

Bennelongia

Environmental
Consultants



British Hill Mine:

Desktop assessment of Short-range Endemic Fauna Values

Prepared for:

Blue Cap Mining Pty Ltd

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Final Report

Short-Range Endemics | Subterranean Fauna

Waterbirds | Wetlands



British Hill Mine: SRE fauna review

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EXECUTIVE SUMMARY

The British Hill Gold Mine is located 40 km south of Marvel Loch in the Goldfields region of Western Australia. The tenements are held by IMD Gold Mines Ltd, which plans to redevelop a gold mine at the site. Gold was first discovered in the 1980s and Eclipse Ridge Pty Ltd mined 160,000 tonnes of ore from a shallow laterite deposit. The Project consists of three tenements (M 77/1256, L 77/221 and L 77/223) and the proposed developments consist of an amalgamated open pit, a waste rock dump and a hardstand area (Figure 1, 2 and 3). The total area of these components is 27.65 ha. The annual tonnage of ore to be processed is unknown and it has not been determined whether this will occur on-site or elsewhere. A significant proportion of the existing landscape in the immediate surrounds of the Project is disturbed.

This desktop review evaluates information on habitat and previous records of terrestrial invertebrate species in the vicinity to evaluate the likelihood of SRE or conservation-listed terrestrial invertebrate species occurring in the British Hill Gold Mine.

Based on the desktop search, around 94 species belonging to SRE Groups have been recorded in the search area including four species of land snail, 49 species of mygalomorph spider, 11 species of millipede, 11 species of pseudoscorpion, 15 species of scorpion and three species of slater. Threatened or Priority invertebrate species recorded within the very broad vicinity of British Hill include two species of butterfly, one bee and two species of trapdoor spider. There are no records of any animals from SRE groups, nor any records of listed species, within the Project development area or within 25 km of it (although this is likely to be a reflection of survey effort rather than SRE distributions).

Habitat prospectivity was assessed by reviewing recent vegetation mapping and 100,000k surface geology. Disturbed areas are locally prominent, suggesting that the occurrence of SRE species within the project development area is unlikely. Moreover, limited habitat variability from a geologic and topographic perspective and the broad extents of the vegetation complexes present at British Hill in surrounding areas suggest that any species from the SRE Groups occurring at British Hill will also occur more extensively.

The potential for significant impacts to SRE species from mine pit excavation and mine-related disturbances is considered to be very low because the occurrence of tightly restricted SRE species is unlikely. In further support of this conclusion, the proposed total area of developments at British Hill is very small (approximately 27.65 ha) in relation to the known ranges of SRE species nearby.

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1. INTRODUCTION

The British Hill Gold Mine is located 40 km south of Marvel Loch in the Goldfields region of Western Australia (Figure 1). Gold was first discovered there in the 1980s and Eclipse Ridge Pty Ltd mined 160,000 tonnes of ore from a shallow laterite deposit. The tenements are now held by IMD Gold Mines Ltd, which plans to redevelop the gold mine ('the Project').

Land clearing at the Project has the potential to remove some of the habitat occupied by species of terrestrial invertebrate. This report provides:

- An assessment of the likelihood of short-range endemic (SRE) invertebrate species occurring in the vicinity of the Project.
- An evaluation of the conservation values of any SRE fauna community (and the constituent species) in the vicinity of the Project (including listing under conservation legislation).
- An assessment of the threats posed to these values by the proposed developments.

1.1. Project Description

The Project consists of three tenements (M 77/1256, L 77/221 and L 77/223) and the proposed developments consist of an amalgamated open pit, a waste rock dump and a hardstand area (Figure 2). The total area of these components is approximately 27.65 ha. The annual tonnage of ore to be processed is unknown and it has not been determined whether this will occur on-site or elsewhere. A significant proportion of the existing landscape in the immediate surrounds of the Project is disturbed.

2. SHORT-RANGE ENDEMIC FAUNA FRAMEWORK

For the purpose of environmental impact assessment in Western Australia, the term 'SRE' is applied to ground-dwelling invertebrates species that have overall ranges of less than 10,000 km² (Harvey 2002). These species tend to exhibit patchy distributions within their range, slow growth, low fecundity and poor dispersal capabilities. Guidelines for the assessment of SRE invertebrates in Western Australia are provided in *Environmental Factor Guideline: Terrestrial Fauna* (EPA 2016a) and *Technical Guidance: Sampling of short range endemic invertebrate fauna* (EPA 2016b). Assessment typically focuses on a small subset of ground-dwelling invertebrate taxa (the SRE Groups) that are known to contain at least some, but more commonly moderate to high proportions of, SRE species. These groups include land snails (Gastropoda); millipedes (Diplopoda); centipedes (Chilopoda); pseudoscorpions (Pseudoscorpiones); scorpions (Scorpiones); spiders [Araneae, mainly Mygalomorphae (trapdoor spiders), but also some modern spider families]; slaters (Isopoda); and harvestmen (Opiliones). Some other groups, such as velvet worms (Onychophora) and earthworms (Oligochaeta), are SRE Groups but are restricted to mesic landscapes.

