

Desktop assessment and targeted survey for SRE and Conservation Significant Invertebrate Fauna for the Moora Grain Receival Site, Western Australia.



Report by Invertebrate Solutions Pty Ltd for 360 Environmental Pty Ltd on behalf of Co-operative Bulk Handling Group Ltd

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Frontispiece: The mygalomorph spider *Idiosoma clypteatum* that is closely related to *I. Dandaragan* .

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Contents

Executive Summary.....	1
1. Introduction.....	2
1.1 Purpose of this report	2
1.2 Project Area	2
1.3 Survey Effort and Timing	2
1.4 Introduction to SRE fauna	3
1.5 Conservation Legislation and Guidance Statements.....	5
1.6 Report Limitations and Exclusions.....	6
2. Desktop Methods	8
2.1 SRE Desktop Methodology	8
2.2 SRE Survey Methodology	9
2.3 Sorting and curation	9
2.4 Taxonomy and Nomenclature	9
2.5 Short Range Endemic Status	10
3. Results	11
3.1 SRE Invertebrates of the Wheatbelt region.....	11
3.2 Conservation Significant Fauna in the Desktop Study Area.....	11
3.3 SRE Habitat in Project Area	12
3.4 Potential occurrence of SRE Invertebrates within the Desktop Study Area	12
3.5 SRE Field Survey Results.....	13
4. Discussion	15
5. Conclusions and Recommendations	19
6. References	20
Appendix 1	
DBCA Conservation Categories	
Appendix 2	
Protected Matters Search Tool Results	

List of Figures

Figure 1	Moora Grain Receival Site	4
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List of Tables

Table 1	Short Range Endemic Status of Species	5
Table 2	SRE species likelihood of occurrence definitions	9
Table 3	Conservation significant terrestrial invertebrates potentially within the Desktop Study Area.	12
Table 4	Desktop records from WAM of potential SRE Invertebrates in the Project Area	13

List of Plates

Plate 1	Previous ground disturbance within the Project area.....	14
Plate 2	Disturbance from rabbits was evident throughout much of the Project area.....	14
Plate 3	Distribution of <i>Idiosoma</i> spp in the Wheatbelt and pastoral regions of Western Australia (After Rix et al. 2018, Figure 374).....	17

Executive Summary

Co-operative Bulk Handling Group Ltd (CBH Group) has undertaken biological assessments to support State and Federal approvals for the clearing of native vegetation to allow for the widening of an existing road and installation of a weighbridge at the Moora Grain Receiving Site (the Project). The Project is located approximately three kilometres (km) south of Moora in the Wheatbelt region of Western Australia.

Invertebrate Solutions was requested by 360 Environmental Pty Ltd (360 Environmental) on behalf of CBH Group to undertake a desktop assessment of short range endemic (SRE) and conservation significant invertebrates for the Project.

The Desktop Study Area contains four Confirmed SRE species and two Likely SRE species:

- Two Confirmed SRE trapdoor spiders (*Idiosoma dandaragan* and *Kwonkan wonganensis*)
- A Confirmed SRE land snail *Bothriembryon `moora` n.sp.*
- A Confirmed SRE brine shrimp *Paralimnadia hyposalina*
- A Likely SRE land snail *Bothriembryon `walebing` n.sp.*
- A Likely SRE slater *Buddelundia sp. '88'*

The Desktop Study Area also contains one Possible SRE species (one ophiid pseudoscorpion) that is due to data deficiencies and taxonomic uncertainty. The remainder of the species were found to be widespread.

The Confirmed species *Idiosoma dandaragan* is also conservation significant and an additional three non SRE, but conservation significant species possibly occur, or have habitat within the Desktop Study Area:

- Two brine shrimp (*Branchinella denticulate* [P3] and *Branchinella simplex* [P1])
- One water flea *Daphnia jollyi* (P1)
- One trapdoor spider *Idiosoma dandaragan* (P2)

A targeted survey for SRE and conservation significant invertebrates with a High likelihood of occurrence within the Project Area was undertaken in March 2020. Specifically, this survey targeted the mygalomorph spider *Idiosoma dandaragan* and the land snails *Bothriembryon `moora` n.sp.* and *Bothriembryon `walebing` n.sp.* The targeted survey recorded no SRE or conservation significant invertebrates within the Project Area.

No additional surveys for SRE or conservation significant invertebrates are required for the Project in order to meet Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

1. Introduction

Co-operative Bulk Handling Group Ltd (CBH Group) has undertaken biological assessments to support State and Federal approvals for the clearing of native vegetation to allow for the widening of an existing road and installation of a weighbridge at the Moora Grain Receiving Site (the Project). The Project is located approximately three kilometres (km) south of Moora in the Wheatbelt region of Western Australia.

Invertebrate Solutions has been requested by 360 Environmental Pty Ltd (360 Environmental) on behalf of CBH Group to undertake a desktop assessment of short range endemic (SRE) and conservation significant invertebrates followed by a targeted survey for these species for the Project.

1.1 Purpose of this report

360 Environmental has requested Invertebrate Solutions to undertake the following scope of works for the Project Area, Western Australia:

- Carry out a desktop review to inform the survey planning and report preparation, including identification of all SRE species likely to occur within the Project Area;
- Undertake a SRE invertebrate survey to identify significant species in accordance with EPA Technical Guidance Sampling of short range endemic invertebrate fauna (EPA 2016);
- Identify to the lowest practical taxonomic unit all potential SRE specimens recorded during the field survey;
- Provide recommendations and any suggested requirements for further work to comply with relevant legislation; and
- Provide a written report containing the above items.

1.2 Project Area

The Project is located approximately three kilometres (km) south of Moora in the Wheatbelt region of Western Australia and is shown in Figure 1. The Desktop Study Area comprised a rectangle of approximately 50 km sides bounded by the north west corner (30.419276°S, 115.734942°E) and the south east corner (-30.891950°S, 116.273525°E) centred on the Project.

1.3 Survey Effort and Timing

Invertebrate Solutions completed a targeted survey for SRE and conservation significant invertebrates on 10th March 2020. This involved grid searching of the entire site by two experienced ecologists, comprised of:

- Dr Timothy Moulds *BSc (Hons) Geol., PhD. Invert. Ecol.* (Invertebrate Solutions); and
- Ms Colleen McDonald *BSc* (360 Environmental).

Survey work was undertaken under the collection licences issued by the Department of Biodiversity, Conservation and Attractions (DBCA):

- BA27000131; Licensee Timothy Moulds (Invertebrate Solutions); Valid 10/10/2020.

