Sanjiv Ridge Stage 1
Short-range Endemic Invertebrate Fauna Desktop Assessment

Report to Atlas Iron Pty Ltd

11 August 2025

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Executive Summary

Atlas Iron Pty Ltd (Atlas) is seeking to further develop the Sanjiv Ridge Project (the Project, formerly known as Corunna Downs Project), an iron ore project located in the Pilbara region of Western Australia, 33 km south of Marble Bar. The Mine Development Envelope (MDE), hereafter referred to as the Study Area, covers approximately 2,258 hectares (ha) and the Existing Approved Disturbance (EAD) for Stage 1 covers 423.11 ha of the MDE. New clearing is required to accommodate below water table mining and additional infrastructure, hereafter referred to as the Proposed Disturbance (PD), which represents an additional 196.79 ha of the MDE.

Atlas commissioned Biologic Environmental (Biologic) to undertake a renewed desktop assessment for short-range endemic (SRE) invertebrate fauna in the Study Area. The objective of the review is to consolidate data on the significant species recorded (or likely to occur) within the Study Area and identify broad fauna habitats present to determine the importance of the Study Area to these species.

Five databases were searched for SRE invertebrate fauna records and relevant ecological communities, within and surrounding the Study Area up to a 40 km radius. Records of mygalomorph spiders, selenopid spiders, harvestmen, pseudoscorpions, scorpions, centipedes, millipedes, land snails, and terrestrial isopods were extracted. Repeat records were consolidated and the most current data was used in the assessment, considering any recent updates to identifications and SRE status. Where taxonomic identification varied between databases for records with identical WAM registration codes, the WAM taxon identification was used as it was considered the most up-to date. A further five reports were also analysed, however, much of the data from these reports were already incorporated in the WAM databases.

Limited SRE sampling has been conducted in the general region of Study Area, however two previous surveys have boundaries overlapping with the current Study Area. A list of 70 taxa representing Confirmed and Potential SRE including indeterminate records was generated from this data. Four taxa are considered Confirmed SRE (three millipedes and one pseudoscorpion), while the remaining 66 are considered Potential SRE based on the records available and knowledge of higher taxonomy where species designation is indeterminate.

Ten Potential SRE taxa were collected from within the boundaries of the Study Area, comprising two spiders, two pseudoscorpions, two scorpions, one snail and three isopods. The likelihood of occurrence analysis found a further seven Potential SRE taxa were

considered Highly Likely to occur, and seven considered Likely to occur, while the remaining 42 taxa were considered Possible or Unlikely to occur within the Study Area.

Records of the Confirmed SRE millipede taxa *Antichiropus apricus, Antichiropus cunicularis* and *Antichiropus nicholasi* all occur within 40 km of the Study Area. Two were considered Possible to occur, *A. apricus* (14.70 km) *and A. nicholasi* (~11.55 km) and *A. cunicularis* was considered Unlikely. *Antichiropus* millipedes are known to inhabit restricted habitat types, such as rocky outcrops or deep gorges, and their above ground activity is limited to narrow time periods where the moisture levels allow for foraging and mating.

Since the survey of the Study Area conducted in 2014, the Confirmed SRE pseudoscorpion *Feaella* sp. indet has been described as *Feaella tealei.* One specimen was recorded ~5.9 km from the Study Area and it is considered Possible to occur. *Feaella tealei*, has been collected from three locations in northern Pilbara: Corunna Station, Sulfur Springs and Wodjina Mine Site, with a known linear range of 58 km.

The renewed desktop assessment demonstrated that while there has been additional resolution for SRE invertebrate fauna in the local region, many of the taxa remain as complexes and indeterminate specimens. Large gaps in survey also remain to the north and east of the Study Area and we do not have a complete picture of the regional fauna. Lack of recent survey and, more significantly, molecular sequencing of regional fauna to the north of the Study Area and within the Study Area is recommended for further analysis of impact.

A small handful of taxa have been described in the formal literature since the Corunna Downs (Sanjiv Ridge) Stage 1 environmental approval was completed, e.g. *Feaella tealei, Antichiropus* spp. (Car *et al.*, 2019; Cullen & Harvey, 2021). However, many taxa still remain undescribed.

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1 Introduction

1.1 Background

Atlas Iron Pty Ltd (Atlas) is seeking to further develop the f the Sanjiv Ridge Project (the Project, formerly known as Corunna Downs Project), an iron ore project located in the Pilbara region of Western Australia, 33 km south of Marble Bar (Figure 1.1). This Mine Development Envelope, hereafter referred to as the Study Area, covers approximately 2,258 hectares (ha). Existing Approved Disturbance (EAD) for Stage 1 covers 423.11 ha of the MDE. New clearing is required to accommodate Stage 5 below water table mining and additional infrastructure, hereafter referred to as the Proposed Disturbance (PD), which represents an additional 196.79 ha of the DE (Figure 1.1).

Atlas has commissioned Biologic Environmental (Biologic) to undertake a renewed desktop assessment for short-range endemic (SRE) invertebrate fauna in the Study Area and the PD. The objective of the review is to consolidate data on the significant species recorded (or likely to occur) within the Study Area and identify broad fauna habitats present to determine the importance of the Study Area to these species.

1.2 Scope and objectives

The objective of this assessment was to identify the occurrence of SRE invertebrate fauna species and their habitats within the Study Area and PD, by using the information gathered during a database search and literature review. The objectives were to:

- Describe and map significant and SRE invertebrate fauna habitat values of the Study Area and PD; and
- Compile an inventory of significant and SRE invertebrate fauna present or potentially present within the Study Area and PD.

This report may be used to inform the environmental assessment and approvals process and may also assist in the preparation of any required environmental impact assessment documentation.

1.3 Short range endemic fauna

Endemism refers to the restriction of a species to a particular area, whether it is at the continental, national, or local scale (Allen *et al.*, 2002). Endemism at a local scale is referred to as short-range endemism (Harvey, 2002). Short-range endemism of a species is influenced by several factors including life history, physiology, habitat requirements, dispersal capabilities, biotic and abiotic interactions and historical conditions which not only influence

the distribution of a species, but also the tendency for differentiation and speciation (Ponder & Colgan, 2002).

