taxonomically ambiguous. This species might be conspecific with other Pilbara *Austrohorus* has been called 'M1' only to distinguish it from other morphospecies recorded in the survey.
Olpiidae	*Beierolpium* '8/2'	P	SRE04, SRE12	Spinifex grassland on island	Low	Oc72, SV8	Littoral	Qe	4	This morphospecies is taxonomically ambiguous, and these specimens possibly represents several cryptic species.

Higher order/ Family	Taxon	SRE status[1]	Site/s (*Italics* = outside DE, **Bold** = in DF, Underline = island)	Habitat	PHR	Soil type[2]	Land system	Surface geology[3]	No. of speci-mens	Comments
Olpiidae	*Beierolpium* '8/3'	P	SRE16, SRE18, *SRE19*	Spinifex grassland, open woodland (riparian)	High, Low	Oc72	Onslow	Qa	5	This morphospecies is taxonomically ambiguous, and these specimens possibly represents several cryptic species.
Olpiidae	*Indolpium* sp. indet.	U	**SRE09**, SRE16, *SRE19*	Spinifex grassland, spinifex grassland on island, open woodland (riparian)	High, Low	Oc72	Onslow Littoral	Qe, Qa	3	These specimens could not be placed in to a morphospecies due to being damaged or juveniles.
Olpiidae	*Indolpium* 'sp. M3'	U	SRE04, SRE07, SRE13, SRE15, **SRE17**, *SRE19*, *SRE20*	Spinifex grassland on island, open woodland (riparian)	High, Low	Oc72, SV8	Onslow Littoral	Qe, Qrc	12	This genus is taxonomically ambiguous. This species might be conspecific with other Pilbara *Indolpium* and was called 'M3' only to distinguish it from other morphospecies recorded in the survey.
Olpiidae	*Indolpium* 'sp. M4'	U	SRE07, SRE16, *SRE19*	Open woodland (riparian), Spinifex grassland on island	High	Oc72	Onslow	Qa, Qrc	3	This genus is taxonomically ambiguous. This species might be conspecific with other Pilbara *Indolpium* and was called 'M4' only to distinguish it from other morphospecies recorded in the survey.
Class: Diplopoda (millipedes)										
Cryptopidae	*Cryptops* 'DNA05'	P	**SRE17**, SRE18	Spinifex grassland; open woodland (riparian)	High, Low	Oc72	Onslow	Qa	2	These specimens are 3.3% divergent from one another, and 7.4% divergent from *Cryptops* 'DNA05' (PES: 7366), which was collected 160 km SE of the study area. Given few records, it is still considered a Potential SRE.
Cryptopidae	*Cryptops* 'DNA06'	P	*SRE20*	Open woodland (riparian)	High	Oc72	Onslow	Qa	3	This specimen has 4% intraspecific divergence with *Cryptops* 'DNA06' (PES:14671), a specimen collected 60 km SSE of the study area.

Higher order/ Family	Taxon	SRE status[1]	Site/s (*Italics* = outside DE, **Bold** = in DF, Underline = island)	Habitat	PHR	Soil type[2]	Land system	Surface geology[3]	No. of speci-mens	Comments
Class: Crustacea, Order: Isopoda (slaters)										
Armadillidae	*Acanthodillo* sp. indet.	U	SRE06, SRE08, SRE10, SRE14, *SRE19*	Spinifex grassland on island; open woodland (riparian)	High, Low	Oc72, SV8	Onslow Littoral	Qe, Qa, Qrc	16	These specimens are all the same species of *Acanthodillo* but due to poor taxonomic knowledge it is uncertain whether they are also represented elsewhere in the Pilbara.
Armadillidae	*Buddelundia* '14re'	Not SRE	*SRE02*, *SRE03*, *SRE11*, SRE15, SRE17, *SRE20*	Shrubland over spinifex grassland; open woodland (riparian)	High, Low	Oc72	Onslow	Qa	23	This is a widespread species known from throughout the Pilbara. This morphospecies has also been collected directly adjacent to the east and west of the study area.
Armadillidae	*Buddelundia* '32'	P	**SRE01**, *SRE03*, SRE04, SRE05, SRE06, SRE07, SRE08, **SRE09**, *SRE11*, SRE12, SRE13, SRE14, SRE16, **SRE17**, SRE18, *SRE19*, *SRE20*	Spinifex grassland; spinifex grassland on island, shrubland over spinifex grassland; open woodland (riparian)	High, Low	Oc72, SV8	Onslow Littoral	Qe, Qa, Qrc	236	This species is a common SRE also known from sites directly adjacent to the study area and from Barrow Island.
Armadillidae	*Buddelundia* '35'	P	*SRE02*, *SRE03*, SRE15, **SRE17**	Shrubland over spinifex grassland; open woodland (riparian)	High, Low	Oc72	Onslow	Qa	61	This morphospecies was also collected from sites near the study area, within the Mardie Expansion Area.
Armadillidae	*Buddelundia* '60'	P	SRE07, **SRE09**	Spinifex grassland on island	Low	Oc72	Onslow Littoral	Qe, Qrc	23	This morphospecies looks similar to specimens collected from Barrow Island (*Buddelundia* 'sp. 2') and Varanus Island.

Higher order/ Family	Taxon	SRE status[1]	Site/s (*Italics* = outside DE, **Bold** = in DF, Underline = island)	Habitat	PHR	Soil type[2]	Land system	Surface geology[3]	No. of speci-mens	Comments
Armadillidae	*Buddelundia* 'sp. 34ms'	P	*SRE02*, *SRE03*, *SRE11*, *SRE15*, **SRE17**, *SRE20*	Shrubland over spinifex grassland; open woodland (riparian)	High, Low	Oc72	Onslow	Qa	26	This morphospecies looks similar to specimens collected from a site approximately 20 km east of the study area (*B*. 'sp 34'), however the taxonomist is unsure if they are conspecific or not. **This species is considered potentially new.**
Armadillidae	*Buddelundia* sp. indet.	U	**SRE17**	Open woodland (riparian)	High	Oc72	Onslow	Qa	3	Damaged or juvenile specimens, likely to be conspecific with one of the morphospecies listed above.
Armadillidae	*Spherillo* sp. indet. A (mardie)	P	SRE04, SRE06, **SRE09**, SRE10, SRE14	Spinifex grassland on island	Low	Oc72, SV8	Onslow Littoral	Qe, Qa, Qrc	14	This morphospecies was also collected from sites near the study area, within the Mardie Expansion Area. **This species is considered new.**
Armadillidae	*Spherillo* sp. indet. B (mardie)	P	SRE07	Spinifex grassland on island	Low	Oc72	Onslow	Qrc	1	This species is known only from the study area. **This species is considered new.**
Oniscidae	*Alloniscus* sp. indet.	Not SRE	SRE07	Spinifex grassland on island	Low	Oc72,	Onslow	Qrc	1	Likely to be *Alloniscus pallidus*, a widespread littoral species that occurs along Australasian shorelines.
Paraplaty-arthidae	*Paraplatyarthrus* sp. indet. B	P	SRE18	Spinifex grassland	Low	Oc72	Onslow	Qa	1	A rarely collected genus in the Pilbara with poor taxonomic knowledge and lack of material. **This species is considered new.**
Philosciidae	*Laevophiloscia* sp. indet.	U	SRE03	Shrubland over spinifex grassland	Low	Oc72	Onslow	Qa	5	This genus is poorly known taxonomically. These specimens might be conspecific with other Pilbara *Laevophiloscia* or may represent new species.

[1] P = Potential, U = Uncertain.
[2] QA = Alluvial sediments, Qrc = Colluvial sediments, Qe = estuarine sediments; Refer to section 3.2 for detailed definitions.
[3] Refer to section 3.2 for definitions.
[4] Oc72 = Level to gently undulating plains: dominant are loamy red duplex soils in some areas with very gravelly-surfaced horizons; SV8 = Salt flats.



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	15/10/2021
Drawn by	IN
Map author	AJ

0 1 2
Kilometers

1:90,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_5-2_SRE_taxa_results_a.mxd

- Study area
- Disturbance footprint
- Development envelope

High Potential

- Shrubland over spinifex grassland on island
- Spinifex grassland on island
- Tussock grassland on island
- Fresh water pool
- Open woodland (riparian)

Low Potential

- Beach and dune
- Low shrubland

- Low shrubland on island
- Mangal community
- Mudflat or saltflat
- Shrubland over spinifex grassland
- Shrubland over tussock grassland
- Spinifex grassland
- Spinifex grassland on rocky hills
- Tidal samphire mudflat
- Tussock grassland