Groups containing species that are mostly widespread due to high vagility, ecological plasticity or xeric adaptation may also have species with restricted ranges (e.g. Framenau *et al.* 2008; López-López *et al.* 2016; Rix *et al.* 2015) and, conversely, some species belonging to SRE Groups are in fact widespread. Determining whether or not a species from an SRE Group actually has a significantly restricted range (i.e. <10,000 km²) is often difficult. However, the distribution of an SRE Group species is likely to reflect the extent of its preferred or obligate habitat(s), so that species that are found only in restricted or patchy habitats usually have smaller ranges than those collected from extensive or common ones. An additional constraint to assessment is that, in some groups, short-range endemism is related to life history rather than historical biogeography, resulting in a species occupying only part of a widespread habitat and therefore being an SRE despite occupying part of an extensive habitat (Harvey 2002; Harvey *et al.* 2011; Rix *et al.* 2015).

In this report, determining SRE status is based on the SRE classification system of the Western Australian Museum (WAM; Appendix 2), modified in some cases to compensate for limited data (and often poorly defined taxonomy).

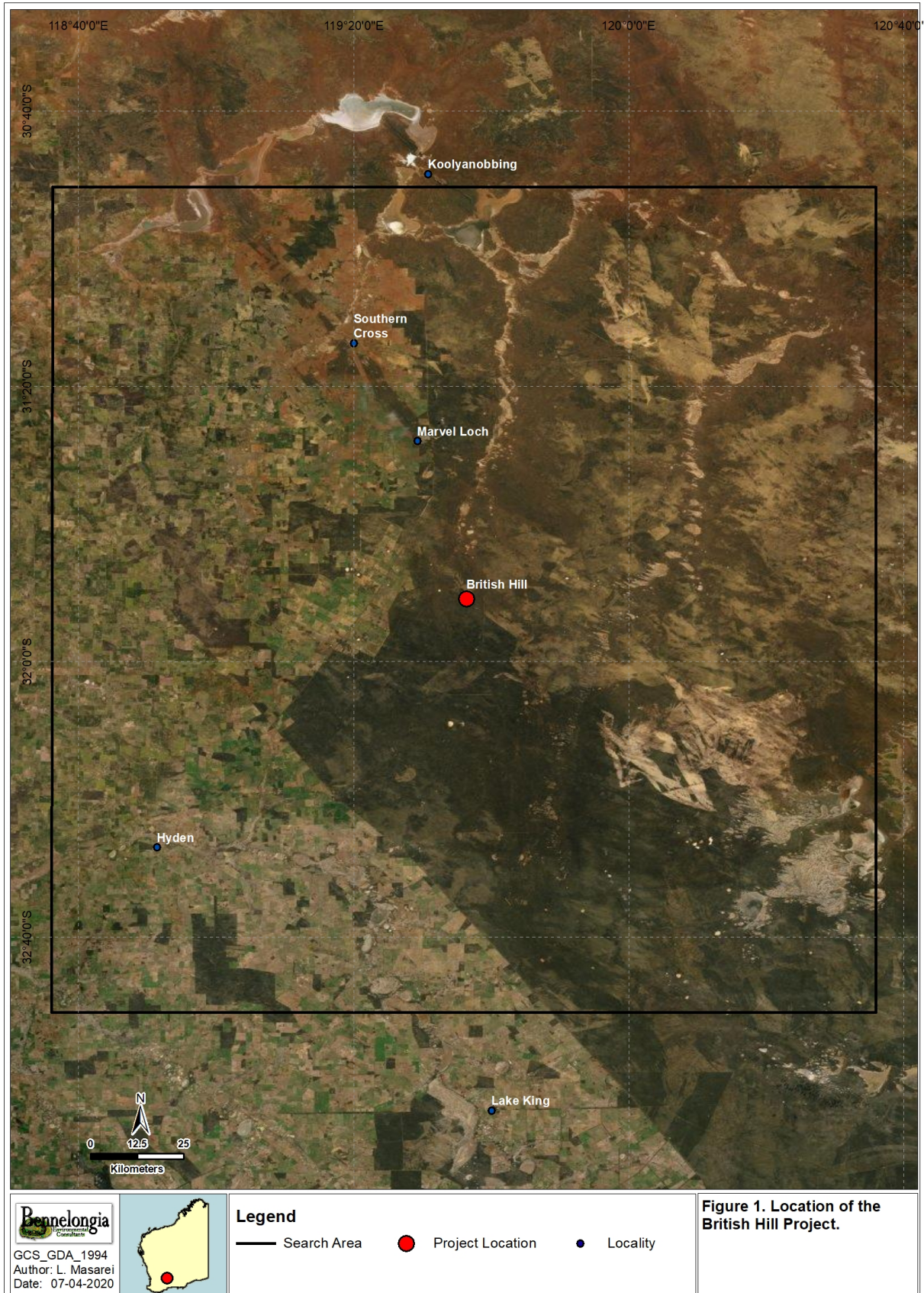


Figure 1. Location of the British Hill Project.