Harvey (2002) proposed a range criterion for terrestrial SRE invertebrate species at less than 10,000 km^2 (or 100 km x 100 km), which has been adopted by regulatory authorities in Western Australia (EPA, 2016b). SRE invertebrate species often share similar biological, behavioural, and life history characteristics that influence their restricted distributions and limit their wider dispersal (Harvey, 2002). For example, burrowing taxa such as mygalomorph spiders and *Urodacus* scorpions may only leave their burrows (or a narrow home territory near the burrow) as juveniles dispersing from the maternal burrow, or when males search for a mate (Rix *et al.*, 2017). Taxa such as terrestrial isopods, millipedes and snails are dispersal-limited because of their slow movement and cryptic habitat (Car *et al.*, 2019), while some taxa can be limited by very specific habitat requirements, such as selenopid spiders within fractured rocky outcrops (Crews, 2013).

Several taxonomic groups of invertebrates are currently understood to have a high proportion of species with restricted ranges and as such are given additional consideration in terrestrial fauna assessments. These include mygalomorph spiders (Castalanelli *et al.*, 2014), selenopid spiders (Crews, 2013), scorpions (Volschenk *et al.*, 2010), pseudoscorpions (Harvey *et al.*, 2016), millipedes (Car *et al.*, 2019), land snails (Johnson *et al.*, 2004), and terrestrial isopods. The Environmental Protection Authority (EPA) considers the existence of SRE invertebrate fauna to be a significant biodiversity issue and that SRE fauna "may be at a greater risk of changes in conservation status as a result of habitat loss or other threatening processes" (EPA, 2016b).

1.4 Conservation legislation

Protection for significant invertebrate species and ecological communities (i.e. Threatened and Priority Ecological Communities (TECs and PECs) is provided under State and Federal legislation, comprising:

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

The majority of SRE invertebrate species and communities are not currently protected under this legislation, due in large part to incomplete taxonomic and ecological knowledge, and as such the assessment of conservation significance for SRE invertebrates is guided primarily by advice provided by the Western Australian Museum (WAM) and other taxonomic experts, and under technical guidance from the EPA, including:

- EPA (2016a) *Environmental Factor Guideline: Terrestrial Fauna.*
- EPA (2016b) *Technical Guidance: Sampling of Short-range Endemic Invertebrate Fauna*
- EPA (2016c) *Technical Guidance: Terrestrial Fauna Surveys*

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IBRA Region
Pilbara

IBRA Subregion
Chichester
Fortescue
Hamersley
Roebourne

Port Hedland
Karratha
Newman

Marble Bar
Limestone - Marble Bar Rd
Marble Bar Rd
Hillside - Marble Bar Rd
Corunna Downs Rd

LEGEND
Study Area
Existing Approved Disturbance
Proposed Disturbance
Local Road
State Road

Scale 1:150,000
0 1 2 3 4 5 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 15/07/2025

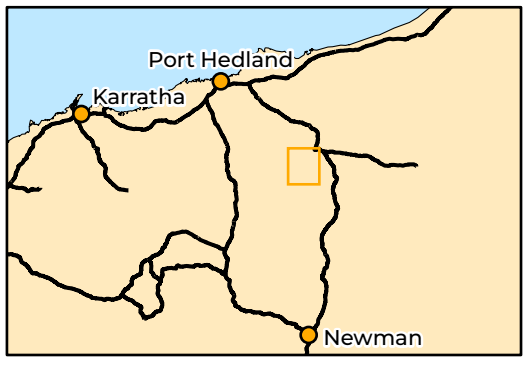

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Figure 1.1: Study Area and regional location

2 Existing Environment

2.1 Biogeography

The Study Area is located within one bioregion, the Pilbara (Figure 1.1), as defined by the Interim Biogeographic Regionalisation for Australia (IBRA) classification system (Commonwealth of Australia, 2012; Thackway & Cresswell, 1995). The Pilbara bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges (Thackway & Cresswell, 1995). Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses (Bastin & ACRIS, 2008). Within the Pilbara bioregion there are four subregions: Hamersley, Chichester, Roebourne and Fortescue Plains.

The Study Area lies wholly within the Chichester subregion (Figure 1.1) which comprises the northern section of the Pilbara Craton (Kendrick & McKenzie, 2003). Undulating Archaean granite and basalt plains include significant areas of basaltic ranges. The basalt plains host a shrub steppe characterised by *Acacia inaequilatera* over *Triodia* spp. hummock grasslands, while *Eucalyptus leucophloia* tree steppes occur on ranges. The Chichester subregion drains to the north via numerous rivers (e.g. De Grey, Oakover, Nullagine, Shaw, Yule, Sherlock) (Kendrick & McKenzie, 2003).

2.2 Climate

The Pilbara bioregion, within which the Study Area occurs, has a semi-desert to tropical climate, with rainfall occurring sporadically throughout the year, although mostly during summer (Thackway & Cresswell, 1995). Summer rainfall is usually the result of tropical low pressure systems and cyclonic activity in the region (Leighton, 2004). Winter rainfall is generally lighter and often associated with cold fronts moving north easterly across the state (Leighton, 2004). The average annual rainfall ranges from 200–400 mm, although there are significant fluctuations between years, with up to 1,200 mm falling in some locations in some years (McKenzie *et al.*, 2009).

2.3 Land systems

Work undertaken by a joint team from the Department of Primary Industries and Regional Development (DPIRD) and the Department of Planning, Lands and Heritage classified the pastoral areas of Western Australia (van Vreeswyk *et al.* (2004). The purpose of the surveys were to provide a comprehensive description and mapping of the biophysical resources of the pastoral areas, together with an evaluation of the pastoral potential and the condition of the soils and vegetation (van Vreeswyk *et al.* (2004).

A total of six land systems have been mapped as occurring within the Study Area, with the description and extent of these land systems listed in Table 2.1 and shown in Figure 2.2. The three dominant land systems are the Capricorn System to the South and the Northern Rocklea and Boolgeeda Systems.

