APPENDIX 6: LEVEL 2 SHORT RANGE ENDEMIC SURVEY OF THE GRUYERE GOLD PROJECT (HAREWOOD 2016A)

Short Range Endemic Invertebrate Survey

Gruyere Project Area

Gold Road Resources Limited

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Version 2

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Cover photo: Abandoned burrow and lid of a mygalomorph spider – Yamarna Station

SUMMARY

This report details the results of a targeted Level 2 terrestrial short range endemic (SRE) invertebrate survey undertaken within Gold Road Resources Limited's (GRRs) Gruyere Project area (the Project area) in the "Yamarna Belt" tenement areas situated about 160km north-east of Laverton, Western Australia (Figure 1).

The assessment has included a review of previous surveys carried out in the area and a targeted invertebrate field survey including wet pit trapping and sampling. Wet pit traps were installed and leaf litter sampling/hand foraging undertaken between the 15 and 17 August 2015. The wet pit traps were retrieved on the 14/15 October 2015, which equates to a trapping period of about 60 days for each site.

The field survey resulted in the collection of 249 specimens representing 20 species from the targeted SRE groups including scorpions, spiders, pseudoscorpions, isopods and centipedes.

A summary of the results of the assessment and the SRE status of each species are as follows:

- None of the species collected were identified by taxonomic experts as being confirmed SREs;
- Eight of the 20 species were identified as representing potential SREs. These are comprised of two species of scorpion, four species of spider, one species of isopod and one species of centipede. The remaining 12 species are considered to be widespread and therefore not SREs;
- All eight species of the potential SREs were collected from outside of the currently proposed disturbance footprint, with only two species (one species of isopod and one species of centipede) also being recorded at one or more sites inside the disturbance footprint;
- Six species of invertebrates collected by Rapallo (2015) within the Gruyere tenement area in 2014 were also identified as representing potential SREs (some of which may be conspecific with specimens collected during the 2015 survey reported on here). None of these specimens were collected within the currently defined disturbance footprint.
- Habitats within which the potential SREs were recorded inside the disturbance footprint are widespread outside of this area.

The results of the targeted survey reported on here, in addition to previous surveys carried out nearby, suggest that the conservation status of SRE taxa will not be adversely changed as a result of the Gruyere Project proceeding in its current form. The surveys carried out to date have not identified any confirmed SRE species as being present within the proposed disturbance footprint. The two species of potential SREs

which have been identified as occurring within areas likely to be impacted on have also been recorded outside of this area and the respective habitats in which they were captured are widespread in the area.

In addition, other mining-related activities such as the construction and operation of narrow linear infrastructure (e.g. pipelines, access roads) outside of the areas surveyed are also very unlikely to have any adverse impact on any SRE invertebrate populations (if present) given the relatively small areas of disturbance at any one location and the widespread extent of identical habitat types in the general area.

It is therefore concluded that there is a very low likelihood of any significant impact/change occurring to local invertebrate communities or to the conservation status of individual species occurring as a result of the Gruyere Project proceeding given that populations can be expected to persist in adjoining unaffected locations.

1. INTRODUCTION

This report details the results of a targeted Level 2 terrestrial short range endemic (SRE) invertebrate survey undertaken within Gold Road Resources Limited's (GRRs) Gruyere Project area (the Project area) in the "Yamarna Belt" tenement areas situated about 160km north-east of Laverton, Western Australia (Figure 1).

The Project area is primarily located within Mining Lease (M) 38/1267 (pending) which is approximately 6,845 hectares (ha) in size. A previous Level 2 (EPA 2004) fauna survey, mainly targeting vertebrate fauna, was undertaken here in late 2014 during which time some invertebrates tentatively identified as "potential short-range endemics" (SREs) were captured as "by-catch" (Rapallo 2015).

As this previous Level 2 survey was mainly aimed at identifying terrestrial vertebrate species and did not specifically target the, then undefined, disturbance footprint (with the exception of three hand foraging sites), doubt existed about the possible impacts the proposed mine and associated infrastructure could have on SRE/potential SRE invertebrates which may or may not be present. The aim of the survey reported on here was therefore to collect more detailed information on the presence and distribution of SRE taxa in the Project area, in particular areas subject to actual development in addition to analogous habitat areas nearby. This information can then be used to determine which, if any, of the known or possible SRE species identified are apparently restricted to, or have most of their population within, the proposed disturbance footprint.

It is understood that information obtained during this assessment will be used in conjunction with other environmental investigations to guide project planning. It is anticipated that the information presented will also be used by regulatory authorities to assess the potential impact of the proposal on fauna and fauna habitats at the site during the project evaluation and approval process.

2. SCOPE OF WORKS

The scope of works was defined as:

- Literature Review

  A review of the previous fauna surveys carried out in the immediate vicinity which have included the collection and identification of invertebrate specimens will be undertaken.

- Field Survey

  Carry out an invertebrate wet pit trapping program, hand foraging and leaf litter sampling specifically targeting the currently defined disturbance

footprint areas and replicate sites in similar habitats nearby to allow for comparisons to be made.

- Report

  A report to be prepared summarising results within an assessment of the potential impacts on SRE invertebrates which may occur as a consequence of mine development.

3. METHODS

3.1 LITERATURE REVIEW

The following fauna survey reports and associated taxonomic reports detailing the result of previous assessments in the area, in which terrestrial invertebrates were collected, have been reviewed:

- KLA (2012). Fauna Assessment (Level 2) Yamarna Project. Unpublished report for Gold Road Resources. October 2012.
  - Burger, M., Castalanelli, M.A and Harvey M.S. (2012). Arachnids from Yamarna, 140 km East of Laverton, Western Australia. Report to Keith Lindbeck and Associates by Western Australian Museum. May 2012.
  - Volschenk, E. (Scorpion ID) (2012). Yamarna Scorpion Identification Report. Unpublished report for Keith Linbeck and Associates.
  - Whisson, C. (2012). Land snails from Yamarna, Western Australia. Unpublished Report, April 2012. Department of Aquatic Zoology, Western Australian Museum, Welshpool, WA.
- Harewood G. (2014). Fauna Assessment (Level 1) Gruyere Project. Unpublished report for Gold Road Resources Ltd. July 2014.
  - Phoenix Environmental Sciences (2014). Identification and assessment of short-range endemism of trapdoor spiders from Yamana [sic] Station, Western Australia. Unpublished report prepared for Botanica Consulting.
- Rapallo Environmental (2015). Fauna Survey of the Gruyere Project Area. Unpublished report for Gold Road Resources Limited. May 2015.
  - Phoenix Environmental Sciences (2015). Identification and assessment of short-range endemism of invertebrates from Yamarna Station, Western Australia. Unpublished report prepared for Rapallo Ltd.

- Volschenk, E. (Scorpion ID) (2015). Taxonomic Report for Invertebrates Surveyed from Yamarna Station. Unpublished report prepared for Rapallo Ltd.

A review of the Western Australian Museums (WAM) invertebrate database has previously been carried out by MBS Environmental (2014). MBS's search area for the database interrogation was centered on -27.98669 and 123.85007. The database includes all invertebrates records submitted to the WAM from previous surveys or opportunistic collections in the wider area. The results of the search were also filtered for specimens listed as known or potential SRE species.

3.2 INVERTEBRATE FIELD SURVEY

3.2.1 Survey Team

The fauna survey team comprised Greg Harewood with assistance from Matt Newlands (Botanica Consulting) and Jaye Small (Gold Road).

The field survey was carried out under a "Licence to Take Fauna for Scientific Purposes" issued by the DPaW (SF 010429).

3.2.2 Timing

Wet pit traps were installed and leaf litter sampling/hand foraging undertaken between the 15 and 17 August 2015. The wet pit traps were retrieved on the 14 and 15 October 2015, which equates to a trapping period of about 60 days for each site.

3.2.3 Survey Methods

The survey was designed to target the main invertebrate groups known to occur in the area that are recognised as having SRE taxa, these being: scorpions, myglamorph spiders, pseudoscorpions, isopods, centipedes, millipedes and snails.

The survey included the installation of 120 wet pit traps (12 sites with 10 pit traps), hand foraging and leaf litter collection.

Wet pit traps were comprised of a 2.5 litre plastic buckets dug down into the ground so that the opening was level with the ground surface. Approximately 800ml of propylene glycol was placed into each bucket and an identifying printed site label dropped in. A 20 litre bucket lid raised 5 to 10 mm was then placed over the trap opening using clothes pegs, rocks or twigs, to act as a "roof" with the aim of limiting the drift of debris and access by vertebrates.

Ten wet pit traps were placed at each of the 12 sites about 10 or 20 metres apart. The traps were strategically placed, where possible, within areas of accumulated leaf litter in shady microhabitats such as beneath trees, shrubs and/or near logs.

Twelve mixed soil and litter samples about 3 litres in volume were collected from each of the 12 wet pit trap sites. Samples were placed in calico bags for transportation to the office for identification.

Hand foraging, and searching in crevices and under logs and bark in a range of microhabitats was carried out at each of the 12 wet pit trap sites concurrent with the installation of the wet pit traps and the collection of the leaf litter samples. Any specimens collected were placed in vials containing 100% ethanol.

At the completion of the wet pit trap program, about two months after installation, the contents of each bucket were decanted into plastic sample bottles with screw lids and transported back to the office for sorting.

3.2.4 Trap Site Selection

Six of the 12 trap sites were placed within areas likely to be disturbed during mining operations, these "impact" sites were GR 1, 2, 4, 5, 6 and 12. The remaining six "reference" sites were in areas outside the currently proposed works footprint, these being GR 3, 7, 8, 9, 10 and 11 (Figure 2).

As far as possible, the reference sites were selected so as to represent the same habitat components as the impact sites as indicated by landform, soil and vegetation type.

