

8th Floor, Durack Centre  
263 Adelaide Terrace  
Perth, WA 6000  
PO Box H615  
Perth, WA 6001  
Australia  
T +61 8 9469 4400

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<b>Subject</b>	<b>Short-range Endemic Invertebrate Fauna Desktop Assessment - West Erregulla Gas Project</b>	<b>Project Name</b>	West Erregulla Gas Project
<b>Attention</b>	Mark Brown		
<b>From</b>	Alicia Michael		
<b>Date</b>	7 April 2022		

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### 1. Executive Summary

The Australian Gas Infrastructure Group (AGIG) is proposing to construct and operate a gas processing plant and pipeline near Dongara, Western Australia, collectively referred to as the West Erregulla Gas Project. Jacobs was engaged to undertake a desktop assessment of the potential presence of Short-range Endemic (SRE) invertebrate fauna within the Development Envelope for the West Erregulla Gas Project.

Short-range Endemic invertebrate fauna are species with a distribution of less than 10,000km<sup>2</sup>. The purpose of this desktop is to determine the likelihood of conservation significant and SRE invertebrate fauna being present within the Development Envelope. The assessment considers the habitat types present within the Development Envelope and species previously recorded within 50 km of the Development Envelope (the Search Area).

Four SRE habitat types have been identified within the Development Envelope, with a small remaining area cleared of vegetation (1.6% of the Development Envelope). Habitat types include *Allocasuarina campestris* tall sparse shrubland over shrubs and sedgeland on either sandy plains (SRE habitat 1), grey brown slopes (SRE habitat 3a) or with exposed laterite outcropping (SRE habitat 3b), and *Banksia* spp. and occasional *Eucalyptus todtiana* mid open woodland over shrubs and sedgeland on sandy plains (SRE habitat 2). Habitat found to support a greater number and diversity of SREs include isolated habitats, habitats with a high level of complexity and habitats where microhabitats are available that support a higher level of moisture such as dense leaf litter and large debris (Durrant, 2011). The majority of habitat types including sandy plains and grey brown slopes are widespread throughout the Development Envelope and the surrounding area. However, SRE habitat 3b is present in small, scattered areas and is associated with decaying, weathered breakaways. This is the only vegetation type within the Development Envelope to exhibit outcropping, with exposed rocks providing a unique habitat feature and provision of microhabitats not available in other vegetation/habitat types that may be utilised by SREs. The Development Envelope was subject to a burn in 2019 that has reduced the availability of microhabitats including bark, leaf litter and large debris. A number of flowering species that are known to be hosts to conservation significant and potential SRE bees are present within the habitat types identified within the Development Envelope.

Eight invertebrate species listed as either threatened or priority under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) or the *Biodiversity Conservation Act* 2016 were identified within the Search Area. Six of these species are considered to have potential to occur within the Development Footprint, including two trapdoor spiders, one land snail, one bee and two katydids. There is limited information available pertaining to the preferred habitat and distribution of a number of these species.

Twelve species previously recorded within the Search Area from SRE taxonomic groups and 12 species from non-SRE taxonomic groups were identified as potential SREs. Two of the species identified as potential SREs from non SRE groups, *Synechocera parvipennis* and *Euhesma semaphora* are considered unlikely to be present within the Development Envelope, as they are associated with particular flora species, *Xanthorrhoea* and *Pileanthus filifolius*, that have not been identified within the Development Envelope in flora surveys (ELA, 2021). Although, these flora species were recorded in the broader area in previous surveys (Woodman Environment, 2013) and so these SREs may be present in the broader area in proximity to the Development Envelope.

This desktop indicates that there is potential for SRE invertebrates to be present within the Development Envelope. However, given the open nature of the vegetation present and the recent burn, it is considered that there are limited micro-habitats available for ground-dwelling SREs within the Development Envelope (212 ha). However, it is noted that SREs may continue to persist under rocks, below ground and in small unburnt patches. The Disturbance Footprint requires the clearing of 90 ha of vegetation, 41.5 ha of this will be reinstated and rehabilitated following the installation of the pipeline including the provision of suitable habitats for SREs. Habitat types proposed to be impacted within the Disturbance Footprint, are well represented within the Development Envelope in the portion to be retained, and also outside of the Development Envelope within the surrounding area. SRE habitat 3b is considered to have a greater potential to support SREs as a result of the presence of exposed lateritic outcropping. However, only 1.5 ha of this habitat is proposed for removal (1.6% of the Disturbance Footprint), all of which will be reinstated. This equates to 27% of the habitat type mapped within the Development Envelope and 2.7% of the habitat mapped within the broader surrounding area within both the current assessment and Woodman Environment (2013). Given the presence of similar habitat outside of the Disturbance Footprint and outside of the Development Envelope, it is not anticipated that the project would result in a decline in the population of any SRE within the broader local area or any change in the viability or conservation status of any SRE taxon.