Table 2.1: Land systems of the Study Area

Land System	Description	Extent in Study Area	
		ha	%
Boolgeeda System	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	427.46	18.93
Capricorn System	Rugged sandstone hills, ridges, stony footslopes and interfluves supporting low acacia shrublands or hard spinifex grasslands with scattered shrubs.	841.79	37.29
River System	Narrow, seasonally active flood plains and major river channels supporting moderately close, tall shrublands or woodlands of acacias and fringing communities of eucalypts sometimes with tussock grasses or spinifex.	117.55	5.20
Rocklea System	Basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	729.71	32.32
Satirist System	Stony plains and low rises supporting hard spinifex grasslands, and gilgai plains supporting tussock grasslands.	124.49	5.51
Talga System	Hills and ridges of greenstone and chert and stony plains supporting hard and soft spinifex grasslands.	16.56	0.73
Total		**2257.56**	**100**

770000

780000

7640000

7630000

Hillside - Marble Bar Rd

LEGEND

- Study Area
- Local Road

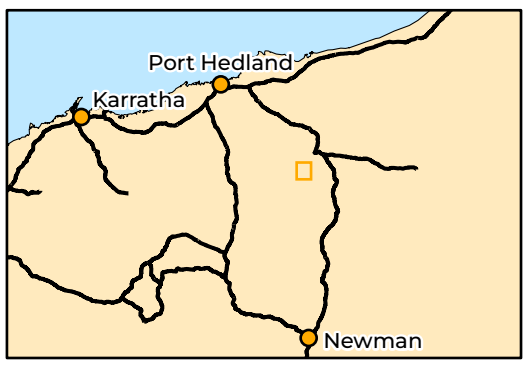
Land Systems

- Boolgeeda System
- Capricorn System
- River System
- Rocklea System
- Satirist System
- Talga System
- Black System
- Calcrete System
- Macroy System

Scale 1:70,000

0 1 2 3 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 11/07/2025



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SRE Invertebrate Fauna
Desktop Assessment

Figure 2.1: Land systems of the Study Area

2.4 Previous habitat assessment

A total of seven broad SRE invertebrate fauna habitat types were recorded and mapped across the Study Area (MWH, 2016; Outback Ecology, 2014a). Since this initial habitat assessment, the Sanjiv Ridge Stage 2 development was also proposed and Biologic updated the habitats of the Stage 1 Study Area to Biologic standards (Biologic, 2021), and detailed in Table 2.2. The habitats of the Study Area have been updated to best reflect these and current satellite imagery, however no new detailed habitat mapping has taken place. The current existing approved disturbance (approximately 423 ha) has been removed from the habitat mapping. The remaining Study Area totals 1834.35 ha and the SRE habitats, in decreasing order of extent, are:

- Undulating Low Hills – 511.26 ha (27.87%)
- Stony Plain – 495.31 ha (27.00%)
- Hillcrest/ Hillslope – 367.15 ha (20.01%)
- Gorge/ Gully – 193.15 ha (10.53%)
- Sandy plain – 138.45 ha (7.55%)
- Drainage Area/ Floodplain – 51.69 ha (2.82%)
- Disturbance – 41.06 ha (2.24%)
- Medium Drainage Lines –36.38 ha (1.98%)

Within the PD the SRE habitats, in decreasing order of extent, are:

- Hillcrest/ Hillslope – 79.26 ha (40.28%)
- Stony Plain – 39.86 ha (20.25%)
- Undulating Low Hills – 35.78 ha (18.18%)
- Gorge/ Gully – 26.50 ha (13.47%)
- Sandy Plain – 7.60 ha (3.86%)
- Disturbance – 6.36 ha (3.23%)
- Drainage Area/ Floodplain – 0.95 ha (0.49%)
- Medium Drainage Line – 0.48 ha (0.24%)

Suitability of habitats within the Study Area for SRE invertebrate fauna was based off the suitability detailed in the Corunna Downs Environmental Impact Assessment (EIA). Of the seven habitats mapped across the Study Area, one is considered of High SRE suitability (Gorge/ Gully) due to its high protection from exposure, high complexity, and high isolation within the landscape (Figure 2.2). One habitat (Drainage Area/ Floodplain) is considered of Moderate significance for SRE fauna, while Hillcrest/ Hillslope, Undulating Low Hills, Sandy Plain, Stony Plain and Medium Drainage Line are considered of Low suitability. See Table 2.3 for physical and biological characters of each habitat assessed.

Table 2.2: Habitat type grouping used for this assessment.

Habitat type – current report	Habitat types encapsulated within
Cleared/ Disturbed	Disturbance
Drainage Area/ Floodplain	Drainage Line
Gorge/ Gully	Rocky Ridge and Gorge
Hillcrest/ Hillslope	Ironstone Ridgetop
Medium Drainage Line	Riverine
Sandy Plain	Sandy Plain
Stony Plain	Calcrete, Spinifex Stony Plain
Undulating Low Hills	Stony Rise, Rocky Foothills, Granitic Uplands

780000

7640000

Hillside - Marble Bar Rd

LEGEND

- Study Area
- Existing Approved Disturbance
- Proposed Disturbance
- Local Road

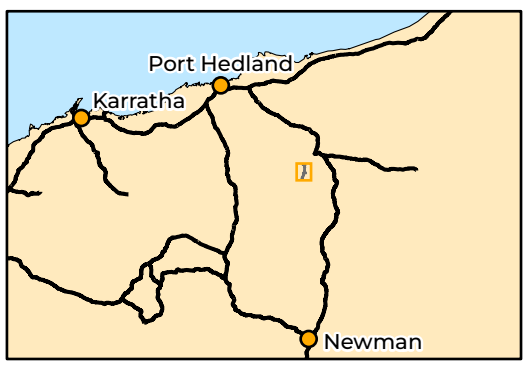
SRE habitat

- Cleared/ Disturbed
- Drainage Area/ Floodplain
- Gorge/ Gully
- Hillcrest/ Hillslope
- Medium Drainage Line
- Sandy Plain
- Stony Plain
- Undulating Low Hills

Scale 1:70,000

0 1 2 3 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 15/07/2025



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SRE Invertebrate Fauna
Desktop Assessment

Figure 2.2: SRE habitats within the Study Area

Table 2.3: Habitat types within the Study Area, with description and explanation of significance for SRE invertebrate fauna

Habitat type, extent, and significance	Habitat description	Potential SRE groups and explanation of significance	Representative photo
Gorge/ Gully 193.15 ha 10.53% Significance: High	This habitat comprises rugged, sometimes steep-sided rocky valleys incised into the surrounding landscape. Gorges tend to be deeply incised, with vertical cliff faces, while gullies are shallower and more open. Vegetation within this habitat is variable depending on position in landscape and can be dense and complex in areas of soil deposition or sparse and simple where erosion has occurred. The vertical or near vertical faces offer consistent shade, plenty of sheltered aspects, complex microhabitats, and higher persistence of moisture.	Selenopid spiders, pseudoscorpions, millipedes, land snails, terrestrial isopods. These habitats are often highly suitable for SRE fauna owing to the high protection from exposure, high complexity and moisture retention, and inherent isolation due to discontinuous landforms. Gorges and south-facing gullies tend to have a higher degree of protection while north-facing gullies tend to be more exposed.	