The factors considered when evaluating the SRE status of each species in this report were the known range of the species; habitat(s) at the collection location(s) and the spatial extent and connectivity of these habitats; and distribution patterns of phylogenetically related surrogate species (ideally members of the same genus). In this assessment, species are considered 'widespread' if their known, or likely range, exceeds 10,000 km² (as per Harvey 2002). However, even restricted species may be locally widespread around a project area. Thus, identifying SRE species is only the first part of a filtering process used to determine whether species may be threatened by a proposed development. The actual level of threat to an SRE species depends on its distribution relative to the development footprint rather than SRE status alone. Determining the likely level of threat to a species requires consideration of the extent of the species' preferred habitat, both within and outside the study area, as well as the area of disturbance.

3. DESKTOP REVIEW

The desktop review evaluated information on habitat and previous records of terrestrial invertebrates in the vicinity of the mine to evaluate the likelihood of SRE or conservation-listed terrestrial invertebrate species occurring in the British Hill Gold Mine.

The British Hill project is located towards the western border of the Great Western Woodlands. This region is unique in that it comprises the largest area of undisturbed Mediterranean climate woodlands in the world. Correspondingly, the biodiversity in the Great Western Woodlands is exceptionally diverse and this is particularly true for SRE groups. For example, over 30 species of millipede of the genus *Antichiropus* are known from the Great Western Woodlands (Car *et al.* 2019). This diversity is well reflected by the extent and diversity of the records below.

3.1. Habitat

Habitat prospectivity was assessed by reviewing recent vegetation mapping by Western Botanical and 100k surface geology (Figure 2 and Figure 3; GSWA 1985). Emphasis was placed on identifying relict, isolated, sheltered or moist habitats but 'specialist' habitats such as rocky outcrops and ranges may also harbour SRE species. Isolated or patchy habitats are generally considered to be more prospective for SRE species.

The geology of the Southern Cross Greenstone Belt in general is complex. The Project lies in an area of granite/pelite and schist, within a broader mafic/ultramafic rock setting (Figure 2; GSWA 1985). Analysis of satellite imagery and topographic mapping shows that there is no relict, isolated, sheltered or moist habitats and no rocky outcrops or ranges present, with little variation in elevation throughout the tenements.

The area surveyed by Western Botanical shows 12 areas of distinct vegetation types, including the previously disturbed and rehabilitated former mining area. These can be condensed into 4 general vegetation complexes: previously disturbed and rehabilitated areas; Eucalypt Mallee woodland; Salmon Gum woodland; and Sheoak shrubland (Figure 3). The landforms on which these vegetation units occur include laterite gravel and ferricrete, clayey soils in depressions and valley floors, clayey sand and aeolian sandsheet. All of these associations are widespread outside the potential impact extent of the Project. The area of disturbed and rehabilitated land occupies a significant portion of the likely mine pit area, and areas of Sheoak shrubland and remnant Eucalypt Mallee and Salmon Gum woodland within the likely mine pit area already have a low level of disturbance in the form of aging drill lines and pads (Figure 3).