## 2. Introduction

Jacobs was engaged by Australian Gas Infrastructure Group (AGIG) to undertake a desktop assessment of the potential presence of Short-range Endemic (SRE) invertebrate fauna within the Development Envelope for the West Erregulla Gas Project.

The aims of this assessment are to determine:

- The occurrence of potential SRE species from invertebrate records in the vicinity of the Project
- The occurrence of any listed invertebrate records in the vicinity of the Project, including species listed under the *Biodiversity Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999*)
- Determine the likelihood that SRE and listed invertebrate species to occur in the Development Envelope, based on the types of habitats present.

The preparation of this desktop assessment has considered the information provided within the *Technical Guidance – Sampling of short range endemic invertebrate fauna* (EPA, 2016).

## 3. Development Envelope

The Development Envelope is 212.2 hectares in size and is located approximately 230 kilometres northeast of Perth, and 50 kilometres south east of Dongara, Western Australia (Figure 3 1).

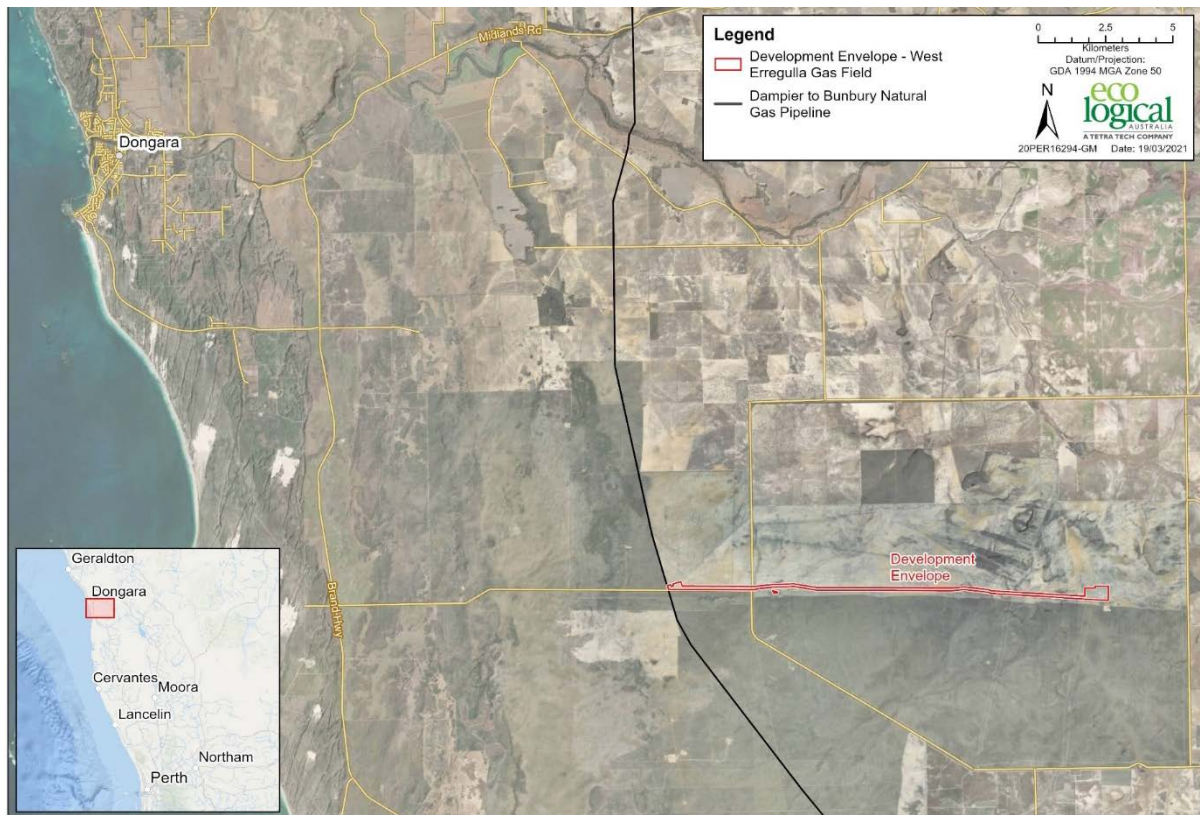


Figure 3-1 Location of Development Envelope for the West Erregulla Gas Project (ELA, 2021).

#### 4. Legislation and Policy

Invertebrate species are listed as threatened at the federal level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the State level under the *Biodiversity Conservation Act 2016* (BC Act). In Western Australia the assessment of SRE fauna for the purposes of environmental impact assessment must be undertaken in accordance with the *Technical Guidance – Sampling of short range endemic invertebrate fauna* (EPA, 2016).

The BC Act is maintained by the Department of Biodiversity, Conservation and Attractions (DBCA) and provides for both the listing of threatened species (critically endangered, endangered or vulnerable) and priority species (species that are possibly threatened but do not meet the survey criteria, or are otherwise data deficient).

The EPBC Act is maintained by the federal Department of Agriculture, Water and the Environment (DAWE). The Act provides for the listing of threatened species, threatened ecological communities and key threatening processes.

