Appendix G

Short Range Endemic Invertebrate Survey (Invertebrate Solutions 2018)

Short Range Endemic invertebrate desktop assessment for Lot 102 Farrall Road, Midvale, Western Australia.

Report by Invertebrate Solutions for Emerge Associates Pty Ltd on Behalf of Peet Stratton Pty Ltd

March 2019

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Invertebrate Solutions. (2018). Short Range Endemic invertebrate desktop assessment for Lot 102 Farrall Rd, Midvale, Western Australia. Unpublished report to Emerge Associates on behalf of Peet Stratton Pty Ltd, March 2019.

Report Number 2018ISJ11_F01_20190304

Prepared for: Emerge Associates

Frontispiece: The tree cricket *Pachysaga munggai* from the Swan Coastal Plain

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Executive Summary

Peet Stratton Pty Ltd (Peet Stratton) proposes to develop Lot 102 Farrall Road, Midvale for urban uses as part of the wider Movida residential development and as broadly outlined in the Farrall Road Local Structure Plan. Due to the potential for impacts to the surface environment, including vegetation clearing and changes to surface hydrology and the potential for subsequent impacts to Short Range Endemic (SRE) invertebrates in the site, Emerge Associates (Emerge) on behalf of Peet Stratton has requested Invertebrate Solutions undertake a desktop review of SRE invertebrates and preliminary impact risk assessment for the proposed development.

The broader Desktop Study Area contains 11 Confirmed SRE species (four land snails, four mygalomorph trapdoor spiders, three groundwater amphipods, and one tree cricket), four Likely SRE species (two tree crickets, one mygalomorph trapdoor spider, and one millipede), and two Possible SRE species (one springtail and one midge). The remainder of the species were found to be widespread. Within Lot 102 Farrall Rd, Midvale, there are no Confirmed SRE species that have a High Likelihood of occurrence.

The only direct impact to SRE fauna is from vegetation clearing within Lot 102 Farrall Rd, Midvale that will directly remove habitat used by SRE species. Given the sites small size and that the majority of vegetation that is not degraded will be preserved and conserved the likely impact is considered Low and it is considered unlikely that the site would result in local extinction or significant impact to any SRE or conservation significant invertebrate species.

The indirect impact of the clearing of native vegetation causing fragmentation of the remaining vegetation may lead to the restriction of genetic flow for SRE species that have limited dispersal capabilities. As the majority of the vegetation that is usable by SRE invertebrates for habitat is being retained then this impact is Low. The incursion of weeds both during construction and following construction is considered to be the most important potential indirect impact to Lot 102 Farrall Rd, Midvale as it has the potential to degrade the *Melaleuca* dampland and *Banksia* woodland areas that are being retained under the LSP. Increased local weed incursion into native bushland can have a significant impact upon SRE species that rely on sometimes small microhabitats within the landscape. This has the potential to cause a Moderate impact to SRE fauna and is considered to be the most important indirect impact to SRE fauna. This impact can be managed through management and mitigation measures including general ongoing weed control. If not managed appropriately, increasing sedimentation and alteration of surface hydrology has the potential to affect SRE fauna such as mygalomorph spiders that live in burrows at ground level. Sedimentation can be managed by appropriate stormwater runoff design and during construction via management and mitigation measures.

The cumulative direct and indirect impacts at the regional scale of the Swan Coastal Plain are considered to be low due to the very small nature of the development, and that the majority of vegetation in Good to Very good condition is being retained and conserved. It is also highly likely that any SRE or conservation significant invertebrates that inhabit the site are also found in the nearly adjacent Talbot Rd Nature Reserve, or in the nearby John Forrest National Park.

The majority of other anticipated impacts are generally Low or able to be managed through standard construction environment management and mitigation measures.

The following recommendations are made with regard to the construction of the Project:

- If the currently proposed LSP (Emerge 2017) is adopted no surveys for terrestrial SRE invertebrates are required to meet the EPA Technical guidance, sampling of short range endemic invertebrate fauna (EPA 2016).
- Given the sites small size and that the majority of vegetation that is not degraded will be preserved and conserved the likely impact is considered Low and it is considered unlikely that the site would result in local extinction or significant impact to any SRE or conservation significant invertebrate species.
- Include appropriate management and mitigation measures to reduce and/or manage the risk of impacts to SREs from weed incursion and increased sedimentation during construction and operations.

1. Introduction

Peet Stratton Pty Ltd (Peet Stratton) proposes to develop Lot 102 Farrall Road, Midvale for urban uses as part of the wider Movida residential development and as broadly outlined in the Farrall Road Local Structure Plan.

Due to the potential impacts to the surface environment, including vegetation clearing and changes to surface hydrology and the potential for subsequent impacts to SRE invertebrates in the site, Emerge Associates (Emerge) on behalf of Peet Stratton has requested Invertebrate Solutions undertake a desktop review of SRE invertebrates and preliminary impact risk assessment for the proposed development.

1.1. Purpose of this report

Invertebrate Solutions has been requested by Emerge to undertake a desktop assessment for SRE invertebrates at Lot 102 Farrall Rd, Midvale and specifically address the following:

- Provide information about the about the suitable habitats for SRE invertebrates within Lot 102 Farrall Rd, Midvale and the immediately adjacent area.
- Provide a summary of the potential direct and indirect impacts to SRE invertebrate fauna as a result of the project.
- Provide an estimate of the number of significant species that are likely to be impacted, in the context of the existing population.
- Provide advice on any management and/or mitigation measures that could be implemented
- Identify any other gaps in the information.
- Provide recommendations and any suggested requirements for further work to comply with relevant legislation.
- Provide a written report containing the above items.

1.2. Desktop Study Area

The desktop study area for the desktop report is defined by a rectangle bounded by the northwest corner (-31.798265°S 115.925537°E) and the southeast corner (-31.977341°S 116.149682°E) and represents an approximately 20 km square centred on the site. The desktop study area boundary and the boundary of Lot 102 Farrall Rd, Midvale (the site) are shown in Figure 1.

1.3. Documents examined

The following documents have been examined in the compilation of this report, along with other referenced scientific papers used to provide general background:

- Emerge Associates (2017). Technical memorandum – Update to the flora and vegetation assessment, Lot 102 Farrall Rd, Midvale. Unpublished report to Peel Stratton Pty Ltd, 41p.

- Harwood (2014). Fauna assessment - miscellaneous Lots Farrall Road/Orchard Avenue Midvale. Unpublished report to Emerge Associates, 110p.

This report has been prepared with regard to the Technical Guidance – Sampling of short range endemic invertebrate fauna (EPA2016).