Table 1: Trap Site Descriptions

Trap Site.	Fauna Habitat Description & Location	Example Image
GR 1	Sandplain – Impact Site Woodland/Mallee Woodland and Shrubland. Lower story *Triodia* dominated. Soil Red sands. Location -27° 59' 13" 123° 51' 00"	

Trap Site.	Fauna Habitat Description & Location	Example Image
GR 2	Sand Dune – Impact Site Eucalypt Woodlands/Mallee Woodlands and Shrublands. Lower story *Triodia* dominated. Soil Red sands Location -27° 59' 02" 123° 51' 13"	
GR 3	Sand Dune – Reference Site Eucalypt Woodlands/Mallee Woodlands and Shrublands. Lower story Triodia dominated. Soil Red sands Location -27° 59' 34" 123° 49' 45"	
GR 4	Rocky Hill Slopes – Impact Site *Acacia* Woodlands. Soil Rocky skeletal red soils Location -27° 59' 34" 123° 49' 45"	
GR 5	Clay-Loam Plain – Impact Site *Acacia* Forests and Woodlands; *Acacia* Shrublands Soil Clay Loam red soil plains Location -27° 58' 25" 123° 52' 31"	

Trap Site.	Fauna Habitat Description & Location	Example Image
GR 6	Drainage Depression – Impact Site *Acacia* Open Woodlands; Mallee Open Woodlands and Sparse Mallee Shrublands. Soil Light brown clays Location -27° 58' 06" 123° 52' 21"	
GR 7	Sandplain – Reference Site Eucalypt Woodlands/Mallee Woodlands and Shrublands; Mallee Woodlands and Shrublands. Lower story *Triodia* dominated. Soil Red sands. Location -28° 00' 45" 123° 50' 41"	
GR 8	Clay-Loam Plain – Reference Site *Acacia* Forests and Woodlands; *Acacia* Shrublands Soil Clay Loam red soil plains Location -28° 00' 11" 123° 51' 59"	
GR 9	Rocky Hill Slopes – Reference Site *Acacia* Woodlands. Soil Rocky skeletal red soils Location -27° 59' 38" 123° 52' 17"	

Trap Site.	Fauna Habitat Description & Location	Example Image
GR 10	Drainage Depression – Reference Site *Acacia* Open Woodlands; Mallee Open Woodlands and Sparse Mallee Shrublands. Soil Light brown clays. Location -27° 59' 30" 123° 52' 31"	
GR 11	Rocky Hill Slopes – Reference Site *Acacia* Woodlands. Soil Rocky skeletal red soils Location -28° 00' 13" 123° 52' 30"	
GR 12	Sandplain – Impact Site Eucalypt Woodlands/Mallee Woodlands and Shrublands; Mallee Woodlands and Shrublands. Lower story Triodia dominated. Soil Red sands. Location -27° 59' 22" 123° 50' 24"	

3.2.5 Sample Sorting and Species Identifications

Upon return to the office, samples collected from the wet pit traps were sorted under a binocular microscope to extract invertebrate specimens belonging to the primary target groups (i.e. scorpions, myglamorph spiders, pseudoscorpions, isopods, centipedes, millipedes and snails). Soil and litter samples were partially sorted using sieves and the resultant samples also examined for target invertebrate species using the binocular microscope or a magnifying glass.

Invertebrate specimens identified from the samples as being from the target SRE groups were catalogued and placed into glass vials with 100% ethanol and an identifying label. These were then forwarded onto taxonomic experts for formal identification and comments on likely SRE status.

Specimens were forwarded to the following taxonomic experts:

- Scorpions, pseudoscorpions and centipedes – Dr Erich Volschenk (Scorpion ID).
- Myglamorph spiders – Dr Volker Framenau (Phoenix Environmental Services)
- Isopods Dr Simon Judd.

(Note: snails and millipedes were not represented in the specimens collected).

4. RESULTS

4.1 LITERATURE REVIEW

The locations of the surveys discussed below, relative to the current assessment are shown Figure 3.

A Level 2 fauna survey was carried out by Keith Linbeck and Associates within Gold Road's Attila and Central Bore project areas in 2011 and 2012 (KLA 2012). These areas are located about 20km south west of the Gruyere Project area.

During the course of this survey, which primarily targeted terrestrial vertebrate species, 54 individual invertebrates were collected and passed onto specialists at the WAM. The assemblage comprised species from *Arachnida* and *Gastropoda*. Within the Arachnida, 10 species totalling 41 individuals representing six families within *Araneae, Psuedoscorpiones and Scorpiones* were identified. *Gastropoda* was represented by one Family and two species totalling 13 individuals.

Given the lack of taxonomic knowledge and reference collections, the results from WAM were often inconclusive depending on the families or genera. Within the Order Araneae, for example, of the four species identified by WAM, one was not a SRE (*Synothele meadhunteri*), one could not be determined (*Synothele* sp.), for one it was at the time not possible to say if the species represents a SRE (*Eucyrtops* sp.) and one 'could' represent a SRE (Burger *et al*. 2012) (Table 24). For the latter, a single mygalomorph, *Aname* 'MYG250' (Nemesiidae) was identified as morphologically unique and has not been previously reported from the area.

Within the Order Pseudoscorpiones, a similar scenario resulted with *Haplochernes* sp. 'PSE030' unlikely to be a SRE, *Austrohorus* sp. 'currently not possible to say if the species represents a SRE', *Indolpium* sp. unlikely to be a SRE and *Beierolpium* 'sp. juv' requiring further work as it could represent a SRE (Burger *et al.* 2012).

The scorpions were identified from one family, Buthidae, with 18 individuals representing two species. At the time both species were considered to have wide distributions across arid Australia and neither were therefore considered to be SREs (Volschenk 2012). However the specimens identified as *Lychas* 'annulatus" (equivalent to *Lychas* 'annulatus complex'') are now regarded as potential SRE species based on more current research data (Volschenk 2015b).

Two species of land snails were identified belonging to the family Pupillidae (Whisson 2012). Both have a widespread distribution and are not considered to be SREs.

KLA (2012) also stated that in terms of potential SRE invertebrate habitat, while there are "no mountainous terrains and no free-standing areas of water within the tenements, the Yamarna area does support some breakaway areas and creeklines that may be considered SRE potential habitat" but that these areas were limited in extent in this particular area.

During the course of a Level 1 fauna survey undertaken within the Gruyere Project area in 2014 two myglamorph spiders were collected from within the currently defined mine pit area (Figure 2) (Harewood 2014). The specimens were identified by taxonomic experts as representing a male "trapdoor spider" of the widespread species *Aganippe* 'MYG159' (family Idiopidae) and an unidentified juvenile spider belong to the family Theraphosidae (Australian tarantulas). Neither specimens were deemed to be SREs or potential SREs given their known or likely large distributions (Phoenix 2014).

A Level 2 fauna survey within the Gruyere Project area carried out in late 2014 (Rapallo 2015) resulted in the collection of a total of 37 invertebrate specimens, comprised of eight spiders, 27 scorpions, and two pseudoscorpions.

Taxonomic identifications (Phoenix 2015a and Volschenk 2015a) revealed that the specimens contained six potential SRE species, comprising three species of Mygalomorph spider, and three species of scorpion. The two pseudoscorpions were identified as being the same species and unlikely to represent SREs.

The potential SRE species captured during Rapallo's survey are listed below:

- *Synothele* sp. indet (Mygalomorph spider Trap site 3)
- *Aname* 'yamarna' (Mygalomorph spider Trap site 3)

- *Kwonkan* 'yamarna' (Mygalomorph spider Trap site 4)
- *Lychas* 'GVD' (Scorpion Trap sites 2 and 4)
- *Lychas* 'multipunctatus complex' (Scorpion Trap sites 1 and 2)
- *Urodacus* 'yaschenkoi complex' (Scorpion Trap site 3)

None of the abovementioned specimens were collected from the currently defined disturbance footprint within the Gruyere Project area, with most collection sites being several kilometres south, the exception being Traps Site 1 (TS 1) which is situated just above the proposed mine pit (Figure 2). The specimen collected here (*Lychas* 'multipunctatus complex') was however also collected at TS 2, well away from the proposed mine area (Rapallo 2015, Figure 5) in sandplain habitat which is widespread in the general area.

The WAM invertebrate database search, filtered for potential SRE's, returned 26 records of nine species. Most of these specimens (22) were collected well outside (>120km) of the Yamarna area. Of the remaining four species, one specimen ("MYG250") represents the record submitted by KLA (2012) and reported on by Berger *et al.* (2012), as previously discussed.

Another two species of spider (*Aname* `red wish-bone sp.` and *Kwonkan* "sp 1") were collected from a location about 7km south west of Gold Roads current camp, ~25kms south west of Gruyere, in the 1990's.

The final species of potential SRE identified in the general vicinity in the database search is a scorpion (*Urodacus* sp. 'Point Sunday'), four specimens of which were collected from a borrow pit on Point Sunday Road in July 2007, approximately 11 km north of the Gruyere project area (MBS 2014).

4.2 INVERTEBRATE FIELD SURVEY

The targeted invertebrate field survey yielded 249 invertebrates specimens of the SRE target groups (scorpions (59), Mygalomorph spiders (10), pseudoscorpions (61), isopods (59), and centipedes (60)). No snails or millipedes were collected. A listing of the specimens submitted is contained within Appendix A.

Following is a summary of the taxonomic identifications provided by the respective experts on each group collected. In each case the species identified are listed along with their SRE status and the traps sites (prefix GR – Figure 2) from which they were collected. The original taxonomic reports are helped in Appendix B.

4.2.1 Scorpions

The scorpions specimens were identified as comprising five species including two potential SREs and three considered to be widespread (Volschenk 2015b), these being:

- *Isometroides* 'GVD' – Widespread (GR 8 & 11)
- *Lychas 'adonis'* – Widespread (GR 1, 2, 3, 4, 5, 8, 7 & 12)
- *Lychas '*annulatus complex' - Potential SRE (GR 3)
- *Lychas jonesae* – Widespread (GR 4, 5, 6, 8, 9 & 11)
- *Urodacus* sp. indet. - Potential SRE (GR 11)

The two potential SRE species collected (*Lychas* 'annulatus complex' and *Urodacus* sp. indet) were represented by single specimens, both collected from outside of the proposed disturbance areas (i.e. GR 3 and GR 11). Keith Linbeck and Associates (2012) also collected specimens of *Lychas* 'annulatus complex' within their survey area over 20km south of the Gruyere Project area suggesting a wide distribution across the general Yamarna area.

4.2.2 Spiders

The 10 Mygalomorph spiders collected were identified as including four potential SREs and a widespread species (Phoenix 2015b), these being:

- *Synothele meadhunteri* – Widespread (GR 8)
- *Synothele* 'gruyere' - Potential SRE (GR 11)
- *Aname* 'gruyere1' – Potential SRE (GR 8, 9 & 11)
- *Aname* 'gruyere2' - Potential SRE (GR 5)
- *Aname* 'gruyere3' – Potential SRE (GR 7)

The results are somewhat inconclusive due to an inability to compare these new specimens with those previously collected and now held at WAM, which is currently closed due to a major re-organisation of specimen storage. As a consequence and until material at WAM becomes available for comparative analysis, it will remain unclear if some of the specimens collected are conspecific with those previously collected in the area by KLA (2012) and Rapallo (2015) (i.e. if *Synothele* 'gruyere' is conspecific with *Synothele* sp. indet. (as reported in Burger *et al.* 2012 and Phoenix 2015a) and if any of the *Aname* species is conspecific with Aname 'MYG250' (as reported in Burger *et al.* 2012) or *Aname* 'yamarna' (as reported in Phoenix 2015a)).

In any event, none of the myglamorph spiders identified as being potential SREs were collected from proposed disturbance areas. In addition, if some of the specimens collected during this most recent survey are found to conspecific with those collected by KLA (2012) and/or Rapallo (2015) wider distributions across the general Yamarna area would be indicated.