Habitat type, extent, and significance	Habitat description	Potential SRE groups and explanation of significance	Representative photo
Drainage Area/ Floodplain 51.69 ha 2.82% Significance: Moderate	Lower lying plain often subjected to sheet flow following large rainfall events. Vegetation and substrates of this habitat was variable, often comprising scattered *Eucalyptus* over *Acacia* and/or *Grevillea* shrubs with an understory dominated by *Triodia* hummock grasses and/or mixed tussock grasses on alluvial substrates, often with heavy clays and gravel. Tussock grasses can be dominant within Drainage Area/ Floodplain habitat.	Mygalomorph spiders, pseudoscorpions, scorpions, land snails, terrestrial isopods. This habitat type offers varying levels of protection and microhabitats such as small rock piles, shade from trees and accumulation of litter.	
Hillcrest/ Hillslope 367.15 ha 20.01% Significance: Low	This habitat comprises rocky outcrops, ridges and stony plain on the tops of ranges, supporting *Triodia* hummock grassland with scattered Eucalyptus and Acacia. Such areas are not highly complex and generally have skeletal soils and sparse open vegetation that can provide pockets of protection from exposure. The primary microhabitats for SRE fauna are the deeper soils and litter beneath mallee-form trees and shrubs, and rocky outcrops.	Selenopid spiders, pseudoscorpions, millipedes, terrestrial isopods. While generally unsuited to SRE fauna due to high exposure and lack of complexity, small microhabitats of deeper soils and leaf litter can be important for some species, as is the case with the Priority 1 species *Antichiropus pendiculus* (`DIP006`) and *A. cirratus* (`DIP007`) at Mining Area C and South Flank (Biologic, 2016b, 2018a). High ranges are often isolated, acting as terrestrial islands for some species. South-facing	

Habitat type, extent, and significance	Habitat description	Potential SRE groups and explanation of significance	Representative photo
		steep slopes may also provide some protection.	
Medium Drainage Line 36.38 ha 1.98% Significance: Low	Mid-sized drainage lines can be densely or sparsely vegetated, and extensive, but tend to be prone to disturbances from flooding. Vegetation often Corymbia, Eucalyptus, or Acacia over shrubby understory and patchy cover of hummock and/or tussock grasses on stony or gravelly substrates.	Mygalomorph spiders, pseudoscorpions, scorpions, land snails, terrestrial isopods. Habitat complexity and exposure protection can be quite high in areas of dense vegetation; however, isolation is generally low as drainage lines form an interconnected network of vegetation-based habitats. Drainage lines may provide dispersal corridors for some SRE fauna.	
Undulating Low Hills 511.26 ha 27.87% Significance: Low	These habitats are often comprised of gentle, open hill slopes with shallow gullies and small breakaways. These areas rarely feature dense vegetation and present limited complex sheltered habitats. These habitats often contain small, discontinuous outcrops and boulder piles on plains or open hill slopes.	Mygalomorph spiders, selenopid spiders, pseudoscorpions, scorpions, and terrestrial isopods. The low levels of habitat complexity, protection and isolation generally make these areas unsuitable for SRE species. Undulating low hills are unlikely to support SRE species due to high exposure, low complexity, and low isolation. The hills occasionally contain small rockpiles, outcropping and breakaways, providing limited shelter and isolation for SRE fauna.	

Habitat type, extent, and significance	Habitat description	Potential SRE groups and explanation of significance	Representative photo
Sandy Plain 138.45 ha 7.55% Stony Plain 495.31 ha 27.00 % Significance: Low	These habitats comprise predominantly flat areas with vegetation dominated by *Triodia* hummock grasses of various life stages and scattered patches of various small to medium shrub species on gravelly clay loam or sandy substrates. These areas are mostly extensive, open plains that may feature pockets of shrubland or open woodland and limited detrital microhabitats.	Mygalomorph spiders, pseudoscorpions, scorpions, terrestrial isopods. Burrowing species may be found as they often occur on patches of deeper clay-loam soils, and for detritivore species that rely on dense leaf litter; however, the low levels of habitat complexity, protection and isolation generally make these areas unsuitable for most SRE species.	

3 Methods

3.1 Database searches

Five databases were searched for SRE invertebrate fauna records and relevant ecological communities, within and surrounding the Study Area up to a 40 km radius (Table 3.1). Records of mygalomorph spiders, selenopid spiders, harvestmen, pseudoscorpions, scorpions, centipedes, millipedes, land snails, and terrestrial isopods were extracted. Indeterminate records were excluded, except where generic level characters and distribution information indicated a high likelihood of short-range endemism. Repeat records were consolidated and the most current data was used in the assessment, considering any recent updates to identifications and SRE status. Where taxonomic identification varied between databases for records with identical WAM registration codes, the WAM taxon identification was used as it was considered the most up-to date.

Table 3.1: Details of database searches conducted.

Database	Retrieval Date	Search Area
ALA (2025) Atlas of Living Australia	23/01/2025	40 km buffer surrounding the Study Area
DBCA (2025) Dandjoo Biodiversity Data Repository	23/01/2025	
WAM (2025a) Arachnida and Myriapoda Database	22/01/2025	
WAM (2025b) Crustacea Database	22/01/2025	
WAM (2025c) Mollusca Database	05/02/2025	

3.2 Literature review

A review of relevant available literature was undertaken to record previously surveyed habitat types present within the Study Area and to locate any additional records of SRE invertebrate fauna not captured in the database searches (Table 3.2).

Table 3.2 Literature sources used for the review.