As described within the *Technical Guidance – Sampling of short range endemic invertebrate fauna* (EPA, 2016). SRE's are defined as terrestrial and freshwater invertebrates that have naturally small distributions of less than 10,000 km<sup>2</sup> (after Harvey, 2002). Taxonomic groups that support a high proportion of SREs include land snails (Gastropoda), millipedes (Diplopoda), centipedes (Chilopoda), pseudoscorpions (Pseudoscorpiones), scorpions (Scorpiones), spiders (Araneae, mainly Mygalomorphae (trapdoor spiders, but also some modern spiders within the Araneaeomorphae), slaters (Isopoda), velvet worms (Onychophora) and earthworms (Oligochaeta).

### 5. Method

A review of the following databases and documents was undertaken to provide information on invertebrate species potentially present within the Development Envelope:

- Western Australian Museum (WAM) databases and previous reports prepared for the Development Envelope. This database comprises historical records of flora and fauna species from across the state. Records are added opportunistically, as flora and fauna surveys are conducted within Western Australia for a variety of purposes. Records from within 50 km of the Development Envelope (the Search Area) have been assessed for this report [accessed 03/11/2021]. Updated data was received from the Western Australian Museum on the 6th April, 2022 including requested databases searches for Mollusca, Arachnida & Myriapoda, Entomology and Crustacea.
- Protected Matters Search Tool (DAWE, 2021): the Protected Matters Search Tool (PMST) highlights any Matters of National Environmental Significance (MNES) relevant to the EPBC Act that are likely to occur within an area. The information generated in this report is from modelled rather than derived data, meaning that threatened species lists supplied by DBCA and WAM are considered more accurate. However, the PMST remains a useful tool for identifying potential values.
- West Erregulla Pipeline Flora and Fauna survey (EcoLogical, 2021) the assessment includes a review of the DBCA Threatened and Priority fauna databases for listed fauna that returned five invertebrate fauna.

The review identified any invertebrate species that were listed as threatened or priority species under the EPBC Act or the BC Act and any invertebrate species that from a review of literature and previous records is likely to have a distribution of less than 10,000 km<sup>2</sup>. This included both invertebrate species belonging to the taxonomic groups identified in *Technical Guidance – Sampling of short range endemic invertebrate fauna* (EPA, 2016) as supporting a high proportion of SREs and non SRE taxonomic groups. Many of the records were higher order identifications for which the species had not been determined, these were removed from the list unless there were no other species level identifications within the same taxonomic group. The SRE status of each species was assigned a category as per the Table 5-1 below.

**Table 5-1 SRE status of invertebrate species identified as potentially occurring within the Development Envelope.**

Status	Definition
Confirmed	A known distribution of < 10,000 km <sup>2</sup> (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. Species may be assigned this status as they are data deficient.
Widespread	Not an SRE, have a known distribution of > 10,000 km <sup>2</sup>

Potential SRE species were assigned a likelihood of occurrence category based on the definitions provided in Table 5-2.

**Table 5-2 Definitions of SRE likelihood of occurrence definitions.**

Status	Definition
Confirmed	The species has been confirmed as occurring within the Development Envelope.
Likely	The species has been recorded from within 20 km of the Development Envelope, and habitat for the species has been identified within the Development Envelope.
Possible	The species has been recorded from within 50 km of the Development Envelope, and habitat for the species has been identified within the Development Envelope
Unlikely	The species has been recorded from within 50 km of the Development Envelope, however no habitat for the species has been identified within the Development Envelope or the distribution of the species is known well enough, that is considered unlikely to be present.

### 5.1 Assumptions and limitations

- This report is intended only for the purpose of identifying potential listed invertebrates and SREs within the Development Envelope.
- Information from the desktop assessment is based on existing data only and is, therefore, only as reliable as the data available. Data accessed were the most current available at the time of assessment. Any changes to these layers may require this report to be updated.
- With regards to the WAM, data is variable depending on the number of previous surveys undertaken and the ability to readily observe species. Invertebrates, including SREs are cryptic and require highly specialist knowledge in most instances to identify to the species level. Hence, the absence of records does not necessarily indicate the absence of these species.

## 6. Summary of findings

### 6.1 Habitat assessment

#### 6.1.1 Regional context

The Development Envelope is situated within the Geraldton Sandplains bioregion (Lesueur Sandplain subregion, GS3). The Geraldton Sandplains bioregion (GS3) is composed mainly of proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain (Desmond and Chant 2001). More specifically, the Lesueur Sandplain subregion comprises Aeolian and limestones, Jurassic siltstones and sandstones of the central Perth Basin. Alluvials are associated with drainage systems and there are extensive yellow sandplains in south-eastern parts. Shrub-heaths rich in endemics occur on a mosaic of lateritic mesas, sandplains, coastal sands, and limestones and heath on lateritised sandplains along the subregions north-eastern margins (Desmond and Chant 2001).