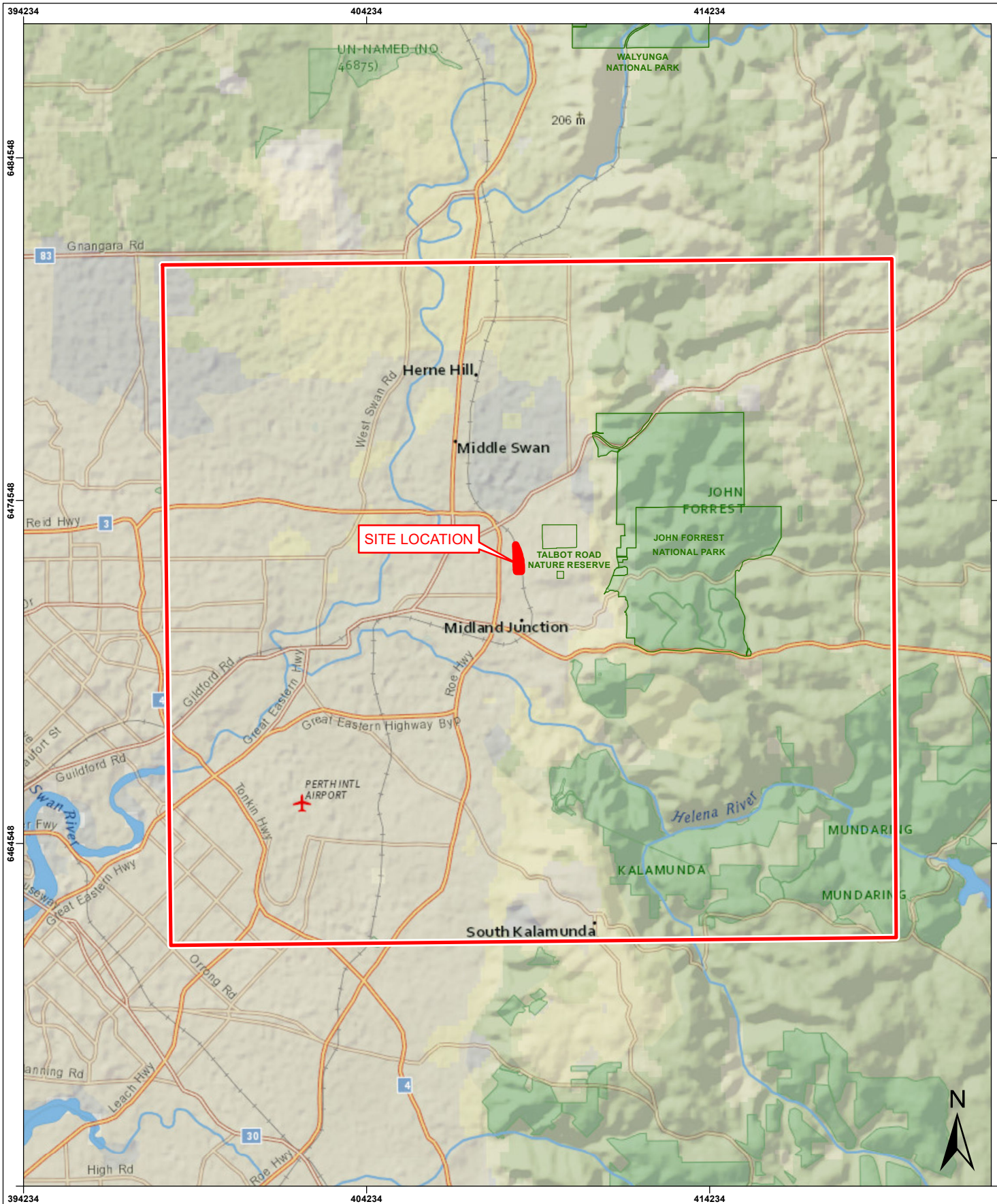
1.4. Introduction to SRE invertebrate fauna

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 km^2 (100 km x 100 km) (Harvey, 2002). Taxa that have been more commonly found to contain SRE invertebrate 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 Area

0 1 2 4
km

Scale: 1:150,000 @ A4

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

SOURCED ESRI NATGEO WORLD MAP

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PROJECT ID	DATE
LOT 102 FARRALL RD, MIDVALE	26/11/2018

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

Emerge Associates Pty Ltd

Figure 1

Desktop Study Area and Site Location, 102 Farrall Rd, Midvale

C:\GIS\Jobs\Invertebrate Solutions\Lot 102 Farrall Rd, Midvale\Figures\Lot102FarrallRdMidvale_F01 Desktop Study Area and Site Location_181126.mxd

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 new 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 Biodiversity Conservation Act, 2018. This notice is updated periodically by the Department of Biodiversity, Conservation and Attractions (DBCA) (formerly the Department of Parks and Wildlife (DPaW) and the current list (November 2018) includes numerous SRE species from the 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" (DPaW 2015). 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 Biodiversity Conservation Act now provides the ability for the state government of Western Australia to formally list Threatened Ecological Communities (TECs), along with threatening processes.

The federal EPBC Act protects both species and ecological communities. The most relevant listing for SRE fauna 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 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.

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 Emerge Associates 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.

Searches of the Western Australian Museum's database records may not return all species present in a search area as database records are sometimes incomplete, or missing. Invertebrate Solutions does not accept liability in connection with such omissions.

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.

1.7. Assumptions

Invertebrate Solutions has made the following assumptions in the writing of this report and its subsequent conclusions:

- The potential impacts identified and assessed in Section 4 and otherwise throughout this report are not necessarily exhaustive and may change with additional detail regarding the potential development.
- The current Farrall Rd Local Structure Plan (LSP) (2018) plans to retain the wetland/dampland area dominated by closed *Melaleuca preissiana* with emergent *Corymbia calophylla* over sparse shrubland over sedgeland, along with the remnant Banksia woodland in the southern portion of the site as these vegetation communities represent the highest value SRE habitat on the site.

2. Methods

The SRE invertebrate desktop review comprises of two distinct sections:

- An assessment of the likelihood that SRE invertebrate species are present in the habitats located within the site.
- Consideration of the potential impacts to SRE invertebrate species that may occur as a result of the development of the site.

2.1 Likelihood of SRE invertebrate occurrence

The likelihood of SRE invertebrate species occurring in the site 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 site.
- Results of a Protected Matters Search from the Federal Government's Department of the Environment and Energy (DEE) website.
- Records of fauna held by the WAM.

When considering the likelihood of SRE invertebrates at the local scale the Talbot Rd Nature Reserve was specifically investigated, whilst assessments at the regional scale included the entire Swan Coastal Plain.

Based on the analysis of all available information the site was assigned a level of likelihood to support SRE invertebrates of either 'Very Low', 'Low', 'Moderate', 'High', or 'Definite'.

Table 1 SRE species likelihood of occurrence definitions

SRE Species Likelihood of occurrence	Definition
Definite	The species is confirmed to occur within the site.
High	Habitat for the species is known to occur within the site and known records of the species are within 20 km.
Moderate	Habitat for the species is known to occur within the site and known records of the species are within 20 km.
Low	The species has been recorded from within 50 km, however, no habitat is present for the species within the site.
Very low	No habitat exists for the species within the site 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 site.

2.2 Short Range Endemic Status

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 2, based upon 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.

It should be noted that Table 5only WAM records from the Arachnida/Myriapoda, Crustacean and Mollusc databases are available to determine SRE status and does not include records of Insects as the WAM Insect database is unavailable for database searches. For insects to be determined as SREs, records from the *Atlas of Living Australia* (www.ala.org.au) were examined along with original literature where available.

Table 2 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. Potential SRE species may be assigned one of the sub categories below: 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

2.3 Potential Impacts to SRE invertebrates

The potential impacts of development on invertebrates may be categorised as:

- Direct impacts; and
- Indirect impacts.

Direct impacts are the obvious and unavoidable destruction or degradation of habitat, generally native vegetation that occurs due to clearing and earthworks (e.g. infrastructure areas etc.). Indirect

impacts are generally gradational, and more difficult to predict and manage because they may occur at moderate to large distances from the project footprint. These impacts may be expressed some time after development has begun.

The zone of influence for indirect impacts may be considerably larger than areas of direct impact. Potential indirect impacts of development include:

- Risk of extinction from reduction and/or fragmentation in habitat;
- Alteration of surface hydrology regimes, sedimentation, and water quality (e.g. under and proximal to roads and infrastructure);
- Habitat degradation due to weed incursion

The local structure plan encompassing the site was reviewed to assess the potential severity of impact to potential SRE habitats. In evaluating the relevance of these factors to the Project, consideration was given to the magnitude, duration and spatial extent of the impacts, where known. This assessment has taken the approach of considering these broad categories of potential impacts and evaluating their occurrence and relative severity. The impacts were then assigned a level of either 'Low', 'Moderate', or 'High' according to their potential degree to adversely affect the EPA's objective to maintain representation, diversity, viability and ecological function at the species, population and assemblage level for SRE fauna.

Where an impact is designated as 'Low' no further consideration to this factor is required if all assumptions made throughout this report are correct.

3. Desktop SRE invertebrate Review

3.1 SRE invertebrates of Swan Coastal Plain

The Swan Coastal Plain (SCP) has a limited occurrence of species considered to be short range endemics, however, due to urban sprawl and associated land clearance, much of the habitat that once occurred on the SCP has been lost or is now highly fragmented. The majority of the conservation significant terrestrial invertebrates on the SCP are insects, with native bees, Katydids (tree crickets) and the Graceful Sun-moth (*Synemon gratiosa*) being the most regularly encountered taxa. Many of these species are also considered SREs under the *sensu stricto* definition of Harvey (2002). In addition there are potential SRE species from the more traditional groups such as mygalomorph spiders, millipedes and land snails.

Idiosoma sigillatum is the dominant idiopid trapdoor spider on the SCP, where it occurs from Dalyellup north to at least Ledge Point (including Rottnest Island and Garden Island) with the eastern limit of its range along the sandy foothills of the Darling Escarpment, from Boyanup north to at least Gingin (refer WAM 2018b, Rix *et al.* 2018). Many of these records are historical in nature and occur within the Perth metropolitan area. It is highly likely that much of the habitat for this species within the Perth metropolitan area has been cleared for urban development and the species is unlikely to occur through much of its historical distribution in urban areas except in remnant habitats (e.g. Kings Park, Bold Park, and Shenton Park bushland) (Rix et al 2018).