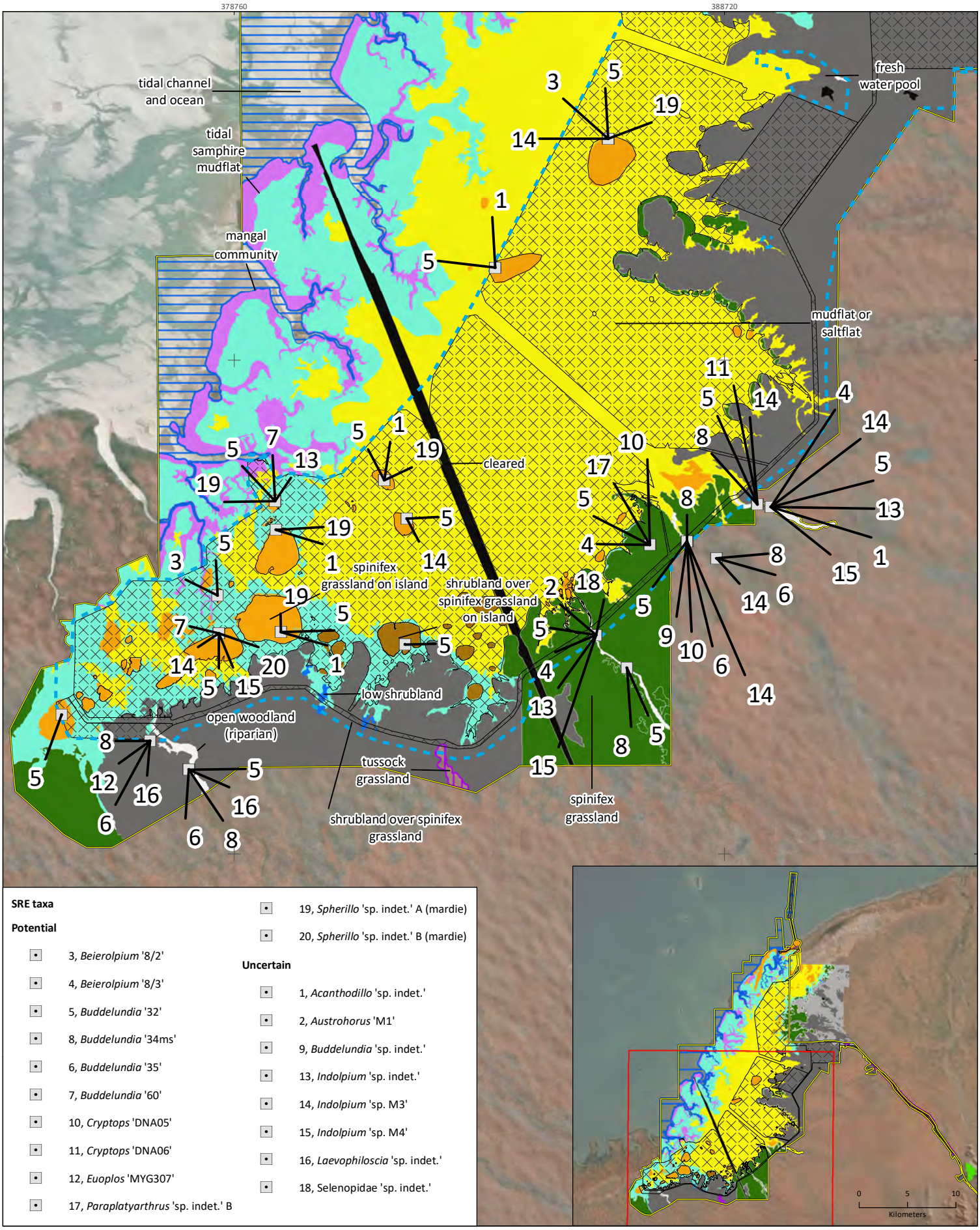
None

- Tidal channel and ocean
- Cleared

Figure 5-2a

SRE taxa recorded in the field survey

PHOENIX ENVIRONMENTAL SCIENCES



SRE taxa

Potential

- 3, *Beierolpium* '8/2'
- 4, *Beierolpium* '8/3'
- 5, *Buddelundia* '32'
- 8, *Buddelundia* '34ms'
- 6, *Buddelundia* '35'
- 7, *Buddelundia* '60'
- 10, *Cryptops* 'DNA05'
- 11, *Cryptops* 'DNA06'
- 12, *Euoplos* 'MYG307'
- 17, *Paraplatyarthrus* 'sp. indet.' B
- 19, *Spherillo* 'sp. indet.' A (mardie)
- 20, *Spherillo* 'sp. indet.' B (mardie)

Uncertain

- 1, *Acanthodillo* 'sp. indet.'
- 2, *Austrohorus* 'M1'
- 9, *Buddelundia* 'sp. indet.'
- 13, *Indolpium* 'sp. indet.'
- 14, *Indolpium* 'sp. M3'
- 15, *Indolpium* 'sp. M4'
- 16, *Laevophiloscia* 'sp. indet.'
- 18, Selenopidae 'sp. indet.'

BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	20/10/2021
Drawn by	IN
Map author	AJ

0 1 2
Kilometers

1:100,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_5-2_SRE_taxa_results_b.mxd

- Study area
- Disturbance footprint
- Development envelope

High Potential

- Shrubland over spinifex grassland on island
- Spinifex grassland on island
- Fresh water pool
- Open woodland (riparian)

Low Potential

- Low shrubland
- Mangal community
- Mudflat or saltflat
- Shrubland over spinifex grassland
- Spinifex grassland
- Tidal samphire mudflat
- Tussock grassland

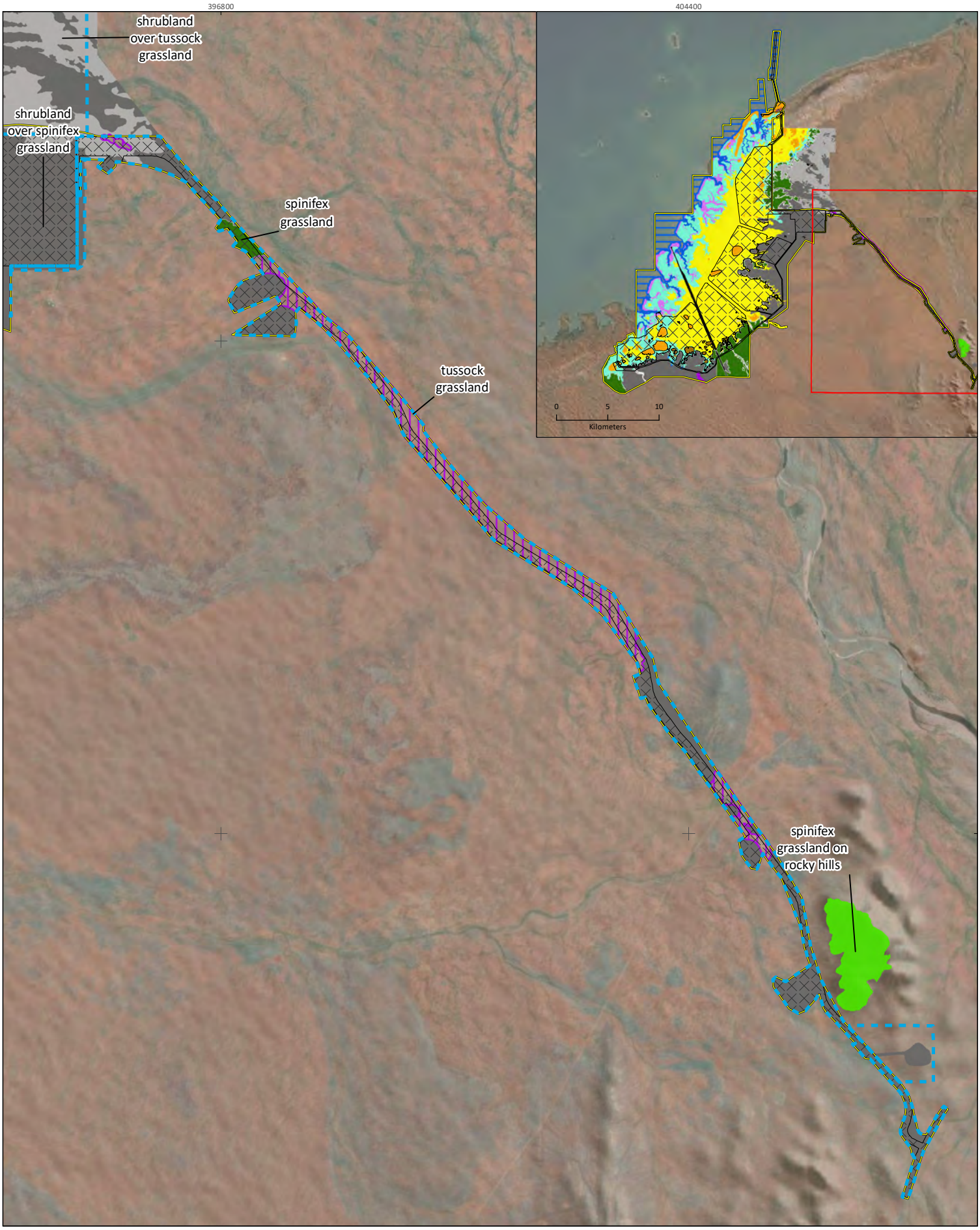
None

- Tidal channel and ocean
- Cleared

Figure 5-2b

SRE taxa recorded in the field survey

PHOENIX ENVIRONMENTAL SCIENCES



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	15/10/2021
Drawn by	IN
Map author	AJ

0 1 2
Kilometers

1:80,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_5-2_SRE_taxa_results_c.mxd

Study area
Disturbance footprint
Development envelope

Low Potential
Shrubland over spinifex grassland
Shrubland over tussock grassland
Spinifex grassland
Spinifex grassland on rocky hills
Tussock grassland

Figure 5-2c

SRE taxa recorded in the field survey

PHOENIX ENVIRONMENTAL SCIENCES

5.2.3. SREs and SRE habitats

Five habitats were sampled in the survey, of which two represent island habitats (Table 5-4). The remaining widespread habitat types within the study area were not surveyed due to sparseness of vegetation or potential inundation (mudflat or salt flat, tidal samphire mudflat). Other habitats not surveyed were either not accessible or were poorly represented within the study area.

The island habitat which is the most common (spinifex grassland on island) occupied 3.57% of the study area and had the most survey sites, n=10). Species diversity was highest at the open woodland (riparian) habitat which recorded the highest total number of species (14). SRE species diversity was fairly even across all SRE habitat types, with the exception of the shrubland over spinifex grassland on island habitat, however this was a minor habitat type with only one survey site.

Table 5-4 SRE taxa by habitat type

Habitat type	No. of survey sites	No. of SRE species	No. of Uncertain SRE species	No. of Non-SRE species	Total no. of species
Open woodland (riparian)	5	6	5	3	14
Shrubland over spinifex grassland	2	4	1	1	6
Shrubland over spinifex grassland on island	1	1	0	0	1
Spinifex grassland	2	4	4	0	8
Spinifex grassland on island	10	5	4	1	10

5.2.4. Survey completeness/effectiveness

Species accumulation curves completed for the two SRE groups where enough specimens were recorded to analyse survey effectiveness (isopods and pseudoscorpions) indicate that survey effort was sufficient. Both species accumulation curves reach asymptote (Figure 5-3; Figure 5-4).

SRE groups which did not record enough specimens to generate a species accumulation curve are the mygalomorph spiders (one species), scorpions (one species) and centipedes (two species). These groups were typically in low abundance in the study area and may have been limited by factors such as habitat types.