1.4 Introduction to SRE fauna

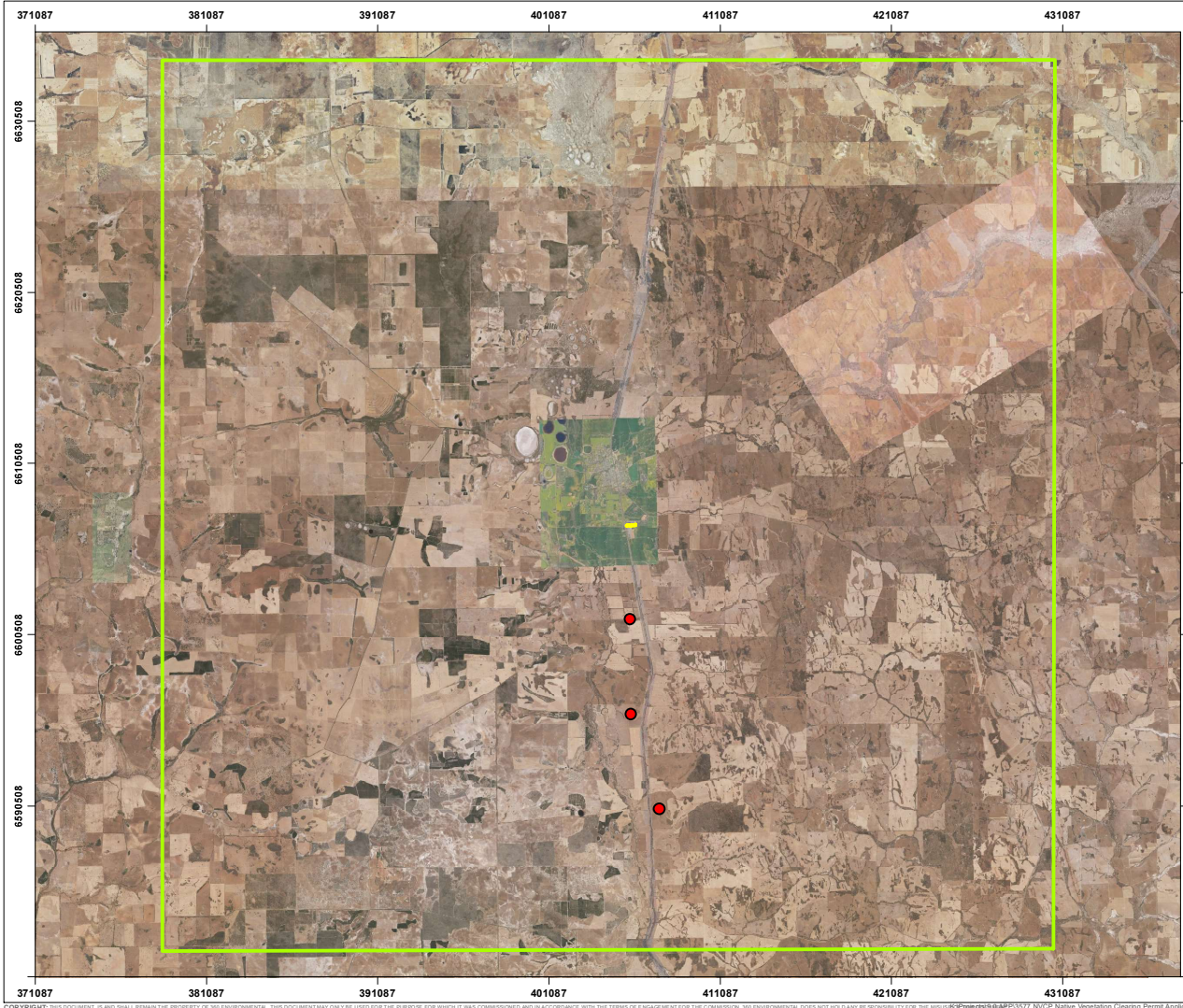
Short range endemic (SRE) invertebrates are species with restricted distributions. The isolation of invertebrates in specific habitats or bioregions leads to endemism at various spatial scales. The vast majority of invertebrates are capable of dispersing substantial distances at some phase of their life cycle. Some groups, however, are susceptible to short range endemism which describes endemic species with restricted ranges, arbitrarily defined in Western Australia as less than 10,000 km² (100 km x 100 km) (Harvey, 2002). Taxa that have been more commonly found to contain SRE representatives include:

- Onychophorans (velvet worms);
- Crustaceans (Isopoda);
- Arachnids (mygalomorph spiders, pseudoscorpions, opiliones, scorpions, schizomids);
- Myriapods (millipedes and centipedes);
- Molluscs (land snails); and
- Insects (hemipterans, grasshoppers, butterflies).

SRE invertebrate fauna taxa are generally found in sheltered, relatively mesic environments such as isolated habitats (e.g. boulder piles, isolated hills, dense patches of vegetation, gullies) and can include microhabitats within these environments such as deep leaf litter accumulation, large logs, under bark, cave areas and springs and permanent water bodies.

Many processes contribute to taxa being susceptible to short range endemism. Generally, these factors are related to the isolation of a species which can include the ability and opportunity to disperse, life history, physiology, habitat requirements, and habitat availability. Taxa that exhibit short range endemism generally exhibit poor dispersal, low growth rates, low fecundity and reliance on habitat types that are discontinuous (Harvey, 2002). Taxa that reside within easily isolated habitats surrounded by physical barriers such as islands, mountains, aquifers, lakes and caves are also more susceptible to becoming SRE species, often including additional taxa not otherwise generally forming SREs.

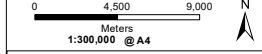
Taxa that exhibit short range endemism are particularly vulnerable to disturbance, either natural or anthropogenic, as they are reliant upon specialised and often restricted habitats (often moist) (Framenau, *et al.*, 2008). Short range endemic taxa are unable to disperse to *refugia* when their habitats are threatened or destroyed, thus making them a priority for conservation efforts.



- Legend**
- Desktop Study Boundary
 - Disturbance Footprint
 - Conservation Significant Invertebrate locations**
 - *Idiosoma dandaragan*, (P2)

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
 - LOCALITY MAP SOURCED LANDGATE 2017
 - OTHER DATA SOURCED LANDGATE 2018
 - AERIAL PHOTOGRAPHY SOURCED LANDGATE 2018
 © Western Australian Land Information Authority 2018

360 Environmental
 10 Bermondsey St, West Leederville, 6007 WA
 t (08) 9388 8360
 f (08) 9381 2300
 www.360environmental.com.au



PROJECT ID	DATE
3577	12/02/2020

HORIZONTAL DATUM AND PROJECTION
 GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
LF	CM	CM	0

CBH Group
Lot 4300 Moora
SRE and Invertebrate
Desktop Assessment

Figure 1
Desktop Study Area

The allocation of short range endemism status can be difficult due to the often incomplete taxonomic framework of many invertebrate groups and the often frequent need for substantial revision to enable accurate identification. Short Range Endemic status is assigned using the categories described in Table 1, based on the available information from the Western Australian Museum (WAM) database and discussion, with appropriate taxonomic authorities for various invertebrate groups. Insufficient information exists for many invertebrate species due to specimens being juvenile, the wrong sex to allow identification, damaged, or inadequate taxonomic frameworks, precluding the assignment of SRE status.