Idiosoma sigillatum was assessed as Vulnerable according to IUCN criteria (Rix *et al.* 2017). It has a known range of 7,100 km^2, and an area of occupancy within that range of < 3,000 km^2 (Rix *et al.* 2017). It is considered to be locally extinct throughout most of its range due to extensive land clearing (Rix *et al.* 2018) and is currently classified by DBCA as a Priority 3 species.

Several other mygalomorph spiders that are Likely or Potential SRE species are also found on the SCP including the species from the family Barychelidae, *Synothele michaelseni* and *S. taurus and S. lowei* from the northern and north eastern SCP (Raven 1994). There are also several undescribed species of Nemesiid trapdoor spiders from the genus Teyl that occur within remnant bushland along the coastal fringe of the SCP that exhibit short range endemism (WAM 2018b).

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 whistleri* is a confirmed SRE species that occurs north of the Swan River, although much of its original habitat has now been cleared for urban development. There are a few disjunct records of the species near Cataby, although following a recent re-examination of these specimens by Dr Cathy Car it is likely that these records represent a distinct and different species (Dr Cathy Car, WAM pers. comm. 2018) and that *Antichiropus whistleri* is restricted to the northern fringe of the SCP. The genus is currently undoing a major revision and it is expected that this taxonomic issue will be resolved in the coming years.

The tree cricket *Throscodectes xiphos* is known only from its type locality in the southern Perth suburb of Jandakot where it was originally collected in the axial leaf bases of grass trees (X*anthorrhoea preissei*) and is a Confirmed SRE species and is currently classified by DBCA as a Priority 1 species (Rentz.1993).

Graceful Sun-moths (GSM) are diurnal, and active on warm bright sunny days with low wind. GSM are generally restricted to the SCP but has also been recorded from the Geraldton sandplains and is known from 49 locations (Bishop *et al.* 2010). Extensive survey and genetic work undertaken throughout the SCP between 2010 – 2013 eventually saw their removal from the WC Act and the EPBC fauna list, however due to their limited distribution, small populations and rarity in nature the GSM is listed on the DBCA Priority fauna listing (Priority 4).

Plate 1 The P4 listed Graceful Sun-moth from near Alkimos (After GHD 2011.).

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 2018 (DBCA 2018) and the DEE's Protected Matters Search Tool (PMST). SRE species that are listed under the WC 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 along with their conservation code. The PMST results listed no known SRE fauna within the site. A full description of the WC and DBCA conservation codes are shown in Appendix 1. The full list of species obtained from the PMST search is shown in Appendix 2.

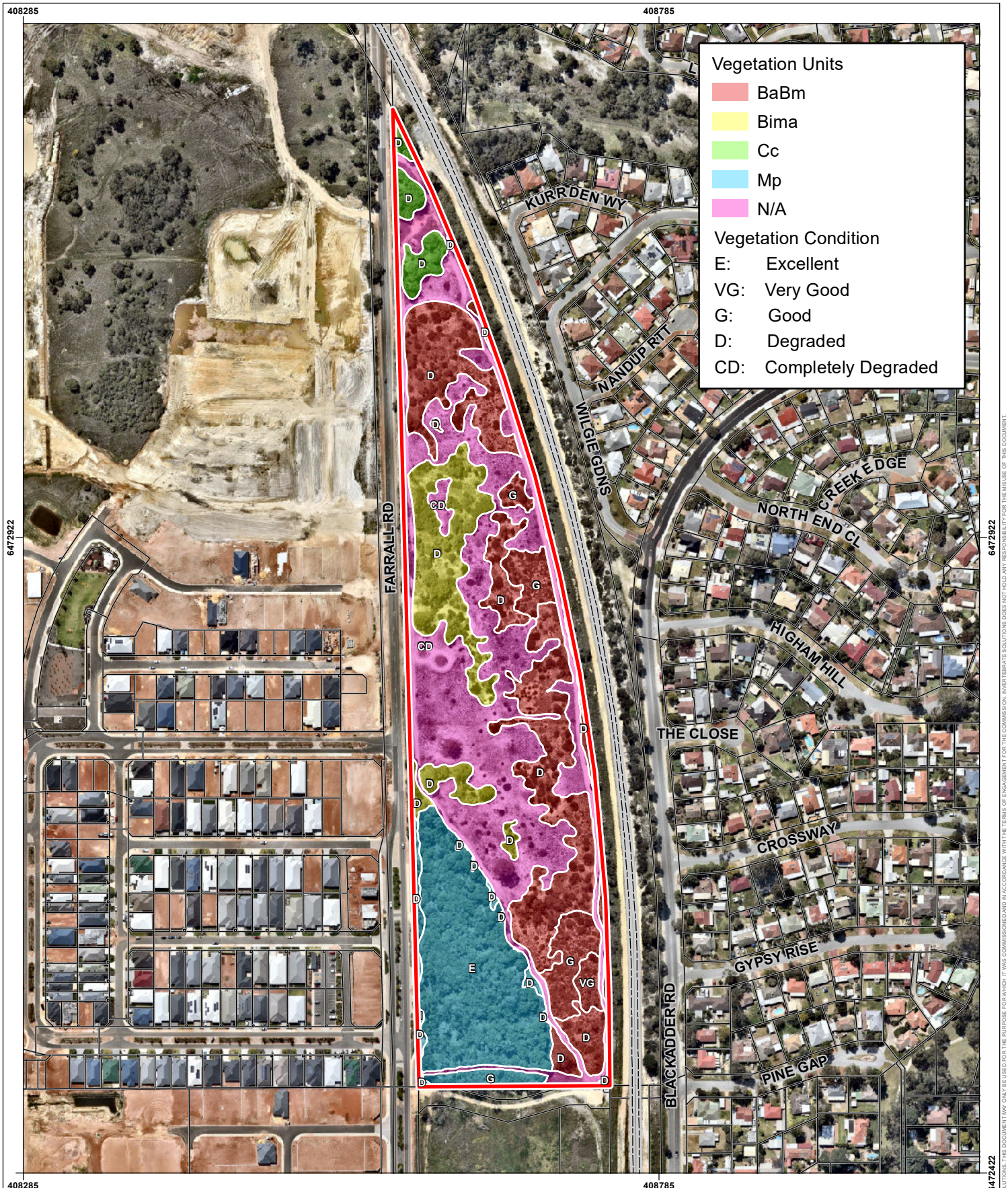
Table 3 Conservation significant SRE Invertebrates potentially within the Desktop Study Area.

Higher Classification	Genus and Species	DBCA/ BC Status	EPBC status
Arachnida: Mygalomorphae: Idiopidae	*Euoplos inornatus*	P3	-
Hexapoda: Collembola	*Australotomurus morbidus*	P3	-
Insecta: Orthoptera	*Austrosaga spinifer*	P2	-
	Pachysaga strobila	P1	-
	Throscodectes xederoides	P3	-
	Throscodectes xiphos	P1	-
Insecta: Diptera	*Austroconops mcmillani*	P2	-
Insecta: Lepidoptera	*Synemon gratiosa*	P4	-
Insecta: Hymenoptera	*Glossurocolletes bilobatus*	P2	-
	Hesperocolletes douglasi	CR / Schedule 1	-
	Hylaeus globuliferus	P3	-
	Leioproctus contrarius	P3	-
	Leioproctus douglasiellus	EN/ Schedule 2	Critically Endangered
	Neopasiphae simplicior	EN/ Schedule 2	Critically Endangered

3.3 SRE Habitat in Lot 102, Farrall Rd, Midvale

The vegetation units and condition mapping identified in the flora and vegetation assessment (Emerge 2017) were used to assess Lot 102 Farrall Rd, Midvale for potential SRE habitat. None of the habitats identified would provide habitat isolates that would be likely to contain SRE taxa within the limited extent of the site. The vegetation condition is largely degraded to completely degraded and offer little habit for SRE invertebrates except for the Melaleuca woodland/dampland (1.63 Ha) and the Banksia woodland (2.52 Ha) areas which are planned to be retained and protected as part of the Farrall Road Local Structure Plan (Emerge 2017).