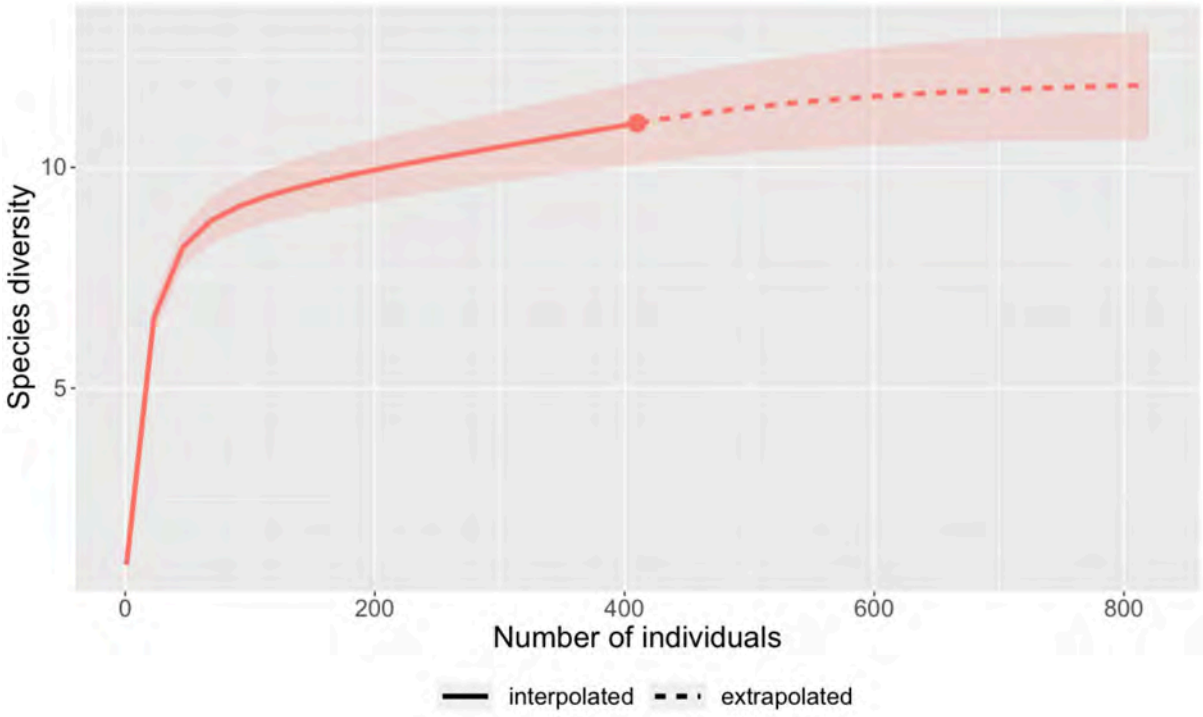


Figure 5-3 **R/E curve, 1,000 bootstrap replicates of all isopod samples collected in the study area (n=73)**

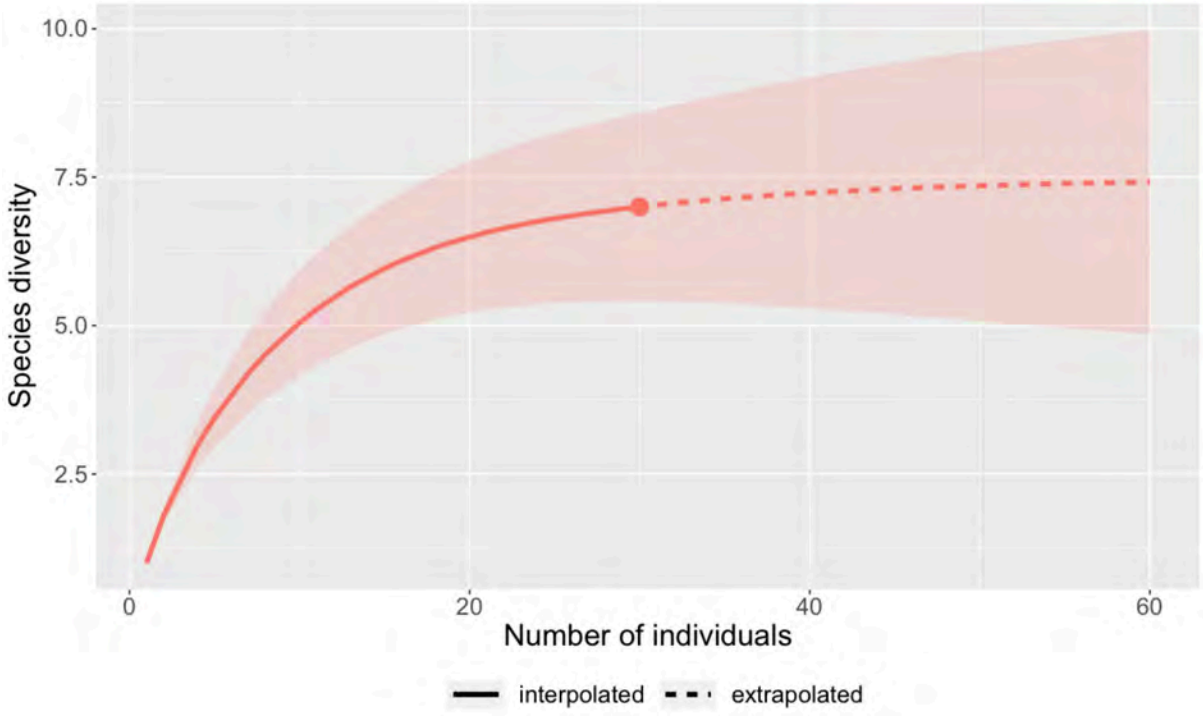


Figure 5-4 **R/E curve, 1,000 bootstrap replicates of all pseudoscorpion samples collected within the study area (n=22)**

5.3. SURVEY LIMITATIONS

Potential limitations of the SRE survey are identified in Table 5-5, adapted from EPA (2020).

Table 5-5 Consideration of potential survey limitations

Limitations	Limitation?	Comments
Availability of data and information	No	Contextual information at a regional and local scale was available through WA Museum databases, previous or concurrent surveys for the Project, and Phoenix's own database which contains an extensive dataset for the region.
Competency/experience of the survey team	No	All personnel carrying out the field survey were suitably qualified and experienced.
Scope - were any faunal groups excluded from the survey?	No	No SRE target groups were excluded from the survey. Wet pitfall traps ensure all SRE groups are included.
Timing, rainfall, season	Yes	The field survey was undertaken in June. The optimal survey period for the Pilbara is November to April due to the heightened activity of key SRE groups during these months. This may have accounted for the absence or under-representation of mygalomorph spiders. However, the six-months prior to the survey recorded significantly higher rainfall and recorded higher than average temperatures, providing more suitable out-of-season weather conditions therefore reducing the likelihood that the out-of-season survey has had a significant influence on the survey outcome. A concurrent SRE survey which was used for the "Mardie Expansion" in May was also out of season; however, also experienced desirable out-of-season rainfall conditions.
Disturbance that may have affected the results of the survey	No	No disturbances were encountered that may have affected the results of the survey.
Proportion of fauna collected and identified	No	Two SRE groups are missing (land snails and millipedes) and one SRE group was potentially under-represented (mygalomorph spiders) from the suite of results. Contextual data indicates that these two groups should occur; however, species accumulation curves for the two SRE groups for which the field survey had sufficient records (isopods and pseudoscorpions), indicate these two groups were sampled effectively and could be extrapolated out to the other groups which are perhaps in very low abundance and/or species diversity in the habitats sampled. Taxonomy issues are ever-present with SRE surveys. Where morphology could not be used to identify specimens, this issue was resolved with the use of molecular assessments. Specimens from SRE groups considered to have comparable genetic material publicly available were sequenced and analysed against GenBank and Phoenix's molecular database.
Access within the study area	No	Targeted habitats were able to be accessed via vehicle or helicopter.
Problems with data and analysis, including sampling biases	No	Half of the sites sampled were island sites, and all sites employed the same survey methodology.

6. DISCUSSION

A total of 11 SRE species from the field survey and/or desktop review are known from the study area (Figure 6-1; Table 6-3). These comprise of seven isopods, two pseudoscorpions, one centipede and one trapdoor spider. All 11 species are considered Potential SREs.

Three of the Potential SREs are currently known from only within the DE, all isopods (Table 6-1). All of these are known from only one habitat type. No SREs are restricted to the DF.

Table 6-1 SREs known only from the DE

Family	Species	Comments
Armadillidae	*Buddelundia* '60'	recorded from the field survey, this morphospecies was recorded from two sites within the DE, one inside and one outside the DF. It was recorded in the spinifex grassland on island habitat only. The islands are approximately 3 km apart. A series of islands connects these two islands which are separated by between <100 m and 380 m. The shortest distance between one of the islands and the "mainland" is 200 m.
Armadillidae	*Spherillo* sp. indet. B (mardie)	recorded from the field survey, this morphospecies was recorded from only one site within the DE. It was recorded in spinifex grassland on island habitat.
Paraplyarthridae	*Paraplatyarthrus* sp. indet. B	recorded from the field survey(Phoenix in prep.-b). This morphospecies was collected from only one site within the DE in spinifex grassland habitat, which is widespread throughout the study area. The located of this record is approximately 500 m from the study area boundary which is continuous and poses no physical barriers to distribution. This genus is seldom collected in the Pilbara, and when it is, it is always in very low numbers. A lack of material makes this group difficult to identify.

6.1. ISLAND SREs

A total of nine distinct taxa were recorded from island habitats (Table 6-2). These include five Potential SREs, three Uncertain SREs, and one widespread non-SRE taxa. They comprise of only two SRE groups, isopods (6) and pseudoscorpions (3). Of these, one isopod is known only from an island habitat, *Spherillo* sp. B (mardie), and one isopod is potentially only known from an island habitat (habitat mapping pending; Phoenix 2021) *Spherillo* sp. A (mardie) (Table 6-2). These morphospecies are from a group of isopods that are very small and difficult to work with (pers. comm. Dr. Simon Judd, Isopod taxonomist).