4.2.3 Pseudoscorpions

The pseudoscorpions collected were identified as comprising three widespread species (Volschenk 2015b), these being:

- *Austrohorus* sp. indet. – Widespread (GR 1, 2, 3, 5, 7, 8 & 11)
- *Beierolpium* '8/3' – Widespread (GR 1, 2, 3, 4, & 11)
- *Indolpium* sp. 'PSE016' – Widespread (GR 2, 8, 9 ,10)

Keith Lindbeck & Associates (2012) also recorded representatives of these three genera; however, Rapallo only (2015) reported the presence of *Indolpium* which appears to be conspecific with *Indolpium* sp. 'PSE016' (Volschenk 2015b).

4.2.4 Isopods

The isopod specimens collected were determined to represent a single, apparently new species which is considered to be a potential SRE (Judd 2015), this being

- *Buddelundia '27gr'* – Potential SRE (GR 1, 2, 3, 4, 5, 7, 8, 10, 11 & 12)

Based on current knowledge, *Buddelundia* '27gr' is known only from the specimens reported on here. The species must therefore, at this stage, be considered a potential SRE primarily because there are knowledge gaps for the taxon and insufficient geographic information to determine its full distribution (Judd 2015).

Isopods of this single species were collected from 10 of the 12 trap sites across all habitat types indicating a wide distribution across the area surveyed, both from within and outside of the currently proposed disturbance areas.

4.2.5 Centipedes

Four species of scolopendromorph centipedes, one species of stone centipede and one species of earth centipede were collected during the field survey. Of these, only the earth centipede (*Mecistocephalus* sp. indet.) was determined to be a potential SRE (Volschenk 2015b). The complete species list is as follows:

- *Mecistocephalus* sp. indet. – Potential SRE (GR 2 & 7)

- *Lamyctes africanus* – Widespread (GR 2 & 7)
- *Cormocephalus rubriceps* – Widespread (GR 2 & 12)
- *Ethmostigmus curtipes* – Widespread (GR 7 & 12)
- *Scolopendra laeta* – Widespread (GR 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 & 12)
- *Scolopendra morsitans* – Widespread (GR 3, 4, 5 & 11)

Volschenk (2015b) reports that the potential SRE *Mecistocephalus* sp. indet. is likely to represent an undescribed species. The taxonomic resolution of this group is very poorly resolved and all recent SRE assessments of this genus have been based on DNA sequences and are unpublished. These investigations indicate the presence of numerous species, most of which appear to be range restricted. For this reason this species is considered to be a potential SRE.

This potential SRE species was collected from sand dune/sand plain habitat located within (GR 2) and outside (GR 7) the proposed disturbance areas.

5. CONCLUSION

The invertebrate survey within the Gruyere Project area resulted in the collection of 249 specimens representing 20 species from the targeted SRE groups including scorpions, spiders, pseudoscorpions, isopods and centipedes.

A summary of the results of the assessment and the SRE status of each species are as follows:

- None of the species collected were identified by taxonomic experts as being confirmed SREs;
- Eight of the 20 species were identified as representing potential SREs. These are comprised of two species of scorpion, four species of spider, one species of isopod and one species of centipede. The remaining 12 species are considered to be widespread and therefore not SREs;
- All eight species of the potential SREs were collected from outside of the currently proposed disturbance footprint, with only two species (one species of isopod and one species of centipede) also being recorded at one or more sites inside the disturbance footprint;
- Six species of invertebrates collected by Rapallo (2015) within the Gruyere tenement area in 2014 were also identified as representing potential SREs (some of which may be conspecific with specimens collected during the 2015 survey reported on here). None of these

specimens were collected within the currently defined disturbance footprint;

- Habitats within which the potential SREs were recorded inside the disturbance footprint are widespread outside of this area.

The results of the targeted survey reported on here, in addition to previous surveys carried out nearby, suggest that the conservation status of SRE taxa will not be adversely changed as a result of the Gruyere Project proceeding in its current form. The surveys carried out to date have not identified any confirmed SRE species as being present within the proposed disturbance footprint. The two species of potential SREs which have been identified as occurring within areas likely to be impacted on have also been recorded outside of this area and the respective habitats in which they were captured are widespread in the area.

In addition, other mining-related activities such as the construction and operation of narrow linear infrastructure (e.g. pipelines, access roads) outside of the areas surveyed are also very unlikely to have any adverse impact on any SRE invertebrate populations (if present) given the relatively small areas of disturbance at any one location and the widespread extent of identical habitat types in the general area.

It is therefore concluded that there is a very low likelihood of any significant impact/change occurring to local invertebrate communities or to the conservation status of individual species occurring as a result of the Gruyere Project proceeding given that populations can be expected to persist in adjoining unaffected locations**.**

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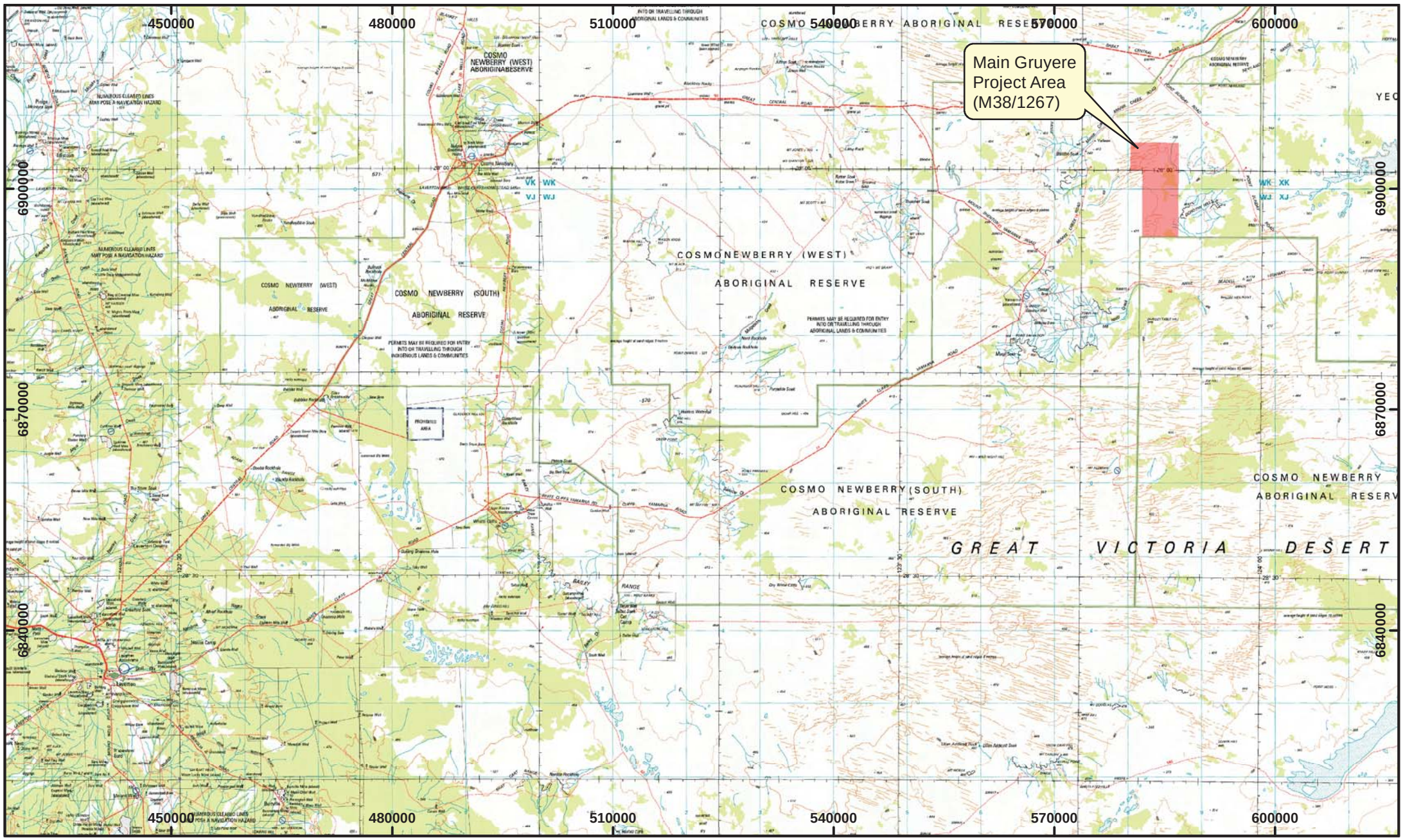
FIGURES



Legend

Main Gruyere Project Area (M38/1267)