Report title	Survey type	Distance from Study Area
Outback Ecology (2013) *Mt Webber Iron Ore Project: SRE Invertebrate Fauna Impact Assessment*	Single season (wet) detailed SRE invertebrate fauna survey Single season (dry) pitfall trapping with vertebrate team	35 km southwest
Outback Ecology (2014a) *Corunna Downs: Terrestrial SRE Invertebrate Fauna Survey*	Level 2 SRE invertebrate fauna survey	Within and Adjacent

Report title	Survey type	Distance from Study Area
Outback Ecology (2014b) *McPhee Creek Haul Road Project: Terrestrial SRE Invertebrate Fauna Survey*	Level 2 Targeted SRE invertebrate fauna survey	25km south
MWH (2016) *Corunna Downs: Terrestrial SRE Invertebrate Fauna Impact Assessment*	Level 2 EIA for SRE invertebrate fauna	Within and Adjacent
Biologic (2020) *Corunna Downs Stage 2 SRE Invertebrate Fauna Report*	Single-season (wet) detailed SRE invertebrate fauna survey	Within and Adjacent West

3.3 SRE status categorisation

The SRE categorization used in this report follows the Western Australian Museum (WAM) revised classification system for SRE invertebrates, based upon the 10,000 km² range criterion proposed by Harvey (2002). This classification system uses three categories (Confirmed SRE, Potential SRE, and Widespread/Not SRE) to describe the degree of certainty with which a species can be considered SRE or not (Table 3.3).

Table 3.3: SRE categorisation used by WAM, adapted from Harvey (2002)

Distribution	Taxonomic Certainty	Taxonomic Uncertainty
Species range < 10,000 km²	**Confirmed SRE** A known distribution of < 10,000 km². The taxonomy is well known. The group is well represented in collections and/or has been comprehensively sampled.	**Potential SRE** Patchy sampling has resulted in incomplete knowledge of geographic distribution. Incomplete taxonomic knowledge. The group is not well represented in collections. Any other significant knowledge gaps occur. **SRE Sub-categories may apply:** A: Data Deficient B: Habitat Indicators C: Morphology Indicators D: Molecular Evidence E: Research & Expertise
Species range > 10,000 km²	**Widespread** A known distribution of > 10,000 km². The taxonomy is well known. The group is well represented in collections and/or has been comprehensively sampled.	

Confirmed SRE species are those for which sufficient evidence exists, from both taxonomic certainty and extent of sampling, to confirm that the species is restricted to a range of less than 10,000 km², whereas Widespread species are confirmed to have a range greater than 10,000 km². For taxa belonging to groups known to include SRE species, unless sufficient evidence exists to denote Confirmed SRE or Widespread status, the default categorisation is Potential SRE. This is usually due to lack of taxonomic knowledge and intensity of sampling.

Potential SRE status is sub-categorised by what information does currently exist about the taxon. Generally, all Potential SRE taxa are considered to be data deficient (sub-category A); however, where there are habitat indicators (B), morphological indicators (C), molecular evidence (D), or general expert knowledge and experience with the taxonomic group (E), there is usually a greater likelihood that the taxon is an SRE, and the more sub-categories that apply, the greater the likelihood.

3.4 Assessment of likelihood of occurrence

The likelihood of occurrence within the Study Area for SRE invertebrate taxa identified in the desktop assessment was assessed using a decision matrix (Table 3.4). The occurrence assessment was based on known information relating to taxon distribution, habitat requirements and locality records from database searches and previous studies within the Desktop Search Area. Where habitat information for a taxon was unavailable, general habitat information for the broader taxonomic group was used.

The assessment assigned each taxon one of five ratings, ranging from Recorded to Highly Unlikely to occur (Table 3.4). Taxonomic groups whose primary habitat is restricted/isolated in the landscape (e.g. rocky outcrops) will have a lower likelihood of occurrence than groups who appear to occupy a variety of habitats. Being short ranging either by life history strategy or restricted due to fragmentation of suitable habitat, some taxa may have limited dispersal across the landscape. These taxa are less likely to cross open or widespread habitat types and it is less likely they would be found further afield from their original occurrence. This is demonstrated in the differing likelihoods between 'Previously recorded in widespread habitat' and 'Previously recorded in restricted habitat'. Where a taxon is known to be dependent on one habitat type such as permanent freshwater and that habitat is not present within the Survey Area, the likelihood of occurrence will reduce further.

Table 3.4: SRE invertebrate species likelihood of occurrence in Study Area.

		Habitat		
		Previously recorded in widespread habitat	**Previously recorded in restricted habitat**	**Habitat not present**
Range	**Recorded within Survey Area**	Recorded	Recorded	Recorded
	Recorded within < 2 km	Highly Likely	Likely	Possible
	Recorded within 2-5 km	Likely	Possible	Possible
	Recorded within 5-20 km	Possible	Possible	Unlikely
	Recorded > 20 km	Possible	Unlikely	Highly Unlikely

4 Results and Discussion

The desktop assessment gathered records of arachnids, myriapods, terrestrial isopods, and land snails from within 40 km of the Study Area. Limited SRE sampling has been conducted in the general region of Study Area, however two previous surveys have boundaries overlapping with the current Study Area This list was narrowed down to Confirmed and Potential SRE (Table 4.1, Figure 4.1 and Appendix A). These represented 68 taxa from SRE invertebrate groups, including indeterminate records. Most records were of arachnids, namely mygalomorph spiders, pseudoscorpions and scorpions. Four are considered Confirmed SRE (three millipedes and one pseudoscorpion), while the remaining 64 are considered Potential SRE based on the records available and knowledge of higher taxonomy where species designation is indeterminate. The likelihood of occurrence for these SRE species identified in the desktop assessment was measured using the decision matrix found in in Section 3.4 (Table 3.4), which takes into consideration proximity to the Study Area and the extent of habitat in which these taxa occur.

Seven Potential SRE taxa have been previously collected from within the boundaries of the Study Area ('Recorded'), none of which were recorded from the PD. These taxa were represented by one spider, two pseudoscorpions, two scorpions and two isopods Table 4.1. The likelihood of occurrence analysis found seven of the Potential SRE taxa were considered Highly Likely to occur, and nine considered Likely to occur, while the remaining 45 SRE taxa were considered Possible or Unlikely to occur within the Study Area (Appendix A).