- *Spherillo* sp. B (mardie) is a singleton record from the survey recorded from spinifex grassland on island in the south of the study area. Several other taxa were collected from this site including two Potential SREs (*Buddelundia*. '60' and *B*. '32'), two Uncertain SREs (*Indolpium* 'sp. M3' and *I*. 'sp. M4') and one widespread non-SRE taxa (*Alloniscus* 'sp. indet.'). These five taxa are also recorded elsewhere including non-island habitats within the study area (Table 6-2). As this genus is uncommonly collected and is known to be generally difficult to collect, it is likely that this singleton record is an outcome of the elusiveness of this species rather than it being restricted to an island.
- *Spherillo* sp. A (mardie) was recorded from five islands spanning 12 km within the study area. An additional record from the Expansion area, immediately NE. adjacent to the study area increases this species' distribution to 35 km along the coastline. The island in the Expansion area is adjacent to ocean on the western side and tidal samphire mudflat on the eastern side. Also on this island are two ubiquitous non-SRE species (*Alloniscus* sp. indet., *Buddelundia*

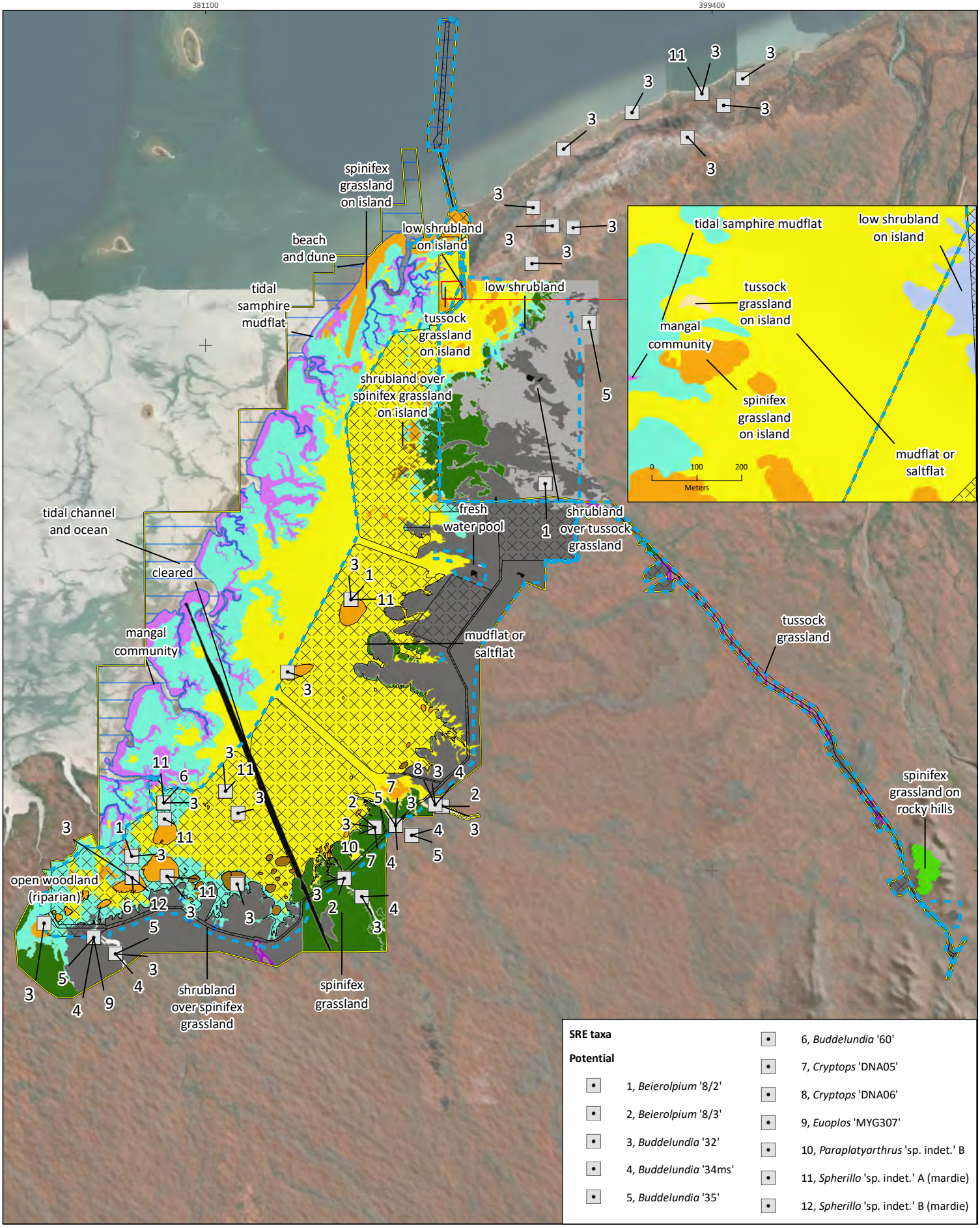
'14re'), one Potential SRE also commonly collected in the study area (*Buddelundia* '32'), and one Confirmed SRE (*Garypus latens*), a shoreline specialist known from Barrow Island and the Pilbara mainland coastline. The six sites from which *Spherillo* sp. A (mardie) was recorded represent two different soil types, two different land systems and three different surface geologies (Table 5-3).

Given all five records of *Spherillo* sp. A (mardie) from the study area are from islands, and the record from the Expansion area is likely from an island too, it seems plausible that *Spherillo* sp. A (mardie) and the similar *Spherillo* sp. B (mardie) both have preferences for island habitats, however the islands are not a barrier to dispersal. There is little doubt that these species are able to disperse to other islands within the mudflats/saltflats or nearby suitable habitats (i.e. spinifex grasslands which are not islands within mudflats or saltflats).

Table 6-2 Taxa recorded from islands

Species[1]	SRE rating	Number of locations from Island habitats		Number of locations from Non-island habitats				Other records or habitats
		Spinifex grassland	Shrubland over spinifex grassland	Spinifex grassland	Shrubland over spinifex grassland	Open woodland (riparian)	Shrubland over tussock grassland	
Beierolpium '8/2'	P	2					1	One record from an unmapped area of the Optimisation Area. Records from other locations nearby, including Varanus Island
Indolpium 'sp. M3'	U	3				4		A poorly known genus, this morphospecies may be synonymous with other records from this genus
Indolpium 'sp. M4'	U	1		1	2			A poorly known genus, this morphospecies may be synonymous with other records from this genus
Acanthodillo sp. indet.	U	4				1		A poorly known genus, this morphospecies may be synonymous with other records from this genus
Buddelundia '32'	P		1	2	1	4		Several records from unmapped areas of the Expansion Area and other areas to the E. and S. incl. hummock grasslands
Buddelundia '60'	P	2						Recorded from Barrow Island and Varanus Island, 50-70 km W. of the study area
Spherillo sp. indet. A (mardie)	P	5						One record from an unmapped area (likely island), of the Mardie Expansion Area
Spherillo sp. indet. B (mardie)	P	1						**No other known records**
Alloniscus sp. indet.	Not SRE	1				n/a		A widespread taxon

[1]Shaded taxa are known only from islands; P = Potentials SRE, U = Uncertain SRE



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	15/10/2021
Drawn by	IN
Map author	AJ

0 2.5 5
Kilometers

1:178,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_6_1_Distribution_records_for_SRE.mxd

Study area
Disturbance footprint
Development envelope

High Potential
Shrubland over spinifex grassland on island
Spinifex grassland on island
Tussock grassland on island
Fresh water pool
Open woodland (riparian)

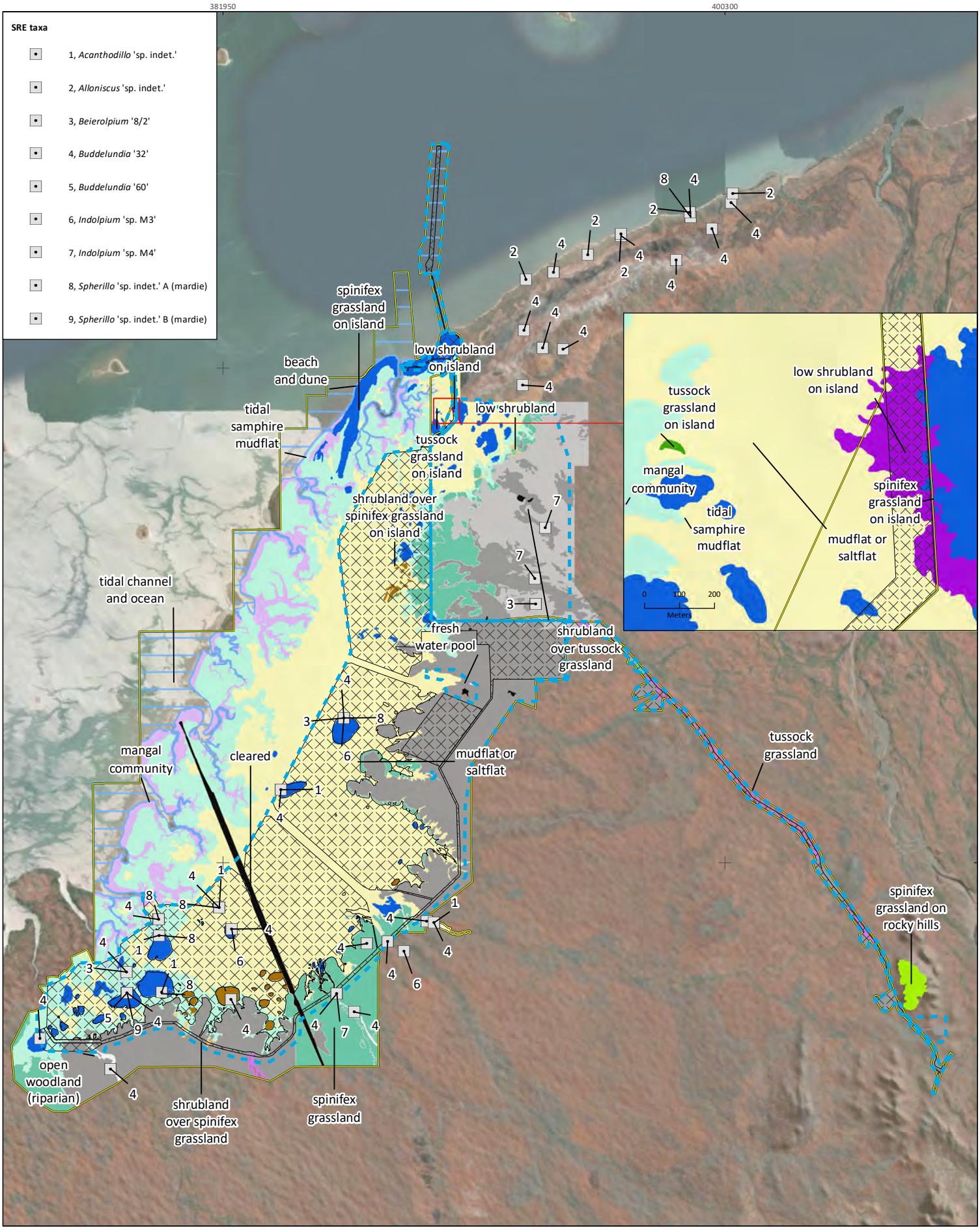
Low Potential
Beach and dune
Low shrubland on island
Mangal community
Mudflat or saltflat
Shrubland over spinifex grassland
Shrubland over tussock grassland
Spinifex grassland
Spinifex grassland on rocky hills
Tidal samphire mudflat
Tussock grassland