Table 1 Short Range Endemic Status of Species

SRE Status	Definition
Confirmed	A confirmed SRE species. A known distribution of < 10,000 km ² (after Harvey 2002). Taxonomy of the group is well known. The group is well represented in collections, or via comprehensive sampling.
Likely	Likely to be a SRE species based upon knowledge of the family/genus, where other closely related species show evidence of short range endemism. Where habitats containing the specimens show discontinuity within the landscape.
Possible	Based upon existing knowledge of the genus / family there is a possibility that the species may have a restricted range. Where habitats containing the specimens may show discontinuity within the landscape. Possible SRE species may be assigned one of the sub categories below: <ul style="list-style-type: none"> A. Data deficient i.e. new species, lack of distribution, taxonomic or collecting knowledge, juvenile specimens, wrong sex for identification B. Habitat indicators C. Morphology indicators D. Molecular evidence E. Research and expertise of WAM staff/taxonomic specialists
Widespread	Not a SRE, a wide ranging distribution of > 10,000 km ²

1.5 Conservation Legislation and Guidance Statements

Terrestrial SRE species are protected under state legislation via the newly enacted *Biodiversity Conservation (BC) Act* (2016) which came into force on 1st January 2019, replacing the outdated *Wildlife Conservation (WC) Act* (1950). The BC Act is aligned with the federal *Environment Protection and Biodiversity Conservation (EPBC) Act* (1999). The assessment of SRE fauna for Environmental Impact Assessment (EIA) is undertaken in Western Australia with regard to Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

At the State level, the BC Act provides a list of species that have special protection as species listed under Part 2 of the BC Act. This notice is updated periodically by the DBCA (formerly the Department of Parks and Wildlife (DPaW)) and the current list (January 2019) includes numerous SRE species from the Goldfields, Wheatbelt, South Coast, Murchison and Pilbara regions. Included in the list are crustaceans, arachnids and myriapods that are considered to be “Rare or Likely to become extinct, as Critically Endangered fauna, or are declared to be fauna that is in need of special protection” (Appendix 1). In addition to the specially protected fauna, DBCA also maintains a list of Priority fauna

that are considered to be of conservation significance, but do not meet the criteria for formal listing under the BC Act. The Priority fauna list is irregularly updated by DBCA and is now part of the BC Act.

The BC Act provides the ability for the state government of Western Australia to formally list Threatened Ecological Communities (TECs), along with threatening processes.

The EPBC Act protects both species, and ecological communities. The most relevant listing for SRE fauna in Western Australia is the mygalomorph spider *Idiosoma nigrum* that occurs in the Wheatbelt region and is listed as Vulnerable.

1.6 Report Limitations and Exclusions

This study was limited to the written scope provided to the client by Invertebrate Solutions (6th February 2020) and in Section 1.1. This study was limited to the extent of information made available to Invertebrate Solutions at the time of undertaking the work. Information not made available to this study, or which subsequently becomes available may alter the conclusions made herein. Assessment of potential impacts to SRE fauna was based on proposed development plans provided by CBH Group.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. Invertebrate Solutions has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by Invertebrate Solutions described in this report (this section and throughout this report). Invertebrate Solutions disclaims liability arising from any of the assumptions being incorrect.

Invertebrate Solutions has prepared this report on the basis of information provided by CBH Group and others (including Government authorities), which Invertebrate Solutions has not independently verified or checked beyond the agreed scope of work. Invertebrate Solutions does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Site conditions may change after the date of this report. Invertebrate Solutions does not accept responsibility arising from, or in connection with, any change to the site conditions. Invertebrate Solutions is also not responsible for updating this report if the site conditions change.

Species were identified to the lowest practical taxonomic level, taking into consideration that the taxonomic framework of many invertebrate groups is incomplete and often in need of substantial revision to enable accurate identification. Short Range Endemic status was assigned using the available information from the WAM database and discussion with appropriate taxonomic authorities for various invertebrate groups. Insufficient information exists for many invertebrate species due to specimens being juvenile, the wrong sex to allow identification, damaged, or inadequate taxonomic frameworks, precluding the assignment of SRE status.

Field surveys for SRE invertebrates require multiple seasonal surveys to fully record all species that may be present in an area, and in varying weather conditions. The current survey was undertaken in

a single season and additional surveys at different times of the year may record additional species. However, the combination of collection techniques and the intensity of the survey provides a high degree of certainty that majority of potential SRE invertebrates present within the Survey Area were recorded.

1.6.1 Survey Specific Limitations

The following specific comments are made with regard to project specific limitations for the Project:

- **Sampling effort** – The single-phase survey included a detailed grid search of the entire site by two experienced ecologists for burrows of mygalomorph spiders and searching under vegetation and organic debris for land snails. The very detailed nature of the survey provides a high degree of certainty that the majority of potential SRE invertebrates present at the time of survey were recorded from the Survey Area.
- **Timing** – The survey was undertaken in March, which is suitable for targeted surveys for mygalomorph spiders and land snails that can be observed throughout the year.
- **Methods** – A wide variety of collecting techniques were used including active searching, rakings, and bark peeling trapping providing a high degree of certainty that the majority of targeted potential SRE invertebrates present at the time of the survey were recorded from the Survey Area.
- **Habitats sampled** – All significant potential SRE habitats within the Survey Area were sampled using a combination of techniques.
- **Access to areas** – No access issues were encountered, and all parts of the site were able to be comprehensively surveyed.

2. Desktop Methods

Invertebrate Solutions undertook the following tasks for the desktop SRE and Conservation Significant Invertebrate assessment of the Project:

- SRE desktop assessment based upon the WAM Records;
- An assessment of the likelihood that SRE invertebrate species are present in the habitats located within the Project Area; and
- An assessment of potential conservation significant invertebrates that may occur in the region based upon DBCA and EPBC conservation listings.

The desktop assessment was undertaken with regard to the Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

2.1 SRE Desktop Methodology

A search of the WAM databases for Arachnids, Crustacea and Molluscs was undertaken for potential SRE taxa occurring in the Moora region. In addition, other published reports including Invertebrate Solutions (2019), were examined. The desktop analysis was used to identify any potential SRE species that may occur in the Moora region and target those taxa during the subsequent field survey of the Project Area.

2.1.1 Likelihood of SRE invertebrate occurrence

The likelihood of SRE invertebrate species occurring in the Project Area was assessed using a combination of regional and local botanical and landform information, and database searches including:

- Analysis of published and unpublished reports concerning SRE invertebrate from the region;
- Botanical and vegetation mapping and other information available for the Project Area;
- Results of a Protected Matters Search from the Federal Government’s Department of the Environment and Energy (DEE) website; and
- Records of fauna held by the WAM.

Based on the analysis of all available information within the Project Area and from the broader Desktop Study Area, each SRE and Conservation Significant invertebrate species was assigned a level of likelihood to occur within the Project Area of either ‘Very Low’, ‘Low’, ‘Moderate’, ‘High’, or ‘Definite’.