4.1 Araneae

One selenopid spider taxon was recorded from within the Study Area from the WAM database search – *Karaops* ` sp. 2` (Table 4.1). *Karaops* sp. indet specimens collected from the Corunna Downs SRE survey {Outback Ecology, 2014 #1885} were sequenced and compared to sequenced specimens in the region and were determined to likely represent two new species (WAM, 2016). WAM database records do not indicate that these species have been described, despite a recent publication on numerous *Karaops* species in the Pilbara (Crews, 2023). A further specimen was collected and sequenced during the Sanjiv Ridge Stage 2 survey undertaken by Biologic (2021) and matched to sequences from the Study Area. As these specimens have been sequenced, we have given them the original morphospecies names, *Karaops* sp. indet. 1 and *Karaops* sp. 2, however, within the WAM database data these sequences are still recorded as *Karaops* sp. indet. together with the other un-sequenced specimens. They are all considered Potential SRE.

Two mygalomorph spiders were identified as Likely or Highly Likely to occur (Table 4.1). A specimen representing the brush-footed spider family Barychelidae was identified as

Aurecocrypta sp. indet. There is still much work to be done on this group as, to date, only two species have been described from this genus, both of which are considered widespread in Western Australia. It is likely that more species require description and based on where these spiders are often found (restricted rocky habitats), it is possible some of these species will represent SRE taxa. However, this taxon was not considered during the environmental impact assessment (EIA) for the Sanjiv Ridge Stage 1 area at the time as it occurred outside of the DE (MWH, 2016).

A further indeterminate arachnid was considered Highly Likely to occur in the Study Area, *Aname* sp. indet. (Table 4.1). This specimen was identified to *Aganippe* ? sp. indet. (Family Idiopidae, WAM T141889) in the original assessment (MWH, 2016). The specimen was sequenced, which was not successful(WAM, 2016) and remains indeterminate. A large number of *Aname* specimens from the Pilbara have been recently sequenced from the museum, it would be of benefit to request that the WA Museum add this specimen to their sequencing efforts.

4.2 Pseudoscorpiones

Since the survey of the Study Area was conducted in 2014, the Confirmed SRE pseudoscorpion *Feaella* sp. indet has been described as *Feaella tealei* (Harvey *et al.*, 2016; Outback Ecology, 2014a). One specimen was recorded ~6 km away from the Study Area and is considered Possible to occur (Table 4.1). *Feaella tealei* has been collected from three locations in the northern Pilbara: Corunna Station, Sulfur Springs and Wodjina Mine Site, with a known linear range of 58 km (Harvey *et al.*, 2016). Species of the genus *Feaella* show extreme short-range endemism and currently there are only four described species in Australia. Two species (*F. tealei and F. callani*) have been collected from five sites and one (*F. linetteae*) from one site in the Pilbara region, with a fourth species described from the Kimberley (Harvey *et al.*, 2016). The genus has a Gondwanan distribution, and species are found in Africa, India, South America and Australia.

The two Potential SRE pseudoscorpion taxa recorded within the Study Area were both genus level identification from the family Olpiidae, *Indolpium* sp. indet. and *Xenolpium* sp. indet. (Table 4.1). The family Olpiidae requires extensive morphological and molecular revision, and it is difficult to comment on indeterminate specimens as distribution cannot be ascertained without a species level identification. There were also four Potential SRE olpiid taxa from unsupported genera, which were considered to be Highly Likely to occur within the Study Area, and two considered Likely to occur (Table 4.1). No genetic work has been carried out on these specimens to date which makes them difficult to analyse in a regional context.

4.3 Scorpiones

Two Potential SRE Buthidae scorpion taxa were recorded within the Study Area, these were *Lychas* `bituberculatus complex` and *Lychas* `hairy tail complex` (Table 4.1). These are considered Potential SRE, however both species complexes require significant revision and are likely to contain a mix of wide-ranging and restricted species. *Lychas* '*gracilimanus*' was also considered Likely to occur.

4.4 Chilopoda

One soil centipede, Oryidae sp. indet. was considered Likely to occur within the Study Area (Table 4.1), however, soil centipedes require extensive taxonomic revision, and further comment cannot be made based on this occurrence.

4.5 Diplopoda

Records of the Confirmed SRE millipede taxa *Antichiropus apricus, Antichiropus cunicularis* and *Antichiropus nicholasi* all occur within 40 km of the Study Area. Two were considered Unlikely to occur within the Study Area, *A. apricus* (14.70 km away) *and A. nicholasi* (~11.55 km away), while *A. cunicularis* was considered Highly Unlikely to occur (Table 4.1). *Antichiropus* millipedes are known to inhabit restricted habitat types, such as rocky outcrops or deep gorges, and their above ground activity is limited to narrow time periods where the moisture levels allow for foraging and mating (Car *et al.*, 2019; Car *et al.*, 2013). Fragments of dead specimens identified as Paradoxosomatidae sp. indet. were collected 6 km from the Study Area (considered as Possible to occur), remain as Paradoxosomatidae sp. indet. These were not included in the table as we only consider specimens with species identifications for designation as a Confirmed SRE taxon. It is very likely that these fragments will represent one of the three species, however no molecular work can be done on these fragments as they are unlikely to contain viable tissue for sequencing.

4.6 Gastropoda

A number of camaenid snails were collected in the Outback Ecology (2014a) surveys of the Corunna Downs area. The presence of camaenids is an indicator of highly prospective SRE habitat (Gibson & Köhler, 2012) and a number of specimens were collected from significant SRE habitat (WAM, 2025c). Seven of these were identified and sequenced at the time as belonging to the *Rhagada convicta* complex. These have been rolled back into *Rhagada* sp. indet (WAM, 2025c), indicating that they are unlikely to represent *R. convicta* in the future. They remain as Potential SRE and are considered Likely to occur within the Study Area (Table 4.1).

A further camaenid specimen was sequenced and considered a separate lineage. At the time of the impact assessment for the Corunna Downs area, it was named *Rhagada* sp. nov. and considered in the EIA (MWH, 2016; Outback Ecology, 2014a). Further analysis showed it matched two other sequences, giving it a linear range of almost 500km, indicating that it is most likely a Widespread species. It has been renamed *Rhagada* MWH cf. *radleyi* n.sp. and will likely be described formally with further work on the genus.