None
Tidal channel and ocean
Cleared

Figure 6-1

Distribution records for SRE taxa from the field survey

PHOENIX ENVIRONMENTAL SCIENCES



BCI Minerals Ltd
Mardie Salt Project

Project No	1424-MSP-BCI-TIN
Date	15/10/2021
Drawn by	IN
Map author	AJ

0 2.5 5
Kilometers

1:180,000 (at A4) GDA 1994 MGA Zone 50

P:\GIS\Projects\MardieSaltProject\1424-MSP-BCI-TIN\Mapping\MapDocuments\Figures\Figure_6-2_Distribution_records_for_taxa_recorded_from_island_habitats.mxd

Study area
Disturbance footprint
Development envelope

Fauna habitat

Shrubland over spinifex grassland on island
Spinifex grassland on island
Tussock grassland on island
Low shrubland on island
Beach and dune
Shrubland over spinifex grassland
Low shrubland
Spinifex grassland on rocky hills
Tidal samphire mudflat
Mangal community
Shrubland over tussock grassland
Spinifex grassland
Mudflat or saltflat
Tussock grassland
Tidal channel and ocean
Fresh water pool
Open woodland (riparian)
Cleared

Figure 6-2

Distribution records for SRE taxa recorded from island habitats

PHOENIX ENVIRONMENTAL SCIENCES

Table 6-3 SREs recorded in the study area

Family	Species	SRE status[1]	SRE habitat	PHR	In DF	Outside DF	Outside DE	Distribution comments
Class: Arachnida, Infraorder: Mygalomorphae (Trapdoor spiders)								
Idiopidae	*Euoplos* 'MYG307'	P	Shrubland over spinifex grassland	Low	No	Yes	Yes	Recorded form the field survey 25 m outside DE and has also been recorded 60 km SE of the study area.
Class: Arachnida, Order: Pseudoscorpiones (Pseudoscorpions)								
Olpiidae	*Beierolpium* '8/2'	P	Spinifex grassland on island	High	No	Yes	Yes	Known from inside and outside the DE.
Olpiidae	*Beierolpium* '8/3'	P	Spinifex grassland, open woodland (riparian)	High, Low	No	Yes	Yes	Known from inside and outside the DE.
Class: Chilopoda (Centipedes)								
Cryptopidae	*Cryptops* 'DNA05'	P	Shrubland over spinifex grassland; open woodland (riparian)	High, Low	Yes	Yes	Yes	Recorded from two locations in the DE and is considered conspecific with a specimen collected 160 km SE of the study area.
Class: Malacostraca, Order: Isopoda (Slaters)								
Armadillidae	*Buddelundia* '32'	P	Spinifex grassland, shrubland over spinifex grassland; open woodland (riparian)	High, Low	Yes	Yes	Yes	Common SRE recorded inside the DF and outside the DE.
Armadillidae	*Buddelundia* '35'	P	Shrubland over spinifex grassland; open woodland (riparian)	High, Low	Yes	Yes	Yes	Known from inside the DF and outside the DE.
Armadillidae	*Buddelundia* '60'	P	Spinifex grassland	Low	Yes	Yes	No	This morphospecies is similar to a taxon from Barrow Island and Varanus Island. Recorded from two sites within the DE, one inside the DF and one outside the DF.

Family	Species	SRE status[1]	SRE habitat	PHR	In DF	Outside DF	Outside DE	Distribution comments
Armadillidae	*Buddelundia* 'sp. 34ms'	P	Shrubland over spinifex grassland; open woodland (riparian)	High, Low	Yes	Yes	Yes	Looks similar to specimens collected from a site approximately 20 km east of the study area (*B*. 'sp 34'); however, the taxonomist is unsure if they are conspecific. Recorded both inside the DF and DE and at several sites outside the DE.
Armadillidae	*Spherillo* sp. indet. A (mardie)	P	Spinifex grassland	Low	Yes	Yes	Yes	Five of six records of this morphospecies are located within the DE, with one of these in the DF. One record is located out of the DE in the Mardie Expansion Area. All records appear to be associated with estuarine environments.
Paraplatyarthidae	*Spherillo* sp. indet. B (mardie)	P	Spinifex grassland	Low	No	Yes	No	The single known record of this species is in the DE but not the DF.
Armadillidae	*Paraplatyarthrus* sp. indet. B	P	Shrubland over spinifex grassland	Low	No	Yes	No	The single known record of this species is in the DE but not the DF.

1 – P = potential.

7. CONCLUSION

Of the 11 SRE species, three are known only from the DE, but none are restricted to the DF. Several taxa were recorded from habitat islands surrounded by mudflats or saltflat habitats. All but two of these were also recorded from non-island habitats. The two species (both isopods from the genus *Spherillo*) that were recorded only from island habitats are considered new species. One was a singleton record, and the other was recorded from several islands within and outside the study area indicating these species have a preference for shoreline habitats. Given all but one of the species recorded from an island were recorded across several islands and/or onto non-island habitats, it is unlikely the saltflat/mudflat habitats are a barrier for SRE dispersal in this area.

REFERENCES

BoM. 2021. *Climate statistics for Australian locations*. Commonwealth of Australia, Bureau of Meterology. Available at: http://www.bom.gov.au/climate/data/

Car, C. A. & Harvey, M. S. 2014. The millipede genus *Antichiropus* (Diplopoda: Polydesmida: Paradoxosomatidae), part 2: species of the Great Western Woodlands region of Western Australia. *Records of the Western Australian Museum* **29**: 20–77.

Chao, A., Gotelli, N.J., Hsieh, T.C., Sander, E.L., Ma, K.H., Colwell, R.K. & Ellison, A.M. . 2014. Rarefaction and extrapolation with Hill numbers: a framework for sampling and estimation in species diversity studies. *Ecological Monographs* **84**: 45-67.

DoEE. 2016. *Maps: Australia's bioregions (IBRA)*. Department of the Environment and Energy, Canberra, ACT. Available at: http://www.environment.gov.au/topics/land/national-reserve-system/science-maps-and-data/australias-bioregions-ibra

DoEE. 2018. *Species Profile and Threats Database*. Department of the Environment and Energy, Australian Government, Canberra, ACT. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

EPA. 2016a. *Environmental Factor Guideline: Terrestrial fauna*. Environmental Protection Authority, Perth, WA. Available at: http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Guideline-Terrestrial-Fauna-131216_3.pdf

EPA. 2016b. *Technical Guidance: Sampling of short range endemic invertebrate fauna*. Environmental Protection Authority, Perth, WA. Available at: http://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Tech%20guidance-%20Sampling-SREs-Dec-2016.pdf

EPA. 2020. *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment*. Environmental Protection Authority, Perth, WA. Available at: https://epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA-Technical-Guidance-Vertebrate-Fauna-Surveys.pdf

EPA. 2021. *Mardie Project. Mardie Minerals Pty Ltd. Report 1704.* Environmental Protection Authority, Joondalup, WA.

Folmer, O., Black, M., Hoeh, W., Lutz, R. & Vrijenhoek, R. C. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* **3**: 294–299.

Government of Western Australia. 2018a. *Wildlife Conservation Act 1950 Wildlife Conservation (Rare Flora) Notice 2018*. Government Gazette, WA. Government of Western Australia, Perth, WA.

Government of Western Australia. 2018b. *Wildlife Conservation Act 1950, Wildlife Conservation (Specially Protected Fauna) Notice 2018*. Government Gazette, WA, Perth, WA.

Harvey, M. S. 2002. Short-range endemism among the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* **16**: 555–570.

Hebert, P. D. N., A., C., Ball, S. L. & de Waard, J. R. 2003a. Biological identifications through DNA barcodes. *Proceedings of the Royal Society London B* **270**: 313–321.

Hebert, P. D. N., Ratnasingham, S. & de Waard, J. R. 2003b. Barcoding animal life: Cytochrome c oxidase subunit 1 divergences among closely related species. *Proceedings of the Royal Society London B, Supplement* **270**: 96–99.

Hsieh, T. C., Ma, K. H. & Chao, A. 2016. iNEXT: An R package for interpolation and extrapolation of species diversity (Hill numbers). *Methods in Ecology and Evolution* **7**: 1451-1456.

Kendrick, P. & McKenzie, N. 2001. Pilbara 1 (PIL1—Chichester subregion). *In:* May, J. E. & McKenzie, N. L. (eds) *A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002.* Department of Conservation and Land Management, Perth, WA, pp. 547–558.

Kendrick, P. & Stanley, F. 2001. Pilbara 4 (PIL4—Roebourne synopsis). *In:* May, J. E. & McKenzie, N. L. (eds) *A biodiversity audit of Western Australia's 53 biogeographical subregions in 2002.* Department of Conservation and Land Management, Perth, WA, pp. 581–594.

Payne, A. L. & Leighton, K. A. 2004. Land systems. *In:* van Vreeswyk, A. M. E., Payne, A. L., Leighton, K. A. & Hennig, P. (eds) *Technical Bulletin 9. An inventory and condition survey of the Pilbara region, Western Australia*. Department of Agriculture, Government of Western Australia, South Perth, WA, pp. 175–384.

Phoenix. 2009a. *Cape Preston short-range endemic invertebrate fauna survey*. Phoenix Environmental Sciences Pty Ltd, Balcatta, WA. Unpublished report prepared for Maunsell AECOM Pty Ltd.