Table 2 SRE species likelihood of occurrence definitions

SRE Species Likelihood of occurrence	Definition
Definite	The species is confirmed to occur within the Project Area
High	Habitat for the species is known to occur within the Project Area and known current records of the species are within 20 km
Moderate	Habitat for the species is known to occur within the Project Area and known current records of the species are within 50 km
Low	The species has been recorded from within 50 km, however, no habitat is present for the species within the Project Area or the records are historical.
Very low	No habitat exists for the species within the Project Area and no records of the species are within 50 km or the distribution of the species is known well enough to exclude its presence within the Project Area.

2.2 SRE Survey Methodology

The SRE survey was undertaken using a combination of sampling techniques and employed both systematic (timed active searching) and opportunistic (litter collection and transect) sampling. Sites were chosen to maximise SRE habitat including south-facing slopes, gullies, rocky outcrops, dense patches of trees and permanent water bodies.

2.2.1 Active searching

Active searching was undertaken across the entire site, and consisted of searching soil and/or leaf litter from suitable habitat areas within each site (land snails); the raking of leaf litter (land snails, mygalomorph burrows); examination of vegetative material below logs and bark (land snails), and an examination of areas of rock outcrops and associated rock piles.

2.3 Sorting and curation

Sorting for all SRE samples occurred in the Invertebrate Solutions laboratory using an Amscope 45x dissecting microscope and was undertaken by Dr Timothy Moulds. Each taxon was identified to the lowest practical taxonomic rank using published keys and descriptions, and the number of each taxon recorded. Each identified taxon was kept in a separate labelled vial and assigned a specimen tracking code. Specimen and site collection data were recorded in an Excel spreadsheet. At the conclusion of the study, all specimens will be lodged at the Western Australian Museum.

2.4 Taxonomy and Nomenclature

Identification of collected invertebrate material was undertaken by Dr Timothy Moulds. Invertebrate groups collected that have no SRE representatives such as, ants and flying insects, were not identified or reported. The presence of winged adults in most insect groups suggests that they are more capable dispersers and are therefore less likely to have a restricted range.

The level of specimen identification achievable is dependent on the level of taxonomic knowledge and expertise available. The majority of the taxonomic expertise relating to SRE taxa resides with the

staff of the WAM, while some groups are also worked on by researchers within other government departments and academic institutions. Taxonomic treatments are available for some invertebrate groups, but not for all. The EPA expects that invertebrates collected for identification will be identified to the lowest taxonomic level possible. Ideally, this is to the species level, however there will be limits due to the nature of specimens and the availability of taxonomic keys.

2.5 Short Range Endemic Status

Taxonomic groups known to contain SRE representatives were examined in more detail to determine if the records in this study are potentially restricted forms. SRE status was assigned after comparison with other close relatives in the group and current knowledge on their distribution and ecology, where known.

3. Results

3.1 SRE Invertebrates of the Wheatbelt region

Whilst there are few systematic surveys for SRE species within the Wheatbelt region of Western Australia, the area has been the subject of numerous invertebrate collections by researchers from the WAM and Universities over the past 80 years or more. This has resulted in a reasonable understanding of the regions fauna within a highly fragmented agricultural landscape. The highly conservation significant *Idiosoma nigrum* (Vulnerable EPBC Act) is now known to be restricted to the central northern Wheatbelt (Rix et al. 2018), along with several other conservation significant mygalomorph spiders from various portions of the Wheatbelt including *Idiosoma dandaragan*, that are known to occur within the Desktop Study Area.

There are few SRE surveys in the vicinity of Moora or the Project Area. The previous studies in the region are almost exclusively related to ad hoc surveys of remnant vegetation, usually nature reserves with little in the way of broad scale systematic data available. Although, the recent work on the mygalomorph spider fauna of Western Australia has greatly increased our knowledge of some specific families and genera, compared with the general SRE fauna. Many species remain to be properly documented and the taxonomy of many groups remains unresolved.

A single baseline survey for SRE invertebrates was undertaken at the North Kiaka Mine, approximately 20km north of Moora in 2018 (Invertebrate Solutions 2019). The SRE survey recorded two Confirmed SRE species; the mygalomorph spider *Kwonkan wonganensis?* and the millipede *Antichiropus sp. 'Moora'*. As well as the land snail *Bothriembryon sp. 'moora'* and the slater *Buddelundia sp. '88'*, that are considered to be Likely SRE species. Whilst another four species are considered to be Possible SRE species, no conservation significant invertebrates were recorded during the field survey at the North Kiaka site (Invertebrate Solutions 2019).

3.2 Conservation Significant Fauna in the Desktop Study Area

A list of conservation significant fauna for the Desktop Study Area was compiled from the DBCA Wildlife Conservation (Specially Protected Fauna) Notice 2019 (DBCA 2019) and the Protected Matters Search Tool (PMST). SRE species that are listed under the BC Act and/or the EPBC Act and are likely to occur, or have known habitat within the Desktop Study Area are shown in Table 3 with their conservation code. The PMST results listed a single invertebrate, the mygalomorph spider *Idiosoma nigrum* as having the potential for habitat based upon bioclimatic modelling to occur within the Project Area. However, the distribution of this species is well known and a recently published generic revision shows that *Idiosoma nigrum* does not occur at Moora, but only occurs further south in the central northern Wheatbelt region (Rix et al. 2018). A full description of the DBCA and EPBC conservation codes are shown in Appendix 1 and Appendix 2 respectively. The full list of species obtained from the PMST search is shown in Appendix 2.

Whilst 21 conservation listed invertebrate species occur within the entire Wheatbelt region, within the Moora area only five of these species have any potential habitat in the local region (Table 3), with the remaining species found several hundreds of kilometres away in the broader region. Of these five species, the mygalomorph spider *Idiosoma dandaragan* (Priority 2) is known to be present

within the Desktop Study Area and the tree cricket *Throscodectes xederoides* (Priority 3) has a Moderate likelihood of occurrence. The remaining three species are considered to have a Low or Very Low likelihood of occurrence within the Desktop Study Area.

Table 3 Conservation significant terrestrial invertebrates potentially within the Desktop Study Area.

Higher Classification	Genus and Species	DBCA/ BC Status	EPBC status	Habitat/Distribution within Desktop Study Area
Bivalvia	<i>Westralunio carteri</i>	Vulnerable	Vulnerable	Not Present
Crustacea	<i>Branchinella denticulata</i>	P3	-	Low
	<i>Branchinella simplex</i>	P1	-	Very Low
	<i>Daphnia jollyi</i>	P1	-	Very Low
Arachnida	<i>Idiosoma castellum</i>	P2	-	Not Present
	<i>Idiosoma dandaragan</i>	P2	-	Present
	<i>Idiosoma mccllementsorum</i>	P2	-	Not Present
	<i>Idiosoma nigrum</i>	Endangered	Vulnerable	Not Present
Insecta	<i>Throscodectes xederoides</i>	P3	-	Not Present

3.3 SRE Habitat in Project Area

The vegetation units and condition mapping identified in the flora and vegetation assessment (360 Environmental 2019) were used to assess the Project Area for potential SRE habitat. The vegetation condition is Very Good to Completely Degraded, with minor cleared walking paths through the centre of the vegetated area. The vegetation mapping undertaken by 360 Environmental (2019) show that the Project Area is situated within a single vegetation type of York Gum Woodland (360 Environmental 2019, Figure 9). This habitat, once widespread and continuous in the region is now largely cleared due to agricultural use and remaining areas are highly fragmented.