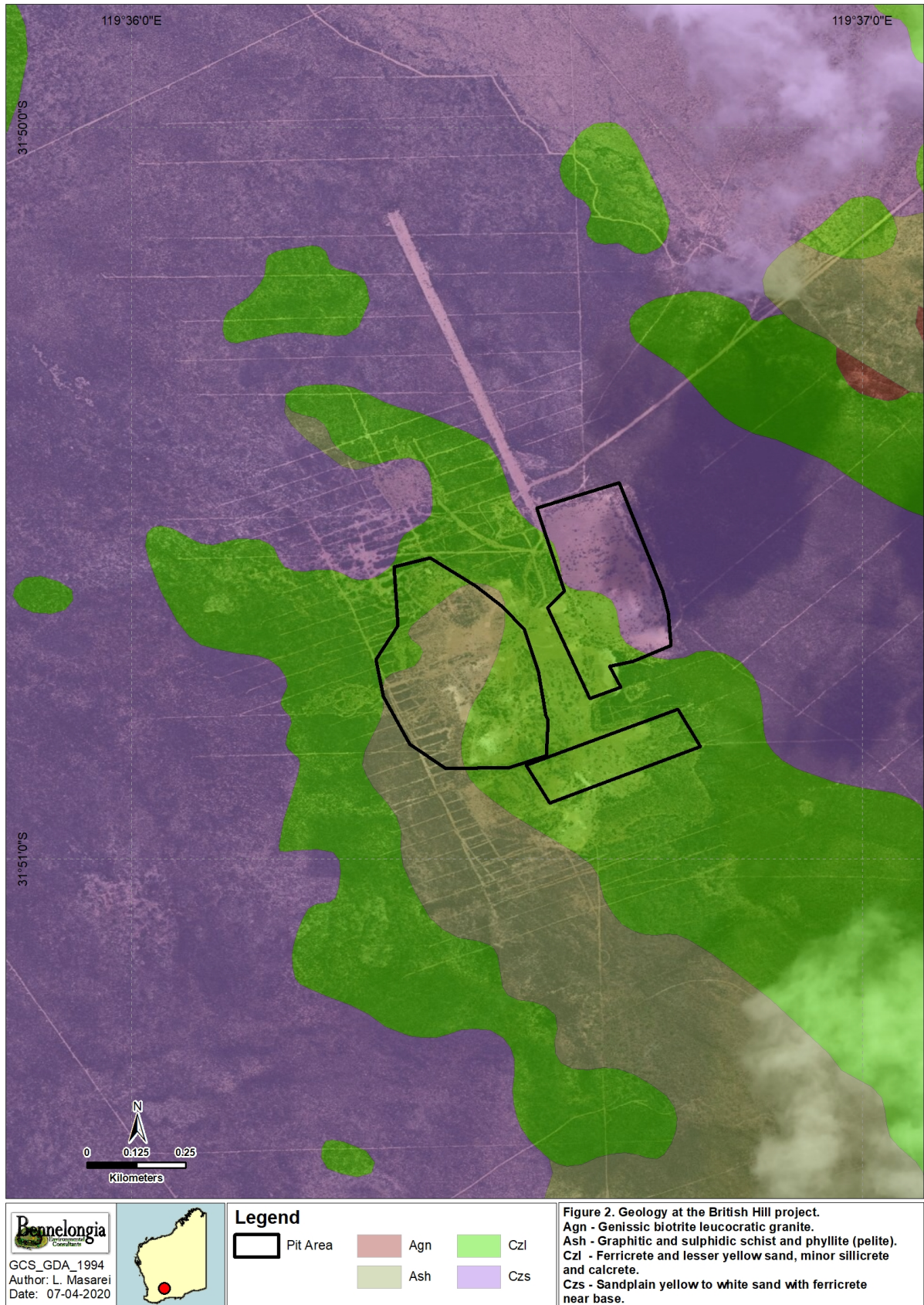


Figure 2. Geology at the British Hill project.