4.7 Isopoda

Two armadillid isopods were 'Recorded' within the Study Area, *Buddelundia* `sp. 11` and *Buddelundia* `sp. 86`. Buddelundiinae`sp. mw` and Philosciidae `sp. corunna` were recorded as 'Highly Likely' to occur. All isopods were morphologically identified, and no further taxonomic or molecular work has been done on these specimens. *Buddelundia* `sp. 11`, *Buddelundia* `sp. 86` and Buddelundiinae`sp. mw` likely represent species complex', and may be split with further identification, representing multiple species (S.Judd, pers. comms.)A large number of sequences have been generated for Armadillidae in the region and further sequencing work would be necessary to confirm whether any of these morphospecies will remain Potential SRE. However, for the present time these taxa all remain as Potential SRE (Table 4.1).

Table 4.1: Confirmed SRE taxa within the desktop assessment search area and the Potential SRE taxa Recorded, Highly Likely or Likely to occur in the Study Area

Higher Taxon	Taxon	SRE status	Distance from Study Area (km)	Likelihood of occurrence
Anamidae	*Aname* `sp. indet`	Potential	1.43	Highly Likely
Barychelidae	*Aurecocrypta* `sp. indet`	Potential	2.35	Likely
Selenopidae	*Karaops* `sp. 2`	Potential	Within	Recorded
Selenopidae	*Karaops* `sp. indet.`	Potential	0.02	Likely
Feaellidae	*Feaella tealei*	Confirmed	6	Possible
Olpiidae	*Austrohorus* `sp. indet.`	Potential	2.97	Likely
Olpiidae	*Beierolpium* `8/3`	Potential	1.92	Highly Likely
	Beierolpium `sp. indet.`	Potential	2.61	Likely
	Indolpium `sp. indet.`	Potential	Within	Recorded
	Indolpium `sp. CRD01`	Potential	0.43	Highly Likely
	Indolpium `sp. CRD02`	Potential	1.06	Highly Likely
	Xenolpium `sp. indet.`	Potential	Within	Recorded
	Xenolpium `sp. CRD01`	Potential	1.06	Highly Likely
Buthidae	*Lychas* `bituberculatus complex`	Potential	Within	Recorded
	Lychas `*gracilimanus*`	Potential	2.35	Likely
	Lychas `hairy tail complex`	Potential	Within	Recorded
	Urodacus `Pilbara 16`	Potential	2.33	Likely
Oryidae	Oryidae `sp. indet.`	Potential	2.73	Likely
Paradoxosomatidae	*Antichiropus apricus*	Confirmed	14.7	Unlikely
	Antichiropus cunicularis	Confirmed	31.59	Highly Unlikely

Higher Taxon	Taxon	SRE status	Distance from Study Area (km)	Likelihood of occurrence
	Antichiropus nicholasi	Confirmed	11.55	Unlikely
Camaenidae	*Rhagada* ` sp. indet.`	Potential	0.08	Likely
	Rhagada MWH cf. Radleyi n.sp.	Likely Widespread	0.02	Likely
Armadillidae	*Buddelundia* `sp. 11`	Potential	Within	Recorded
	Buddelundia `sp. 86`	Potential	Within	Recorded
	Buddelundiinae`sp. mw`	Potential	0.01	Highly Likely
Philosciidae	Philosciidae `sp. corunna`	Potential	0.05	Highly Likely

770000

780000

7640000

7630000

Hillside - Marble Bar Rd

Potential SRE

- *Aname* `sp. indet.'
- *Aurecocrypta* `sp. indet.`
- *Karaops* `sp. 2`
- *Karaops* `sp. indet.`
- *Austrohorus* `sp. indet.`
- *Beierolpium* `8/3`
- *Beierolpium* `sp. indet.`
- *Indolpium* `sp. CRD01`
- *Indolpium* `sp. CRD02`
- *Indolpium* `sp. indet.`
- *Xenolpium* `sp. CRD01`
- *Xenolpium* `sp. indet.`
- *Lychas* `bituberculatus complex`
- *Lychas* `gracilimanus`
- *Lychas* `hairy tail complex`
- *Urodacus* `Pilbara 16`
- Oryidae `sp. indet.`
- *Rhagada* `sp. indet.`
- *Rhagada* MWH cf. Radleyi n.sp.
- *Buddelundia* `sp. 11`
- *Buddelundia* `sp. 86`
- *Buddelundinae* `sp. mw`
- Philosciidae `sp. corunna`

LEGEND

- Study Area
- Existing Approved Disturbance
- Proposed Disturbance
- Local Road

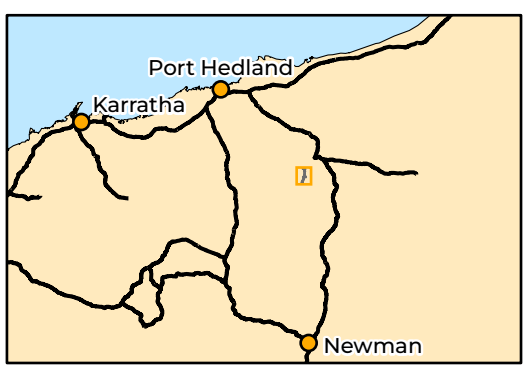
Confirmed SRE

- *Antichiropus apricus*
- *Antichiropus cunicularis*
- *Antichiropus nicholasi*
- *Feaella tealei*

Scale 1:70,000

0 1 2 3 Km

Coordinate System: GDA 1994 MGA Zone 50
Transverse Mercator Created: 15/07/2025



Biologic

ATLAS IRON
Sanjiv Ridge Stage 1
SRE Invertebrate Fauna
Desktop Assessment
Figure 4.1: SRE taxa Recorded, Highly Likely or Likely to occur in the Study Area

5 Conclusion

The renewed desktop assessment demonstrated that while there has been additional resolution for SRE invertebrate fauna in the local region, many of the taxa remain as complexes and indeterminate specimens. Large gaps in survey also remain to the north and east of the Study Area and we do not yet have a complete picture of the regional fauna. Further survey and molecular sequencing of regional fauna to the north of the Study Area and within the Study Area is recommended for further analysis of impact.

A small handful of taxa have been described in the formal literature since the Corunna Downs (Sanjiv Ridge) Stage 1 environmental approval was completed, e.g. *Feaella tealei, Antichiropus* spp. (Car *et al.*, 2019; Cullen & Harvey, 2021). However, many taxa still remain undescribed.