Generally on the SCP native vegetation has a Low/Moderate likelihood of containing an SRE taxa (Invertebrate Solutions 2018), whilst on the Darling scarp the likelihood increases for high quality vegetation due to the presence of sheltered gullies, rocky granite outcrops and other potential habitat isolates and *refugia*. Although urban areas are broadly considered to have no suitability for SRE fauna, small remnant bushland patches can and do support SRE fauna within the Perth metropolitan area (Rix *et al.* 2018a).



Legend

- Desktop Study Area
- Cadastre
- Railway

0 25 50 100
metres
Scale: 1:4,000 @ A4
N

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY MAP

SOURCED IMAGERY - NEARMAPS, 25.09.18
CADASTRE - LANDGATE, 2018

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PROJECT ID	DATE
LOT 102 FARRALL RD, MIDVALE	14/11/2018

HORIZONTAL DATUM AND PROJECTION
GDA 1994 MGA Zone 50

CREATED	CHECKED	APPROVED	REVISION
ENVIRONMAPS	TM	TM	0

Emerge Associates Pty Ltd

Figure 2
Vegetation Units and Condition for Lot 102 Farrall Rd, Midvale

C:\GIS\Jobs\Invertebrate Solutions\Lot 102 Farrall Rd, Midvale\Figures\Lot102FarrallRdMidvale_F02 Vegetation units and condition for Lot 102 Farrall Rd, Midvale_181114.mxd

Table 4 Vegetation units in Lot 102 Farrall Rd, Midvale and SRE invertebrate habitat potential (after Emerge 2017).

Vegetation Unit (after Emerge 2017)	SRE Fauna Suitability	Area (Ha)
Mp - Woodland to low open forest of *Melaleuca preissiana*, with emergent Corymbia calophylla over sparse shrubland of *Astartea scoparia, Marianthus* sp., *Xanthorrhoea preissii* and *Acacia pulchella* over sedgeland to closed sedgeland of *Dielsia stenostachya* and Cyperaceae sp. and open forbland of *Corynotheca micrantha* subsp. *micrantha*, *Drosera* spp. and *Burchardia congesta*.	Moderate	1.63
Cc -Woodland of *Corymbia calophylla* over shrubland *Jacksonia* spp., *Adenanthos cygnorum* and **Leptospermum laevigatum* (or shrub layer absent) over closed forb/grassland of pasture weeds.	Low	0.22
Ba Bm - Sparse to open woodland of *Banksia attenuata and Banksia menziesii* over open shrubland to shrubland of *Adenanthos cygnorum* and *Allocasuarina humilis* over low sparse shrubland to shrubland of *Conostephium pendulum, Stirlingia latifolia* and *Hibbertia* spp. over forb and sedgeland of *Lyginia* spp., *Dasypogon bromeliifolius*, *Conostylis aculeata*, *Podotheca gnaphalioides* and forb/grassland of pasture weeds.	Moderate	2.52
Bima - Open woodland to woodland of *Banksia ilicifolia, B. menziesii* and *B. attenuata* over scrubland to tall open shrubland of *Adenanthos cygnorum* and *Stirlingia latifolia* over low open shrubland *Acacia huegelii* and *Hemiandra pungens* over open native herbland and grassland of pasture weeds such as **Ehrharta calycina*.	Low	0.85
PC - Sparse native and planted exotic trees over closed forb/grassland of pasture weeds	Low	3.08

3.4 Potential occurrence of SRE Invertebrates within the Desktop Study Area

A search was undertaken of the WAM databases for Crustaceans (WAM 2018a), Arachnids/Myriapods (WAM 2018b) and Molluscs (WAM 2018c). The searches were undertaken as an approximate 20 km x 20 km rectangle centred on Lot 102 Farrall Rd, Midvale bounded by the northwest corner (-31.798265°S 115.925537°E) and the southeast corner (-31.977341°S 116.149682°E). The results of these were filtered for groups that potentially contain SRE species as shown in Table 5 with Confirmed SRE species highlighted for ease of reference. Definitions for SRE status are found in Table 2.

Table 5 Potential SRE Invertebrates in WAM databases recorded from within the Desktop Study Area.

Higher Classification	Genus and Species	SRE status and Notes
Gastropoda		
Heterobranchia: Bothriembryontidae	*Bothriembryon* sp. 'Darling Range'	**Confirmed**
	Bothriembryon serpentinus	**Confirmed**
Pulmonata: Succineidae	*Succinea contenta*	**Confirmed**
Pulmonata: Charopidae	*Luinodiscus cf. sublesta*	**Confirmed**
Onychophora		
Peripatopsidae	*Occiperipatoides gilesii*	Widespread
Crustacea		
Decapoda: Parastacidae	*Cherax cainii*	Widespread
	Cherax preissii	Widespread
	Cherax quinquecarinatus	Widespread
	Cherax tenuimanus	Widespread
Amphipoda		
Paramelitidae	*Hurleya kalamundae*	**Confirmed (Stygofauna)**
	Uroctena affinis	**Confirmed (Stygofauna)**
	Uroctena westralis	**Confirmed (Stygofauna)**

Higher Classification	Genus and Species	SRE status and Notes
Isopoda		
Armadillidae	*Buddelundia opaca*	Widespread
	Armadillidium vulgare	Widespread
Oniscidae	*Hanoniscus tuberculatus*	Widespread
Porcellionidae	*Porcellio laevis*	Widespread
Arachnida: Aranaeomoprhae		
Selenopidae	*Karaops ellenae*	Widespread
	Karaops jarrit	Widespread
Araneae: Mygalomorphae		
Actinopodidae	*Missulena granulosa*	Widespread
	Missulena hoggi	Widespread
	Missulena occatoria	Widespread
Barychelidae	*Idiommata blackwalli*	Widespread
	Synothele durokoppin	Widespread
	Synothele michaelseni	Likely
Dipluridae	*Cethegus fugax*	Widespread
Idiopidae	*Bungulla harrisonae*	**Confirmed**
	Eucyrtops latior`	Widespread
	Euoplos inornatus	**Confirmed**
	Idiosoma jarrah	**Confirmed**
	Idiosoma sigillatum	**Confirmed**
	Idiosoma cupulifex	Widespread
	Idiosoma rhaphiduca	Widespread
Nemesiidae	*Aname mainae*	Widespread
	Aname tepperi	Widespread
Opiliones		
Triaenonychidae	*Nunciella aspera*	Widespread
Neopilionidae	*Ballarra longipalpus*	Widespread
	Megalopsalis tanisphyros	Widespread
Pseudoscorpionida		
Withiidae	*Withius piger*	Widespread
Scorpiones		
Bothriuridae	*Cercophonius granulosus*	Widespread
	Cercophonius squama	Widespread
	Cercophonius sulcatus	Widespread
Buthidae	*Isometroides vescus*	Widespread
Urodacidae	*Urodacus armatus*	Widespread
	Urodacus novaehollandiae	Widespread
	Urodacus planimanus	Widespread
Diplopoda		
Iulomorphidae	*Dinocambala ingens*	Likely
Julidae	*Ommatoiulus moreletti*	Widespread
	Cylindroiulus latestriatus	Widespread
Paradoxosomatidae	*Antichiropus variabilis*	Widespread
	Oxidus gracilis	Widespread
	Akamptogonus novarae	Widespread
Polyxenidae	Phryssonotus novaehollandiae	Widespread
Chilopoda		
Geophilida: Oryidae	*Orphnaeus brevilabiatus*	Widespread
Lithobiida: Henicopidae	*Henicops dentatus*	Widespread
Scolopendrida: Scolopendridae	*Cormocephalus aurantiipes*	Widespread

Higher Classification	Genus and Species	SRE status and Notes
	Cormocephalus novaehollandiae	Widespread
	Cormocephalus rubriceps	Widespread
	Cormocephalus strigosus	Widespread
	Cormocephalus turneri	Widespread
	Notiasemus glauerti	Widespread
	Scolopendra laeta	Widespread
Scutigerida: Scutigeridae	*Allothereua maculata*	Widespread

The Desktop Study Area contains 11 Confirmed SRE species (four land snails, four mygalomorph trapdoor spiders, three groundwater amphipods, and one tree cricket), four Likely SRE species (two tree crickets, one mygalomorph trapdoor spider, and one millipede), and two Possible SRE species (one springtail and one midge). The remainder of the species were found to be widespread.

Within Lot 102 Farrall Rd, Midvale, there are no Confirmed SRE species that have a High Likelihood of occurrence (Table 6). All Confirmed and Likely SRE species are considered in depth in Sections 3.5. Other non SRE but conservation significant invertebrates that have potential habitat present within the site are discussed in Section 3.7.