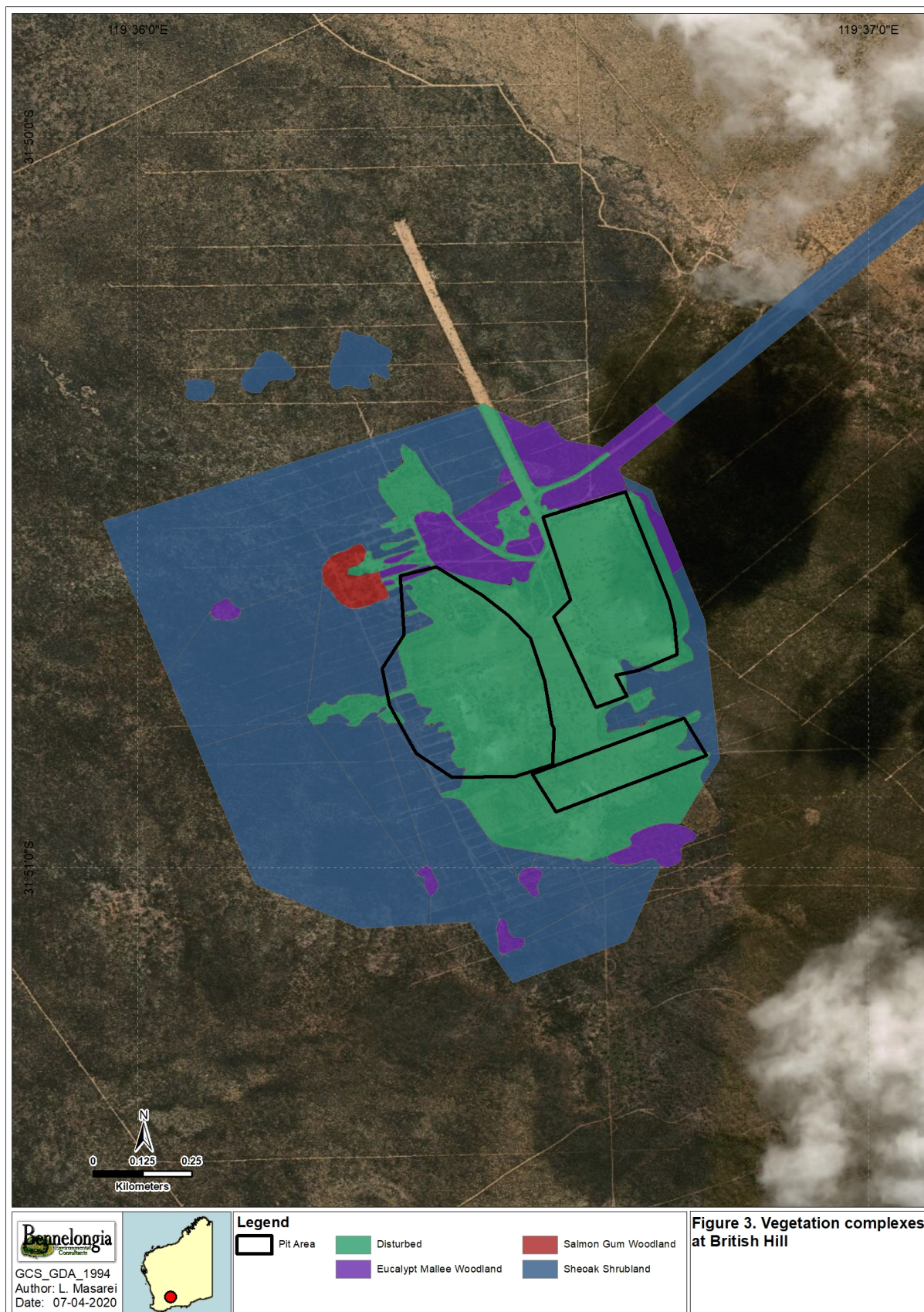


Figure 3. Vegetation complexes at British Hill.

3.2. Previous Records

Previous records of species from the SRE Groups within a 2-degree search area centred on British Hill (31.848° S, 119.607° E; Figure 4) were compiled by searching the databases of the WAM and Bennelongia. This type of desktop search gives only an indication of the level of species richness that can be expected in the development area; it does not provide a precise number of species that exists in the development area. Appendix 2 gives a tabulated list of species recorded in the search area. Due to incomplete or inconsistent taxonomy for some records, it is not usually practicable to determine the exact number of species that has been collected in the search area but, as mentioned above this is not important because the search is only intended to indicate the overall nature of the community likely to occur in and around the project. Some species listed in Appendix 2 may contain multiple taxa and, conversely, some specimens assigned to different taxa may represent the same species.

The desktop search revealed records of approximately 94 species from the SRE Groups in the search area including four species of land snail (*Stylommatophora*), 49 species of mygalomorph spider, 11 species of millipede (*Spirostreptida* and *Polydesmida*), 11 species of pseudoscorpion, 15 species of scorpion and three species of slater (Appendix 2).

Using species records as a proxy for sampling coverage, effort to collect terrestrial invertebrates in the vicinity of British Hill has been concentrated about 70 km to the south of the mine, and then sparsely in all other directions except to the east and south-east where there appears to have been little survey. The closest intensive sampling to the mine is 25 km to the north at Parker Range. Sampling appears to have occurred in broad ranges of habitats and geologies surrounding British Hill (Figure 4).

3.2.1. Listed Invertebrate Species at the Search Area

While there are no Priority Ecological Communities (PECs) or Threatened Ecological Communities (TECs) listed on the basis of terrestrial invertebrates in Western Australia, two species of invertebrates listed as Threatened occur in the wider vicinity of British Hill, as do three species listed as Priority by the Department of Biodiversity, Conservation and Attractions (DBCAs).

The butterfly *Ogyris subterrestris petrina*, listed as Critically Endangered under both state and federal acts, has been recorded at two sites near Kalgoorlie (Atlas of Living Australia 2020) in Mallee woodland. This species is commensal on the sugar ant (*Camponotus terebrans*), with the butterfly depositing its eggs at the entrances of sugar ant nests that about the base of trees and shrubs of various species. The ants then protect and tend to the emergent caterpillars. The host ant species is widespread across Australia. There are no records of this butterfly species (either historical or recent) in the search area and mining activity at British Hill is unlikely to have any impact on it.

There are at least 18 species in the *nigrum* species complex of shield-backed trapdoor spider (Rix *et al.* 2018). Based on the known distributions of these species, the one most likely to occur at British Hill is *Idiosoma intermedium*, which is listed as Priority 3 by the DBCA. Like other species in the *nigrum* complex, this species is often treated as an SRE for assessment purposes, although it is relatively widespread with a known (and likely underestimated) overall range of nearly 14,500 km² (Rix *et al.* 2018). The southern extent of its range is Bodallin, approximately 75 km west of Marvel Loch. Even if the range of this species extends southeast to British Hill, mine development would have minimal impact on its overall habitat.

The Priority 1 butterfly *Jalmenus aridus* is known from a handful of records near Kalgoorlie and Ngaanyatjarraku in the northern Yilgarn, indicating that it may be rare but widespread in the Yilgarn. The species is not commonly collected and is poorly represented in Australian research collections. The larvae of this butterfly feed on the leaves and flowers of *Senna* spp. and *Acacia tetragonophylla* (Graham and Moulds 1988). This suggests that *Jalmenus aridus* may be widespread but poorly sampled. The conservation status of the butterfly is unlikely to be impacted by mine development.