#### 6.1.2 Habitat within the Development Envelope

Vegetation communities within the Development Envelope were mapped by Eco Logical (2021). A total of six vegetation communities have been delineated within the Development Envelope (ELA 2021). The vegetation was dominated by *Allocasuarina campestris* tall sparse shrublands and Banksia mid open woodlands. The majority of the vegetation assessed was in Excellent condition, however it is noted that the Development Envelope was burnt in April 2019.

Three fauna habitat types were identified within the Development Envelope by ELA (2021). *Allocasuarina campestris* tall sparse shrubland over shrubs and sedgeland on either sandy plains (Fauna habitat 1) or stony rises (Fauna habitat 3), and *Banksia* spp. and occasional *Eucalyptus todtiana* mid open woodland over shrubs and sedgeland on sandy plains (Fauna habitat 2).

Habitats identified as likely to support SREs include habitats that are naturally restricted within the landscape, thus restricting the range of the species that rely on these habitat types (EPA, 2016). The majority of habitats within the Development Envelope are widespread both within the Development Envelope and the broader surrounding area. The exception to this is vegetation type AcAhGp, that is identified as correlating to Vegetation Type (VT)9 within Woodman Environmental Consulting (2013). This vegetation type is described in ELA (2021) as *Allocasuarina campestris* tall sparse shrubland over *Allocasuarina humilis*, *Hakea auriculata*, *Petrophile shuttleworthiana* mid open shrubland over *Gastrolobium plicatum* low open shrubland and *Ecdeiocolea monostachya*, *Schoenus armeria* low open sedgeland. As described in Woodman (2013) this vegetation type is present in small, scattered areas and is associated with decaying, weathered breakaways. Only 5.5 ha of this habitat type was mapped within the Development Envelope accounting for 2.59%. This is the only vegetation type within the Development Envelope to exhibit outcropping, with the exposed rocks providing a unique habitat feature and provision of microhabitats not available in other vegetation types that may be utilised by SREs. Potential SRE habitat types are identified in Table 6-1. These habitat types are based on those described in ELA (2021), with Fauna habitat 3, broken into two habitat types to distinguish the presence of exposed laterite outcropping in AcAhGp, distinct from AcDdMI that is otherwise incorporated into Fauna habitat 3 but displays no outcropping.

Microhabitats preferred by SREs include those that have a higher local moisture content than surrounding areas, including bark, leaf litter beds, large debris and south-facing slopes (Bennelongia, 2021). Given that the Development Envelope has been burnt relatively recently, and as evident in the photographs provided at Appendix G of the West Erregulla Pipeline Flora and Fauna survey (ELA, 2021) and reproduced at Figure 6-1 through to Figure 6-4, there is limited leaf litter and large debris present within the Development Envelope. The majority of the Development Envelope also supports gently undulating sandplains and so has limited south facing slopes with potential to retain higher moisture levels.

However, previous assessments in proximity to the Geraldton Sandplains Bioregion have indicated that habitat characterisation may be of limited value in predicting the occurrence of possible SRE species, with some SREs found in widespread habitats (Bennelongia Pty Ltd, 2013). Species from numerous SRE groups have been recorded in the Geraldton Sandplains including mygalomorph spiders, isopods, millipedes and snails (ecologia 2010).

**Table 6-1: SRE habitat types mapped within the Development Envelope**

SRE Habitat type	Description	Extent within Development Envelope (ha)	Extent within the Disturbance Footprint (ha)
SRE habitat 1	<i>Allocasuarina campestris</i> tall sparse shrubland over shrubs and sedgeland on sandy plains	72.2	38.3
SRE habitat 2	<i>Banksia</i> spp. and occasional <i>Eucalyptus tottiana</i> mid open woodland over shrubs and sedgeland on sandy plains	95.1	37.7
SRE habitat 3a	<i>Allocasuarina campestris</i> tall sparse shrubland over shrubs and sedgeland on grey brown slopes	41.4	12.5
SRE habitat 3b	<i>Allocasuarina campestris</i> tall sparse shrubland over shrubs and sedgeland with exposed laterite outcropping.	5.5	1.5
Cleared	Cleared	3.5	1.5
<b>TOTAL</b>		<b>212.2</b>	<b>89.9</b>



**Figure 6-1 SRE Habitat type 1 showing the lack of leaf litter and large debris.**



**Figure 6-2 SRE Habitat type 2**



**Figure 6-3 SRE Habitat type 3a showing the open, low, sparse nature of the vegetation**



**Figure 6-4 SRE Habitat type 3b showing exposed lateritic outcropping**

## 6.2 Listed threatened invertebrates in the Search area

The desktop search identified eight threatened invertebrates as potentially present within the Development Envelope (Table 6-2). All species have been recorded from 20-50 km away from the Development Envelope. Two of these species are considered unlikely to be present as suitable habitat has not been identified within the Development Envelope. The remainder of the species are considered as possibly occurring with the Development Envelope, however, there is limited information available pertaining to the preferred habitat and distribution of these species.