Table 6 SRE and conservation significant taxa within Lot 102 Farrall Rd, Midvale

Higher Classification	Genus and Species	SRE status	Likely habitat present within Lot 102 Farrall Rd, Midvale	Likelihood of species within Lot 102 Farrall Rd, Midvale
Gastropoda				
Heterobranchia: Bothriembryontidae	*Bothriembryon serpentinus*	**Confirmed**	**Not present**	**Low**
	Bothriembryon sp. 'Darlign Range'	**Confirmed**	**Not present**	**Low**
Pulmonata: Charopidae	*Luinodiscus cf. sublesta*	**Confirmed**	**Not present**	**Low**
Pulmonata: Succineidae	*Succinea contenta*	**Confirmed**	**Not present**	**Low**
Crustacea				
Amphipoda Paramelitidae	*Hurleya kalamundae*	**Confirmed**	**Not present**	**Very Low**
	Uroctena affinis	**Confirmed**	**Not present**	**Very Low**
	Uroctena westralis	**Confirmed**	**Not present**	**Very Low**
Arachnida				
Araneae: Mygalomorphae				
Barychelidae	*Synothele michaelseni*	**Likely**	**Present**	**High**
Idiopidae	*Bungulla harrisonae*	**Confirmed**	**Not present**	**Low**
	Euoplos inornatus	**Confirmed**	**Not present**	**Low**
	Idiosoma jarrah	**Confirmed**	**Not present**	**Very Low**
	Idiosoma sigillatum	**Confirmed**	**Present**	**Moderate**
Diplopoda				
Iulomorphidae	*Dinocambala ingens*	**Likely**	**Not present**	**Low**
Hexapoda				
Collembola	*Australotomurus morbidus*	**Possible (A)**	**Not present**	**Low**

Higher Classification	Genus and Species	SRE status	Likely habitat present within Lot 102 Farrall Rd, Midvale	Likelihood of species within Lot 102 Farrall Rd, Midvale
Insecta				
Orthoptera	*Austrosaga spinifer*	**Likely**	**Present**	**High**
	Pachysaga strobila	**Likely**	**Not present**	**Very low**
	Throscodectes xiphos	**Confirmed**	**Present**	**Very low**
Diptera	*Austroconops mcmillani*	**Possible (A)**	**Not present**	**Very Low**
Lepidoptera	*Synemon gratiosa*	**Widespread**	**Not present**	**Low**
Hymenoptera	*Hesperocolletes douglasi*	**Possible (A)**	**Unknown**	**Low**
	Hylaeus globuliferus	**Widespread**	**Present**	**Moderate**
	Leioproctus contrarius	**Widespread**	**Present**	**Moderate**
	Leioproctus douglasiellus	**Widespread**	**Not Present**	**Very Low**
	Neopasiphae simplicior	**Widespread**	**Not present**	**Low**

3.5 Confirmed SRE species with potential habitat in Lot 102 Farrall Rd, Midvale

3.5.1 Gastropoda

Bothriembryon sp. 'Darling Ranges n. sp.'

The land snail *Bothriembryon* sp. 'Darling Ranges n. sp.' occurs on the Darling Scarp at Red Hill, Greenmount and Mundering Wier and south to from Perth to near Dwellingup (refer (refer WAM 2018c). The species occurs in the very south eastern extremity of the desktop Study Area and has a Low probability of occurring within Lot 102 Farrall Rd, Midvale. There no records of this species in the vicinity of Lot 102 and hence no impacts are expected to this species as a result of the development to Lot 102 Farrall Rd, Midvale.

Bothriembryon serpentinus

The land snail *Bothriembryon serpentinus* occurs on the Darling Scarp from Perth south to near Dwellingup (refer (refer WAM 2018c). There are no records of the species from within or adjacent to Lot 102 Farrall Rd, Midvale. The species occurs in the very south eastern extremity of the desktop Study Area and has a Low probability of occurring within Lot 102 Farrall Rd, Midvale as it restricted to the slopes of the scarp and the hills. There no records of this species in the vicinity of Lot 102 and hence no impacts are expected to this species as a result of the development to Lot 102 Farrall Rd, Midvale.

Luinodiscus cf. sublesta

The land snail *Luinodiscus cf. sublesta* is similar to *Luinodiscus sublesta* that historically occurred in Perth's western suburbs, with an easterly limit of Kings Park (WAM 2018c, ALA 2018). The species occurs within the Perth Hills from Marradong, near Boddington north to Paulls Valley Near Mundering Wier but is not found on the SCP (WAM 2018c). The species occurs in the very south eastern extremity of the desktop Study Area and has a Low probability of occurring within Lot 102

Farrall Rd, Midvale. There no records of this species in the vicinity of Lot 102 and hence no impacts are expected to this species as a result of the development to Lot 102 Farrall Rd, Midvale.

Succinea contenta

The land snail *Succinea contenta* occurred historically on Rottnest Island, remnant bushland in the western Perth metropolitan area and on the Darling Scarp at Red Hill near John Forrest National Park (refer WAM 2018c). It has not been collected since 1969 in its original distribution and is unlikely to persist within the SCP. There are no records of the species from within or adjacent to Lot 102 Farrall Rd, Midvale. The species has a Low probability of occurring within the degraded and highly degraded portions of Lot 102 Farrall Rd, Midvale that are planned to be developed, and due to records immediately adjacent to John Forrest National Park it is anticipated that the species will also occur in this conservation estate and hence no significant impacts are expected to this species as a result of the development under the current LSP to Lot 102 Farrall Rd, Midvale.

3.5.2 Crustacea: Amphipoda:

Paramelitidae (Stygofauna spp.)

Three species of Paramelitid amphipods known from single locations in the Darling and Kalamunda region were recorded from the WAM Crustacean database (Chilton 1925, Straškraba 1966, Williams and Barnard 1988, WAM 2018a). These are groundwater dependent (known as stygofauna) and outside of the scope of this desktop review. It should, however, be noted that none of these species are recorded from the Swan Coastal Plain and all occur within aquifers on the Darling Scarp and hence no impacts are expected to this species as a result of the development to Lot 102 Farrall Rd, Midvale.

3.5.3 Araneae: Mygalomorphae

Bungulla harrisonae

Bungulla harrisonae is an extremely rare species known only from a single locality within John Forrest National Park, in the northern jarrah forest due east of Perth (Rix et al 2018b). Little is known of the biology of this species (Rix et al 2018b). The species has a Very Low probability of occurring within Lot 102 Farrall Rd, Midvale and due to its presence within John Forrest National Park it is anticipated no impacts are expected to this species as a result of the development to Lot 102 Farrall Rd, Midvale.

Euoplos inornatus

The trapdoor spider *Euoplos inornatus* is restricted to relatively mesic, often riparian habitats in the Northern Jarrah forests of the western Darling Range, east of the Swan Coastal Plain. There are two outlying populations on the Swan Coastal Plain at Kings Park (Mt Eliza) and on the Mount Henry Peninsula. (Rix et al 2017 WAM 2018b). There are no records of the species from within or adjacent to Lot 102 Farrall Rd, Midvale. The species has a Very Low probability of occurring within Lot 102 Farrall Rd, Midvale and due to records immediately adjacent to John Forrest National Park it is anticipated that the species will also occur in this conservation estate and hence no impacts are expected to this species as a result of the development to Lot 102 Farrall Rd, Midvale.

Idiosoma jarrah

The trapdoor spider *Idiosoma jarrah* is endemic to the Jarrah Forest bioregion, where it occurs east of the Darling Escarpment, from Bullsbrook south to at least Boddington and Arthur River (refer WAM 2018b, Rix *et al.* 2018a). There are no records of the species from within or adjacent to Lot 102 Farrall Rd, Midvale. *Idiosoma jarrah* has a known range of 3,907 km^2,making the species a short range endemic accordingly to the definition by Harvey (2002), although the known range is likely to be an underestimate due to the paucity of records throughout the south of its range (Rix *et al.* 2018a). *Idiosoma jarrah* is known to occur in at least two conservation estates; Walyunga National Park and John Forrest National Park. This species has a Very Low probability of occurring within Lot 102 Farrall Rd, Midvale as its distribution is reasonably well known and restricted to the Jarrah forest bioregion and as such there is expected to be no impact to *Idiosoma jarrah* from the development to the site.