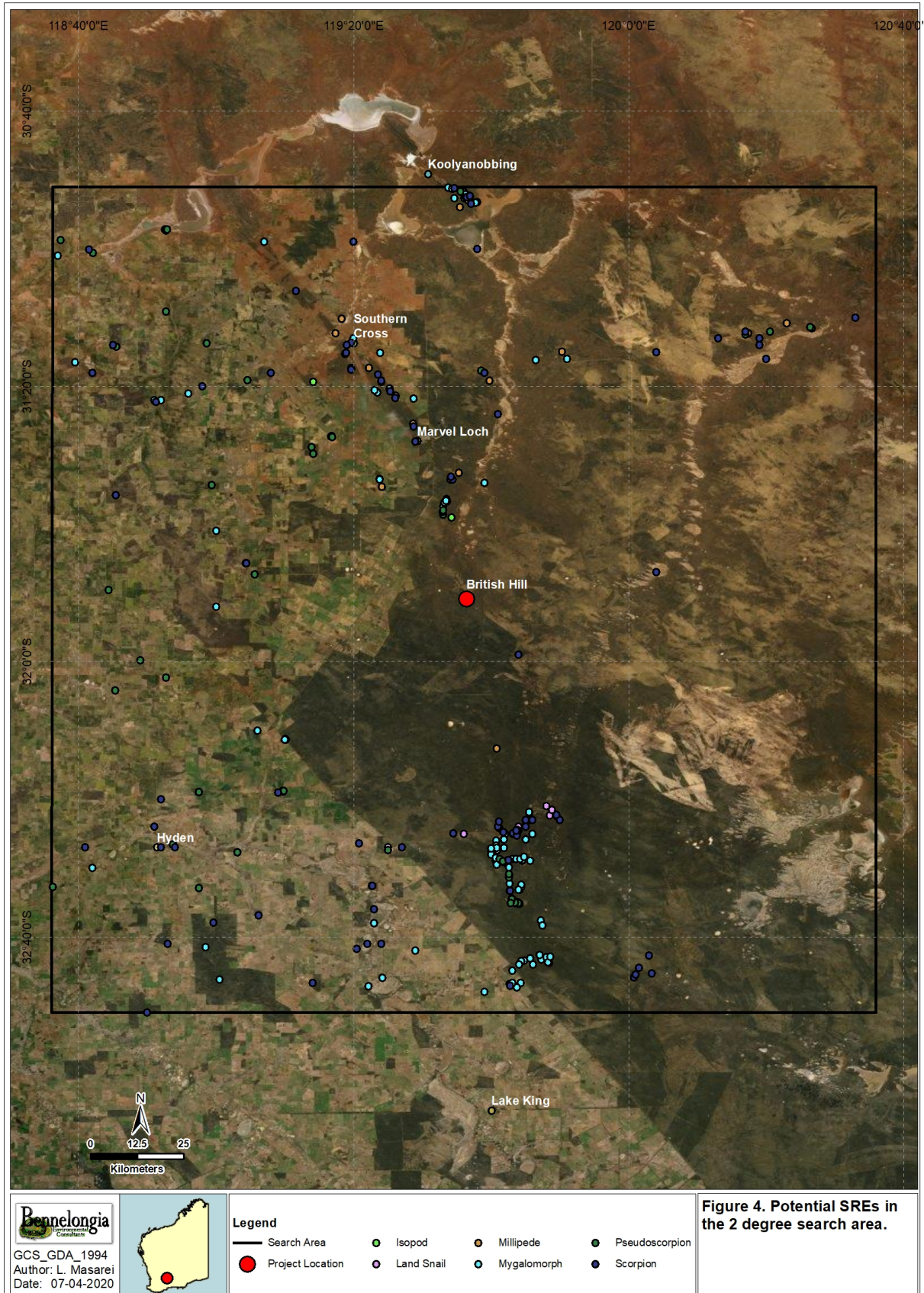


Figure 4. Potential SREs in the 2 degree search area.

Figure 4: Potential SREs in the 2 degree search area.

The woolybush bee *Hylaeus globuliferus* is listed as Priority 3 and has a large range that extends from Eneabba in the northwest to Fitzgerald River National Park in the southeast. The closest record of this species to the mine is approximately 120 km away, north of Newdegate, though it is been recorded over much of the south-west of WA (Atlas of Living Australia 2020). The large range of this species relative to the proposed development area at British Hill suggests that negative impacts to this species from mine development are highly unlikely.

The Priority 4 tree-stem trapdoor spider *Idiosoma castellum* (formerly *Aganippe castellum*) is known from at least 22 populations in south-west Western Australia. These populations extend from the south and east at Merredin and Southern Cross, respectively, to Pintharuka Nature Reserve in the north. The closest population to British Hill is approximately 70 km away at Southern Cross. As a result the conservation status of this species is highly unlikely to be affected by the Project.