3.4 Potential occurrence of SRE Invertebrates within the Desktop Study Area

A search of the WAM databases for potential SRE taxa occurring in the Desktop Study Area centred on the Project Area to the north of Moora was undertaken (Figure 1, WAM 2020a, b, c). The results of these were filtered for groups that potentially contain SRE species as shown in Table 4. Definitions for SRE status are found in Table 1. Results of the SRE survey of the North Kiaka mine site (Invertebrate Solutions 2019) were also included.

The Desktop Study Area contains four Confirmed SRE species; two trapdoor spiders, a brine shrimp and a land snail, and two Likely SRE species; a *Bothriembryon* land snail and a *Buddelundia* slater, and one Possible SRE species (one oliiid pseudoscorpion). The remainder of the species were found to be widespread.

Table 4 Desktop records from WAM of potential SRE Invertebrates in the Project Area

Higher Order	Genus and species	SRE Status and notes	Likelihood of occurrence within the Project Area
Gastropoda			
Heterobranchia:			
Bothriembryontidae	<i>Bothriembryon 'walebing' n.sp.</i>	Likely	High
	<i>Bothriembryon 'moora' n.sp.</i>	Confirmed	High
Crustacea:			
Diplostraca: Limnadiidae	<i>Paralimnadia hyposalina</i>	Confirmed	Very Low
Isopoda	<i>Buddelundia sp. '88'</i>	Likely	Low
Arachnida: Mygalomorphae			
Actinopodidae	<i>Missulena granulosa</i>	Widespread	-
	<i>Missulena hoggi</i>	Widespread	-
	<i>Missulena occatoria</i>	Widespread	-
Idiopidae	<i>Idiosoma dandaragan</i>	Confirmed/P2	Very High
Nemesiidae	<i>Aname mainae</i>	Widespread	-
	<i>Kwonkan wonganensis</i>	Confirmed	Low
Arachnida:			
Pseudoscorpiones:			
Chernetidae	<i>Troglochernes dewae</i>	Widespread	-
Olpiidae	<i>Genus indet.</i>	Possible (A)	- ¹
Arachnida: Scorpiones			
Buthidae	<i>Lychas 'splendens'</i>	Widespread	-
Urodacidae	<i>Urodacus armatus</i>	Widespread	-
	<i>Urodacus novaehollandiae</i>	Widespread	-
Chilopoda:			
Scolopendridae	<i>Cormocephalus aurantiipes</i>	Widespread	-
	<i>Cormocephalus turneri</i>	Widespread	-
	<i>Ethmostigmus rubripes</i>	Widespread	-
	<i>Scolopendra morsitans</i>	Widespread	-
Geophilida:			
Oryidae	<i>Orphnaeus brevilabiatus</i>	Widespread	-
Diplopoda:			
Paradoxosomatidae	<i>Antichiropus sp. 'moora'</i>	Confirmed	Moderate

¹All olpiid pseudoscorpions are considered Possible SRE species due to an incomplete taxonomic framework (refer section 4.1 for full details).

3.5 SRE Field Survey Results

The targeted field survey recorded no SRE or conservation significant invertebrates from the Project Area.

The Project Area was found to be disturbed from historical minor earth works in most areas (Plate 1) and further disturbed by rabbit diggings (Plate 2) that have degraded the potential habitat for SRE and conservation significant invertebrate species.



Plate 1 Previous ground disturbance within the Project area



Plate 2 Disturbance from rabbits was evident throughout much of the Project area

4. Discussion

4.1 SRE Invertebrate Assessment

The Desktop Study Area contains four Confirmed SRE species and two Likely SRE species:

- Two Confirmed SRE trapdoor spiders (*Idiosoma dandaragan* and *Kwonkan wonganensis*)
- A Confirmed SRE land snail *Bothriembryon `moora` n.sp.*
- A Confirmed SRE brine shrimp *Paralimnadia hyposalina*
- A Likely SRE land snail *Bothriembryon `walebing` n.sp.*
- A Likely SRE slater *Buddelundia sp. '88'*

The Desktop Study Area also contains one Possible SRE species (one olpiid pseudoscorpion) that is due to data deficiencies and taxonomic uncertainty. The remainder of the species were found to be widespread.

The Confirmed species *Idiosoma dandaragan* is also conservation significant and an additional three non SRE but conservation significant species possibly occur, or have habitat within the Desktop Study Area:

- Two brine shrimp (*Branchinella denticulate* [P3] and *Branchinella simplex* [P1])
- One water flea *Daphnia jollyi* (P1)
- One trapdoor spider *Idiosoma dandaragan* (P2)

These species are discussed in detail in section 4.1.1 – 4.1.4.

4.1.1 Gastropoda: Bothriembryontidae

Bothriembryon 'Moora' n. sp. – Confirmed SRE

The land snail specimen is known to occur in the northern Wheatbelt (Invertebrate Solutions 2019, Corey Whisson, Western Australian Museum, pers comm. March 2019). The taxa is a Confirmed SRE species, primarily due to the highly fragmented nature of the remnant vegetation in the region reducing available habitat and area of occurrence for the species. The taxa most likely occurs throughout all vegetated areas in the Northern Wheatbelt but was not recorded from the Project Area during the targeted field survey in March 2020. Therefore it is not anticipated to be subject to significant impact from the Project development.

Bothriembryon 'Walebing' n. sp. – Likely SRE

The land snail *Bothriembryon 'Walebing' n. sp.* identified during the desktop assessment is known from a single record near the locality of Walebing, less than 20 km to the east of the Project Area. It differs from *Bothriembryon 'Moora' n. sp.* recorded at North Kiaka (Invertebrate Solutions 2019) by the radial whorls across the shell (Corey Whisson, Western Australian Museum, pers comm. March 2019). The taxa is considered a Likely SRE species, primarily due to the highly fragmented nature of the remnant vegetation in the region reducing available habitat and area of occurrence for the species. This species was not recorded from the Project Area during the targeted field survey in

March 2020 and therefore is not anticipated to be subject to significant impact from the Project development.

4.1.2 Crustacea

Diplotrachea: Limnadiidae: *Paralimnadia hyposalina* – Confirmed SRE

This is a species of clam shrimp that occurs in salt and clay pans to the west of Comberdale (Timms 2016), that is located approximately 25 km to the north of the Project Area. This species is known only from a series of salt pans in this area, however, these will not to be the subject of any impacts from the development of the Project and thus no impacts are anticipated to occur to the endemic clam shrimp.