0 10 20

Kilometres

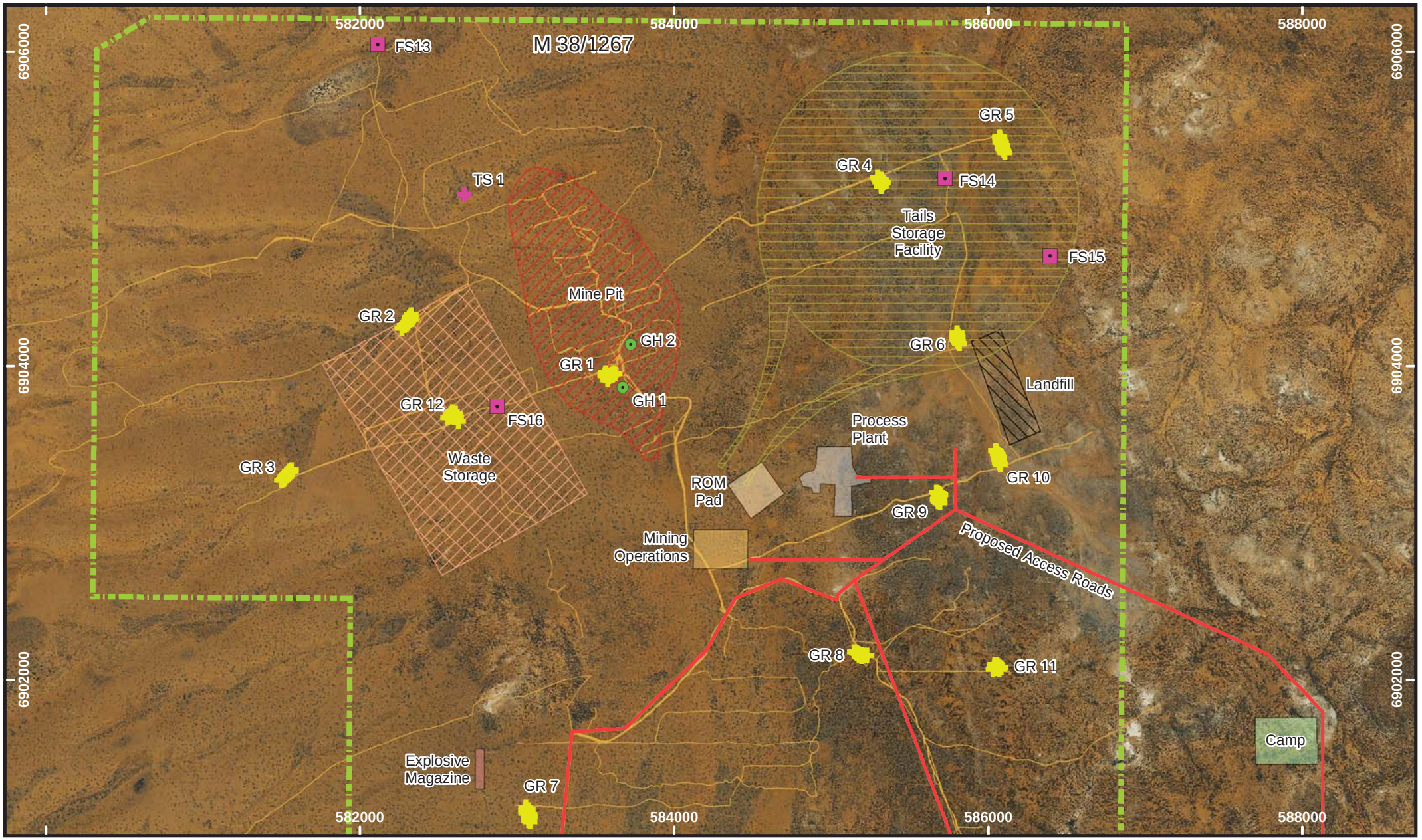
SRE Survey

Gold Road Resources Ltd
Gruyere Project

Project Area and Surrounds

DRAWN:G Harewood
DATE : Dec 2015
SCALE: 1:660,000
PROJECTION: MGA Zone 51

Figure: 1



Legend

- Harewood 2015 Invertebrate Wet Pit Trap & Leaf Litter Forage Sites (Prefix GR)
- Harewood 2014 Opportunistic (Prefix GH)
- Rapollo 2014 Survey Vertebrate Dry Pit Trap Sites (Prefix TS)
- Rapollo 2014 Survey SRE Leaf Litter Forage Sites (Prefix FS)

N

0 0.5 1 1.5 2

Kilometres

MGA Zone 51

SRE Survey

DRAWN: G Harewood

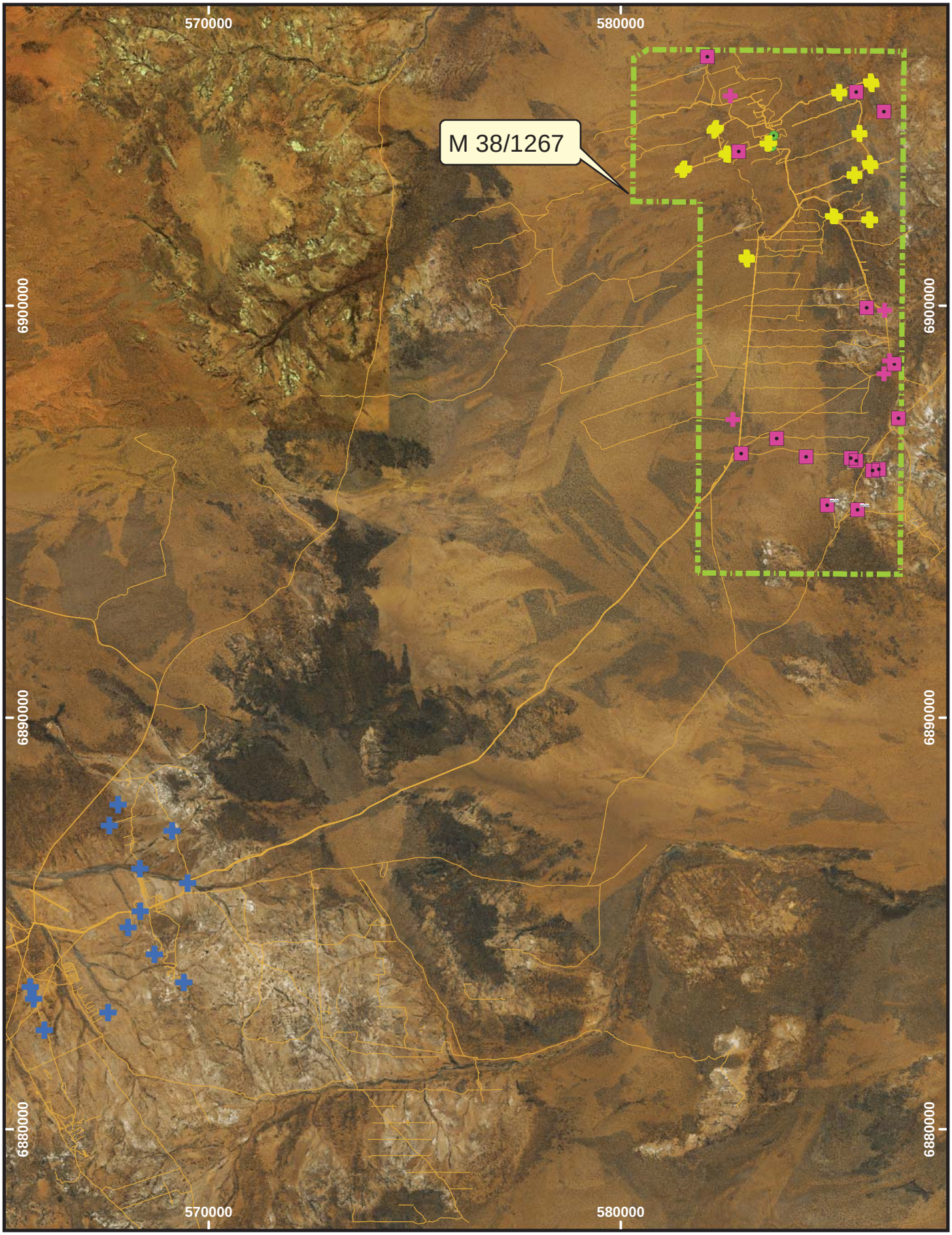
DATE : Dec 2015

SCALE: 1:32,000

Gold Road Resources Ltd
Gruyere Project

Invertebrate Collection Sites

Figure: 2



Legend

- KLA 2012 Trap/SRE Sites
- Harewood 2014 Opportunistic Collection Sites
- Rapollo 2014 Vertebrate Dry Pit Trap Sites
- Rapollo 2014 SRE Leaf Litter Forage Sites
- Harewood 2015 Invertebrate Wet Pit Trap & Leaf Litter Forage Sites

0 1 2 3 4 5

Kilometres

MGA Zone 51

SRE Survey

DRAWN: G Harewood

DATE : Dec 2015

SCALE: 1:120,000

Gold Road Resources Ltd

Gruyere Project

Fauna Survey Locations Yamarna

Figure: 3

APPENDIX A

LIST OF TARGET SRE INVERTEBRATES COLLECTED

Gruyere Inverebrates

Datum GDA94

Specimen	Trap Site	ID Number	Locality	Lat	Long	Start Date	End Date	Collectors	Method	Habitat
Pseudoscorpion	GR 1	101	9km NW of Dorothy Hills, Yamarna Station	-27° 59' 13"	123° 51' 00"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Scorpion	GR 1	105	9km NW of Dorothy Hills, Yamarna Station	-27° 59' 13"	123° 51' 00"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Centipede	GR 1	106	9km NW of Dorothy Hills, Yamarna Station	-27° 59' 13"	123° 51' 00"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Pseudoscorpion	GR 2	201	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 02"	123° 51' 13"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Centipede	GR 2	202	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 02"	123° 51' 13"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Scorpion	GR 2	205	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 02"	123° 51' 13"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Centipede	GR 2	207	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 02"	123° 51' 13"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Centipede	GR 3	301	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 34"	123° 49' 45"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Scorpion	GR 3	302	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 34"	123° 49' 45"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Pseudoscorpion	GR 3	304	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 34"	123° 49' 45"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Mygal	GR 3	306	10km NW of Dorothy Hills, Yamarna Station	-27° 59' 34"	123° 49' 45"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Ridge - Eucalypt /Mallee Woodland, Lower story Triodia dominated
Centipede	GR 4	401	9km NW of Dorothy Hills, Yamarna Station	-27° 58' 33"	123° 52' 03"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Scorpion	GR 4	402	9km NW of Dorothy Hills, Yamarna Station	-27° 58' 33"	123° 52' 03"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Pseudoscorpion	GR 4	404	9km NW of Dorothy Hills, Yamarna Station	-27° 58' 33"	123° 52' 03"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Centipede	GR 5	501	9km NW of Dorothy Hills, Yamarna Station	-27° 58' 25"	123° 52' 31"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Scorpion	GR 4	502	9km NW of Dorothy Hills, Yamarna Station	-27° 58' 25"	123° 52' 31"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Pseudoscorpion	GR 5	505	9km NW of Dorothy Hills, Yamarna Station	-27° 58' 25"	123° 52' 31"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Scorpion	GR 6	601	8km NW of Dorothy Hills, Yamarna Station	-27° 58' 06"	123° 52' 21"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Drainage Depression - Acacia and/or Mallee Open Woodland over chenopods
Centipede	GR 6	602	8km NW of Dorothy Hills, Yamarna Station	-27° 58' 06"	123° 52' 21"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Drainage Depression - Acacia and/or Mallee Open Woodland over chenopods
Centipede	GR 6	603	8km NW of Dorothy Hills, Yamarna Station	-27° 58' 06"	123° 52' 21"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Drainage Depression - Acacia and/or Mallee Open Woodland over chenopods
Mygal	GR 7	701	7km NW of Dorothy Hills, Yamarna Station	-28° 00' 45"	123° 50' 41"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Scorpion	GR 7	702	7km NW of Dorothy Hills, Yamarna Station	-28° 00' 45"	123° 50' 41"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Centipede	GR 7	703	7km NW of Dorothy Hills, Yamarna Station	-28° 00' 45"	123° 50' 41"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Pseudoscorpion	GR 7	706	7km NW of Dorothy Hills, Yamarna Station	-28° 00' 45"	123° 50' 41"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Centipede	GR 7	707	7km NW of Dorothy Hills, Yamarna Station	-28° 00' 45"	123° 50' 41"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Mygal	GR 7	708	7km NW of Dorothy Hills, Yamarna Station	-28° 00' 45"	123° 50' 41"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Pseudoscorpion	GR 8	801	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 11"	123° 51' 59"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Scorpion	GR 8	802	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 11"	123° 51' 59"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Centipede	GR 8	804	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 11"	123° 51' 59"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Mygal	GR 8	806	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 11"	123° 51' 59"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Centipede	GR 8	807	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 11"	123° 51' 59"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Mygal	GR 8	808	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 11"	123° 51' 59"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Clay Loam Plain - Acacia Forest and Woodland over Acacia Shrubland.
Pseudoscorpion	GR 9	901	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 38"	123° 52' 17"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Mygal	GR 9	902	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 38"	123° 52' 17"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Scorpion	GR 9	903	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 38"	123° 52' 17"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Centipede	GR 9	904	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 38"	123° 52' 17"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Centipede	GR 9	905	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 38"	123° 52' 17"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Pseudoscorpion	GR 10	1001	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 30"	123° 52' 31"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Drainage Depression - Acacia and/or Mallee Open Woodland over chenopods
Scorpion	GR 10	1002	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 30"	123° 52' 31"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Drainage Depression - Acacia and/or Mallee Open Woodland over chenopods
Centipede	GR 10	1004	7km NW of Dorothy Hills, Yamarna Station	-27° 59' 30"	123° 52' 31"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Drainage Depression - Acacia and/or Mallee Open Woodland over chenopods
Pseudoscorpion	GR 11	1101	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 13"	123° 52' 30"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Mygal	GR 11	1102	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 13"	123° 52' 30"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Mygal	GR 11	1103	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 13"	123° 52' 30"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Mygal	GR 11	1104	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 13"	123° 52' 30"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Scorpion	GR 11	1105	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 13"	123° 52' 30"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Scorpion	GR 11	1106	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 13"	123° 52' 30"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Centipede	GR 11	1107	6km NW of Dorothy Hills, Yamarna Station	-28° 00' 13"	123° 52' 30"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Rocky Hill Slope - Acacia Forest and Woodland
Scorpion	GR 12	1201	9km NW of Dorothy Hills, Yamarna Station	-27° 59' 22"	123° 50' 24"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Centipede	GR 12	1205	9km NW of Dorothy Hills, Yamarna Station	-27° 59' 22"	123° 50' 24"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated
Pseudoscorpion	GR 12	1206	9km NW of Dorothy Hills, Yamarna Station	-27° 59' 22"	123° 50' 24"	15-August-2015	14-October-2015	Greg Harewood	Wet Pit Trap	Sand Plain - Eucalypt /Mallee Woodland, Lower story *Triodia* dominated