4. CONCLUSIONS

Even when SRE fauna are present at a mine site, significant impacts on the conservation values of the fauna will only occur when the species have small ranges relative to the area of mine-related disturbance. The potential for significant impacts to SREs by mine pit excavation and mine-related disturbance at British Hill is considered to be low. This is based on the small size of the mine pit (approximately 27.65 ha) in relation to the known ranges of SRE species found in the search area. In addition, the relatively high proportion of existing clearing within the Project area makes the occurrence of SRE species unlikely.

The desktop assessment of the potential occurrence of SRE species considered information on regional setting, including geology, vegetation and botanical mapping; and accounts of the habitats occupied by SRE species, as detailed in taxonomic literature. When combined, these resources suggest that prior to historical mine development at British Hill, SRE species (or, at least, species belonging to SRE Groups) are highly likely to have occurred in the development area. This reflects the high levels of species-diversity of SRE groups throughout the Great Western Woodlands. However, the development area would not have been markedly different from surrounding land and, reflecting this habitat connectivity, the species present would also have occurred in the surrounds of the Project.

Currently, subsequent to clearing associated with the historical mine development, due to habitat loss it is unlikely that many species in the SRE Groups remain within the development area. Any species that have persisted are likely to have wider occurrence in the surrounding areas of uncleared woodland and shrubland. Furthermore, the small size of the proposed disturbance (27.65 ha) makes it highly unlikely that the conservation status of any species that may have persisted within the Project area will be significantly affected by mine development. The ranges of SRE species are, for the most part, 1,000s of square kilometres. In comparison, the mine pit will occupy about 0.3 km.

5. REFERENCES

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Appendix 1. Records of species from the SRE Groups retrieved from Western Australian Museum and Bennelongia databases within a 2-degree search area centred on the Project.

Higher Classification	Lowest Identification
Mollusca	
Gastropoda	
Stylommatophora	
Bothriembryontidae	<i>Bothriembryon sp.</i>
	<i>Bothriembryon sp. nov.</i>
	<i>Bothriembryon dux</i>
	<i>Bothriembryon barretti</i>
Punctidae	<i>Westralaoma cf. expicta</i>
Arthropoda	
Chelicerata	
Arachnida	
Scorpiones	<i>Scorpiones sp.</i>
Buthidae	<i>Buthidae sp.</i>
	<i>Lychas sp.</i>
	<i>Lychas 'adonis' ms</i>
	<i>Lychas splendens</i>
	<i>Lychas 'annulatus complex'</i>
	<i>Lychas jonesae</i>
	<i>Lychas 'subsplendens' ms</i>
	<i>Isometroides sp.</i>
	<i>Isometroides vescus</i>
Bothriuridae	<i>Cercophonius sp.</i>
	<i>Cercophonius sulcatus</i>
	<i>Cercophonius michaelsoni</i>
	<i>Cercophonius ?michaelsoni</i>
Urodacidae	<i>Urodacus sp.</i>
	<i>Urodacus novaehollandiae</i>
	<i>Urodacus armatus s.l.</i>
	<i>Urodacus 'woodwardii?'</i>
	<i>Urodacus 'gibson 2'</i>
	<i>Urodacus hoplurus</i>
	<i>Urodacus similis</i>
Pseudoscorpiones	<i>Pseudoscorpiones sp.</i>
Chthoniidae	<i>Austrochthonius 'similis'</i>
Olpiidae	<i>Olpiidae sp.</i>
	<i>Indolpium sp.</i>
	<i>Beierolpium sp.</i>
	<i>Beierolpium 8/4 sp.</i>
Garypidae	<i>Synsphyronus sp.</i>
	<i>Synsphyronus mimulus</i>
	<i>Synsphyronus 'Wheatbelt 8/3'</i>
	<i>Synsphyronus 'sp. nov. Wheatbelt 6/2 large'</i>
	<i>Synsphyronus 'PSE117'</i>
	<i>Synsphyronus dorothyae</i>
Atemnidae	<i>Oratemnus sp.</i>
Chernetidae	<i>Chernetidae sp.</i>
	<i>Haplochernes sp.</i>
	<i>Haplochernes ?ramosus</i>
Araneae	
Mygalomorphae	<i>Mygalomorphae sp.</i>
Barychelidae	<i>Barychelidae sp.</i>
	<i>Synothele sp.</i>
	<i>Synothele 'forrestiana'</i>
	<i>Synothele longbottomi</i>
	<i>Idiommata sp.</i>
	<i>Idiommata cf. blackwalli</i>
	<i>Idiommata 'yelbeni'</i>
Nemesiidae	<i>Aname sp.</i>
	<i>Aname cf. mainae</i>
	<i>Aname mainae</i>
	<i>Aname 'MYG182'</i>
	<i>Aname 'MYG010'</i>
	<i>Aname 'MYG181'</i>
	<i>Aname 'MYG461'</i>
	<i>Aname 'MYG008'</i>
	<i>Aname 'Trayning'</i>
	<i>Merredinia damsonoides</i>
	<i>Teyl sp.</i>
	<i>Teyl 'marked angle door group'</i>
	<i>Teyl 'MYG457'</i>
	<i>Teyl 'MYG480'</i>