**Table 6-2 Threatened and Priority Listed Invertebrates recorded within 50 km of the Development Envelope.**

Higher classification	Lowest Identification	Habitat	Source	Conservation Status	Likelihood of occurrence within the Development Envelope
Araneae	<i>Idiosoma arenaceum</i> (Geraldton Sandplain shield-backed trapdoor spider)	Occupies near-coastal sandy habitats (Rix, 2018).	WAM/ DBCA	<b>BC Act</b> p3	Possible - Records are from the 1950's. Located 43 km north of the Development Envelope. Records within the search area are at the southern extent of the known range for this species.
Araneae	<i>Idiosoma kwongan</i> (Kwongan heath shield-backed trapdoor spider)	The collection was from Kwongan vegetation at the Eneabba Mineral Sands mine.	WAM	<b>BC Act</b> p3	Possible. Records are from the 1980's, 45 km south of the Development Envelope. Records within the search area are at the northern extent of the known range for this species.
Araneae	<i>Idiosoma nigrum</i> (Shield-backed Trapdoor Spider)	Species inhabits clay soils of eucalypt woodlands and acacia vegetation (DAWE, 2013)	PMST	<b>EPBC</b> Vulnerable	Unlikely. Species has not been recorded within 50 km of the Development Envelope and suitable habitat is not present.
Hymenoptera	<i>Hylaeus globuliferus</i> (Woollybush bee)	This species appears to be a Proteaceae specialist and the collections in the search area were all associated with flowers and foliage of the woollybush <i>Adenanthos cygnorum</i> . <i>H. globuliferus</i> is also known to frequent flowers of other Proteaceae species such as Banksia (Bennelongia Environmental Consultants, 2021).	DBCA	<b>BC Act</b> p3	Possible – Records are from 28 kms south of the Development Envelope. No woolly bush present within the Development Envelope. However, Banksia species are present. Potential habitat is present in SRE Habitat Type 2. A total of 95.1 ha of this community was mapped within the Development Envelope and 3450 ha was mapped within the broader local area (Woodman Environmental Consulting, 2013). A total of 37.7 ha is present within the Disturbance Footprint, accounting for 1.09% of the extent of this SRE habitat type within the broader local area. All known records of this species are to the south of the Development Envelope.

Higher classification	Lowest Identification	Habitat	Source	Conservation Status	Likelihood of occurrence within the Development Envelope
Lepidoptera	<i>Synemon gratiosa</i> (graceful sunmoth)	The graceful sun-moth is currently only known from two general vegetation types: Banksia woodland/ woolly bush on deep sands, in the northern suburbs of Perth on the Swan Coastal Plain. In these sites the GSM breeds on <i>Lomandra hermaphrodita</i> , which often occurs in low numbers. Open areas of herbland, heathland and shrubland on Quindalup soils (sand and limestone) close to the coast where it breeds on <i>Lomandra maritima</i> , which is often present in reasonable numbers and may even be a dominant understorey herb. Sites on limestone may have both <i>Lomandra</i> species present.	DBCA/ PMST	BC Act p4	Unlikely. All records are from 50 km southwest near Leeman. <i>Lomandra hermaphrodita</i> was not recorded within the Development Envelope.
Orthoptera	<i>Hemisaga vepreculae</i> (thorny bush katydid (Moora))	Limited information available	WAM/ DBCA	BC Act p2	Possible – Records are from the 1980's 38 kms south of the Development Envelope.
Orthoptera	<i>Phasmodes jeeba</i> (springtime corroboree stick katydid (Eneabba))	Limited information available.	DBCA	BC Act p3	Possible – Record is from the 1980's. Nearest record is just over 20 km south of the Development Envelope.
Stylommatophora	<i>Bothriembryon perobesus</i> (a bothriembryontid land snail (Moore River))	Previous collections are associated with Banksia woodlands and low shrublands on white sandy soils. The species is typically collected within leaf litter but has also been found on bare sand and the branches of shrubs (Whisson, 2019).	WAM	BC Act p1	Possible – Recorded from similar habitat as is present in the Development Envelope. Nearest record is 15 km to the south west of the Study Area.

### 6.3 SRE Group Invertebrates in the Search Area

A total of twelve species were identified from the Search Area from SRE taxonomic groups that have known or potential ranges of less than 10,000 km<sup>2</sup> (Table 6-3). These species include modern and trapdoor spiders, scorpions, land snails and millipedes.

Table 6-3 Likely SREs for SRE group invertebrates recorded within 50 km of the Development Envelope.