Isopoda: Armadillidae: *Buddelundia* sp. '88' – Likely SRE

The taxonomic framework of slaters in Australia is extremely poor, making assessment of SRE status for this fauna difficult. The armadillid isopods from the Australian genus *Buddelundia* are extremely diverse in arid Australia, with over 150 putative species identified in collections. These are primarily from Western Australia, but require taxonomic revision at a family level making the proper identification of species difficult (Dalens 1992; Judd and Perina 2013).

This species was collected from five sites at North Kiaka and match a single specimen collected approximately 150 km north of Moora at Koolanooka (Invertebrate Solutions 2019). These are the only records for *Buddelundia* sp. '88' and it is considered a Likely SRE, however, it is noted that due to a lack of collecting in the Wheatbelt it is likely that the taxon occurs elsewhere in remnant vegetation within the region (Invertebrate Solutions 2019). The species is considered to have a Low likelihood of occurrence when considering the disturbance to the site observed during the targeted field survey in March 2020, and therefore is not anticipated to be subject to significant impact from the Project development.

4.1.3 Arachnida: Mygalomorphae

Idiopidae: *Idiosoma dandaragan* – Confirmed SRE / Priority 2

Idiosoma dandaragan was formerly known by WAM code 'MYG477' is a member of the sigillate complex and has a restricted distribution along the eastern margin of the Dandaragan Plateau, from near New Norcia in the south, and north to at least the Watheroo National Park (Figure 1, Plate 3, Rix et al. 2018). *Idiosoma dandaragan* has a known extent of occurrence of approximately 1,230 km², however, the area of occupancy within that range is less than 500 km² at less than 10 severely fragmented sites (Rix et al. 2018). The distribution of *I. dandaragan* is closely adjacent to the north-western extent of the range of *I. nigrum* near New Norcia and Carani (Rix et al. 2018). Both *I. dandaragan* and *I. nigrum* have a strongly sclerotised abdomens, although they are easily separated by morphology and molecular data (Rix et al. 2018).

This species was not recorded from the Project Area during the targeted field survey in March 2020 and therefore is not anticipated to be subject to significant impact from the Project development.

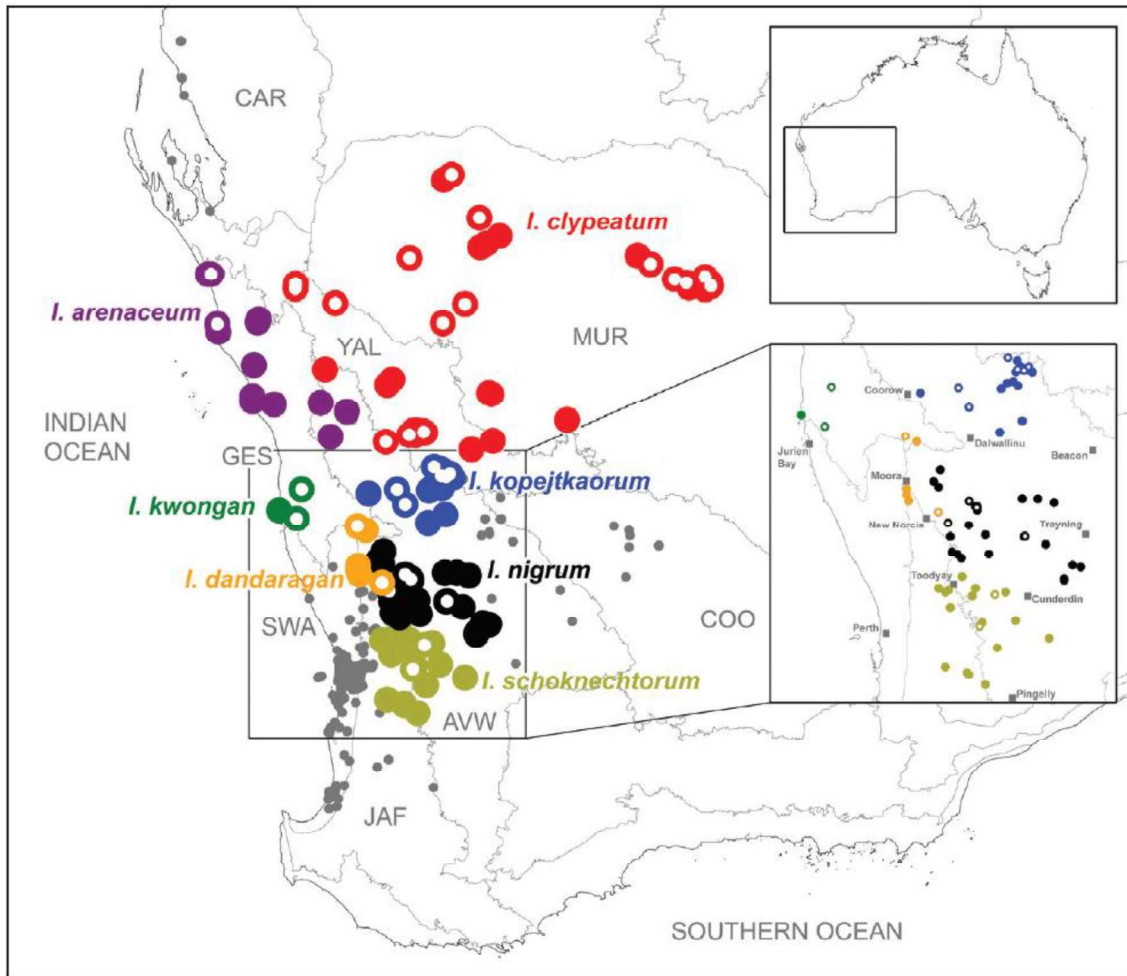


Plate 3 Distribution of *Idiosoma* spp in the Wheatbelt and pastoral regions of Western Australia (After Rix et al. 2018, Figure 374)

Nemesiidae: *Kwonkan wonganensis* – Confirmed SRE

This mygalomorph spider is known from the Wongan Hills Nature Reserve, some 60 km to the east of the Project Area (Main 1977, Invertebrate Solutions 2019). The species was described from adult female specimens only, whilst adult male specimens were recorded from North Kiaka. The specimens from Wongan Hills were dug from their distinctive burrows, made of small pebbles. Female mygalomorph spiders can only live in remnant vegetation that has limited fire regimes and are protected from grazing, so it is likely to be restricted to the vegetated rocky outcrop areas in the local region. This species was not recorded from the Project Area during the targeted field survey in March 2020 and therefore is not anticipated to be subject to significant impact from the Project development.

4.1.4 Diplopoda: Paradoxosomatidae

Antichiropus. ‘Moora’ n. sp.

Millipedes from the genus *Antichiropus* all have limited powers of dispersal and conservative ecological requirements (Car et al. 2013). In addition, the above-ground activity of most *Antichiropus*

species are limited to a very small window of opportunity when there is sufficient moisture for them to forage and mate during wetter winter months (Car et al. 2013). *Antichiropus* species are, consequently, short range endemics with very small distributions *sensu* Harvey 2002.