APPENDIX B

TAXONOMIC REPORTS

ScorpionID

ABN: 33577027061
Phone: 0457111317
email: evolsche@gmail.com

TAXONOMIC AND SHORT–RANGE ENDEMISM ASESSMENT OF INVERTEBRATES SURVEYED FROM YAMARNA STATION (NOVEMBER 2015)

Prepared for Greg Harewood

The contents of 67 samples of invertebrates from Yamarna Station were assessed for short-range endemism. These contained a total of 14 species: five species of scorpions, three species of pseudoscorpions, four species of scolopendromorph centipedes, one species of stone centipede and one species of earth centipede. Eleven species are considered to be widespread and three species are potential SRE's: the scorpions *Lychas* 'annulatus complex' and *Urodacus* sp. indet., and the earth centipede *Mecistocephalus* sp. indet.

Author:	Dr Erich S. Volschenk
Date:	20 November 2015
Submitted to	Greg Harewood
Report No:	16-06
Version	1

SCOPE OF WORK

In November 2015, Greg Harewood submitted a collection of 65 invertebrate samples from Yamarna Station in the Great Victoria Desert. Taxonomic identifications and SRE assessment of these samples was requested. The species present in this collection were also related to two previous surveys undertaken at Yamarna Station (Keith Lindbeck & Associates 2012; Rapallo 2015). In addition to these reports, the species identified in this collection were also compared with the results from a search of the W.A. Museum's database of arachnids and myriapods in the area between the following coordinates (WGS84):

Latitude (South), 28.730660 – 27.560263
Longitude (East), 123.158339 – 124.553168

BACKGROUND AND METHODS

The methods used to make species identifications and assess SRE categories closely follow those used by the W.A. Museum. A more detailed description of the methods and principals used to identify species and assess SRE categories are detailed in Appendix 1.

RESULTS

The collection contained a total of 14 species representing five orders and six families. Eleven species were widespread and three species were considered potential SRE's (Table 1). The complete record of the specimens identified is presented in Appendix 2.

Table 1. List of species present

Class	Order	Family	Species	SRE category
Arachnida	Pseudoscorpiones	Olpiidae	*Austrohorus* sp. indet.	Widespread
Arachnida	Pseudoscorpiones	Olpiidae	*Beierolpium* '8/3'	Widespread
Arachnida	Pseudoscorpiones	Olpiidae	*Indolpium* sp. 'PSE016'	Widespread
Arachnida	Scorpiones	Buthidae	*Isometroides* 'GVD'	Widespread
Arachnida	Scorpiones	Buthidae	*Lychas* 'adonis'	Widespread
Arachnida	Scorpiones	Buthidae	*Lychas* 'annulatus complex'	Potential SRE
Arachnida	Scorpiones	Buthidae	*Lychas* jonesae	Widespread
Arachnida	Scorpiones	Urodacidae	*Urodacus* sp. indet.	Potential SRE
Chilopoda	Geophilomorpha	Mecistocephalidae	*Mecistocephalus* sp. indet.	Potential SRE
Chilopoda	Lithobiomorpha	Henicopidae	*Lamyctes africanus*	Widespread
Chilopoda	Scolopendromorpha	Scolopendridae	*Cormocephalus rubriceps*	Widespread
Chilopoda	Scolopendromorpha	Scolopendridae	*Ethmostigmus curtipes*	Widespread
Chilopoda	Scolopendromorpha	Scolopendridae	*Scolopendra laeta*	Widespread
Chilopoda	Scolopendromorpha	Scolopendridae	*Scolopendra morsitans*	Widespread

The W.A. Museum database search results (WAMDB071) yielded 10 species that may be conspecific with the species identified in this collection and they are listed in Appendix 3.

DISCUSSION

Three potential SRE species and 11 widespread species were present in this collection. These species and the justification for these rankings are as follows.

ARACHNIDA, PSEUDOSCORPIONES, OLPIIDAE

***Indolpium* sp. 'PSE016', *Austrohorus* sp. indet. and *Beierolpium* '8/3'** represent genera that are taxonomically poorly resolved; however, species in these genera from arid Western Australia appear to have widespread distributions and are not considered to be SRE's. *Indolpium* sp. indet. and *Austrohorus* sp. indet. were identified from the W.A. Museum database search. An unidentified juvenile record of *Beierolpium* was also present in the database search results (Appendix 3). Keith Lindbeck & Associates (2012) also recorded representatives of these three genera; however, Rapallo only (2015) reported the presence of *Indolpium* which appears is conspecific with *Indolpium* sp. 'PSE016'.

ARACHNIDA, SCORPIONES

***Isometroides* 'GVD' (Family Buthidae)** is known from two surveys of the Great Victoria Desert. Prior to the records from the current survey, this species was considered to be a potential SRE. This species is only known from four localities (including those recorded in this collection), however, they represent two small areas more than 400 km apart. This species is therefore likely to be widespread in the Great Victoria Desert and is no longer considered to be a potential SRE.

An undescribed species of *Isometroides* was identified in the W.A. Museum's database search results. This specimen will need to be examined in order to assess its relationship with Isometroides 'GVD', currently not possible while the W.A. Museum Taxonomic Services Unit is closed. No *Isometroides* species were recorded by Keith Lindbeck & Associates (2012) or Rapallo (2015).

***Lychas* 'annulatus complex' (Family Buthidae)** is known from numerous localities across Australia; however, recent genomics studies of this species indicate the presence of several cryptic species, some of which appear to be SRE's (unpublished data). This species is therefore considered to be a potential SRE. Comparison of DNA sequences is required in order to make a more resolved assessment of these specimens.

Lychas 'annulatus complex' was identified in a W.A. Museum database search results as *Lychas* 'annulatus'. Keith Lindbeck & Associates (2012) reported *Lychas* 'annulatus complex' (as *Lychas* 'annulatus'). In that report *Lychas* 'annulatus complex' was also regarded as a widespread species; however, current data indicates that it is a potential SRE. This species was not reported by Rapallo (2015)

***Lychas* 'adonis' and *Lychas jonesae* (Family Buthidae)** are both widespread species and known from arid parts of southern Australia.

Lychas 'adonis' and *Lychas jonesae* were both identified in a database search of the WA Museum. Keith Lindbeck & Associates (2012) also reported the presence of *L. jonesae* while it was not recorded by Rapallo (2015).

***Urodacus* sp. indet. (Family Urodacidae)** could not be clearly identified owing to the absence of adult males in the samples. Adult male specimens are necessary to identify *Urodacus* species using morphology. This species is considered to be a potential SRE owing to:

- ambiguity of its identity
- presence of SRE species within this genus, *i.e. Urodacus planimanus* and *Urodacus koolanensis*,
- presence of numerous undescribed species of *Urodacus* in Western Australia.

Nine different species of *Urodacus* were identified in the database search of W.A. Museum however most of these are significantly larger than the species present in this collection. Among the potential conspecific records was *Urodacus* 'armatus'. Only a handful of W.A. *Urodacus armatus* have been confirmed (by the author) to be this species with the vast majority representing undescribed species, several of which represent potential SRE species. For this reason these W.A. Museum records are referred to as *Urodacus* sp. indet. None of the specimens reported from the database search results were adult females and therefore direct comparisons with these specimens is unlikely to be productive in resolving this identification.

Rapallo (2015) reported the presence of Urodacus 'yaschenkoi complex' which can be readily diagnosed from other Urodacus species groups including the species in this collection. Keith Lindbeck & Associates (2012) did not report the presence of this genus in their survey.

CHILOPODA, GEOPHILOMORPHA

***Mecistocephalus* sp. indet. (Mecistocephalidae)** is likely to represent an undescribed species. The taxonomic resolution of the Australian Geophilomorpha is very poorly resolved and all recent SRE assessments of this genus have been based on DNA sequences and are unpublished. These investigations indicate the presence of numerous species, most of which appear to be range restricted. For this reason this species is considered to be a potential SRE.

The results of the WA Museum database search yielded no records for this order nor were any of its representatives reported on by Keith Lindbeck & Associates (2012) or Rapallo (2015)

CHILOPODA, LITHOBIOMORPHA

***Lamyctes africanus* (Family Henicopidae)** is indigenous to Africa but has been introduced to Western Australia (Hollington and Edgecombe 2004). In Western Australia records of this species are from localities near Human developments and in more mesic environments. This presence of this species from the Great Victoria Desert is unexpected owing to the aridity and remoteness from human influence.

The results of the WA Museum database search yielded no records for this order nor were any of its representatives reported on by Keith Lindbeck & Associates (2012) or Rapallo (2015).