Phoenix. 2009b. *Vertebrate Fauna Survey of the Mineralogy Cape Preston Iron Ore Project and Impact Assessment of the Mineralogy Expansion Proposal*. Phoenix Environmental Sciences Pty Ltd, Northbridge, WA. Unpublished report prepared for Mineralogy.

Phoenix. 2017. *Environmental desktop review and reconnaissance site visit for the Mardie Salt Project*. Phoenix Environmental Sciences Pty Ltd, Balcatta, WA. Unpublished report prepared for BC Iron Ltd.

Phoenix. 2020a. *Detailed flora and vegetation survey for the Mardie project*. Phoenix Environmental Sciences, Balcatta, WA. Unpublished report prepared for BCI Minerals Ltd.

Phoenix. 2020b. *Level 2 targeted terrestrial fauna survey for the Mardie Project*. Phoenix Environmental Sciences, Osborne Park, WA. Unpublished report prepared for BCI Minerals Ltd.

Phoenix. 2021. *Detailed flora and vegetation survey of the Mardie Salt project expansion area*. Phoenix Environmental Sciences Pty Ltd, Osborne Park, WA. in preparation, unpublished report for BCI Minnerals Ltd.

Phoenix. in prep.-a. *Basic (Level 1) terrestrial fauna survey for the Mardie Salt Project Optimisation Area and Quarry Area*. Phoenix Environmental Sciences Pty Ltd, Osborne Park, WA. Unpublished report prepared for BCI Minerals Ltd.

Phoenix. in prep.-b. *Basic Fauna and SRE Survey for the Mardie Salt Project Expansion Area*. Phoenix Environmental Sciences Pty Ltd, Osborne Park, WA. Unpublished report prepared for BCI Minerals Ltd.

Rix, M. G., Huey, J. A., Cooper, S. J. B., Austin, A. D. & 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* **756**: 1–121 http://dx.doi.org/10.3897/zookeys.756.24397.

Schoknecht, N. R. & Payne, A. L. 2011. *Land systems of the Kimberley region, Western Australia*. Department of Agriculture and Food, Western Australia, Perth.

Slack-Smith, S. & Whisson, C. 2009. *The land snail component of a faunal survey in the Cape Preston area, Western Australia, collected by Phoenix Environmental Science [sic] during August, 2008.* Western Australian Museum, Welshpool, WA. Unpublished report prepared for Phoenix Environmental Sciences Pty Ltd.

Vink, C. J., Thomas, S. M., Paquin, P., Hayashi, C. Y. & Hedin, M. 2005. The effects of preservatives and temperatures on arachnid DNA. *Invertebrate Systematics* **19**: 99–104.

WAM. 2009. *The short-range endemic invertebrate fauna from Cape Preston, Western Australia*. Western Australian Museum, Welshpool, WA. Unpublished report prepared for Phoenix Environmental Sciences Pty Ltd.

WAM. 2013. *WAM short-range endemic categories and sub-categories*. Western Australian Museum, Welshpool.

WAM. 2021. *WA Museum Arachnology/Myriapodology, Crustacea and Mollusca database*, Welshpool, WA.

Appendix 1 Survey site descriptions

Appendix 2 Short-range endemic invertebrate desktop results

Family	Species	SRE status	Source			
			WAMDB	Phoenix DB	Mardie Optimisation	Mardie Expansion
Class: Arachnida, Infraorder: Araneomorphae (modern spiders)						
Selenopidae	*Karaops* '1004DNA01'	Potential	●			
	Karaops burbidgei	Potential	●			
	Karaops 'DNA01'	Potential	●	●		
	Karaops 'Phoenix070'	Potential				●
	Karaops 'sp. indet.'	Uncertain	●	●		
	Karaops 'sp. Middle Robe 1'	Potential	●			
	Karaops 'sp. Middle Robe 2'	Potential	●			
Class: Arachnida, Infraorder: Mygalomorphae (trapdoor spiders)						
Actinopodidae	*Missulena* 'MYG040'	Potential	●			
	Missulena 'sp. indet.'	Uncertain	●			
Barychelidae	*Aurecocrypta* 'Barrow sp. 1'	Potential	●			
	Aurecocrypta 'MYG057'	Potential		●		
	Aurecocrypta 'MYG319-DNA'	Potential	●			
	Idiommata 'sp. indet.'	Uncertain	●			
	Synothele butleri	Potential	●			
	Synothele 'DNA05'	Potential	●	●		
	Synothele karara	Not SRE	●	●		
	Synothele 'MYG313'	Potential	●	●		
	Synothele 'preston'	Potential	●			
	Synothele 'sp. indet.'	Uncertain	●	●		
Halonoproctidae	*Conothele* 'MYG295'	Potential	●			
	Conothele 'MYG297'	Potential	●			
	Conothele 'MYG536'	Potential	●			
	Conothele 'sp. indet.'	Uncertain	●			
Idiopidae	*Euoplos* 'MYG218'	Potential	●			
	Euoplos 'MYG307'	Potential	●			
	Idiosoma 'MYG083'	Potential		●		
	Idiosoma 'MYG302-DNA'	Potential	●			
	Idiosoma 'occidentalis sp. group'	Potential	●			
	Idiosoma 'sp. indet.'	Uncertain	●			
Nemesiidae	*Aname* 'mainae sp. group.'	Potential	●			
	Aname mellosa	Potential	●	●		
	Aname 'MYG001 group'	Potential	●			
	Aname 'MYG079'	Potential	●	●		
	Aname 'MYG102'	Potential	●			
	Aname 'MYG178'	Potential	●			

Family	Species	SRE status	Source			
			WAMDB	Phoenix DB	Mardie Optimisation	Mardie Expansion
	Aname 'MYG271-DNA'	Potential	●			
	Aname 'MYG275, Barrow sp. 5'	Potential	●			
	Aname 'MYG328'	Potential	●			
	Aname 'MYG369-DNA'	Potential	●			
	Aname 'MYG413-DNA'	Potential	●			
	Aname 'MYG579'	Potential	●			
	Aname 'MYG593'	Potential		●		
	Aname 'Phoenix0060'	Potential		●		
	Aname sinuata	Not SRE	●	●		
	Aname 'sp. indet.'	Uncertain	●	●		
	Kwonkan 'MYG090'	Potential	●			
	Kwonkan 'MYG093'	Potential	●			
	Kwonkan 'MYG274'	Potential	●			
	Kwonkan 'po2'	Potential	●			
	Kwonkan 'sp. indet.'	Uncertain	●			
	Nemesiidae 'sp. indet.'	Uncertain	●			
	Yilgarnia 'Barrow sp. 1'	Potential	●			
	Yilgarnia 'MYG374-DNA'	Potential	●			
	Yilgarnia 'MYG375-DNA'	Potential	●			
	Yilgarnia 'MYG376-DNA'	Potential	●			
	Yilgarnia 'sp. indet.'	Uncertain	●			
Class: Arachnida, Order: Opiliones (harvestmen)						
Assamiidae	*Dampetrus* 'DNA01'	Potential	●			
	Dampetrus 'DNA07'	Potential	●			
	Dampetrus 'sp. Middle Robe'	Potential	●			
Class: Arachnida, Order: Scorpiones (scorpions)						
Buthidae	Buthidae 'sp. indet.'	Uncertain	●			
	Isometroides 'middle robe'	Potential	●			
	Isometroides 'SCO051' (barrow)	Potential	●	●		
	Isometroides 'sp. indet.'	Uncertain	●			
	Lychas annulatus	Potential	●			
	Lychas 'barrow'	Potential	●	●		
	Lychas 'bituberculatus complex'	Potential	●	●		
	Lychas 'hairy tail complex'	Potential	●	●		
	Lychas 'multipunctatus complex'	Potential	●			
	Lychas 'nubby'	Potential	●			
	Lychas 'SCO039' (glauerti)	Potential	●	●		
	Lychas 'sp. indet.'	Uncertain	●	●		
	Lychas 'spiny hairy tail group'	Potential	●			

Family	Species	SRE status	Source			
			WAMDB	Phoenix DB	Mardie Optimisation	Mardie Expansion
	Lychas 'warramboo 1'	Potential	●			
Urodacidae	*Aops* 'ops'	Confirmed	●			
	Urodacus butleri	Potential	●			
	Urodacus 'erramurra'	Potential		●		
	Urodacus 'glauerti'	Potential	●			
	Urodacus 'pilbara 1'	Not SRE		●		
	Urodacus 'pilbara 5'	Not SRE		●		
	Urodacus 'saipem1'	Potential	●			
	Urodacus 'sp. 7'	Potential	●			
	Urodacus 'sp. indet.'	Uncertain	●	●		
	Urodacus 'waramboo'	Potential	●			
Class: Arachnida, Order: Pseudoscorpiones (Pseudoscorpions)						
Atemnidae	*Oratemnus* 'sp. Bungaroo'	Potential	●			
	Oratemnus 'sp. indet.'	Uncertain	●			
	Oratemnus 'sp. Middle Robe'	Potential	●			
Cheiridiidae	*Apocheiridium* 'Barrow1'	Potential	●			
	Apocheiridium 'sp. indet.'	Uncertain		●		
Chthoniidae	*Austrochthonius* 'sp. Bungaroo'	Potential	●			
	Lagynochthonius 'sp. nov. Bungaroo 2'	Potential	●			
	Tyrannochthonius aridus	Not SRE	●	●		
	Tyrannochthonius 'bungaroo'	Potential	●			
	Tyrannochthonius 'sp. Bungaroo 2'	Potential	●			
	Tyrannochthonius 'sp. indet.'	Not SRE	●	●		
Garypidae	*Anagarypus heatwolei*	Potential	●			
	Garypus latens	Confirmed	●			●
	Synsphyronus gurdoni	Potential	●			
	Synsphyronus 'Mortland River'	Potential	●			
	Synsphyronus 'sp. indet.'	Uncertain	●	●		
Garypinidae	*Protogarypinus* 'sp. indet.'	Uncertain	●			
Geogarypidae	*Geogarypus* 'sp. indet.'	Uncertain	●			
Hyidae	*Indohya* 'PSE002'	Potential		●		
Olpiidae	*Austrohorus* 'sp. indet.'	Uncertain	●	●		
	Beierolpium '8/2'	Potential		●		●
	Beierolpium 'Barrow sp. 3'	Potential	●			
	Beierolpium 'sp. indet.'	Uncertain		●		
	Euryolpium 'sp. indet.'	Uncertain	●	●		●
	Euryolpium 'sp. M2'	Uncertain				●
	Indolpium 'sp. Bungaroo 1'	Potential	●			