Idiosoma sigillatum

Idiosoma sigillatum is the dominant idiopid trapdoor spider on the Swan Coastal Plain, where it occurs from Dalyellup north to at least Ledge Point (including Rottnest Island and Garden Island) with the eastern limit of its range along the sandy foothills of the Darling Escarpment, from Boyanup north to at least Gingin (refer (refer WAM 2018b, Rix *et al.* 2018a). Many of these records are historical in nature and occur within the Perth metropolitan area. It is highly likely that much of the habitat for this species within the Perth metropolitan area has been cleared for urban development and the species is unlikely to occur through much of its historical distribution in urban areas except in remnant habitats (e.g. Kings Park, Bold Park, and Shenton Park bushland) (Rix et al 2018a).

Idiosoma sigillatum was assessed as Vulnerable according to IUCN criteria (Rix *et al.* 2017). It has a known range of 7,100 km^2, and an area of occupancy within that range of < 3,000 km^2 (Rix *et al.* 2017). It is considered to be locally extinct throughout most of its range due to extensive land clearing (Rix *et al.* 2018a).

Burrows of *Idiosoma sigillatum* usually occur in Banksia woodland and heathland on sandy soils (Rix *et al.* 2018a) such as within areas of Lot 102 Farrall Rd, Midvale, and the adjacent Talbot Rd Nature Reserve, giving the species a High probability of occurring within Lot 102 Farrall Rd, Midvale. Given the that much of the vegetation within Lot 102 Farrall Rd, Midvale is degraded to highly degraded the species has a Low probability of occurring within the portions of Lot 102 that are planned to be developed.

3.5.4 Insecta: Orthoptera

Throscodectes xiphos

The tree cricket *Throscodectes xiphos* is known only from its type locality in the southern Perth suburb of Jandakot where it was originally collected in the axial leaf bases of grass trees (X*anthorrhoea preissei*). There are no records of the species from within or adjacent to Lot 102 Farrall Rd, Midvale. The species is currently classified by DBCA as Priority 1 (refer Table 3). It has not been recorded from within Lot 102 Farrall Rd, Midvale, although suitable (degraded) habitat does occur (refer Table 4). It is not anticipated that *Throscodectes xiphos* will be impacted by the development to Lot 102 Farrall Rd, Midvale as no other records of this species have historically been recorded within the Desktop Study Area (Table 6).

3.6 Likely SRE species with potential habitat in Lot 102 Farrall Rd, Midvale

3.6.1 Diplopoda: Iulomorphidae

Dinocambala ingens

The millipede *Dinocambala ingens* occurs mainly east of the Darling Scarp and adjacent jarrah forests, although its historical distribution does encompass some central Perth suburbs and Garden Island (refer WAM 2018b). There are no records of the species from within or adjacent to Lot 102 Farrall Rd, Midvale. There are numerous records of this species from conservation areas on the Darling Scarp including John Forrest and Walyunga National Parks. The species has a Low probability of occurring within Lot 102 Farrall Rd, Midvale and hence no impacts are expected to this species as a result of the development to the site.

3.6.2 Araneae: Mygalomorphae

Synothele michaelseni

The trapdoor spider *Synothele michaelseni* occurs on the SCP from Bibra Lake to near Hillarys Boat Harbour and on the Darling Scarp from Serpentine to north of Bindoon (refer WAM 2018b). There are no records of the species from within or adjacent to Lot 102 Farrall Rd, Midvale, with the closest record being John Forrest National Park. Many of these records are historical in nature and occur within the Perth metropolitan area. It is highly likely that much of the habitat for this species within the Perth metropolitan area has been cleared for urban development and the species is unlikely to occur through much of its historical distribution in urban areas except in remnant habitats.

Burrows of *Synothele michaelseni* occur in a variety of habitats on the Swan Coastal Plain and the Darling Scarp including Banksia woodland and heathland on sandy soils (Raven 1994) such as within areas of Lot 102 Farrall Rd, Midvale, and the adjacent Talbot Rd Nature Reserve, giving the species a High probability of occurring within Lot 102 Farrall Rd, Midvale. Given the that much of the vegetation within Lot 102 Farrall Rd, Midvale is degraded to highly degraded the species has a Low probability of occurring within the portions of Lot 102 that are planned to be developed.

3.6.3 Insecta: Orthoptera

Pachysaga strobila

The orthopteran family Tettigoniidae are commonly known as Katydids inhabit tree and shrubs and can be found mostly in the southern half of Australia in heath or mixed woodland and often host plant species or genus specific (Rentz 1993). The *Vasse* Pachysaga occurs as the name suggests near the townsite of Vasse in the far south west and is listed by DBCA as a Priority 1 species in Western Australia. The species has a Very Low probability of occurring within Lot 102 Farrall Rd, Midvale and hence no impacts are expected to this species as a result of the development to the site.

3.7 Non SRE Conservation Significant Insects with potential habitat in Lot 102 Farrall Rd, Midvale.

Orthoptera: Austrosaga spinifer

Very few records exist for this spiny tree cricket, but it has been recorded from Boya only 5 km from Lot 102, Farrall Rd, Midvale. The species is known to hide in shrubs and sing at night (Rent 1993). The absence of other habitat data and the close proximity of a record of this species would suggest that *A. spinifer* has High likelihood of being present on site, but only within the higher quality vegetation that is currently planned to be retained and protected under the LSP (Emerge 2017). It would also be expected that if *A. spinifer* is present on Lot 102, Farrall Rd, then it would also be present within the nearly adjacent Talbot Rd Nature Reserve and also John Forrest National Park. It is therefore anticipated that no significant impacts will occur to any *A. spinifer* that may be present from the development of the site.

Hymenoptera: Hesperocolletes douglasi

This enigmatic native bee was previously known only from Rottnest Island where it was presumed extinct until 2015 when an extant specimen was recorded from near Pinjar on the northern SCP during a general insect research project (Houston 2018, WA Government, 2018). Very little is known of this species including any floristic associations and hence whilst it is difficult to completely exclude the species as being present on the site, it would be anticipated that due to the generally degraded nature of much of the site and if the proposed LSP for Farrall Rd is implemented then no impacts to this species are anticipated. It is also likely that any potential habitat on the site that could be used by *Hesperocolletes douglasi* would also be present and in better condition in the almost adjacent Talbot Rd Nature Reserve.

Hymenoptera: Hylaeus globuliferus

This native bee has distribution in Western Australia from north of Eneabba, through the southern Wheatbelt and the SCP, and east along the south coast to the Fitzgerald National Park (ALA 2018). All available records from the SCP are historical in nature and its current status in the Perth metropolitan area is unknown. *Hylaeus globuliferus* is known to be associated with *Adenanthos cygnorum* and *Banksia attenuata* amongst other native plants (Houston 2018) that are both present within the site (Emerge 2017). It is therefore Moderately likely to occur on the site due to the presence of its associated plants, however, due to the absence of any recent records within the desktop study area it is considered that the implementation of the Farrall Rd LSP will not significantly impact upon the species.

Hymenoptera: Leioproctus contrarius

Limited potential habitat for the native bee *Leioproctus contrarius* is present (*Scaevola sp repens* var. *repens*) in the local area (Tauss and associates 2016, in Emerge 2017), where the species was found on an adjacent lot but not on Lot 102, Farrall Rd. Furthermore, the association of *L. contrarius* is only confirmed to *Scaevola* sp rather than a specific species (Houston 2000). The species is more commonly associated with *Lechenaultia* (Houston 2018) which is not present on the site (Emegre 2017).It is therefore a low probability that *Leioproctus contrarius* is present within the degraded to highly degraded areas of Lot 102 Farrall Rd, that are currently planned to be developed under the LSP (Emerge 2017) and so no significant impacts are anticipated to occur to this species.

4. SRE preliminary impact assessment

This preliminary impact assessment is based primarily upon the Farrall Rd Local Structure Plan (Emerge 2017). The main components of the overall project consist of the following:

Plate 2 Draft Farrall Road Structure Plan showing areas of native vegetation to be preserved within Lot 102.

4.1 Local impacts during construction

The potential impacts to SRE fauna within Lot 102 Farrall Rd, Midvale are summarised in Table 7 and Table 8. The assessment of the impact to SRE fauna at both the local and regional (SCP) scale from each disturbance mechanism takes into account both the likelihood of the impact occurring, its duration and severity, the potential consequence to SRE fauna and the likelihood of SRE fauna being present.