The millipede *Antichiropus* sp. 'Moora' was collected as dead specimens from two sites near the centre of the North Kiaka Project Area north of Moora (Invertebrate Solutions 2019) and was recorded from rocky vegetated areas. The precise habitat requirements for the species are unknown. This species was not recorded from the Project Area during the targeted field survey in March 2020 and therefore is not anticipated to be subject to significant impact from the Project development.

5. Conclusions and Recommendations

The Desktop Study Area contains four Confirmed SRE species and two Likely SRE species:

- Two Confirmed SRE trapdoor spiders (*Idiosoma dandaragan* and *Kwonkan wonganensis*)
- A Confirmed SRE land snail *Bothriembryon `moora` n.sp.*
- A Confirmed SRE brine shrimp *Paralimnadia hyposalina*
- A Likely SRE land snail *Bothriembryon `walebing` n.sp.*
- A Likely SRE slater *Buddelundia sp. '88'*

The remainder of the species were found to be widespread. The Confirmed species *Idiosoma dandaragan* is also conservation significant and an additional three non SRE, but conservation significant species possibly occur, or have habitat within the Desktop Study Area:

- Two brine shrimp (*Branchinella denticulate* [P3] and *Branchinella simplex* [P1])
- One water flea *Daphnia jollyi* (P1)
- One trapdoor spider *Idiosoma dandaragan* (P2)

The targeted SRE and conservation significant invertebrate survey undertaken on the entire Project Area on 10th March 2020 recorded no SRE or conservation significant invertebrates. The Project Area was found to be disturbed from minor earth works in most areas, and further disturbed by rabbit diggings that have degraded the potential habitat for SRE and conservation significant invertebrate species. No significant impacts to SRE or conservation significant invertebrates are anticipated to occur from the Project development and no further surveys are required to be undertaken to meet Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA 2016).

6. References

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- Western Australian Museum (WAM). (2020a). Arachnida and Myriapoda database search February 2020.
- Western Australian Museum (WAM). (2020b). Crustacea database search February 2020.
- Western Australian Museum (WAM). (2020c). Mollusc database search February 2020.

Appendix 1

DBCA Conservation Categories



CONSERVATION CODES

For Western Australian Flora and Fauna

Specially protected fauna or flora are species* which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected fauna and flora are:

T Threatened species

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act.

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR Critically endangered species

Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EN Endangered species

Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

VU Vulnerable species

Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EX Presumed extinct species

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.

IA Migratory birds protected under an international agreement

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.

CD Conservation dependent fauna

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

OS Other specially protected fauna

Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Appendix 2

Protected Matters Search Tool Results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 15/02/20 14:51:14

[Summary](#)

[Details](#)

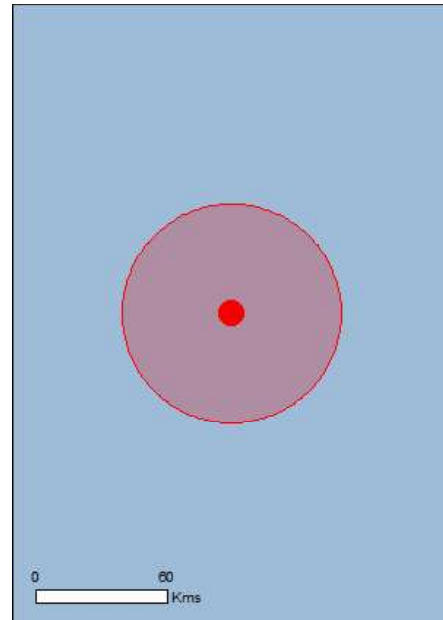
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 50.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	79
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	33
Regional Forest Agreements:	1
Invasive Species:	23
Nationally Important Wetlands:	None
Key Ecological Features (Marine):	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur within area
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding known to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence area
Phascogale calura Red-tailed Phascogale, Red-tailed Wambenger, Kenngoor [316]	Vulnerable	Species or species habitat likely to occur within area
Other		
Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat known to occur within area
Plants		
Acacia aprica Blunt Wattle [64821]	Endangered	Species or species habitat likely to occur within area
Acacia aristulata Watheroo Wattle [64822]	Endangered	Species or species habitat known to occur within area
Acacia ataxiphylla subsp. magna Large-fruited Tammin Wattle [64823]	Endangered	Species or species habitat may occur within area
Acacia cochlocarpa subsp. cochlocarpa Spiral-fruited Wattle [23877]	Endangered	Species or species habitat known to occur within area
Acacia cochlocarpa subsp. velutinosa Velvety Spiral Pod Wattle [65112]	Critically Endangered	Species or species habitat likely to occur within area
Acacia forrestiana Forest's Wattle [17235]	Vulnerable	Species or species habitat known to occur within area
Acacia splendens Splendid Wattle, Dandaragan Wattle [81510]	Endangered	Species or species habitat known to occur within area
Acacia vassalii Vassal's Wattle [6144]	Endangered	Species or species habitat known to occur within area
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area
Asterolasia nivea Bindoon Starbush [8225]	Vulnerable	Species or species habitat likely to occur within area
Banksia fuscobracteata Dark-bract Banksia [83059]	Critically Endangered	Species or species habitat known to occur within area
Banksia mimica Summer Honeypot [82765]	Endangered	Species or species habitat likely to occur within area
Banksia serratuloides subsp. perissa Northern Serrate Dryandra [82767]	Critically Endangered	Species or species habitat may occur within area
Banksia serratuloides subsp. serratuloides Southern Serrate Dryandra [82768]	Vulnerable	Species or species habitat known to occur within area
Caladenia drakeoides Hinged Dragon Orchid [68687]	Endangered	Species or species