Family	Species	SRE status	Source			
			WAMDB	Phoenix DB	Mardie Optimisation	Mardie Expansion
	Indolpium 'sp. Bungaroo 2'	Potential	●			
	Indolpium 'sp. indet.'	Uncertain	●	●		
	Indolpium 'sp. M4'	Uncertain				●
	Indolpium 'sp. M5'	Uncertain				●
	Olpiidae 'sp. indet.'	Uncertain	●			
	Xenolpium 'sp. indet.'	Uncertain		●		
Sternophoridae	*Afrosternophorus* 'sp. indet.'	Uncertain		●		
Class: Diplopoda (millipedes)						
Paradoxosomatidae	*Antichiropus* 'DIP009'	Potential	●			
	Antichiropus 'DIP011'	Potential	●			
	Antichiropus 'DIP025'	Potential	●			
	Antichiropus 'DIP032'	Potential	●			
	Antichiropus 'DIP041'	Potential	●			
	Antichiropus 'DIP049'	Potential	●			
	Antichiropus 'DIP051'	Potential	●			
	Antichiropus 'DNA01'	Potential		●		
	Antichiropus 'Phoenix0072'	Potential		●		
	Antichiropus 'Phoenix0073'	Potential				●
	Antichiropus simmonsi	Confirmed	●	●		
	Antichiropus 'sp. indet.'	Uncertain	●			
	Antichiropus uvulus	Confirmed	●	●		
	Boreohesperus delicatus	Confirmed	●			
	Boreohesperus dubitalis	Confirmed	●			
	Boreohesperus undulatus	Confirmed	●			
	Cryptops 'Phoenix0072'	Potential				●
	Paradoxosomatidae 'DIPAAA' 'DIP020'	Potential	●			
	Paradoxosomatidae 'Genus indet.' 'DNA02'	Potential	●			
Siphonotidae	Siphonotidae 'sp. indet.'	Uncertain	●			
Class: Chilopoda (centipedes)						
`Family indet.`	Geophilida 'Barrow gen. 2' 'Barrow sp. 1'	Potential	●			
	Geophilida 'Barrow gen. 3' 'Barrow sp. 1'	Potential	●			
	Geophilida 'Barrow gen. 4' 'Barrow sp. 1'	Potential	●			
Ballophilidae	*Ballophilus australiae*	Potential	●			
Chilenophilidae	*Sepedonophilus* 'Phoenix0071'	Potential				●
	Sepedonophilus 'DNA04'	Potential	●			

Family	Species	SRE status	Source			
			WAMDB	Phoenix DB	Mardie Optimisation	Mardie Expansion
	Sepedonophilus 'DNA05'	Potential	●			
Cryptopidae	*Cryptops* 'DNA06'	Potential	●	●		
	Cryptops 'DNA07'	Potential		●		
	Cryptops 'DNA10'	Potential	●			●
	Cryptops 'DNA11'	Potential	●			
	Cryptops 'Phoenix0069'	Potential		●		
	Cryptops 'Phoenix0072'	Potential				●
	Cryptops 'Phoenix0073'	Potential		●		
	Cryptops 'sp. indet.'	Uncertain		●		
Geophilidae	*Tuoba sydneyensis*	Not SRE	●			●
Mecistocephalidae	Mecistocephalidae 'Barrow gen. 1' 'Barrow sp. 1'	Potential	●			
	Mecistocephalus 'DNA08'	Potential	●			
	Mecistocephalus 'DNA09'	Potential	●			
	Mecistocephalus 'DNA10'	Potential	●			
	Mecistocephalus 'DNA12'	Potential	●			
	Mecistocephalus 'sp. indet.'	Uncertain	●			
Trigoniulidae	*Austrostrophus* 'sp. indet.'	Uncertain	●	●		
	Austrostrophus 'sp. WAMT148560'	Potential		●		
Class: Crustacea, Order: Isopoda						
Armadillidae	*Acanthodillo* 'sp. indet.'	Uncertain	●	●		
	Armadillidae 'varanus island'	Potential		●		
	Barrowdillo '2'	Potential		●		
	Barrowdillo pseudopyrgoniscus	Potential	●			
	Buddelundia '14'	Not SRE		●		
	Buddelundia '14re'	Not SRE		●		●
	Buddelundia '35'	Potential				●
	Buddelundia '41'	Potential		●		
	Buddelundia 53ms	Potential				●
	Buddelundia '60'	Potential		●		
	Buddelundia 'sp. 10'	Potential	●			
	Buddelundia 'sp. 10bf'	Potential	●	●		
	Buddelundia 'sp. 32'	Potential	●	●		●
	Buddelundia 'sp. 33'	Potential	●			
	Buddelundia 'sp. 34'	Potential	●			
	Buddelundia 'sp. 36'	Potential	●			
	Buddelundia 'sp. 37'	Potential	●			
	Buddelundia 'sp. 40'	Potential	●			
	Buddelundia 'sp. 41'	Potential	●			

Family	Species	SRE status	Source			
			WAMDB	Phoenix DB	Mardie Optimisation	Mardie Expansion
	Buddelundia 'sp. 61'	Potential	●			
	Buddelundia 'sp. 62'	Potential	●			
	Buddelundia 'sp. indet.'	Uncertain	●	●		●
	Buddelundia 'sp. indet.' mardie 1	Potential			●	
	Buddelundiinae 'pes1052a'	Potential		●		
	Buddelundiinae 'pes1052b'	Potential		●		
	Buddelundiinae 'sp. indet.' (mardie 2)	Potential			●	
	Oniscidae 'sp. 62'	Potential	●			
	Oniscidae 'sp. 70'	Potential	●			
	Spherillo 'sp. indet.'	Uncertain		●		●
	Spherillo 'sp. indet.' A (mardie)	Potential				●
	Spherillo 'varanus island'	Potential		●		
Oniscidae	*Alloniscus* 'sp. indet.'	Not SRE				●
	Armadillidae 'sp. indet.'	Uncertain	●			
Paraplatyarthidae	*Paraplatyarthrus* 'sp. indet.' A	Potential				●
Philosciidae	*Laevophiloscia* cf. yalgoonensis	Potential		●		
	Laevophiloscia 'sp. indet.'	Uncertain		●		●
	Philosciidae 'DNA01'	Potential		●		
	Philosciidae 'DNA02'	Potential		●		
	Philosciidae 'DNA03'	Potential		●		
	Philosciidae 'DNA04'	Potential		●		
	Philosciidae 'pannawonica'	Potential		●		
	Philosciidae 'sp. indet.'	Uncertain				●
Class: Gastropoda, Order: Eupulmonata						
Bothriembryontida	*Bothriembryon* 'Pilbara' n.sp.	Potential	●			
Camaenidae	Camaenidae 'sp. indet.'	Uncertain	●	●		
	cf. *Quistrachia* sp.	Uncertain	●			
	Quistrachia montebelloensis	Potential	●			
	Quistrachia barrowensis	Potential	●			
	Quistrachia cf. herberti	Potential	●			
	Quistrachia cf. legendrei	Potential	●			
	Quistrachia cf. montebelloensis	Potential	●			
	Quistrachia herberti	Potential	●			
	Quistrachia legendrei	Potential	●			
	Quistrachia legendrei sp. 'Burrup'	Potential	●			
	Quistrachia legendrei sp. 'Dampier Arch.'	Potential	●			
	Quistrachia montebelloensis	Potential	●			
	Quistrachia 'sp. indet.'	Uncertain	●	●		

Family	Species	SRE status	Source			
			WAMDB	Phoenix DB	Mardie Optimisation	Mardie Expansion
	Quistrachia sp. nov.	Potential	●			
	Quistrachia sp. nov. 'W'	Potential	●			
	Rhagada angulata	Potential	●			
	Rhagada barrowensis	Potential	●			
	Rhagada 'Cape Preston' n.sp.	Potential	●			
	Rhagada cf. barrowensis	Potential	●			
	Rhagada cf. convicta	Potential	●	●		
	Rhagada cf. pilbarana	Potential	●			
	Rhagada cf. plicata	Potential	●			
	Rhagada cf. radleyi	Potential	●	●		
	Rhagada convicta	Not SRE	●	●	●	●
	Rhagada dampierana	Potential	●			
	Rhagada elachystoma	Potential	●			
	Rhagada intermedia	Potential	●			
	Rhagada minima	Potential	●			
	Rhagada n.sp.	Uncertain	●			
	Rhagada ngurrana	Potential	●			
	Rhagada 'Pannawonica' n.sp.	Potential	●			
	Rhagada perprima	Potential	●			
	Rhagada 'Phoenix0070'	Potential		●		
	Rhagada 'Phoenix0071'	Potential		●		
	Rhagada plicata	Potential	●			
	Rhagada radleyi 'Du Boulay' n.sp.	Potential	●			
	Rhagada sp. 12	Potential	●			
	Rhagada sp. 'banded'	Potential	●			
	Rhagada sp. 'banded medium'	Potential	●			
	Rhagada sp. 'Cape Preston'	Potential	●			
	Rhagada sp. 'Du Boulay'	Potential	●			
	Rhagada 'sp. indet.'	Uncertain	●	●		
	Rhagada sp. 'med. banded'	Potential	●			
	Rhagada sp. nov. 'Hearson Cove'	Potential	●			
	Rhagada 'sp. Pilbara banded'	Not SRE	●	●		
	Rhagada sp. 'small banded'	Potential	●			
	Rhagada sp. 'small-med banded'	Potential	●			