Phylum	Class	Order	Infraorder	Family	Species name	No. of record	Most recent record	SRE Category	Likelihood of occurrence
Arthropoda	Arachnida	Araneae	Araneomorphae	Zodariidae	<i>Pentasteron securifer</i>	1	1987	Likely SRE	Possible
Arthropoda	Arachnida	Araneae	Mygalomorphae	Idiopidae	<i>Bungulla bringo</i>	1	1953	Likely SRE	Possible
Arthropoda	Arachnida	Araneae	Mygalomorphae	Idiopidae	<i>Euoplos mcmillani</i>	1	1992	Likely SRE	Possible
Arthropoda	Arachnida	Scorpiones		Urodacidae	<i>Urodacus</i> 'SCO016 'Mingenew'	1	2012	Likely SRE	Possible
Arthropoda	Diplopoda	Polydesmida		Paradoxosomatidae	<i>Antichiropus sulcatus</i>	18	1998	Confirmed SRE	Possible
Arthropoda	Diplopoda	Polydesmida		Paradoxosomatidae	<i>Antichiropus</i> 'DIP076'	3	2021	Likely SRE	Possible
Arthropoda	Diplopoda	Polydesmida		Paradoxosomatidae	<i>Antichiropus</i> 'DIP078, <i>Eneabba</i> 1	2	2007	Likely SRE	Possible
Arthropoda	Diplopoda	Polydesmida		Paradoxosomatidae	<i>Antichiropus</i> 'DIP081, <i>geraldton</i> 1	1	2013	Likely SRE	Possible
Arthropoda	Diplopoda	Polydesmida		Paradoxosomatidae	<i>Antichiropus</i> 'DIP099, <i>mcmillani</i> '	1	2000	Likely SRE	Possible
Arthropoda	Diplopoda	Polydesmida		Paradoxosomatidae	<i>Antichiropus</i> 'DIP136,mobilis'	1	2000	Likely SRE	Possible
Arthropoda	Diplopoda	Spirostreptida		Lulomorphidae	<i>Podykipus</i>	13	2007	Possible SRE- limited information	Likely
Mollusca	Gastropoda	Stylommatophora	Orthalioidae	Bothriembryontidae	<i>Bothriembryon whitleyi</i>	2	1975	Confirmed SRE	Possible

### 6.3.1 Araneomorph (modern) spiders

One potential SRE species of ground dwelling modern spider, an ant spider, *Pentasteron securifer*, has previously been recorded within a 50 km buffer of the Development Envelope. The species is known only from the Swan Coastal Plain and the Geraldton Sandplains and so has been classified as a likely SRE.

### 6.3.2 Mygalomorph (trapdoor) spiders

Two species of trapdoor spider, both from the Idiopidae family, have previously been recorded within a 50 km buffer of the Development Envelope, along with the two conservation listed species *Idiosoma arenaceum* and *Idiosoma kwongan*. The described species *Bungulla bringo* and *Euoplus mcmillani*, are restricted to the Geraldton Sandplains region. *Bungulla bringo* is known only from near Briongo railway cutting and Ebano Creek, east and south east of Geraldton, with very little known about the distribution of the species (Rix et al. 2018). *Euoplus mcmillani* prefers Kwongan heathland on sandy soils (Rix et al. 2019).

A field assessment of the West Erregulla gas field project that extends directly north and south of the eastern extent of the Development Envelope completed by Bamford Consulting Ecologists (2021) identified five trapdoor spiders within a narrow band of unburnt *Allocasuarina campestris* outside of the gas field project area. The trapdoor spiders were recorded 2.5 km south east of the Development Envelope. The trapdoor spiders were identified as members of the genus *Idiosoma* sp., through the distinctive leaf litter construction around its burrow. So could be possibly, *Idiosoma arenaceum* or *Idiosoma kwongan*. The lack of leaf litter as a result of the fire, both within the West Erregulla gas field project area and the Development Envelope means it is currently not possible to detect this species within these areas. However, given the majority of the Development Envelope supports an overstorey of *Allocasuarina campestris*, it is possible that this species is present. Habitats with an overstorey of *Allocasuarina campestris* are also widespread throughout the surrounding area (Woodman, 2013).

### 6.3.3 Diplopods (millipedes)

Two species of millipede identified within the search area were considered to be potential SREs. One was a polydesmid, *Antichiropus sulcatus*. This species has been predominantly collected from the Eneabba area (Car et al. 2013). The other species is an undescribed spirostrepid of the genus *Podykipus*. This genus is endemic to south western Australia and given the lack of detail the genus has been identified as a potential SRE.

### 6.3.4 Scorpion

A single species of scorpion was identified within the search area and considered to be a potential SRE. There is a single record of the species *Urodacus* 'SCO016', 'Mingenew', within the search area, located 26 km north east of the Development Envelope just south of Mingenerew. The specimen was pulled from a burrow, in grey soil with litter and rubbish. There is limited information available to determine whether the species is likely to be present within the Development Envelope.

### 6.3.5 Gastropods (snails)

Two land snails identified within the search area are considered to be SREs. One, *Bothriembryon perobesus*, is listed as a Priority One, poorly known species and so is listed in Table 6-2. This species has been found in similar habitat to that present within the Project area and so has potential to be present within the Development Envelope. The other, *Bothriembryon whitleyi* has been identified in

white coastal sand dunes, sometimes supporting Acacia shrublands (Whisson, 2019). and so is considered unlikely to be present within the Development Envelope.