4.1.1 Direct impacts

The only direct impact to SRE fauna is from vegetation clearing within Lot 102 Farrall Rd, Midvale that will directly remove habitat used by SRE species. Given the sites small size and that the majority of vegetation that is not degraded will be preserved and conserved the likely impact is considered Low and it is considered unlikely that the site would result in local extinction of any SRE species.

Table 7 Risk of direct impact to SRE invertebrates from the development of Lot 102 Farrall Rd, Midvale.

Direct disturbance mechanism	Likelihood of impact occurring	Potential of Impact to SRE Fauna locally	Potential of Impact to SRE Fauna Regionally (SCP)
Vegetation clearing directly removing and/or disturbing SRE habitat	**Low**	**Low**	**Low**

4.1.2 Indirect impacts

The indirect impact of the clearing of native vegetation causing fragmentation of the remaining vegetation may lead to the restriction of genetic flow for SRE species that have limited dispersal capabilities. As the majority of the vegetation that is usable by SRE invertebrates for habitat is being retained then this impact is Low. The incursion of weeds both during construction and following construction is considered to be the most important potential indirect impact to Lot 102 Farrall Rd, Midvale as it has the potential to degrade the *Melaleuca* dampland and *Banksia* woodland areas (refer Figure 2) that are being retained under the LSP. Increased local weed incursion into native bushland can have a significant impact upon SRE species that rely on sometimes small microhabitats within the landscape. This has the potential to cause a Moderate impact to SRE fauna and is considered to be the second most significant indirect impact to SRE fauna. This impact can be managed through management and mitigation measures including general ongoing weed control.

Table 8 Risk of indirect impact to SRE invertebrates from the development of Lot 102 Farrall Rd, Midvale

Indirect disturbance mechanism	Likelihood of impact occurring	Potential of Impact to SRE Fauna locally	Potential of Impact to SRE Fauna Regionally (SCP)
Habitat fragmentation and genetic isolation due to vegetation clearing and construction works	**Low**	**Low**	**Low**
Weed incursion during and following construction works	**Moderate**	**Low/Moderate**	**Low**
Alteration of surface hydrology and increased sedimentation during and post construction	**Moderate**	**Low**	**Low**

Indirect disturbance mechanism	Likelihood of impact occurring	Potential of Impact to SRE Fauna locally	Potential of Impact to SRE Fauna Regionally (SCP)
works			
Hydrocarbon spills during construction and/or operations	**Low**	**Moderate**	**Low**
Vibration disturbance from construction activities	**Low**	**Low**	**Low**
Noise during construction works	**Low**	**Low**	**Low**

If not managed appropriately, increasing sedimentation and alteration of surface hydrology has the potential to affect SRE fauna such as mygalomorph spiders that live in burrows at ground level. Sedimentation can be managed by appropriate stormwater runoff design and during construction via management and mitigation measures.

Contamination of surface and groundwater during construction and operations may also impact upon SRE habitat, but risks of contamination can be minimised by employing management and mitigation measures to minimise and prevent contamination. The potential for contamination during construction is limited to isolated areas of chemical storage and small quantities of hydrocarbons where machinery or generators are working. Risks can be minimised by measures included in a construction environment management plan (CEMP). Where management measures are implemented, the risk of hydrocarbon contamination to SRE species and habitat is anticipated to be Low, however, should a major spill occur and not adequately contained and remediated, then the impacts would be significant.

Vibration and noise from the construction is expected to be minimal, especially considering the proximity to the existing rail line. These impacts are considered to be Low.

4.2 Regional significance and cumulative impacts

At a regional scale across the SCP the direct and indirect impacts are generally considered to be low due to the very small nature of the development, and that the majority of vegetation in Good to Very good condition is being retained and conserved. It is also highly likely that any SRE or conservation significant invertebrates that inhabit the site are also found in the nearly adjacent Talbot Rd Nature Reserve, or in the nearby John Forrest National Park. Fragmentation is substantially mitigated through the vegetation that will be retained as part of the LSP for Farrall Rd and the remaining vegetation within the adjacent rail corridor that maintains a link with the Talbot Rd Nature Reserve. Other anticipated impacts including altering local hydrology are considered to be insignificant in the scale of the northern SCP.

Cumulative impacts on the SCP will be low, albeit marginally increasing fragmentation on the urban fringe (Table 8). The primary cumulative impact from the development of Lot 102 Farrall Rd is land clearance. It is anticipated that the site will not add significantly to the cumulative impacts to SRE fauna in the local area, especially since none of the habitats identified would provide habitat isolates that would be likely to contain SRE taxa within the limited extent of Lot 102 Farrall Rd, Midvale.

5. Conclusions and Recommendations

The Desktop Study Area contains 11 Confirmed SRE species (four land snails, four mygalomorph trapdoor spiders, three groundwater amphipods, and one tree cricket), four Likely SRE species (two tree crickets, one mygalomorph trapdoor spider, and one millipede), and two Possible SRE species (one springtail and one midge). The remainder of the species were found to be widespread. Within Lot 102 Farrall Rd, Midvale, there are no Confirmed SRE species that have a High Likelihood of occurrence (Table 6).

The only direct impact to SRE fauna is from vegetation clearing within Lot 102 Farrall Rd, Midvale that will directly remove habitat used by SRE species. Given the sites small size and that the majority of vegetation that is not degraded will be preserved and conserved the likely impact is considered Low and it is considered unlikely that the site would result in local extinction or significant impact to any SRE or conservation significant invertebrate species.

The indirect impact of the clearing of native vegetation causing fragmentation of the remaining vegetation may lead to the restriction of genetic flow for SRE species that have limited dispersal capabilities. As the majority of the vegetation that is usable by SRE invertebrates for habitat is being retained then this impact is Low. The incursion of weeds both during construction and following construction is considered to be the most important potential indirect impact to Lot 102 Farrall Rd, Midvale as it has the potential to degrade the *Melaleuca* dampland and *Banksia* woodland areas that are being retained under the LSP. Increased local weed incursion into native bushland can have a significant impact upon SRE species that rely on sometimes small microhabitats within the landscape. This has the potential to cause a Moderate impact to SRE fauna and is considered to be the most important indirect impact to SRE fauna. This impact can be managed through management and mitigation measures including general ongoing weed control. If not managed appropriately, increasing sedimentation and alteration of surface hydrology has the potential to affect SRE fauna such as mygalomorph spiders that live in burrows at ground level. Sedimentation can be managed by appropriate stormwater runoff design and during construction via management and mitigation measures.

Contamination of surface and groundwater during construction may also impact upon SRE habitat, but the potential for contamination during construction is limited to isolated areas of chemical storage and small quantities of hydrocarbons where machinery or generators are working. Risks can be minimised by measures included in a construction environment management plan (CEMP). Where management measures are implemented, the risk of hydrocarbon contamination to SRE species and habitat is anticipated to be Low, however, should a major spill occur and not adequately contained and remediated, then the impacts would be significant.

At a regional scale across the SCP the direct and indirect impacts are generally considered to be low due to the very small nature of the development, and that the majority of vegetation in Good to Very good condition is being retained and conserved. It is also highly likely that any SRE or conservation significant invertebrates that inhabit the site are also found in the nearly adjacent Talbot Rd Nature Reserve, or in the nearby John Forrest National Park.

At the regional scale of the Study Area that encompasses much of the northern SCP, Lot 102 Farrall Rd, Midvale represents only 0.008 % of Medium and 0.004% of Low SRE suitable habitat, and no High SRE suitable habitat (Invertebrate Solutions 2018). Fragmentation is substantially mitigated through the vegetation that will be retained as part of the LSP for Farrall Rd and the remaining vegetation within the adjacent rail corridor that maintains a link with the Talbot Rd Nature Reserve. Other anticipated impacts including altering local hydrology are considered to be insignificant in the scale of the northern SCP.

The majority of anticipated impacts are generally Low or able to be managed through standard construction management and mitigation measures.

5.1 Recommendations

The following recommendations are made with regard to construction of the development to Lot 102 Farrall Rd, Midvale:

- If the currently proposed LSP (Emerge 2017) is adopted no surveys for terrestrial SRE invertebrates are required to meet the EPA Technical guidance, sampling of short range endemic invertebrate fauna (EPA 2016).
- Given the sites small size and that the majority of vegetation that is not degraded will be preserved and conserved the likely impact is considered Low and it is considered unlikely that the site would result in local extinction or significant impact to any SRE or conservation significant invertebrate species.
- Include appropriate management and mitigation measures to reduce and/or manage the risk of impacts to SREs from weed incursion and increased sedimentation during construction and operations.