CHILOPODA, SCOLOPENDROMORPHA

Cormocephalus rubriceps*, *Ethmostigmus curtipes*, *Scolopendra laeta* and *Scolopendra morsitans are considered to be widespread species in Western Australia**.** The results of the WA Museum database search yielded one record for this order: *Ethostigmus curtipes*. No scolopendromorph centipedes were reported by either Keith Lindbeck & Associates (2012) or Rapallo (2015).

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APPENDIX 1. BACKGROUND AND METHODS

SHORT-RANGE ENDEMISM

Short-range endemics are organisms with small geographic distributions (Harvey 2002; Ponder and Colgan 2002), nominally less than 10,000 km^2 (Harvey 2002). These organisms are typically characterised by one or more of the following characteristics:

- limited dispersal capabilities,
- seasonal activity (cooler or wetter periods),
- slow growth, and
- low levels of fecundity.

Isolating mechanisms are typically inhospitable habitat such as rivers, rocky ridges or plains that act to prevent dispersal (gene flow) between populations. Two types of short-range endemism have been recognised: Relictual Endemism and Habitat Specialist Endemism (Harvey 2002; Ponder and Colgan 2002).

Relictual SREs result when speciation occurs following the fragmentation of continuous habitat into two or more refugia. In Australia, the primary driver of this over the last 65 million years has been aridification, which acted to isolate formerly widespread species living in mesic forests to small patches of mesic refugia. Relictual SREs include scorpions in the genus *Aops* (Volschenk and Prendini 2008), pseudoscorpions in the genera *Tyrannochthonius* (Edward and Harvey 2008; Harvey 1991), *Indohya* (Harvey 1993b; Harvey and Volschenk 2007) and *Idioblothrus* (Harvey 1993a; Harvey and Leng 2008; Muchmore 1982) and millipedes in the genus *Antichiropus* (Car and Harvey 2014; Car *et al.* 2013). Troglobites are thought to be extreme examples of relictual SREs; most troglobites from the Pilbara have surface dwelling relatives living in the more mesic forests of northern Australia (Harvey 2002; Ponder and Colgan 2002).

Habitat specialist SREs are species that have adapted to very specific environment types, including those found in arid environments (e.g. rocky outcrops or isolated dune systems). Such habitats are often relatively young (<10 million years) and therefore are not refugial. Examples of habitat specialist SREs include spiders in the family Selenopidae and pseudoscorpions in the genera *Synsphyronus* (Harvey 2011, 2012) and *Feaella* (Harvey 1989; Harvey and Volschenk 2007).

DEFINING SHORT-RANGE ENDEMISM

Assessment of short-range endemism can be challenging when data for evaluation are absent or limited. Limitations may include any of the following:

- **Poor survey coverage,** e.g. the fauna of an area has not been sampled extensively enough to enable assessment of species distributions. The absence of a species from survey records may not mean that it is absent from the area.
- **Poor taxonomic resolution,** e.g. a species has not been subject to systematic investigation, and/or the identity is either difficult or impossible to determine. Good taxonomic resolution does not necessarily need to be in the form of published revisions, as it can be facilitated by any of the following:
  - a researcher actively working on the group who can authorise identifications,
  - a publically accessible reference collection, and/or;
  - assessment of species boundaries using genomic methods such as DNA barcoding (Hebert *et al.* 2003a; Hebert *et al.* 2003b).
- **Identification issues**, e.g. surveys sampled life stages of potential SREs that are impossible to identify on the basis of morphological characters. Examples of relevant taxa include juvenile or female millipedes, mygalomorph spiders and *Urodacus* scorpions. Genomic methods have great potential to overcome this type of limitation.

There are no published systems for assessing the SRE potential for a species. Given this, ScorpionID employs the three categories used by the WA Museum to assess SRE-status of invertebrates (Western Australian Museum 2013):

- **Confirmed SRE:** This category applies when the identity of the taxon is unambiguous and its distribution is less than 10 000km^2 based on publically available vouchered records. Supporting data can be either genomic (from DNA sequences) or morphological, ideally both.
- **Potential SRE:** This category applies to situations where there are knowledge gaps for the taxon. The following sub-categories further elucidate this status:
  - **Data Deficiency:** This category covers taxa for which there is insufficient data available to determine SRE status. Factors that fall under this category include:
    - insufficient geographic information,
    - insufficient taxonomic information, and/or
    - inappropriate life stages prevent identification to species level.
  - **Habitat Indicators:** This category employs habitat characteristics to evaluate SRE status when particular habitats are known to support SRE taxa. For example, many species sampled from subterranean habitats are known to be range restricted; a new species discovered from such habitat therefore has greater potential to be range restricted (i.e. a SRE) than widespread.
  - **Morphological Evidence:** This category uses one or more morphological characters that are characteristic of SRE taxa inhabiting restricted environments, e.g. the specialised morphological features of animals adapted to subterranean habitats, including body markings that are absent or significantly paler than surface dwelling relatives, eyes that are absent or significantly reduced, and/or longer appendages (legs and antennae) than surface relatives.
  - **Unpublished Research & Expertise:** This category relies on unpublished research or expertise to develop SRE status.

  These categories of categories of potential SRE may be helpful in developing conservation priorities, however, each taxon should be assessed on its merit and in accordance with the *Precautionary Principle* (EPA 2002):

  > "*where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation*" (EPA 2002).

- **Widespread (not an SRE)**: This category applies when vouchered evidence demonstrates a distribution greater than 10,000 km^2.

TAXONOMY

The taxonomic nomenclature of invertebrates follows the references detailed in Table 2. Morphospecies designations follow the parataxonomy of the scientist(s) working on the group; these informal names are written between single quotation marks rather than being italicised as they are not valid under the International Code of Zoological Nomenclature (1999).

Table 2. Nomenclatural references, morphospecies designations and reference collections used to determine scorpion and pseudoscorpion species

Order	Taxonomic reference	Morphospecies and reference collection
Pseudoscorpiones	Harvey 1992; Harvey 2012, 2013; Murienne *et al.* 2008	Reference collection and morphospecies codes of the WA Museum.
Scorpiones	Fet *et al.* 2000; Glauert 1925; Koch 1977; Kovařík 1997; Kovařík 2002; Volschenk 2008; Volschenk *et al.* 2010; Volschenk *et al.* 2012; Volschenk and Prendini 2008; Volschenk *et al.* 2000	Reference collection at the WA Museum. Morphospecies designation by the author.
Chilopoda	Colloff *et al.* 2005; Lewis 1981	Reference collection and morphospecies codes of the WA Museum.

Phylogenetic Species Concept (Cracraft 1983) is used for delineating morphospecies:

> "A species is the smallest diagnosable cluster of individual organisms within which there is a parental pattern of ancestry and descent."

IDENTIFICATION

Unless otherwise stated, species identifications were carried out by the author. The references used for species determination are summarised in Table 2.

SPECIMEN LODGEMENT

In accordance with EPA Guidance Statement 20 (2009), all specimens submitted to ScorpionID for taxonomic identification are lodged with the WA Museum.

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APPENDIX 2. LIST OF SPECIMENS IDENTIFIED FROM YAMARNA STATION

Order	Family	Species	Sample code	Latitude (South)	Longitude (East)	Males	Females	Juveniles	TOTAL
Class Arachnida									
Pseudoscorpiones	Olpiidae	*Austrohorus* sp. indet.	101	27°59'13.0	123°51'00.0		1		1
		Austrohorus sp. indet.	505b	27°58'25.0	123°52'31.0	1	1		2
		Austrohorus sp. indet.	801	28°00'11.0	123°51'59.0	2	3		5
		Austrohorus sp. indet.	201b	27°59'02.0	123°51'13.0	1	4		5
		Austrohorus sp. indet.	706	28°00'45.0	123°50'41.0		1		1
		Austrohorus sp. indet.	304b	27°59'34.0	123°49'45.0	1	2		3
		Austrohorus sp. indet.	1101b	28°00'13.0	123°52'30.0		1		1
		Beierolpium '8/3'	404	27°58'33.0	123°52'03.0	1			1
		Beierolpium '8/3'	1101	28°00'13.0	123°52'30.0	1	2		3
		Beierolpium '8/3'	304	27°59'34.0	123°49'45.0	1			1
		Beierolpium '8/3'	201	27°59'02.0	123°51'13.0	1	4		5
		Beierolpium '8/3'	101c	27°59'13.0	123°51'00.0	1	1		2
		Indolpium sp. 'PSE016'	201c	27°59'02.0	123°51'13.0	1	4		5
		Indolpium sp. 'PSE016'	901	27°59'38.0	123°52'17.0	3	3	2	8
		Indolpium sp. 'PSE016'	801b	28°00'11.0	123°51'59.0	4	2	1	7
		Indolpium sp. 'PSE016'	1001	27°59'30.0	123°52'31.0	1			1

		Indolpium sp. 'PSE016'	101b	27°59'13.0	123°51'00.0	1	2	1	4
		Indolpium sp. 'PSE016'	706b	28°00'45.0	123°50'41.0	2	1	1	4
		Indolpium sp. 'PSE016'	1206	27°59'22.0	123°50'24.0	1			1
		Indolpium sp. 'PSE016'	1101c	28°00'13.0	123°52'30.0	1	1		2
		Indolpium sp. 'PSE016'	505	27°58'25.0	123°52'31.0				3
		Indolpium sp. 'PSE016'	404b	27°58'33.0	123°52'03.0	1	2		2
Scorpiones	Buthidae	*Isometroides* 'GVD'	1002	27°59'30.0	123°52'31.0			1	1
		Isometroides 'GVD'	802	28°00'11.0	123°51'59.0			1	1
		Lychas 'adonis'	205	27°59'02.0	123°51'13.0	2	4	1	7
		Lychas 'adonis'	1201	27°59'22.0	123°50'24.0	5	4		9
		Lychas 'adonis'	502b	27°58'25.0	123°52'31.0	1		1	2
		Lychas 'adonis'	302b	27°59'34.0	123°49'45.0	1	3	1	5
		Lychas 'adonis'	802b	28°00'11.0	123°51'59.0	2	2	1	5
		Lychas 'adonis'	702	28°00'45.0	123°50'41.0		2		2
		Lychas 'adonis'	402b	27°58'33.0	123°52'03.0	1			1
		Lychas 'adonis'	105	27°59'13.0	123°51'00.0	5	3		8
		Lychas 'annulatus complex'	302	27°59'34.0	123°49'45.0	2	1		3
		Lychas jonesae	402	27°58'33.0	123°52'03.0		1		1
		Lychas jonesae	802c	28°00'11.0	123°51'59.0	6	2	1	9
		Lychas jonesae	1105	28°00'13.0	123°52'30.0			1	1
		Lychas jonesae	502	27°58'25.0	123°52'31.0	1		1	2
		Lychas jonesae	903	27°59'38.0	123°52'17.0	1			1
		Lychas jonesae	601	27°58'06.0	123°52'21.0	1		1	2
	Urodacidae	*Urodacus* sp. indet.	1106	28°00'13.0	123°52'30.0		1		2
Class Chilopoda									