### 6.4 Non-SRE Group Invertebrates in the Search Area

An additional eleven potentially range restricted species from non-SRE groups were recorded in the search area (Table 6-4). This included four beetle species and seven bee species.

**Table 6-4 Potential SREs identified within the search area from non SRE groups.**

Phylum	Class	Order	Family	Species name	No. of record	Most recent record	SRE Category	Likelihood of occurrence
Arthropoda	Insecta	Coleoptera	Zodariidae	<i>Blackbolbus quinquecavus</i>	1		Likely SRE	Possible
Arthropoda	Insecta	Coleoptera	Buprestidae	<i>Castiarina chlorota</i>	8	2006	Likely SRE	Likely
Arthropoda	Insecta	Coleoptera	Buprestidae	<i>Synechocera parvipennis</i>	7		Likely SRE	Unlikely
Arthropoda	Insecta	Coleoptera	Erotylidae	<i>Xenocryptus</i>	1	2002	Possible SRE – limited information	Possible
Arthropoda	Insecta	Coleoptera	Tenebrionidae	<i>Sympetes patelliformis</i>	4	1993	Possible SRE – limited information	Possible
Arthropoda	Insecta	Hymenoptera	Colletidae	<i>Euhesma semaphore</i>	19		Likely SRE	Unlikely
Arthropoda	Insecta	Hymenoptera	Colletidae	<i>Euhesma undeneya</i>	2	2002	Likely SRE	Possible
Arthropoda	Insecta	Hymenoptera	Colletidae	<i>Euhesma undulata</i>	6	2004	Likely SRE	Likely
Arthropoda	Insecta	Hymenoptera	Colletidae	<i>Leioproctus sexmaculatus</i>	1	2001	Likely SRE	Likely
Arthropoda	Insecta	Hymenoptera	Colletidae	<i>Leioproctus tomentosus</i>	2		Likely SRE	Possible
Arthropoda	Insecta	Hymenoptera	Colletidae	<i>Trichocolletes platyprosopis</i>	1		Likely SRE	Possible
Arthropoda	Insecta	Hymenoptera	Colletidae	<i>Trichocolletes simus</i>	1		Likely SRE	Possible

Three of the beetle species, *Blackbolbus quinquecavus*, *Castiarina chlorota* and *Synechocera parvipennis* are only known from the Geraldton Sandplains (Bennelongia Environmental Consultants, 2021). The collections of *Synechocera parvipennis* were associated with the host plant *Xanthorrhoea*. No *Xanthorrhoea* species were recorded in the Development Envelope (ELA, 2021). As such, it is unlikely that *Synechocera parvipennis* is present within the Development Envelope.

There is limited information available about *Sympetes patelliformis*. There are 10 records within the Atlas of Living Australia from both Museums Victoria and the Western Australian Museum. The record extend along the coastline from Geraldton to Perth. The collections within the Study Area are from the dune system to the south of Greenough.

The other beetle is from the genus *Xenocryptus*. Little is known about this genus. The only species that is described in Australia is *Xenocryptus tenebroides*, that is a pollinator of *Macrozamia riedlei* (Terry et al 2005). No *Macrozamia*s were recorded within the Development Envelope. However, as the *Xenocryptus* identified within the Search Area was not identified to the species level, it is data deficient and so identified as a likely SRE.

The seven species of bees identified as potential SREs are known to be endemic to the coastal sandplains of south western Australia. *Leioproctus tomentosus* is known to be associated with *Conospermum*, two species of *Conospermum* were recorded within the Development Envelope (Houston, 1989). *Euhesma semaphore* is known to be associated with *Pileanthus filifolius* (Houston 1992). *Pileanthus filifolius* was not identified within the Development Envelope and so it is unlikely this species is present within the Development Envelope. *Trichocolletes platyprosopis* and *Trichocolletes simus* are known to be associated with *Daviesia* (Batley and Houston, 2012). Three species of *Daviesia* were recorded within the Development Envelope.

## 7. Discussion

Four SRE habitat types have been identified within the Development Envelope. *Allocasuarina campestris* tall sparse shrubland over shrubs and sedgeland on either sandy plains (SRE habitat 1), grey brown slopes (SRE habitat 3a) or with exposed laterite outcropping (SRE habitat 3b), and *Banksia* spp. and occasional *Eucalyptus tottiana* mid open woodland over shrubs and sedgeland on sandy plains (SRE habitat 2). A minor area of cleared land was also identified. It is considered possible that taller and or thicker vegetation communities comprise a higher proportion of suitable microhabitats for SREs, than the open communities that dominate the Development Envelope (Bennelongia Environmental Consultants, 2021). However, a range of SREs are known from the Geraldton Sandplains, and species such as male trapdoor spiders identified within the Search Area, wander in search of a mate, and so may be located outside of micro-habitats categorised as suitable.