Higher Classification	Lowest Identification
	<i>Teyl luculentus</i>
	<i>Teyl</i> `MYG021`
	<i>Teyl</i> `MYG068`
	<i>Anaminae</i> sp.
	<i>Kwonkan</i> `MYG060`
	<i>Kwonkan</i> `MYG183`
	<i>Proshermacha</i> `MYG429`
Theraphosidae	<i>Selenotholus foelschei</i>
Actinopodidae	<i>Missulena</i> sp.
	<i>Missulena granulosa</i>
	<i>Missulena pinguipes</i>
	<i>Missulena occatoria</i>
	<i>Missulena</i> `MYG042`
Ctenizidae	<i>Conothele</i> sp.
	<i>Conothele</i> `MYG059`
Idiopidae	<i>Idiopidae</i> sp.
	<i>Idiosoma</i> sp.
	<i>Idiosoma intermedium</i>
	<i>Idiosoma castellum</i>
	<i>Idiosoma</i> `MYG064`
	<i>Idiosoma</i> `MYG065`
	<i>Idiosoma</i> `Biota sp. A`
	<i>Idiosoma</i> `twig-lining sp.`
	<i>Idiosoma/Eucyrtops</i> sp.
	<i>Idiosoma</i> `bifida spp. Grp`
	<i>Idiosoma</i> `cupulifex spp. group`
	<i>Idiosoma</i> `galeosomoides_sp_2`
	<i>Idiosoma</i> `jessupi`
	<i>Eucyrtops</i> sp.
	<i>Gaius</i> sp.
	<i>Gaius austini</i>
	<i>Gaius</i> `MYG063`
	<i>Gaius villosus</i> s.l.
	<i>Gaius cooperi</i>
	<i>Gaius mainae</i>
	<i>Eucanippe agastachys</i>
	<i>Eucanippe mallee</i>
	<i>Arbanitini</i> sp.
Dipluridae	<i>Cethegus</i> sp.
Crustacea	
Malacostraca	
Isopoda	<i>Isopoda</i> sp.
Philosciidae	<i>Philosciidae</i> sp.
	<i>Laevophiloscia</i> sp. B06
	<i>Laevophiloscia</i> sp.
Armadillidae	<i>Armadillidae</i> sp.
	<i>Buddelundia</i> sp.
	<i>Buddelundia binotata</i>
Myriapoda	
Diplopoda	
Polydesmida	
Paradoxosomatidae	<i>Antichiropus</i> sp.
	<i>Antichiropus exclamatus</i>
	<i>Antichiropus framenau</i>
	<i>Antichiropus howardi</i>
	<i>Antichiropus inflatus</i>
	<i>Antichiropus kealleyi</i>
	<i>Antichiropus laticlavus</i>
	<i>Antichiropus saxatilis</i>
	<i>Antichiropus serratus</i>
	<i>Antichiropus succedaneus</i>
	<i>Antichiropus</i> `Marvel Loch?`
Spirostreptida	
Iulomorphidae	<i>Atelomastix</i> sp.
	<i>Atelomastix bamfordi</i>

Appendix 2. Classification scheme of the Western Australian Museum for SRE invertebrates.

Categories:

- **Confirmed SRE:** species with a well surveyed range of less than 10,000 km².
- **Potential SRE:** species with imperfectly understood ranges because sampling has been patchy. In some cases, the uncertainty about range is compounded by an incomplete taxonomic framework.
- **Unlikely SRE:** includes potentially new species that do not possess the traits of a SRE species (i.e. biological or habitat factors). For example, this subcategory may include species recorded during a survey from one or more habitat types that have low prospectivity for SREs or species possessing very few morphological features typical of SREs.
- **Widespread:** known range of more than 10,000 km² or good evidence (multiple collections from different habitats) pointing towards a similarly-large range.
- **Unknown:** usually higher level identifications (possibly due to immature specimens) or identifications of species complexes where there have been recent revisions that make it unclear which species were originally collected.

The museum divides Potential SREs into five subcategories that provide some information about why the species is treated as a Potential SRE (definitions are paraphrased here). The subcategories are:

- Data deficient: There are insufficient data available to determine SRE status, because of few collecting records (and a belief sampling for the species has been geographically restricted) or uncertain identification.
- Habitat Indicators: The status of a species may be inferred using its association with a particular habitat.
- Morphological Indicators: The status of a species may be inferred using its morphological characteristics.
- Molecular Evidence: DNA sequence data may reveal patterns congruent or incongruent with SRE status for a species; and
- Research & Expertise: Available research data and/or WAM expertise may suggest the species is likely (or not) to be an SRE.