6. References

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Appendix 1

Department of Parks and Wildlife Conservation Codes (November 2015)

Department of Parks and Wildlife

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

Department of Environment and Energy – Protected Matters Search Tool

Australian Government
Department of the Environment and Energy

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.

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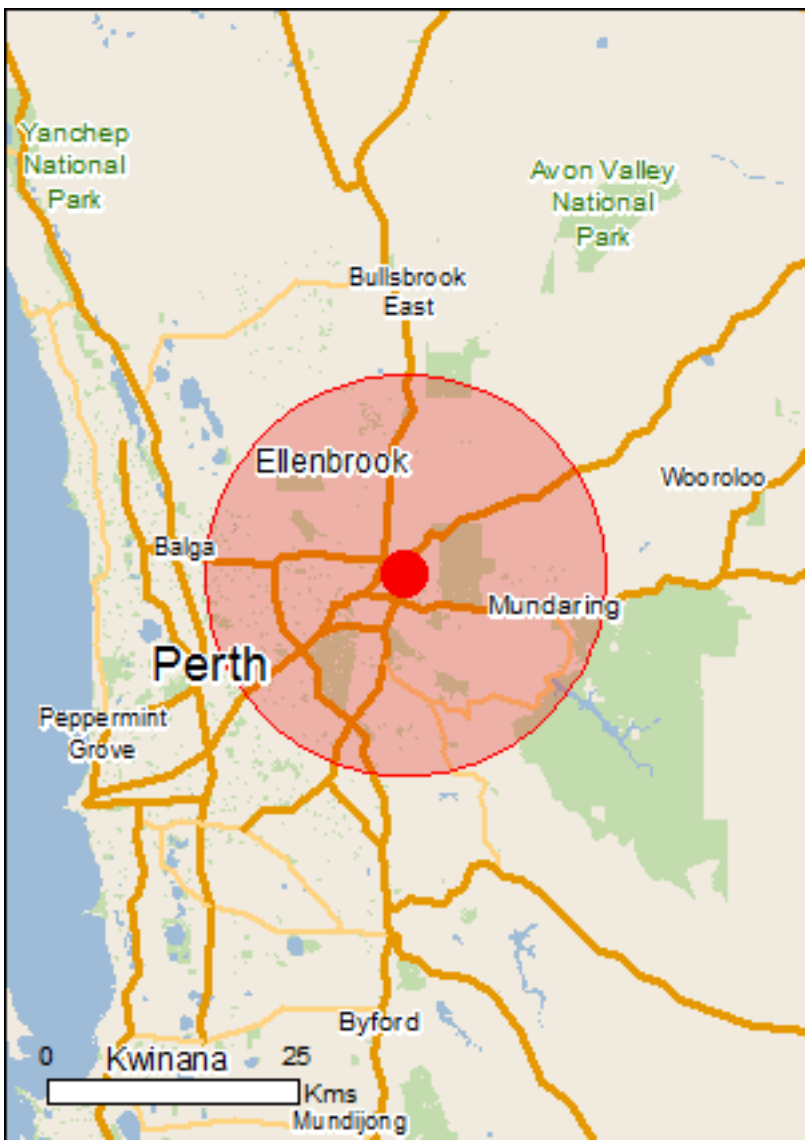
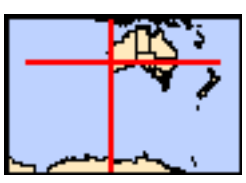


This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 20.0Km



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:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	8
Listed Threatened Species:	70
Listed Migratory Species:	25

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:	8
Commonwealth Heritage Places:	2
Listed Marine Species:	32
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:	30
Regional Forest Agreements:	1
Invasive Species:	46
Nationally Important Wetlands:	5
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
Goldfields Water Supply Scheme, Western Australia	WA	Listed place

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
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	Community known to occur within area
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
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	Community known to occur within area
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	Community known to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calyptorhynchus banksii naso		
Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area
Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	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
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Galaxiella nigrostriata Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat likely to occur within area
Insects		
Leioproctus douglasiellus a short-tongued bee [66756]	Critically Endangered	Species or species habitat known to occur within area
Mammals		
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Translocated population known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Acacia anomala Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat known to occur within area
Acacia aphylla Leafless Rock Wattle [13553]	Vulnerable	Species or species habitat known to occur within area
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat known to occur within area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area
Anthocercis gracilis Slender Tailflower [11103]	Vulnerable	Species or species habitat known to occur within area
Austrostipa bronwenae [87808]	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
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Calytrix breviseta subsp. breviseta Swamp Starflower [23879]	Endangered	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
Conospermum undulatum Wavy-leaved Smokebush [24435]	Vulnerable	Species or species habitat likely to occur within area
Darwinia apiculata Scarp Darwinia [8763]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat may occur within area
Diplolaena andrewsii [6601]	Endangered	Species or species habitat known to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat known to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	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
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Goodenia arthrotricha [12448]	Endangered	Species or species habitat likely to occur within area
Grevillea christineae Christine's Grevillea [64520]	Endangered	Species or species habitat known to occur within area
Grevillea curviloba subsp. curviloba Curved-leaf Grevillea [64908]	Endangered	Species or species habitat known to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat known to occur within area
Grevillea flexuosa Zig Zag Grevillea [2957]	Vulnerable	Species or species habitat likely to occur within area
Grevillea thelemanniana Spider Net Grevillea [32835]	Critically Endangered	Species or species habitat known to occur within area
Lasiopetalum pterocarpum Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat may occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
[Macarthuria keigheryi](#) Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
[Ptilotus pyramidatus](#) Pyramid Mulla-mulla [18216]	Critically Endangered	Species or species habitat known to occur within area
[Synaphea sp. Fairbridge Farm (D. Papenfus 696)](#) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
[Thelymitra dedmaniarum](#) Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat known to occur within area
[Thelymitra stellata](#) Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area
[Trithuria occidentalis](#) Swan Hydatella [42224]	Endangered	Species or species habitat likely to occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
[Pseudemydura umbrina](#) Western Swamp Tortoise [1760]	Critically Endangered	Translocated population known to occur within area

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 within area
[Diomedea amsterdamensis](#) Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
[Diomedea epomophora](#) Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
[Diomedea exulans](#) Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
[Diomedea sanfordi](#) Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
[Macronectes giganteus](#) Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
[Macronectes halli](#) Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
[Thalassarche cauta](#) Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
[Thalassarche impavida](#) Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
[Thalassarche melanophris](#) Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
[Thalassarche steadi](#) White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Manta alfredi](#) Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
[Manta birostris](#) Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur 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 known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pandion haliaetus		
Osprey [952]		Breeding 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 -
Defence - AIRTC CANNINGTON
Defence - BUSHMEAD RIFLE RANGE
Defence - BUSHMEAD TRAINING AREA
Defence - HOLDFAST BARRACKS
Defence - PALMER BARRACKS - SOUTH GUILDFORD
Defence - PEARCE - AP11OBSTRUCTION BEACON NO.5
Defence - RAAF CAVERSHAM

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Inglewood Post Office	WA	Listed place
Victoria Park Post Office	WA	Listed place

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 known to occur within area
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may 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]		Breeding 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 known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may 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
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species

Name	Threatened	Type of Presence
		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
Mammals		
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Beelu	WA
Ellen Brook	WA
Gooseberry Hill	WA
Greenmount	WA
John Forrest	WA
Kalamunda	WA
Kenwick Wetlands	WA
Korung	WA
Lesmurdie Falls	WA
NTWA Bushland covenant (0074)	WA
NTWA Bushland covenant (0157)	WA
Parkerville	WA
Talbot Road	WA
Twin Swamps	WA
Unnamed WA23076	WA
Unnamed WA24657	WA
Unnamed WA28740	WA
Unnamed WA29815	WA
Unnamed WA37997	WA
Unnamed WA44853	WA
Unnamed WA45106	WA
Unnamed WA46875	WA
Unnamed WA46919	WA
Unnamed WA46920	WA

Name	State
Unnamed WA47244	WA
Unnamed WA49079	WA
Unnamed WA49300	WA
Unnamed WA49363	WA
Unnamed WA50069	WA
Walyunga	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 Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		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
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		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
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		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 norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		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		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		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
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to 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
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		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
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Brixton Street Swamps	WA
Ellen Brook Swamps System	WA
Perth Airport Woodland Swamps	WA
RAAF Caversham	WA
Swan-Canning Estuary	WA

Acknowledgements

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-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
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Please feel free to provide feedback via the Contact Us page.

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