The Development Envelope was burnt in 2019, reducing the availability of suitable microhabitats, such as bark, leaf litter beds and large debris. As such, it is considered there are limited microhabitats for ground-dwelling invertebrates currently available in the Development Envelope. Studies have indicated that species diversity and density of invertebrates are reduced after burning (Saunders, et al. 2021, Springett, 1976). However, it is noted that SREs may continue to persist under rocks, below ground and in small unburnt patches.

Eight invertebrate species listed as either threatened or priority were identified as potentially occurring within the Development Envelope. Five of these species are considered to have potential to occur within the Development Footprint, however there is limited information available pertaining to the preferred habitat and distribution of a number of these species.

Twelve species previously recorded within the Search Area from SRE taxonomic groups and 12 species from non-SRE taxonomic groups were identified as potential SREs. Two of these potential SRE species, *Synechocera parvipennis* and *Euhesma semaphore* are considered unlikely to be present within the Development Envelope as they are associated with particular flora species, *Xanthorrhoea* and *Pileanthus filifolius*, that have not been identified within the Development Envelope in flora surveys (ELA, 2021). Although, these flora species were recorded in the broader local area in previous surveys

(Woodman Environment, 2013) and so these SREs may be present in the broader area in proximity to the Development Envelope.

There is the potential for the Proposal to result in both primary impacts to SREs through the clearing of vegetation to enable the installation of the pipeline and development of the processing plant, and secondary impacts that result in the degradation of habitat, such as increased dust levels and encroachment by weeds.

The loss of habitat from the Disturbance Footprint for the processing plant comprising 42 ha will be permanent. However, habitat along the Disturbance Footprint for the pipeline will be reinstated once the pipeline is installed. To enable the installation of the pipeline, the vegetation will be cleared and stockpiled, and topsoil also stockpiled separately from the subsoil. Once the pipeline is installed the subsoil will be reinstated, followed by the topsoil and cleared vegetation redistributed over the disturbance footprint. This process will provide numerous microhabitats for SREs and in time flowering species currently present within the Development Envelope will regenerate. Monitoring would be undertaken to ensure adequate regeneration, both in terms of diversity and coverage of the disturbance footprint.

An access track would be maintained by periodic slashing. This would enable microhabitats including leaf litter, bark and large debris to be retained across the pipeline corridor limiting the fragmentation of habitat for SREs from one side of the Development Envelope to the other.

The 12 species recorded from SRE taxonomic groups where present, are likely to be present in habitats on or near the surface. These habitats are not restricted to particular vegetation community compositions, but more so the presence of certain microhabitats. Given that the Development Envelope is surrounded by remnant vegetation on intact landscapes, similar habitats are available outside of the Development Envelope. SRE habitat 3b is considered to have a greater potential to support SREs as a result of the presence of exposed lateritic outcropping. However, only 1.5 ha of this habitat is proposed for removal (1.6% of the Disturbance Footprint), all of which will be reinstated. This equates to 27% of the habitat type mapped within the Development Envelope and 2.7% of the habitat mapped within the broader surrounding area within both the current assessment and Woodman Environment (2013). Given the presence of this habitat outside of the Disturbance Footprint and outside of the Development Envelope it is not anticipated that the project would result in a decline in the population of any SRE reliant on this habitat within the broader local.

The six species of SRE bees potentially present within the Development Area are associated with various host plants. These feeding plants including *Conospermum* and *Daveisia*, are a dominant component of the BpDdHh (Vegetation Type 13b) and AcDdMI (Vegetation Type 12) vegetation communities identified within the Development Footprint (ELA, 2021, Woodman Consulting, 2013). The BpDdHh community covers only 5.66% (12ha) of the Development Envelope, but is well represented outside of the Development Envelope with 547.55 ha of the community identified in the surrounding area by Woodman (2013). The AcDdMI vegetation community covers 16.9 % (35.9 ha) of the Development Envelope, with 243.32 ha recorded in the surrounding area. Given the presence of this habitat outside of the Disturbance Footprint and outside of the Development Envelope it is not anticipated that the project would result in a decline in the population of any SRE bees reliant on this habitat within the broader local area.

Mitigation measures to prevent the occurrence of secondary impacts to potential SRE habitat, including deposition of dust, increased frequency of burning and encroachment by weeds, are provided within the project Construction Environmental Management Plan (CEMP). With the

implementation of these measures and associated monitoring it is considered unlikely that the Project would result in secondary impacts to potential SRE habitat outside of the Disturbance Footprint.

This desktop indicates that there is potential for SRE invertebrates to be present within the Development Envelope. However, given the open nature of the vegetation present and the recent burn, it is considered there are limited micro-habitats currently available for ground-dwelling SREs within the Development Envelope. The Disturbance Footprint requires the clearing of 90 ha of vegetation, half of this will be reinstated and rehabilitated following the installation of the pipeline. Given the presence of similar habitat outside of the Disturbance Footprint and outside of the Development Envelope, including restricted SRE habitat type 3b, it is not anticipated that the project would result in a decline in the population of any SRE within the broader local area or any change in the viability of conservation status of any SRE taxon.

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