Geophilomorpha	Mecistocephalidae	*Mecistocephalus* sp. indet.	202	27°59'02.0	123°51'13.0	1		1	7
		Mecistocephalus sp. indet.	707	28°00'45.0	123°50'41.0			2	2
Lithobiomorpha	Henicopidae	*Lamyctes africanus*	804	28°00'11.0	123°51'59.0				1
		Lamyctes africanus	603	27°58'06.0	123°52'21.0				1
		Lamyctes africanus	905	27°59'38.0	123°52'17.0				1
Scolopendromorpha	Scolopendridae	*Cormocephalus rubriceps*	1205b	27°59'22.0	123°50'24.0				1
		Cormocephalus rubriceps	207	27°59'02.0	123°51'13.0				1
		Ethmostigmus curtipes	703b	28°00'45.0	123°50'41.0				1
		Ethmostigmus curtipes	1205c	27°59'22.0	123°50'24.0				1
		Scolopendra laeta	703	28°00'45.0	123°50'41.0				2
		Scolopendra laeta	1004	27°59'30.0	123°52'31.0				1
		Scolopendra laeta	1205	27°59'22.0	123°50'24.0				5
		Scolopendra laeta	807	28°00'11.0	123°51'59.0				6
		Scolopendra laeta	1107	28°00'13.0	123°52'30.0				1
		Scolopendra laeta	904	27°59'38.0	123°52'17.0				5
		Scolopendra laeta	207b	27°59'02.0	123°51'13.0				1
		Scolopendra laeta	301b	27°59'34.0	123°49'45.0				4
		Scolopendra laeta	602	27°58'06.0	123°52'21.0				1
		Scolopendra laeta	106	27°59'13.0	123°51'00.0				1
		Scolopendra laeta	401	27°58'33.0	123°52'03.0				7
		Scolopendra laeta	501	27°58'25.0	123°52'31.0				3
		Scolopendra morsitans	501b	27°58'25.0	123°52'31.0				2
		Scolopendra morsitans	401b	27°58'33.0	123°52'03.0				4
		Scolopendra morsitans	301	27°59'34.0	123°49'45.0				1
		Scolopendra morsitans	1107b	28°00'13.0	123°52'30.0				1

APPENDIX 3. SPECIES PRESENT IN THIS COLLECTION AND ALSO RECORDED FROM W.A. MUSEUM DATABASE SEARCH (WAMDB071)

Class	Order	Family	Species	Latitude	Longitude	W.A. Museum Registration Number
Arachnida	Pseudoscorpiones	Olpiidae	*Austrohorus* `sp. indet.`	-28.15	123.683	T121607
			Beierolpium `sp. indet. (juvenile)`	-28.15	123.683	T121604
			Indolpium `sp. indet.`	-28.1667	123.683	T121600
			Indolpium `sp. indet.`	-28.1333	123.7	T121601
			Indolpium `sp. indet.`	-28.1333	123.7	T121602
			Indolpium `sp. indet.`	-28.1333	123.7	T121603
			Indolpium `sp. indet.`	-28.1333	123.7	T121605
			Indolpium `sp. indet.`	-28.15	123.683	T121606
			Indolpium `sp. indet.`	-28.15	123.683	T121608
			Indolpium `sp. indet.`	-28.15	123.7	T121598
			Indolpium `sp. indet.`	-28.1333	123.7	T121599
	Scorpiones	Buthidae	*Isometroides* `sp. indet.`	-27.4097	122.712	T102430
			Lychas `annulatus complex`	-28.2	123.6	T33575
			Lychas `annulatus complex`	-27.5093	122.303	T85036
			Lychas `annulatus complex`	-27.5093	122.309	T85039
			Lychas `annulatus complex`	-27.5093	122.303	T85042
			Lychas `annulatus complex`	-28.2	123.6	T33394
			Lychas `annulatus complex`	-27.5093	122.303	T83889
			Lychas `annulatus complex`	-28.2	123.6	T60415

			Lychas jonesae	-27.5845	122.363	T83864
			Lychas jonesae	-27.5845	122.363	T83880
			Lychas jonesae	-27.5845	122.363	T83881
			Lychas `adonis`	-27.5845	122.363	T83860
			Lychas `adonis`	-27.5845	122.363	T83862
		Urodacidae	*Urodacus* `sp. indet.`*	-28.1653	123.668	T87565
			Urodacus `sp. indet.`*	-27.95	123.767	T4340
			Urodacus `sp. indet.`*	-27.95	123.767	T4341
			Urodacus `sp. indet.`*	-27.95	123.767	T4342
			Urodacus `sp. indet.`*	-27.95	123.767	T4343
			Urodacus `sp. indet.`*	-27.95	123.767	T4344
			Urodacus `sp. indet.`*	-27.95	123.767	T4345
			Urodacus `sp. indet.`*	-27.95	123.767	T4346
			Urodacus `sp. indet.`*	-27.95	123.767	T4347
			Urodacus `SCO005, De La Poer`	-27.4094	122.712	T102429
Chilopoda	Scolopendromorpha	Scolopendridae	*Ethmostigmus curtipes*	-28.2	123.6	T60164

*These species were present in the WA Museum database search results as " *Urodacus* `armatus` "; however, they do not belong to the described species *Urodacus armatus*. They have therefore been renamed these as *Urodacus* `sp. indet.`

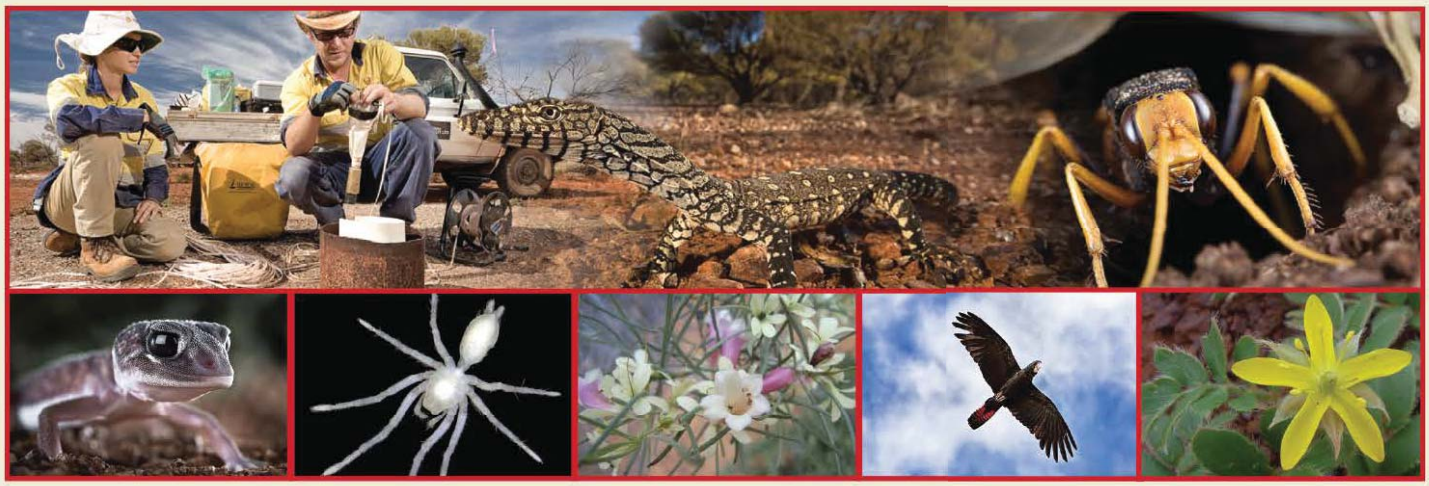
PHOENIX
ENVIRONMENTAL SCIENCES

Identification and assessment of short-range endemism of trapdoor spiders (Mygalomorphae) from the Gruyere Project (Yamarna Station), Western Australia

Prepared for Greg Harewood (on behalf of Gold Road Resources Ltd)

November 2015

Taxonomic Report



Identification and assessment of short-range endemism of trapdoor spiders (Mygalomorphae) from the Gruyere Project (Yamarna Station), Western Australia

Prepared for Greg Harewood (on behalf of Gold Road Resources Ltd)

Taxonomic Report

Authors: Volker Framenau

Date: 11 November 2015

Submitted to: Greg Harewood

Chain of authorship and review			
Name	Task	Version	Date
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1 BACKGROUND

Short-range endemics (SREs) are organisms with a naturally narrow distribution range, in Western Australia environmental assessments nominally consider this to be less than 10,000 km^2 (EPA 2009; Harvey 2002). There are uncertainties in determining the range-restrictions of many invertebrates in Western Australia due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. The WA Museum has introduced a three-tier system to account for these uncertainties, confirmed and potential SREs in addition to widespread species (Western Australian Museum 2013).

2 SCOPE OF WORKS

In November 2015, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Greg Harewood (on behalf of Gold Road Resources Ltd) to identify trapdoor spiders (Mygalomorphae) collected at the Gruyere Project (Yamarna Station), Western Australia. Previous reports on SREs from Yamarna Station Station were to be considered in the analysis (Table 2-1).

Table 2-1 Mygalomorph spiders previously recorded from Yamarna Station

Family	Species	SRE Category (Western Australian Museum 2013)	Source
Barychelidae	*Synothele meadhunteri*	Widespread	Keith Lindbeck & Associates (2012)
	Synothele sp. indet.	Potential	Keith Lindbeck & Associates (2012)
	Synothele sp. indet. (juvenile)	Potential	Phoenix (2015)
Idiopidae	*Eucyrtops* sp. indet. (juvenile)	Potential	Keith Lindbeck & Associates (2012)
	Aganippe 'MYG159'	Widespread	Phoenix (2014)
Nemesiidae	*Aname* 'MYG250'	Potential	Keith Lindbeck & Associates (2012)
	Aname 'yamarna'	Potential	Phoenix (2015)
	Kwonkan 'yamarna'	Potential	Phoenix (2015)
Theraphosidae	Theraphosidae sp. indet. (juvenile)	Widespread	Phoenix (2014)

3 METHODS

Specimens were identified by V.W. Framenau. Spider taxonomy followed the World Spider Catalog (2014). The WA Museum does currently not issue 'MYG'-numbers for species not present in their morphospecies collection (K. Abrams, email to V.W. Framenau, 27 March 2015) and is also closed for identifications or specimen submisssions (http://www.museum.wa.gov.au/consultation/submissions; accessed 11 November 2015). An interim morphological nomenclature based on the locality data is therefore used here. WA Museum registration numbers can only be provided after future lodgement of specimens.