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Appendix A: Likelihood of occurrence within the Study Area for SRE invertebrate fauna identified in the desktop assessment

Higher order	Taxon	SRE status	Distance from Study Area (km)	Likelihood of occurrence
ARACHNIDA: Araneae				
Anamidae	*Aname* `FP-12639 (EP01)`	Potential	11.19	Possible
	Aname `MYG770`	Potential	8.84	Possible
	Aname `sp. indet.`	Potential	1.43	Highly Likely
	Anamidae `sp. indet.`	Potential	33.70	Possible
	Kwonkan `MYG200`	Potential	34.61	Possible
	Kwonkan `sp. indet.`	Potential	27.76	Possible
	Teyl `sp. indet.`	Potential	36.80	Possible
Barychelidae	*Aurecocrypta* `sp. indet.`	Potential	2.35	Likely
	Barychelidae `sp. indet.`	Potential	11.55	Possible
	Synothele `sp. indet.`	Potential	34.51	Possible
Idiopidae	Idiopidae `sp. indet.`	Potential	11.55	Possible
Selenopidae	*Karaops* `sp. indet.`	Potential	0.02	Likely
	Karaops nyamal	Potential	36.25	Highly Unlikely
	Karaops `sp. indet. 1`	Potential	2.35	Possible
	Karaops `sp. 2`	Potential	Within	Recorded
ARACHNIDA: Pseudoscorpiones				
Chthoniidae	*Tyrannochthonius* `*aridus*`	Potential	36.24	Possible
Feaellidae	*Feaella tealei*	Confirmed	6.00	Possible
Garypidae	*Synsphyronus* `8/3 pilbara`	Potential	6.00	Unlikely
	Synsphyronus `PSE091, 7/3 short`	Potential	22.24	Highly Unlikely

Higher order	Taxon	SRE status	Distance from Study Area (km)	Likelihood of occurrence
Olpiidae	`Genus 7/4` `sp. 7/4A`	Potential	36.24	Possible
	`Genus 7/4` `sp. indet.`	Potential	36.34	Possible
	`PSEAAA` `sp. indet.`	Potential	34.94	Possible
	Austrohorus `sp. indet.`	Potential	2.97	Likely
	Beierolpium `8/2`	Potential	34.21	Possible
	Beierolpium `8/3`	Potential	1.92	Highly Likely
	Beierolpium `8/4`	Potential	37.52	Possible
	Beierolpium `sp. indet.`	Potential	2.61	Likely
	Euryolpium `sp. indet.`	Potential	37.03	Possible
	Indolpium `sp. indet.`	Potential	Within	Recorded
	Indolpium `sp. CRD01`	Potential	0.43	Highly Likely
	Indolpium `sp. CRD02`	Potential	1.06	Highly Likely
	Olpiidae `sp. indet.`	Potential	15.88	Possible
	Xenolpium `sp. indet.`	Potential	Within	Recorded
	Xenolpium `sp. CRD01`	Potential	1.06	Highly Likely
ARACHNIDA: Scorpiones				
Buthidae	*Lychas* `annulatus complex`	Potential	39.21	Possible
	Lychas `bituberculatus complex`	Potential	Within	Recorded
	Lychas `*gracilimanus*`	Potential	2.35	Likely
	Lychas `hairy tail complex`	Potential	Within	Recorded
	Lychas `harveyi complex`	Potential	22.52	Possible

Higher order	Taxon	SRE status	Distance from Study Area (km)	Likelihood of occurrence
	Lychas `pilbara 1`	Potential	34.61	Possible
	Lychas `sp. 1`	Potential	11.55	Possible
	Lychas `sp. 2`	Potential	6.74	Possible
	Lychas `sp. 3`	Potential	31.04	Possible
	Lychas `sp. 4`	Potential	6.74	Possible
	Lychas `sp. 6`	Potential	6.74	Possible
	Lychas `sp. indet.`	Potential	24.49	Possible
Urodacidae	*Urodacus* `sp. indet.`	Potential	31.58	Possible
	Urodacus `*butleri*`	Potential	23.93	Possible
	Urodacus `butleri`	Potential	23.93	Possible
CHILOPODA: Geophilomorpha				
Oryidae	Oryidae `sp. indet.`	Potential	2.73	Likely
DIPLOPODA: Polydesmida				
Paradoxosomatidae	*Antichiropus* `DIP037, balfour1`	Potential	27.76	Highly Unlikely
	Antichiropus `sp. indet.`	Potential	31.03	Highly Unlikely
	Antichiropus apricus	Confirmed	14.70	Unlikely
	Antichiropus cunicularis	Confirmed	31.59	Highly Unlikely
	Antichiropus nicholasi	Confirmed	11.55	Unlikely
	Paradoxosomatidae `sp. indet.`	Potential	6.00	Unlikely
DIPLOPODA: Spirobolida				
Trigoniulidae	*Austrostrophus* `sp. indet.`	Potential	37.86	Highly Unlikely

Higher order	Taxon	SRE status	Distance from Study Area (km)	Likelihood of occurrence
	Austrostrophus `stictopygus`	Potential	37.86	Highly Unlikely
MALACOSTRACA: Isopoda				
Armadillidae	*Acanthodillo `sp. indet.`*	Potential	6.00	Possible
	Armadillidae `sp. abydos`	Potential	2.97	Likely
	Buddelundia `sp. 11`	Potential	Within	Recorded
	Buddelundia `sp. 86`	Potential	Within	Recorded
	Buddelundia `sp. 14mw`	Potential	Within	Recorded
	Buddelundiinae `sp. mw`	Potential	0.01	Highly Likely
Philosciidae	Philosciidae `sp. corunna`	Potential	0.05	Highly Likely
GASTROPODA				
Camaenidae	*Rhagada `sp. indet.`*	Potential	0.08	Likely
	Rhagada aff. *richardsonii*	Potential	27.74	Highly Unlikely
	Rhagada cf. *richardsonii*	Potential	12.09	Unlikely
	Rhagada MWH cf. Radleyi n.sp.	Likely Widespread	0.02	Likely
Succineidae	*Succinea `sp. indet.`*	Potential	12.09	Unlikely