Appendix 3 Details of taxa recorded during the survey

Species	WAM reg. No.	Phoenix reg. no.	Site code	Sample type	males	females	juveniles	indet sex	Comments
Acanthodillo sp.	TBC	30813	SRE06	wet pitfall trap	0	1	0	0	
Acanthodillo sp.	TBC	33004	SRE08	wet pitfall trap	0	0	5	0	bumpy
Acanthodillo sp.	TBC	30816	SRE08	wet pitfall trap	0	1	1	5	
Acanthodillo sp.	TBC	33006	SRE10	wet pitfall trap	0	0	1	0	bumpy, juvenile female
Acanthodillo sp.	TBC	33043	SRE14	wet pitfall trap	0	1	0	0	
Acanthodillo sp.	TBC	33022	SRE19	wet pitfall trap	0	1	0	0	bumpy, juvenile female
Alloniscus sp.	TBC	32974	SRE07	litter sifting	0	1	0	0	
Austrohorus 'M1'	TBC	33013	SRE16	wet pitfall trap	0	1	0	0	
Beierolpium '8/2'	TBC	32982	SRE04	foraging	1	0	0	0	under bark
Beierolpium '8/2'	TBC	33017	SRE04	wet pitfall trap	1	1	0	0	
Beierolpium '8/2'	TBC	33025	SRE12	wet pitfall trap	0	1	0	0	
Beierolpium '8/3'	TBC	32879	SRE16	wet pitfall trap	1	0	0	0	
Beierolpium '8/3'	TBC	33000	SRE18	wet pitfall trap	0	1	1	0	
Beierolpium '8/3'	TBC	32875	SRE19	litter sifting	1	0	0	1	
Buddelundia '14re'	TBC	32992	SRE02	foraging	1	3	0	0	
Buddelundia '14re'	TBC	33038	SRE02	wet pitfall trap	1	2	4	0	
Buddelundia '14re'	TBC	32999	SRE03	foraging	0	1	0	0	
Buddelundia '14re'	TBC	30809	SRE03	wet pitfall trap	0	1	1	0	
Buddelundia '14re'	TBC	30820	SRE11	wet pitfall trap	0	3	0	0	
Buddelundia '14re'	TBC	33045	SRE15	foraging	0	1	0	0	
Buddelundia '14re'	TBC	33047	SRE17	foraging	0	1	0	0	
Buddelundia '14re'	TBC	33050	SRE17	wet pitfall trap	0	1	1	0	
Buddelundia '14re'	TBC	33053	SRE20	foraging	0	0	2	0	
Buddelundia '32'	TBC	33026	SRE01	wet pitfall trap	1	0	1	0	
Buddelundia '32'	TBC	30808	SRE03	foraging	0	0	0	1	
Buddelundia '32'	TBC	30810	SRE03	wet pitfall trap	0	2	0	0	
Buddelundia '32'	TBC	33016	SRE04	wet pitfall trap	1	2	0	0	
Buddelundia '32'	TBC	32983	SRE05	foraging	9	14	0	0	under dung
Buddelundia '32'	TBC	33021	SRE05	wet pitfall trap	2	1	0	0	
Buddelundia '32'	TBC	33032	SRE06	wet pitfall trap	3	0	0	0	
Buddelundia '32'	TBC	32972	SRE07	foraging	0	1	0	0	under rocks
Buddelundia '32'	TBC	33031	SRE07	wet pitfall trap	3	0	2	0	
Buddelundia '32'	TBC	32979	SRE08	litter sifting	1	3	2	0	
Buddelundia '32'	TBC	33003	SRE08	wet pitfall trap	3	1	1	0	
Buddelundia '32'	TBC	32987	SRE09	foraging	3	3	0	0	under coral
Buddelundia '32'	TBC	32995	SRE09	foraging	1	1	0	0	under coral
Buddelundia '32'	TBC	33015	SRE09	wet pitfall trap	15	16	0	0	

Buddelundia '32'	TBC	30821	SRE11	wet pitfall trap	1	0	0	0	
Buddelundia '32'	TBC	32968	SRE12	foraging	2	2	0	0	under rock
Buddelundia '32'	TBC	32970	SRE13	foraging	0	1	1	0	
Buddelundia '32'	TBC	33010	SRE13	wet pitfall trap	6	3	3	0	
Buddelundia '32'	TBC	32980	SRE14	litter sifting	1	1	0	1	
Buddelundia '32'	TBC	33008	SRE14	wet pitfall trap	11	8	0	0	
Buddelundia '32'	TBC	32993	SRE16	litter sifting	3	3	0	0	
Buddelundia '32'	TBC	33012	SRE16	wet pitfall trap	0	0	0	52	
Buddelundia '32'	TBC	32969	SRE17	foraging	0	1	0	0	
Buddelundia '32'	TBC	33051	SRE17	wet pitfall trap	1	0	1	0	
Buddelundia '32'	TBC	32965	SRE18	foraging	1	2	0	0	under logs
Buddelundia '32'	TBC	32977	SRE18	litter sifting	0	3	0	0	
Buddelundia '32'	TBC	33001	SRE18	wet pitfall trap	12	2	4	0	
Buddelundia '32'	TBC	33023	SRE19	wet pitfall trap	1	0	10	0	
Buddelundia '32'	TBC	33052	SRE20	foraging	0	1	0	0	
Buddelundia '32'	TBC	32967	SRE20	foraging	1	2	1	0	
Buddelundia '32'	TBC	33028	SRE20	wet pitfall trap	0	0	1	0	
Buddelundia '35'	TBC	30807	SRE02	wet pitfall trap	2	2	0	0	
Buddelundia '35'	TBC	30811	SRE03	wet pitfall trap	3	2	4	0	
Buddelundia '35'	TBC	33046	SRE15	foraging	0	3	1	0	
Buddelundia '35'	TBC	33029	SRE15	wet pitfall trap	2	7	8	0	
Buddelundia '35'	TBC	32963	SRE17	litter sifting	7	7	0	0	
Buddelundia '35'	TBC	33036	SRE17	wet pitfall trap	5	8	0	0	
Buddelundia '60'	TBC	30815	SRE07	foraging	2	2	1	2	males darker, females lighter
Buddelundia '60'	TBC	30817	SRE09	foraging	3	2	0	2	
Buddelundia '60'	TBC	30818	SRE09	foraging	0	5	2	2	
Buddelundia '34ms'	TBC	30806	SRE02	wet pitfall trap	1	2	0	0	
Buddelundia '34ms'	TBC	32989	SRE03	foraging	1	2	0	0	
Buddelundia '34ms'	TBC	33034	SRE03	wet pitfall trap	4	5	2	0	
Buddelundia '34ms'	TBC	33019	SRE11	wet pitfall trap	2	0	0	0	
Buddelundia '34ms'	TBC	32985	SRE15	foraging	0	2	0	0	leaf litter
Buddelundia '34ms'	TBC	33048	SRE17	foraging	0	2	0	0	
Buddelundia '34ms'	TBC	32997	SRE20	foraging	1	2	0	0	riverbank
Buddelundia sp.	TBC	33049	SRE17	litter sifting	0	0	3	0	most likely Buddelundia 32
Chilopoda sp. indet.	TBC	32971	SRE07	foraging	0	0	0	1	under rock
Cryptops 'DNA05'	TBC	32964	SRE17	litter sifting	0	0	0	1	
Cryptops 'DNA05'	TBC	32978	SRE18	litter sifting	0	0	0	1	
Cryptops 'DNA06'	TBC	32998	SRE20	foraging	0	0	0	3	under logs
Euoplos 'MYG307'	TBC	32990	SRE02	foraging	0	0	0	1	
Indolpium sp. indet.	TBC	32996	SRE09	foraging	0	0	0	1	under log
Indolpium sp. indet.	TBC	32994	SRE16	litter sifting	0	0	1	0	
Indolpium sp. indet.	TBC	32874	SRE19	litter sifting	0	0	1	0	

Indolpium 'sp. M3'	TBC	32877	SRE04	foraging	0	0	1	0	under bark
Indolpium 'sp. M3'	TBC	32881	SRE04	wet pitfall trap	0	0	1	0	
Indolpium 'sp. M3'	TBC	32976	SRE07	litter sifting	1	0	0	0	
Indolpium 'sp. M3'	TBC	33011	SRE13	wet pitfall trap	0	0	1	0	
Indolpium 'sp. M3'	TBC	32882	SRE15	wet pitfall trap	0	1	1	0	
Indolpium 'sp. M3'	TBC	33037	SRE17	wet pitfall trap	0	1	1	0	
Indolpium 'sp. M3'	TBC	33024	SRE19	wet pitfall trap	0	1	0	0	
Indolpium 'sp. M3'	TBC	33027	SRE20	wet pitfall trap	1	2	0	0	
Indolpium 'sp. M4'	TBC	32876	SRE07	litter sifting	1	0	0	0	
Indolpium 'sp. M4'	TBC	32878	SRE16	wet pitfall trap	0	1	0	0	
Indolpium 'sp. M4'	TBC	32973	SRE19	litter sifting	1	0	0	0	
Laevophiloscia sp.	TBC	33039	SRE02	wet pitfall trap	0	2	0	0	
Laevophiloscia sp.	TBC	33035	SRE03	wet pitfall trap	0	2	1	0	
Lychas 'SCO046'	TBC	33018	SRE11	wet pitfall trap	0	0	0	1	
Olpiidae sp. indet.	TBC	32880	SRE16	wet pitfall trap	0	0	1	0	
Paraplatyarthrus sp. indet. B	TBC	33002	SRE18	wet pitfall trap	1	0	0	0	
Selenopidae sp. indet.	TBC	33014	SRE16	wet pitfall trap	0	0	0	2	
Spherillo sp. indet. A (mardie)	TBC	30812	SRE04	wet pitfall trap	0	1	0	0	
Spherillo sp. indet. A (mardie)	TBC	30814	SRE06	wet pitfall trap	1	1	0	0	male (smaller) and female with right antenna detached and in vial
Spherillo sp. indet. A (mardie)	TBC	30819	SRE09	wet pitfall trap	1	5	0	0	
Spherillo sp. indet. A (mardie)	TBC	33007	SRE10	wet pitfall trap	1	0	0	0	
Spherillo sp. indet. A (mardie)	TBC	33044	SRE14	wet pitfall trap	2	2	0	0	
Spherillo sp. indet. B (mardie)	TBC	32975	SRE07	litter sifting	1	0	0		
Tyrannochthonius sp. indet.	TBC	33030	SRE15	wet pitfall trap	1	1	0	0	