4 RESULTS

The material submitted included four potential SREs and a widespread species (Table 4-1 and Table 4-2). Until material at the WA Museum is available for comparative analysis, it will remain unclear if *Synothele* 'gruyere' is conspecific with *Synothele* sp. indet. (as reported in Keith Lindbeck & Associates 2012) and if any of the *Aname* species is conspecific with *Aname* 'MYG250' (as reported in Phoenix 2014) or *Aname* 'yamarna' (as reported in Phoenix 2015) (see also Table 2-1). It is recommended to review these species and eventually incorporate them into the WA Museum MYG-nomenclatural system once the WA Museum taxonomic services are available again.

Table 4-1 Taxonomy and SRE categories of invertebrate species identified from the Gruyere Project (Yamarna Station)

Order	Family	Species	SRE Category (Western Australian Museum 2013)	Comment
Araneae (Mygalomorphae)	Barychelidae	*Synothele meadhunteri*	Widespread	Only pedipalp in vial with juvenile *Aname* 'gruyere1'
		Synothele 'gruyere'	Potential	
	Nemesiidae	*Aname* 'gruyere1'	Potential	
		Aname 'gruyere2'	Potential	
		Aname 'gruyere3'	Potential	*Aname mellosa* group

Table 4-2 Identification of SRE target invertebrates from the Gruyere Project (Yamarna Station)

Phoenix reg. no.	Client reg. no.	Family	Genus and species	♂♂	♀♀	Juv.	Total
22329	GR306	Nemesiidae	*Aname* 'gruyere2'	1			**1**
22330	GR701	Nemesiidae	*Aname* 'gruyere3'	1			**1**
22331	GR708	Nemesiidae	*Aname* 'gruyere3'	1			**1**
22332	GR806	Nemesiidae	*Aname* 'gruyere1'			1	**1**
22333	GR808	Nemesiidae	*Aname* 'gruyere1'	1			**1**
22334	GR902	Nemesiidae	*Aname* 'gruyere1'	1			**1**
22335	GR1102	Barychelidae	*Synothele* 'gruyere'	1			**1**
22336	GR1103	Nemesiidae	*Aname* 'gruyere1'			1	**1**
22337	GR1104	Nemesiidae	*Aname* 'gruyere1'	1			**1**
22338	exGR806	Barychelidae	*Synothele meadhunteri*	1*			**1**
Total:				**8**		**2**	**10**

* single pedipalp only in vial with juvenile *Aname* 'gruyere1'

4.1 *SYNOTHELE* 'GRUYERE' (FAMILY BARYCHELIDAE)

Barychelid spiders, commonly called brush-footed trapdoor spiders, are small to fairly large in size with well-developed claw tufts and short terminal segment of the posterior lateral spinnerets (Raven 1994). In Western Australia, the genera Aurecocrypta, Idiommata, Mandjelia and Synothele are known to occur from the Southwest region into the Pilbara region and Moruga has been found in the Kimberleys (Raven 1994). Of all trapdoor spiders, few are as cryptic as the Barychelidae. Their burrows tend to be less than 60 cm deep and often lack the firm thick door of the Ctenizidae or the extensive webs of Dipluridae.

The genus *Synothele* can be identified by the low number of maxillary cuspules in combination with the lack of lyra (specialised clubbed setae) on the maxillae, and the often mottled abdomen (uniformly dark in the similar Aurecocrypta). The genus is widespread throughout Western (21 species) and South Australia (3 species) with most species known only from very limited ranges (Raven 1994). All unidentified specimens of *Synothele* should therefore be considered potential SREs.

The submitted specimen is a male. It is not the widespread *S. meadhunteri*, previously recorded from the region (Table 2-1), or any other of the locally described *Synothele* species as it does not key out using Raven's (1994) revision. Comparison with other morphotypes lodged at the WA Museum is currently not possible. Based on our current knowledge on the distribution of species within the genus Synothele, S. 'gruyere' should be considered a potential SRE.

A single pedipalp of the widespread *Synothele meadhunteri* was within the vial of a juvenile *Aname* 'gruyere1' (Table 4-2).

4.2 *ANAME* 'GRUYERE1', 'GRUYERE2' AND 'GRUYERE3' (FAMILY NEMESIIDAE)

Members of the mygalomorph spider family Nemesiidae include those trapdoor spiders with two rows of teeth on the superior tarsal claws and comparatively long spinnerets. The family currently includes 98 described species in 14 genera in Australia, but the fauna is clearly much more diverse with an estimated 250+ species (Framenau *et al.* 2014). In Western Australia the family is represented by several genera, including *Aname*, *Chenistonia*, *Yilgarnia*, *Stanwellia*, *Teyl*, *Swolnpes* and *Kwonkan* (Main & Framenau 2009). They usually dig burrows in the soil, and do not cover their burrow entrances with lids.

The genus *Aname* currently includes 37 named species (Framenau 2014) in Australia and is well represented by four named and numerous unnamed species from many different regions in Western Australia. *Aname* currently represent a highly diverse array of species of very small to large spiders. Males generally have a spur and spine on the first tibia of males opposing an often incrassate metatarsus. Members of the genus *Aname* are believed to be most common in sclerophyll forest, but are also known from rainforests and deserts (Raven 1981). *Aname* regularly belongs to the most diverse mygalomorph genera in biological spider surveys and with 12 species the Pilbara survey (Durrant *et al.* 2010) resulted in a similar number as found during the Carnarvon Basin survey (13 species) (Main *et al.* 2000). However, recent molecular studies suggest that the number of species in the Pilbara is much higher than previously anticipated (Castalanelli *et al.* 2014). Many *Aname* species appear to have restricted distributions as shown by two studies from northern Australia, including the Pilbara (Harvey *et al.* 2012; Raven 1985). Therefore, unidentifiable specimens are considered potential SREs.

Three species of *Aname* were in the submitted material. These were not present in the Phoenix reference collection and the WA Musuem collection is currently in accessible. Therefore, it is unclear if they are conspecific with the two other species of *Aname* previously recorded from the area, *Aname* 'MYG250' or *Aname* 'yamarna' (Table 2-1).

Two juvenile specimens submitted are most likely *Aname* 'gruyere1' based on the presence of a distinct pattern on the abdomen. *Aname* 'gruyere3' belongs to the widespread, but highly fragmented *Aname mellosa*-group (Castalanelli *et al.* 2014; Harvey *et al.* 2012). Based on distribution patterns within the genus Aname, all *Aname* specimens are here considered to represent potential SREs.

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25th November 2015

Re: Terrestrial Isopod Identification for Gruyere Project, Yamarna Station.

SUMMARY
I have examined the 11 vials received from the Gruyere Project area, Yamarna Station. The specimens were generally in excellent condition and contained males, females and juveniles. A completed data sheet accompanies this report. All specimens are considered to be the same morphospecies. This morphospecies was not present in my collection and has been given the name "*Buddelundia* '27gr'. I consider it a potential SRE species. This is because there are knowledge gaps for the taxon and insufficient geographic information to determine the distribution of this species.

SPECIMENS IDENTIFIED

FAMILY ARMADILLIDAE
Genus *Buddelundia* Michaelsen 1912.

This genus is the most common in WA and species of *Buddelundia* dominate the isopod fauna of the arid and semi-arid areas. The genus is in need of revision and contains many undescribed species.

*Buddelundia '*27gr'.

This morphospecies is morphologically typical of the *Buddelundia* found in the arid zone. The species was significantly morphologically different to other material examined. The most similar morphospecies is *Buddelunia* '27dv' which is found about 180 km to the east of the current study sites. *Buddelunia* '27dv' is known only from a single and incomplete male specimen. There are a number of small morphological differences between this specimens and the material examined here, but additional material of *Buddelunia* '27dv' is needed for further work to confirm this determination.

The terrestrial isopods of this part of the Great Victoria Desert are unknown. The specimen of *Buddelunia* '27dv' mentioned above is geographically the closest other record to the specimens reported here. Because of the lack of distributional information, and also because of some taxonomic uncertainty between *Buddelundia* '27 gr' and *Buddelundia* '27dv', the morpho species should be considered a potential SRE species. Based on current knowledge, *Buddelundia* '27gr' is known only from the specimens reported here.

Unless instructed otherwise I will retain a voucher specimen(s), lodge the remaining specimens with the Western Australian Museum and advise you of the registration numbers in due course.

End of report. Please contact me if you require more information.

Yours sincerely,
Simon Judd.

REGNO	OLDNO	FAMILY	GENUS	SPECIES	IDENTITY	FLDNO	SPECNUM	REMARKS	LOCALITY	STATION	LATDMS	LONGDMS	LATDEC	LONGDEC	DTFR	DTTO	COLLTOR	COLLMETH	HABIT	SNAME
	SJ5065	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR104	9	1♂ 2♀ 6J	9 km NW of Dorothy Hills, Yamarna Station	10	27°59'13.0"S	123°51'05.00"E	-27.986944°	123.851389°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5066	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR204	14	1♂ 1♀ 12J	10 km NW of Dorothy Hills, Yamarna Station	20	27°59'02.0"S	123°51'13.00"E	-27.983889°	123.853611°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5067	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR305	3	1♂ 1♀ 1J	10 km NW of Dorothy Hills, Yamarna Station	30	27°59'34.0"S	123°49'45.0"E	-27.992778°	123.829167°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5068	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR405	1	1J	9 km NW of Dorothy Hills, Yamarna Station	40	27°58'33.0"S	123°52'03.00"E	-27.975833°	123.867500°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5069	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR503	1	1J	9 km NW of Dorothy Hills, Yamarna Station	50	27°58'25.0"S	123°52'31.00"E	-27.973611°	123.875278°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5070	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR704	5	2♀ 3J	7 km NW of Dorothy Hills, Yamarna Station	70	28°00'45.0"S	123°50'41.00"E	-28.012500°	123.844722°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5071	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR805	4	2♀ 2J	6 km NW of Dorothy Hills, Yamarna Station	80	28°00'11.0"S	123°51'59.0"E	-28.003056°	123.866389°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5072	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR1003	1	1♀	7 km NW of Dorothy Hills, Yamarna Station	10	27°59'30.0"S	123°53'31.00"E	-27.991667°	123.891944°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5073	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR1108	8	1♂ (largest) 7J	6 km NW of Dorothy Hills, Yamarna Station	11	28°00'13.0"S	123°52'30.0"E	-28.003611°	123.875000°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	T	G. H. Consulting
	SJ5074	Armadillidae	Buddelundia	27gr	Buddelundia 27gr	GR1202	13	1♂ 4♀ 8J	9 km NW of Dorothy Hills, Yamarna Station	12	27°59'22.0"S	123°50'24.00"E	-27.989444°	123.840000°	15-Aug-15	14-Oct-15	Harewood, G.	Prop. Glycol Pitfall Trap	t	G. H. Consulting

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The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

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