Name	Status	Type of Presence
Chamelaucium sp. Cataby (G.J.Keighery 11009) Griffin's Waxflower [82509]	Vulnerable	habitat known to occur within area Species or species habitat known to occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat may occur within area
Chorizema humile Prostrate Flame Pea [32573]	Endangered	Species or species habitat known to occur within area
Conospermum densiflorum subsp. unicephalatum One-headed Smokebush [64871]	Endangered	Species or species habitat known to occur within area
Darwinia acerosa Fine-leaved Darwinia [9004]	Endangered	Species or species habitat known to occur within area
Darwinia carnea Mogumber Bell, Narrogin Bell [9736]	Endangered	Species or species habitat likely to occur within area
Dasymalla axillaris Native Foxglove [38829]	Critically Endangered	Species or species habitat likely to occur within area
Daviesia dielsii Diels' Daviesia [19617]	Endangered	Species or species habitat known to occur within area
Daviesia euphorbioides Wongan Cactus [3477]	Endangered	Species or species habitat may occur within area
Diplolaena andrewsii [6601]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
Eremophila glabra subsp. chlorella [84927]	Endangered	Species or species habitat known to occur within area
Eremophila pinnatifida Pinnate-leaf Eremophila [64894]	Endangered	Species or species habitat likely to occur within area
Eremophila scaberula Rough Emu Bush [16729]	Endangered	Species or species habitat known to occur within area
Eucalyptus absita Badgingarra Box [24260]	Endangered	Species or species habitat known to occur within area
Eucalyptus crispata Yandanooka Mallee [24268]	Vulnerable	Species or species habitat may occur within area
Eucalyptus dolorosa Dandaragan Mallee, Mount Misery Mallee [56709]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
Eucalyptus impensa Eneabba Mallee [56711]	Endangered	within area Species or species habitat may occur within area
Eucalyptus leprophloia Scaly Butt Mallee, Scaly-butt Mallee [56712]	Endangered	Species or species habitat may occur within area
Eucalyptus pruiniramis Midlands Gum, Jingymia Gum [56403]	Endangered	Species or species habitat known to occur within area
Eucalyptus recta Silver Mallet [56430]	Endangered	Species or species habitat known to occur within area
Eucalyptus rhodantha Rose Mallee [9362]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Frankenia conferta Silky Frankenia [6074]	Endangered	Species or species habitat may occur within area
Gastrolobium appressum Scale-leaf Poison [7358]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium hamulosum Hook-point Poison [9212]	Endangered	Species or species habitat known to occur within area
Glyceria drummondii Nangetty Grass [14008]	Endangered	Species or species habitat known to occur within area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat known to occur within area
Grevillea calliantha Foote's Grevillea, Cataby Grevillea, Black Magic Grevillea [56339]	Endangered	Species or species habitat known to occur within area
Grevillea christineae Christine's Grevillea [64520]	Endangered	Species or species habitat known to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Grevillea dryandroides subsp. hirsuta Hairy Phalanx Grevillea [64577]	Endangered	Species or species habitat may occur within area
Grevillea pythara Pythara Grevillea [64525]	Endangered	Species or species habitat may occur within area
Grevillea sp. Gillingarra (R.J.Cranfield 4087) [86383]	Critically Endangered	Species or species habitat known to occur within area
Hakea megalosperma Lesueur Hakea [10505]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Haloragis platycarpa Broad-fruited Haloragis [15371]	Critically Endangered	Species or species habitat likely to occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat known to occur within area
Hemiandra rutilans Sargents Snakebush, Colourful Snakebush [17932]	Endangered	Species or species habitat likely to occur within area
Jacksonia pungens Pungent Jacksonia [64920]	Endangered	Species or species habitat likely to occur within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Melaleuca sciotostyla Wongan Melaleuca [24324]	Endangered	Species or species habitat may occur within area
Paracaleana dixonii Sandplain Duck Orchid [86882]	Endangered	Species or species habitat likely to occur within area
Ptychosema pusillum Dwarf Pea [11268]	Vulnerable	Species or species habitat likely to occur within area
Roycea pycnophylloides Saltmat [21161]	Endangered	Species or species habitat likely to occur within area
Spirogardnera rubescens Spiral Bush [15667]	Endangered	Species or species habitat may occur within area
Synaphea quartzitica Quartz-loving Synaphea [64978]	Endangered	Species or species habitat known to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area
Thomasia sp. Green Hill (S.Paust 1322) Green Hill Thomasia [64542]	Endangered	Species or species habitat likely to occur within area
Verticordia staminosa subsp. staminosa Wongan Featherflower [55825]	Endangered	Species or species habitat may occur within area

Reptiles

Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
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Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlw Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Bundarra	WA
Dandarangan	WA
Gillingarra	WA
Gunyidi	WA
Jam Hill	WA
Karamarra	WA
Koodjee	WA
Lake Wannamal	WA
Long Pool	WA
Manaling	WA
Merewana	WA
Minyulo	WA
Mogumber	WA
Mogumber West	WA
Moochamulla	WA
NTWA Bushland covenant (0048)	WA
NTWA Bushland covenant (0057)	WA
NTWA Bushland covenant (0115)	WA
Namban	WA
Quins Hill	WA

Name	State
Unnamed WA23179	WA
Unnamed WA25591	WA
Unnamed WA28710	WA
Unnamed WA39322	WA
Unnamed WA39571	WA
Unnamed WA41042	WA
Unnamed WA43811	WA
Unnamed WA44081	WA
Unnamed WA45337	WA
Unnamed WA46899	WA
Unnamed WA47694	WA
Unnamed WA47808	WA
Watheroo	WA

Regional Forest Agreements [\[Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species

Name	Status	Type of Presence
Sus scrofa Pig [6]		habitat likely to occur within area Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.63667 116.00392

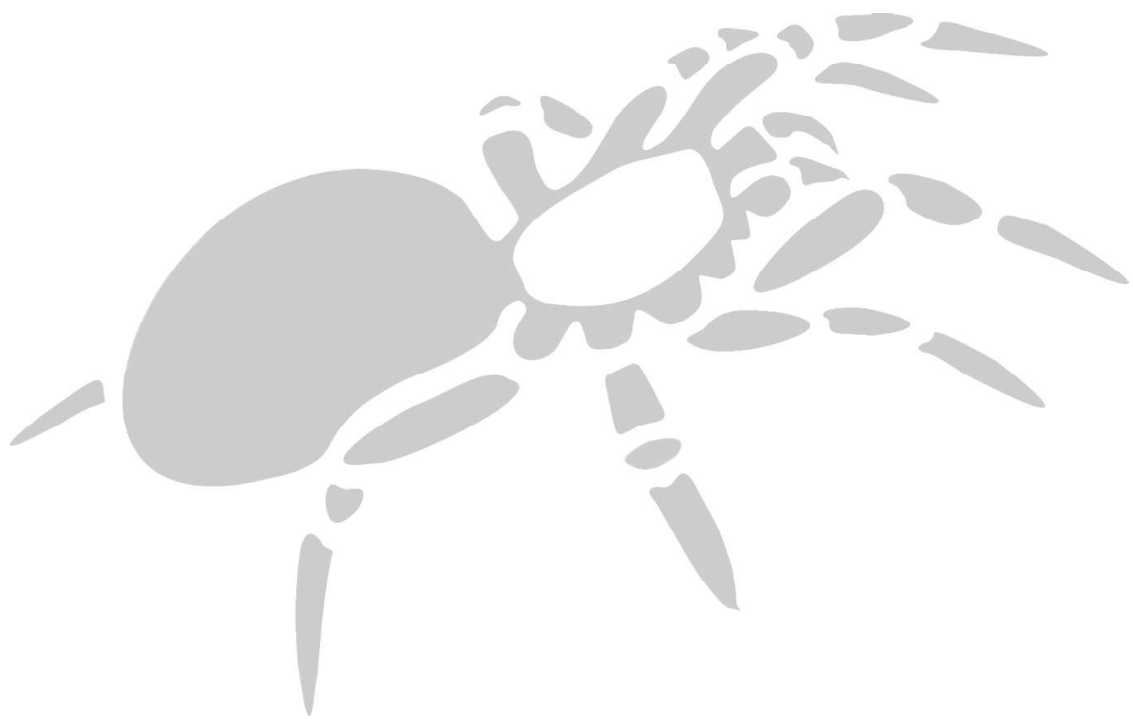
Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.



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